

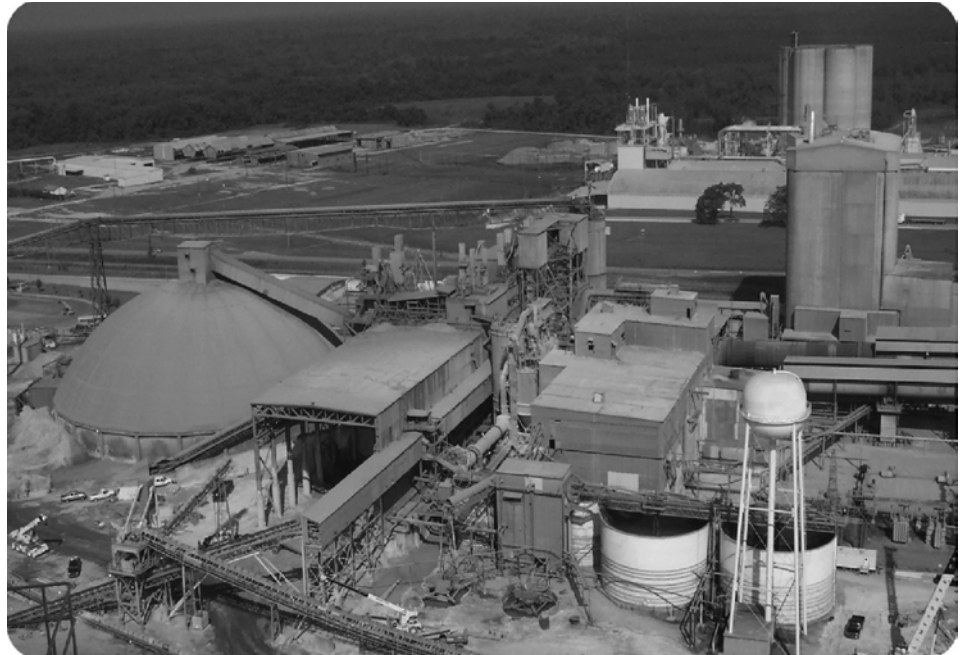
User Manual

Original Instructions



OneGear Medium Voltage SMC-50 Motor Controller (10...15 kV)

Catalog Numbers 7760F, 7761F, 7762F, 7763F



Important User Information

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

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

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

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

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

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



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

IMPORTANT

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

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



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.



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

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Notes:

Manual Objectives

This manual is intended for use by personnel familiar with medium voltage and solid-state power equipment. The manual contains material which will allow the user to operate, maintain and troubleshoot the OneGear™ MV SMC™-50 family of controllers. The family consists of the following Bulletin numbers: 7760F, 7761F, 7762F, and 7763F. This manual applies only to this series of products.

TIP This user manual pertains to units with firmware release 6.xxx (or later).

Service Procedure

For your convenience, the Rockwell Customer Support and Maintenance (CSM), provides an efficient and convenient method of servicing medium voltage products.

Contact your local area support office to make arrangements to have a qualified service representative come to your facility.

A complete listing of Area Support Offices may be obtained by calling your local Rockwell Automation Distributor or Sales Office.

For MV SMC-50 technical support on start-up or existing installations, contact your Rockwell Automation representative.

You can also call **1-519-740-4790** for assistance Monday through Friday from 9:00 a.m. to 5:00 p.m. (Eastern time zone).

Additional Resources

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

| Resource | Description |
|--|--|
| OneGear Medium Voltage SMC-50 Motor Controller (10...15 kV) Installation Instructions, publication 7760F-IN001 | Provides information on transportation and handling, storage, plenum, and installation |
| OneGear Medium Voltage SMC-50 Motor Controller (10...15 kV) Specifications, publication 7760F-TD001 | Outlines equipment design and selection information, and basic data sheets |
| Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1 | Provides general guidelines for installing a Rockwell Automation industrial system. |
| General Handling Procedures for MV Controllers, publication MV-QS050 | Provides information around receiving, storing, and moving medium voltage controllers. |
| Product Certifications website: rok.auto/certifications | Provides declarations of conformity, certificates, and other certification details. |

You can view or download publications at <http://www.rockwellautomation.com/global/literature-library/overview.page>.

Notes:

Product Overview

Description

The OneGear™ Medium Voltage SMC™-50 controller is a solid-state, three-phase, AC line controller. It is designed to provide microprocessor-controlled starting and stopping of standard three-phase, squirrel-cage induction motors, using the same control module as the Allen-Bradley® Bulletin 1500 SMC-50 controller.

7703F – OEM Controller

A solid-state controller designed to be mounted in an OEM structure and work with existing or OEM- or customer-supplied start and bypass controllers. It is composed of several modular components, including:

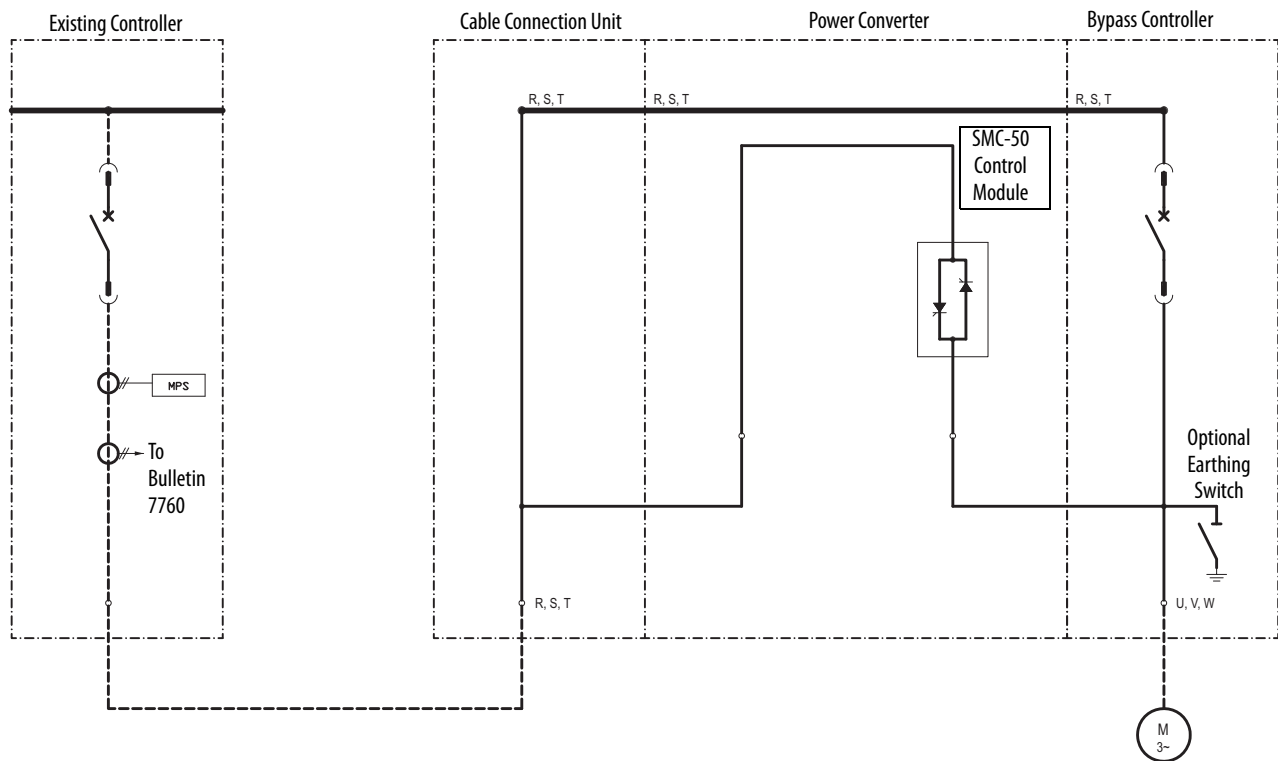
- PowerBrick™ SCR assemblies including gate driver boards
- Loose interface and voltage sensing boards
- Fiber-optic cables for SCR firing
- Microprocessor based control module
- Fiber-optic Interface Board

7760F – Retrofit Controller

A solid-state controller that is designed to work with an existing customer-supplied start controller. It includes:

- Tin-plated, insulated copper, horizontal power bus (optional)
- A continuous, bare copper ground bus (8 x 50 mm [0.3 x 2.0 in.])
- Removable PowerBrick™ SCR assemblies
- Drawout bypass vacuum contactor/breaker
- Voltage sensing board
- A low voltage control panel complete with microprocessor-based control module
- Fiber-optic connection from SMC-50 control module to gate driver board on PowerBrick
- Provision for bottom fed line and load connections
- Earthing switch (optional)

Figure 1 - Typical OneGear Single-Line Diagram, Bulletin 7760F (10...14.4 kV) (Vacuum Breaker)

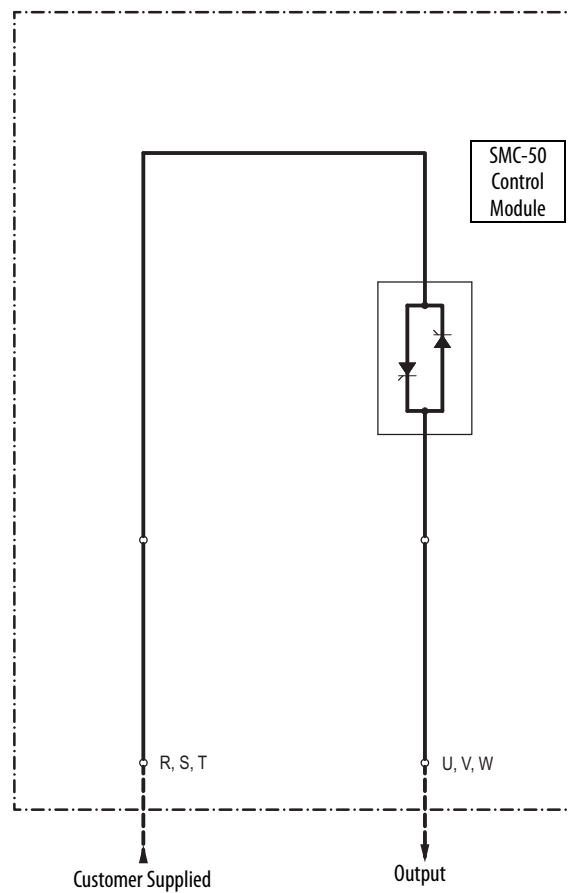


7761F – Combination Controller

A medium voltage solid-state controller that is designed to work with OEM/customer-supplied start and bypass controllers. It includes:

- Removable PowerBrick SCR assemblies
- Voltage sensing board
- Fiber-optic connection from SMC-50 control module to gate driver boards on PowerBricks
- A low voltage control panel complete with microprocessor-based control module and control terminations
- A continuous bare copper ground bus (8 x 50 mm [0.3 x 2.0 in.])
- Provision for bottom fed line and load connections

Figure 2 - Typical OneGear Single-Line Diagram, Bulletin 7761F (10...14.4 kV)

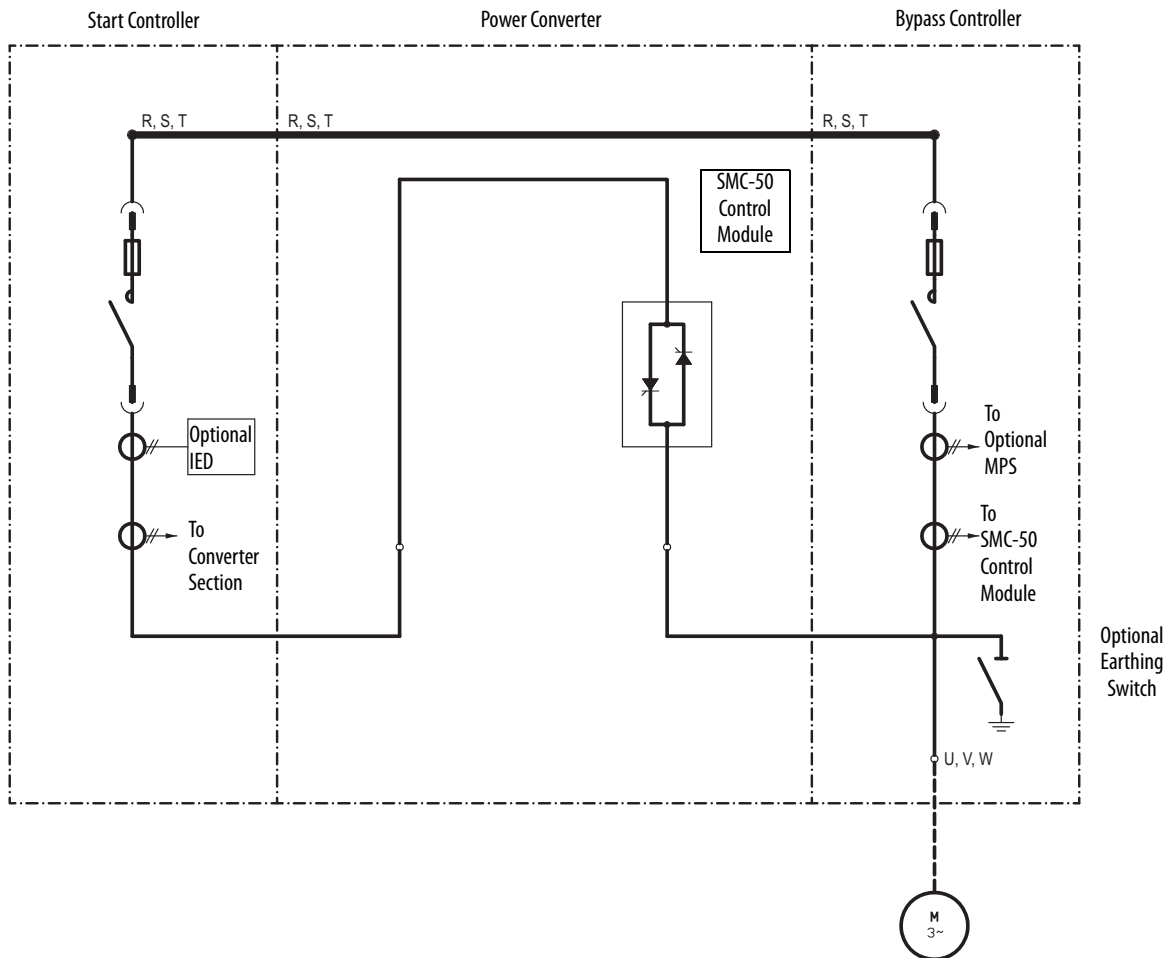


7762F – Combination Controller (Vacuum Contactor)

A medium voltage solid-state controller that provides isolation and protection for new installations. It includes:

- Tin-plated, insulated copper, horizontal power bus
- A continuous, bare copper ground bus (8 x 50 mm [0.3 x 2.0 in.])
- Removable PowerBrick SCR assemblies
- Drawout main isolation (START) vacuum contactor
- Drawout bypass (RUN) vacuum contactor
- Six current-limiting power fuses
- Six current transformers
- Fiber-optic connection from SMC-50 control module to gate driver board on PowerBricks
- A low voltage control panel complete with microprocessor-based control module
- Space for necessary auxiliary control and metering devices
- Motor overload protection (included in SMC-50 control module)
- Earthing switch (optional)

Figure 3 - Typical OneGear Single-Line Diagram, Bulletin 7762F (10...12 kV)

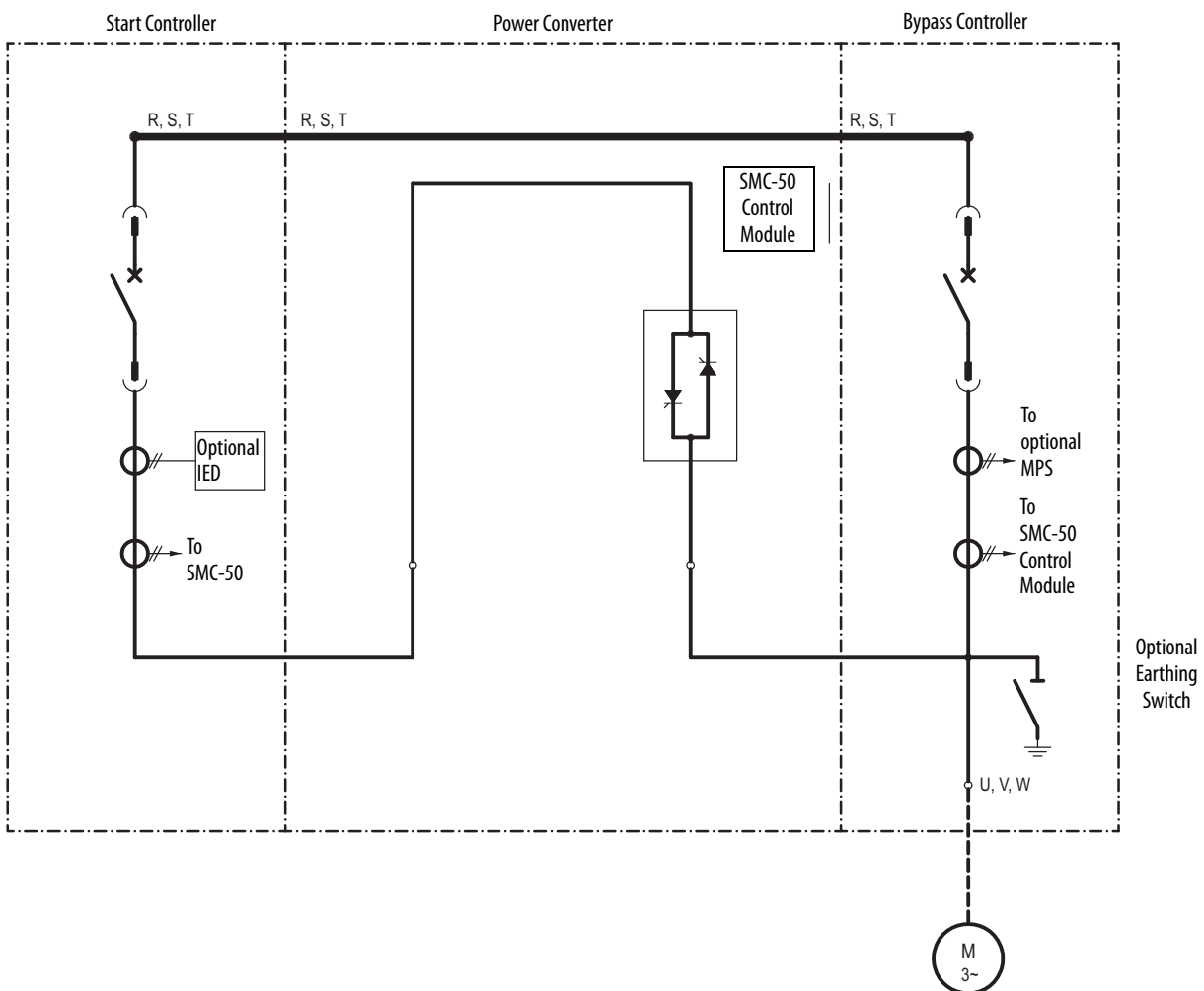


7763F – Combination Controller (Vacuum Breaker)

A medium voltage solid-state controller that provides isolation and protection for new installations. It includes:

- Tin-plated, insulated copper, horizontal power bus
- A continuous, bare copper ground bus (8 x 50 mm [0.3 x 2.0 in.])
- Removable PowerBrick SCR assemblies
- Drawout main isolation (START) vacuum breaker
- Drawout bypass (RUN) vacuum breaker
- Six current transformers
- Fiber-optic connection from SMC-50 control module to gate driver board on PowerBricks
- A low voltage control panel complete with microprocessor-based control module
- Space for necessary auxiliary control and metering devices
- Motor overload protection
- Earthing switch (optional)

Figure 4 - Typical OneGear Single-Line Diagram, Bulletin 7763F (10...14.4 kV)



Power Factor Correction Capacitors

OneGear SMCs can be installed on a system with power factor correction capacitors. These capacitors must be installed on the line side of the Power Converter to prevent damage to the SMC-50 Controller silicon-controlled rectifiers (SCR). A separate switching contactor or breaker is required for the power factor correction capacitors. This switching device closes only after the bypass contactor has closed. The power factor correction capacitors must also be opened before the bypass contactor is opened to perform a stop function.

TIP Consult that the factory if there are capacitors on the same branch circuit as the OneGear SMC.



WARNING: Do not connect power factor correction capacitors in the circuit when OneGear SMC SCRs are gating.

Acceptable optional PFCC connection methods for Bulletin 7760F, 7762F, and 7763F are shown in [Figure 5](#), [Figure 6](#), and [Figure 7](#). The same concept applies to Bulletin 7761F.

Figure 5 - Typical OneGear Single-Line Diagram Bulletin 7760F (10...14.4 kV) with two optional Power Factor Correction Capacitor positions (Vacuum Breaker)

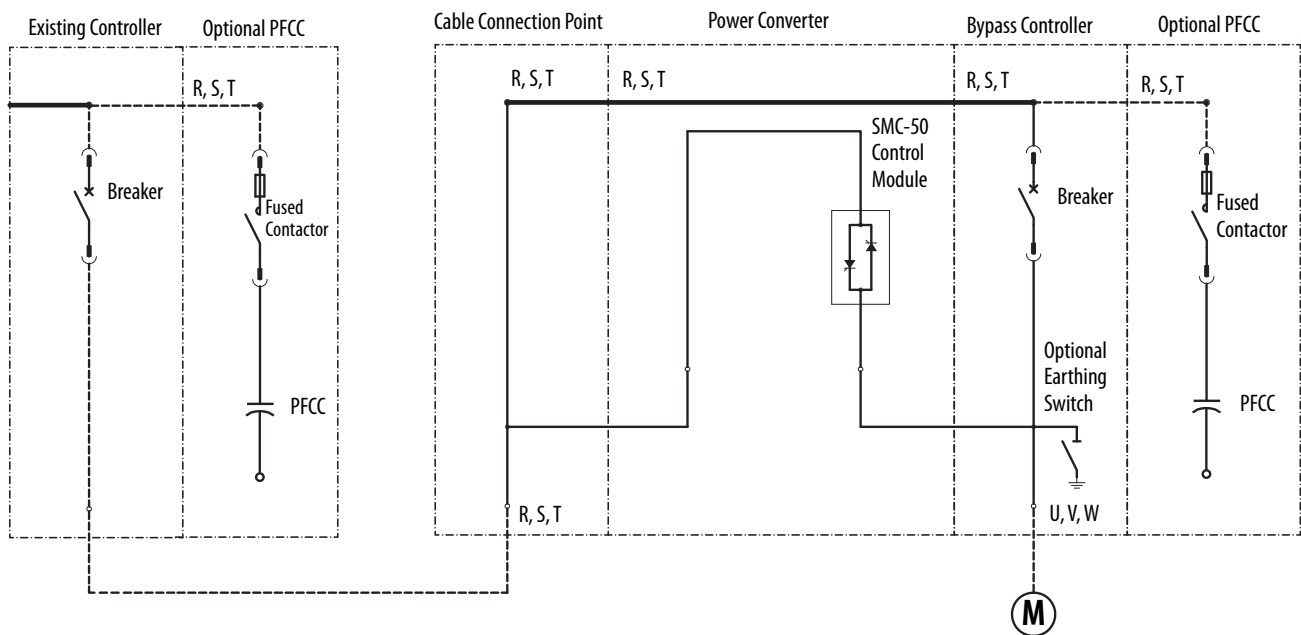


Figure 6 - Typical OneGear Single-Line Diagram, Bulletin 7762F (10...12 kV)

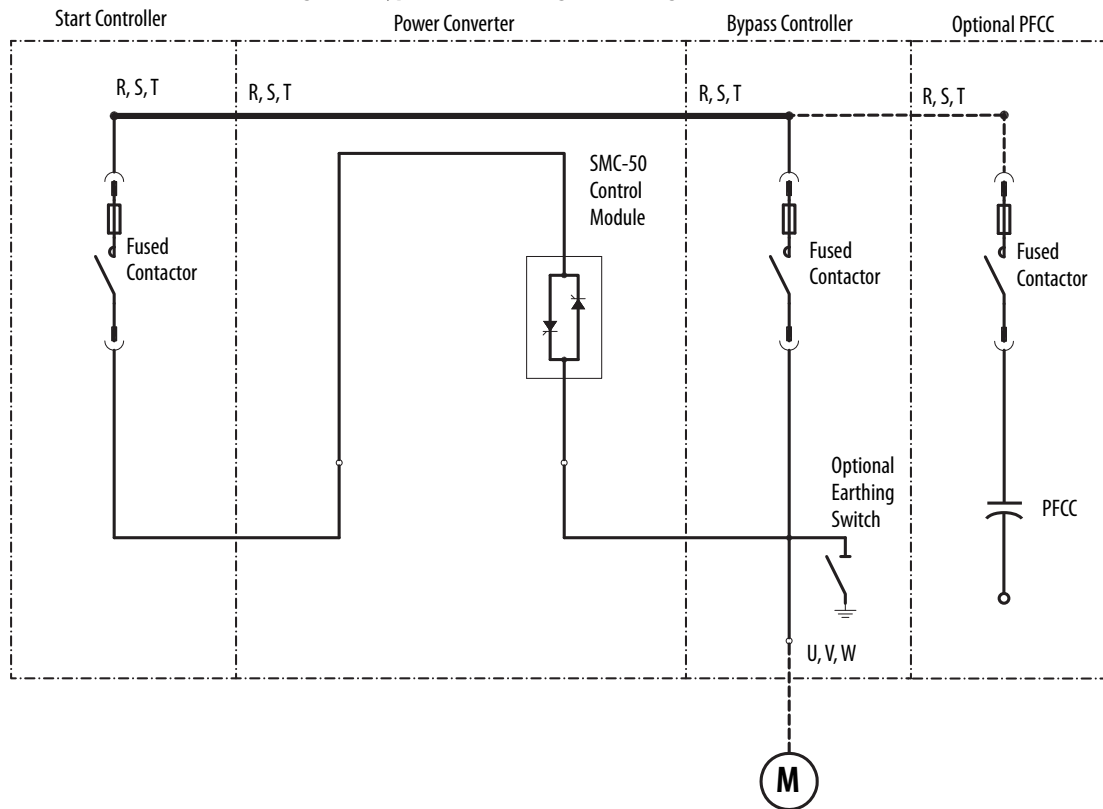
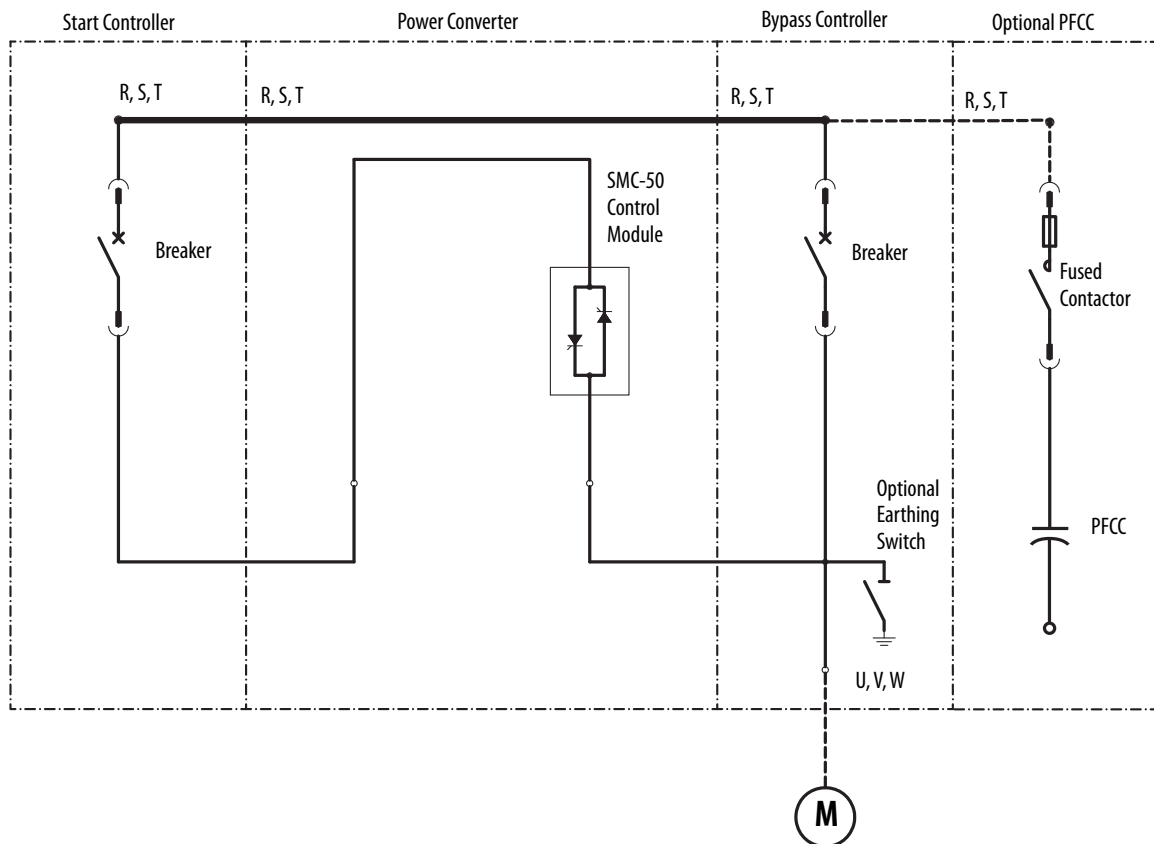


Figure 7 - Typical OneGear Single-Line Diagram with Optional Power Factor Correction Capacitor, Bulletin 7763F (10...14.4 kV)



SMC-50 Control Module

The SMC-50 control module offers a full range of starting and stopping modes as standard:

- Soft Start with Selectable Kickstart
- Soft Stop
- Current Limit Start with Selectable Kickstart
- Sensorless Linear Acceleration
- Sensorless Linear Deceleration
- Pump Control (Start and Stop Control modes)
- Torque Control Start
- Dual Ramp Start
- Full Voltage Start (Emergency Run)

Other features that offer further user benefit include:

- Extensive protection and diagnostic features
- Metering
- Communication capability
- I/O

These modes, features and options are further described in this chapter.

Starting Modes

| Starting Mode | Page |
|---|------|
| Soft Start | 19 |
| Sensorless Linear Speed Acceleration | 20 |
| Torque Control Start | 21 |
| Current Limit Start | 21 |
| Selectable Kickstart | 21 |
| Pump Control Mode | 22 |
| Dual Ramp Start | 24 |
| Emergency Bypass Run (Full Voltage Start) | 24 |

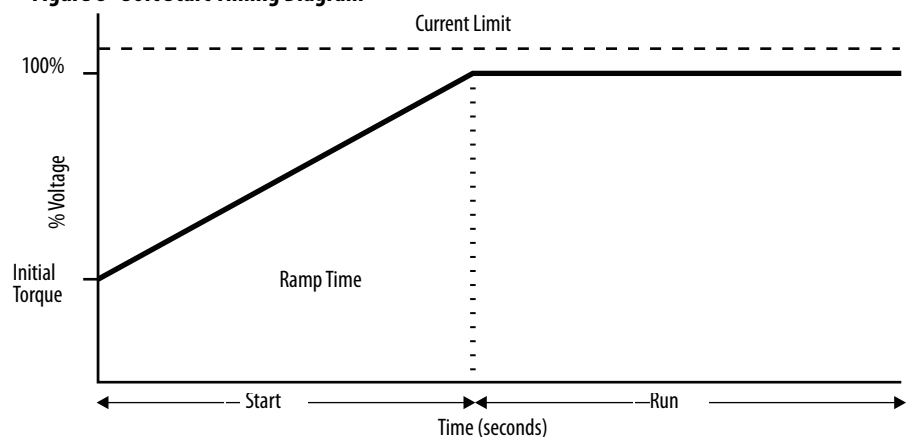
TIP For any of the following starting modes, the motor only accelerates in the programmed time if that time and the current limit setting is appropriate for the connected load. If the set time is too short, or the load is too great, the motor will take longer to reach full speed.

Soft Start

This method covers the most general applications. The motor is given an initial torque setting, which is user adjustable. From the initial torque level, the output voltage to the motor is steplessly increased (ramped) during the acceleration ramp time, which is user-adjustable. A user-adjustable current limit value is also available. This limits the current throughout the soft start.

TIP A motor's torque curve is not a linear function and depends on both applied voltage and current. As such, if the soft starter ramped voltage applied to the motor is sufficient for it to develop torque high enough to overcome the inertia of the load, the motor could quickly accelerate to full speed in less than the configured ramp time when using the Soft Start mode.

Figure 8 - Soft Start Timing Diagram



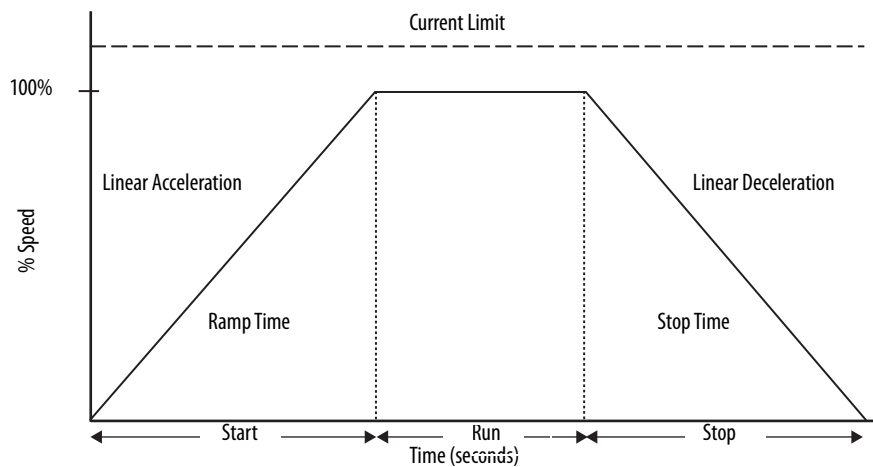
Sensorless Linear Speed Acceleration

With this type of starting mode, the motor acceleration is at a constant rate. The controller accelerates the motor in a linear fashion from the off (0 speed) condition to full speed condition in the time configured in the user-defined ramp time. This is done using a proprietary motor speed feedback algorithm to sense motor speed.

- NOTE: An external speed sensor is NOT required.

This starting mode presents the least amount of stress on mechanical components. An initial torque value is configured to define a motor starting value. A current limit value is also available to limit the starting current throughout the linear acceleration start maneuver.

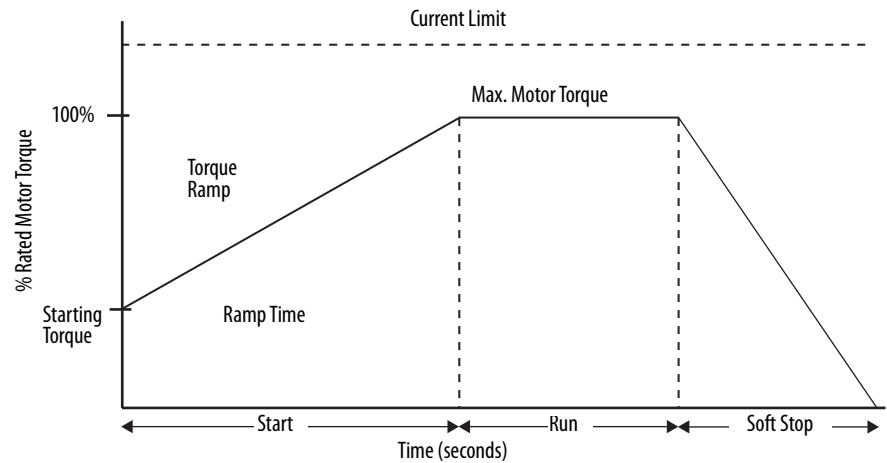
Figure 9 - Linear Speed Acceleration Timing Diagram



Torque Control Start

This method provides a torque ramp from a user-adjustable, initial motor starting torque to a user-adjustable, maximum torque over the defined starting ramp time. The torque control mode provides a more linear starting ramp than a soft start, potentially resulting in less stress on mechanical components and a more time controlled ramp. A current limit value is also available to limit the starting current throughout the torque start.

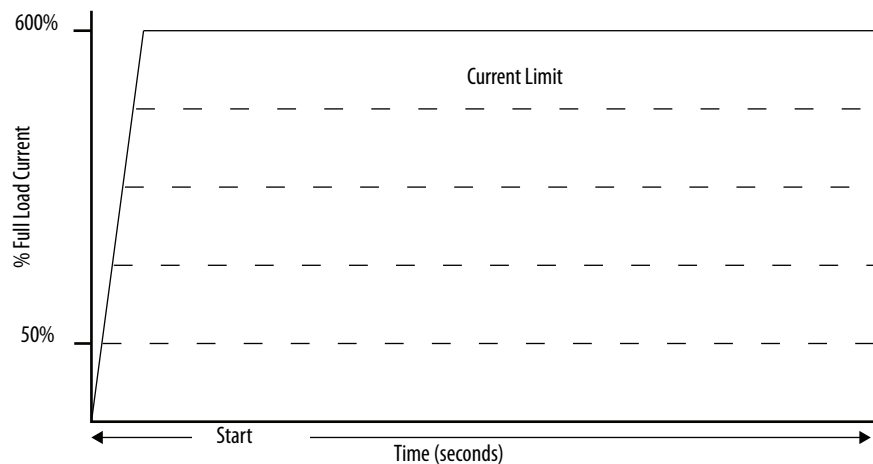
Figure 10 - Torque Control Start Timing Diagram



Current Limit Start⁽¹⁾

This method provides a current limit controlled start by maintaining a constant current to the motor and is used when it is necessary to limit the maximum starting current. The starting current and current limit starting ramp time is user-adjustable. Current Limit Start can also be used in conjunction with Soft Start, Torque Control, and Linear Speed Acceleration Starts.

Figure 11 - Current Limit Start Timing Diagram

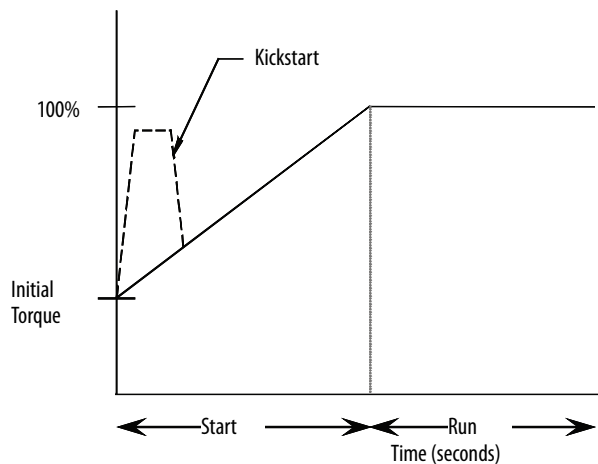


(1) Kickstart is also available with Current Limit Start and Dual Ramp Start.

Selectable Kickstart

Selectable kickstart provides a power boost at start-up that is user-adjustable from 0...90% of locked rotor torque. The additional power helps motors generate higher torque to overcome the resistive mechanical forces of some applications when they are started. The selectable kickstart time is user-adjustable from 0.0...2.0 seconds.

Figure 12 - Selectable Kickstart



Pump Control Mode

This mode is used to reduce surges in a fluid piping system and the resulting fluid hammer or check valve slam caused by starting a centrifugal pump at full voltage and full speed. This mode also reduces pump cavitations, increasing pump life. To provide these benefits, the SMC-50 module's microprocessor generates a motor starting curve which follows the starting characteristics of a centrifugal pump and monitors operation during start to ensure reliable pump starts.

1. Consult factory if start time settings over 30 seconds are required. See [Appendix B](#) for controller duty cycle ratings.
2. The Pump Control option functions only for centrifugal pumps. It is not suited for positive displacement, piston, or other types of pumps.
3. The Pump Stop option functions only for a centrifugal pump running at greater than approximately 2/3 of the motor rated horsepower.
4. Pump applications with input and/or output valves that are closed during starting and/or stopping may not benefit from the Pump Control option. Consult the factory for applications with valves.
5. For starting or stopping times longer than 15 seconds, power fuse selection should be reviewed to ensure no element damage occurs. The fuse minimum melting time-current characteristic curve should be consulted to ensure that, at 1.1 times the full voltage locked rotor current of the motor, the actual starting or stopping time does not exceed 75% of the fuse melting time.

6. Motor overload and/or upstream breaker settings may have to be adjusted to allow the starting or stopping current to flow for extended periods.

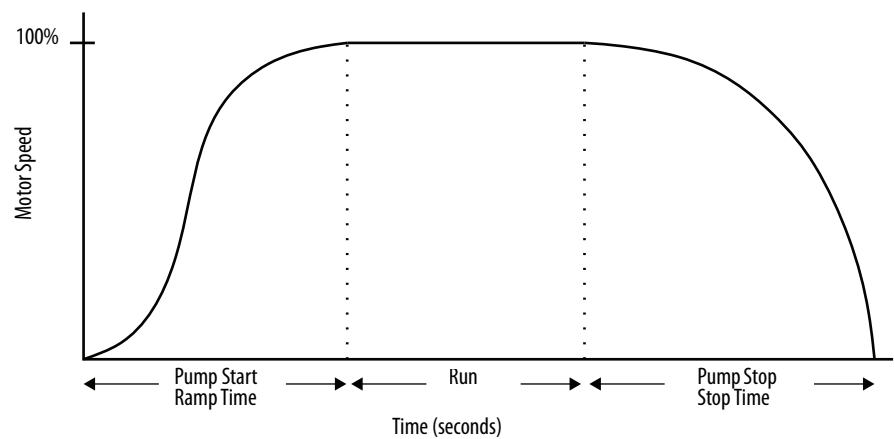


ATTENTION: Pump stopping is not intended to be used as an emergency stop. Refer to the applicable standard for emergency stop requirements.



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.

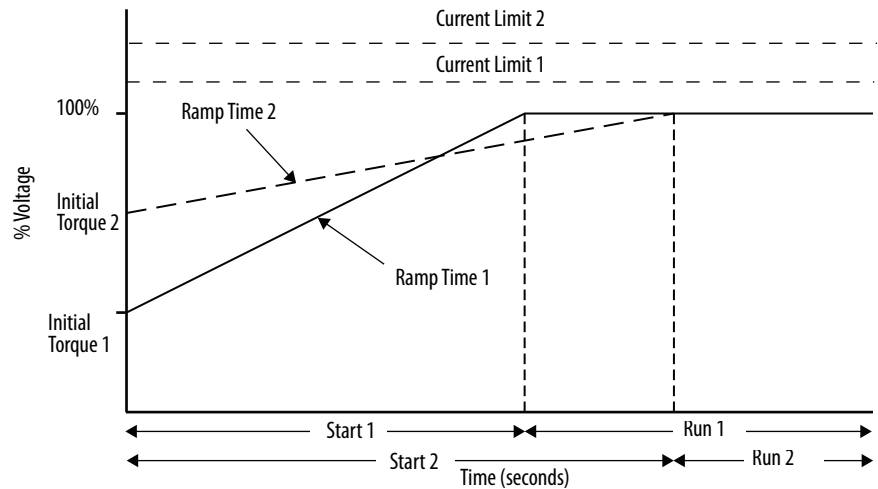
Figure 13 - Pump Control Mode Timing Diagram



Dual Ramp Start⁽¹⁾

This method is useful on applications with varying loads, starting torque, and start time requirements. Dual Ramp Start gives you the ability to select between two separate start profiles via any programmable auxiliary input. Each start profile can use any of the available starting modes.

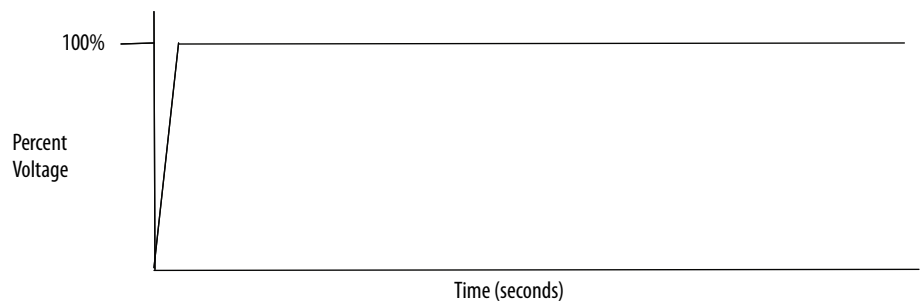
Figure 14 - Dual Ramp Start Timing Diagram



Emergency Bypass Run (Full Voltage Start)

This starting mode is used to provide ‘Emergency Bypass Run’ when Power switching devices are faulted (for example, shorted SCRs) and any of the soft starting modes cannot be utilized. When programmed for ‘Emergency Bypass Run’, a ‘Start’ command will first close the bypass contactor, then the line contactor for an across-the-line (Full voltage) start of the motor. A ‘Stop’ command will open the line contactor first and allow the motor to coast, regardless of the programmed ‘stop mode’.

Figure 15 - Emergency Bypass Start



(1) Kickstart is also available with Current Limit Start and Dual Ramp Start.

Stopping Modes

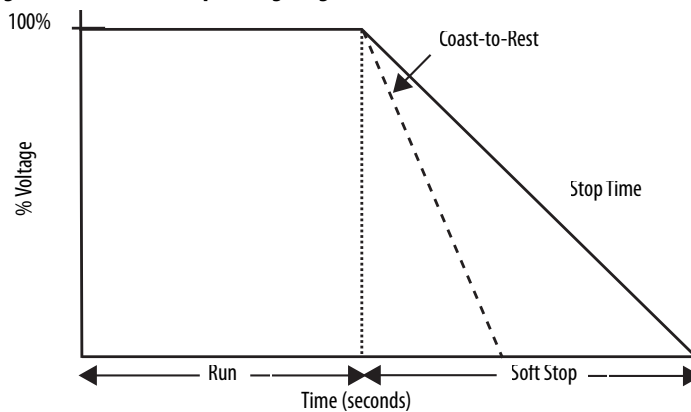
The SMC-50 Smart Motor Controller provides the following Stopping Modes of operation as standard.

| Stopping Mode | Page |
|---------------------------|------|
| Coast | 25 |
| Soft Stop | 25 |
| Linear Speed Deceleration | 26 |
| Pump Stop | 27 |

Coast

Configuring the stop mode to coast sets the controller to perform a motor coast-to-stop maneuver.

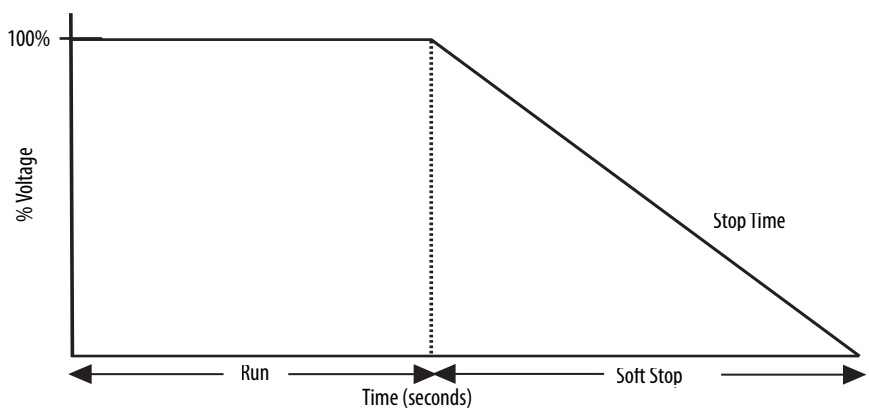
Figure 16 - Coast-to-Stop Timing Diagram



Soft Stop

The Soft Stop mode can be used in applications requiring an extended stop time. The voltage ramp down time is user-adjustable from 0...999 seconds. This load stops when the programmed stop time has elapsed or the voltage ramp drops to a point where the load torque is greater than the motor torque.

Figure 17 - Soft Stop Timing Diagram



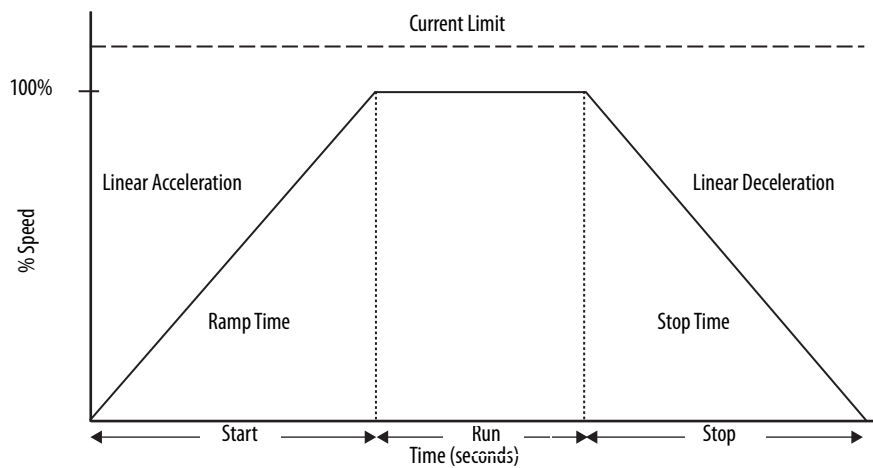
Linear Speed Deceleration

Configuring the motor stop mode to Linear Speed Deceleration mode commands the motor to stop from full speed to zero speed following a linear ramp based on the user-configured stop time. A current limit value is also available to limit the stopping current throughout the Linear Speed Deceleration maneuver.



ATTENTION: Linear deceleration is not intended to be used as an emergency stop. Such usage may result in severe injury or death. Refer to the applicable standards for emergency stop requirements.

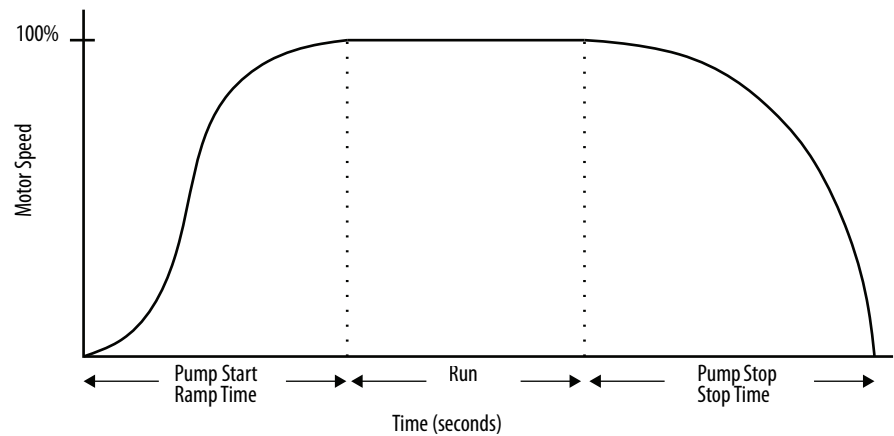
Figure 18 - Linear Speed Deceleration Timing Diagram



Pump Stop

Just as starting a centrifugal pump at full voltage causes fluid hammer and check valve slam, stopping a centrifugal pump that is running at full speed can also produce the same results. The SMC- 50 module's Pump Stop mode generates a motor stop curve, which follows the stop characteristics of a centrifugal pump. This results in the gradual decrease in motor speed.

Figure 19 - Pump Stop Timing Diagram



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.

IMPORTANT Energy Saver Run operation and Motor Winding heater operation are not offered for use in MV applications. Consult the factory for further assistance.

Motor and Starter Protection Features

The SMC-50 control module provides both motor and starter alarms and faults. An alarm condition is intended to provide an alert that a potential system issue, or fault is pending to allow time to take corrective action. A fault is intended to protect equipment from damage by shutting that equipment down and/or removing power. The SMC-50 module lets you individually enable or disable motor and starter alarms and faults by bit (On/Off) selection. Alarm and fault trip points are typically user-configurable to allow for application dependence. In addition, many alarms and faults provide a separate user-configurable alarm and fault time delay parameter to limit nuisance trips and shutdowns.



The SMC-50 module has a separate Fault Buffer and Alarm Buffer to maintain a Fault/Alarm history. In addition to the fault/alarm code and description, a time and date stamp is provided by the SMC-50 controller's Real Time Clock (RTC). The Fault Buffer holds the last five faults which provide the time and date; the Alarm Buffer holds the last 100 alarm events which detail the time, date, parameter change, Start, Stop, Coast, Operation, Alarm, Fault, and Fault Reset.

As standard, the SMC-50 module enables manual reset of a fault from the PUSH-TO-RESET/HOLD-TO-TEST button, located adjacent to the LED status indicator. Fault indication and reset can also be performed from a panel-mount HIM or from PC software (such as Connected Components Workbench™ software).

| Protection Feature (ANSI/IEEE Device Number) | Page |
|--|------|
| Overload Protection (49) | 29 |
| Underload Protection (37) | 31 |
| Undervoltage Protection (27) | 31 |
| Overvoltage Protection (59) | 31 |
| Voltage Unbalance Protection (47) | 32 |
| Current Imbalance (46) | 32 |
| Stall Protection and Jam Detection (48) | 32 |
| Ground Fault (50G/51G) | 33 |
| Open Gate | 34 |
| Line Faults with Phase Indication (46) | 34 |
| Excessive Starts/Hour (66) | 35 |
| Overtemperature (23) | 35 |
| Overcurrent Protection (50/51) | 35 |
| Total Harmonic Distortion (THD) Fault and Alarm (68) | 35 |

Overload Protection

The SMC-50 control module meets applicable requirements as a motor overload protection device. Thermal memory provides added protection and is maintained even when control power is removed. The built-in overload algorithm controls the value stored in Parameter 18, Motor Thermal Usage (see [Chapter 4](#)). An Overload Fault will occur when this value reaches 100%. The parameters below provide application flexibility and easy setup.

| Parameter | Range |
|----------------|---------------|
| Overload Class | 5...30 |
| Overload Reset | Manual – Auto |
| Motor FLC | 1...2200 A |
| Service Factor | 0.01...1.99 |

If the SMC-50 is used to control a multi-speed motor, or more than one motor, the Overload Class parameter must be programmed to “OFF” and separate overload relays must be supplied for each speed/motor. The trip rating is 118% of the programmed FLC.

[Figure 20](#) and [Figure 21](#) provide the typical overload trip curves for the available trip classes.

Figure 20 - Overload Trip Curves

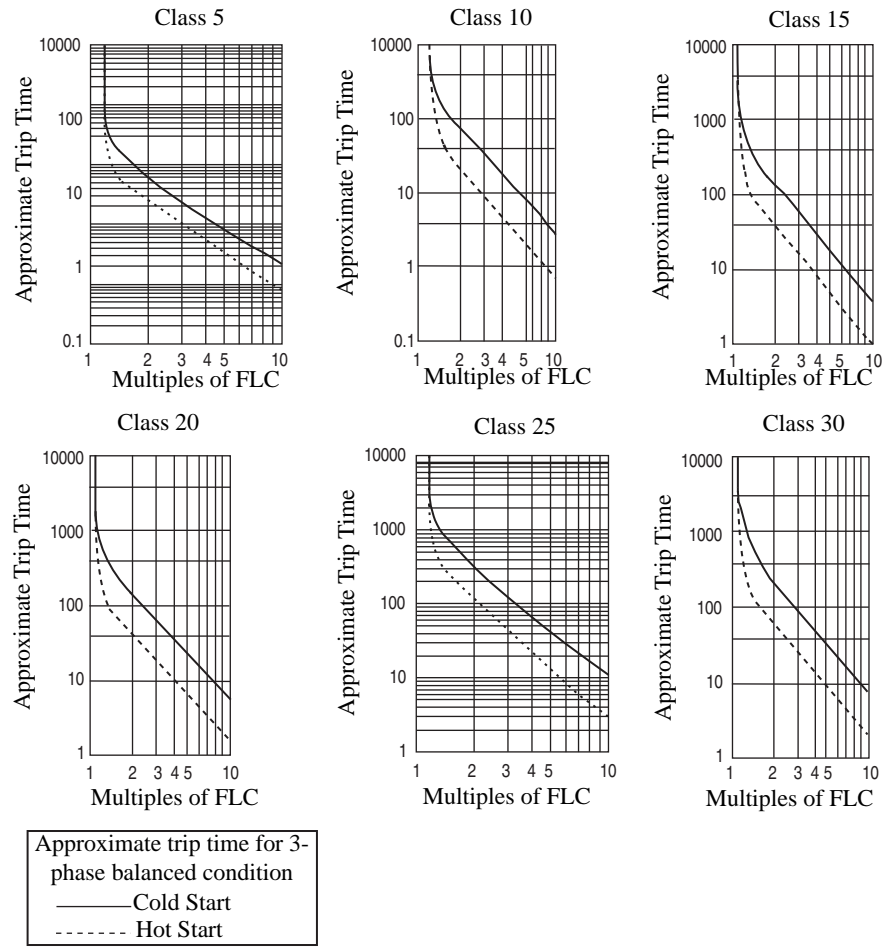
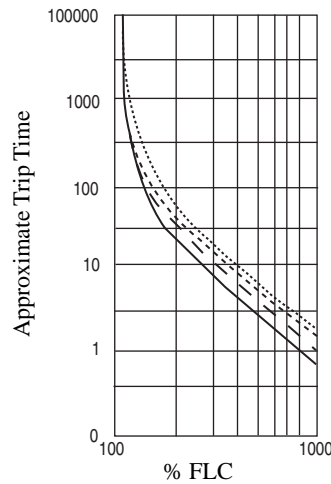


Figure 21 - Restart Trip Curves after Auto Reset



| Trip Class | Auto Reset time [s] | |
|------------|---------------------|-----|
| — | 10 | 90 |
| - - - | 15 | 135 |
| | 20 | 180 |
| - · - · - | 30 | 270 |

Underload Protection

Utilizing the underload protection of the SMC-50 module, motor operation can be halted if a sudden drop in current is sensed.

The SMC-50 control module provides an adjustable underload trip setting from 0...99% of the programmed motor full load current rating. Trip delay time can be adjusted from 0...99 seconds.

Undervoltage Protection

Utilizing the undervoltage protection of the SMC-50, motor operation can be halted if a sudden drop in voltage is detected.

The SMC-50 module provides an adjustable undervoltage trip setting from 0...99% of the programmed motor voltage. Trip delay time can be adjusted from 0...99 seconds.

TIP For medium voltage applications, undervoltage protection should be set from 80...99%.

An alarm (pre-fault) indication level can be programmed to indicate the unit is getting close to faulting. The alarm modification information is displayed through the HIM, Communication (if applicable), and alarm contact closing.

Overvoltage Protection

Utilizing the overvoltage protection of the SMC-50, motor operation can be halted if a sudden increase in voltage is detected.

The SMC-50 module provides an adjustable overvoltage trip setting from 100...199% of the programmed motor voltage. Trip delay time can be adjusted from 0...99 seconds.

TIP For medium voltage applications, overvoltage protection should be set from 100...115%.

An alarm (pre-fault) indication level can be programmed to indicate the unit is getting close to faulting. The alarm modification information is displayed through the HIM, Communication (if applicable), and alarm contact closing.

Voltage Unbalance Protection

The SMC-50 module is able to detect an unbalance in line voltages. Motor operation can be halted if the unbalance is greater than the desired range.

The SMC-50 module provides an adjustable unbalance setting from 1...25% of the line voltages. Trip delay time can be adjusted from 0...99 seconds.

An alarm (pre-fault) indication level can be programmed to indicate the unit is getting close to faulting. The alarm modification information is displayed through the HIM, Communication (if applicable), and alarm contact closing.

Current Imbalance

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, which results in degradation of the motor insulation and reduction in life expectancy. Rapid current imbalance fault detection helps to extend the motor's life expectancy and minimize potential damage and loss of production.

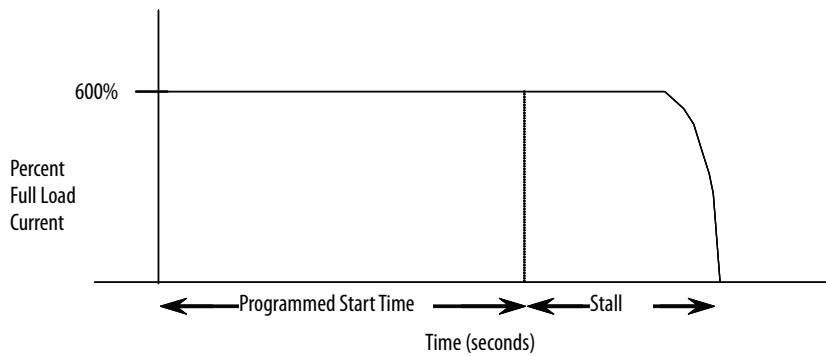
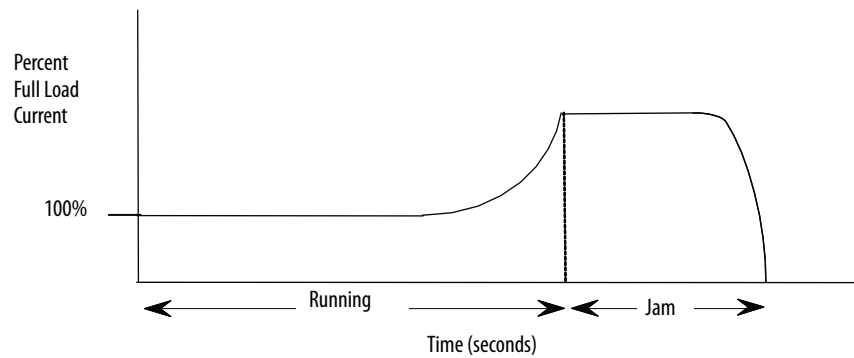
The current imbalance calculation is equal to the largest deviation of the three current signals (RMS phase current) from the average phase current, divided by the average phase current. Note that the power pole current is used for the current imbalance calculation.

Current imbalance setting is adjustable from 1...25% of the phase current. Trip delay time can be adjusted from 0...99 seconds. This protection is also available when motor is at speed.

Stall Protection and Jam Detection

The SMC-50 control module provides both stall protection and jam detection for enhanced motor and system protection.

- Stall protection is user-adjustable from 0.0...10.0 seconds (This feature is enabled by Default and delay time set at 1 s).
- An alarm (pre-fault) indication level can be programmed to indicate the unit is getting close to faulting. The alarm modification information is displayed through the HIM, Communication (if applicable), and alarm contact closing.
- Jam detection allows the user to determine the jam level (up to 1000% of the motor's full-load current rating) and the delay time (up to 99.0 s) for application flexibility.

Figure 22 - Stall Protection**Figure 23 - Jam Detection**

Ground Fault

For grounded power systems (solid or impedance grounded), core-balanced current sensors are typically used to detect low level ground faults caused by insulation breakdowns or entry of foreign objects. Detection of such ground faults can be used to interrupt the system to prevent further damage, or to alert the appropriate personnel to perform timely maintenance.

The SMC-50 module can provide ground fault indication when used with the 150-SM2 Option Module and an external core balance current transformer.

Open Gate

An open-gate fault indicates that improper SCR firing, typically caused by an open SCR gate or driver system, has been detected on one of the power poles. Before the controller shuts down, it will attempt to start the motor a total of three times (or as programmed in Parameter 133).

An open gate is detected when the module sends a gate signal to the SCRs but does not detect that they turned on. SCR turn-on is detected when the voltage across the leg (L-T) collapses. The Open Gate detection is active during starting or stopping only.

Line Faults with Phase Indication

The SMC-50 control module continually monitors line conditions for abnormal factors. Pre-start protection includes:

- Line Fault (with phase indication)
 - Line voltage loss
 - Missing load connection
 - Shorted SCR

Running protection includes:

- Line Fault (no phase indication)
 - Line voltage loss
 - Missing load connection

Phase reversal protection⁽¹⁾ can be toggled either ON or OFF.

The SMC-50 control module can individually identify and provide a Fault and or Alarm if a power line loss occurs on any phase.

TIP 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.

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

(1) Phase reversal protection is functional only at pre-start.

Excessive Starts/Hour

The SMC-50 module allows the user to program the desired number of starts per hour (up to 99). This helps eliminate motor stress caused by repeated starting over a short time period.

TIP Refer to [Appendix B on page 241](#) for duty cycles of the controller highlighting recommended starts per hour.

Overtemperature

The power module temperature is monitored during starting and stopping maneuvers by thermistors. The thermistor is connected to the gate driver board where it is processed, and the status is transmitted by fiber-optic cable through the interface board to the control module. When an overtemperature condition exists (>85 °C), the control module trips and indicates a “PTC Power Pole” fault.

An overtemperature condition could indicate high ambient temperature, overloading or excessive cycling. After the power module temperature is reduced to allowable levels, the fault can be cleared (see [Troubleshooting on page 157](#) for instructions).

Overcurrent Protection

This feature provides protection to the controller from high level of current during starting and stopping. The trip level is hard-coded to be 9 times of the controller's rated current and this protection cannot be disabled. Also, SMC provides user-adjustable overcurrent trip level through Parameter 351 (800% to 1000% of motor FLC). This user-adjustable overcurrent trip can be enabled or disabled through Par 230 overcurrent bit.

Total Harmonic Distortion (THD) Fault and Alarm

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

The SMC-50 control module lets you read power line THD which is the average of 32 line frequency harmonics. The calculation for THDI and THDV (THD_x) is:

$$\text{THD}_x = \sqrt{\frac{(\text{THD}_2^2 + \text{THD}_3^2 \dots \text{THD}_{31}^2)}{\text{THD}_1}}$$

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 1 - THD Parameter List

| Parameter Number | Parameter Name ⁽¹⁾ | Minimum/Maximum Value | Default Value | Access | Units |
|------------------|-------------------------------|-----------------------|---------------|--------|-------|
| 118 | THD V F Lvl | 0.0...1000.0 | 1000.0 | R/W | % |
| 119 | THD V F Dly | 0.1...99.0 | 0.1 | | SECS |
| 120 | THD V A Lvl | 0.0...1000.0 | 1000.0 | | % |
| 121 | THD V A Dly | 0.1...99.0 | 0.1 | | SECS |
| 122 | THD I F Lvl | 0.0...1000.0 | 1000.0 | | % |
| 123 | THD I F Dly | 0.1...99.0 | 0.1 | | SECS |
| 124 | THD I A Lvl | 0.0...1000.0 | 1000.0 | | % |
| 125 | THD I A Dly | 0.1...99.0 | 0.1 | | SECS |

(1) As displayed on the HIM or Connected Components Workbench configuration tools.

Metering

Metering System

Power and operational monitoring parameters include:

- **Current**—The RMS current value is provided for each phase, plus the average current of all three.
- **Voltage**—The RMS line-to-line and line-to-neutral voltage values are provided while the motor is running and when stopped. The average of all three is also provided.
- **Line Frequency**—The SMC-50 control module measures and provides user access to the line frequency (Hz).
- **Power**—Real, reactive, and apparent power values are calculated for each phase plus the total for all 3 phases. In addition, the current power demand and the maximum power demand is provided.
- **Power Factor**—The value of the power factor is provided for each phase and as a total of all three.
- **Peak Starting Current**—The SMC-50 control module stores the peak average RMS motor current consumed for the last 5 start cycles.
- **Total Harmonic Distortion (THD)**—The SMC-50 control module calculates and provides user access to the THD for the 3 line voltages and 3 motor currents, along with the average value of each.
- **Voltage Unbalance**—The calculation of the voltage unbalance signal is provided.
- **Current Imbalance**—The calculation of the current imbalance signal is provided.
- **Motor Torque**—Electromechanical motor torque is calculated based on current and voltage sensing from the motor.

- **Motor Speed**—The SMC-50 control module provides a calculated estimate of motor speed in percent of full speed when operating in the linear speed acceleration starting or deceleration stopping mode.
- **Elapsed Time and Elapsed Time 2**—An elapsed time meter is provided to account for the total accumulated hours the motor has been running. You can reset the meter. Elapsed Time 2 cannot be user reset and holds after 50,000 hours have elapsed.
- **Running Time**—The running time meter accumulates time (in hours) from the point the motor start command is given up to the point the motor stop command is issued. When a new start command is given, the meter resets to zero and begins accumulating time again.
- **Actual Start Time**—The unit stores the actual time it takes to complete a start cycle (motor start command issued until motor is up-to speed). The last five start times are stored as parameters for user access and in the Alarm Buffer as events.
- **Total Starts**—The total starts counter increments on every successful start (no prestart fault occurred) and cannot be reset. The maximum value is 65,635.

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 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 control module 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%.

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.

Motor thermal capacity usage is determined by the built-in electronic thermal overload. An overload fault occurs when this value reaches 100%.

Inputs and Outputs

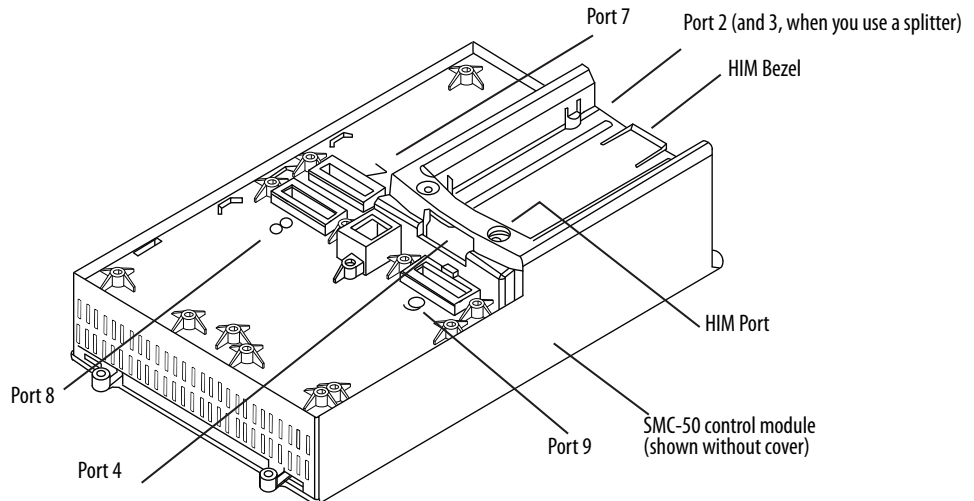
The SMC-50 control module has the ability to accept up to two (2) inputs and two (2) outputs controlled over a network. The two inputs are +24V DC rated (Input #1, terminal 10 and Input #2, terminal 11). Input #1 is used for the Emergency Run function. Input #2 is available and a contact could be inserted between terminal 12 and terminal 11 to realize certain function as expected. For these two inputs, see [Chapter 4](#) for the parameter settings and [Chapter 7](#) for bit identification.

The two outputs are Aux #1 and Aux #2. Aux #1 is programmed to be 'Ext. Bypass' Aux #2 is programmed to be 'Normal' all the time.

TIP For MV applications, refer to [Status Indication on page 40](#) for additional details. I/O used for the start and stop command are from the 150-SM4 option module.

Communication Interface

Figure 24 - SMC-50 Controller Control Module—Shown without Cover



Device Peripheral Interface (DPI) Protocol

The SMC-50 soft starter communicates in the same manner as the drive products using the DPI™ protocol. This enables almost any DPI-supported Human Interface Module (HIM), PC software (such as Connected Components Workbench™ software), or network communications module (20-COMM-xx) to be used with the SMC-50 control module. The SMC-50 module supports four DPI ports for communication devices. Port #1 is located in the module bezel for the front-mounted HIM. Port #2, located on the top of the module, supports a second and third device via Port #3 when a DPI splitter is used. Port #4, located directly below the module bezel, is dedicated to a 20-COMM-xx network communications module when inserted into the space allotted for module option Port #9. All four communication ports can be used simultaneously.

DeviceLogix

DeviceLogix™ is an embedded control technology in selected Allen-Bradley products that can control outputs and manage status information on board a device. The SMC-50 control module with DeviceLogix technology can help improve system performance and productivity by controlling outputs and managing status and information within the SMC-50 module. Processing information within the controller can speed up reaction time, which reduces dependency on network throughput and provides an option for decision making if communication with the main control module is lost.

Programming

Figure 25 shows how to connect a HIM and DPI device to the SMC-50 control module. Table 2 provides a description of each port.

TIP The SMC-50 control module 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 25 - SMC-50 Control Module with a HIM

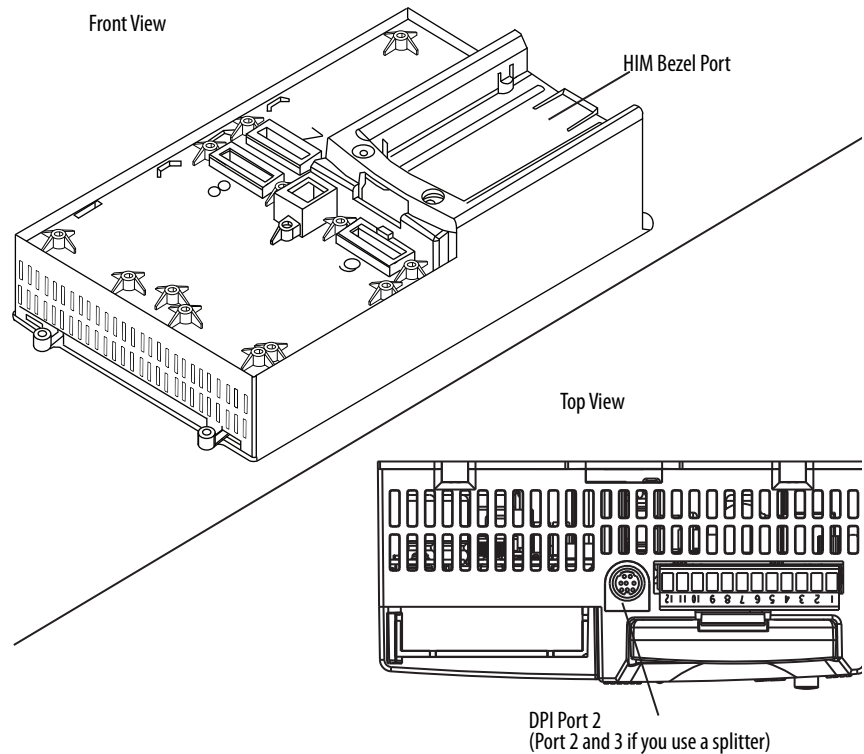


Table 2 - Description of Ports

| DPI Port Number | Source |
|------------------|---|
| 1 | Front-Mounted HIM (HIM Bezel) |
| 2 | Remote DPI (top of SMC-50 control module) |
| 3 | Remote DPI (top of SMC-50 control module with splitter) |
| 4 ⁽¹⁾ | 20-COMM-x Module |

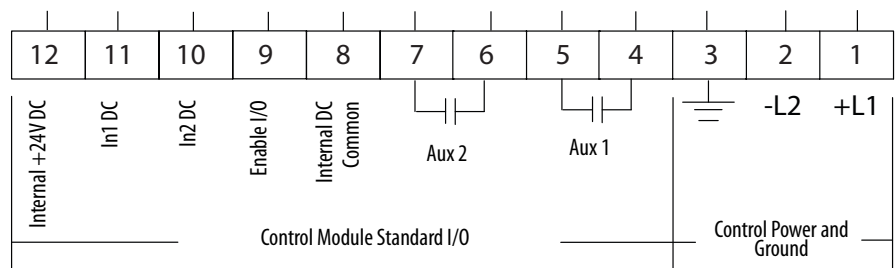
(1) When using a 20-COMM-x network communication module, it must physically be located in control module hardware port 9. However, its DPI Port Number assignment is 4. The cable connection for the DPI Port 4 is located below the HIM bezel (see Figure 25).

Status Indication

All auxiliary contacts can be programmed as NO or NC. The contact without a suffix indicates a NO state (Normal). A contact followed by NC indicates a normally closed state (Normal NC).

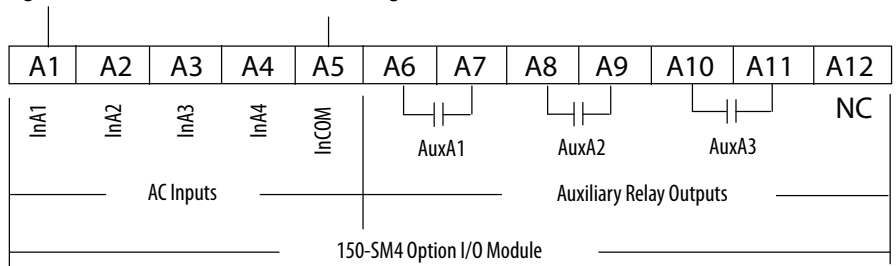
| State | Description |
|------------------------------------|--|
| Normal/Normal NC | The contact state changes when the unit receives a Start/Stop signal. |
| Up-to-Speed/Up-to-Speed NC | The contact state changes when the motor approaches rated speed. |
| Alarm/Alarm NC | The contact state changes when an Alarm condition is detected. |
| Fault/Fault NC | The contact state changes when a Fault condition is detected. |
| Network Control/Network Control NC | The contact state is controlled over the network. (Refer to SMC-50 Control Module—Bit Identification on page 140 , which describes logic command word to control auxiliary outputs). |
| External Bypass | This contact controls the Bypass contactor for MV applications. |
| External Brake | The contact state changes when the external braking command is active and opens when it is not active Aux. Control: The contact state changes when an auxiliary output is configured for Aux. Control. |

Figure 26 - Control Terminals - SMC-50 Control Module



- The Aux #1 contact is always programmed for External Bypass (NO) to control the bypass contactor in MV applications.
- The Aux #2 contact is always configured as Normal (NO) to control the line contactor for MV applications.
- In1 DC is typically programmed for Emergency Run in MV Applications

Figure 27 - Control Terminals - 150-SM4 Digital I/O Card (Slot 7)



- Input #A1 is typically programmed for 'Start' in MV applications.
- Input #A2 is typically programmed for 'Stop Option' in MV applications.
- Input #A3 is typically programmed for 'Coast' in MV applications.
- Aux #A1 is typically programmed for 'Fault' in MV applications.

Hardware Description

The following sections contain descriptions of system components and system operation. Each section will be described to give the user an understanding of the SMC-50 to facilitate operation and maintenance of the system. Refer to [Figure 29](#) and [Figure 30](#), Typical SMC-50 Power System.

Power Module

The controller consists of three power modules, one for each phase. Each power module consists of incoming and outgoing terminals for cables, SCRs, heatsink and clamp assembly. The SCRs are connected in inverse parallel (and in series for 12- or 18-SCR assemblies) to form a three-phase, AC line controller configuration.

Each power module includes a snubber circuit to limit the rate of rise in voltage across each SCR pair. The module also includes patented current loop gate driver circuits which derive their power primarily from the snubber circuit.

Voltage sharing resistors are connected across each SCR pair to provide static voltage balance for series-connected SCRs. These resistors are tapped to provide a reference for overvoltage protection circuitry on the gate driver board.

A voltage sensing board is used to reduce the line-side and load-side voltages to lower levels that can be measured by the SMC-50 control module.

Current Loop Gate Driver (CLGD) Board

This board provides the turn-on capability for SCR devices. The board also provides optical fiber isolation between itself and the gating source logic. It is primarily powered by recovering energy from the snubber circuit, so it is fully isolated from the control and logic circuits. The board also receives short-term power from the current loop power supply.

The SMC-50 has three heatsinks fitted with a thermistor to monitor temperature rise. The circuitry on the gate driver board accepts the thermistor, and drives a fiber-optic cable if the temperature is below the setpoint (85 °C). If the temperature rises above the setpoint, the driver is turned off, and the SMC-50 is signaled to stop gating and initiate a temperature fault.

Interface Board

This circuit board takes current transformer signals plus line-side and load-side voltage sensing signals from the voltage sensing board and passes them to the SMC-50 for processing. The control module produces gating signals for the SCRs, which are received on the interface board, and used to drive fiber-optic transmitters. The gating signals are sent to the gate-driver circuit board via fiber-optic cables. The interface board also receives temperature feedback from the gate-driver board via fiber-optic cable(s). If the heatsink temperature rises above a set value, a signal is sent to the SMC-50 to stop gating the SCRs and initiate a temperature fault.

For a detailed layout of this circuit board, refer to [Figure 37 on page 76](#).

Figure 28 - PowerBrick Cart Assembly Schematic

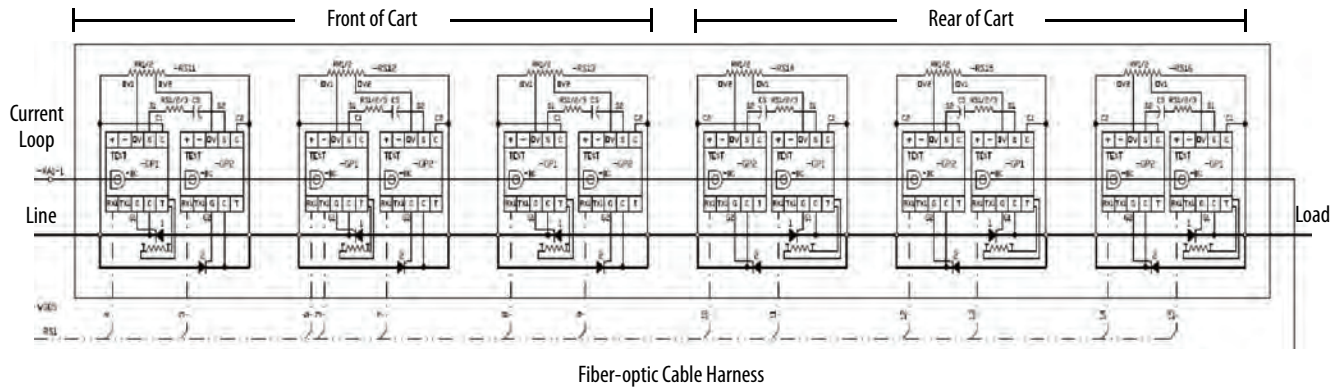


Figure 29 - Typical OneGear SMC-50 Power System – Bulletin 7763F

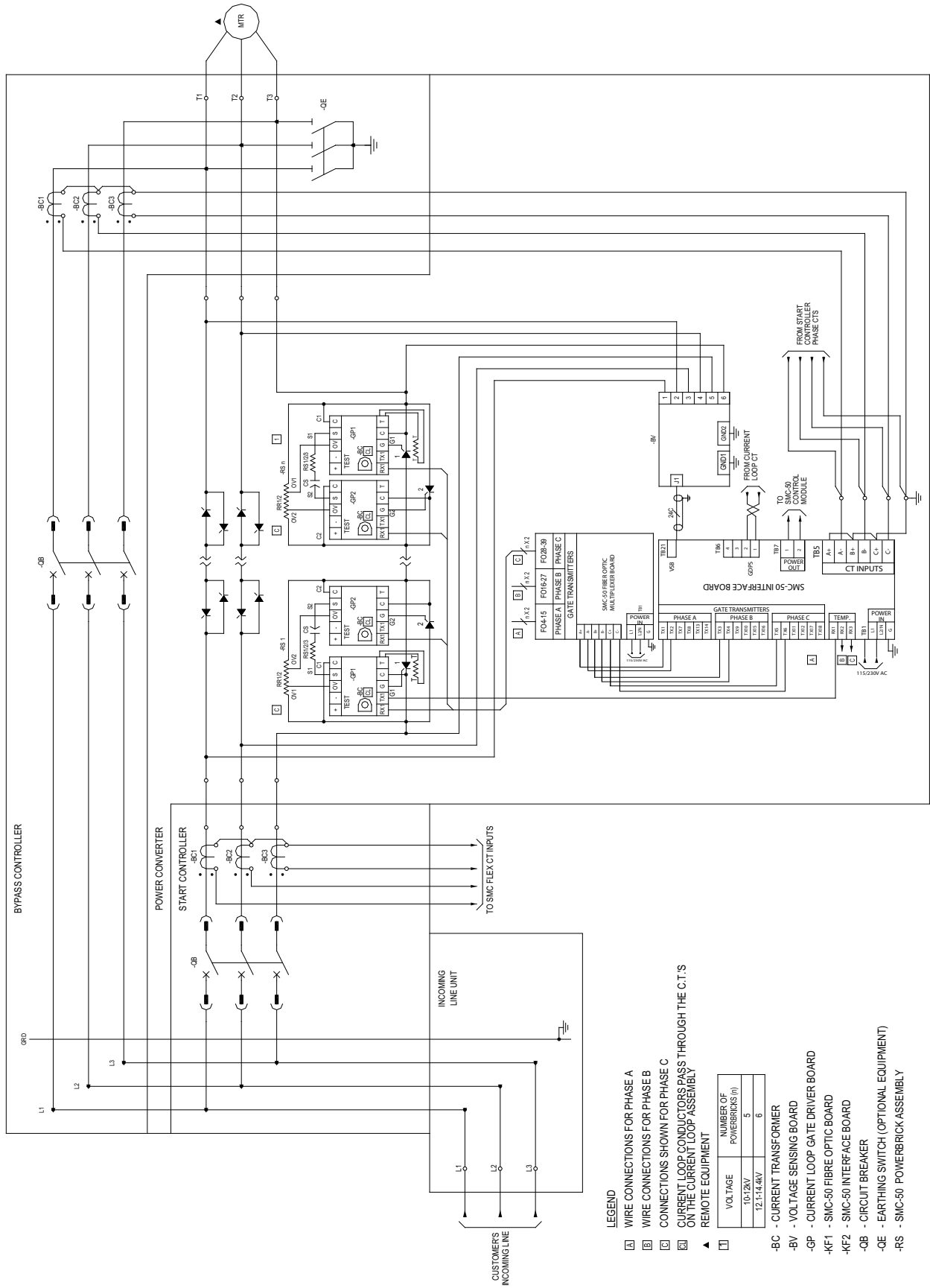
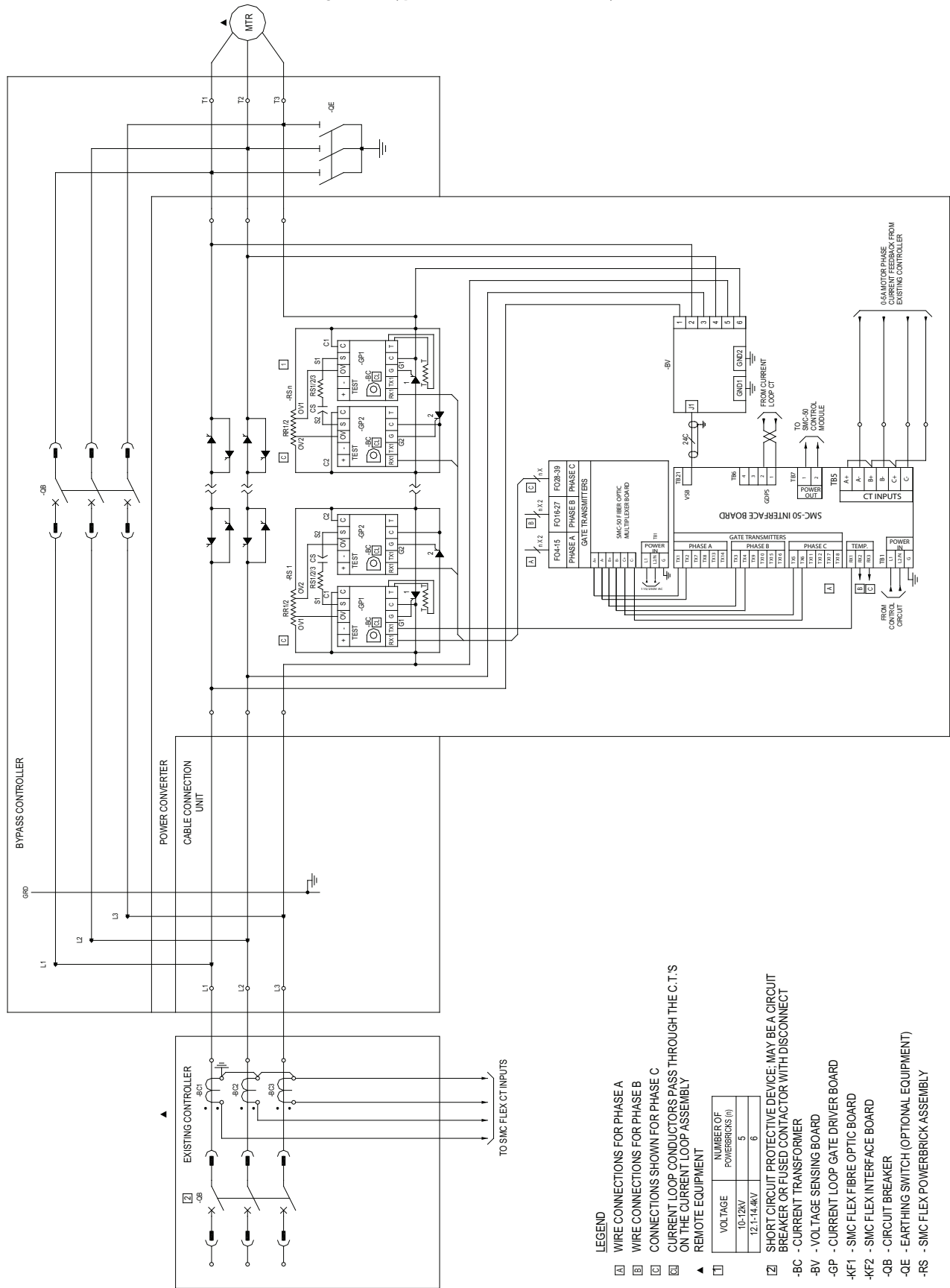


Figure 30 - Typical OneGear SMC-50 Power System – Bulletin 7760F



Functional Description

Bulletin 7762F and 7763F

When wired as shown in [Figure 31 on page 47](#), the controller operates as follows:

Pressing the 'Start' button initiates the start sequence. Relay '-KG1' closes and applies control power to terminal A1 of the SMC-50 module (-KF3). The 'AUX 2' contact (set for 'normal') closes, picking up '-KG3', which completes the hold-in circuit on the start button, and closes the start breaker (or contactor).

The SMC-50 module examines the line voltage, looks for fault conditions, checks phase rotation, calculates zero crossing information, and begins gating the SCRs to start the motor.

When the motor approaches rated speed, the SMC-50 module closes the 'AUX1' (External Bypass) or 'AUX A3' (Up-to-Speed) auxiliary contacts, closing relay '-KG2', which closes the bypass breaker. The motor then runs at full line voltage. External Bypass is used when the bypass breaker is positioned in parallel with the power electronics; Up-To-Speed is used when the bypass breaker is connected directly to the main bus.

When the 'Stop' button is pressed, the '-KG1' relay opens terminal A1 on the SMC-50 module. The 'AUX2' and 'AUX1' contacts open, which opens the start and bypass breakers, allowing the motor to stop, with whichever stop function has been programmed in the SMC-50 controller (Coast, Soft Stop, Pump Stop, etc.). If the bypass is around the power electronics, the bypass breaker will remain closed for a short time after the motor is stopped, only if a coast stop is performed. If the bypass comes from the main bus, the bypass opens with the stop command.

In order to do an option stop, the current loop must be functional, to precharge the gate driver circuits while in Bypass mode. If the current loop is not active, '-KG7' will not be closed, and will result in a Coast Stop when the motor is stopped, regardless of how the controller is programmed. An amber pilot light on the enclosure cover will indicate the status of the current loop. A contact from -KG7 can be used for remote signaling of the status.

If an option stop is programmed, and a coast stop is desired, an extra 'Coast Stop' command may be inserted in the 'A3' input rung of the SMC-50 controller.

If PFCCs are installed, the last rung controls the breaker. When a start command is given, '-KG1' closes, then '-KG3' closes. After the motor is up to speed and the Bypass breaker has closed, the -QB2' contact will close, which closes '-KG4' to close the PFCC breaker. If a stop command is given, or the 'Normal' command is opened, the PFCC breaker opens immediately to avoid interaction with the PowerBricks.

Bulletin 7760F

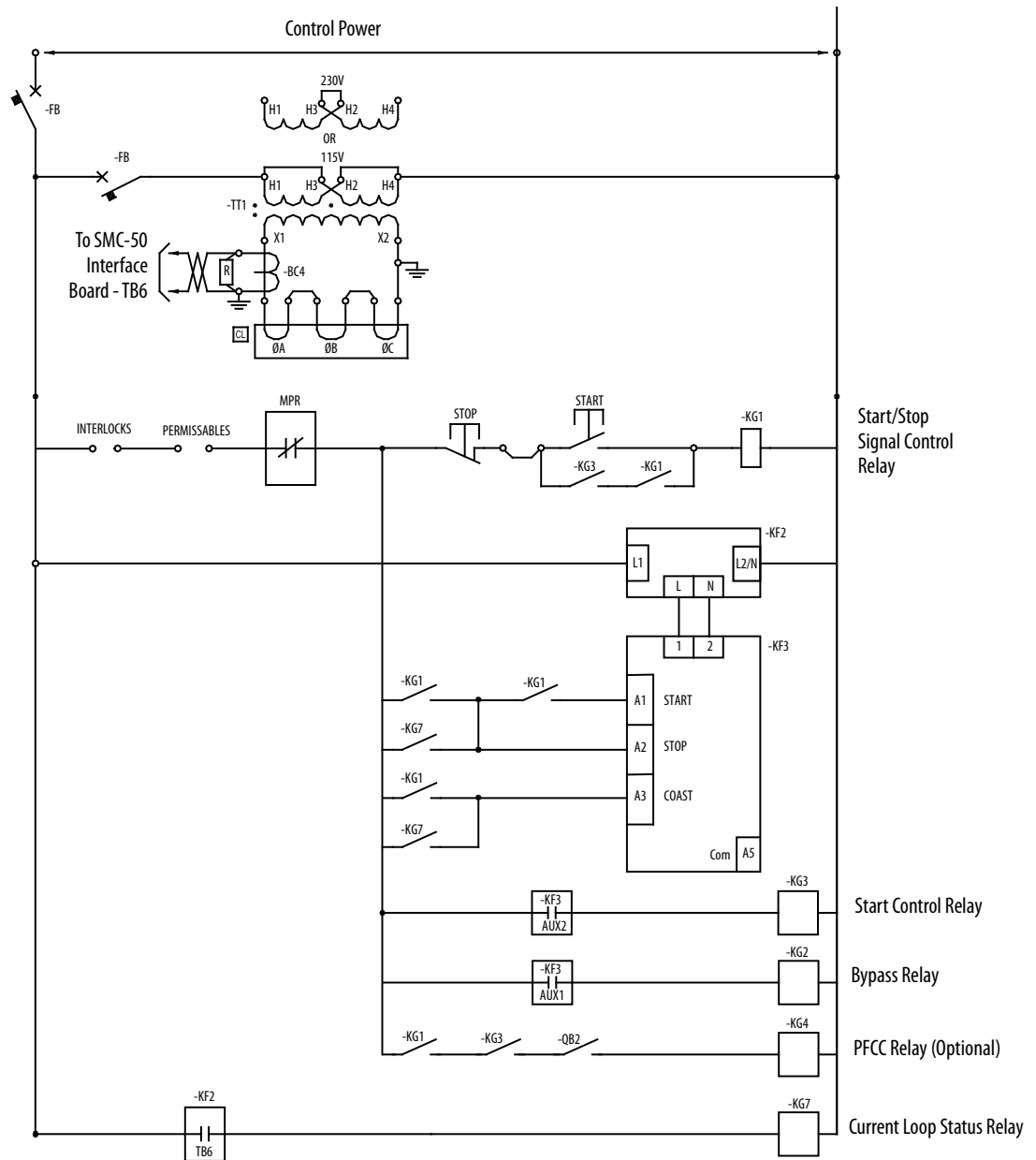
The Bulletin 7760F is intended for addition to an existing motor controller, which provides circuit isolation, motor switching, and overload and overcurrent protection. The control circuit for the combination of the existing controller and the Bulletin 7760F should be integrated so that it functions as described above, and in [Figure 31](#).

A start command in the existing controller should energize '-KG1'. Relay '-KG3' should be used to control the contactor or breaker in the existing controller.

A stop command from the existing controller should open '-KG1', and not open the existing contactor or breaker directly

The 'Fault' contact on the SMC-50 module must be wired into the existing controller to trip the main contactor (or breaker) in the event of a fault condition sensed by the SMC-50 module.

Figure 31 - Typical OneGear SMC-50 Control Circuit



Legend

- KF2 Interface Circuit Board
- KF3 SMC-50 Controller
- QB2 Bypass Circuit Breaker Auxiliary Contact
- CL Current Loop Conductors pass through the C.T.'s on the current loop assembly
- KG1 Start/Stop Signal Control Relay
- BC4 Current Loop Current Sensor
- FB Miniature Circuit Breaker or Control Fuse
- KG2 Bypass Controller Pilot Control Relay
- KG3 Start Controller Pilot Control Relay
- TT1 Current Loop Transformer

Notes:

Commissioning Procedure

Preliminary Setup

1. The work area must be clean and tidy. Pathways to the main disconnect and emergency stop push-button must be clear and unobstructed.
2. Prepare the following test equipment for use:
 - Test power supply, with each controller
 - Multimeters
 - Hi-Pot Tester (recommended) or insulation resistance tester
 - Oscilloscope with memory (optional)
3. Complete the drawing package and parts list.
4. Specification of project.

System Characteristics

Job Name: _____ Job Number: _____

Rated Voltage: _____ Rated Current: _____ S.F.: _____

Actual Motor Load

Load Type: Fan ___ Pump ___ Conveyor ___ Compressor ___ Mixer ___

Other _____

Constant Torque _____ or Variable Torque _____

Actual Motor Data: _____

Motor HP: _____

Motor Rated Speed: _____

Motor F.L.A.: _____

Motor S.F.: _____

Motor L.R.A.: _____

Frequency: _____

Phases: _____

Important Commissioning Checks



ATTENTION: All sources of power must be isolated and locked out before working on installed equipment. Verify that all circuits are voltage free using a hot stick or appropriate voltage measuring device. Failure to do so can result in severe burns, injury, or death.

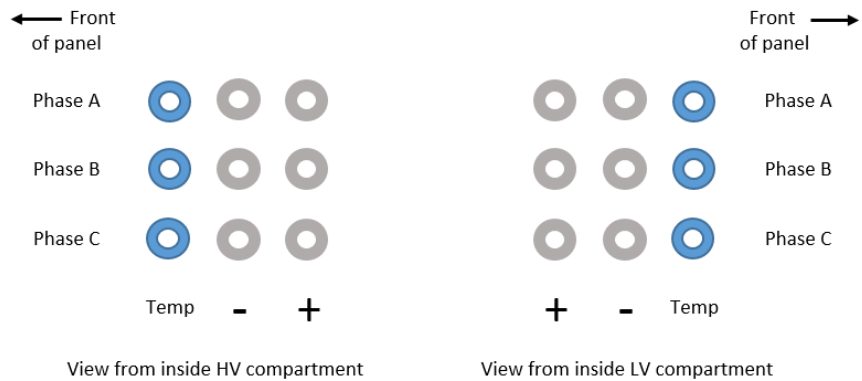


ATTENTION: When commissioning an MV SMC-50 controller, it is critical that following important checks are completed. For more details, follow the commissioning guidelines that follow this page.

- Inspect the equipment for any signs of physical damage.
- Verify that the SMC-50 physical installation is complete. This check includes physical attachment to adjacent cabinets, bus bar, power cable, and control cable interconnections with Line and Bypass control gear, and power cables to the motor.
- Verify that any apparatus covers and barriers that were removed during installation have been replaced and secured.
- Verify the integrity and operation of all safety interlocks.
- Verify that motor mechanical installation is complete.
- Verify that incoming power wiring to the equipment is complete and all connections are tight.
- Verify that motor cabling to the equipment is complete and that all connections are tight.
- Verify that control wiring between units of the equipment is complete.
- Check for any damaged components and verify that electrical clearances have not been reduced while installing power cables or apparatus.
- Verify Power System Grounding (Earthing).
- Check if there are any power factor correction capacitors. For correct installation requirements of these capacitors, see publication [7760F-IN001](#).
- Check if surge capacitors or surge arrestors are installed at the motor. Open the motor junction box and verify. These components must be disconnected from the circuit. See publication [7760F-IN001](#).
- Verify the fiber-optic cables are connected at the right location and polarity (fiber-optic cables from the interface board and fiber-optic board for Phase A+ go to the correct gate driver boards in phase A; fiber-optic cables for phase A- go to the correct gate driver boards in phase A; similarly for phase B and C) and the connectors are fully seated in their sockets.

- Verify that fiber optic cables from the interface board are connected to the proper through-panel connectors at the right front corner of the low voltage compartment. The cable connectors that mate with the through-hole connectors are round, not rectangular. The gray gate signal transmitters on the interface board connect to the rear six gray connectors (Phase A top; + rear, - middle, phase B middle, phase C bottom), and the three blue receivers at the lower left corner of the interface board connect to the front three blue connectors.
- The rear six gray connectors in the medium voltage cell connect to the blue receivers on the fiber-optic board, and the front three blue connectors receive the temperature feedback cables from the power pole harnesses (one per power pole). See [Figure 33](#) and the electrical diagram for the controller for details on the connections and polarities of the fiber-optic cable system.
- Verify that circuit board plug connectors are installed and fully inserted in their sockets.
- Verify that the cooling fan (if supplied) is secured and the rotor is not obstructed.
- Complete device resistance checks per installation instructions. See publication [7760F-IN001](#).
- Complete power supply tests. See publication [7760F-IN001](#).
- Program the module with correct parameter settings.
- Start the unit and record (if available) scope waveforms (line voltage, motor voltage and motor current).

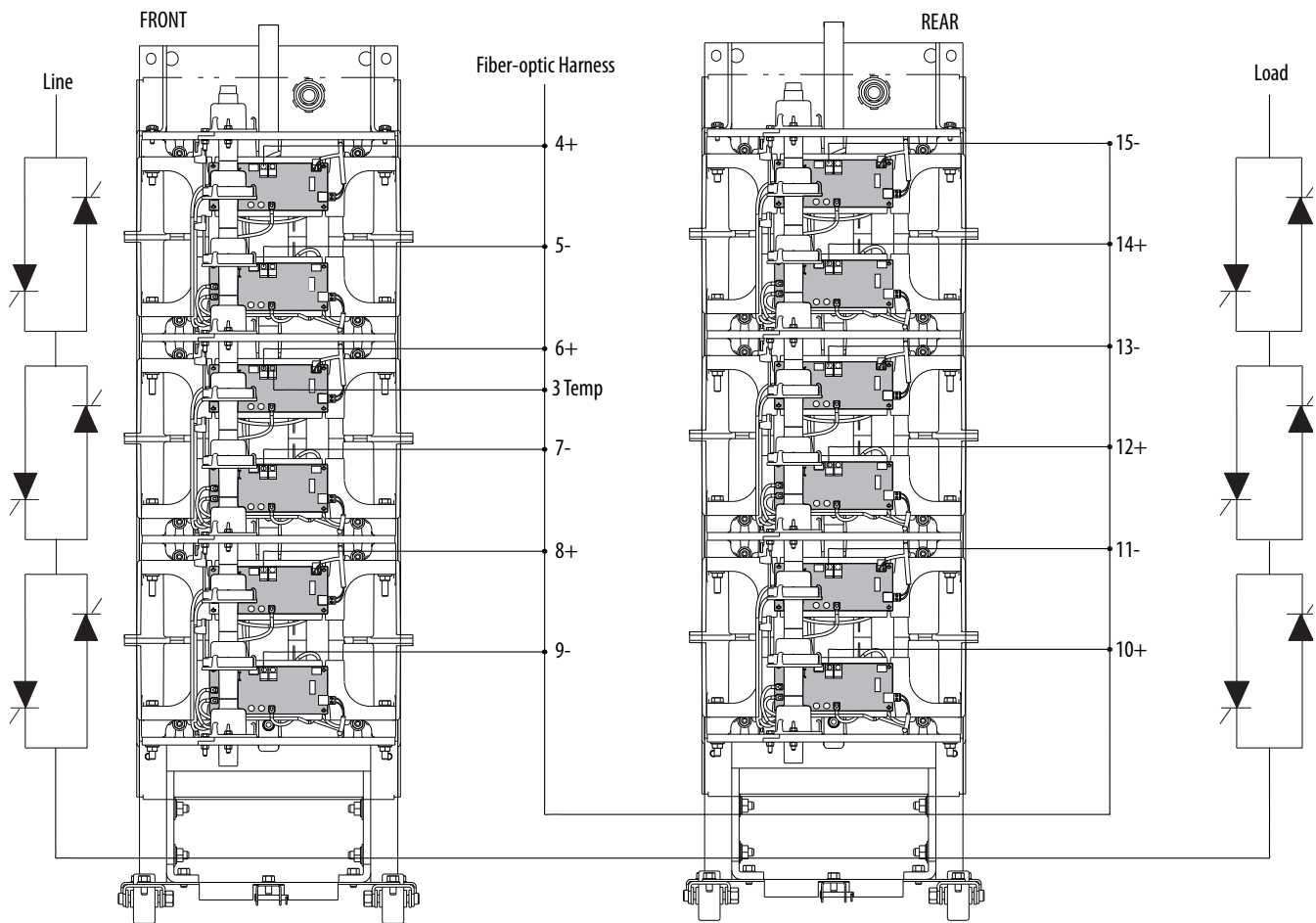
Figure 32 - Fiber-optic Cable Connections for MV SMC-50 Module



The blue connectors are for the temperature feedback cables, direct from the power cart harness, and to the Interface board on the LV panel side.

The gray connectors in the third (rear) column go to A+, B+ and C+ transmitters on the Interface board, and receivers on the fiber-optic board.

The gray connectors in the middle column go to the A-, B- and C- transmitters on the Interface board, and receivers on the fiber-optic board.

Figure 33 - PowerBrick Stack Polarities

Programming

MV SMC-50 Module

See [Chapter 3](#) for programming procedures.

The default (factory) parameter settings are on [page 163](#).

Settings can be different on engineered orders, or when option modules or customer requirements dictate different settings.

IMPORTANT The module must be programmed with an understanding of how the SMC functions, and the characteristics of the motor and driven load. Inappropriate settings can elicit unexpected results such as lack of acceleration torque or full-voltage starting.

IMPORTANT When SMC-50 module is energized for the very first time, HIM may take couple of minutes to recognize Medium voltage controller. Once the ID file is recognized, HIM will display 'MV Soft Start'.

If the factory settings are not suitable for the application, program the module to meet the application requirements. Contact your local Rockwell Automation representative or the factory if assistance is required.

Hi-Pot and Insulation Resistance Test

It is recommended that insulation levels be checked before energizing power equipment. Complete this check with a High-Voltage AC insulation tester (Hi-Pot) or an insulation resistance tester. See Vacuum Contactor User Manual for suggested Hi-Pot testers, and for test procedures for vacuum contactors. If using an insulation resistance tester, a minimum 5000V type is recommended.



ATTENTION: High voltage can destroy solid-state devices. Use jumper wires between line and load terminals above the power poles to short out the SCRs before applying high test voltages to the power circuit. Disconnect ground wires from the voltage sensing board and remove the plug connector. If voltage transformers are present, remove one primary fuse from each device.



ATTENTION: Use caution when performing the HI-POT or insulation resistance test. High voltage testing is potentially hazardous and may cause severe burns, injury, or death. Where appropriate, the case of the test equipment should be connected to ground.

Insulation can be tested from phase to phase and phase to ground. The recommended level for AC HI-POT testing is (2 X VLL) Volts, where VLL is the rated line-to-line voltage of the power system. The leakage current may be recorded for future comparison testing, and must be less than 40 mA.

If an insulation tester is used, it must indicate 50 k megohms or greater if it is isolated. If the motor is connected, the insulation resistance tester must indicate 5 k megohms or greater.

It is recommended that the main and bypass switches be in the open position, and that the input and output cables be disconnected for each phase. If an earthing switch is provided, it must be open. This will ensure the unit is isolated from the line, earth and the motor. The line and the motor may be tested separately to locate problem areas.

After completing the test, remove all semiconductor jumpers and test the devices with a multimeter to ensure no damage has occurred from the insulation test. Reconnect the system as it existed before this section. Perform the power supply and resistance checks in the following sections.



ATTENTION: Failure to reconnect all wires and cables correctly may result in equipment damage, personal injury, or death.

Figure 34 - Connection and Test Information for Interface Board

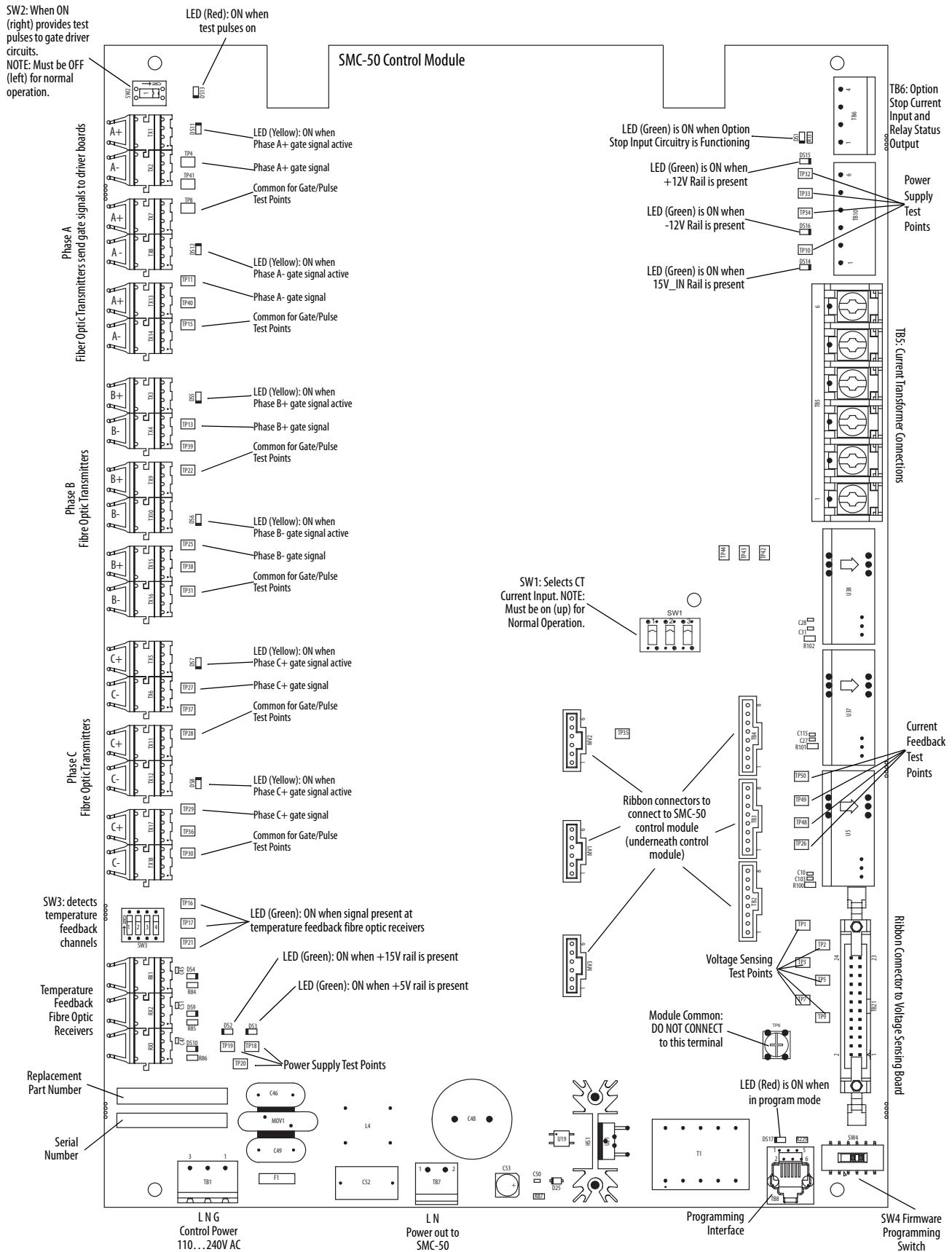
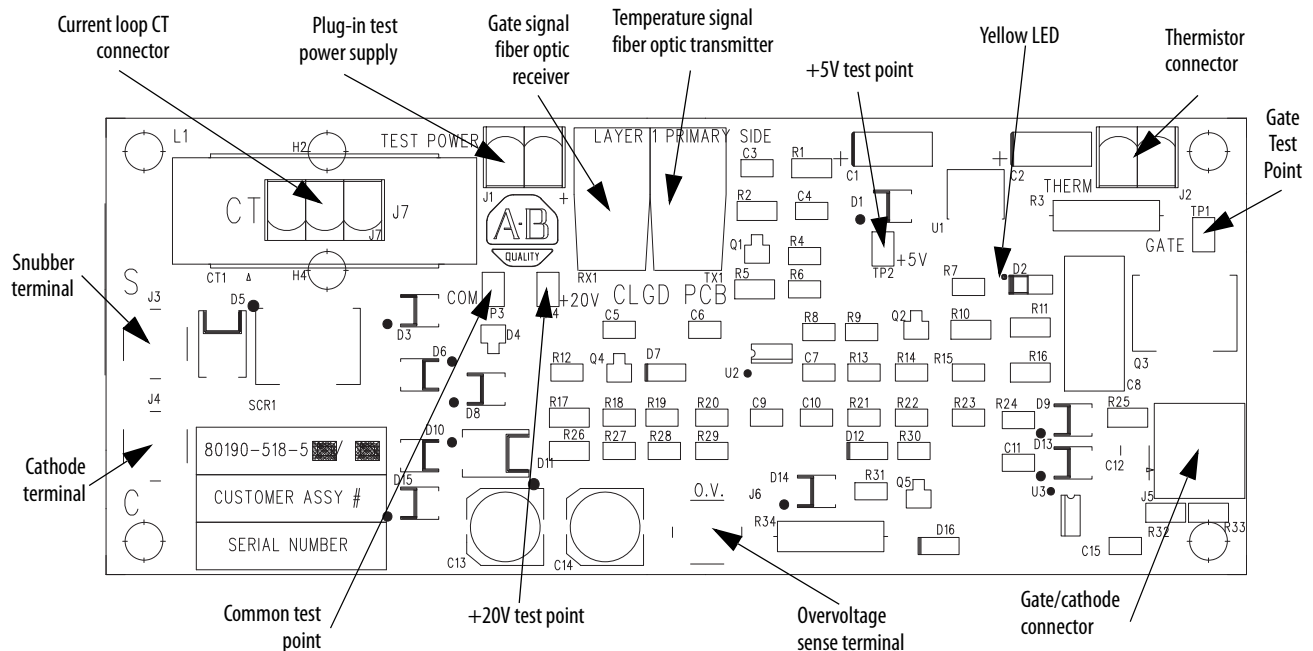


Figure 35 - Connection for Gate Driver Board



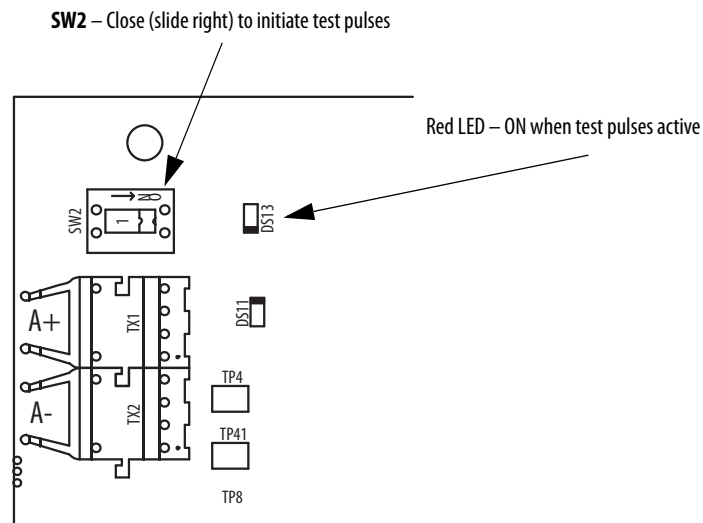
Resistance Checks and Power Supply Tests



ATTENTION: Servicing energized industrial control equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment. Before proceeding, all sources of power must be isolated and locked out. Verify that all circuits are voltage free using a hot stick or appropriate voltage measuring device. Replace any covers or barriers that were removed before energizing equipment. Where appropriate, the case of test equipment should be connected to ground.

1. Isolate incoming power to the incoming line unit and, if provided, close the earthing switch in the bypass unit.
2. Open the doors providing access to the SCR Power trucks as detailed below. Open the Phase 'U' SCR Power Truck Door first, open 'V' and 'W' phase next as they are interlocked. For re closing operation the operation sequence is the reverse.
3. The SCR Power Trucks have to be isolated from Main Power and control before racking out. The SCR power trucks are to be racked out to carryout the Power Supply Test and Resistance Checks.
4. The main power connection of the SCR Power Truck to the Bus is by copper flexible link to the first and last SCR of the series connections of SCR in the SCR Power Truck. [Figure 37](#) shows the mechanical connections to bolt the truck in position and the electrical connections. See publication [7760F-IN001](#) for instructions on removing the SCR Power trucks.
5. The fiber optic cables are removed at the fiber optic board end and gently coil the cable bundle on the power truck to be racked out.

6. The current loop cables are removed from the terminal blocks and kept free of any ties to be free while racking out the SCR Power Truck.
7. Once after racking out the SCR Power truck, the truck should be positioned directly in front of and in parallel with the front of the enclosure. The fiber optic cables are then plugged in to the fiber optic board using the fiber optic extension cable, to carryout the Power supply and pulse checks.
8. Verify the fiber-optic cables are connected to the correct transmitters on the fiber-optic board. The SCRs are polarized, and must be connected to the correct '+' or +-+ transmitters. See the system schematic and [Figure 33](#) for correct polarities.
9. The clear polycarbonate covers must be removed from the SCR Power Truck by removing two screws from the top and the bottom mounting brackets at the front and rear.

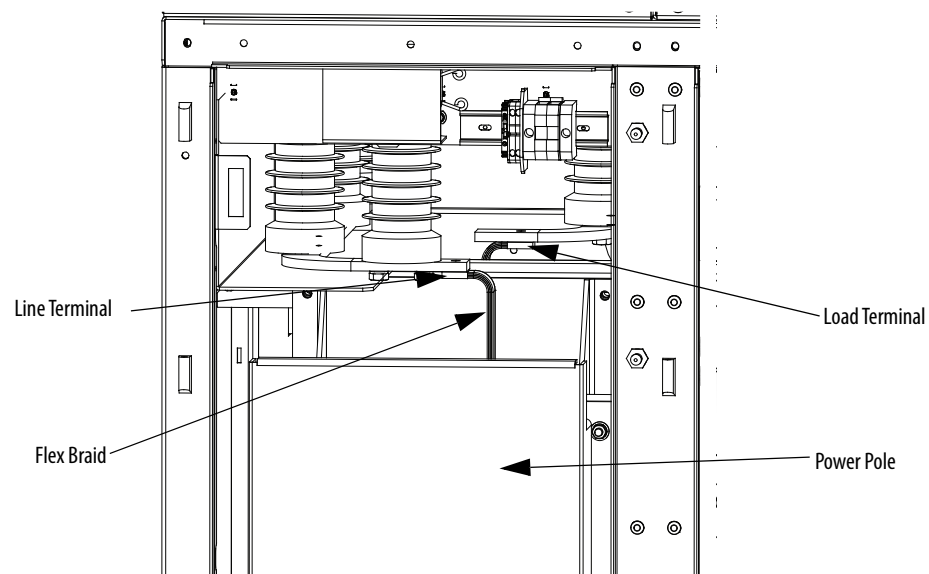
Figure 36 - Interface PCB

To ensure that resistors and connections have not been damaged during shipment and installation, the following resistance tests should be performed before energizing the starter.

10. Perform PowerBrick DC resistance checks per the procedure [PowerBrick \(SCR\) Testing on page 150](#).
11. Check that all connections are secure and tight, and all fibre optic cables are fully seated in their sockets
12. Re-connect the current loop cables to the terminal blocks.
13. Apply rated control voltage to the control circuits.
14. Check voltage on each gate-driver board by connecting a DC voltmeter at TP4(+) and TP3(-) [Figure 35](#). The voltage should be 18...22V DC.

15. Locate the SMC-50 interface board in the LV control. This circuit board has the control module mounted on it. Locate the switch labeled SW2 at the upper left corner of the board. Close the switch by sliding the toggle right (Figure 36). This starts a pulse generator to supply simulated gate-pulse signals via fiber-optic cables to the gate driver boards. A red LED beside the switch, and the three yellow LEDs on the left side of the interface board should be lit. They may appear dim, depending on ambient light conditions.
16. When test pulses are generated by the interface board, the '+' gate driver circuit board yellow LEDs in the upper right quadrant will flash once, then the '-' circuit board LEDs will flash once. The flashes will start on phase A, then move to the next phase. The sequence repeats as long as SW2 is on.

Figure 37 - SCR Power Truck showing mechanical bolting, power and control connections



17. With the gate pulses on, check the voltage again on each gate-driver board as described in step 14 above. The voltage should be 18...22 VDC, but may dip when a gate pulse is received.
18. Locate the Portable Test Power Supply that was included with the equipment, and verify that the rating corresponds to the available power system (for example, 110/120V AC or 220/240V AC). Plug the unit into the power source, and plug the green connector into J1 on each of the gate driver boards (see Figure 35)
19. The yellow LED on the upper right-hand side of the energized gate driver circuit should flash when the test pulse sequence gets to the board being tested (it may appear dim, depending on ambient light conditions). While the gate pulses are still on, check the voltage on each gate driver board as described in step 14 above. The voltage should be 10...12V DC. If the voltage is less than 5V, then you have a bad gate driver board. Do not leave the Portable Test Power Supply connected to a bad gate driver board. The power supply adapter will overheat if the gate driver board is shorted.

20. A more detailed check is performed by verifying the actual gate pulses by connecting an oscilloscope between TP1 and TP3(-) [Figure 35](#). To check gate pulses, the pulse generator must be enabled (SW2 toggled on) and the Portable Test Power Supply should be connected to J1. The pulse should appear as shown in [Figure 38](#) and [Figure 39](#).

Figure 38 - Gate Pulse Detail – Typical SCR (ABB)

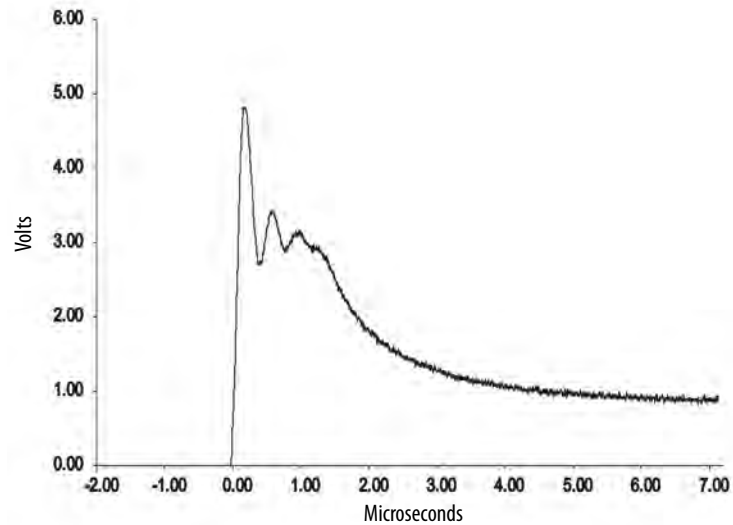
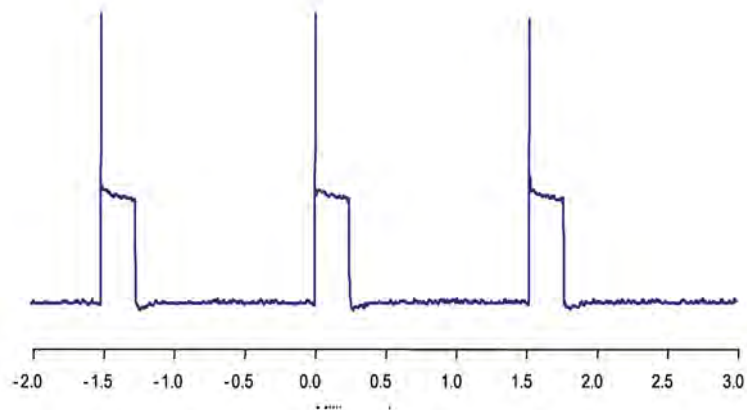


Figure 39 - Gate Pulse Test Waveform



21. If no pulse is observed, and the yellow LED is lit, check for a shorted gate on the SCR by removing the green plug and connecting an ohm-meter to the gate leads. If the LED is still not lit, and the circuit voltage is as specified in step 18 (above), pinch the tab on the blue fire-optic connector and carefully pull it straight out of the receiver. The end of the connector should glow red to indicate the presence of a gate signal. If it does not, remove the other end of the cable from the interface or Fibre Optic board and check that the grey transmitter is emitting red light. If it is, the fibre optic cable must be replaced. If it is not, the interface board should be replaced or Fibre Optic board should be replaced.

IMPORTANT The fibre optic system used in this equipment utilizes LED transmitters classified as IEC 60825-1 AEL Class 1, which are considered eye safe. However, the light is concentrated in the fibre, and it is recommended that users not look directly into the fibre and connectors. Directing the light to a fingertip or another object is sufficient to determine correct performance.

22. When each gate-driver circuit has been checked, disconnect the power supply and remove it from the cabinet. Disconnect the current loop cable from the terminal blocks and lay it on the cart.
23. Open the switch SW2 on the interface board ([Figure 34](#)) before returning the unit to service. Ensure the red LED is off.
24. Remove the fiber optic cables from the fiber optic board and gently coil the cable bundle on the SCR Power truck to be racked in.
25. Replace the clear polycarbonate barriers on the SCR Power Truck and secure with two screws at the top and two screw at the bottom on both the front and the rear.



ATTENTION: The clear barriers provide insulation between the converter module and the enclosure and unit Bus at the rear . They must be replaced before re-installing the converter modules. Failure to do so may result in arc faults which could result in burns, injury or death.

26. Carefully rack in the SCR Power Truck, connect all the fiber optic cables on the fiber optic board, and the temperature fiber optic cable to the bulkhead connector. Connect the current loop cables in the terminal blocks routing the cable through the ties provided.
27. Verify the fiber-optic cables are connected to the correct transmitters on the fiber-optic board. The SCRs are polarized, and must be connected to the correct '+' or '-' transmitters. See the system schematic and [Figure 33](#) for correct polarities.
28. Finally make the power connections with the flexible links to the Bus and torque to 20 lb•ft (27 N•m). Do not drop any hardware during the process of re-connecting the links.

Control Function Tests

Perform the following tasks before performing the control function test.

1. The medium voltage to the incoming line unit is locked and tagged out.
2. The earthing switch on the bypass unit is closed.
3. The SCR Power Trucks are racked in and mechanically bolted in position.
4. The Power connections to SCR Power Truck are made and torqued to 14 N•m (11 lb•ft). The fiber optic connections on the fiber optic board are plugged in and the current loop wires are terminated.
5. The soft starter unit doors are closed in the required sequence as per interlock sequence.
6. The connector for control wiring of the bypass and main circuit breakers or contactors are plugged in.
7. The bypass and main circuit breakers or contactors are racked to the 'Test' position for the control function test.

Perform the following control function test.

1. Apply rated control voltage to the control circuit.
2. Using the control schematic, apply control signals to cause relays, circuit breakers or contactors to energize to verify operation.
3. Remove any jumpers used in the test and restore all circuits to normal when finished.

Voltage Sensing Module

The voltage sensing module consists of a voltage sensing board and mounting plate ([Figure 51](#)). The voltage sensing board has six independent channels, with different sized resistors base on voltage range, which convert system voltages to low voltage levels that can be used by the SMC-50 control logic.

[Table 3](#) shows the input voltage ranges for the voltage-sensing module. The output voltages are scaled to provide close to 10V peak for a 140% input voltage at the high end of each of the voltage ranges. Software will be used to scale the output to show the correct value on the SMC-50 front panel display. (see Parameter 106 – MV Ratio in [Table 58 on page 163](#))

Table 3 - Input Voltage Ranges

| Module-rated Voltage | Voltage Range | MV Ratio |
|----------------------|-----------------|----------|
| 12,000 | 10,000...12,000 | 126 |
| 14,400 | 12,001...15,000 | 97 |

The MV ratios shown above are nominal values and may be fine tuned to achieve better accuracy on the display of the SMC-50 control module. While running the motor in bypass mode, compare the voltage displayed on the control module to a known accurate meter connected to the same source voltage as the motor the MV SMC-50 is controlling. Parameter 106, MV Ratio, may be changed up or down to match the HIM display to the external meter. A small change in ratio can make a large change in the display, so 2 or 3 units at a time is recommended. Increasing the ratio will decrease the displayed voltage, and visa versa.

Start-Up

1. Remove any temporary jumpers or grounding devices used during commissioning.
2. Check that all tools are removed from the equipment. Any tools or hardware used or dropped during installation and commissioning must be retrieved.
3. All barriers or covers removed during installation or commissioning must be securely mounted.
4. Close and secure all doors, and verify function of all interlocks that prevent access to medium voltage compartments when the unit is energized.
5. If an earthing switch is provided, it must be opened before the apparatus can be inserted to the service position.
6. The controller is ready to power the motor.

Programming

Overview

This chapter provides a basic understanding of the programming/configuration tools available to modify the SMC-50 control module's parameters. Unlike previous SMC products (for example, SMC-3 and SMC Flex), the SMC -50 control module does not contain a built-in programming tool. This lets you select from several programming tools to best suit your application.

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

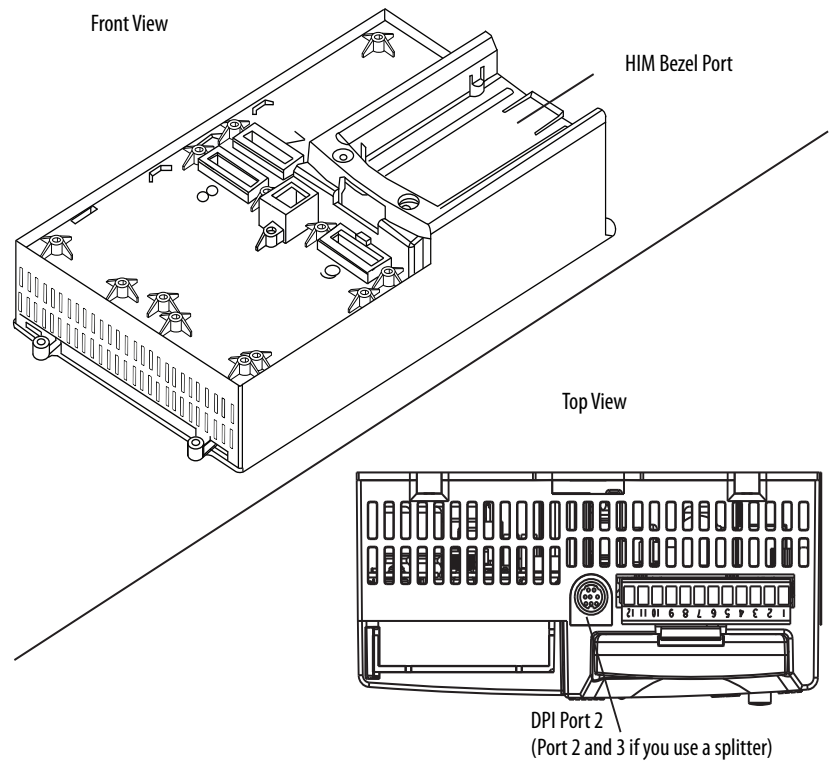
The 20-HIM-A6 lets you:

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

TIP 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 controller 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 control module DPI Port 2 on the top of the module. For additional information on mounting the 20-HIM-A6 or the 20-HIM-C6S, see the HIM user manual, publication [20HIM-UM001](#).

Figure 40 - 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 about 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 you are using.

Table 4 - HIM Single-Function Keys



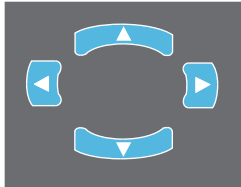
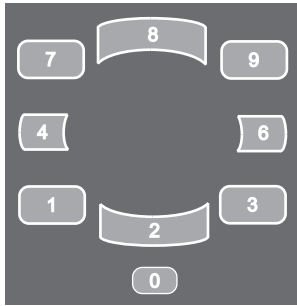

| Key | Function |
|----------|--|
| Start | Starts the controller if the control module's Logic Mask is enabled for the port the HIM is connected to. ⁽¹⁾ |
| Folders | Accesses folders for parameters, diagnostics, memory functions, preferences, and other tests. |
| Controls | Accesses jog, direction,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

(1) If the device (port) is enabled and removed under power or an expansion device is removed, a fault is generated. The bit location (for example, 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 5 - HIM Soft Key Functions

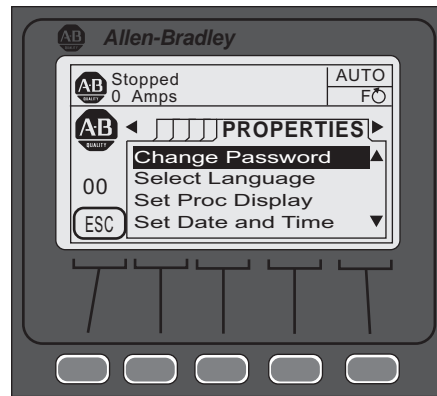
| Soft Key | Description | Function |
|---|---------------------|--|
|  | Multi-Function—Blue | <ul style="list-style-type: none"> • Scrolls through menus and screens as directed by each arrow • Performs corresponding functions displayed in the data area |
|  | Numeric Keys—Grey | <ul style="list-style-type: none"> • Enters their respective numeric values |
|  | 5/Enter | <ul style="list-style-type: none"> • 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 control module provides password protection by numeric code (0...65,535) to prevent unwanted modification of parameters. You can view or monitor data and parameter values 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 41](#).

Figure 41 - PROPERTIES Folder Screen



TIP 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 41](#).
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 control module's memory.

Parameter Access Level Modification Using the HIM

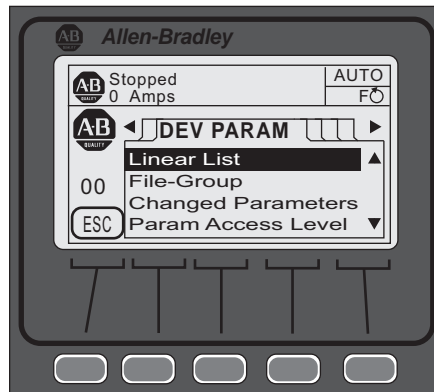
The SMC-50 control module provides three different parameter access levels: Monitor, Basic, and Advanced. These access levels let you limit user access and/or speed viewing or changing of certain parameters.

- TIP**
- The access level is **not** maintained if power to the module is cycled.
 - The default access level is Basic.
 - The advanced level provides access to all parameters.
 - Individual parameter access levels are shown in [Table 14](#) through [Table 18](#) beginning on [page 89](#) and is also contained in the Parameter Linear List, [Table 21](#) through [Table 35](#) beginning on [page 102](#).

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. Press the forward or back arrow key until the DEV PARAM folder screen appears.

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

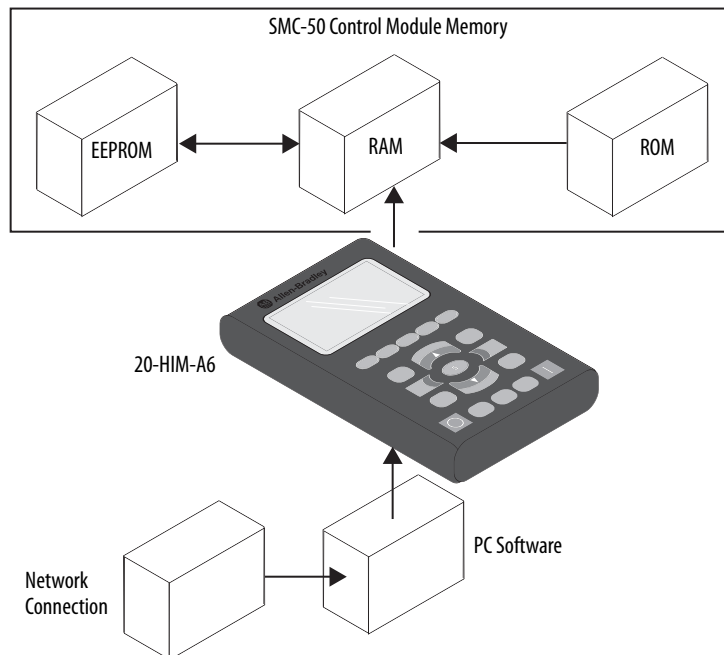


4. Use the up or down arrow to scroll up or down until you reach the desired access level
5. Press Enter (#5) to view that access level.

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.

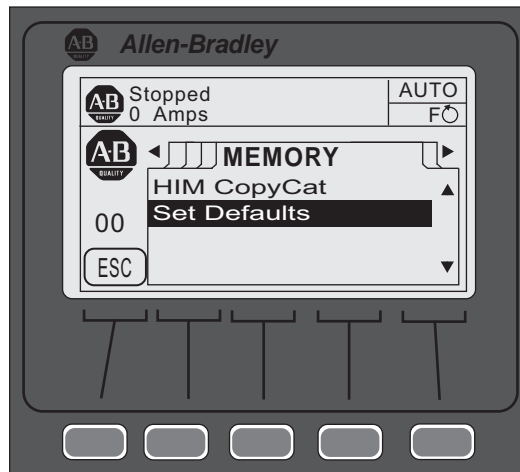
Figure 42 - Memory Block Diagram



RAM (Random Access Memory)

RAM is the work area of the module after it is powered up. The SMC-50 control module 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 before the enter key is pressed, these values are lost. When the device powers up, it copies the values from the EEPROM area of memory into RAM.

ROM (Read-only Memory)—Set Defaults



The SMC-50 control module 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.

TIP 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 is 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.

TIP You can also restore factory defaults by using the Parameter Management, Parameter 229, available in the Utility File-Group.

EEPROM

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

Parameter Configuration

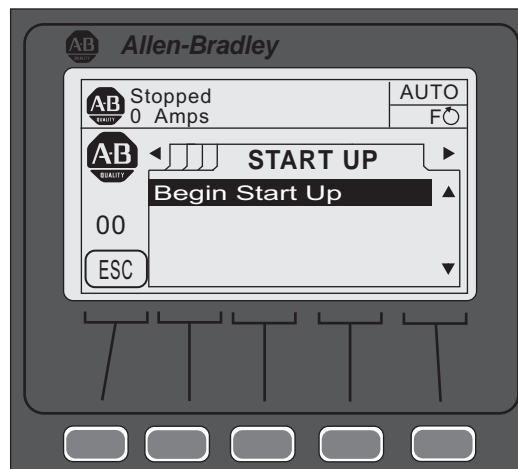
Using the START UP Configuration Tool (20-HIM-A6 or 20-HIM-C6S)

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

Not all parameters are configured with this tool. You can configure any non-configured startup parameters by using the parameter number or File—Group search method. See [Basic Configuration using the HIM on page 92](#).

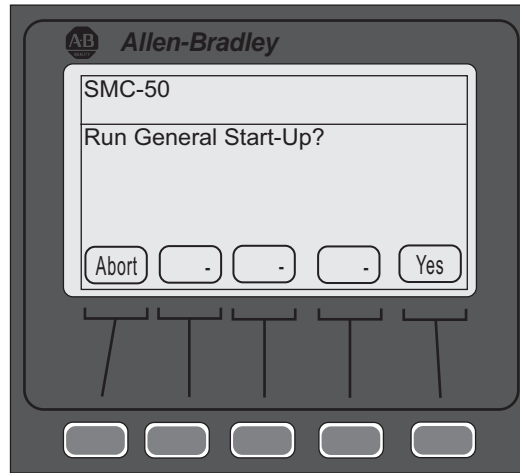
Accessing the General START UP Tool

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 displays "Run General Start-up?".

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



The HIM displays a series of questions about the Motor, Start, and Stop processes.

TIP 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.

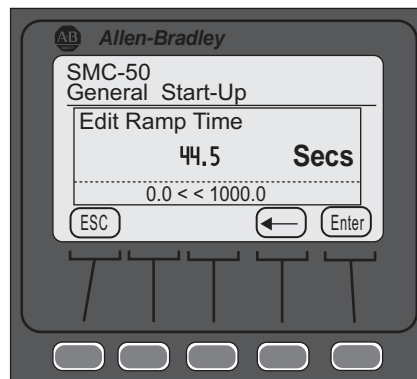
Reason: These parameters are specific to the Torque Start parameter group.

Entering Data into General Startup

- Display the parameter.

If the HIM provides the allowable range (for example, 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.

Enter the data value if you see this screen



Use the up and down arrows or soft keys to display your selection if you see this screen



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

TIP If you enter an incorrect value: 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.

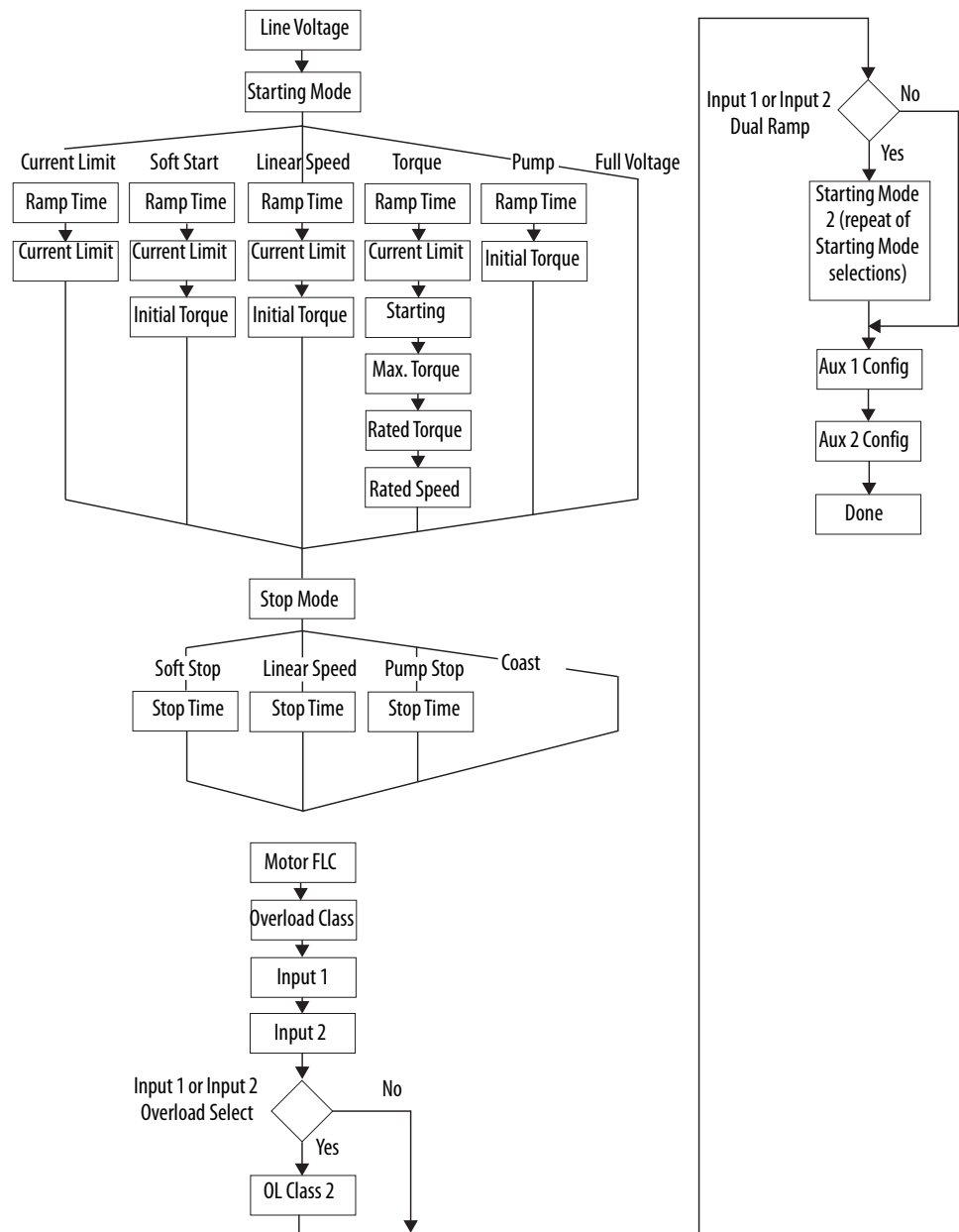
Once all parameters are entered, the START-UP folders screen appears.

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.

TIP To modify parameter data, use the procedure outlined in [Entering Data into General Startup on page 70](#).

Figure 43 - Flow Chart—General Startup Parameters



Parameter Search and Configuration

The 20-HIM-A6 or 20-HIM-C6S modules can access all of the controller parameters. These modules provide two basic ways to search for and modify a specific parameter or group of parameters: by parameter number or File-Group. The following example explains how to search by parameter number using the 20-HIM-A6 module.

Parameter Search and Configuration by Parameter Number

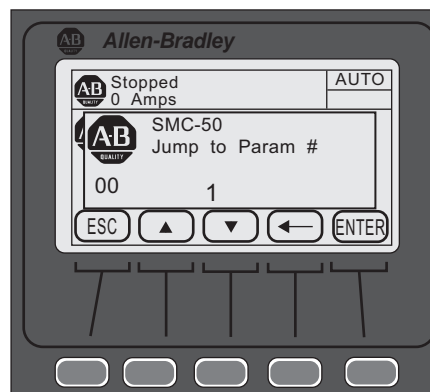
To perform a parameter number search and modification, perform the following steps.

Parameter Search and Configuration by Parameter Number

1. Ensure that the initial controller Power Up screen appears on the HIM.



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.



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

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

For additional details on these procedures, see the 20-HIM-A6 or 20-HIM-C6S user manual, publication [20HIM-UM001](#).

Parameter Search and Configuration by File-Group Structure

Parameter Structure

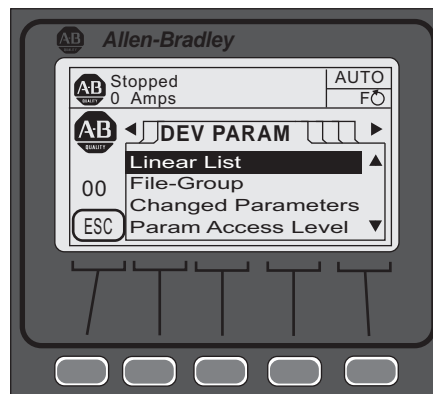
The parameters of the controller are structured into five parameter File-Groups:

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

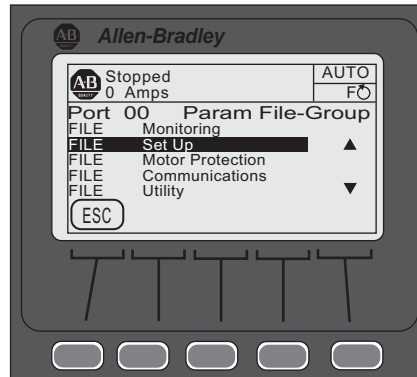
The parameters associated with each of these five File-Groups are shown in [Table 14](#) through [Table 18](#) beginning on [page 89](#) of this chapter.

Parameter Search and Configuration by File-Group (SMC-50 Control Module Category Search)

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 control module 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 displays 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 displays the setup categories (for example, Basic, Starting).



5. With Basic highlighted, press ENTER (number 5 on the keypad).
6. Scroll to the desired parameter (for example, 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 steps 5 through 7. To return to a higher level category, press the BACK arrow key.

TIP Using the DEV PARAM folder screen and the File-Group selection, the controller parameters can be selected and configured by functional category. See the [Parameter File-Group Structure on page 89](#).

Parameter Configuration - Overview Using the Setup File Group

Table 6 shows the parameter sets available within the Basic Setup group.

Table 6 - Setup File Group

| Setup File Group Parameters | | | | | | | | |
|-----------------------------|-----------------|-----------------|-----------------|---------------------|----------------------|--------------------|---------------------|----------------------|
| Basic (BA) | | Starting (BA) | Stopping (BA) | Dual Ramp (BA) | Advanced | I/O (BA) | Advanced Tuning | |
| Motor Config | Input 2 | Starting Mode | Stop Mode | Starting Mode 2 | Pump Pedestal (A) | Input 1 | Force Tuning (A) | Phase Shift 0% (A) |
| Line Voltage | Aux 1 Config | Ramp Time | Stop Time | Ramp Time 2 | Load Type (A) | Input 2 | Starter R | Phase Shift 10% (A) |
| Starting Mode | Aux 2 Config | Cur Limit Level | Backspin Timer | Cur Limit Level 2 | UTS Level (A) | Aux 1 Config | Total R | Phase Shift 20% (A) |
| | Ramp Time | Overload Class | | Initial Torque | Initial Torque 2 | Stall Position (A) | Aux 1 Invert | Coupling Factor |
| Initial Torque | | Service Factor | Max Torque | Starting Torque 2 | Stall Level (A) | Aux 1 On Delay | Inductance | Phase Shift 40% (A) |
| Max Torque | Kickstart Time | | Max Torque 2 | Kickstart Time 2 | V Shut Off Level (A) | Aux 1 Off Delay | Speed PGain (A) | Phase Shift 50% (A) |
| Cur Limit Level | Motor FLC | Kickstart Level | Starting Torque | Kickstart Level 2 | I Shut Off Level (A) | Aux 2 Config | Transient Gain (A) | Phase Shift 60% (A) |
| Stop Mode | Starting Torque | Start Delay | | Timed Start (A) | Aux 2 Invert | Aux 2 On Delay | | Phase Shift 70% (A) |
| Stop Time | Max Torque | Rated Torque | Rated Speed | Bypass Delay (A) | Aux 2 Off Delay | Aux 2 Off Delay | Transient Zero (A) | Phase Shift 80% (A) |
| Input 1 | Rated Speed | | | Demand Period (BA) | Aux Control | Transient Mag (A) | Phase Shift 90% (A) | |
| | | | | Num of Periods (BA) | | | Transient Mag (A) | Phase Shift 100% (A) |
| | | | | | | | Ping Degree (A) | |
| | | | | | | | Pings (A) | |

TIP For a complete parameter set listing within each parameter File—Group, see [Parameter File-Group Structure on page 89](#).

The Basic parameter set in the setup group is limited, yet powerful. It lets you quickly start the system with minimal adjustments and provides quick access to parameters that are required for standard motor connection and overload protection. If you are using advanced controller features (for example, Dual Ramp), however, you must also use the parameter set that is associated with those features. The Setup group is used throughout this section as a baseline for system configuration.

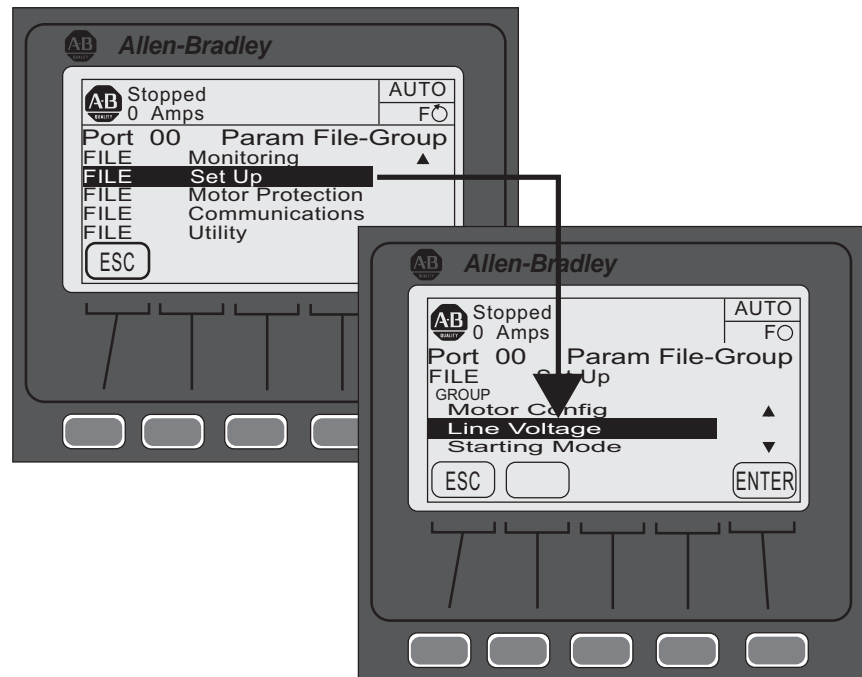
IMPORTANT Parameter values that are modified while the motor is operating are not valid until the next time the operation for that parameter occurs.



ATTENTION: For Overload Protection, it is critical that you enter the data into the SMC-50 control module as it appears on the motor nameplate.

Figure 44 shows the initial FILE Setup screens using the HIM.

Figure 44 - Initial FILE Setup Screens



Soft Start and Stop

To program a soft start with simple stop mode operation, you can use the parameters listed in Table 7. You can access the Basic parameter set with the HIM from the Port <00> DEV PARAM folder under the File-Group, File: Setup, Group: Basic Selection sequence.

Table 7 - Soft Start Parameter Group

| Parameter Name | Description | Options | Default Value |
|---------------------|---|---|------------------------------|
| Motor Configuration | Setting for the motor configuration Line Connected Wye or Inside-the-Delta. ⁽¹⁾ | Line, Delta, Auto Detect | Auto Detect |
| Line Voltage | Select the value of line voltage being used in the system. You must enter the correct line voltage value for the voltage protection functions to work properly. | 0...15,000V | 4160V |
| Starting Mode | This mode must be programmed for Soft Start. | Soft Start ⁽⁵⁾⁽⁶⁾ | Soft Start ⁽⁵⁾⁽⁶⁾ |
| Ramp Time | Programs the time period that the controller will ramp the output voltage up to full voltage and to full speed from the Initial Torque level. | 0...1000 s | 10 s |
| 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% LRT | 70% LRT |
| Current Limit Level | Limits the current supplied to the motor throughout the Soft Start cycle. ⁽²⁾ | 50...600% FLC | 350% FLC |
| Stop Mode | Programs the desired Stop Mode. ⁽³⁾ | Coast, Soft Stop, Linear Speed, Pump Stop | Coast |
| 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 s | 0 s |

Table 7 - Soft Start Parameter Group (Continued)

| Parameter Name | Description | Options | Default Value |
|-----------------|--|--|---------------|
| 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). | Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run | Start/Coast |
| 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). | | Disable |
| Aux 1 Config | Aux 1 Config Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. ⁽⁴⁾ | Normal, UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ⁽⁷⁾ , Network 1, Network 2, Network 3, Network 4, Fan Control | Normal |
| Aux 2 Config | Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. ⁽⁴⁾ | | |
| Overload Class | Required for motor protection. Lets you 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 A | 1.0 A |
| Starting Torque | NOT used for a Soft Start. | 0...300% RMT | 100% RMT |
| Max Torque | NOT used for a Soft Start. | 0...300% RMT | 250% RMT |
| Rated Torque | NOT used for a Soft Start. | 0...100,000 N·m | 10 N·m |
| Rated Speed | NOT used for a Soft Start. | 750, 900, 1000, 1200, 1500, 1800, 3500, 3600 rpm | 1800 rpm |

- (1) In the AUTO Detect [default] selection, the controller automatically checks the motor configuration.
- (2) Enter a value to limit the current but not low enough to inhibit the start cycle.
- (3) The stopping mode does not need to match the starting mode (for example, a Soft Start can have a stop mode programmed for [Coast], or Linear Stop—there is no Current Limit Stop or Torque Stop mode).
- (4) Relay Operational Options (for example, ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See [Table 6](#).
- (5) 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 [Table 6](#)). Setting either parameter to zero disables Kickstart.
- (6) You can also program a start delay time 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.
- (7) Any auxiliary output configured for Aux Control using the AuxX Config parameter is 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 you enter the data into the SMC-50 control module as it appears on the motor nameplate.

Current Limit Start with Simple Stop Mode

Use the parameters in [Table 8](#) to program a Current Limit Start with simple Stop Mode operation. You can access the Basic parameter set with the HIM.

Table 8 - Current Limit Start with Simple Stop Mode Parameters

| Parameter Name | Description | Options | Default Value |
|---------------------|--|--|---------------------------------|
| Motor Config | Setting for the motor configuration Line Connected Wye or Inside-the-Delta. ⁽¹⁾ | Line, Delta, Auto Detect | 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...15,000V | 4160V |
| Starting Mode | This mode must be programmed for Current Limit. | Current Limit ⁽⁵⁾⁽⁶⁾ | Current Limit ⁽⁵⁾⁽⁶⁾ |
| Ramp Time | Programs the time period that the controller will HOLD the fixed reduced voltage/current before switching to full voltage. | 0...1000 [10] seconds | 10 s |
| Initial Torque | NOT used for a Current Limit Start. | 0...90% LRT | 70% LRT |
| Current Limit Level | Current Limit Level Limits the current supplied to the motor throughout the Start cycle. ⁽²⁾ | 50...600% FLC | 350% FLC |
| Stop Mode | Programs the desired Stop Mode. ⁽³⁾ | Coast, Soft Stop, Linear Speed, Pump Stop | Coast |
| 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 | 0 s |
| 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). | Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run | Start/Coast |
| 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). | | Disable |
| Aux 1 Config | Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. ⁽⁴⁾ | Normal, UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ⁽⁷⁾ , Network 1, Network 2, Network 3, Network 4, Fan Control | Normal |
| Aux 2 Config | Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. | | |
| Overload Class | Required for motor protection. Lets you 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 A | 1.0 A |
| Starting Torque | NOT used for a Current Limit Start. | 0...300% RMT | 100% RMT |
| Max Torque | NOT used for a Current Limit Start. | 0...300% RMT | 250% RMT |
| Rated Torque | NOT used for a Current Limit Start. | 0...100,000 N-m | 10 N-m |
| Rated Speed | NOT used for a Current Limit Start. | 750, 900, 1000, 1200, 1500, 1800, 3500, 3600 rpm | 1800 rpm |

(1) In the AUTO Detect [default] selection, the controller automatically checks the motor configuration.

(2) Enter a value to limit the current but not low enough to inhibit the start cycle.

(3) The stopping mode does not need to match the starting mode (for example, a Soft Start can have a stop mode programmed for [Coast], or Linear Stop—there is no Current Limit Stop or Torque Stop mode).

(4) Relay Operational Options (for example, ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See [Table 6](#).

(5) 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 [Table 6](#)). Setting either parameter to zero disables Kickstart.

(6) You can also program a start delay time 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.

(7) Any auxiliary output configured for Aux Control using the AuxX Config parameter is 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 you enter the data into the SMC-50 control module as it appears on the motor nameplate.

Linear Acceleration (Linear Speed) Start with Stop

Use the parameters in [Table 9](#) to program a Linear Acceleration Start and Simple Stop Mode operation. You can access the Basic parameter set with the HIM (see [Table 6](#)).

Table 9 - Linear Acceleration (Speed Sense) Start with Stop Parameters

| Parameter Name | Description | Options | Default Value |
|---------------------|---|--|--------------------------------|
| Motor Config | Setting for the motor configuration Line Connected Wye or Inside-the-Delta. ⁽¹⁾ | Line, Delta, Auto Detect | 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...15,000V | 4160V |
| Starting Mode | This mode must be programmed for Linear Speed. | Linear Speed ⁽⁵⁾⁽⁶⁾ | Linear Speed ⁽⁵⁾⁽⁶⁾ |
| Ramp Time | Programs the time period that the controller 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 closes to this value depending on load characteristics. | 0...1000 s | 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% LRT | 70% LRT |
| Current Limit Level | Limits the current supplied to the motor throughout the Linear Start and Stop cycle. ⁽²⁾ | 50...600% FLC | 350% FLC |
| Stop Mode | Programs the desired Stop Mode. ⁽³⁾ | Coast, Soft Stop, Linear Speed, Pump Stop | Coast |
| Stop Time | Programs the amount of time desired to ramp from full to zero voltage for Soft, Linear, and Pump Stop mode. Actual ramp stop time depends on the stopping mode selected and load inertia. | 0...999 s | 0 s |
| 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). | Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run | Start/Coast |
| 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). | | Disable |
| Aux 1 Config | Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. ⁽⁴⁾ | Normal, UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ⁽⁷⁾ , Network 1, Network 2, Network 3, Network 4, Fan Control | Normal |
| Aux 2 Config | Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. ⁽⁴⁾ | | |
| Overload Class | Required for motor protection. Lets you 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. | 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 A | 1.0 Amps |
| Starting Torque | NOT used for a Linear Speed Start. | 0...300% RMT | 100 RMT |
| Max Torque | NOT used for a Linear Speed Start. | 0...300% RMT | 250% RMT |
| Rated Torque | NOT used for a Linear Speed Start. | 0...100,000 N-m | 10 N-m |
| Rated Speed | NOT used for a Linear Speed Start. | 750, 900, 1000, 1200, 1500, 1800, 3500, 3600 rpm | 1800 rpm |

- (1) In the AUTO Detect [default] selection, the controller automatically checks the motor configuration.
- (2) Enter a value to limit the current but not low enough to inhibit the start cycle.
- (3) The stopping mode does not need to match the starting mode (for example, a Soft Start can have a stop mode programmed for [Coast], or Linear Stop—there is no Current Limit Stop or Torque Stop mode).
- (4) Relay Operational Options (for example, ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See [Table 6](#).
- (5) 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 [Table 6](#)). Setting either parameter to zero disables Kickstart.
- (6) You can also program a start delay time 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.
- (7) Any auxiliary output configured for Aux Control using the AuxX Config parameter is 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 you enter the data into the SMC-50 control module as it appears on the motor nameplate.

Torque Start with Stop

Use the parameters in [Table 10](#) to program a Torque Start with simple Stop operation. You can access the basic parameter set with the HIM (see [Table 6 on page 76](#)).

Table 10 - torque Start with Stop Parameters

| Parameter Name | Description | Options | Default Value |
|---------------------|---|--|----------------------------------|
| Motor Config | Setting for the motor configuration Line Connected Wye or Inside-the-Delta. ⁽¹⁾ | Line, Delta, Auto Detect | 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...15,000V | 4160V |
| Starting Mode | This mode must be programmed for Torque Ramp. | Torque Ramp ⁽⁵⁾⁽⁶⁾⁽⁷⁾ | Torque Ramp ⁽⁵⁾⁽⁶⁾⁽⁷⁾ |
| Ramp Time | Programs the time period that the controller will ramp the output voltage from the Starting Torque Value to the Programmed Max Torque Value. | 0...1000 s | 10 s |
| Initial Torque | NOT used for a Torque Ramp Start. | 0...90% LRT | 70% LRT |
| Current Limit Level | Limits the current supplied to the motor throughout the Torque Ramp Start cycle. ⁽²⁾ | 50...600% FLC | 350% FLC |
| Stop Mode | Programs the desired Stop Mode. ⁽³⁾ | Coast, Soft Stop, Linear Speed, Pump Stop | Coast |
| Stop Time | 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 | 0...999 s |
| Input 1 | 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, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run | Start/Coast |
| Input 2 | 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] | | Disable |
| Aux 1 Config | Programs control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. ⁽⁴⁾ | Normal, UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ⁽⁸⁾ , Network 1, Network 2, Network 3, Network 4, Fan Control | Normal |
| Aux 2 Config | Programs control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. ⁽⁴⁾ | | |
| Overload Class | Required for motor protection. Lets you 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. | 5...30 10 | 10 |

Table 10 - torque Start with Stop Parameters (Continued)

| Parameter Name | Description | Options | Default Value |
|-----------------|---|--|---------------|
| 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 | 1.0 A |
| Starting Torque | Programmed initial or starting point for a Torque Ramp Start. | 0 ... 300% RMT | 100% RMT |
| Max Torque | Programmed end point for a Torque Ramp Start. | 0 ... 300% RMT | 250% RMT |
| Rated Torque | The actual rated torque of the motor being used in a Torque Ramp Start. | 0 ... 100,000 N·m | 10 N·m |
| Rated Speed | The actual rated speed of the motor used in the Torque Ramp Start. | 750, 900, 1000, 1200, 1500, 1800, 3500, 3600 rpm | 1800 rpm |

- (1) In the AUTO Detect [default] selection, the controller automatically checks the motor configuration.
- (2) Enter a value to limit the current but not low enough to inhibit the start cycle.
- (3) The stopping mode does not need to match the starting mode (for example, a Soft Start can have a stop mode programmed for Coast, or Linear Stop—there is no Current Limit Stop or Torque Stop mode).
- (4) Relay Operational Options (for example, ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See [Table 6](#).
- (5) Torque Ramp Starting mode requires you to perform a Motor Tuning Cycle. The SMC-50 control module does this automatically the first time the motor is run. You 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 control module's Reset button for 10 seconds with the motor stopped.
- (6) You can also program a start delay time to delay starting for a period of time after the initiation of the START command. You can access the Start Delay parameter from the Group Starting selection. See [Table 6](#).
- (7) Kickstart is available when using Torque Start. You must configure a Kickstart Level and Time if you use this mode is. Access these parameters via the Starting Setup Group. You can access the Starting Setup Group with the HIM from the Port <00> DEV PARAM folder under the File-Group, File: Setup, Group: Starting selection sequence. See [Table 6](#). Setting either parameter to zero disables Kickstart
- (8) Any auxiliary output configured for Aux Control using the AuxX Config parameter is 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 you enter the data into the SMC-50 control module as it appears on the motor nameplate.

Pump Start with Stop

Use the parameters in [Table 11](#) to program a Pump Start with simple Stop operation. You can access the basic parameter set with the HIM (see [Table 6 on page 76](#))

Table 11 - Pump Start with Stop Parameters

| Parameter Name | Description | Options | Default Value |
|---------------------|---|------------------------------|------------------------------|
| Motor Config | Setting for the motor configuration Line Connected Wye or Inside-the-Delta. ⁽¹⁾ | Line, Delta, Auto Detect | 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 ... 15,000V | 4160V |
| Starting Mode | This mode must be programmed for Pump Start. | Pump Start ⁽⁵⁾⁽⁶⁾ | Pump Start ⁽⁵⁾⁽⁶⁾ |
| Ramp Time | Programs the time period that the controller will ramp the output voltage to full voltage and motor speed from the programmed Initial Torque value. | 0 ... 1000 s | 10 s |
| 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% LRT | 70% LRT |
| Current Limit Level | Limits the current supplied to the motor throughout the Torque Ramp Start cycle. ⁽²⁾ | 50...600% FLC | 350% FLC |

Table 11 - Pump Start with Stop Parameters (Continued)

| Parameter Name | Description | Options | Default Value |
|-----------------|---|--|---------------|
| Stop Mode | Programs the desired Stop Mode. ⁽³⁾ | Coast, Soft Stop, Linear Speed, Pump Stop | Coast |
| Stop Time | Programs the amount of time desired to ramp from full to zero voltage for Soft, Linear, and Pump Stop mode. Actual ramp stop time depends on the stop mode selected and load inertia. | 0...999 s | 0 s |
| 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). | Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run | Start/Coast |
| 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). | | Disable |
| Aux 1 Config | Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. ⁽⁴⁾ | Normal, UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ⁽⁷⁾ , Network 1, Network 2, Network 3, Network 4, Fan Control | Normal |
| Aux 2 Config | Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. ⁽⁴⁾ | | |
| Overload Class | Required for motor protection. Lets you 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. | 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 A | 1 A |
| Starting Torque | NOT used for Pump Start. | 0...300% RMT | 100% RMT |
| Max Torque | NOT used for Pump Start. | 0...300% RMT | 250% RMT |
| Rated Torque | NOT used for Pump Start. | 0...100,000 N·m | 10 N·m |
| Rated Speed | NOT used for Pump Start. | 750, 900, 1000, 1200, 1500, 1800, 3500, 3600 rpm | 1800 rpm |

- (1) In the AUTO Detect [default] selection, the controller automatically checks the motor configuration.
- (2) Enter a value to limit the current but not low enough to inhibit the start cycle.
- (3) The stop mode does not need to match the start mode (example: a Soft Start can have a stop mode programmed for Coast, or Linear Stop—there is no Current Limit Stop or Torque Stop mode).
- (4) Relay Operational Options (for example, ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See [Table 6](#).
- (5) For best results with a Pump Start, it is recommended that the tuning cycle be run. The SMC-50 control module automatically performs the tuning cycle the first time the motor is run. You 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 control module's Reset button for 10 seconds with the motor stopped.
- (6) You can program a start delay time to delay starting for a period after the initiation of the START command. You can access the Start Delay parameter from the Group Starting selection. See [Table 6](#).
- (7) Any auxiliary output configured for Aux Control using the AuxX Config parameter is 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 you enter the data into the SMC-50 control module as it appears on the motor nameplate.

Full Voltage Start with Stop

The SMC-50 control module 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. Use the parameters in [Table 12](#) to program a Full Voltage Start and Simple or Stop Mode operation. You can access the basic parameter set with the HIM (see [Table 6 on page 76](#)).

Table 12 - Full Voltage Start with Stop Parameters

| Parameter Name | Description | Options | Default Value |
|-----------------|---|---|-----------------------------|
| Motor Config | Setting for the motor configuration Line Connected Wye or Inside-the-Delta. ⁽¹⁾ | Line, Delta, Auto Detect | 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...15,000V | 4160V |
| Starting Mode | This mode must be programmed for Full Voltage Start. | Full Voltage ⁽⁴⁾ | Full Voltage ⁽⁴⁾ |
| Ramp Time | Programs the time period that the controller will ramp the output voltage to full voltage and motor speed from the programmed Initial Torque value. | 0...1000 s | 10 s |
| Initial Torque | NOT used for Full Voltage Start. | 0...90% LRT | 70% LRT |
| Current Limit | NOT used for Full Voltage Start. | 50...600% FLC | 350% FLC |
| Stop Mode | Programs the desired Stop Mode. ⁽²⁾ | Coast, Soft Stop, Linear Speed, Pump Stop | Coast |
| Stop Time | Programs the amount of time desired to ramp from full to zero voltage for Soft, Linear, and Pump Stop mode. Actual ramp stop time depends on the stop mode selected and load inertia. | 0...999 s | 0 s |
| 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). | Disable, Start, Coast, Stop Option, Start/Coast, Start/Stop, Dual Ramp, OL Select, Fault, Fault NC, Clear Fault, Emerg Run | Start/Coast |
| 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). | | Disable |
| Aux 1 Config | Programs the control function of the Auxiliary Output Contact #1, wired across control terminal #4 and #5. ⁽³⁾ | Normal, UTS, Fault, Alarm, Ext Bypass, Ext Brake, Aux Control ⁽⁵⁾ , Network 1, Network 2 Network 3, Network 4, Fan Control | Normal |
| Aux 2 Config | Programs the control function of the Auxiliary Output Contact #2, wired across control terminal #6 and #7. ⁽⁴⁾ | | |
| Overload Class | Required for motor protection. Lets you 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. | 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 A | 1 A |
| Starting Torque | Starting Torque NOT used for Full Voltage Start. | 0...300% RMT | 100% RMT |
| Max Torque | NOT used for Full Voltage Start. | 0...300% RMT | 250% RMT |
| Rated Torque | NOT used for Full Voltage Start. | 0...100,000 N•m | 10 N•m |
| Rated Speed | NOT used for Full Voltage Start. | 750, 900, 1000, 1200, 1500, 1800, 3500, 3600 rpm | 1800 rpm |

(1) In the AUTO Detect [default] selection, the controller automatically checks the motor configuration.

(2) The stopping mode does not need to match the starting mode (for example, a Soft Start can have a stop mode programmed for Coast, or Linear Stop—there is no Current Limit Stop or Torque Stop mode).

(3) Relay Operational Options (for example, ON and OFF delay, etc.) are provided in the File: Setup, Group: I/O selection sequence. See [Table 6](#).

- (4) You can also program a start delay time to delay starting for a period of time after the initiation of the START command. You can access the Start Delay parameter from the Group Starting selection. See [Table 6](#).
- (5) Any auxiliary output configured for Aux Control using the AuxX Config parameter is 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 you enter the data into the SMC-50 control module as it appears on the motor nameplate.

Dual Ramp Start with Stop

The controller lets you select between two start profiles. Configure Start Profile 1 using the Basic parameter set as explained in the previous sections. You can access the basic parameter set with the HIM (see [Table 6 on page 76](#)).

TIP 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.

Set up Start Profile 2 by using the Dual Ramp parameter set. You can use the HIM to access Dual Ramp from the <Port 00> DEV PARAM folder (see [Table 6 on page 76](#)). Use the parameters in [Table 13](#) to program a Dual Ramp adjustment.

Table 13 - Dual Ramp Start with Stop Parameters

| Parameter Name | Description | Options | Default Value |
|-----------------------|--|--|---------------|
| Starting Mode 2 | Select the desired starting mode for Profile 2 | Soft Start, Full Voltage, Linear Speed, Torque Start, Current Limit, Pump Start. ⁽³⁾⁽⁴⁾ | — |
| Ramp Time 2 | Programs the Profile 2 time period that the controller will ramp the output voltage to full voltage and motor speed from the programmed Initial Torque value. | 0...1000 s | 10 s |
| 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. ⁽¹⁾ | 50...600% FLC | 350% FLC |
| Initial Torque 2 | 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% LRT | 70% LRT |
| Starting Torque 2 | 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% RMT | 100% RMT |
| 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% RMT | 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. ⁽²⁾ | 0...2 s | 0 s |
| Kickstart Level 2 | For Start Profile 2, if required, this parameter programs the amount of current (torque) applied to the motor during Kickstart time. ⁽²⁾ | 750, 900, 1000, 1200, 1500, 1800, 3500, 3600 rpm | 1800 rpm |

(1) Enter a value to limit the current but not low enough to inhibit the start cycle.

(2) Available for Soft Start, Current Limit, and Torque Start modes. Set to zero to disable Kickstart.

(3) Torque Ramp and Linear Speed Starting modes require you to perform a Motor Tuning Cycle. The SMC-50 control module does this automatically the first time the motor is run. You 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 controller's Reset button for 10 seconds with the motor stopped.

(4) You can also program a start delay time 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 [Table 6](#)).

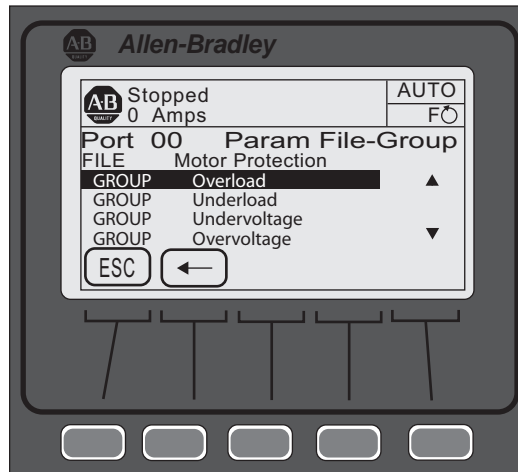
Motor Protection

The Motor Protection Group (see [Table 16 on page 90](#)) 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 control module lets you individually enable, disable, or restart the motor and starter Faults and Alarms. Each of the 21 different Motor/Starter Protection Setup groups (for example, Overload, Underload, Jam, Stall, Voltage Unbal, etc.) has at least one selection for Fault Enable, Alarm Enable, and Restart Enable.

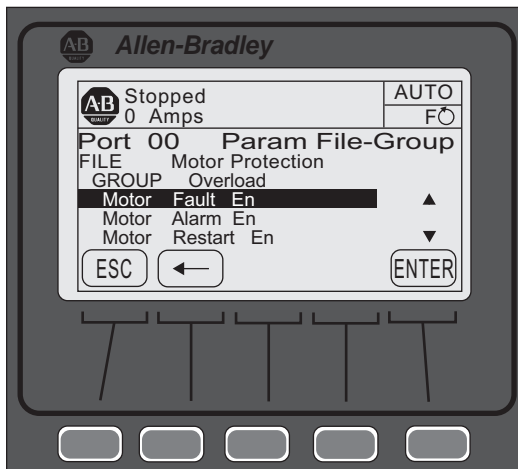
IMPORTANT The majority of parameters have a Fault and an Alarm setting.

To modify any Fault or Alarm bit for enable/disable functionality, perform the following steps.

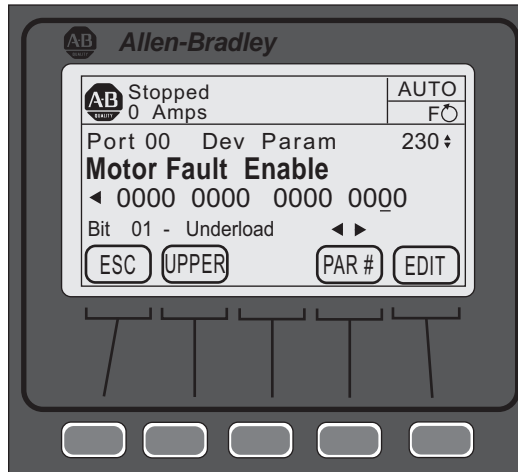
1. From the Motor Protection Group, select the desired group.



2. Press ENTER (number 5 from keypad) to display the associated bit parameters.

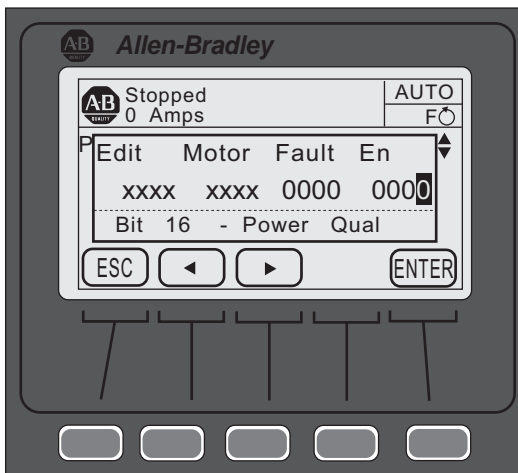


3. Select the desired 16 bit field, then press EDIT.



TIP 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 control module.



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.

Table 14 - Monitoring Group

| Monitoring File Group Parameters | | | | | | | |
|----------------------------------|----------------------|------------------------|----------------------|---------------------|-------------------|-------------------|---------------------|
| Metering Basic (MBA) | Metering Volts (MBA) | Metering Current (MBA) | Metering Power (MBA) | | Start Stats (MBA) | Monitoring (MBA) | Power Quality (MBA) |
| Volts P-P Ave | Volts P-P Ave | Current Ave | Real Power | Apparent Power | Start Time 1 | Elapsed Time | THD Va |
| Volts P-N Ave | Volts Phase A-B | Current Phase A | Real Power A | Apparent Power A | Start Time 2 | Elapsed Time 2 | THD Vb |
| Current Average | Volts Phase B-C | Current Phase B | Real Power B | Apparent Power B | Start Time 3 | Running Time | THD Vc |
| Torque | Volts Phase C-A | Current Phase C | Real Power C | Apparent Power C | Start Time 4 | Energy Savings | THD Vave |
| Motor Speed | Volts P-N Ave | Current Imbal | Real Demand | Apparent Demand | Start Time 5 | Motor Therm Usage | THD Ia |
| Power Factor | Volts Phase A-N | | Max Real Demand | Max Apparent Demand | Peak Current 1 | Time to OL Trip | THD Ib |
| Real Power | Volts Phase B-N | | Reactive Power | Power Factor | Peak Current 2 | Time to OL Reset | THD Ic |
| Reactive Power | Volts Phase C-N | | Reactive Power A | Power Factor A | Peak Current 3 | Time to PM | THD Iave |
| Apparent Power | Volts Unbal | | Reactive Power B | Power Factor B | Peak Current 4 | Starts to PM | |
| Real Energy | | | Reactive Power C | Power Factor C | Peak Current 5 | Total Starts | |
| Reactive Energy + | | | Reactive Demand | | | Product Status | |
| Reactive Energy - | | | Max Reactive Demand | | | | |
| Apparent Energy | | | | | | | |
| Meter Reset | | | | | | | |

Table 15 - Setup File Group

| Setup File Group Parameters | | | | | | | | |
|-----------------------------|-----------------|-----------------|----------------|-------------------|----------------------|-----------------|--------------------|----------------------|
| Basic (BA) | | Starting (BA) | Stopping (BA) | Dual Ramp (BA) | Advanced | I/O (BA) | Advanced Tuning | |
| Motor Config | Input 2 | Starting Mode | Stop Mode | Starting Mode 2 | Pump Pedestal (A) | Input 1 | Force Tuning (A) | Phase Shift 0% (A) |
| Line Voltage | Aux 1 Config | Ramp Time | Stop Time | Ramp Time 2 | UTS Level (A) | Input 2 | Starter R | Phase Shift 10% (A) |
| Starting Mode | Aux 2 Config | Cur Limit Level | Backspin Timer | Cur Limit Level 2 | Stall Position (A) | Aux 1 Config | Total R | Phase Shift 20% (A) |
| | Ramp Time | Overload Class | | Initial Torque | Initial Torque 2 | Stall Level (A) | Aux 1 Invert | Coupling Factor |
| Starting Torque | | | | Starting Torque 2 | V Shut Off Level (A) | Aux 1 On Delay | Inductance | Phase Shift 40% (A) |
| Initial Torque | Service Factor | Max Torque | | Max Torque 2 | I Shut Off Level (A) | Aux 1 Off Delay | Speed PGain (A) | Phase Shift 50% (A) |
| Max Torque | | Kickstart Time | | Kickstart Time 2 | Notch Maximum (A) | Aux 2 Config | Transient Gain (A) | Phase Shift 60% (A) |
| Cur Limit Level | Motor FLC | Kickstart Level | | Kickstart Level 2 | Timed Start (A) | Aux 2 Invert | | Transient Zero (A) |
| Stop Mode | Starting Torque | Start Delay | | | Bypass Delay (A) | Aux 2 On Delay | | |
| | | | | | Demand Period (BA) | Aux 2 Off Delay | | Phase Shift 90% (A) |
| Stop Time | Max Torque | | | | Num of Periods (BA) | Aux Control | | Phase Shift 100% (A) |
| Input 1 | Rated Torque | | | | | | | |
| | Rated Speed | | | | | | Ping Degree (A) | |
| | | | | | | | Pings (A) | |

Table 16 - Motor Protection Group

| Motor Protection File Group Parameters | | | | | | | |
|--|----------------------|------------------------|------------------------|----------------------|----------------------|----------------------|-----------------------|
| Overload (BA) | Underload (BA) | Undervoltage (BA) | Overvoltage (BA) | Jam (BA) | Stall (BA) | Real Power (BA) | Reactive + Power (BA) |
| Motor Fault Enable | Motor Fault Enable | Starter Fault Enable | Starter Fault Enable | Motor Fault Enable | Motor Fault Enable | Motor Fault Enable | Motor Fault Enable |
| Motor Alarm Enable | Motor Alarm Enable | Starter Alarm Enable | Starter Alarm Enable | Motor Alarm Enable | Motor Alarm Enable | Motor Alarm Enable | Motor Alarm Enable |
| Motor Restart Enable | Motor Restart Enable | Starter Restart Enable | Starter Restart Enable | Motor Restart Enable | Motor Restart Enable | Motor Restart Enable | Motor Restart Enable |
| Overload Class | Underload F Level | | | Jam F Level | Stall Delay | MWatts Ov F Level | +MVAR Ov F Level |
| Overload Class 2 | Underload F Delay | Undervolt F Level | Overvolt F Level | Jam F Delay | | MWatts Ov F Delay | +MVAR Ov F Delay |
| Service Factor | Underload A Level | Undervolt F Delay | Overvolt F Delay | Jam A Level | | MWatts Ov A Level | +MVAR Ov A Level |
| Motor FLC | Underload A Delay | Undervolt A Level | Overvolt A Level | Jam A Delay | | MWatts Ov A Delay | +MVAR Ov A Delay |
| OL Reset Level | | Undervolt A Delay | Overvolt A Delay | | | MWatts Un F Level | +MVAR Un F Level |
| OL Shunt Time | | MWatts Un F Delay | +MVAR Un F Delay | | | | |
| OL Inhibit Time | | MWatts Un A Level | +MVAR Un A Level | | | | |
| Overload A Level | | MWatts Un A Delay | +MVAR Un A Delay | | | | |

Table 16 - Motor Protection Group (Continued)

| Motor Protection File Group Parameters | | | | | | | |
|--|----------------------|---------------------------|----------------------|------------------------|------------------------|------------------------|----------------------|
| Reactive - Power (BA) | Apparent Power (BA) | Leading PF (BA) | Lagging PF (BA) | Voltage Unbal (BA) | Current Imbal (BA) | Voltage THD (BA) | Current THD (BA) |
| Motor Fault Enable | Motor Fault Enable | Motor Fault Enable | Motor Fault Enable | Starter Fault Enable | Motor Fault Enable | Starter Fault Enable | Motor Fault Enable |
| Motor Alarm Enable | Motor Alarm Enable | Motor Alarm Enable | Motor Alarm Enable | Starter Alarm Enable | Motor Alarm Enable | Starter Alarm Enable | Motor Alarm Enable |
| Motor Restart Enable | Motor Restart Enable | Motor Restart Enable | Motor Restart Enable | Starter Restart Enable | Motor Restart Enable | Starter Restart Enable | Motor Restart Enable |
| -MVAR Ov F Level | MVA Ov F Level | Lead PF F Level | Lag PF F Level | | Current Imbal F Level | | THD I F Level |
| -MVAR Ov F Delay | MVA Ov F Delay | Lead PF F Delay | Lag PF F Delay | Voltage Unbal F Level | Current Imbal F Delay | THD V F Level | THD I F Delay |
| -MVAR Ov A Level | MVA Ov A Level | Lead PF A Level | Lag PF A Level | | | THD V F Delay | THD I A Level |
| -MVAR Ov A Delay | MVA Ov A Delay | Lead PF A Delay | Lag PF A Delay | Voltage Unbal F Delay | Current Imbal A Level | THD V A Level | THD I A Delay |
| +MVAR Un F Level | MVA Un F Level | Lead PF F Level | Lag PF F Level | | | THD V A Delay | |
| -MVAR Un F Delay | MVA Un F Delay | Lead PF F Delay | Lag PF F Delay | Voltage Unbal A Level | Current Imbal A Delay | | |
| -MVAR Un A Level | MVA Un A Level | Lead PF A Level | Lag PF A Level | | | | |
| -MVAR Un A Delay | MVA Un A Delay | Lead PF A Delay | Lag PF A Delay | Voltage Unbal A Delay | | | |
| Line Frequency (BA) | | Maintenance | | History (MBA) | Restart (BA) | | Locked Rotor (BA) |
| Starter Fault Enable | | Motor Fault Enable (BA) | | Fault 1 | Motor Restart Enable | | Motor Fault Enable |
| Starter Alarm Enable | | Motor Alarm Enable (BA) | | Fault 2 | Starter Restart Enable | | Motor Alarm Enable |
| Starter Restart Enable | | Motor Restart Enable (BA) | | Fault 3 | Restart Attempts | | Motor Restart Enable |
| Frequency High F Level | | PM Hours (BA) | | Fault 4 | Restart Delay | | Locked Rotor F Level |
| Frequency High F Delay | | PM Starts (BA) | | Fault 5 | | | Locked Rotor F Delay |
| Frequency High A Level | | Time to PM (MBA) | | Alarm 1 | | | Locked Rotor A Level |
| Frequency High A Delay | | Starts to PM (MBA) | | Alarm 2 | | | Locked Rotor A Delay |
| Frequency Low F Level | | Starts per Hour (MBA) | | Alarm 3 | | | OverCurrent LVL |
| Frequency Low F Delay | | | | Alarm 4 | | | |
| Frequency Low A Level | | | | Alarm 5 | | | |
| Frequency Low A Delay | | | | | | | |

Table 17 - Communications Group Parameters

| Communications File Group Parameters | | |
|--------------------------------------|-----------------|-------------|
| Communications Masks (BA) | Data Links (BA) | |
| Logic Mask | Data In A1 | Data Out A1 |
| Logic Mask Act | Data In A2 | Data Out A2 |
| Write Mask Cfg | Data In B1 | Data Out B1 |
| Write Mask Act | Data In B2 | Data Out B2 |
| Port Mask Act | Data In C1 | Data Out C1 |
| | Data In C2 | Data Out C2 |
| | Data In D1 | Data Out D1 |
| | Data In D2 | Data Out D2 |

Table 18 - Utility Group Parameters

| Utility File Group Parameters | | |
|-------------------------------|--------------------------|---------------------------|
| Preferences | Motor Data | Expansion (MBA) |
| Language (BA) | Motor Connection (MBA) | Expansion A Configuration |
| Fan Configuration (BA) | Line Voltage (BA) | Expansion A Configuration |
| Motor Configuration (BA) | Motor FLC (BA) | Expansion A Configuration |
| Parameter Management (A) | Rated Torque (BA) | |
| | Rated Speed (Ba) | |
| | User CT Ratio (A) | |
| | Factory CT Ratio (A) | |
| | Voltage Ratio (A) | |
| | Parameter Management (A) | |

Option Module Configuration

Basic Configuration using the HIM

When you plug an Option Module into one of the three available ports (07, 08, or 09), you may need to configure the option module parameters. These parameters reside in the option module through one of the ports (07, 08, or 09) and are not included in the SMC-50 (Port <00>) parameter list.

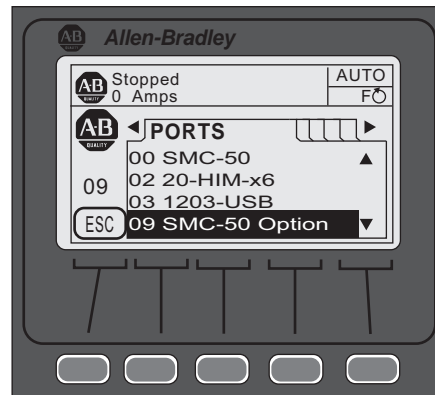
Perform the following steps to access the option module parameters using the HIM.

One Digital I/O card (150-SM4) is always required for MV applications, and it is always inserted in Slot 7.

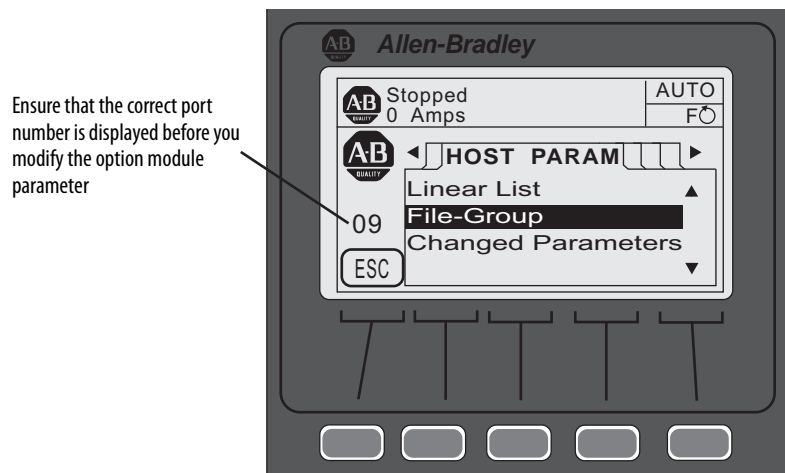
TIP Before proceeding with these steps: Take note of the SMC-50 control module port number (07, 08, or 09) that the option module is connected to.

1. Press the FOLDERS single function key.

- Use the forward or back arrow until the PORTS folder screen is displayed.



- Use the up or down arrow until the noted port number of the option module is displayed. The HIM displays the HOST PARM file screen and indicates the option module port control module number below the AB logo.



- Ensure the correct port number is displayed, then configure the parameters using either the Linear List or File-Group selection.

TIP 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](#).

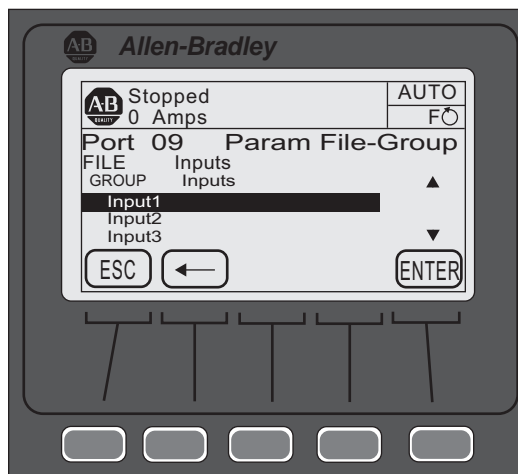
150-SM4 Digital I/O Option Module

In addition to the two on-board 24V DC input and two auxiliary relay outputs of the SMC-50 control module, the 150-SM4 Digital I/O Option Module has four 120...240V AC inputs and three auxiliary relay outputs. You can use these inputs and outputs for control functions.

Configure 120...240V AC Inputs

TIP Before proceeding with the following steps, perform steps [1](#) through [4](#) in [Basic Configuration using the HIM](#).

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 (for example, Start, Stop, Coast, etc.), then press the ENTER soft key to load the selection. If necessary, use the back arrow to return to the previous selection.

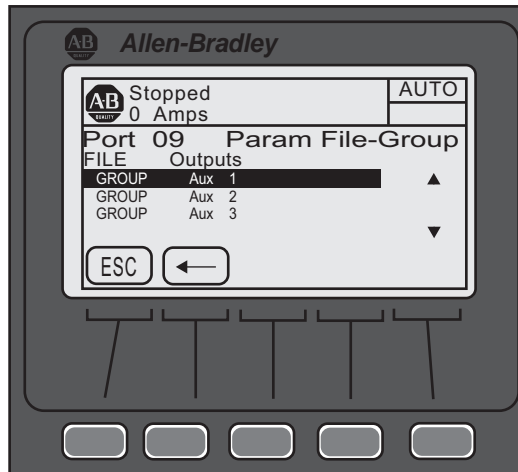
TIP For a complete list of 150-SM4 parameters, see the [Digital I/O Option Module Parameter List on page 95](#).

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

TIP Before proceeding with the following steps, perform steps [1](#) through [4](#) in [Basic Configuration using the HIM](#).

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 in [Table 19](#).

Table 19 - 150-SM4 Parameters

| Parameter | | Min/Max Values | Default Value | Access | Units | |
|-----------------------|-----------------|---|--|---------|-------|------------------------------------|
| Number ⁽¹⁾ | Name | | | | | |
| 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 | Dual Ramp OL Select Fault Fault NC Clear Fault Emerg Run Motor Heater | Disable | 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 ⁽²⁾ Network 1 Network 2 Network 3 Network 4 Fan Control | Normal | R/W | NA |
| X.7 | Aux 1 Invert | Disable Enable | | Disable | R/W | |
| X.8 | Aux 1 On Delay | 0.0 ... 10.0 | | 0.0 | R/W | seconds |
| X.9 | Aux 1 Off Delay | 0.0 ... 10.0 | | 0.0 | R/W | seconds |
| X.10 | Aux 2 Config | Normal UTS (Up-to-Speed) Fault Alarm Ext Bypass Ext Brake | DeviceLogix Aux Control ⁽²⁾ Network 1 Network 2 Network 3 Network 4 Fan Control | Normal | R/W | NA |
| X.11 | Aux 2 Invert | Disable Enable | | Disable | R/W | NA |
| X.12 | Aux 2 On Delay | 0.0 ... 10.0 | | 0.0 | R/W | seconds |
| X.13 | Aux 2 Off Delay | 0.0 ... 10.0 | | 0.0 | R/W | seconds |
| X.14 | Aux 3 Config | [Normal] UTS (Up-to-Speed) Fault Alarm Ext Bypass Ext Brake | DeviceLogix Aux Control ⁽²⁾ Network 1 Network 2 Network 3 Network 4 Fan Control | Normal | R/W | NA |
| X.15 | Aux 3 Invert | Disable Enable | | Disable | R/W | NA |
| X.16 | Aux 3 On Delay | 0.0 ... 10.0 | | 0.0 | R/W | seconds |
| X.17 | Aux 3 Off Delay | 0.0 ... 10.0 | | 0.0 | R/W | seconds |
| X.18 | Parameter Mgmt | Ready Factory Default | | Ready | R/W | NA |

(1) "X" indicates the port number (07, 08, or 09) the 150-SM4 is connected to the SMC-50 control module. This port number is displayed on the HIM screen below the Allen-Bradley brand logo.

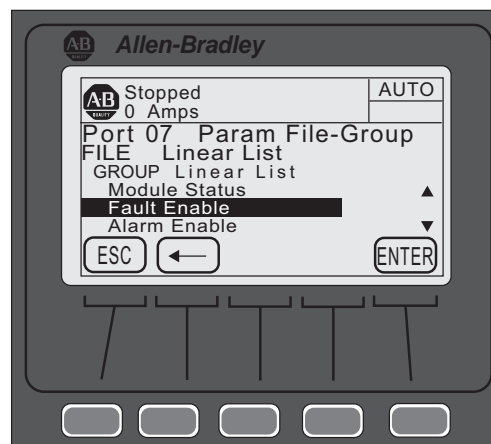
(2) An auxiliary output configured for Aux Control using the AuxX Config parameter is under control of its associated bit form the AuxControl, Parameter 180.

150-SM2 PTC, Ground Fault, and 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 controller for certain application conditions. When installing the 150-SM2 into the SMC-50 control module, the following installation requirements **must** be followed:

- Only one 150-SM2 can be installed in one SMC-50 control module.
- 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 control module 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 you force tuning of the SMC-50 control module through the Force Tuning, Parameter 194, or the HOLD TO TEST button on the SMC-50 control module is held for > 10 seconds when stopped.

To configure the 150-SM2, follow the steps in [Basic Configuration using the HIM on page 92](#) then proceed with the following steps.



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.

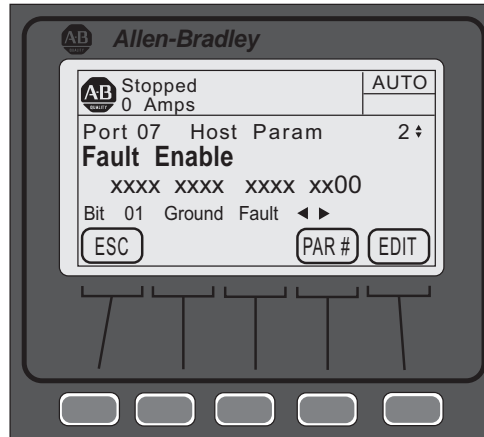
If the parameter is bit configured (for example, Fault Enable):

- 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 (for example, Turns Ratio):

- a. Press the EDIT.
- b. Change the value within the displayed limits, then press ENTER to load the parameter contents into memory.



[Table 20](#) provides the parameter detail of the 150-SM2.

Table 20 - 150-SM2 Parameters

| Parameter | | Min/Max Values | Default Value | Access | Units |
|-----------------------|--------------------------------------|--|---------------|--------|-----------------------------------|
| Number ⁽¹⁾ | Name | | | | |
| 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 ⁽²⁾ | 100...2000 | 1000 | R/W | NA |
| X.6 | Ground Fault Level ⁽³⁾ | 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 ⁽⁴⁾ | 0.0...250.0 | 10.0 | R/W | Seconds |
| X.11 | Ground Current | 0.00...5.00 | 0.00 | R | Amps |
| X.12 | CT Enable | Disable Enable | Disable | 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 | | | | |

Table 20 - 150-SM2 Parameters (Continued)

| Parameter | | Min/Max Values | Default Value | Access | Units |
|-----------------------|----------------|--------------------------|---------------|--------|--------|
| Number ⁽¹⁾ | Name | | | | |
| 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 | Ready | R/W | NA |

(1) "X" indicates the port number (07, 08, or 09) the 150-SM6 is connected to the SMC-50 control module. This port number is displayed on the HIM screen below the AB brand logo.

(2) Configure Turns Ratio to the value of the Ground Fault sensor CT Turns Ratio (for example, 825-CBCT=100:1 Set X.5 to 100.

(3) The sensing range of the module.

(4) Inhibit Time lets you inhibit (disable) ground fault protection for the time selected during starting.

Notes:

Metering

Overview

While the SMC-50 operates a motor, it is also monitoring several different parameters to provide a full-function metering package.

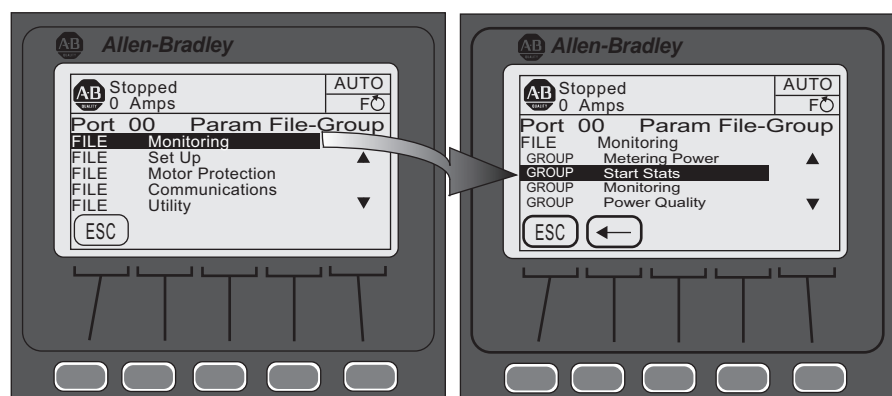
Viewing Metering Data

To access the metering information using the 20-HIM-A6, use the keypad to follow the procedure below.

1. From the SMC-50 control module standard power-up screen, select **FOLDERS**.
2. Use the right or left arrow until the **Port 00 DEV PARAM** screen is displayed.

TIP 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 66](#).

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 appears.
4. Use the up or down Arrow key to select File Monitoring. The Port 00 Param File-Group File Monitoring screen appears 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.

TIP 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 36](#) and [Metering Parameters on page 102](#) 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 (Preventive 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...4, [Viewing Metering Data](#).

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 is reset to zero with the exception of the Starts to PM.

TIP When the ENTER key is pressed and Starts to PM is selected, its contents is set to the value contained in PM Starts, Parameter 127.

Metering Parameters

Current

The SMC-50 control module calculates true RMS current based on Current Transformer (CT) feedback for all three phases. It also calculates an average value of the three phase currents. During Braking operation, the calculated current is estimated based on time and current settings. This parameter reports the three-phase motor current measurements. These measurements are always line current, regardless of the type of connection. The accuracy of the current calculation is $\pm 5\%$ of the true RMS current.

Table 21 - Metering Parameters Associated with Current

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|------------------|---------------|---------------|--------|-------|
| 5 | Current Average | 0...15,000 | 0 | 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 is $\pm 2\%$ of the true RMS voltage.

Table 22 - Metering Parameters Associated with Voltage

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|---------------------|---------------|---------------|--------|-------|
| 1 | Voltage P-P Average | [0]...15,000 | [0] | R | Volts |
| 2 | Volts Phase A-B | | | | |
| 3 | Volts Phase B-C | | | | |
| 4 | Volts Phase C-A | | | | |
| 265 | Voltage P-N Average | [0]...9000 | [0] | R | Volts |
| 266 | Volts Phase A-N | | | | |
| 267 | Volts Phase B-N | | | | |
| 268 | Volts Phase C-N | | | | |

Torque

The SMC-50 control module calculates true electromechanical torque based on the existing motor voltage and current feedback data.

- TIP**
- During Braking operations, Torque reads 0.
 - 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 $\pm 10\%$ of the true electromechanical torque.

Table 23 - Metering Parameters Associated with Torque

| Parameter Number | Name/Description | Min/Max Value | Default Value | 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 102](#) for further details.

- TIP** 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 24 - Metering Parameters Associated with Power

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|-------------------|---------------|---------------|--------|-------|
| 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 | | | | |

Table 24 - Metering Parameters Associated with Power (Continued)

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units | |
|------------------|----------------------|---------------|---------------|--------|-------|------|
| 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 | | | | | |
| 290 | Demand Period | 1...255 | 1 | R/W | min | |
| 291 | Number of Periods | 1...15 | 1 | R/W | — | |

Power Factor

Power Factor is calculated for each phase along with a total power factor value. The power factor calculation does not apply during Braking operations.

Table 25 - Metering Parameters Associated with Power Factor

| Parameter Number | Name/Description | Min/Max Value | Default Value | 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 | | | | |

Elapsed Time

The SMC-50 control module 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 102](#)).

Elapsed Time 2 is similar to Elapsed Time. Elapsed Time 2 differs in that you cannot reset it and will count up to 50,000 hours and then hold that value (it will not roll over).

Table 26 - Metering Parameters Associated with Elapsed Time

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|------------------|---------------|---------------|--------|-------|
| 12 | Elapsed Time | 0.0...50000.0 | 0.0 | R | 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.

TIP When the controller is stopped, the parameter displays the length of time the motor was previously operating.

Table 27 - Metering Parameters Associated with Running Time

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|------------------|---------------|---------------|--------|-------|
| 14 | Running Time | 0.0...50000.0 | 0.0 | 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 controller 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 28 - Metering Parameters Associated with Motor Speed

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|------------------|---------------|---------------|--------|-------|
| 34 | Motor Speed | 0...100 | 0.0 | R | % |

Actual Start Time

The SMC-50 control module 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 29 - Metering Parameters Associated with Actual Start Time

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|------------------|---------------|---------------|--------|---------|
| 24 | Start Time 1 | 0...1000 | 0 | R | Seconds |
| 25 | Start Time 2 | | | | |
| 26 | Start Time 3 | | | | |
| 27 | Start Time 4 | | | | |
| 28 | Start Time 5 | | | | |

Peak Start Current

The SMC-50 control module 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 30 - Metering Parameters Associated with Peak Start Current

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|------------------|---------------|---------------|--------|-------|
| 29 | Peak Current 1 | 0...15,000 | 0 | R | Amps |
| 30 | Peak Current 2 | | | | |
| 31 | Peak Current 3 | | | | |
| 32 | Peak Current 4 | | | | |
| 33 | Peak Current 5 | | | | |

Total Starts

The SMC-50 control module maintains a Total Start counter which is incremented each time the controller is started. As shipped, the counter value is zero. You cannot reset it.

TIP The Total Starts counter is not incremented if the controller faults on a pre-start fault. It is incremented once SCR gating begins.

Table 31 - Metering Parameters Associated with Total Starts

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|------------------|---------------|---------------|--------|-------|
| 23 | Total Starts | 0...30,000 | 0.0 | R | NA |

Total Harmonic Distortion (THD)

The SMC-50 control module provides the IEEE calculated THD value for the three Line Voltages (Line-to-Neutral) and the three Motor Phase Currents (current through controller Power Pole⁽¹⁾). 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.

TIP When the motor is not running, the Current-Based THD values read 0.

(1) When in external bypass running mode/configuration, you can use an external CT (825-MCM) and a 150-SM2 Option Module to read current-based (THD Ix) values.

Table 32 - Metering Parameters Associated with THD

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|----------------------|---------------|---------------|--------|-------|
| 35 | THD V _a | 0.0...1000.0 | 0.0 | R | % |
| 36 | THD V _b | | | | |
| 37 | THD V _c | | | | |
| 38 | THD V _{ave} | | | | |
| 39 | THD I _a | | | | |
| 40 | THD I _b | | | | |
| 41 | THD I _c | | | | |
| 42 | THD I _{ave} | | | | |

Line Frequency

The SMC-50 control module 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 controller, the parameter maintains the value of the previous frequency reading.

Table 33 - Metering Parameters Associated with Line Frequency

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|------------------|---------------|---------------|--------|-------|
| 224 | Line Frequency | 0...100 | 0 | R | Hz |

Current Imbalance

The SMC-50 control module 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 controller Power Pole Current is used for the Current Imbalance calculation.

Table 34 - Metering Parameters Associated with Current Imbalance

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|-------------------|---------------|---------------|--------|-------|
| 295 | Current Imbalance | 0...100 | 0 | R | % |

Voltage Unbalance

The SMC-50 control module 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 35 - Metering Parameters Associated with Voltage Unbalance

| Parameter Number | Name/Description | Min/Max Value | Default Value | Access | Units |
|------------------|-------------------|---------------|---------------|--------|-------|
| 296 | Voltage Unbalance | 0...100 | 0 | R | % |

Notes:

Optional HIM Operation

Overview

The SMC-50 control module 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 control options on the controller. [Table 36](#) and [Table 37](#) detail the functionality of each control button. For additional details on using the 20-HIM-A6, see the user manual, publication [20HIM-UM001](#).

IMPORTANT You must enable the logic mask port before you initiate control commands except for Stop, which always initiate a Coast-to-Stop command. See [Control Enable on page 117](#) for instructions.



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.

Table 36 - 20-HIM-A6 Control Button Functionality, Standard Control








| Option | Action | Operation When Pressed |
|--|---|--|
| Soft Stop Current Limit Full Voltage Linear Speed |  | The green start button begins motor acceleration to full speed. |
| |  | The red stop button provides a coast stop, and/or reset a fault. |
| |  | This button brings up the Control Screen to enable the stop option maneuver. See the HIM Control Screen on page 112 section. |

Table 37 - 20-HIM-A6 Control Button Functionality, Pump Control

| Option | Action | Operation When Pressed |
|--------------|---|---|
| Pump Control |  | The green start button begins motor acceleration to full speed. |
| |  | The red stop button provides a coast stop, and/or reset a fault. |
| |  | Displays the Control Screen with the Jog button. The jog button initiates a pump stop maneuver. |

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, you must press the ESC soft key. This deactivates the Control Screen and displays the previous screen.

Figure 45 - HIM Control Screen

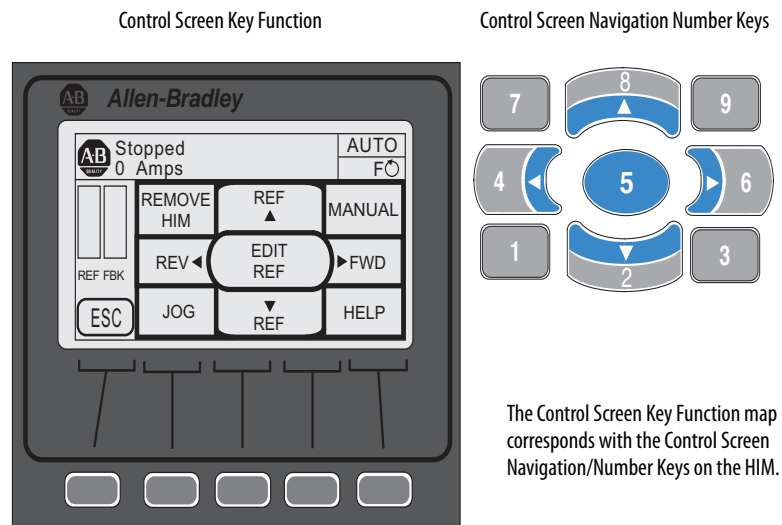











Table 38 - Control Screen Soft Key Functionality

| Label | Name | Function |
|-------|--------|--------------------------------------|
| ESC | Escape | Reverts back to the previous screen. |

Table 39 - Control Screen Navigation/Number Keys

| Label | Name | Function |
|------------|--|--|
| JOG |  | Stop Option for controller |
| REF ? |  | NA |
| HELP |  | Displays Rockwell Automation Drive's Technical Support direct phone number, website address, and email address. |
| REV ◀ |  | NA |
| EDIT REF |  | NA |
| FWD ▶ |  | NA |
| REMOVE HIM |  | 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 controller. In this case, a fault occurs if the HIM is removed. |
| REF ? |  | NA |
| MANUAL |  | NA |

CopyCat Function of the 20-HIM-A6

The SMC-50 control module 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](#).

Notes:

Communications

Overview

The SMC-50 control module provides advanced communications capabilities that allow you to start and stop it from multiple sources and provide diagnostic information through the use of communication interfaces. The SMC-50 control module uses DPI as an internal method of communication bus; therefore, all standard DPI communication interfaces that are used by other devices (for example, PowerFlex® Drives) can be used in the SMC-50 control module. SCANport™ devices are not supported by the SMC-50 control module.

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. [Table 40](#) shows a list of available modules.

Table 40 - 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 control module 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 in [Table 40](#) to the internal DPI communication card connection (SMC-50 control module hardware controller port 9).

HIM Keypad and Displays

The SMC-50 control module can be programmed with the optional Bulletin 20-HIM-A6 LCD display. Parameters are organized in a multi-level menu structure and are divided into programming groups.

Connecting the HIM to the Control Module

Figure 46 shows how to connect a HIM and DPI device to the SMC-50 control module. Table 41 provides a description of each port.

TIP The SMC-50 controller 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 46 - SMC-50 Control Module with a HIM

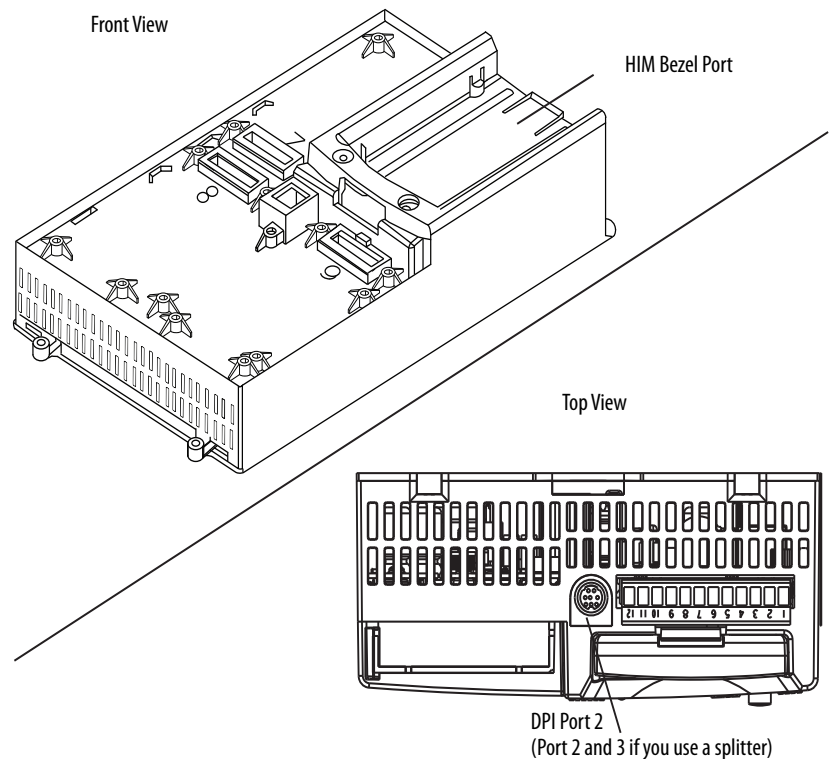


Table 41 - Description of Ports

| DPI Port Number | Source |
|------------------|---|
| 1 | Front-Mounted HIM (HIM Bezel) |
| 2 | Remote DPI (top of SMC-50 control module) |
| 3 | Remote DPI (top of SMC-50 control module with splitter) |
| 4 ⁽¹⁾ | 20-COMM-x Module |

(1) 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 46).

Control Enable

Logic Mask, Parameter 148, lets you 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)⁽¹⁾ communication fault. You can disconnect a device that is disabled through the logic mask without causing a fault⁽²⁾



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 controller. 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 control module standard power-up screen.

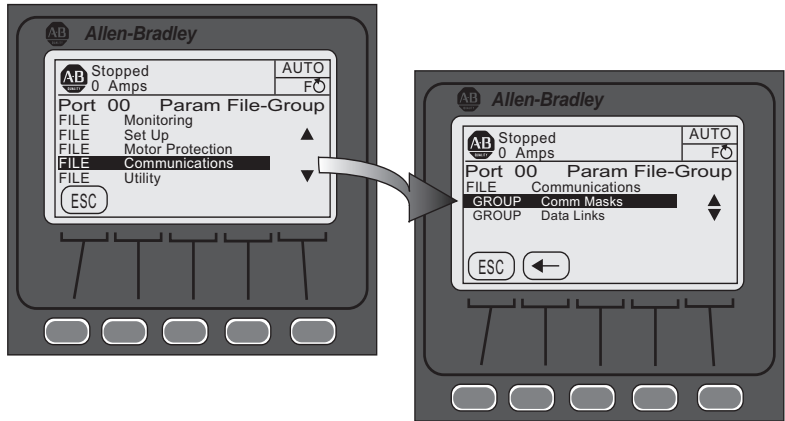
1. Press the  key. Use the right or left arrow key on the keypad to display the <00> DEV PARAM folder screen.
2. Select/highlight the File-Group.
3. Press the  (enter) key. The Port 00 Param File-Group screen appears.

TIP 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 66](#).

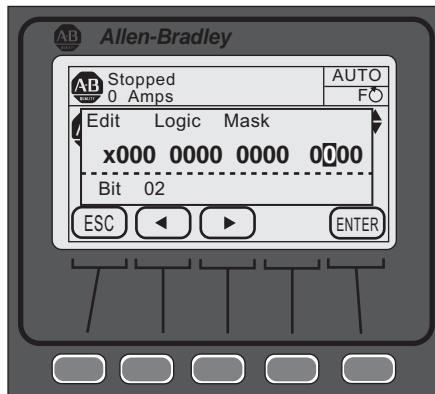
4. Press the  to select FILE Communications, then press . The GROUP Comm Masks and Data Links screen appears.

(1) 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.

(2) 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 5](#).



5. With Comm Mask selected/highlighted, press the **5** key. The GROUP Comm Masks screen appears 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 appears.



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 42 - Logic Mask and Logic Mask Active Parameter Specifications

| Parameter | | Bit Number | DPI Assignment | Access | Units [default] |
|-----------|----------------|------------|----------------|--------|---|
| Number | Name | | | | |
| 148 | Logic Mask | 0 - NA | Port 0 - NA | R/W | Bit = 0 [disabled] Bit = 1 enabled |
| | | 1 | Port 1 | | |
| 149 | Logic Mask Act | 2 | Port 2 | R | Bit = 0 [disabled] Bit = 1 enabled [Follows Logic Mask] |
| | | 3 | Port 3 | | |
| | | 4 | Port 4 | | |
| | | 5 - 15 NA | Port 5 - 15 NA | | |

-
- IMPORTANT**
- The Logic Mask must be set to 0 or the "REMOVE HIM" key is depressed via the HIM controller screen (see [Chapter 5](#)) before you disconnect the HIM from the SMC-50 control module. 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 that 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 vary when used with a communication card. The default configuration is arranged according to the following table.

Table 43 - Default Configuration

| Word | Produced Data (Status) | Consumed Data (Control) |
|------|-------------------------|--------------------------|
| 0 | Logic Status | Logic Command |
| 1 | Feedback ⁽¹⁾ | Reference ⁽²⁾ |

(1) The feedback word is always Ave Current.

(2) The reference word is not used with the SMC-50 control module, however the space must be reserved.

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 control module.

Variable Input/Output Configuration

The SMC-50 control module supports 32-bit Data Links. Therefore, you can configure the device 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 44 - 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 122](#).

SMC-50 Control Module— Bit Identification

Product Functional (Logic) Status, Parameter 43, is used to provide SMC-50 control module functional (logic) status to communication devices. [Table 45](#) details Parameter 43, which is a read-only parameter.

Table 45 - 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 | 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 46 - Logic Command Word (Control)

| Bit Number | Control | Description | |
|------------|---------------|---|--|
| | | 1 | 0 |
| 0 | Stop | Coast/Inhibit | No action |
| 1 | Start | Start | No action |
| 2 | Stop Option | Stop/Maneuver | No action |
| 3 | Clear Fault | Clear fault | No action |
| 5 | Emergency Run | Enable emergency run mode | Disable emergency run mode |
| 8...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 control module does not offer the analog **Reference** feature. The analog **Feedback** feature is supported and provides Current Average, Parameter 5, automatically as the feedback word.

Parameter Information

A complete listing of the SMC-50 parameters is located in [Appendix A on page 163](#).

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. Because 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 control module, is 75 A. Because 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.

Table 47 - Meter Reset Parameter Example

| Text Description | 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 control module. DataLink is a mechanism that most drives use to transfer data to and from the controller without using an explicit message. The SMC-50 control module supports a 32-bit DataLink, allowing you to configure the device 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 control module determine the data passed through the DataLink mechanism.
- When DataLink is used to change a value in the SMC-50 control module, the value is not written to the Non-Volatile Storage (NVS). However, if the controller is powered down, the current value is written to NVS.

To configure DataLink, you must use Parameters 153...168 of the SMC-50 control module. See [Table 48](#) for a detailed listing of these parameters. For additional information about DataLink, see the communication interface's user manual.

Table 48 - Parameter 153 - 168 DataLinks Detail

| Parameter Number | Description | | Min/Max [Default] | Access | Units | |
|------------------|-------------|----------|---|--------|-------|---|
| 153 | Data In | A1 | [0]-Max Parameter Number ⁽¹⁾ | 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 | | — | | | |

(1) The data transferred via the DataLink function is the setting (content(s)) of the parameter number as entered by you here.

Updating Firmware

You can obtain the latest version of firmware and instructions for the SMC-50 control module can be obtained from <http://ab.rockwellautomation.com/Motor-Control/LV-Soft-Starters/SMC-50#resources>.

Notes:

Diagnostics

Overview

This chapter describes the fault diagnostics of the controller and the conditions that cause various faults to occur.

Protection Programming

Many of the protective features available with the SMC-50 control module can be enabled and adjusted through the programming parameters provided. For further details on programming, see [Motor Protection on page 86](#).

Diagnostic Status Indicators

The SMC-50 control module 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 controller.

Table 49 - Corresponding LED Color and Fault Conditions

| Status LED Color | Device Mode | SMC-50 Control Module Status |
|------------------|-------------|---|
| Green | Running | Running without an alarm |
| Green/Amber | Running | Running with an alarm |
| Green Flashing | Ready | Ready (no inhibit and no fault) without an alarm |
| Amber/Flashing | Ready | Ready (no inhibit and no fault) with tuning enabled on the next start |
| Amber | Ready | Ready with alarm (no tuning enabled) |
| Red/Amber | Inhibit | Inhibited; cannot start due to a Stop command |
| Red | Faulted | A non-resettable fault has occurred |
| Red/Flashing | Faulted | A resettable fault has occurred |
| Red/Green | Download | Firmware is being downloaded |

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

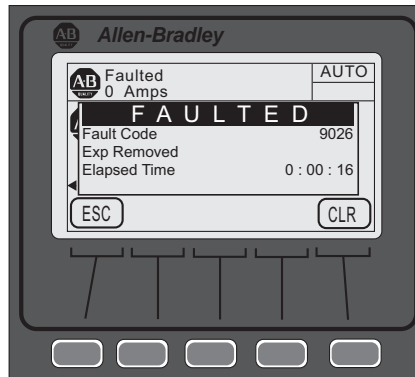
Table 50 - Function Initiation of the HOLD TO TEST, PUSH TO RESET Button

| 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 (motor must be stopped) |

Fault Display (20-HIM-A6)

When you use the SMC-50 control module with a 20-HIM-A6, the HIM displays the fault information.

Figure 47 - Fault Display



IMPORTANT Resetting a fault does not correct the cause of the fault condition. You must take corrective action before you reset the fault.

The fault display remains active as long as control power is applied. If you cycle control power, the fault is cleared, the control module re-initializes, and the display shows 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 control module is still in a faulted state.

Clear Fault

You can clear a fault 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 control module 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.

TIP 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 You cannot reset an overload fault until the value of the Motor Thermal Usage, Parameter 18, is below the value programmed in OL Reset, Parameter 80.

Fault and 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.

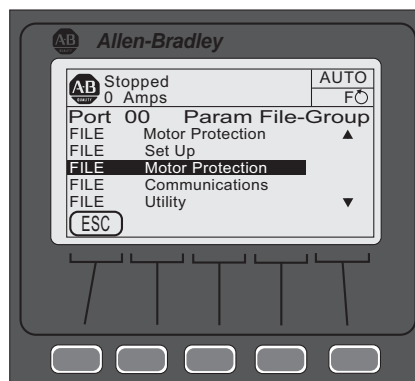
Accessing the Fault and Alarm Parameters

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:

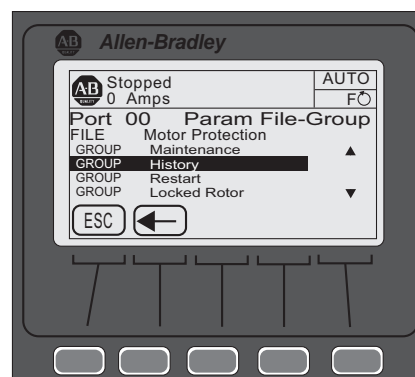
1. From the SMC-50 control module standard power up screen, press the Folders keypad key at the lower left of the display.

TIP Make sure that the Advanced access level (located at the bottom of the <00> DEV PARAM screen) is selected before pressing ENTER. See [Parameter Access Level Modification Using the HIM on page 66](#) for additional details.

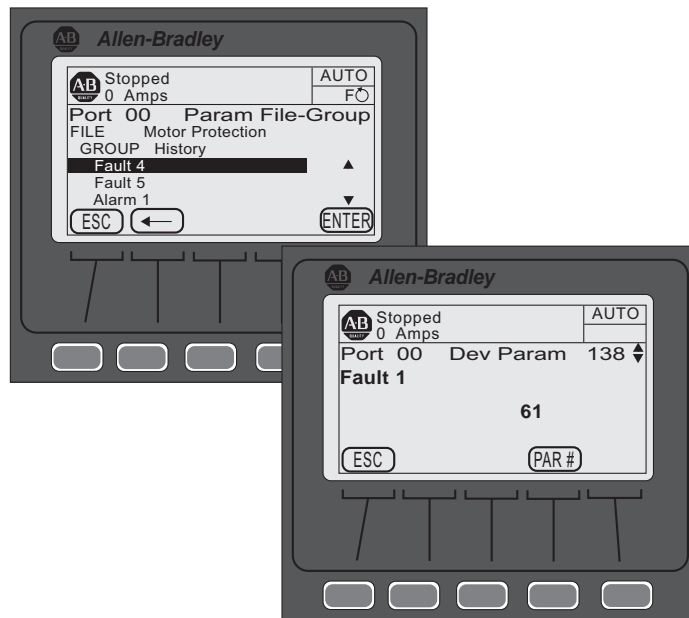
2. From the <00> DEV PARAM folder screen select File-Group, then press ENTER (number 5 from the keypad). The Port 00 Param File Group screen appears.
3. Use the down arrow key to select (highlight) FILE Motor Protection, then press ENTER (number 5 from the keypad).



4. Use the down arrow key to select GROUP History, then press ENTER (number from the keypad).



- 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).



TIP In [step 5](#), Fault 61 is displayed. For Fault/Alarm code data, see [Table on page 131](#).

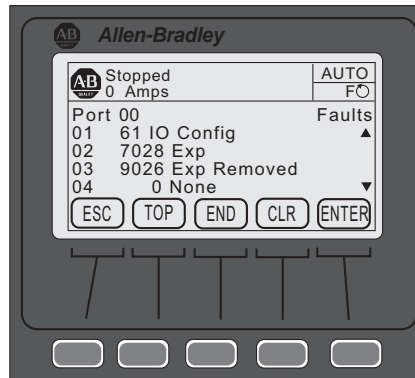
Accessing the Fault and Alarm Buffers

In addition to the SMC-50 control module 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, you must access the Diagnostic folder. To do so, perform the following steps.

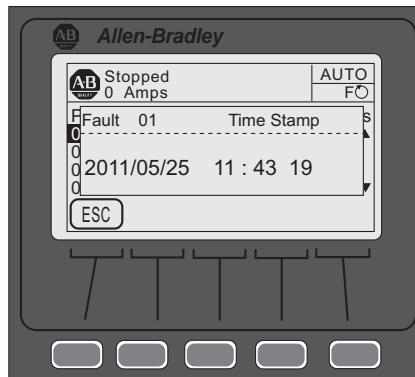
- From the SMC-50 control module standard power up screen, press the Folders key at the lower left of the display.
- Using the right or left arrow key, display the DIAGNOSTIC folder.
- Using the up or down arrow key, select either Faults or Alarms, then press ENTER. In this example, Faults is used.



The HIM displays the five most recent Fault codes if Faults was selected. The HIM displays the 100 most recent Alarm codes with an abbreviated description if Alarm codes were selected. The most recent code is 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 is displayed.



TIP The Fault/Alarm buffers are available using Connected Components Workbench software via the Explore and Device properties drop-down menu. Ensure 0-SMC-50 controller is selected from the list of Devices.

Fault Codes

Table 51 provides a complete cross-reference of the available fault codes and corresponding fault descriptions.

Table 51 - Fault/Alarm Code Cross-Reference

| Fault/Alarm Name | | Code | LED Code | Category ⁽²⁾ | Host | DPI/HIM/COMM | Exp 7, 8, 9 | Fault/Alarm Name | Code | LED Code | Category ⁽²⁾ | Host | DPI/HIM/COMM | Exp 7, 8, 9 | |
|------------------|---|------|----------|-------------------------|------|--------------|-------------|----------------------------|------|----------|-------------------------|------|--------------|-------------|---|
| Line Loss | A | 1 | 1 | D | X | — | — | Under Power Real | 43 | — | M | X | — | — | |
| | B | 2 | | | | | | Over Power Real | 44 | — | M | X | — | — | |
| | C | 3 | | | | | | Un Power Reac + | 45 | — | M | — | — | — | |
| Shorted SCR | A | 4 | 1 | D | X | — | — | Ov Power Reac + | 46 | — | M | — | — | — | |
| | B | 5 | | | | | | Und Power App | 47 | — | M | — | — | — | |
| | C | 6 | | | | | | Ov Power App | 48 | — | M | — | — | — | |
| Open Gate | A | 7 | 2 | D | X | — | — | Frequency | 49 | — | M | X | — | — | |
| | B | 8 | | | | | | PM Hours | 50 | — | M | X | — | — | |
| | C | 9 | | | | | | PM Starts | 51 | — | M | X | — | — | |
| SCR Overtemp | | 10 | 3 | D | X | — | — | Power Quality | A | 52 | — | M | X | — | — |
| Open Bypass | A | 11 | 2 | D | X | — | — | | B | 53 | — | M | X | — | — |
| | B | 12 | | | | | | C | 54 | — | M | X | — | — | |
| | C | 13 | | | | | | Power Quality THD V | 55 | — | M | X | — | — | |
| No Load | | 14 | 2 | M | X | — | — | Power Quality THD I | 56 | — | M | X | — | — | |
| Open Load | A | 15 | 2 | M | X | — | — | Config Change | 57 | — | D | X | — | — | |
| | B | 16 | | | | | | Ground Fault | 58 | — | M | — | — | X | |
| | C | 17 | | | | | | Motor PTC | 59 | — | M | — | — | X | |
| Voltage Unbal | | 18 | 3 | M | X | — | — | Power Pole PTC | 60 | 3 | D | X | — | — | |
| Overvoltage | | 19 | — | M | X | — | — | I/O Config | 61 | — | D | X | — | — | |
| Undervoltage | | 20 | — | M | X | — | — | Test Fault | 62 | 6 | D | X | — | — | |
| Overload | | 21 | 4 | M | X | — | — | | | | | | | | |
| Underload | | 22 | — | M | X | — | — | Und PF Lag | 63 | — | M | — | — | — | |
| Jam | | 23 | — | M | X | — | — | Und PF Lead | 64 | — | M | X | — | — | |
| Stall | | 24 | 5 | M | X | — | — | Ovr PF Lag | 65 | — | M | X | — | — | |
| Phase Reversal | | 25 | 6 | M | X | — | — | Ovr PF Lead | 66 | — | M | X | — | — | |
| Exp Removed | | 26 | — | D | — | X | X | –MVAR Over | 67 | — | M | X | — | — | |
| Exp Incompat | | 27 | — | D | — | — | X | –MVAR Under | 68 | — | M | X | — | — | |
| Expansion | | 28 | — | D | — | X | X | RTC Battery Low | 69 | 5 | D | X | — | — | |
| Excess Starts | | 29 | — | M | X | — | — | Locked Rotor | 70 | — | M | X | — | — | |
| CT Loss | A | 30 | 4 | D | X | — | — | Start ⁽³⁾ | 71 | — | — | — | — | — | |
| | B | 31 | | | | | | Stop Option ⁽³⁾ | 73 | — | — | — | — | — | |
| | C | 32 | | | | | | Coast ⁽³⁾ | 74 | — | — | — | — | — | |
| HAL ID | | 33 | 5 | D | X | — | — | | | | | | | | |

Table 51 - Fault/Alarm Code Cross-Reference (Continued)

| Fault/Alarm Name | Code | LED Code | Category ⁽²⁾ | Host | DPI/HIM/COMM | Exp 7, 8, 9 | Fault/Alarm Name | Code | LED Code | Category ⁽²⁾ | Host | DPI/HIM/COMM | Exp 7, 8, 9 | |
|-------------------------|------|----------|-------------------------|------|--------------|-------------|-----------------------------|---------|----------|-------------------------|------|--------------|-------------|---|
| NVS Error | 34 | 5 | D | — | — | — | Clear Fault ⁽³⁾ | 75 | — | — | — | — | — | |
| V24 Recovery | 35 | 5 | D | X | — | — | Fault ⁽³⁾ | 76 | — | — | — | — | — | |
| V24 Loss | 36 | 5 | D | X | — | — | Param Change ⁽³⁾ | 77 | — | — | — | — | — | |
| VControl Loss | 37 | 5 | D | X | — | — | Reserved | 78-99 | — | — | — | — | — | |
| TB Input ⁽¹⁾ | 1 | 38 | 6 | D | X | — | System Faults | 100-199 | 5 | D | X | — | — | |
| | 2 | 39 | | | X | — | | | | | | | | X |
| | 3 | 40 | | | — | — | | | | | | | | X |
| | 4 | 41 | | | — | — | | | | | | | | X |
| Current Imbal | 42 | 7 | M | X | — | — | | | | | | | | |

(1) TB = Terminal Block Input

(2) For Category, M= Motor; D=Device

(3) Codes 71...77 are Event codes.

[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.

TIP 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).

Table 52 - Linear Listing—Fault and Alarm Code Overview

| Fault/Alarm Code Name | F/A Code | Time Delay Avail. | F/A Bit Enable | Restart Enable | Description F/A= Fault and 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 | N A | A During prestart checks (motor stopped not running), the SMC-50 control module monitors for current flow in each individual phase. NOTE: In Wye configurations, a single Phase A, B, or C shorted SCR is not 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 (for example, open SCR Gate) has been sensed during the starting sequence. |
| | B 8 | | | | |
| | C 9 | | | | |
| SCR Overtemp | 10 | N | N | N A | F The SMC-50 control module protects the SCRs from damage caused by overtemperature operation using an internally configured I ² t. NOTE: This fault is always enabled. |

Table 52 - Linear Listing—Fault and Alarm Code Overview (Continued)

| Fault/Alarm Code Name | F/A Code | Time Delay Avail. | F/A Bit Enable | Restart Enable | Description | | |
|-----------------------|----------|-------------------|------------------|----------------|--|---|--|
| | | | | | F/A= Fault and Alarm, A= Alarm, F= Fault | | |
| Open Bypass | A | 11 | N | N | N | F Open Bypass Phase A | Device senses that the bypass contactor did not close on the respective phase. |
| | B | 12 | N | N | N | F Open Bypass Phase B | |
| | C | 13 | N | N | N | F Open Bypass Phase C | |
| No Load | | 14 | N | Y | Y | F/A The SMC-50 control module 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. | |
| Jam | | 23 | Y | Y | Y | 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. | |
| Stall | | 24 | Y | Y | Y | F/A Condition exists and a Fault/Alarm is generated if the SMC-50 control module 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. | |
| Phase Reversal | | 25 | N | Y | Y | F/A Fault/Alarm is indicated when the incoming power to the SMC-50 control module is in any sequence other than ABC. | |
| Exp Removed | | 26 | N | N | N | F Removing an expansion module (device) (for example, a 150-SM4) from a SMC-50 control module will result in a x026 fault, where "x" is the SMC-50 control module port number (7, 8, or 9) the expansion module was installed. DPI devices (for example, 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) (for example, a 150-SM4 is removed from a SMC-50 controller), the message "Device Conflicts Port xy Not Found" is displayed on the HIM or PC software) when power returns. | |
| Exp Incompat | | 27 | N | N | N | F Inserting an expansion module or DPI device into an incompatible control module port number or inserting an expansion module into a control module with incompatible version of firmware results in this Fault. The port number of the offending device is included as the first digit of this Fault code. | |
| Expansion | | 28 | N | N | N | 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. | |

Table 52 - Linear Listing—Fault and Alarm Code Overview (Continued)

| Fault/Alarm Code Name | F/A Code | Time Delay Avail. | F/A Bit Enable | Restart Enable | Description | |
|-----------------------|----------|-------------------|----------------|----------------|--|--|
| | | | | | F/A= Fault and Alarm, A= Alarm, F= Fault | |
| Starts per Hour | 29 | N | Y | Y | 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. | |
| CT Loss | A 30 | N | N | N | F CT Loss A (Phase A) | fault occurs when current feedback is invalid. This Fault is always enabled. |
| | B 31 | | | | F CT Loss B (Phase B) | |
| | C 32 | | | | F CT Loss B (Phase B) | |
| HAL ID | 33 | N | N | N | F HAL ID Fault is generated if the controller determines that an incorrect (incompatible) power pole is installed. This Fault is always enabled. | |
| NVS Error | 34 | N | N | N | F Indicates an error in the SMC-50 control module'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. | |
| Future Use | 35 | | | | Future use. | |
| V24 Loss | 36 | N | N | N | F Indicates that the voltage level of the SMC-50 control module's internal 24V DC supply which provides power to the control module logic and on-board 24V DC I/O has fallen outside of the allowable range. This Fault is always enabled. | |
| VControl Loss | 37 | N | N | N | 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 | N | 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. | |
| 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 preventive 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 preventive maintenance should be performed. | |

Table 52 - Linear Listing—Fault and Alarm Code Overview (Continued)

| Fault/Alarm Code Name | F/A Code | Time Delay Avail. | F/A Bit Enable | Restart Enable | Description | |
|-----------------------|----------|-------------------|----------------|----------------|--|--|
| | | | | | F/A= Fault and Alarm, A= Alarm, F= Fault | |
| 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 Phase SCR. C Phase SCR. |
| | B | 53 | | | | |
| | C | 54 | | | | |
| 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 control module 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. |
| Power Pole PTC | | 60 | N | N | N A | F Built-in Power Pole PTC Temperature Sensor is used to measure power pole temperature. A fault occurs when the temperature rises above a predetermined level. This fault is always enabled. |
| I/O Config | | 61 | N | N | N A | F Occurs when any input is programmed as a start and no input is configured as a coast or stop. The fault occurs 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. |
| Test Fault | | 62 | N | N | N A | F Occurs when the Push-to-Reset, Hold-to-Test push button on the SMC-50 control module is pushed for ≥ 3 seconds but < 10 seconds. |
| Under PF Lag | | 63 | Y | Y | Y | F/A Occurs when the lagging Power Factor goes below the user-defined fault/alarm level. |
| Under PF Lead | | 64 | Y | Y | Y | F/A Occurs when the leading Power Factor goes below the user-defined fault/alarm level. |
| Over PF Lag | | 65 | Y | Y | Y | F/A Occurs when the lagging Power Factor goes above the user-defined fault/alarm level. |
| Over PF Lead | | 66 | Y | Y | Y | F/A Occurs when the leading Power Factor goes above the user-defined fault/alarm level. |
| -MVAR Over | | 67 | Y | Y | Y | F/A Occurs when the magnitude of the Reactive Power rises above the user-defined level. |
| -MVAR Under | | 68 | Y | Y | Y | F/A Occurs when the magnitude of the Reactive Power falls below the user-defined level. |
| RTC Battery Low | | 69 | N | N | N A | A Occurs when the SMC-50 control module battery that maintains the value of the Real Time Clock (RTC) is low and needs to be replaced immediately. Alarm is always enabled. |
| Locked Rotor | | 70 | Y | Y | Y | 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. |

Table 52 - Linear Listing—Fault and Alarm Code Overview (Continued)

| Fault/Alarm Code Name | F/A Code | Time Delay Avail. | F/A Bit Enable | Restart Enable | Description | |
|-----------------------|---------------|-------------------|----------------|----------------|---|----------------------------------|
| | | | | | F/A= Fault and Alarm, A= Alarm, F= Fault | |
| Start | 71 | N A | N A | N A | This is an Event Code and is stored in the Alarm Buffer for: | Start Event tracking. |
| Stop Option | 73 | N A | N A | N A | | Stop Option Event tracking. |
| Coast | 74 | N A | N A | N A | | Coast Event tracking. |
| Clear Fault | 75 | N A | N A | N A | | Clear Fault Event tracking. |
| Fault | 76 | N A | N A | N A | | Fault Event tracking. |
| Parm Change | 77 | N A | N A | N A | | Parameter Change Event tracking. |
| Reserved | 78...9 9 | N | N | N | Future Use. | |
| System Faults | 100... 199 | N | N | N A | A general Fault/Alarm typically associated with the SMC-50 control module hardware (for example, system Watchdog Time failure). | |

(1) Overload is inherently a time-based fault.

Auxiliary Relay Output Fault or Alarm Indication

You can program Auxiliary Relay Output contacts for Fault or Alarm, N.O., or N.C. indication. You can also configure an ON or OFF Delay Time. Basic parameter setup (without N.C. or timed functions) is in the Setup / I/O Parameter Group. Full configuration is available from the Setup / I/O Parameter Group.

Notes:

Troubleshooting

Introduction

For safety of maintenance personnel and others who might be exposed to electrical hazards associated with maintenance activities, follow the local safety related work practices (for example, 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 controller is off. To avoid shock hazard, disconnect main power before working on the controller, motor, and control devices (for example, 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 insulation resistance tester.

The flowchart in [Figure 48](#) aids in quick troubleshooting.

TIP The time it takes for the motor to come up to speed may differ from the time programmed. This depends upon the motor and load characteristics.

Figure 48 - Troubleshooting Flowchart

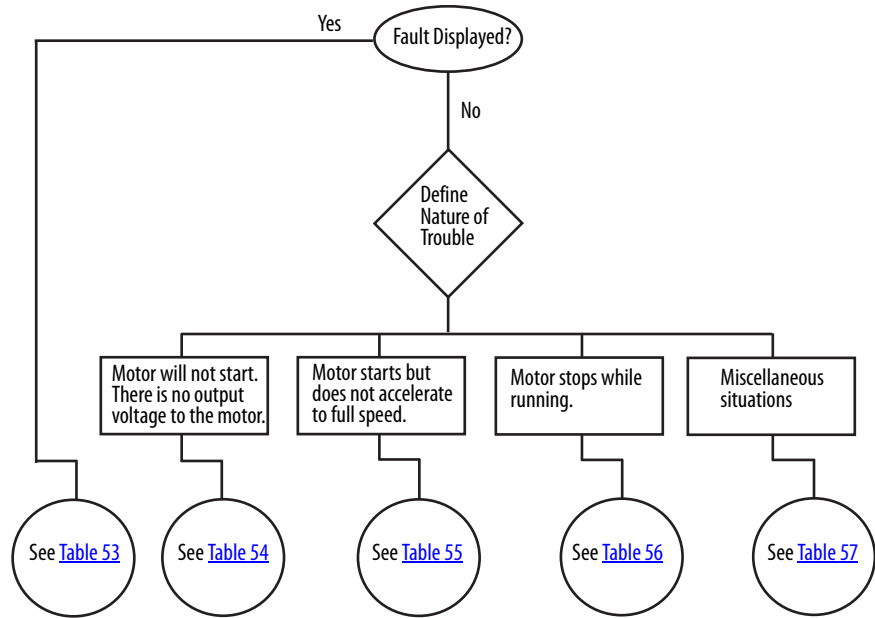


Table 53 - Fault Display Explanation

| Display | Fault Code | Fault Enabled | Possible Causes | Possible Solutions |
|--|----------------|----------------------|---|---|
| Line Loss (with phase indication) | 1, 2, 3 | Prestart and Running | <ul style="list-style-type: none"> High impedance line connection Missing supply phase Motor not connected properly Incoming 3-phase voltage instability | <ul style="list-style-type: none"> Check for line and load loose connections. Check for open line (for example, 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 | <ul style="list-style-type: none"> Shorted power module. | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Open gate circuitry Loose gate lead | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Controller ventilation blocked Controller duty cycle exceeded Ambient temperature limit exceeded Failed thermistor | <ul style="list-style-type: none"> Check for proper controller ventilation. Check application-appropriate duty cycle. Wait for controller to cool or provide external cooling if ambient temperature is high. Replace power module or control module as needed. |
| Open Bypass | 11, 12, 13 | In All Modes | <ul style="list-style-type: none"> Control voltage is low Inoperable power module bypass | <ul style="list-style-type: none"> Check control voltage power supply. Replace power module. Check control module TB2...TB4 and TB5...TB7 for proper order and secureness. Make sure that no auxiliary contact is set to "external bypass". |
| No Load or Open Load (with Phase Indication) | 14, 15, 16, 17 | Prestart Only | <ul style="list-style-type: none"> Loss of load side power wiring with phase indication (15=A, 17=C) Start command cycled unexpectedly with motor rotating | <ul style="list-style-type: none"> Check all load side power connections. Check motor windings (insulation resistance test). |
| Voltage Unbalance or Current Imbalance | 18 or 42 | Running | <ul style="list-style-type: none"> Power line unbalance is greater than the programmed value The delay time programmed is too short for the application | <ul style="list-style-type: none"> 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. |
| Overvoltage | 19 | Running | <ul style="list-style-type: none"> Power line grid voltage is greater than the programmed value Abnormal voltage regulation The parameter settings and/or delay time programmed are not suited for the application | <ul style="list-style-type: none"> 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 and/or extend the delay time to match the application requirements. Disable this fault/alarm feature. |

Table 53 - Fault Display Explanation (Continued)

| Display | Fault Code | Fault Enabled | Possible Causes | Possible Solutions |
|---------------------|---------------------|---------------|--|--|
| Undervoltage | 20 | Running | <ul style="list-style-type: none"> Power line grid voltage is less than the programmed value Abnormal voltage regulation The parameter settings and or delay time programmed are not suited for the application | <ul style="list-style-type: none"> 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 and/or extend the delay time to match the application requirements. Disable this fault/alarm feature. |
| Overload | 21 | Running | <ul style="list-style-type: none"> Motor overloaded Overload parameters are not matched to the motor | <ul style="list-style-type: none"> Check motor overload condition. Check programmed values for overload class and motor FLC; verify current draw of the motor. Disable this fault/alarm feature.⁽³⁾ |
| Underload | 22 | Running | <ul style="list-style-type: none"> Broken motor shaft, belt, grating, etc. Pump cavitation Programmed setting incorrect for application | <ul style="list-style-type: none"> Check machine drive components and loading. Check pump system. Repair or replace motor. Check programmed settings. Disable this fault/alarm feature. |
| Jam | 23 | Running | <ul style="list-style-type: none"> Motor current has exceeded the user programmed jam level for the programmed time | <ul style="list-style-type: none"> Correct source of jam or excessive loading. Check programmed time value. Disable this fault/alarm feature. |
| Stall | 24 | Running | <ul style="list-style-type: none"> The motor did not reach full speed by the end of the programmed ramp time Incorrect programmed setting | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> The controller is not detecting incoming supply voltage in the expected ABC sequence | <ul style="list-style-type: none"> Check power wiring and correct, if necessary. Disable this fault/alarm feature. |
| Exp Removed | x026 ⁽²⁾ | In All Modes | <ul style="list-style-type: none"> Expansion module is loose or removed Expansion module is defective | <ul style="list-style-type: none"> Reseat or replace the expansion module connector to the control module and tighten module screws. Replace defective module. |
| Exp Incompat | x027 ⁽²⁾ | In All Modes | <ul style="list-style-type: none"> Expansion module is inserted into an incompatible control module port number Controller firmware is not compatible with the expansion module Expansion module is defective | <ul style="list-style-type: none"> Insert the expansion module into a compatible control module port. Update the control module firmware Replace defective module. |
| Expansion | x028 ⁽²⁾ | In All Modes | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Reseat and/or replace loose/removed module and tighten module screws. Replace defective expansion module. Update control module firmware. |
| Starts per Hour | 29 | Starting | <ul style="list-style-type: none"> The number of starts within the last hour has exceeded the programmed value Programmed setting is incorrect for the application | <ul style="list-style-type: none"> 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. |
| CT Loss: A, B, or C | 30, 31, or 32 | In All Modes | <ul style="list-style-type: none"> 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) | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Loose cables between the controller and power section. Incompatible power section installed with the controller | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Controller memory corrupted Option module error (Fault Code 7034, 8034, or 9034) | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Loose connection at Control Terminals 1 (+L1) and 2 (-L2) Excessive load on internal 24V supply Low line voltage condition | <ul style="list-style-type: none"> Check the control power and verify it is within the specification; check the line connections and grounding to the SMC-50 controller control terminals. Replace the control module. |

Table 53 - Fault Display Explanation (Continued)

| Display | Fault Code | Fault Enabled | Possible Causes | Possible Solutions |
|--|--------------------|---------------|--|--|
| V Control Loss | 37 | In All Modes | <ul style="list-style-type: none"> Loose connection at Control Terminals 1 (+L1) and 2 (-L2) Low line voltage condition | <ul style="list-style-type: none"> Check the control power and verify it is within the specification; check the connections and grounding to the controller control terminals. Replace the control module. |
| TB Input:1, 2, 3 and 4 | 38, 39, 40, and 41 | In All Modes | <ul style="list-style-type: none"> The condition to generate the TB Input fault is satisfied Terminal wiring configuration or fault N.O./N.C. configuration of input is incorrect | <ul style="list-style-type: none"> Clear the fault condition. Rewire and/or reconfigure the input. |
| Voltage Unbalance or Current Imbalance | 42 or 18 | Running | <ul style="list-style-type: none"> Power line unbalance is greater than the programmed value The delay time programmed is too short for the application | <ul style="list-style-type: none"> 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 ⁽¹⁾ | 43 | Running | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 ⁽¹⁾ | 44 | Running | <ul style="list-style-type: none"> Abnormally high real (KW) power draw by the motor Programmed setting is incorrect for the application | <ul style="list-style-type: none"> 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 ⁽¹⁾ | 45 | Running | <ul style="list-style-type: none"> Abnormally reduced reactive (+MVAR) power produced by the motor Programmed setting is incorrect for the application | <ul style="list-style-type: none"> 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. |
| Ov Pwr Reac ⁽¹⁾ | 46 | Running | <ul style="list-style-type: none"> Abnormally high reactive (+MVAR) power produced by the motor Programmed settings are incorrect for the application | <ul style="list-style-type: none"> 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 ⁽¹⁾ | 47 | Running | <ul style="list-style-type: none"> Abnormally reduced apparent (MVA) power draw by the motor Programmed settings are incorrect for the application | <ul style="list-style-type: none"> 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 ⁽¹⁾ | 48 | Running | <ul style="list-style-type: none"> Abnormally high apparent (MVA) power draw by the motor Programmed settings are incorrect for the application | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Speed control regulation system of the generator prime mover (for example, 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> The number of hours programmed in the PM Hours Parameter has been reached | <ul style="list-style-type: none"> Perform required maintenance and reset the PM Hours parameter. Disable this fault/alarm feature. |
| PM Starts | 51 | Pre-Start | <ul style="list-style-type: none"> The number of Starts programmed in the PM Start Parameter has been reached | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Incoming 3-phase voltage instability or distortion High impedance line or load connection | <ul style="list-style-type: none"> 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. |

Table 53 - Fault Display Explanation (Continued)

| Display | Fault Code | Fault Enabled | Possible Causes | Possible Solutions |
|--------------------------------|---------------------|---------------|---|---|
| Power Quality: THD V | 55 | Running | <ul style="list-style-type: none"> The current mix of loads on the power line contributing to the THD V has exceeded the programmed THD V level and/or time | <ul style="list-style-type: none"> Check the mix of loads (what was added, what was changed); modify the load mix if necessary. Change the programmed THD V level and/or delay time. Disable this fault/alarm feature. |
| Power Quality: THD I | 56 | Running | <ul style="list-style-type: none"> The current mix of loads on the power line contributing to the THD I has exceeded the programmed THD I level and/or time | <ul style="list-style-type: none"> Check the mix of loads (what was added, what was changed); modify the load mix if necessary. Change the programmed THD I level and/or delay time. Disable this fault/alarm feature. |
| Config Change | 57 | In All Modes | <ul style="list-style-type: none"> A controller parameter has been modified | <ul style="list-style-type: none"> Disable this fault/alarm feature. |
| Ground Fault | X058 ⁽²⁾ | Running | <ul style="list-style-type: none"> The ground fault current level has exceeded the programmed value The delay time is too short for the application <p>NOTE: An optional 150-SM2 Ground Fault PTC Module is required for this fault.</p> | <ul style="list-style-type: none"> 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. |
| Motor PTC | X059 ⁽²⁾ | In All Modes | <ul style="list-style-type: none"> Motor ventilation is blocked. Motor duty cycle is exceeded PTC open or shorted <p>NOTE: An optional 150-SM2 Ground Fault PTC Module is required for this fault.</p> | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Controller ventilation blocked Controller duty cycle exceeded Ambient temperature limit exceeded Failed thermistor | <ul style="list-style-type: none"> Check for proper controller ventilation. Check application-appropriate duty cycle. Wait for controller to cool or provide external cooling if ambient temperature is high. Replace power module or control module as needed. |
| I/O Config | 61 | Pre-Start | <ul style="list-style-type: none"> The configuration of the control I/O does not meet the system rules | <ul style="list-style-type: none"> Modify the control I/O configuration to meet the established rules. |
| Test Fault | 62 | In All Modes | <ul style="list-style-type: none"> The SMC-50 control module's Push to Reset/ Hold to Test push button was pressed for more than three seconds, but less than ten The SMC-50 control module's Push to Reset/ Hold to Test push button is stuck or damaged | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 ⁽¹⁾ | 67 | Running | <ul style="list-style-type: none"> Abnormally high reactive (-MVAR) power consumed by the motor Programmed settings are incorrect for the application | <ul style="list-style-type: none"> 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 ⁽¹⁾ | 68 | Running | <ul style="list-style-type: none"> Abnormally reduced reactive (-MVAR) power consumed by the motor Programmed settings are incorrect for the application | <ul style="list-style-type: none"> Repair/replace the condition causing the reduced -MVAR. Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature. |
| RTC Battery Low | 69 | Pre-Start | <ul style="list-style-type: none"> Battery reading is below the acceptable level to potentially maintain the real time clock and calendar | <ul style="list-style-type: none"> Replace battery (CR2032) as soon as possible. |

Table 53 - Fault Display Explanation (Continued)

| Display | Fault Code | Fault Enabled | Possible Causes | Possible Solutions |
|---------------|------------|---------------|---|---|
| Locked Rotor | 70 | In All Modes | <ul style="list-style-type: none"> Motor has stalled; rotor is not turning | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> A start event (command) has occurred. This is not a fault. | <ul style="list-style-type: none"> NA |
| Stop Option | 73 | Stop Option | <ul style="list-style-type: none"> A stop option event (command) has occurred. This is not a fault. | <ul style="list-style-type: none"> NA |
| Coast | 74 | Coast | <ul style="list-style-type: none"> A coast-to-stop event (command) has occurred. This is not a fault. | <ul style="list-style-type: none"> NA |
| Clear Fault | 75 | Faulted | <ul style="list-style-type: none"> A clear fault event (command) has occurred. This does not generate a fault. | <ul style="list-style-type: none"> NA |
| Fault | 76 | Faulted | <ul style="list-style-type: none"> A fault event (command) has occurred. This is not a fault. | <ul style="list-style-type: none"> NA |
| Param Change | 77 | Stopped | <ul style="list-style-type: none"> A change to one of the controller parameters has occurred. This is not a fault. | <ul style="list-style-type: none"> NA |
| Reserved | 78...99 | NA | <ul style="list-style-type: none"> NA | <ul style="list-style-type: none"> NA |
| System Faults | 100...199 | In All Modes | <ul style="list-style-type: none"> There is an issue with the control module wiring The control module is defective | <ul style="list-style-type: none"> 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. |

- (1) 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 (for example, Underload, Overload, Jam, Stall, etc.) does not provide. To understand what is an abnormal running operation, you need to determine a "normal" or "typical" value, usually established during system startup.
- (2) "X" indicates a port number in which the expansion module resides in the SMC-50 control module.
- (3) If controller based motor overload is disabled, external motor overload protection should be used.

Table 54 - Motor Will Not Start—No Output Voltage to the Motor

| Display | Possible Cause | Possible Solutions |
|----------------------|--|--|
| Fault displayed | <ul style="list-style-type: none"> See fault description | <ul style="list-style-type: none"> See Table 53 addressing fault conditions |
| HIM display is blank | <ul style="list-style-type: none"> Failed HIM Control voltage is absent Failed control module HIM connection is loose | <ul style="list-style-type: none"> Check control wiring and correct if necessary Check HIM connection Cycle control power Replace HIM only Replace control module only |
| Stopped 0.0 Amps | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Check wiring; follow the instructions on page 137 to enable control capability. Check control voltage Replace control module |
| Starting | <ul style="list-style-type: none"> One or more power phases are missing Isolation contactor (if used) is not picking up | <ul style="list-style-type: none"> Check power system Check that the controller Aux. relay output controlling the Isolation Contactor is configured to "Normal". Check the Isolation Contactor for proper operation |

Table 55 - Motor Rotates but Does Not Accelerate to Full Speed

| Display | Possible Cause | Possible Solutions |
|-----------------|--|--|
| Fault displayed | <ul style="list-style-type: none"> See fault description | <ul style="list-style-type: none"> See Table 53 addressing fault conditions |
| Starting | <ul style="list-style-type: none"> Mechanical problems Inadequate Current Limit setting Failed control module | <ul style="list-style-type: none"> Check for binding or external loading and correct Check motor Adjust the Current Limit Level to a higher setting Replace control module |

Table 56 - Motor Stops While Running

| Display | Possible Cause | Possible Solutions |
|----------------------|---|--|
| Fault displayed | <ul style="list-style-type: none"> See fault description | <ul style="list-style-type: none"> See addressing fault conditions |
| HIM display is blank | <ul style="list-style-type: none"> Failed HIM Control voltage is absent Failed control module HIM connection is loose | <ul style="list-style-type: none"> Replace HIM Check control wiring and correct if necessary Replace control module Check HIM connection |
| Stopped 0.0 Amps | <ul style="list-style-type: none"> Pilot devices Failed control module | <ul style="list-style-type: none"> Check control wiring and correct if necessary Replace control module |
| Starting | <ul style="list-style-type: none"> One or more power phases are missing Failed control module | <ul style="list-style-type: none"> Check power system Replace control module |

Table 57 - Miscellaneous Situations

| Display | Possible Causes | Possible Solutions |
|---|---|---|
| Motor current and voltage fluctuates with steady load | <ul style="list-style-type: none"> Motor Erratic Load | <ul style="list-style-type: none"> Verify type of motor as a standard squirrel cage induction motor Check load conditions |
| Erratic operation | <ul style="list-style-type: none"> Loose connections | <ul style="list-style-type: none"> Shut off all power to controller and check for loose connections |
| Accelerates too fast | <ul style="list-style-type: none"> Starting time Initial torque Current limit setting Kickstart | <ul style="list-style-type: none"> Increase starting time Lower initial torque setting Decrease current limit setting Lower kickstart time or turn off |
| Accelerates too slow | <ul style="list-style-type: none"> Starting time Initial torque Current limit setting Kickstart | <ul style="list-style-type: none"> Decrease starting time Increase initial torque setting Increase current limit setting Increase kickstart time or turn off |
| Motor stops too quickly with Soft Stop option | <ul style="list-style-type: none"> Time setting | <ul style="list-style-type: none"> Verify the programmed stopping time and correct if necessary |
| Motor stops too slowly with Soft Stop option | <ul style="list-style-type: none"> Stopping time setting Misapplication | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Misapplication | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Overload Blocked ventilation | <ul style="list-style-type: none"> Allow motor to cool and reduce load. Remove blockage and ensure motor is being adequately cooled. |
| Motor short circuit | <ul style="list-style-type: none"> Winding fault | <ul style="list-style-type: none"> Identify fault and correct Check for shorted SCR; replace if necessary Ensure power terminals are secure |
| Motor coasts when option stop is programmed | <ul style="list-style-type: none"> Option not programmed Current loop power supply not active Incorrect control logic Bypass contactor set for delayed drop-out | <ul style="list-style-type: none"> Verify the option parameter settings and correct if necessary Verify current loop power supply Verify connections to module terminals 16 and 17 Verify that the Bypass Contactor is configured for <100ms drop-out time. For relay control, the FDO version contactor is required; for IntelliVAC control, set Drop-out time to 50 ms (no PFCC) or 75 ms (if PFCC contactor in same controller). For IntelliVAC settings, refer to Chapter 4 of 1503-UM053. |

Control Module Removal

The control module is not intended for field repair. The entire module must be replaced in the event of failure. The following procedure must be followed before unplugging the control module.

1. Remove all power from the equipment.



SHOCK HAZARD: To avoid shock hazard, ensure the main power has been disconnected before working on the controller, motor or control devices. Verify that all circuits are voltage free using a hot stick or appropriate voltage measuring device. Failure to do so may result in burns, injury or death.

2. Make sure that the wires are properly marked and that the program parameters are recorded.
3. Disconnect all control wires to control module.
4. Loosen the four control module screws.
5. Carefully rotate the module to the left, and unplug the five ribbon cables from the interface board.



ATTENTION: When removing the control module, make sure to hold the module in place as the screws are removed, to avoid strain on the ribbon cables.

To install control module, follow the reverse order for removal.

TIP The MV SMC-50 must use firmware release 4.006 or later. This User Manual pertains to units with firmware released 6.xxx (or later).

Real Time Clock (RTC) Battery Replacement

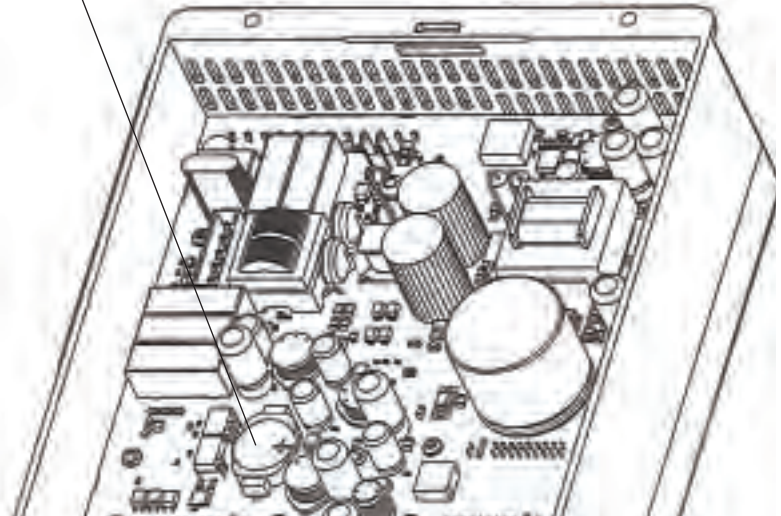
The SMC-50 control module comes standard with a RTC used to time and date stamp Faults and Alarms. When the control power is not applied to the SMC-50, the operation of the RTC is maintained by an off-the-shelf Lithium CR2032 coin cell battery. The battery must be replaced if the SMC-50's low battery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

To replace the battery:

1. Perform the steps that are required to remove the control module. See the control module installation instructions, publication [150-IN078](#).
2. Locate the battery on the circuit board. Note the positive symbol is facing upward.

Bottom Side of SMC-50

Remove and replace battery with positive (+) symbol facing upward.



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 that are required to replace the control module. See the control module installation instructions, publication [150-IN078](#).
6. Reprogram/reset the clock.

Voltage Sensing Circuit Tests

If the motor does not start, it may be necessary to temporarily modify the control circuit to close the line contactor without applying a start signal to the SMC-50 module. In this case, the three line voltages (Line A, Line B, Line C) measured with respect to ground should be approximately 1 volt rms. It is important that the level in each phase is the same as the other phases, within $\pm 1\%$.

If any voltage is well outside this range, there may be a problem either with the system voltage, or with the voltage sensing board. Note that the load side voltages (Load A, Load B, Load C) will be very low, since the SCRs are not turned on, and only a low leakage current flows to the motor.

If the motor will start and run, the line and load voltages should be the same when the bypass contactor is closed.

Voltage-Sensing Board Replacement



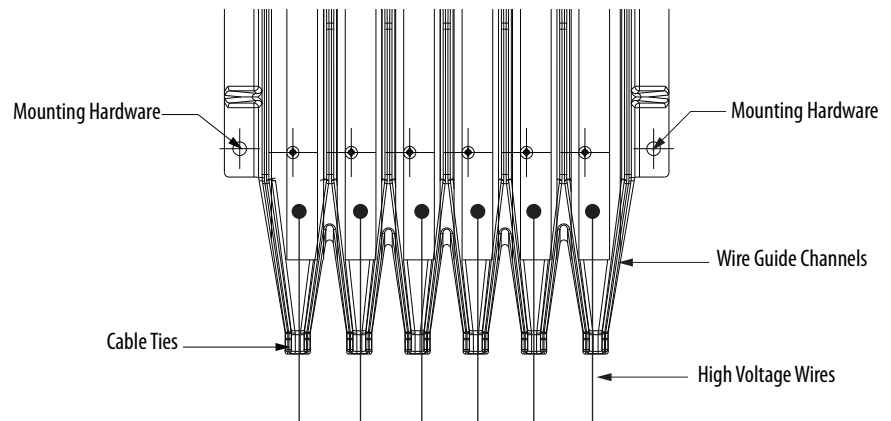
SHOCK HAZARD: To prevent electrical shock, main power must be disconnected before working on the sensing board. Verify that all circuits are voltage free using a hot stick or appropriate high voltage-measuring device. Failure to do so can result in injury or death.

1. Mark the position of the ribbon cable and wires.
2. Disconnect the high voltage wires from the end that connects to the bus bars, and release the wires from the plastic stand off clips.
3. Release the locking mechanism on each side of the ribbon cable connector. Pull the ribbon cable straight out to prevent bending the pins. Remove the green ground wires.
4. Remove the four fasteners that secure the assembly to the panel. Remove the assembly, including the high-voltage wires, from the equipment.

For a 12 kV Voltage Sensing Board (VSB)

- a. Place the assembly on a flat surface (table or bench) and disconnect the wires from the six channels at the end of the VSB. Cut the cable ties and remove the wires from the assembly.
- b. Install the wires on the new assembly in the same positions and secure them with cable ties at the ends of the wire guide channels.

Figure 49 - Sensing Board High Voltage Wire Connections



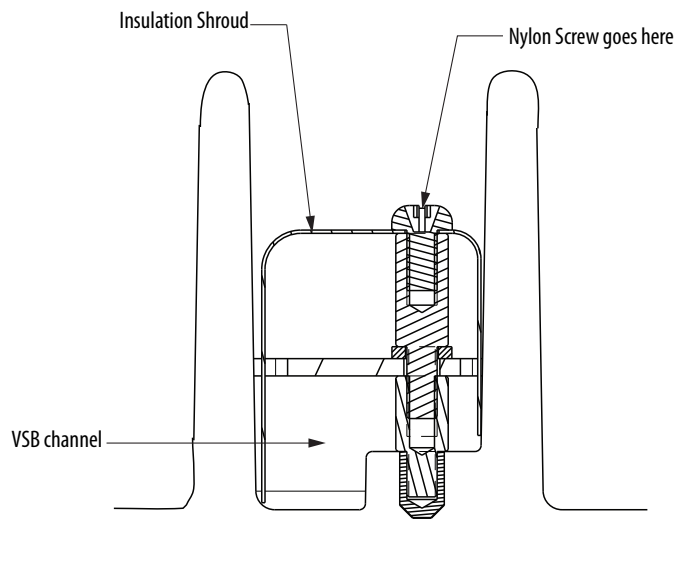
For a 14.4 kV Voltage Sensing Board (VSB)

- c. Place the assembly on a flat surface (table or bench).
- d. Remove the nylon screws that secure the insulation shrouds from the ends of the VSB channels, and remove the shrouds.
- e. Disconnect the wires from the six channels at the end of the VSB. Cut the cable ties and remove the wires from the assembly.
- f. Install the wires on the new assembly in the same positions and secure them with cable ties at the ends of the wire guide channels.
- g. Re-install the insulation shrouds with nylon screws, torque to 0.3 N•m (2.7 lb•in).



ATTENTION: The insulation shrouds are required to prevent insulation breakdowns due to surge voltages. Failure to replace all six covers with nylon hardware before energizing may result in personal injury, property damage or economic loss.

Figure 50 - 14.4 kV Sensing Board Insulation Shrouds



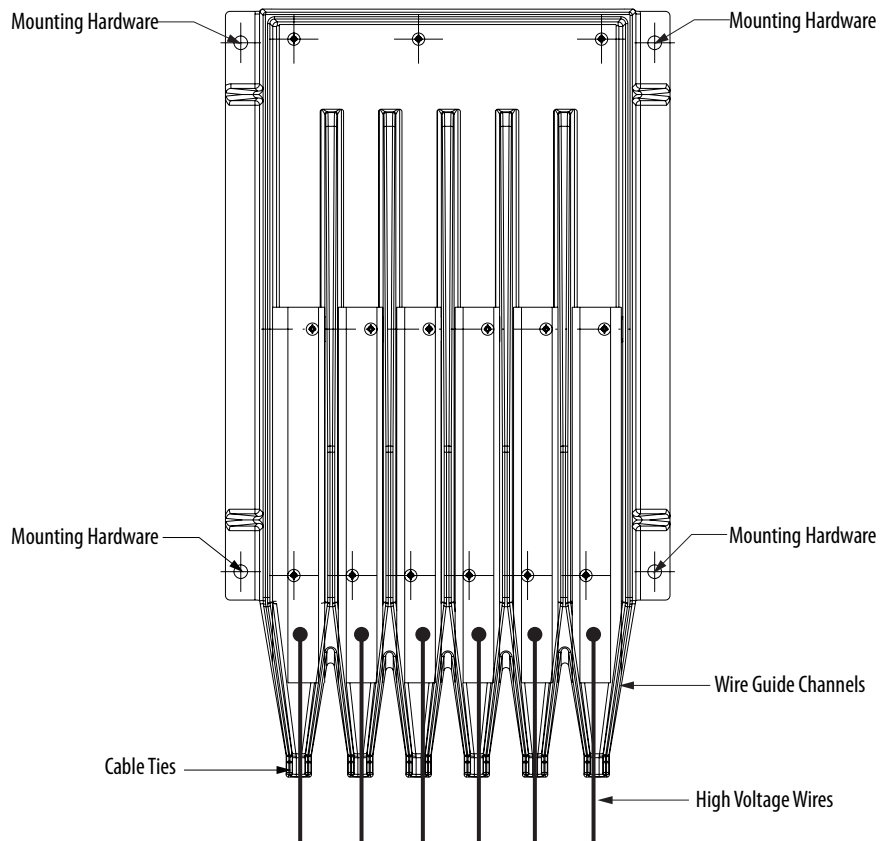
5. Replace with the new assembly securing with all four fasteners ([Figure 51](#)).
 - a. Reconnect the high-voltage wire to the bus bars and plastic stand off clips.



ATTENTION: The high-voltage wires must not touch earthed metal or bare conductors.

6. Plug in ribbon cable properly, so the locking mechanism is engaged. Reconnect both ground wires and shield connection for the ribbon cable.
7. For personnel and equipment safety, reconnect both grounding connections to the sensing board.

Figure 51 - Sensing Board with mounting hardware placement

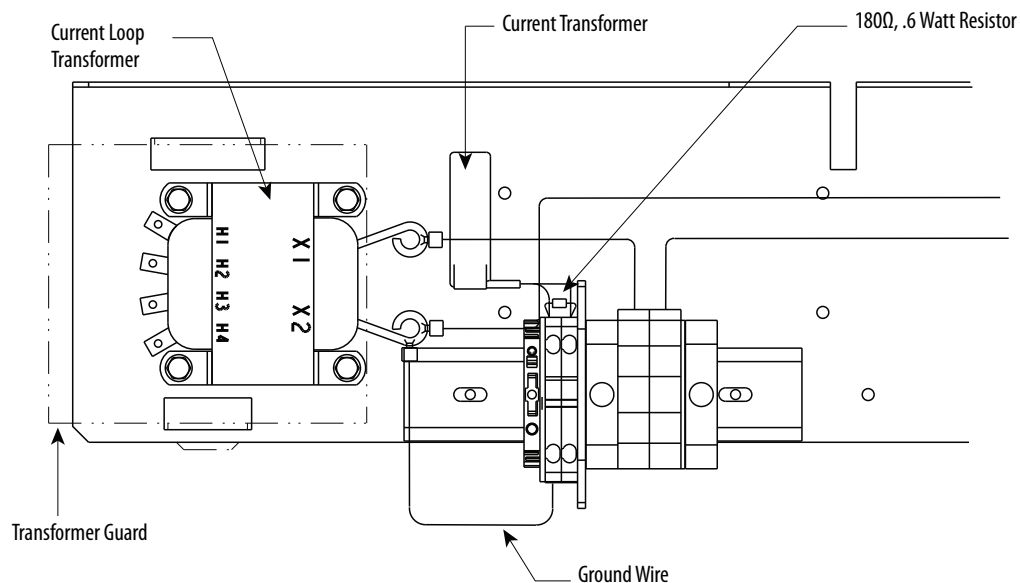


Current Loop Power Supply

The current loop gate driver (CLGD) boards that are mounted on each PowerBrick (see [Figure 53](#)) receive power from two sources:

1. The snubber circuit (while the SCR power modules are active).
2. The current loop power supply, which maintains a pre-charge level of power during periods when the SCR power modules, are inactive. This allows SCR gating while the snubber circuit is being charged.

Figure 52 - Current Loop Power Supply



The current loop power supply provides a current of 40...50 A AC to each SCR power module phase assembly. If this current is not detected and fed back to the interface boards, stop maneuvers do not function (an alarm is generated).

Circuit Board Replacement

The replacement of printed circuit boards is straightforward, but there are a number of precautions that must be considered when handling the boards.



ATTENTION: Some circuit boards may contain CMOS components, which can be destroyed by static charges that are generated by friction of materials that are made with synthetic fibers. Use of damaged circuit boards may also damage related components. A grounding wrist strap is recommended for handling sensitive circuit boards.

1. Remove all power from the equipment.



ATTENTION: To avoid shock hazard, disconnect the main power before working on the controller, motor, or control devices. Verify that all circuits are voltage free using a hot stick or appropriate voltage measuring device. Failure to do so may result in burns, injury, or death.

- Carefully detach all wires, cables and connectors. Note their location and orientation. For the interface board, remove the control module.



ATTENTION: The fiber-optic cables can be damaged if struck or bent sharply. Some have a locking feature that requires pinching the tab on the connector and gently pulling straight out. The component on the printed circuit board must be held to prevent damage.

- For boards mounted with hardware, remove the hardware. Do not drop anything onto other circuits. For boards with nylon stand-off posts, squeeze the section above the board and carefully pull the board up and off the post.
- Lift out the circuit board, and check that the replacement board is the correct part number and revision before installation (see [Accessories on page 207](#)). Install the new board by replacing the hardware, or pressing down onto nylon stand offs. Connect all wires, cables, and connectors. All switch and/or jumper settings on the new board must identical to the settings on the old board, and correct for the application.

Power Circuit

PowerBrick (SCR) Testing

If a power semiconductor is suspected of malfunctioning, it may be checked as follows:

- Remove all power from the equipment.



SHOCK HAZARD: To avoid shock hazard, ensure the main power has been disconnected before working on the controller, motor or control devices. Verify that all circuits are voltage free using a hot stick or appropriate voltage measuring device. Failure to do so may result in burns, injury or death.

- Measure DC resistance as follows:

Complete power pole (from line side to load side)

12 kV (5 PowerBricks) 100...145 k Ω

15 kV (6 PowerBricks) 125...175 k Ω

It may be necessary to isolate one side of the power pole by disconnecting one of the SMC-50 braid connections at the top of the power pole assembly. Parallel resistance paths may be created due to earthing connections, motor windings or other connected equipment.

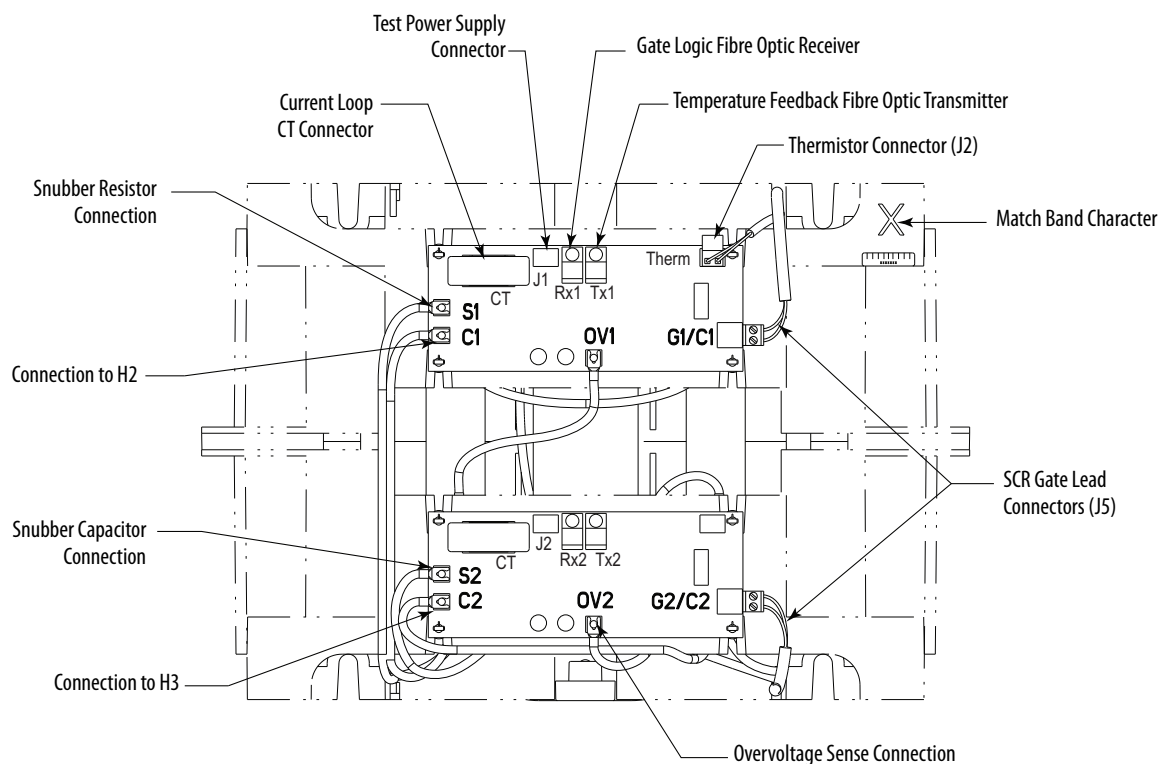
Variations may also be noted based on the devices used in different ratings of PowerBricks. The key is to look for notable differences between individual PowerBricks or power poles.

If the power pole resistance is a multiple of 25 k lower than specified above, there may be one or more shorted SCRs in the PowerBricks.

3. If a short circuit is suspected, the power pole cart must be removed from the equipment to facilitate further testing. See cart removal instructions in publication [7760F-IN001](#).
4. Remove the clear plastic guards from the front and rear of the power pole assembly by removing two screws from the top and bottom of each guard.
5. Measure DC resistances as follows for each PowerBrick: (see [Figure 53](#)).

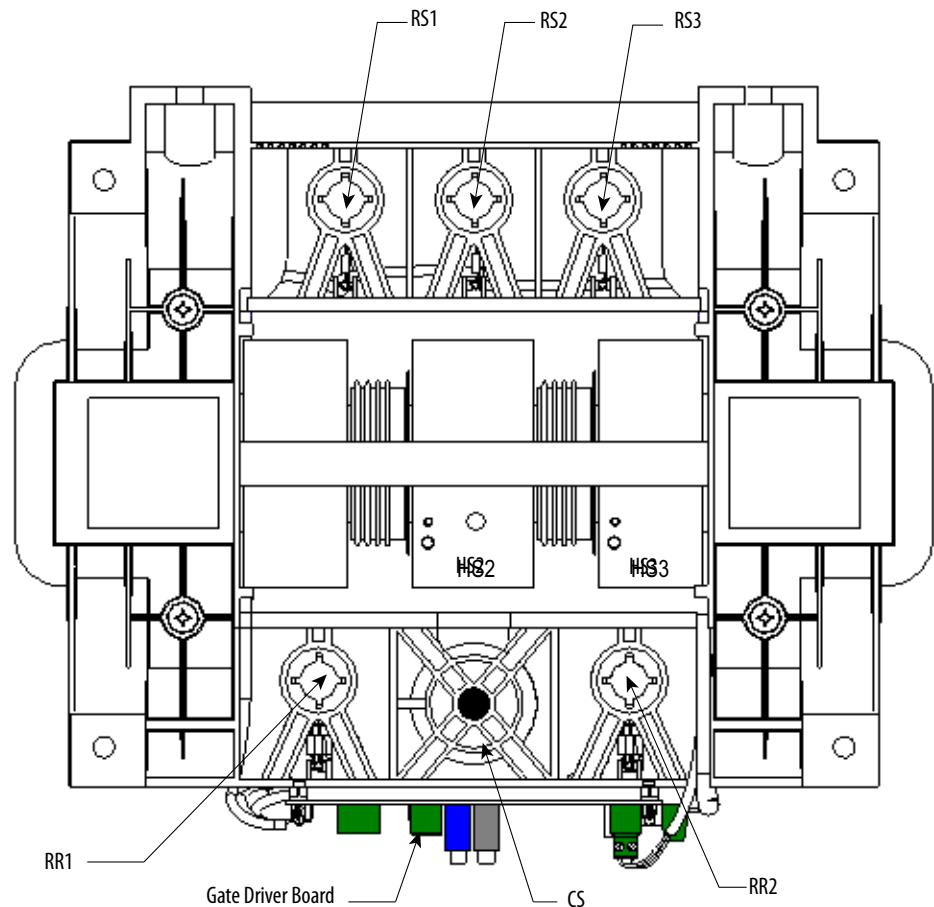
| | |
|------------------------|-----------|
| C1 to C2: | 21...29 k |
| Gate to Cathode (G/C): | 4...40 |

Figure 53 - PowerBrick Current Loop Gate Driver Board Connections



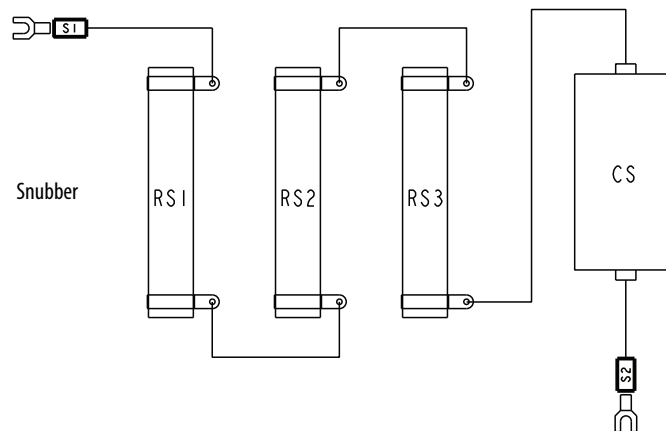
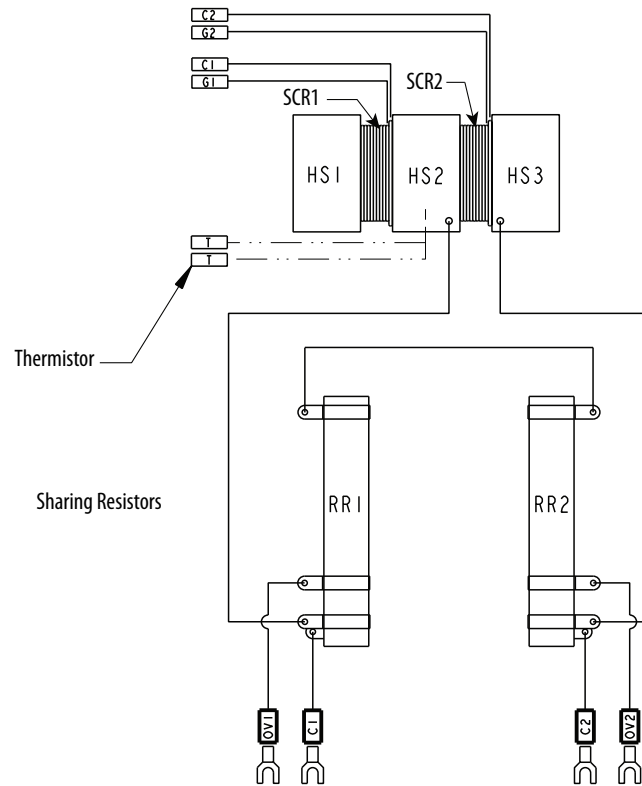
6. If the resistance values are out of range, the PowerBrick must be removed from the power pole cart assembly. Refer to PowerBrick removal procedure in the Installation Manual (publication [7760-IN001-EN-P](#)).
7. Refer to [Figure 54](#) (PowerBrick Component Locations - Top View). Once the PowerBrick has been removed, remove the "HS2" wire from the top of the center heatsink to isolate the SCRs from the snubber and sharing resistors. Unplug the SCR gate connectors from the gate driver boards. Measure the DC resistance between the center and either end heatsink. The value should be greater than 100 k. If so, and the gate-cathode resistance is between 4-40 , the SCRs do not need to be changed. If the resistance is very low (< 4), an SCR has failed and must be replaced. Note the Match Band character from the front of the PowerBrick, and refer to Appendix C for replacement parts.

Figure 54 - PowerBrick Component Locations — Top View



8. If the SCRs are healthy, measure the DC resistance from "S1" on the upper gate driver board to "CS" as shown in [Figure 54](#) (same as above). The connection to "CS" is made at the hex socket head screw that protrudes through the round plastic feature at the top of the snubber capacitor. This resistance should be 60 ± 6 . If a capacitance meter is available, connect from "CS" to "S2" on the lower gate driver board. The snubber capacitor should be $0.68 \pm 0.04 \mu\text{F}$. If a capacitance meter is not available, an ohmmeter may be used, and should ramp up to $>2 \text{ M}\Omega$ over several seconds. This method does not ensure that the capacitor is healthy, but shows if it is shorted or open. If the snubber components are suspect, repair or replace the PowerBrick. Refer to Appendix C for replacements parts.
9. Measure DC resistance between "C1" and "C2" at the gate driver boards. The value should be $32.5 \pm 1.7 \text{ k}$. If this point is open, the sharing resistors are damaged, or wire connections are open. Repair or replace the PowerBrick (refer to Appendix C).
10. If the PowerBrick is replaced, ensure that all components are securely connected per [Figure 55](#). Check DC resistance values per [step 5](#) above.
11. Replace the PowerBrick in the power pole assembly.

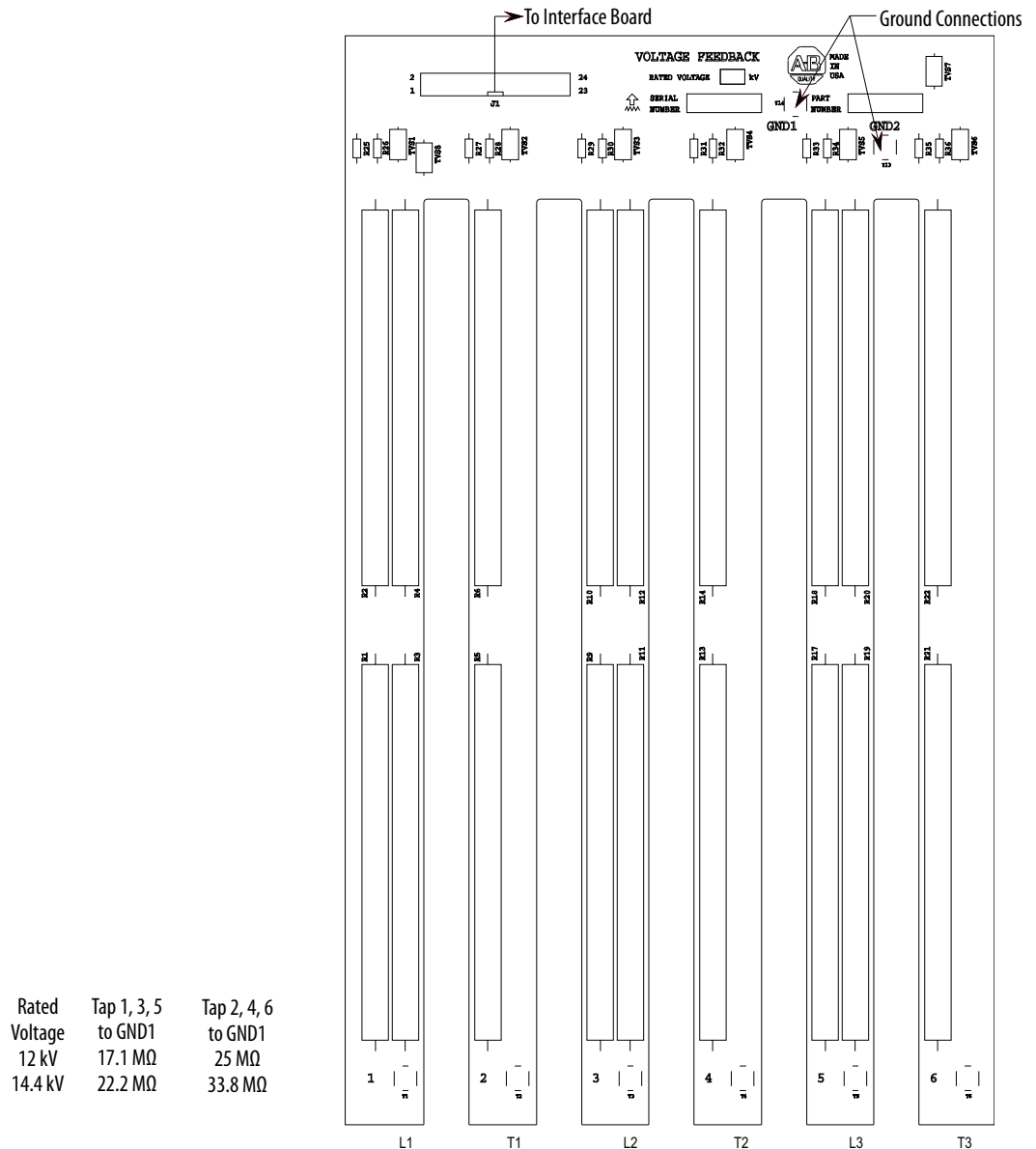
Figure 55 - PowerBrick Component Wiring Diagram



Voltage Sensing Board Testing

1. Check the resistance of the voltage sensing module (refer to [Figure 56](#)). Remove the ribbon connector from J1 by pressing down on the locking tabs then gently pulling the connector out. Measure the resistance between each tap and the ground connection, and compare to the values in [Figure 56](#). If the equipment includes an earthing switch, the board will be effectively short-circuited to ground. In this case, remove the ground wires before taking measurements.

Figure 56 - Voltage Sensing Board



Measure across R2, R4, R6, R10, R12, R14, R18, R20 and R22 located at the bottom of each leg of the module. The resistance should be 11.3 kohm. (The two ground connections must be connected to ground, or to each other if the module has been removed.)

If the values for each leg vary by more than 1%, the voltage sensing module may need to be replaced. See Renewal Parts listing in Appendix C, and refer to [Voltage-Sensing Board Replacement on page 146](#).



ATTENTION: Grounds must be reconnected on the voltage sensing boards. Failure to do so may result in injury, death or damage to equipment.

The white high voltage wires must be connected to the correct tap on each leg of the voltage sensing module. Failure to do so may result in equipment damage. Special care must be taken when working with the white high voltage wire to ensure it is not damaged.

The ribbon cable must be connected to J1 on the voltage sensing board or the equipment will not function.

2. When repairs are complete, re-assemble all parts, check all fasteners, and verify all connections are correct and tight. Make sure all barriers and mechanical parts are in place and secured.



ATTENTION: Make sure ground wires from the Voltage Sensing Module are securely connected to the ground bar in the low voltage panel or ground bus. Failure to do so may result in severe injury or equipment damage.

3. Repeat [PowerBrick \(SCR\) Testing on page 150](#) and [Resistance Checks and Power Supply Tests on page 56](#).

Power Resistor Replacement

When replacing the ceramic wire-wound type resistors, use caution when handling the parts. The resistor element is under a thin coating on the ceramic tube, and it may be damaged if dropped, struck or scraped.

Notes:

Maintenance

Safety and Preventative

The maintenance technician must become familiar with the layout and be aware of the basic system parameters. Only qualified technicians are allowed to work with this equipment under competent supervision.

Keep the components as dust free as possible. A scheduled program of inspection reduces the possibility of problems.



ATTENTION: Servicing energized industrial control equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment. Recommended practice is to disconnect and lockout control equipment from power sources, and allow any stored energy in capacitors to dissipate. If it is necessary to work in the vicinity of energized equipment, the safety-related work practices of NFPA 70E, Electrical Safety Requirements for Employee Workplaces, must be followed.

Periodic Inspection

For OEM-supplied components, refer to the OEM documentation for recommended periodic maintenance procedures.

Inspect industrial control equipment periodically. Base the inspection intervals on environmental and operating conditions, and adjusted as indicated by experience. Rockwell Automation suggests an initial inspection within 3 or 4 months after installation.

Contamination

If inspection reveals that dust, moisture or other contamination has reached the control equipment, the source must be eliminated. Contamination in the control equipment can indicate an incorrect or ineffective enclosure, unsealed enclosure openings (conduit or other), or incorrect operating procedures. Replace dirty, wet, or contaminated parts unless they can be cleaned effectively by vacuuming or wiping.



ATTENTION: Allen-Bradley magnetic starters, contactors, and relays are designed to operate without lubrication – do not lubricate these devices since oil or grease on the pole face (mating surfaces) of the operating magnet may cause the device to stick in the “ON” mode. Erratic operation can result with injury or death.

Parts of other devices are factory lubricated – if lubrication during use or maintenance of these devices is needed, it is specified in their individual instructions. If in doubt, consult the nearest Rockwell Automation sales office for information.

Vacuum Bottles

The contacts in a vacuum bottle cannot be seen or examined directly. They rely on the high vacuum to operate properly and to interrupt current.

See the vacuum contactor or breaker user manual for service instructions.

Terminals

Loose connections can cause overheating that can lead to equipment malfunction or failure. Check the tightness of all terminals and bus bar connections and securely tighten any loose connections. Replace any parts or wiring that is damaged by overheating.

Coils

If a coil exhibits evidence of overheating (cracked, melted or burned insulation), it must be replaced. In that event, check for and correct overvoltage or undervoltage conditions, which can cause coil failure. Be sure to clean any residues of melted coil insulation from other parts of the device or replace such parts.

Solid-state Devices

Solid-state devices require little more than a periodic visual inspection. Inspect printed circuit boards to determine whether all cables are properly seated in their connectors. Board locking tabs must also be in place. Necessary replacements must be made only at the PC board or plug-in component level. Do not use solvents on printed circuit boards. Where blowers are used, air filters, if supplied, must be cleaned or changed periodically depending on the specific environmental conditions encountered. For additional information, see NEMA Standards Publication No. ICS 1.1 - 1987 entitled “Safety Guidelines for the Application, Installation and Maintenance of Solid State Control”.



ATTENTION: Use of other than factory-recommended test equipment for solid-state controls may result in damage to the control or test equipment, or unintended actuation of the controlled equipment.

Static-Sensitive Items

While performing maintenance on the controller, special precautions must be observed in handling or touching certain static-sensitive components in the cabinet. Most circuit cards and SCRs can be damaged by electro-static discharge (ESD). If you contact an ESD-sensitive component during maintenance, they must be grounded. Ground with a wriststrap that is connected to an approved ground.

Overload Maintenance After a Fault Condition

See NEMA Standards Publication No. ICS 2 Appendix A entitled “Maintenance of Motor controllers after a fault condition”.

Final Check Out

After maintenance or repair of industrial controls, always test the control system for proper functioning under controlled conditions that avoid hazards in the event of a control malfunction.

Keep Good Maintenance Records

Good maintenance records help reduce shutdowns by demanding the use of proper test equipment, and an appropriate inventory of spare parts. This suggestion is most helpful in locating possible intermittent problems by pointing to a particular area of recurring trouble within the overall system. For additional information see NFPA 70B, “RECOMMENDED PRACTICE FOR ELECTRICAL EQUIPMENT MAINTENANCE”, published by the National Fire Protection Association.

Power Components

Keep power components clean and free of dirt and obstructions. This practice avoids tracking and heat build-up, increasing the life of the device.

Control Components – Electronic

Keep printed circuit boards clean and free of any accumulations of dirt and foreign materials.

Materials that create static electricity should never be allowed near circuit boards while in the unit, or in storage. Caution should be used when one is near or handling circuit boards. There are no other requirements, other than housekeeping standards, that the maintenance program requires on the logic control components.

Fans

Physically rotating and observing the fans for noise or binding will indicate if fan failure is evident.

Interlocks

Verify that interlocks function as intended, and have not been forced, damaged, or removed.

Barriers

Verify that all barriers are in place and securely fastened.

Environmental Considerations

Hazardous materials

Environmental protection is a top priority for Rockwell Automation. The facility that manufactured this medium voltage product operates an environmental management system that is certified to the requirements of ISO 14001. As part of this system, this product was reviewed in detail throughout the development process to ensure that environmentally inert materials were used wherever feasible. A final review has found this product to be substantially free of hazardous material.

Rockwell Automation is actively seeking alternatives to potentially hazardous materials for which no feasible alternatives exist. In the interim, the following precautionary information is provided for your protection and for the protection of the environment. Contact the factory for any environmental information on any material in the product or with questions regarding environmental impact.

Capacitor Dielectric Fluid

The fluids that are used in the snubber capacitors are considered safe and are fully sealed within the capacitor housings. Shipping and handling of this fluid is typically not restricted by environmental regulations. In the unlikely event that capacitor fluid leaks out, avoid ingestion or contact with skin or eyes. Rubber gloves are recommended for handling.

To clean up fluid, soak into an absorbent material and discard into an emergency container. Do not dispose into any drain or into general landfill refuse. Dispose according to local regulations. The same precautions exist if disposing of an entire capacitor.

Printed Circuit Boards

Printed circuit boards can contain a small amount of lead in components and materials. Shipping and handling these boards are typically not restricted by environmental regulations, however, lead is considered a hazardous substance. Circuit boards must be disposed of according to local regulations and must not be disposed of with general landfill refuse.

In Case Of Fire

This product is protected against arcing faults and therefore it is unlikely it would cause of a fire. The materials that are used are self-extinguishing (that is, they do not burn without a sustained external flame). If the product is subjected to a sustained fire from some other source, some of the polymer materials produce toxic gases. Wear a self-contained breathing apparatus to protect against inhalation of toxic gases.

Disposal

When disposing of the product, disassemble and separate into groups of recyclable material as much as possible (steel, copper, plastic, wire, and so forth). Send these materials to local recycling facilities. In addition, all disposal precautions that are mentioned here must also be taken for those particular materials.

Notes:

Parameter Information

Parameter List

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Table 58 - SMC -50 Parameter List

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|--------------------|-------|------------|---------|-----------|--|-----|
| 1 | Volts Phase PP Ave | Volt | 0/15000 | 0 | | Displays the calculated average voltage of the applied three phase to phase line voltages being measured by the SMC-50. | R |
| 2 | Volts A-B | Volts | 0/15000 | 0 | | Displays the Phase A to Phase B voltage applied to the SMC at the supply terminals. | R |
| 3 | Volts B-C | Volts | 0/15000 | 0 | | Displays the Phase B to Phase C voltage applied to the SMC at the supply terminals. | R |
| 4 | Volts C-A | Volts | 0/15000 | 0 | | Displays the Phase C to Phase A voltage applied to the SMC at the supply terminals. | R |
| 5 | Current Phase Ave | Amps | 0/15000 | 0 | | Displays the average of the three phase currents flowing through the SMC Power section to the load. | R |
| 6 | Current Phase A | Amps | 0/15000 | 0 | | Displays the Current flowing through the Phase A power pole of the SMC Power section to the load. | R |
| 7 | Current Phase B | Amps | 0/15000 | 0 | | Displays the Current flowing through the Phase B power pole of the SMC Power section to the load. | R |
| 8 | Current Phase C | Amps | 0/15000 | 0 | | Displays the Current flowing through the Phase C power pole of the SMC Power section to the load. | R |
| 9 | Torque | % | -50/300 | 0.0 | | Displays the true electromechanical torque calculated based on current and voltage sensing. In order for this reading to display correctly the value for Rated Torque parameter must be set. | R |
| 10 | Real Power | MW | -1000/1000 | 0.000 | | Displays the total Real Power. | R |
| 11 | Real Energy | MWH | -1000/1000 | 0.000 | | 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 | 0/50000 | 0.0 | | Displays the elapsed motor running time since the last reset of the Elapsed timer by the user. | R |
| 13 | Elapsed Time 2 | Hours | 0/50000 | 0.0 | | Displays the elapsed motor running time since the control module was manufactured. | R |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-------------------|-------|---------|---------|--|---|-----|
| 14 | Running Time | Hours | 0/50000 | 0.0 | | 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 |
| 16 | Meter Reset | | 0/4 | 0 | -Ready -Elapsed Timer -Time to PM -Starts to PM | Provides the user the ability to reset various timers and counters by selecting the appropriate reset option. Ready: Ready state of parameter, waiting for selection Elapsed Timer: Zero the elapsed timer Time to PM: Reset 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) | R/W |
| 17 | Power Factor | | -1/1 | 0.00 | | 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 | | 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 |
| 19 | Time to OL Trip | Secs | 0/1000 | 0 | | 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 | | 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 | 0/10000 | 0 | | 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 | | 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 | | 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 | | Displays the measured start time of the previous start. | R |
| 25 | Start Time 2 | Secs | 0/1000 | 0 | | Displays the measured start time of the 2nd previous start. | R |
| 26 | Start Time 3 | Secs | 0/1000 | 0 | | Displays the measured start time of the 3rd previous start. | R |
| 27 | Start Time 4 | Secs | 0/1000 | 0 | | Displays the measured start time of the 4th previous start. | R |
| 28 | Start Time 5 | Secs | 0/1000 | 0 | | Displays the measured start time of the 5th previous start. | R |
| 29 | Peak Current 1 | Amps | 0/15000 | 0 | | Displays the measured peak current of the previous start. | R |
| 30 | Peak Current 2 | Amps | 0/15000 | 0 | | Displays the measured peak current of the 2nd previous start. | R |
| 31 | Peak Current 3 | Amps | 0/15000 | 0 | | Displays the measured peak current of the 3rd previous start. | R |
| 32 | Peak Current 4 | Amps | 0/15000 | 0 | | Displays the measured peak current of the 4th previous start. | R |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|----------------|------|---------|---------|-----------|--|-----|
| 33 | Peak Current 5 | Amps | 0/15000 | 0 | | Displays the measured peak current of the 5th previous start. | R |
| 34 | Motor Speed | % | 0/100 | 0 | | 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 Va | % | 0/1000 | 0 | | Measures the THD of the applied Phase A line voltage. | R |
| 36 | THD Vb | % | 0/1000 | 0 | | Measures the THD of the applied Phase B line voltage. | R |
| 37 | THD Vc | % | 0/1000 | 0 | | Measures the THD of the applied Phase C line voltage. | R |
| 38 | THD Vave | % | 0/1000 | 0 | | Displays the calculated average of the three voltage THD measurements. | R |
| 39 | THD Ia | % | 0/1000 | 0 | | Measures the THD of the applied Phase A current. | R |
| 40 | THD Ib | % | 0/1000 | 0 | | Measures the THD of the applied Phase B current. | R |
| 41 | THD Ic | % | 0/1000 | 0 | | Measures the THD of the applied Phase C current. | R |
| 42 | THD Iave | % | 0/1000 | 0 | | Displays the calculated average of the three current THD measurements. | R |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|------------------|------|----------|---------|---|---|-----|
| 43 | Product Status | | 0/65535 | 0 | bit 0 = Enabled/Ready bit 1 = Running bit 2 = Phasing bit 3 = Phasing Active bit 4 = Starting (Accel) bit 5 = Stopping (Decel) bit 6 = Alarm bit 7 = Fault bit 8 = At Speed bit 9 = Start/Isolate bit 10 = Bypass bit 11 = Ready bit 12 - 13 = Reserved bit 14 = Input #1 bit 15 = Input #2 | 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. bit 0: 1 -Ready; 0 -Not Ready; bit 1: 1 -Power Applied to Motor (Gating SCRs or Bypass closed); 0 -Power NOT Applied to Motor bit 2: 1 -ABC Phasing; 0 -CBA Phasing bit 3: 1 -3 Phase is valid; 0 -No valid 3-phase detected bit 4: 1 -Performing a Start Maneuver ; 0 -Not Performing a Start Maneuver bit 5: 1 -Performing a Stop Maneuver (coast to stop not included); 0 -Not Performing a Stop Maneuver bit 6: 1 -Alarm Present; 0 -No Alarm Preset bit 7: 1 -Fault Condition Exists and hasn't been cleared; 0 -No Fault Condition bit 8: 1 -Full Voltage Applied (Bypass or full SCR conduction); 0 -Not Full Voltage Applied bit 9: 1 -Start/Isolate Contactor Enabled; 0 -Start/Isolate Contactor Disabled bit 10: 1 -Bypass Contactor Enabled; 0 -Bypass Contactor Disabled bit 11: 1 indicates that the SMC is eady to accept a Start command. The device is not faulted or in the process of stopping, starting or jogging bit 12-13: 0 always bit 14: Control Module Input #1 Status. 1 =Input Closed; bit 15: Control Module Input #2 Status. 1 =Input Closed; | R |
| 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 | 0/15000 | 4160 | | The Line voltage applied to the SMC L1, L2, L3 terminals. | R/W |
| 47 | Rated Torque | Nm | 0/100000 | 10 | | Enables the user the ability to enter the rated torque of the motor as read from the motors pecifications (typically nameplate). This is required for proper torque mode starts and stops. | R/W |
| 48 | Rated Speed | RPM | 0/7 | 5 | 750 900 1000 1200 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-----------------|------|---------|---------|---|--|-----|
| 49 | Starting Mode | | 0/5 | 2 | -Full Voltage -Current Limit -[Soft Start] -Linear Speed- (Sensorless) -Torque Ramp -Pump Start | Used to program the SMC controller for the type of starting mode that best fits the application. 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. | R/W |
| 50 | Ramp Time | Sec | 0/1000 | 10.0 | | 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 | | The initial reduced voltage output level for the voltage ramp is established and adjusted with this parameter. | R/W |
| 52 | Max. Torque | % | 0/300 | 250 | | 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 | | The current limit level that is applied for the ramp time selected. | R/W |
| 54 | Kickstart Time | SEC | 0/2 | 0.0 | | A boost of current is applied to the motor for this programmed time. | R/W |
| 55 | Kickstart Level | %LRT | 0/90 | 0 | | 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 | | 0/14 | 4 | Disable Start Coast Stop Option [Start/Coast] Start/Stop Reserved Reserved Dual Ramp OL Select Fault Fault NC Clear Fault Emerg Run Reserved | Allows the user to select the operation of Terminal 11, Input 1 on the control module. 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 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). | R/W |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-------------------|------|---------|---------|--|--|-----|
| 57 | Input 2 | | 0/14 | 0 | [Disable] Start Coast Stop Option Start/Coast Start/Stop Reserved Reserved Dual Ramp OL Select Fault Fault NC Clear Fault Emerg Run Reserved | Allows the user to select the operation of Terminal 11, Input 2 on the control module. [Disable]: Disable the input - ignores any assertion to Input 2, Terminal 11. Start: Initiates a start as set up by the start parameters at Input 2, Terminal 11 (High). Coast: Initiates a coast stop.- no current to motor at Input 2, Terminal 11 (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- Initiates a start as set up by the start parameters Start/Stop: if Input 2 = 0- Initiates a stop maneuver as set up by stopping parameters; 1- Initiates a start as set up by the start parameters Dual Ramp: if Input 2 = 0 - Use starting mode 1; 1 - Use starting mode 2 OL Select: if Input 2 = 0 - Use Motor Overload Class 1; 1 - Use Motor Overload Class 2 Fault: A fault condition forced if Input 2= 1. Fault NC: A fault condition forced if Input 2 = 0. Clear Fault: Clear a fault from Input 2 Terminal 11 (High). Emerg Run: Allow motor to run in emergency run mode if asserted from Input 2, Terminal 11 - does not start motor (High). | R/W |
| 58 | Starting Mode 2 | | 0/5 | 2 | Full Voltage Current Limit [Soft Start] Linear Speed Torque Ramp Pump Start | Allows the user to program an alternate starting mode for the SMC-50 that suits the application. 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. | R/W |
| 59 | Ramp Time 2 | Sec | 0/1000 | 10.0 | | 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 | | 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 | | 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 | | 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 | | 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 | | Allows the user to set an alternate adjustment of the amount of current applied to the motor during the kickstart period. | R/W |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|------------------|------|-----------|---------|---|---|-----|
| 65 | Stop Mode | | 0/5 | 0 | [Coast] Soft Stop Linear Speed Pump Stop Reserved External Brake | Allows the user to program the SMC-50 for the type of stopping that best suits the application. [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. External Brake: Closes an external contactor to apply braking current to the motor. | R/W |
| 66 | Stop Time | Sec | 0/999 | 0 | | Sets the time period which the controller will ramp the voltage during a stopping maneuver. | R/W |
| 67 | Backspin Timer | Sec | 0/999 | 0 | | 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 | | 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 |
| 75 | Overload Class | | 5/30 | 10 | | 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 | | 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 | | 0.01/1.99 | 1.15 | | Parameter to enter the value of the motor's service factor from the nameplate. | R/W |
| 78 | Motor FLC | Amps | 1/2200 | 1.0 | | Parameter to enter the Full Load Current (FLC) value from the motor's nameplate. | R/W |
| 79 | Motor FLC 2 | Amps | 1/2200 | 1.0 | | 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 | | 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 | | 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 | | Disables the overload from tripping during stopping maneuvers. The MTU, Therm Usage continues to increment during these maneuvers. | R/W |
| 83 | Overload A Level | %MTU | 0/100 | 90 | | 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|------------------|------|----------|---------|-----------|--|-----|
| 84 | Locked Rtr F Lvl | %FLC | 400/1000 | 600 | | 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 | 0.1 | | 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 | | 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 | 0.1 | | 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 | | 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 an alarm. | R/W |
| 89 | Underload A Dly | Secs | 0.1/99 | 0.1 | | 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 an alarm. | R/W |
| 90 | MWatts Ov F Lvl | MW | 0/1000 | 0.000 | | 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 | 0.1 | | 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 | 0/1000 | 0.000 | | 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 | 0.1 | | 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 | 0/1000 | 0.000 | | 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 signaled. The MWatts Un bit in the Motor Fault En parameter must be set to signal a fault. | R/W |
| 95 | MWatts Un F Dly | Secs | 0.1/99 | 0.1 | | 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 | 0/1000 | 0.000 | | 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 | 0.1 | | 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|------------------|------|---------|---------|-----------|--|-----|
| 98 | Undervolt F Lvl | %V | 0/100 | 90 | | 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 | 3.0 | | 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 | | 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 | 3.0 | | 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 | | 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 | 3.0 | | 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 | | 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 | 3.0 | | 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 | | 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 | 3.0 | | 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 | | 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 | 3.0 | | 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 | | 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-----------------|------|---------|---------|-----------|---|-----|
| 111 | Cur Imbal F Dly | Secs | 0.1/99 | 3.0 | | 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 | | 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 | 3.0 | | 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 |
| 114 | Jam F Lvl | %FLC | 0/1000 | 1000 | | 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 | 0.1 | | 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 | | 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 | 0.1 | | 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 | | 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 | 0.1 | | 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 | | 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 | 0.1 | | 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 | | 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 signaled. 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 | 0.1 | | 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 | | 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-------------------|------|---------------|-------------|--|--|-----|
| 125 | THD I A Dly | Secs | 0.1/99 | 0.1 | | 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 | 1/10000 | 10000 | | 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 | | 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 | | 1/10 | 2 | | 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 | | 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 | | 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 | | 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 | | 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 | | 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 | | Provides a delay time prior to the SMC-50's attempt to restart the motor after a fault. | R/W |
| 135 | Starts Restart En | | Bit Value 0/1 | 0 Future | Volt Unbal Overvoltage Undervoltage Phase Rev Line Loss Open Gate Config Change Freq THD V Future | 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|------------------|------|---------------|---|--|---|-----|
| 136 | Starter Fault En | | Bit Value 0/1 | 0 0 0 0 1 1 0 0 0 | Volt Unbal Overvoltage Undervoltage Phase Rev Line Loss Open Gate Config Change Freq THD V | 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 |
| 137 | Starter Alarm En | | Bit Value 0/1 | 0 | Volt Unbal Overvoltage Undervoltage Phase Rev Line Loss Open Gate Config Change Freq THD V | 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 |
| 138 | Fault 1 | | 0/10000 | 0 | | First entry in the fault buffer and is the most recent fault to have occurred. | R/W |
| 139 | Fault 2 | | 0/10000 | 0 | | Second entry in the fault buffer. | R/W |
| 140 | Fault 3 | | 0/10000 | 0 | | Third entry in the fault buffer. | R/W |
| 141 | Fault 4 | | 0/10000 | 0 | | Fourth entry in the fault buffer. | R/W |
| 142 | Fault 5 | | 0/10000 | 0 | | Fifth entry in the fault buffer. The oldest fault displayed in the fault buffer. | R/W |
| 143 | Alarm 1 | | 0/10000 | 0 | | First entry in the alarm buffer and is the most recent alarm to have occurred. | R/W |
| 144 | Alarm 2 | | 0/10000 | 0 | | Second entry in the alarm buffer. | R/W |
| 145 | Alarm 3 | | 0/10000 | 0 | | Third entry in the alarm buffer. | R/W |
| 146 | Alarm 4 | | 0/10000 | 0 | | Fourth entry in the alarm buffer. | R/W |
| 147 | Alarm 5 | | 0/10000 | 0 | | 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. | R/W |
| 148 | Logic Mask | | 0/65535 | 0 | | 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 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|----------------|------|----------|---------|-----------|--|-----|
| 149 | Logic Mask Act | | 0/65535 | 0 | | 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 | | 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 | | 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 | | 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 | | This is the a channel 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 | Data In A2 | | 0/159999 | 0 | | This is the a channel 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 |
| 155 | Data In B1 | | 0/159999 | 0 | | This is the a channel 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|---------------|------|----------|---------|-----------|--|-----|
| 156 | Data In B2 | | 0/159999 | 0 | | This is the a channel 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 |
| 157 | Data In C1 | | 0/159999 | 0 | | This is the a channel 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 |
| 158 | Data In C2 | | 0/159999 | 0 | | This is the a channel 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 |
| 159 | Data In D1 | | 0/159999 | 0 | | This is the a channel 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 |
| 160 | Data In D2 | | 0/159999 | 0 | | This is the a channel 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 |
| 161 | Data Out A1 | | 0/159999 | 0 | | This is the a channel OUT Datalink index, holding the parameter number of the parameter that will be read to during Datalink communications. A value of 0 indicates that it is disabled. | R/W |
| 162 | Data Out A2 | | 0/159999 | 0 | | This is the a channel OUT Datalink index, holding the parameter number of the parameter that will be read to during Datalink communications. A value of 0 indicates that it is disabled. | R/W |
| 163 | Data Out B1 | | 0/159999 | 0 | | This is the a channel OUT Datalink index, holding the parameter number of the parameter that will be read to during Datalink communications. A value of 0 indicates that it is disabled. | R/W |
| 164 | Data Out B2 | | 0/159999 | 0 | | This is the a channel OUT Datalink index, holding the parameter number of the parameter that will be read to during Datalink communications. A value of 0 indicates that it is disabled. | R/W |
| 165 | Data Out C1 | | 0/159999 | 0 | | This is the a channel OUT Datalink index, holding the parameter number of the parameter that will be read to during Datalink communications. A value of 0 indicates that it is disabled. | R/W |
| 166 | Data Out C2 | | 0/159999 | 0 | | This is the a channel OUT Datalink index, holding the parameter number of the parameter that will be read to during Datalink communications. A value of 0 indicates that it is disabled. | R/W |
| 167 | Data Out D1 | | 0/159999 | 0 | | This is the a channel OUT Datalink index, holding the parameter number of the parameter that will be read to during Datalink communications. A value of 0 indicates that it is disabled. | R/W |
| 168 | Data Out D2 | | 0/159999 | 0 | | This is the a channel OUT Datalink index, holding the parameter number of the parameter that will be read to during Datalink communications. A value of 0 indicates that it is disabled. | R/W |
| 169 | Voltage Ratio | | 1/32767 | 3079 | | 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-----------------|------|---------|---------|--|--|-----|
| 170 | User CT Ratio | | 1/1500 | 50 | | 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 | I FDBK scale | | 0.01/10 | 1 | | 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 |
| 172 | Aux 1 Config | | 0/12 | 4 | [Normal] UTS Fault Alarm Ext Bypass Ext Brake DeviceLogix Aux Control Network 1 Network 2 Network 3 Network 4 | <p>Allows the user to configure the functionality of the Aux1 relay output on the control module based on the following selections.</p> <p>[Normal]: Aux 1 closes when start command asserted and opens when motor stops [Default].</p> <p>UTS: Aux 1 closes when motor reaches up to speed and opens when motor is not at speed.</p> <p>Fault: Aux1 closes when the SMC-50 enters a fault state and opens when the fault is cleared.</p> <p>Alarm: Aux1 closes when the SMC-50 detects an alarm condition and opens when alarm is cleared.</p> <p>Ext Bypass: Aux1 closes when the SMC-50 enters the external bypass mode and opens when it leaves that mode.</p> <p>Ext Brake: Aux1 closes when Ext Braking command is active and opens when it is not active.</p> <p>DeviceLogix: Aux1 is controlled by DeviceLogix program.</p> <p>Aux Control: When an auxiliary is configured for Aux Control, a bit within the parameter Aux Control controls the state of that auxiliary.</p> <p>Network 1: With an auxiliary configured as Network 1, it is controlled over the Local Area Network (LAN) as Relay 1.</p> <p>Network 2: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 2.</p> <p>Network 3: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 3.</p> <p>Network 4: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 4.</p> | R/W |
| 173 | Aux 1 Invert | | 0/1 | 0 | [Disable] Enable | <p>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.</p> <p>Disable: Aux 1 relay output not inverted [Default] (N.O.).</p> <p>Enable: Aux 1 relay output inverted (N.C.)</p> | R/W |
| 174 | Aux 1 On Delay | Secs | 0/10 | 0.0 | | <p>A time delay in activating the Aux1 relay contact can be programmed.</p> <p>Note: when an aux relay is configured for External Bypass, that delay is not applied to the relay output.</p> | R/W |
| 175 | Aux 1 Off Delay | Secs | 0/10 | 0.0 | | <p>A time delay in de-activating the Aux1 relay contact can be programmed.</p> <p>Note: when an aux relay is configured for External Bypass, that delay is not applied to the relay output.</p> | R/W |

Table 58 - SMC-50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-----------------|------|---------|---------|--|--|-----|
| 176 | Aux2 Config | | 0/12 | 0 | [Normal] UTS Fault Alarm Ext Bypass Ext Brake DeviceLogix Aux Control Network 1 Network 2 Network 3 Network 4 | <p>Allows the user to configure the functionality of the Aux2 relay output on the control module based on the following selections.</p> <p>[Normal]: Aux2 closes when start command asserted and opens when motor stops [Default].</p> <p>UTS: Aux2 closes when motor reaches up to speed and opens when motor is not at speed.</p> <p>Fault: Aux2 closes when the SMC-50 enters a fault state and opens when the fault is cleared.</p> <p>Alarm: Aux2 closes when the SMC-50 detects an alarm condition and opens when alarm is cleared.</p> <p>Ext Bypass: Aux2 closes when the SMC-50 enters the external bypass mode and opens when it leaves that mode.</p> <p>Ext Brake: Aux2 closes when Ext Braking command is active and opens when it is not active.</p> <p>DeviceLogix: Aux2 is controlled by DeviceLogix program.</p> <p>Aux Control: When an auxiliary is configured for Aux Control, a bit within the parameter Aux Control controls the state of that auxiliary.</p> <p>Network 1: With an auxiliary configured as Network 1, it is controlled over the Local Area Network (LAN) as Relay 1.</p> <p>Network 2: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 2.</p> <p>Network 3: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 3.</p> <p>Network 4: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 4.</p> | R/W |
| 177 | Aux 2 Invert | | 0/1 | 0 | [Disable] Enable | <p>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.</p> <p>Disable: Aux 1 relay output not inverted [Default] (N.O.).</p> <p>Enable: Aux 1 relay output inverted (N.C.)</p> | R/W |
| 178 | Aux 2 On Delay | Secs | 0/10 | 0.0 | | <p>A time delay in activating the Aux1 relay contact can be programmed.</p> <p>Note: when an aux relay is configured for External Bypass, that delay is not applied to the relay output.</p> | R/W |
| 179 | Aux 2 Off Delay | Secs | 0/10 | 0.0 | | <p>A time delay in de-activating the Aux1 relay contact can be programmed.</p> <p>Note: when an aux relay is configured for External Bypass, that delay is not applied to the relay output.</p> | R/W |

Table 58 - SMC-50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-----------------|------|---------|---------|---|---|-----|
| 180 | Aux Control | | | 0 | Aux 1/Aux 2/ Aux 7-1/Aux 7-2/Aux 7-3/Aux 7-4/Aux 8-1/ Aux 8-2/Aux 8-3/Aux 8-4/Aux 9-1/Aux 9-2/ Aux 9-3/Aux 9-4/Reserved/ Reserved | When an Auxiliary Relay output is configured for "Aux Control" a bit within this parameter will control the state of the auxiliary. Bit 0 - Control Module Aux Relay 1; Bit 1 - Control Module Aux Relay 2; Bit 2 - Expansion Port 7 Aux Relay 1; Bit 3 - Expansion Port 7 Aux Relay 2; Bit 4 - Expansion Port 7 Aux Relay 3; Bit 5 - Expansion Port 7 Aux Relay 4; Bit 6 - Expansion Port 8 Aux Relay 1; Bit 7 - Expansion Port 8 Aux Relay 2; Bit 8 - Expansion Port 8 Aux Relay 3; Bit 9 - Expansion Port 8 Aux Relay 4; Bit 10 - Expansion Port 9 Aux Relay 1; Bit 11 - Expansion Port 9 Aux Relay 2; Bit 12 - Expansion Port 9 Aux Relay 3; Bit 13 - Expansion Port 9 Aux Relay 4; Bits 14, 15 - Reserved. | R/W |
| 181 | Language | | 0/6 | 0 | [English] French Spanish Italian German Portuguese Mandarin | 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 |
| 182 | Start Delay | Secs | 0/30 | 0 | | 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 | [Disable] Enable | 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. Disable: Complete starting mode when up-to-speed detected. Enable: Complete starting mode when ramp time expires. | R/W |
| 184 | V Shutoff Level | % | 0/100 | 25 | | 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 | | 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 58 - SMC-50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|------------------------------|------|---------|---------|-----------------|--|-----|
| 186 | UTS Level | % | 0/100 | 75 | | 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 | | 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 | 0/30 | 1.0 | | 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 | | 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) | | 50/70 | 60.0 | | 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 | % | 40/100 | 87.5 | | 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 | 2/10 | 2 | | During the coast to stop, the bypass contactor will be hold by this number after the Main Contactor open. | R/W |
| 194 | Forced Tuning | | 0/1 | 1 | FALSE [TRUE] | Enables the controller's tuning algorithms to analyze the load and supply and adjust parameters for easy set up and optimum performance. FALSE: Do not run tuning algorithm (was already run or disabled by user). [TRUE]: Run tuning algorithm at next start command [Default]. | R/W |
| 195 | Stator R | Ohms | 0/50 | 0.00 | | Enables the user to read/view the motor stator resistance value that was measured during the tuning process. | R |
| 196 | Total R | Ohms | 0/50 | 0.00 | | Enables the user to read/view the motor total load resistance that was measured during the tuning process. | R |
| 197 | Coupling Factor | | 0/10 | 0.00 | | This is a coefficient inserted by the controller during the tuning process and viewable by the user. | R |
| 198 | Inductance | mH | 0/1000 | 0.00 | | Enables the user to read/view the motor inductance that was measured during the tuning process. | R |
| 199 | Speed Pgain | | 1/10000 | 1000 | | 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 | | 0/2 | 0.90 | | 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|----------------|------|----------|---------|-----------|--|-----|
| 201 | Transient Zero | | 0/10 | 5.00 | | 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 |
| 202 | Transient Gain | | 0/4 | 1.00 | | 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 |
| 203 | Ping Degree | | 0/180 | 50.0 | | 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 | | 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 |
| 205 | Phase Shift 0 | | -360/360 | 0 | | 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 | Phase Shift 10 | | -360/360 | 0 | | 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 |
| 207 | Phase Shift 20 | | -360/360 | 0 | | 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 |
| 208 | Phase Shift 30 | | -360/360 | 0 | | 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 |
| 209 | Phase Shift 40 | | -360/360 | 0 | | 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 |
| 210 | Phase Shift 50 | | -360/360 | 0 | | 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 |
| 211 | Phase Shift 60 | | -360/360 | 0 | | 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 |
| 212 | Phase Shift 70 | | -360/360 | 0 | | 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 |
| 213 | Phase Shift 80 | | -360/360 | 0 | | 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 |
| 214 | Phase Shift 90 | | -360/360 | 0 | | 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-----------------|------|----------|---------|--|---|-----|
| 215 | Phase Shift 100 | | -360/360 | 0 | | 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 |
| 216 | Board Temp | °C | -25/100 | 20 | | Displays the internal temperature of the SMC control module. | R |
| 217 | Exp 7 Config | | 0/5 | 0 | [None] Input/Output Analog I/O (future) GFCT/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) GFCT/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) GFCT/PTC/CT DIP Switch Seq Start (future) | Displays the type of expansion board plugged into Expansion Port 9. | R |
| 224 | Line Frequency | Hz | 0/100 | 0 | | 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 | 0.1 | | 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 | 0.1 | | 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 |
| 227 | Freq Low F Dly | Secs | 0.1/99 | 0.1 | | 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|----------------|------|---------------|---------|---|---|-----|
| 228 | Freq Low A Dly | Secs | 0.1/99 | 0.1 | | 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 | [Ready] Factory Default | 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: [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. | R/W |
| 230 | Motor Fault En | | Bit Value 0/1 | | [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 Overcurrent EN | 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 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|----------------|------|---------------|---------|---|--|-----|
| 231 | Motor Alarm En | | Bit Value 0/1 | | 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 | 0/1000 | 0.000 | | 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. | R/W |
| 233 | +MVAR Ov F Dly | Secs | 0.1/99 | 0.1 | | 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 | R/W |
| 234 | +MVAR Ov A Lvl | MVAR | 0/1000 | 0.000 | | 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. | R/W |
| 235 | +MVAR Ov A Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|----------------|------|---------|---------|-----------|--|-----|
| 236 | +MVAR Un F Lvl | MVAR | 0/1000 | 0.000 | | 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. | R/W |
| 237 | +MVAR Un F Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 238 | +MVAR Un A Lvl | MVAR | 0/1000 | 0.000 | | 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. | R/W |
| 239 | +MVAR Un A Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 240 | MVA Ov F Lvl | MVA | 0/1000 | 0.000 | | 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. | R/W |
| 241 | MVA Ov F Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 242 | MVA Ov A Lvl | MVA | 0/1000 | 0.00 | | 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. | R/W |
| 243 | MVA Ov A Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 244 | MVA Un F Lvl | MVA | 0/1000 | 0.00 | | 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. | R/W |
| 245 | MVA Un F Dly | Secs | 0.1/99 | 0.1 | | 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 |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|------------------|------|---------|---------|-----------|---|-----|
| 246 | MVA Un A Lvl | MVA | 0/1000 | 0.00 | | 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. | R/W |
| 247 | MVA Un A Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 248 | Lead PF Ov F Lvl | | 0/1 | 0.00 | | 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. | R/W |
| 249 | Lead PF Ov F Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 250 | Lead PF Ov A Lvl | | 0/1 | 0.00 | | 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. | R/W |
| 251 | Lead PF Ov A Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 252 | Lead PF Un F Lvl | | 0/1 | 0.00 | | 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. | R/W |
| 253 | Lead PF Un F Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 254 | Lead PF Un A Lvl | | 0/1 | 0.00 | | 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. | R/W |
| 255 | Lead PF Un A Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|------------------------------------|------|---------|---------|-----------|---|-----|
| 256 | Lag PF Ov F Lvl | | -1/0 | 0.00 | | 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. | R/W |
| 257 | Lag PF Ov F Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 258 | Lag PF Ov A Lvl | | -1/0 | 0.00 | | 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. | R/W |
| 259 | Lag PF Ov A Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 260 | Lag PF Un F Lvl | | -1/0 | 0.00 | | 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. | R/W |
| 261 | Lag PF Un F Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 262 | Lag PF Un A Lvl | | -1/0 | 0.00 | | 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. | R/W |
| 263 | Lag PF Un A Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 264 | Motor Restart En (Refer to 264) | | | | | Manual P111: 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. | |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-------------------|-------|---------------|---------|---|--|-----|
| 264 | Motor Restart En | | Bit Value 0/1 | | 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 | 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 | 0/9000 | 0 | | Displays the average of the sum of the three phase voltages to neutral. | R |
| 266 | Voltage Phase A-N | Volts | 0/9000 | 0 | | Displays Phase A (L1) to neutral voltage. | R |
| 267 | Voltage Phase B-N | Volts | 0/9000 | 0 | | Displays Phase B (L2) to neutral voltage. | R |
| 268 | Voltage Phase C-N | Volts | 0/9000 | 0 | | Displays Phase C (L3) to neutral voltage. | R |
| 269 | Real Power A | MW | -1000/1000 | 0.000 | | 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 | MW | -1000/1000 | 0.000 | | Displays the Real Power of the Phase B branch which is equal to Phase B Voltage x Phase B Current x PF. | R |
| 271 | Real Power C | MW | -1000/1000 | 0.000 | | Displays the Real Power of the Phase C branch which is equal to Phase C Voltage x Phase C Current x PF. | R |
| 272 | Real Demand | MW | -1000/1000 | 0.000 | | Displays Real Energy (MWH) averaged over a period of time defined by Demand Period. | R |
| 273 | Max. Real Demand | MW | -1000/1000 | 0.000 | | Displays the Maximum energy demand recorded since the last energy meter reset. | R |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-------------------|-------|------------|---------|-----------|---|-----|
| 274 | Reactive Power A | MVAR | -1000/1000 | 0.000 | | Displays the reactive power of the Phase A branch. | R |
| 275 | Reactive Power B | MVAR | -1000/1000 | 0.000 | | Displays the reactive power of the Phase B branch. | R |
| 276 | Reactive Power C | MVAR | -1000/1000 | 0.000 | | Displays the reactive power of the Phase C branch. | R |
| 277 | Reactive Power | MVAR | -1000/1000 | 0.000 | | Displays the total reactive power. | R |
| 278 | Reactive Energy C | MVARH | -1000/1000 | 0.000 | | Displays the reactive energy being consumed by the load. | R |
| 279 | Reactive Energy P | MVARH | -1000/1000 | 0.000 | | Displays the reactive energy being produced by the load. | R |
| 280 | Reactive Energy | MVARH | -1000/1000 | 0.000 | | Displays the total reactive energy which is equal to Reactive Power X time. | R |
| 281 | Reactive Demand | MVAR | -1000/1000 | 0.000 | | Displays the Reactive Energy consumed or generated by the system over the Demand Time Period. | R |
| 282 | Max. Reactive Dmd | MVAR | -1000/1000 | 0.000 | | Displays the maximum reactive energy demand recorded since the energy meters were reset | R |
| 283 | Apparent Power A | MVA | -1000/1000 | 0.000 | | Displays the Apparent Power (VA) measured in the phase A branch. | R |
| 284 | Apparent Power B | MVA | -1000/1000 | 0.000 | | Displays the VA measured in the phase B branch. | R |
| 285 | Apparent Power C | MVA | -1000/1000 | 0.000 | | Displays the VA measured in the phase C branch. | R |
| 286 | Apparent Power | MVA | -1000/1000 | 0.000 | | Displays the total apparent power consumed (-) or produced (+) by the load. | R |
| 287 | Apparent Energy | MVAH | -1000/1000 | 0.000 | | Displays the Apparent Energy which is equal to Apparent Power x Time. | R |
| 288 | Apparent Demand | MVA | -1000/1000 | 0.000 | | 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 | -1000/1000 | 0.000 | | Displays the maximum apparent demand recorded since energy meters were reset. | R |
| 290 | Demand Period | Mins | 1/255 | 1 | | 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 | | Enables the user to enter the number of periods that energy measurements are taken in calculating demand. | R/W |
| 292 | Power Factor A | | -1/1 | 0.00 | | Displays the power factor in the Phase A branch of the load circuit. | R |
| 293 | Power Factor B | | -1/1 | 0.00 | | Displays the power factor in the Phase B branch of the load circuit. | R |
| 294 | Power Factor C | | -1/1 | 0.00 | | Displays the power factor in the Phase C branch of the load circuit. | R |
| 295 | Current Imbal | % | 0/100 | 0.00 | | 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 | | 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 | -1000/0 | 0.000 | | 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. | R/W |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-------------------|------|---------|---------|-----------|---|-----|
| 298 | -MVAR Ov F Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 299 | -MVAR Ov A Lvl | MVAR | -1000/0 | 0.000 | | 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. | R/W |
| 300 | -MVAR Ov A Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 301 | -MVAR Un F Lvl | MVAR | -1000/0 | 0.000 | | 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. | R/W |
| 302 | -MVAR Un F Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 303 | -MVAR Un A Lvl | MVAR | -1000/0 | 0.000 | | 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. | R/W |
| 304 | -MVAR Un A Dly | Secs | 0.1/99 | 0.1 | | 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. | R/W |
| 305 | Starting Torque | % | 0/300 | 100 | | Enables the user to enter Starting Torque value required for a torque start operation. | R/W |
| 306 | Starting Torque 2 | % | 0/300 | 100 | | Enables the user to enter an alternate Starting Torque required for a torque start operation. | R/W |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|--------------------|------|----------|---------|--|--|-----|
| 309 | Input Status | | 0/65535 | 0 | Input 1 Input 2 Input 7-1 Input 7-2 Input 7-3 Input 7-4 Input 8-1 Input 8-2 Input 8-3 Input 8-4 Input 9-1 Input 9-2 Input 9-3 Input 9-4 | Displays the status of all the digital inputs for the SMC-50 Bit 0 - Displays status of control module input #1; Bit 1 - Displays status of Control Module Input #2. Bit 2 - Displays status of Control Module Port 7, 150-SM4 Option Module Input #1. Bit 3 - Displays status of Control Module Port 7, 150-SM4 Option Module Input #2. Bit 4 - Displays status of Control Module Port 7, 150-SM4 Option Module Input #3. Bit 5 - Displays status of Control Module Port 7, 150-SM4 Option Module Input #4. Bit 6 - Displays status of Control Module Port 8, 150-SM4 Option Module Input #1. Bit 7 - Displays status of Control Module Port 8, 150-SM4 Option Module Input #2. Bit 8 - Displays status of Control Module Port 8, 150-SM4 Option Module Input #3. Bit 9 - Displays status of Control Module Port 8, 150-SM4 Option Module Input #4. Bit 10 - Displays status of Control Module Port 9, 150-SM4 Option Module Input #1. Bit 11 - Displays status of Control Module Port 9, 150-SM4 Option Module Input #2. Bit 12 - Displays status of Control Module Port 9, 150-SM4 Option Module Input #3. Bit 13 - Displays status of Control Module Port 9, 150-SM4 Option Module Input #4. Bit 14 & 15 - Reserved. | R |
| 310 | Locked Rotor A Lvl | %FLC | 400/1000 | 600 | | 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. | R/W |
| 311 | Locked Rotor A Dly | Secs | 0.1/100 | 0.1 | | 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. | R/W |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|------------------|-------|---------|---------|---|--|-----|
| 312 | Product Command | | 0/65535 | 0 | Stop Start Jog Clear Fault Reserved Emer Run Reserved Reserved Reserved Reserved Reserved Aux Enable Network_1 Network_2 Network_3 Network_4 | Displays an image of the DPI product command required for DPI communications. 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; Emer Run: 1 - Enable Emergency Run Mode; 0 - Disable Emergency Run Mode; 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"; | R |
| 313 | Rebalance Level | % | 0/100 | 0 | | The percentage of motor current imbalance above which the SMC-50 will rebalance the motor current | R/W |
| 314 | Va Peak | Volts | 0/15000 | 0 | | 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 | Volts | 0/15000 | 0 | | 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 | Volts | 0/15000 | 0 | | 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 | | 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 | | 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 | | 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 | Volts | 0/15000 | 0 | | 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 | Volts | 0/15000 | 0 | | 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 | Volts | 0/15000 | 0 | | 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 | | 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 | | Snapshot of the Phase B current when a fault occurs. The value is overwritten if a subsequent fault occurs. | R |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|------------------|------|---------|---------|--|---|-----|
| 325 | SSCurrent Phas C | Amps | 0/15000 | 0 | | Snapshot of the Phase C current when a fault occurs. The value is overwritten if a subsequent fault occurs. | R |
| 326 | SSPower Factor | | -1/1 | 0 | | 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 | | 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 | | Snapshot of the Motor Speed when a fault occurs. The value is overwritten if a subsequent fault occurs | R |
| 329 | SSTHD Vave | % | 0/1000 | 0 | | 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 | % | 0/1000 | 0 | | 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 | Enable/Ready Running Phasing Phasing Active Starting (Accel) Stopping (Decel) Alarm Fault At Speed Start/Isolate Bypass Ready Reserved Reserved Input #1 Input #2 | Snapshot of the product status when a fault occurs. The value is overwritten if a subsequent fault occurs. Bit 0 - 1 -Ready; 0 -Not Ready Bit 1 - 1 -Power Applied to Motor(Gating SCRs or Bypass closed); 0 -Power not applied; Bit 2 - 1 -ABC Phasing; 0 -CBA Phasing; Bit 3 - 1 -3 phase is valid; 0 -No valid 3 phase; Bit 4 - 1 - Performing a Start Maneuver ; 0 -Not Performing Bit 5 - 1 - Performing a Stop Maneuver (coast to stop not included); 0 -Not Performing Bit 6 - 1 - Alarm Present; 0 -No Alarm Present; Bit 7 - 1 – Fault Condition Exists and hasn't been cleared; 0 -No Fault Condition; Bit 8 - 1 – Full Voltage Applied (Bypass or full SCR conduction); 0 -Not Full Voltage Applied; Bit 9 - 1 – Start/Isolate Contactor Enabled; 0 -Start/Isolate Contactor Disabled; Bit 10 - 1 – Bypass Contactor Enabled; 0 - Bypass Contactor Disabled Bit 11 - 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 - 0 Bit 13 - 0 Bit 14 - Control Module Input #1 Status. 1 = Input Closed. Bit 15 - Control Module Input #2 Status. 1 = Input Closed. | R |
| 332 | SSBoard Temp | °C | -25/100 | 20 | | 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 | | 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 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|----------------|------|-----------------------------------|--------------|--|--|-----|
| 334 | Restart Auto | | Bit Value 0/1 | 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 | | -2 ³¹ /2 ³¹ | 0 | | General purpose parameter used as an input to the DeviceLogix Engine. | R/W |
| 336 | DLX Input 2 | | -2 ³¹ /2 ³¹ | 0 | | General purpose parameter used as an input to the DeviceLogix Engine. | R/W |
| 337 | DLX DL Input 1 | | 0/159999 | 1 | | 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 | | 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 | | 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 | | 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 | | 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 | | 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 | | -2 ³¹ /2 ³¹ | 0 | | General purpose parameter that can be written by the DeviceLogix engine and monitored from a HIM or network device. | R |
| 344 | DLX Output 2 | | -2 ³¹ /2 ³¹ | 0 | | 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 |
| 347 | Load Type | | 0/1 | | [Motor] Resistive | Allow choice of Motor Load or Resistive Heater Load -Motor Load -Resistive Heater Load | R/W |

Table 58 - SMC -50 Parameter List (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | R/W |
|--------|-----------------|------|----------|---------|--|---|-----|
| 348 | Ref Source | | 0/8 | | [Output V Ref] P7 In1 P7 In2 P8 In1 P8 In2 P9 In1 P9 In2 DLX Output 1 DLX Output 2 | Allows selection of Source for Resistive Heater Output Voltage -Output Voltage Reference Parameter (Set in Par349) -Analog Input #1 from 150-SM3 option module in Expansion Port 7 -Analog Input #2 from 150-SM3 option module in Expansion Port 7 -Analog Input #1 from 150-SM3 option module in Expansion Port 8 -Analog Input #2 from 150-SM3 option module in Expansion Port 8 -Analog Input #1 from 150-SM3 option module in Expansion Port 9 -Analog Input #2 from 150-SM3 option module in Expansion Port 9 -DeviceLogix Output #1 -DeviceLogix Output #2 | R/W |
| 349 | Output V Ref | % | 1/100 | 1 | N/A | Parameter that can be set from 1% to 100% output voltage for Resistive Heating Mode. | R/W |
| 351 | OverCurrent LVL | % | 800/1000 | 800 | | Threshold for overcurrent protection (the manually enabled one) | R/W |

Table 59 - 150-SM2 Option Card Parameters

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | Read/Write |
|----------------|----------------------------------|------|----------|---------|-------------------------------|---|------------|
| SM2.01 (GF) | Module Status | | 0/7 | 7 | [Ready] [PTC] [CT Loss] | Displays information about the operational status of the 150-SM2 PTC, Ground Fault, and External Current Transformer (CT) Option Module. 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 | R |
| SM2.02 (GF) | Fault Enable | | 0/3 | 0 | PTC Ground Fault | PTC: 0 = PTC Fault Disabled; 1 = PTC Fault Enabled GF: 0 = Ground Fault Disabled; 1 = Ground Fault Enabled | R/W |
| SM2.02 (GF) | Fault Enable (Refer to SM2.2) | | | | | | |
| SM2.03 (GF) | Alarm Enable | | 0/3 | 0 | PTC Ground Fault | PTC: 0 = PTC Alarm Disabled; 1 = PTC Alarm Enabled GF: 0 = Ground Fault Alarm Disabled; 1 = Ground Fault Alarm Enabled | R/W |
| SM2.04 (GF) | Restart Enable | | 0/3 | 0 | PTC Ground Fault | PTC: 0 = does not restart after PTC Fault is cleared; 1 = restart after PTC Fault is cleared GF: 0 = does not restart after the Ground Fault is cleared; 1 = restart after the Ground Fault is cleared | R/W |
| SM2.05 (GF) | Turns Ratio | :1 | 100/2000 | 1000 | | Enables user to configure the turns ratio for the GFCT being used. | R/W |
| SM2.06 (GF) | Gnd Flt Level | Amps | 0/5 | 2.50 | | Enables the user to configure the level (value) of ground current (primary current of GFCT) that determines a ground fault condition. | R/W |
| SM2.07 (GF) | Gnd Flt Delay | Secs | 0.1/250 | 0.5 | | Sets the time limit that the ground fault level must be exceeded before signalling a fault. | R/W |
| SM2.08 (GF) | Gnd Flt A Level | Amps | 0/5 | 2.50 | | Sets the level of ground current that determines a ground fault alarm condition. | R/W |
| SM2.09 (GF) | Gnd Flt A Delay | Secs | 0.1/250 | 0.5 | | Sets the time limit that the ground fault level must be exceeded before signalling an alarm. | R/W |
| SM2.10 (GF) | Gnd Flt Inh Time | Secs | 0/250 | 10.00 | | User configurable time delay to inhibit ground fault after a start. | R/W |
| SM2.11 (GF) | Ground Current | Amps | 0/5 | 0.00 | | Measured ground current. | R/W |
| SM2.12 (GF) | CT Enable | | 0/1 | 0 | [Disable] Enable | Disable/Enable CT Function. | R/W |
| SM2.13 (GF) | CT Scaling A | | 0/5 | 0.01 | | Displayed result of the SMC-50 tuning feature determination of the scaling between external CT and the internal current measuring circuitry. | R |
| SM2.14 (GF) | CT Scaling B | | 0/5 | 0.01 | | Displayed result of the SMC-50 tuning feature determination of the scaling between external CT and the internal current measuring circuitry. | R |
| SM2.15 (GF) | CT Scaling C | | 0/5 | 0.01 | | Displayed result of the SMC-50 tuning feature determination of the scaling between external CT and the internal current measuring circuitry. | R |

Table 59 - 150-SM2 Option Card Parameters (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | Read/Write |
|----------------|----------------|------|------------|---------|----------------------------|--|------------|
| SM2.16 (GF) | Phase Shift A | Deg | -12.5/12.5 | 0 | | Displayed result of the SMC-50 tuning feature determination of the phase shift between external CT and the internal current measuring circuitry. | R |
| SM2.17 (GF) | Phase Shift B | Deg | -12.5/12.5 | 0 | | Displayed result of the SMC-50 tuning feature determination of the phase shift between external CT and the internal current measuring circuitry. | R |
| SM2.18 (GF) | Phase Shift C | Deg | -12.5/12.5 | 0 | | Displayed result of the SMC-50 tuning feature determination of the phase shift between external CT and the internal current measuring circuitry. | R |
| SM2.19 (GF) | Parameter Mgmt | | 0/1 | 0 | [Ready] Factory Default | Ready: Waiting for command to set defaults. Factory Default: Set all writable parameters to factory default values. | R/W |

Table 60 - 150-SM4 Parameters

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | Read/Write |
|-----------------|---------------|------|---------|---------|--|--|------------|
| SM4.01 (DIO) | Module Status | | 0/256 | 0 | Ready Input 1 Input 2 Input 3 Input 4 Aux 1 Aux 2 Aux 3 Bit 8-15 Spare | Displays information about the operational status of the 150-SM4 Digital I/O Option Module. Ready: Bit 0 = Ready; Bit Set = indicates the module is ready for operation. Input1: Bit 1 = Input 1; Bit Set (1) indicates the input is ON. Input2: Bit 2 = Input 2; Bit Set (1) indicates the input is ON. Input3: Bit 3 = Input 3; Bit Set (1) indicates the input is ON. Input4: Bit 4 = Input 4; Bit Set (1) indicates the input is ON. Aux1: Bit 5 = Aux 1; Bit Set (1) indicates the auxiliary relay output is ON. Aux2: Bit 6 = Aux 2; Bit Set (1) indicates the auxiliary relay output is ON. Aux3: Bit 7 = Aux 3; Bit Set (1) indicates the auxiliary relay output is ON. | R |
| SM4.02 (DIO) | Input 1 | | 0/13 | 1 | [Disable] Start Coast Stop Option Start/Coast Start/Stop Reserved Dual Ramp OL Select Fault Fault NC Clear Fault Emerg Run Reserved | Allows the user to select the operation of Input Terminal A1, Option Input 1 on the 150-SM4 Digital I/O Option Module. Disable: Disable the input - ignores any assertion to Input 1, Terminal A1. Start: Initiates a start as set up by the start parameters at Input 1, Terminal A1 (High). Coast: Initiates a coast stop.- no current to motor at Input 1, Terminal A1 (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 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 A1 (High). Emerg Run: Allow motor to run in emergency run mode if asserted from Input 1, Terminal A1 - does not start motor (High). | R/W |

Table 60 - 150-SM4 Parameters (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | Read/Write |
|-----------------|---------|------|---------|---------|--|---|------------|
| SM4.03 (DIO) | Input 2 | | 0/13 | 3 | [Disable] Start Coast Stop Option Start/Coast Start/Stop Reserved Dual Ramp OL Select Fault Fault NC Clear Fault Emerg Run Reserved | <p>Allows the user to select the operation of Input Terminal A2, Option Input 2 on the 150-SM4 Digital I/O Option Module.</p> <p>Disable: Disable the input - ignores any assertion to Input 1, Terminal A2.</p> <p>Start: Initiates a start as set up by the start parameters at Input 1, Terminal A2 (High).</p> <p>Coast: Initiates a coast stop.- no current to motor at Input 1, Terminal A2 (Low).</p> <p>Stop Option: Initiates a stop maneuver as set up by the stopping parameters at Input 1 (Low).</p> <p>[Start/Coast]: if Input 1 = 0 - Stops motor; 1- Initiates a start as set up by the start parameters</p> <p>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</p> <p>Dual Ramp: if Input 1 = 0 - Use starting mode 1; 1 - Use starting mode 2</p> <p>OL Select: if Input 1 = 0 - Use Motor Overload Class 1; 1 - Use Motor Overload Class 2</p> <p>Fault: A fault condition forced if Input 1= 1.</p> <p>Fault NC: A fault condition forced if Input 1 = 0.</p> <p>Clear Fault: Clear a fault from input 1 Terminal A2 (High).</p> <p>Emerg Run: Allow motor to run in emergency run mode if asserted from Input 1, Terminal A2 - does not start motor (High).</p> | R/W |
| SM4.04 (DIO) | Input 3 | | 0/13 | 2 | [Disable] Start Coast Stop Option Start/Coast Start/Stop Reserved Dual Ramp OL Select Fault Fault NC Clear Fault Emerg Run Reserved | <p>Allows the user to select the operation of Input Terminal A3, Option Input 3 on the 150-SM4 Digital I/O Option Module.</p> <p>Disable: Disable the input - ignores any assertion to Input 1, Terminal A3.</p> <p>Start: Initiates a start as set up by the start parameters at Input 1, Terminal A3 (High).</p> <p>Coast: Initiates a coast stop.- no current to motor at Input 1, Terminal A3 (Low).</p> <p>Stop Option: Initiates a stop maneuver as set up by the stopping parameters at Input 1 (Low).</p> <p>[Start/Coast]: if Input 1 = 0 - Stops motor; 1- Initiates a start as set up by the start parameters</p> <p>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</p> <p>Dual Ramp: if Input 1 = 0 - Use starting mode 1; 1 - Use starting mode 2</p> <p>OL Select: if Input 1 = 0 - Use Motor Overload Class 1; 1 - Use Motor Overload Class 2</p> <p>Fault: A fault condition forced if Input 1= 1.</p> <p>Fault NC: A fault condition forced if Input 1 = 0.</p> <p>Clear Fault: Clear a fault from input 1 Terminal A3 (High).</p> <p>Emerg Run: Allow motor to run in emergency run mode if asserted from Input 1, Terminal A3 - does not start motor (High).</p> | R/W |

Table 60 - 150-SM4 Parameters (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | Read/Write |
|-----------------|---------|------|---------|---------|--|---|------------|
| SM4.05 (DIO) | Input 4 | | 0/13 | 0 | [Disable] Start Coast Stop Option Start/Coast Start/Stop Reserved Dual Ramp OL Select Fault Fault NC Clear Fault Emerg Run Reserved | <p>Allows the user to select the operation of Input Terminal A4, Option Input 4 on the 150-SM4 Digital I/O Option Module.</p> <p>Disable: Disable the input - ignores any assertion to Input 1, Terminal A4.</p> <p>Start: Initiates a start as set up by the start parameters at Input 1, Terminal A4 (High).</p> <p>Coast: Initiates a coast stop.- no current to motor at Input 1, Terminal A4 (Low).</p> <p>Stop Option: Initiates a stop maneuver as set up by the stopping parameters at Input 1 (Low).</p> <p>[Start/Coast]: if Input 1 = 0 - Stops motor; 1- Initiates a start as set up by the start parameters</p> <p>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</p> <p>Dual Ramp: if Input 1 = 0 - Use starting mode 1; 1 - Use starting mode 2</p> <p>OL Select: if Input 1 = 0 - Use Motor Overload Class 1; 1 - Use Motor Overload Class 2</p> <p>Fault: A fault condition forced if Input 1= 1.</p> <p>Fault NC: A fault condition forced if Input 1 = 0.</p> <p>Clear Fault: Clear a fault from input 1 Terminal A4 (High).</p> <p>Emerg Run: Allow motor to run in emergency run mode if asserted from Input 1, Terminal A4 - does not start motor (High).</p> | R/W |

Table 60 - 150-SM4 Parameters (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | Read/Write |
|-----------------|----------------|------|---------|---------|--|---|------------|
| SM4.06 (DIO) | Aux1 Config | | 0/12 | 2 | [Normal] UTS Fault Alarm Ext Bypass Ext Brake DeviceLogix Aux Control Network 1 Network 2 Network 3 Network 4 | <p>Allows the user to configure the functionality of the Aux1 Relay Output on the 150-SM4 Digital I/O Option Module.</p> <p>[Normal]: Aux 1 closes when start command asserted and opens when motor stops [Default].</p> <p>UTS: Aux 1 closes when motor reaches up to speed and opens when motor is not at speed.</p> <p>Fault: Aux1 closes when the SMC-50 enters a fault state and opens when the fault is cleared.</p> <p>Alarm: Aux1 closes when the SMC-50 detects an alarm condition and opens when alarm is cleared.</p> <p>Ext Bypass: Aux1 closes when the SMC-50 enters the external bypass mode and opens when it leaves that mode.</p> <p>Ext Brake: Aux1 closes when Ext Braking command is active and opens when it is not active.</p> <p>DeviceLogix: Aux1 is controlled by DeviceLogix program.</p> <p>Aux Control: When an auxiliary is configured for Aux Control, a bit within the parameter Aux Control controls the state of that auxiliary.</p> <p>Network 1: With an auxiliary configured as Network 1, it is controlled over the Local Area Network (LAN) as Relay 1.</p> <p>Network 2: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 2.</p> <p>Network 3: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 3.</p> <p>Network 4: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 4.</p> | R/W |
| SM4.07 (DIO) | Aux1 Invert | | 0/1 | 0 | [Disable] Enable | <p>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.</p> <p>Disable: Aux1 Relay Output is not inverted (N.O.).</p> <p>Enable: Aux1 Relay Output is inverted (N.C.)</p> | R/W |
| SM4.08 (DIO) | Aux1 On Delay | Secs | 0/10 | 0.0 | | <p>A user-selected time delay in activating the Aux1 Relay Contact can be programmed.</p> <p>Note: when an aux relay is configured for External Bypass, that delay is not applied to the relay output.</p> | R/W |
| SM4.09 (DIO) | Aux1 Off Delay | Secs | 0/10 | 0.0 | | <p>A user-selected time delay in de-activating the Aux1 Relay Contact can be programmed.</p> <p>Note: when an aux relay is configured for External Bypass, that delay is not applied to the relay output.</p> | R/W |

Table 60 - 150-SM4 Parameters (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | Read/Write |
|-----------------|----------------|------|---------|---------|--|---|------------|
| SM4.10 (DIO) | Aux2 Config | | 0/11 | 0 | [Normal] UTS Fault Alarm Ext Bypass Ext Brake DeviceLogix Aux Control Network 1 Network 2 Network 3 Network 4 | <p>Allows the user to configure the functionality of the Aux2 Relay Output on the 150-SM4 Digital I/O Option Module.</p> <p>[Normal]: Aux 2 closes when start command asserted and opens when motor stops [Default].</p> <p>UTS: Aux 2 closes when motor reaches up to speed and opens when motor is not at speed.</p> <p>Fault: Aux2 closes when the SMC-50 enters a fault state and opens when the fault is cleared.</p> <p>Alarm: Aux2 closes when the SMC-50 detects an alarm condition and opens when alarm is cleared.</p> <p>Ext Bypass: Aux2 closes when the SMC-50 enters the external bypass mode and opens when it leaves that mode.</p> <p>Ext Brake: Aux2 closes when Ext Braking command is active and opens when it is not active.</p> <p>DeviceLogix: Aux2 is controlled by DeviceLogix program.</p> <p>Aux Control: When an auxiliary is configured for Aux Control, a bit within the parameter Aux Control controls the state of that auxiliary.</p> <p>Network 1: With an auxiliary configured as Network 1, it is controlled over the Local Area Network (LAN) as Relay 1.</p> <p>Network 2: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 2.</p> <p>Network 3: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 3.</p> <p>Network 4: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 4.</p> | R/W |
| SM4.11 (DIO) | Aux2 Invert | | 0/1 | 0 | [Disable] Enable | <p>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.</p> <p>Disable: Aux2 Relay Output is not inverted (N.O.).</p> <p>Enable: Aux2 Relay Output is inverted (N.C.)</p> | R/W |
| SM4.12 (DIO) | Aux2 On Delay | Secs | 0/10 | 0.0 | | <p>A user-selected time delay in activating the Aux2 Relay Contact can be programmed.</p> <p>Note: when an aux relay is configured for External Bypass, that delay is not applied to the relay output.</p> | R/W |
| SM4.13 (DIO) | Aux2 Off Delay | Secs | 0/10 | 0.0 | | <p>A user-selected time delay in de-activating the Aux2 Relay Contact can be programmed.</p> <p>Note: when an aux relay is configured for External Bypass, that delay is not applied to the relay output.</p> | R/W |

Table 60 - 150-SM4 Parameters (Continued)

| Number | Name | Unit | Min/Max | Default | Enum Text | Description | Read/Write |
|-----------------|----------------|------|---------|---------|--|---|------------|
| SM4.14 (DIO) | Aux3 Config | | 0/12 | 0 | [Normal] UTS Fault Alarm Ext Bypass Ext Brake DeviceLogix Aux Control Network 1 Network 2 Network 3 Network 4 | <p>Allows the user to configure the functionality of the Aux3 Relay Output on the 150-SM4 Digital I/O Option Module.</p> <p>[Normal]: Aux3 closes when start command asserted and opens when motor stops [Default].</p> <p>UTS: Aux3 closes when motor reaches up to speed and opens when motor is not at speed.</p> <p>Fault: Aux3 closes when the SMC-50 enters a fault state and opens when the fault is cleared.</p> <p>Alarm: Aux3 closes when the SMC-50 detects an alarm condition and opens when alarm is cleared.</p> <p>Ext Bypass: Aux3 closes when the SMC-50 enters the external bypass mode and opens when it leaves that mode.</p> <p>Ext Brake: Aux3 closes when Ext Braking command is active and opens when it is not active.</p> <p>DeviceLogix: Aux3 is controlled by DeviceLogix program.</p> <p>Aux Control: When an auxiliary is configured for Aux Control, a bit within the parameter Aux Control controls the state of that auxiliary.</p> <p>Network 1: With an auxiliary configured as Network 1, it is controlled over the Local Area Network (LAN) as Relay 1.</p> <p>Network 2: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 2.</p> <p>Network 3: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 3.</p> <p>Network 4: With an auxiliary configured as Network 2 it is controlled over the LAN as Relay 4.</p> | R/W |
| SM4.15 (DIO) | Aux3 Invert | | 0/1 | 0 | [Disable] Enable | <p>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.</p> <p>Disable: Aux3 Relay Output is not inverted (N.O.).</p> <p>Enable: Aux3 Relay Output is inverted (N.C.)</p> | R/W |
| SM4.16 (DIO) | Aux3 On Delay | Secs | 0/10 | 0.0 | | <p>A user-selected time delay in activating the Aux3 Relay Contact can be programmed.</p> <p>Note: when an aux relay is configured for External Bypass, that delay is not applied to the relay output.</p> | R/W |
| SM4.17 (DIO) | Aux3 Off Delay | Secs | 0/10 | 0.0 | | <p>A user-selected time delay in de-activating the Aux3 Relay Contact can be programmed.</p> <p>Note: when an aux relay is configured for External Bypass, that delay is not applied to the relay output.</p> | R/W |
| SM4.18 (DIO) | Parameter Mgmt | | 0/1 | 0 | [Ready] Factory Default | <p>Allows the user to set all 150-SM4 Digital I/O Option Module parameters to default values.</p> <p>Ready: Waiting for command to set defaults.</p> <p>Factory Default: Set all writable parameters to factory default values.</p> | R/W |

Notes:

Spare Parts

Table 61 - PowerBrick™ Replacements

| Part Number | Description | PowerBrick Current Rating | Match Designator | |
|----------------|---|---------------------------|------------------|----|
| 81020-230-51-R | Complete PowerBrick (excluding gate driver board) | 160 A | W | |
| 81020-752-51-R | | | IJ | |
| 81020-761-51-R | Complete Rollout Assembly 10...12 kV (with power bricks, gate driver boards, and CT loop) | | W | |
| 81020-295-51-R | Complete Rollout Assembly 12.4...14.4 kV (with PowerBricks, gate driver boards, and CT loop) | | W | |
| 81020-230-57-R | Complete PowerBrick replacement assembly (excluding gate driver board) | | 340 A | Y |
| 81020-230-58-R | | | | Z |
| 81020-761-57-R | Complete Rollout Assembly 10...12 kV (with power bricks, gate driver boards, and CT loop) | | | Y |
| 81020-295-57-R | Complete Rollout Assembly 12.4...14.4 kV (with power bricks, gate driver boards, and CT loop) | | | Y |
| 81020-752-85-R | Complete PowerBrick replacement assembly (excluding gate driver board) | 580 A | | DM |
| 81020-752-86-R | | | | DN |
| 81020-761-85-R | Complete Rollout Assembly 10...12 kV (with power bricks, gate driver boards, and CT loop) | | | DM |
| 81020-295-85-R | Complete Rollout Assembly 12.4...14.4 kV (with power bricks, gate driver boards, and CT loop) | | | DM |

IMPORTANT Since there are devices in series, matching is required. All PowerBricks on a cart assembly must have the same match designator.

Table 62 - Common Parts

| Part Number | Description | Quantity |
|----------------|--|---------------------------|
| PN-281287 | Control Module (Standard) | 1 |
| PN-71481 | SMC-50 Digital I/O Module | 1 |
| 80190-520-02-R | Current loop self-powered gate driver board (CLGD) | 1 per SCR |
| 81020-237-52-R | Voltage Sensing Board (VSB) | 10...12 kV |
| 81020-237-53-R | | 12.1...15 kV |
| PN-545832 | Interface board, 160 A, 10...15 kV | 1 |
| PN-545833 | Interface board, 340 A, 10...15 kV | 1 |
| PN-545835 | Interface board, 580 A, 10...15 kV | 1 |
| PN-552840 | Fiber Optic Board | 1 per controller |
| 80026-762-51-R | Fiber Optic Cable Kit | 1 per power pole |
| 81023-213-09-R | Fiber Optic Cable Kit (Low Voltage Panel) | 1 per controller |
| 80187-051-51-R | Test Power Supply | 120V AC for North America |
| 80187-245-51-R | | Universal |
| 80022-133-02-R | Current loop power transformer | 100VA, 115/230:1.5V |
| 80018-246-57-R | Current loop cable | 9.6 m (15 ft) |
| 81023-036-61-R | Current loop mounting bracket assembly (includes hardware) | 1 per Powerbrick + 6 |
| 81023-213-01-R | Current loop flange | 1 per SCR + 6 |
| 81023-095-51-R | Current loop current transformer | 1 per SCR |
| 80022-163-01-R | Current loop sense CT | 1 per controller |
| 80026-146-56-R | Ribbon cable from VSB to interface board | 1 per controller |
| 80174-201-01-R | Ribbon cable from control module to Interface board | 6-pin |
| 80174-201-02-R | | 8-pin |

Table 63 - Accessories

| Part Number | Description | Quantity |
|--------------|---------------------------------|----------|
| 350325-A06 | HIM (Bezel-mounted) | 1 |
| PN-71480 | SMC-50 Ground Fault, PTC Module | 1 |
| 80144-491-02 | Fuse Extractor | |

7703E – For OEM products, refer to OEM-supplied documentation for specific spare parts list.

Accessories

Table 64 - Accessories

| Catalog Number | Description | Description/Used With |
|----------------|-----------------------|---|
| 20-HIM-C3 | HIM | Remote Door Mounted P66 (Type 4/12) Programmer Only |
| 20-COMM-R | Communication Modules | Remote I/O |
| 20-COMM-S | | RS 485 (DF-1) |
| 20-COMM-D | | DeviceNet |
| 20-COMM-C | | ControlNet |
| 20-COMM-E | | EtherNet/IP |
| 20-COMM-P | | Profibus® |
| 20-COMM-I | | InterBus |
| 20-COMM-L | | LonWorks |
| 20-COMM-Q | | ControlNet (Fiber) |
| 20-COMM-H | | RS485 HVAC |

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| Local Technical Support Phone Numbers | Locate the phone number for your country. | http://www.rockwellautomation.com/global/support/get-support-now.page |
| Direct Dial Codes | Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer. | http://www.rockwellautomation.com/global/support/direct-dial.page |
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