

SMC[™]-50 Fully Solid-State Smart Motor Controller

Bulletin 150











Troubleshooting

Introduction

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



SHOCK HAZARD: Hazardous voltage is present in the motor circuit even when the SMC-50 is off. To avoid shock hazard, disconnect main power **before** working on the controller, motor, and control devices (e.g., Start-Stop push buttons). Procedures that require parts of the equipment to be energized during troubleshooting, testing, etc., **must** be performed by properly qualified personne using appropriate local safety work practices and precautionary measures.



ATTENTION: Disconnect the controller from the motor **before** measuring insulation resistance (IR) of the motor windings. Voltages used for insulation resistance testing can cause SCR failure. **Do not** make any measurements on the controller with an IR tester (megger).

The following flowchart is provided to aid in quick troubleshooting.

NOTE: The time it takes for the motor to come up to speed may be more or less than the time programmed. This depends upon the motor and load characteristics.

NOTE: Depending upon the application, the braking options (SMB Smart Motor Braking and Slow Speed) may cause some vibration or noise during the stopping cycle. To minimize vibration or noise, lower the braking current adjustment. If this is a concern in your application, please consult the factory before implementing the braking options.





Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
Line Loss (with phase indication)	1, 2, 3	Prestart & Running	 High impedance line connection Missing supply phase Motor not connected properly Incoming 3-phase voltage instability 	 Check for line and load loose connections. Check for open line (e.g., blown fuse). Check for open line lead(s). Verify power quality. Disable this fault/alarm feature.
Shorted SCR (with phase Indication)	4, 5, 6	In All Modes	Shorted power module.	• Check for shorted SCR, perform a resistance check (refer to Power Module Check section), or replace power module if necessary.
Open Gate (with phase indication)	7, 8, 9	Start or Stop	 Open gate circuitry Loose gate lead 	 Perform a resistance check (refer to Power Module Check section), replace power module if necessary. Remove control module from the power section and check gate lead connections (TB5, TB6, and TB 7) are firmly seated to the control module. Disable this fault/alarm feature.
SCR Overtemp or PTC Power Pole	10 or 60	In All Modes	 Controller ventilation blocked Controller duty cycle exceeded Fan failure Ambient temperature limit exceeded Failed thermistor 	 Check for proper controller ventilation. Check application-appropriate duty cycle. Wait for controller to cool or provide external cooling if ambient temperature is high. Check for fan operation. Replace fan, if necessary. Replace power module or control module as needed.
No Load or Open Load (with Phase Indication)	14, 15, 16, 17	Prestart Only	 Loss of load side power wiring with phase indication (15=A, 17=C) Start command cycled unexpectedly with motor rotating 	Check all load side power connections.Check motor windings (megger).
Voltage Unbalance or Current Imbalance	18 or 42	Running	 Power line unbalance is greater than the programmed value The delay time programmed is too short for the application 	 Check the power system and correct if necessary or change the programmed value. Extend the delay time to match the application requirements. Disable this fault/alarm feature.

Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
Overvoltage	19	Running	 Power line grid voltage is greater than the programmed value Abnormal voltage regulation The parameter settings &/or delay time programmed are not suited for the application 	 Check the power system and correct if necessary. NOTE: If the power source is a backup generator, check the stability of the generator voltage regulator. Replace if necessary. Modify the parameter &/or extend the delay time to match the application requirements. Disable this fault/alarm feature.
Undervoltage	20	Running	 Power line grid voltage is less than the programmed value Abnormal voltage regulation The parameter settings & or delay time programmed are not suited for the application 	 Check the power system and correct if necessary. NOTE: If the power source is a backup generator, check the stability of the generator voltage regulator. Replace if necessary. Modify the parameter &/or extend the delay time to match the application requirements. Disable this fault/alarm feature.
Overload	21	Running	 Motor overloaded Overload parameters are not matched to the motor 	 Check motor overload condition. Check programmed values for overload class and motor FLC; verify current draw of the motor. Disable this fault/alarm feature.
Underload	22	Running	 Broken motor shaft, belt, greating, etc. Pump cavitation Programmed setting incorrect for application 	 Check machine drive components and loading. Check pump system. Repair or replace motor. Check programmed settings. Disable this fault/alarm feature.
Jam	23	Running	 Motor current has exceeded the user programmed jam level for the programmed time 	 Correct source of jam or excessive loading. Check programmed time value. Disable this fault/alarm feature.
Stall	24	Running	 The motor did not reach full speed by the end of the programmed ramp time Incorrect programmed setting 	 Check pump system, machine drive components, and loading; repair or replace motor, if necessary. Check programmed settings. Disable this fault/alarm feature.
Phase Reversal	25	Prestart Only	The controller is not detecting incoming supply voltage in the expected ABC sequence	 Check power wiring and correct, if necessary. Disable this fault/alarm feature.
Exp Removed	x026 ①	In All Modes	 Expansion module is loose or removed Expansion module is defective 	Reseat or replace the expansion module connector to the control module and tighten module screws.Replace defective module.
Exp Incompat	x027 ①	In All Modes	 Expansion module is inserted into an incompatible control module port number Controller firmware is not compatible with the expansion module Expansion module is defective 	 Insert the expansion module into a compatible contorl module port. Update the control module firmware Replace defective module.
Expansion	x028 ①	In All Modes	 Expansion module is loose or removed Expansion module is defective Expansion module is inserted into an incompatible control module port number Controller firmware is not compatible with the expansion module 	 Reseat and/or replace loose/removed module and tighten module screws. Replace defective expansion module. Update control module firmware.
Starts per Hour	29	Starting	 The number of starts within the last hour has exceeded the programmed value Programmed setting is incorrect for the application 	 Wait for the hour to expire, then restart the motor. Reduce the actual number of starts per hour or increase the programmed start time (if allowed by the application) and controller thermal limits. Turn off this fault/alarm feature.

Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
CT Loss A, B, or C	30, 31, or 32	In All Modes	 Loose CT cable connection between the power section and the control module Phase A (F30), B (F31), or C (F32) current transformer feedback circuit has failed Option Module 150-SM2 with external CT operation (Fault Code 7030, 8030) 	 Remove the control module from the power section; verify connectors TB2 (A), TB3 (B), and TB4 (C) are firmly seated to the control module. Replace the control module and/or the power section. Inspect the CT sensor cables for loose connections; check CTs for damage; repair/replace CTs if necessary; replace 150-SM2 option module if necessary.
Hall ID	33	In All Modes	 Loose cables betweeen the controller and power section. Incompatible power section installed with the controller 	 Remove the control module from the power section; verify connectors TB2 (A), TB3 (B), and TB4 (C) are firmly seated to the control module. Check the power section and replace, if necessary.
NVS Error	34	In All Modes	 Controller memory corrupted Option module error (Fault Code 7034, 8034, or 9034) 	 Modify a parameter or load parameter defaults (preferred) and reload the customer-specific parameters. Check the option module sensor cables. Replace the option module.
Future Use	35	NA	NA	NA
V24 Loss	36	In All Modes	 Loose connection at Control Terminals 1 (+L1) and 2 (-L2) Excessive load on internal 24V supply Low line voltage condition 	 Check the control power and verify it is within the specification; check the line connections and grounding to the SMC-50 control terminals. Replace the control module.
V Control Loss	37	In All Modes	 Loose connection at Control Terminals 1 (+L1) and 2 (-L2) Low line voltage condition 	 Check the control power and verify it is within the specification; check the connections and grounding to the SMC-50 control terminals. Replace the control module.
TB Input 1, 2, 3 & 4	38, 39, 40, & 41	In All Modes	 The condition to generate the TB Input fault is satisfied Terminal wiring configuration or fault N.O./N.C. configuration of input is incorrect 	 Clear the fault condition. Rewire and/or reconfigure the input.
Und Pwr Real 2	43	Running	 Abnormally reduced real (MW) power draw by the motor possibly due to broken mechanical connection (belt, gears, etc.) between motor and load Pump cavitation Programmed setting is incorrect for the application 	 Repair/replace the condition causing the reduced real power load. Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
Ovr Pwr Real 🛛	44	Running	 Abnormally high real (KW) power draw by the motor Programmed setting is incorrect for the application 	 Repair/replace the condition causing the high KW power draw. Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
Un Pwr Reac+ 🕑	45	Running	 Abnormally reduced reactive (+MVAR) power produced by the motor Programmed setting is incorrect for the application 	 Repair/replace the condition causing the reduced +MVAR power draw. Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
Ov Pwr Reac+ 2	46	Running	 Abnormally high reactive (+MVAR) power produced by the motor Programmed settings are incorrect for the application 	 Repair/replace the condition causing the high +MVAR power draw. Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.

Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
Und Pwr App 🛛	47	Running	 Abnormally reduced apparent (MVA) power draw by the motor Programmed settings are incorrect for the application 	 Repair/replace the condition causing the reduced +MVA power draw. Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
Ovr Pwr App 🕑	48	Running	 Abnormally high apparent (MVA) power draw by the motor Programmed settings are incorrect for the application 	 Repair/replace the condition causing the high +MVA power draw. Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
Frequency	49	Running	 Speed control regulation system of the generator prime mover (e.g., diesel engine) is unable to adjust to current load conditions or is defective Abnormal power grid connections; power generation source is operating outside its normal frequency limits or range 	 Reduce the generator load, increase grenerator output, replace the speed control system, or generator. NOTE: For a diesel generator system, Rockwell Automation recommends it be oversized by a factor of three for Soft Start applications. Contact the power company for additional information. Modify the programmed fault/alarm parameters to better suit the application.
PM Hours	50	In All Modes	The number of hours programmed in the PM Hours Parameter has been reached	 Perform required maintenance and reset the PM Hours parameter. Disable this fault/alarm feature.
PM Starts	51	Pre-Start	The number of Starts programmed in the PM Start Parameter has been reached	 Perform required maintenance and reset the PM Hours parameter. Disable this fault/alarm feature.
Power Quality A, B, or C	52, 53, or 54	Start or Stop	 Incoming 3-phase voltage instability or distortion High impedence line or load connection 	 Check supply voltage for capability to start/stop the motor; check for loose connections on the line side or motor side of the power wires. Verify and correct the input power quality issue Disable this fault/alarm feature.
Power Quality THD V	55	Running	 The current mix of loads on the power line contributing to the THD V has exceeded the programmed THD V level &/or time 	 Check the mix of loads (what was added, what was changed); modify the load mix if necessary. Change the programmed THD V level &/or delay time. Disable this fault/alarm feature.
Power Quality THD I	56	Running	 The current mix of loads on the power line contributing to the THD I has exceeded the programmed THD I level &/or time 	 Check the mix of loads (what was added, what was changed); modify the load mix if necessary. Change the programmed THD I level &/or delay time. Disable this fault/alarm feature.
Config Change	57	In All Modes	A controller parameter has been modified	Disable this fault/alarm feature.
Ground Fault	X058 ①	Running	 The ground fault current level has exceeded the programmed value The delay time is too short for the application NOTE: An optional 150-SM2 Ground Fault PTC Module is required for this fault. 	 Check the power system and motor; correct if necessary. Check the programmed ground fault levels to match application requirements; modify if necessary. Extend the delay time to match the application requirements. Disable this fault/alarm feature.
Motor PTC	X059 O	In All Modes	 Motor ventilation is blocked. Motor duty cycle is exceeded PTC open or shorted NOTE: An optional 150-SM2 Ground Fault PTC Module is required for this fault. 	 Check for proper ventilation. Check application duty cycle. Wait for motor to cool or provide external cooling, then check resistance of PTC. Disable this fault/alarm feature.

Table 110	- Fault	Display	Explanation
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Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
I/O Config	61	Pre-Start	• The configuration of the control I/O does not meet the system rules as defined in Chapter 4, Configuration Functions on page 120	 Modify the control I/O configuration to meet the established rules.
Test Fault	62	In All Modes	 The SMC-50's Push to Reset/Hold to Test push button was pressed for more than three seconds, but less than ten The SMC-50's Push to Reset/Hold to Test push button is stuck or damaged 	 To reset the Test fault, press the Push to Reset/Hold to Test push button for less than two seconds. NOTE: Only use the Push to Reset push button when absolutely necessary. Attempt to dislodge the push button or replace the control module if necessary.
Und PF Lag	63	In All Modes	 A lagging PF is abnormally under the typical value; less inductance or more capacitance has been introduced to the power line A programmed setting or time value is incorrect for the application 	 Determine the cause of the reduced Lagging PF. Modify the porgrammed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
Und PF Lead	64	Running	 A leading PF is abnormally under the typical value; less inductance or more capacitance has been introduced to the power line A programmed setting or time value is incorrect for the application 	 Determine the cause of the reduced Leading PF Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
Ovr PF Lag	65	Running	 A lagging PF is abnormally over the typical value; more inductance or less capacitance has been introduced to the power line A programmed setting or time value is incorrect for the application 	 Determine the cause of the Over PF Lagging Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
Ovr PF Lead	66	Running	 A leading PF is abnormally under the typical value; less inductance or more capacitance has been introduced to the power line A programmed setting or time value is incorrect for the application 	 Determine the cause of the Over PF Leading. Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
-MVAR Over 🛛	67	Running	 Abnormally high reactive (-MVAR) power consumed by the motor Programmed settings are incorrect for the application 	 Repair/replace the condition causing the high -MVAR. Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
-MVAR Under 🕑	68	Running	 Abnormally reduced reactive (-MVAR) power consumed by the motor Programmed settings are incorrect for the application 	 Repair/replace the condition causing the reduced -MVAR. Modify the programmed fault/alarm parameters to better suit the application. Disable the fault/alarm feature.
RTC Battery Low	69	Pre-Start	 Battery reading is below the acceptable level to potentially maintain the real time clock and calendar 	• Replace battery (CR2032) as soon as possible.
Locked Rotor	70	In All Modes	Motor has stalled; rotor is not turning	 Check motor and load for binding or jammed conditions Parameters are not adequately configured for the application. Review and adjust. Disable the fault/alarm feature.
Start	71	Starting	• A start event (command) has occurred. This is not a fault.	• NA
Slow Speed	72	Slow Speed	• A slow speed event (command) has occurred. This is not a fault.	• NA

Display	Fault Code	Fault Enabled	Possible Causes	Possible Solutions
Stop Option	73	Stop Option	• A stop option event (command) has occurred. This is not a fault.	• NA
Coast	74	Coast	• A coast-to-stop event (command) has occurred. This is not a fault.	• NA
Clear Fault	75	Faulted	 A clear fault event (command) has occured. This does not generate a fault. 	• NA
Fault	76	Faulted	• A fault event (command) has occured. This is not a fault.	• NA
Param Change	77	Stopped	 A change to one of the controller parameters has occured. This is not a fault. 	• NA
Reserved	78-99	NA	NA	NA
System Faults	100-199	In All Modes	 There is an issue with the control module wiring The control module is defective 	 Review the control module wiring. Ensure the ground terminal is secure and connected to the system's earth ground. Ensure an RC snubber/suppressor is connected to all inductive loads in the control circuit. Refer to input wiring. Replace the control module.

• "X" indicates a port number in which the expansion module resides in the SMC-50.

The Real, Reactive, and Apparent Power faults/alarms are best suited to provide indication of an abnormal running operation of the motor or system which another parameter (e.g., Underload, Overload, Jam, Stall, etc.) does not provide. To understand what is an abnormal running operation, a "normal" or "typical" value, usually established during system startup, needs to be determined by the user.

If controller based motor overload is disabled, external motor overload protection should be used.

Display	Possible Cause	Possible Solutions
Fault displayed	See fault description	See Table 110 addressing fault conditions
HIM display is blank	 Failed HIM Control voltage is absent Failed control module HIM connection is loose 	 Replace HIM Check control wiring and correct if necessary Replace control module Cycle control power Check HIM connection
Stopped 0.0 Amps	 Pilot devices SMC Enable input is open at terminal 9 Configured or wired input terminals are not wired correctly Start-Stop control has not been enabled for the human interface module Control voltage Failed control module 	 Check wiring Check wiring; follow the instructions on page 193 to enable control capability. Check control voltage Replace control module
Starting	 One or more power phases are missing Isolation contactor (if used) is not picking up 	 Check power system Check that the SMC-50 Aux. relay output controlling the Isolation Contactor is configured to "Normal". Check the Isolation Contactor for proper operation

Table 111 - Motor Will Not Start — No Output Voltage to the Motor

Table 112 - Motor Rotates but Does Not Accelerate to Full Speed

Display	Possible Cause	Possible Solutions
Fault displayed	See fault description	See Table 110 addressing fault conditions
Starting	 Mechanical problems Inadequate Current Limit setting Failed control module 	 Check for binding or external loading and correct Check motor Adjust the Current Limit Level to a higher setting Replace control module

Display	Possible Cause	Possible Solutions
Fault displayed	See fault description	See addressing fault conditions
HIM display is blank	 Failed HIM Control voltage is absent Failed control module HIM connection is loose 	 Replace HIM Check control wiring and correct if necessary Replace control module Check HIM connection
Stopped 0.0 Amps	Pilot devicesFailed control module	Check control wiring and correct if necessaryReplace control module
Starting	 One or more power phases are missing Failed control module 	Check power systemReplace control module

Table 113 - Motor Stops While Running

Situation	Possible Cause	Possible Solutions
Motor current and voltage fluctuates	 Motor Erratic Load 	 Verify type of motor as a standard squirrel cage induction motor Check load conditions
Erratic operation	Loose connections	Shut off all power to controller and check for loose connections
Accelerates too fast	 Starting time Initial torque Current limit setting Kickstart 	 Increase starting time Lower initial torque setting Decrease current limit setting Lower kickstart time or turn off
Accelerates too slow	 Starting time Initial torque Current limit setting Kickstart 	 Decrease starting time Increase initial torque setting Increase current limit setting Increase kickstart time or turn off
Fan does not operate O	Control wiringFailed fan(s)	Check control wiring and correct if necessaryReplace fan module
Motor stops too quickly with Soft Stop option	Time setting	 Verify the programmed stopping time and correct if necessary
Motor stops too slowly with Soft Stop option	 Stopping time setting Misapplication 	 Verify the programmed stopping time and correct if necessary The Soft Stop option is intended to extend the stopping time for loads that stop suddenly when power is removed from the motor.
Fluid surges with pumps still occur with the Soft Stop option	Misapplication	• Soft Stop ramps voltage down over a set period of time. In the case of pumps, the voltage may drop too rapidly to prevent surges. A closed loop system such as Pump Control would be more appropriately suited.
Motor overheats	Duty cycle	 Preset Slow Speed and SMB options: Extended operation at slow speeds reduces motor cooling efficiency. Consult motor manufacturer for motor limitations. Smart Motor Braking option: Check duty cycle. Consult motor manufacturer for motor limitations.
Motor short circuit	Winding fault	 Identify fault and correct. Check for shorted SCR; replace if necessary. Ensure power terminals are secure.
Fan operation is controll	ad by the SMC-50 Control Module. T	he fan may not run in low amhient temperatire conditions. Refer

Table	114 -	Miscel	laneous	Situations
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• Fan operation is controlled by the SMC-50 Control Module. The fan may not run in low ambient temperatire conditions. Refe to Chapter 2, Fan Power on page 28 for additional details.

Power Module Check

If a power module needs to be checked, use the applicable procedure that follows.





ATTENTION: Make sure that wires are properly marked and programmed parameter values are recorded.

Shorted SCR Test

1. Using an ohm meter, measure the resistance between the line and load terminals of each phase on the controller. (L1-T1, L2-T2, & L3-T3)

The resistance should be greater than 5,000 ohms. Replace the power assembly if this reading is not reached. Refer to Appendix C for the list of Spare/Replacement SMC-50 parts.