



AC SMARTMOTION CONTROLLERS
for Standalone And TAU Net Systems

FAULT LIST

and

TROUBLESHOOTING

(Rev. 2.0: December 2013)



SME S.p.A.
Via della Tecnica, n° 40
36071 Arzignano (VI) - ITALY
Phone: +39 (0444) 470511
Fax: +39 (0444) 451803
E-mail: info@grupposme.com
www.grupposme.com

Table Of Contents

1. Fault Levels	3
2. Fault List.....	4
Appendix A: Document history	9

1. Fault Levels

PRIORITY	LEVEL	ACTIONS
1 (HIGHEST)	Blocking	Main contactor opened Motors disabled Outputs disabled.
2	Stopping	Main contactor closed Motors stopped Outputs enabled.
3	Limiting	Main contactor closed Motors limited Outputs enabled.
4 (LOWEST)	Warning	Main contactor closed Motors enabled Outputs enabled.

2. Fault List

Code	Level	Fault	Possible Causes	Set Condition	Clear Condition
1	1	Over Voltage	<ul style="list-style-type: none"> Battery resistance too high while regenerating. Battery disconnected while regenerating. 	Key-switch voltage or capacitors voltage is above the maximum level allowed for the controller.	Bring key-switch voltage below over-voltage limit and then cycle key switch.
2	1	Under Voltage	<ul style="list-style-type: none"> Battery seriously damaged or exhausted. Battery resistance too high. Battery disconnected while driving. Blown key-switch fuse. External load drains power from battery. 	Key-switch voltage is below the minimum level allowed for the controller.	Bring key-switch voltage above under-voltage limit and then cycle key switch.
3	1	User Over Voltage	<ul style="list-style-type: none"> Battery resistance too high while regenerating. Battery disconnected while regenerating. Too low voltage level defined by the user 	Key-switch voltage is above the maximum level defined by the user.	Bring key-switch voltage below user over voltage limit and then cycle key switch.
4	1	User Under Voltage	<ul style="list-style-type: none"> Battery serious damaged or exhausted. Battery resistance too high. Battery disconnected while driving. Blown key-switch fuse. External load drains power from battery. Too high voltage level defined by the user. 	Key-switch voltage is below the minimum level defined by the user.	Bring key-switch voltage above user under voltage limit and then cycle key switch.
5	1	Inverter 1 Over Current	<ul style="list-style-type: none"> External or internal short-circuit between U1, V1 or W1 AC motor's phases. Incorrect motor 1 parameter/s. Inverter 1 power module damaged. 	Inverter 1 phase current exceeded its current limit.	Cycle key switch.
6	1	Inverter 2 Over Current	<ul style="list-style-type: none"> External or internal short-circuit between U2, V2 or W2 AC motor's phases. Incorrect motor2 parameter/s. Inverter 2 power module damaged. 	Inverter 2 phase current exceeded its current limit.	Cycle key switch.
7	-	-	-	-	-
8	2	Inverter 1 Over Temperature	<ul style="list-style-type: none"> Operation in high temp environment. Operation with high load. Wrong mounting of the controller heat sink. Wrong working of controller cooling system. 	Inverter 1 power module temperature above +100°C.	Bring power module temperature of inverter1 below 100°C and cycle key switch.
9	2	Inverter 2 Over Temperature	<ul style="list-style-type: none"> Operation in high temp environment. Operation with high load. Wrong mounting of the controller heat sink. Wrong working of controller cooling system. 	Inverter 2 power module temperature above +100°C.	Bring power module temperature of inverter2 below 100°C and cycle key switch.
10	3	Inverter 1 High Temperature	<ul style="list-style-type: none"> Operation in high temp environment. Operation with high load. Wrong mounting of the controller heat sink. Wrong working of controller cooling system. 	Inverter 1 power module temperature above +80°C.	Bring power module temperature of inverter1 below 80°C.
11	3	Inverter 2 High Temperature	<ul style="list-style-type: none"> Operation in high temp environment. Operation with high load. Wrong mounting of the controller heat sink. Wrong working of controller cooling system. 	Inverter 2 power module temperature above +80°C.	Bring power module temperature of inverter2 below 80°C.
12	2	Inverter 1 Under Temperature	<ul style="list-style-type: none"> Operation in low temp environment. 	Inverter 1 power module temperature below -40°C.	Bring inverter 1 power module temperature above -40°C and cycle key switch.
13	2	Inverter 2 Under Temperature	<ul style="list-style-type: none"> Operation in low temp environment. 	Inverter 2 power module temperature below -40°C.	Bring inverter 2 power module temperature above -40°C and cycle key switch.
14	1	Inverter 1 Current Sensor Fault	<ul style="list-style-type: none"> Leakage current due to motor 1 stator short-circuit. Controller's sensor faulty. 	Current sensor of inverter 1 has an invalid offset reading at key on.	Cycle key switch.
15	1	Inverter 2 Current Sensor Fault	<ul style="list-style-type: none"> Leakage current due to motor 2 stator short. Controller's sensor faulty. 	Current sensors of inverter 2 have an invalid offset reading at key on.	Cycle key switch.
16	-	-	-	-	-
17	2	Inverter 1 Temp Sensor Fault	<ul style="list-style-type: none"> Inverter 1 internal temperature sensor not connected or shorted. 	Difference between inverter 1 and microprocessor temp greater than 70 °C.	Cycle key switch.

18	2	Inverter 2 Temp Sensor Fault	<ul style="list-style-type: none"> ▪ Inverter 2 internal temperature sensor not connected or shorted. 	Difference between inverter 2 and microprocessor temp greater than 70 °C.	Cycle key switch.
19	2	Motor 1 Over Temperature	<ul style="list-style-type: none"> ▪ Motor 1 temperature is too high. ▪ Wrong Motor 1 thermal probe type or input. ▪ Motor 1 thermal probe not connected or shorted input. 	Motor 1 temperature is above the motor over temperature parameter setting.	Bring motor 1 temperature below over temperature limit and cycle the key switch.
20	2	Motor 2 Over Temperature	<ul style="list-style-type: none"> ▪ Motor 2 temperature is too high. ▪ Wrong Motor 2 thermal probe type or input. ▪ Motor 2 thermal probe not connected or shorted input. 	Motor 2 temperature is above the motor over temperature parameter setting.	Bring motor 2 temperature below over temperature limit and cycle the key switch.
21	3	Motor 1 High Temperature	<ul style="list-style-type: none"> ▪ Motor 1 temperature is too high. ▪ Wrong Motor 1 thermal probe type or input. ▪ Motor 1 thermal probe not connected or shorted input. 	Motor 1 temperature is above the motor start cutback temperature parameter setting.	Bring motor 1 temperature below start cutback temperature and cycle the key switch.
22	3	Motor 2 High Temperature	<ul style="list-style-type: none"> ▪ Motor 2 temperature is too high. ▪ Wrong Motor 2 thermal probe type or input. ▪ Motor 2 thermal probe not connected or shorted input. 	Motor 2 temperature is above the motor start cutback temperature parameter setting.	Bring motor 2 temperature below start cutback temperature and cycle the key switch.
23	-	-	-	-	-
24	-	-	-	-	-
25	-	-	-	-	-
26	-	-	-	-	-
27	2	Microprocessor Over Temperature	<ul style="list-style-type: none"> ▪ Microprocessor faulty. ▪ Microprocessor temperature sensor faulty. 	Microprocessor temperature is above 125°C.	Cycle key switch.
28	1	+5V Supply Failure	<ul style="list-style-type: none"> ▪ External load impedance on +5V output is too low. 	+5V supply is outside the +5V± 10% range.	Remove all external load, bring +5V supply inside range and cycle the key switch.
29	1	+12V Supply Failure	<ul style="list-style-type: none"> ▪ External load impedance on +12V output is too low. 	+12V supply is outside the +12V ±10% range.	Remove all external load, bring +12V supply inside and cycle the key switch.
30	1	Encoder 1 Fault	<ul style="list-style-type: none"> ▪ Motor 1 encoder failure. ▪ Motor 1 encoder faulty wirings. ▪ Motor 1 speed changes too quickly. ▪ Electromagnetic noise on the Motor 1 sensor bearing. 	The difference of speed evaluated between two consecutive readings of the encoder is above the fixed limit	Cycle key switch.
31	1	Encoder 2 Fault	<ul style="list-style-type: none"> ▪ Motor 2 encoder failure. ▪ Motor 2 encoder faulty wirings. ▪ Motor 2 speed change very fast. ▪ Electromagnetic noise on the Motor 2 sensor bearing. 	The difference of speed evaluated between two consecutive readings of the encoder is above the fixed limit.	Cycle key switch.
32	1	Driver Output 1 Open/Short	<ul style="list-style-type: none"> ▪ Open or short-circuit of driver output 1 load. ▪ Driver output 1 damaged. 	Driver output 1 is either opened or shorted.	Correct open or short in driver output 1 load and cycle key switch. If fault condition is present without load connected replace the controller.
33	1	Driver Output 2 Open/Short	<ul style="list-style-type: none"> ▪ Open or short-circuit of driver output 2 load. ▪ Driver output 2 damaged. 	Driver output 2 is either opened or shorted.	Correct open or short in driver output 2 load and cycle key switch. If fault condition is present without load connected replace the controller.
34	1	Driver Output 3 Open/Short	<ul style="list-style-type: none"> ▪ Open or short-circuit of driver output 3 load. ▪ Driver output 3 damaged. 	Driver output 3 is either opened or shorted.	Correct open or short in driver output 3 load and cycle key switch. If fault condition is present without load connected replace the controller.

35	1	Digital Output 1 Open/Short	<ul style="list-style-type: none"> Open or short-circuit of digital output 1 load. Digital output 1 damaged. 	Digital output 1 is either opened or shorted.	Correct open or short in digital output 1 load and cycle key switch. If fault condition is present without load connected replace the controller.
36	1	Digital Output 2 Open/Short	<ul style="list-style-type: none"> Open or short-circuit of digital output 2 load. Digital output 2 damaged. 	Digital output 2 is either opened or shorted.	Correct open or short in digital output 2 load and cycle key switch. If fault condition is present without load connected replace the controller.
37	1	EEPROM Failure	<ul style="list-style-type: none"> Failure to read/write EEPROM memory. 	Error during read/write operation in EEPROM memory.	Cycle key switch.
38	1	EEPROM Corrupted	<ul style="list-style-type: none"> Wrong firmware version or parameters. 	Memory CRC doesn't match.	Download correct firmware or restore default parameters.
39	-	-	-	-	-
40	1	Precharge Circuit Fault	<ul style="list-style-type: none"> Pre-charge circuit faulty. Short on capacitors between +B and -B Power module short-circuit. 	Pre-charge is too fast or capacitors voltage is fixed to zero during precharge.	Cycle key switch.
41	1	Precharge Failed	<ul style="list-style-type: none"> External load on capacitors. Pre-charge circuit faulty. 	Pre-charge phase fails to charge capacitors till the key switch voltage.	Cycle key switch.
42	1	Main Contactor Welded	<ul style="list-style-type: none"> Line contactor contacts are welded closed. Motor phases are not connected. An external wiring is providing voltage to capacitors. 	Before closing main contactor capacitors are loaded for a short time and voltage don't discharge.	Cycle key switch.
43	1	Main Contactor Did Not Close	<ul style="list-style-type: none"> Main contactor did not close after contactor's coil has been powered Main contactor coils are not connected. +B fuse is blown. 	The difference between key switch and capacitors voltage id too high after the contactor has been powered.	Cycle key switch.
44	2	Interlock Disabled	<ul style="list-style-type: none"> Interlock input is not active. 	Interlock input is not active and line contactor is open.	Activate interlock input.
45	4	Static Return To Off Traction	<ul style="list-style-type: none"> Traction throttle or direction selector are active at key on, after the Emergency Reverse or a controlled stop procedure. 	One or more traction inputs are active at key on, after an EMR or a controlled stop procedure.	De-select all traction inputs.
46	4	Static Return To Off Hydraulic	<ul style="list-style-type: none"> Hydraulic throttle or Auxiliary input are active at key on or after a controlled stop procedure. 	One or more hydraulic inputs are active at key on or after a controlled stop procedure.	De-select all hydraulic inputs.
47	2	Traction Throttle Fault	<ul style="list-style-type: none"> Traction throttle wiring/s (analog/digital) are not connected. 	A fault condition of traction throttle is detected. See throttle type documentation.	Cycle key switch.
48	2	Hydraulic Throttle Fault	<ul style="list-style-type: none"> Hydraulic throttle wiring/s (analog/digital) are not connected. 	A fault condition of hydraulic throttle is detected. See throttle type documentation.	Cycle key switch.
49	2	Brake Throttle Fault	<ul style="list-style-type: none"> Brake throttle wiring/s (analog/digital) are not connected. 	A fault condition of brake throttle is detected. See throttle type documentation.	Cycle key switch.
50	4	Service Time Expired	<ul style="list-style-type: none"> Service interval time has expired. 	Service timer has expired.	Reset service timer.
51	3	Low Battery State Of Charge	<ul style="list-style-type: none"> Battery state of charge drops below the setting parameters. 	Battery state of charge estimated is lower than minimum setting.	Bring battery state of charge above reset parameter setting and cycle key switch.
52	1	Wrong Parameter	<ul style="list-style-type: none"> Wrong value of a parameter setting is entered. 	Parameter setting is out of permitted range.	Bring wrong parameter within correct range and cycle key switch.
53	4	Restart Required	<ul style="list-style-type: none"> A parameter setting is changed and you need to restart the controller to become it effective. 	Changed a parameter setting.	Cycle key switch.
54	1	CAN Bus Off	<ul style="list-style-type: none"> Short between L, H channels or H channel and GND of CAN driver. Wrong cable wirings. Wrong baud rate configuration of one node. 	Bus off condition detected.	Cycle key switch.

55	1	CAN Open Circuit	<ul style="list-style-type: none"> ▪ H or/and L channel not connected. ▪ Wrong cable wirings. ▪ All other nodes of the net not powered up. 	Messages not longer received.	Cycle key switch.
56	1	CAN Bad Wiring	<ul style="list-style-type: none"> ▪ Wrong cable wirings. ▪ Swap of L channel and GND of CAN driver. 	CAN bus synchronization phase failed.	Cycle key switch.
57	1	CAN Fault On Bootup	<ul style="list-style-type: none"> ▪ Supply failure of one or more device/s connected to the bus. 	The Slave receives more than one boot-up message from Master after having entered the Operational mode.	Cycle key switch.
58	1	CAN Fault On Start	<ul style="list-style-type: none"> ▪ Communication protocol mismatch. ▪ Loss of communication. 	The Master has changed its operative state after having entered the Operational mode.	Cycle key switch.
59	1	CAN Fault On Operational	<ul style="list-style-type: none"> ▪ One or more device/s is/are not in operative mode after startup. 	The Master hasn't ever entered the Operational mode.	Cycle key switch.
60	1	CAN Fault On Heartbeat	<ul style="list-style-type: none"> ▪ One or more device/s doesn't/don't send heartbeat. ▪ Loss of communication. 	Heartbeat is never received.	Cycle key switch.
61	1	CAN Fault On RPDO	<ul style="list-style-type: none"> ▪ Communication not present 	At least one PDO is never received.	Cycle key switch.
62	1	Net Timeout Heartbeat	<ul style="list-style-type: none"> ▪ Temporary loss of communication. 	Heartbeat hasn't been received for the timeout established by the user through the CAN configuration settings.	Cycle key switch.
63	1	Net Timeout PDO	<ul style="list-style-type: none"> ▪ Temporary loss of communication. 	At least one PDO hasn't been received for the timeout established by the user through the CAN configuration settings (for standard application and for electric steering application).	Cycle key switch.
64	1	CAN Slave Precharge Done Timeout	<ul style="list-style-type: none"> ▪ 5 sec after pre-charge is ended up, the power line is not ready (for master). 	Pre-charge timer has expired before the master sends the power ready request.	Cycle key switch.
65	1	CAN Slave Fault From Master	<ul style="list-style-type: none"> ▪ Master has requested a fault condition. 	Fault request is received from master.	Cycle key switch.
66	1	CAN Master Timeout	<ul style="list-style-type: none"> ▪ Net synchronization failure. 	Probably some nodes are not present in the network.	Check all nodes connected and cycle key switch.
67	1	Net Startup Timeout	<ul style="list-style-type: none"> ▪ Net synchronization failure at startup. 	The Node hasn't been able to synchronize itself to the network.	If needed, correct net startup parameter and cycle key switch.
68	2	Net External Failure	<ul style="list-style-type: none"> ▪ Net synchronization lost. 	At least one Node has become not operational.	Cycle key switch.
69	1	Net Mains Manager Wrong Sequence	<ul style="list-style-type: none"> ▪ A TAU Node, Helper or Follower for the main contactor management, signals that the powering sequence made by the Manager is wrong. 	The main contactor Manager has executed a wrong powering sequence.	Cycle key switch.
70	1	Net Mains Manager Precharge Too Slow	<ul style="list-style-type: none"> ▪ A TAU Node, Helper for the main contactor management, signals that the precharge phase has been too slow. 	DC Bus voltage will not increase after discharging phase.	Cycle key switch.
71	1	Net Mains Manager Closing Too Slow	<ul style="list-style-type: none"> ▪ A TAU Node, Helper for the main contactor management, signals that the main closing phase has been too slow. 	The main contactor doesn't close.	Check the cable which command the contactor and cycle the key switch.
72	1	Net Mains Manager Powering Alarm	<ul style="list-style-type: none"> ▪ A TAU Node, Helper or Follower for the main contactor management, signals that the main Manager has the powering state machine alarmed. 	At least one fault has occurred on main contactor Manager controller.	Cycle key switch.
73	1	CO Synchro Failed	<ul style="list-style-type: none"> ▪ Net never synchronized 	At least one node of the net could be wrong configured or switched off .	Check that all nodes are switched on and have right net configuration before cycle key switch.

74	2	C0 Synchro Lost	▪ Net synchronization lost	At least one node of the net could be wrong configured or switched off during operation.	Check that all nodes are correctly supplied and have right net configuration before cycle key switch.
75	2	Stopped For System Fault	▪ Node stopped for system fault	Node is stopped because another node has a stopping/blocking fault condition.	Reset system fault stopping condition or verify system faults remapping configuration. Cycle key switch.
76	1	Blocked For System Fault	▪ Node blocked for system fault	Node is blocked because another node has a stopping/blocking fault condition.	Reset system fault stopping condition or verify system faults remapping configuration. Cycle key switch.
77	1	BMS Wall Charge	▪ The BMS is recharging the battery.	The TAU Node sets a blocking fault.	Cycle key switch.
78	2	BMS Stop	▪ The BMS requires a system stop.	The TAU Node sets a stopping fault.	Cycle key switch.
79	1	BMS Fault	▪ The BMS signals its faulty state.	The TAU Node sets a blocking fault.	Cycle key switch.
80	3	BMS Limiting	▪ The BMS requires a current limit.	The TAU Node limits its current to the required value.	Cycle key switch.
81	3	Steering Sensor Fault	▪ Steering sensor wiring/s (analog/digital) are not connected.	A fault condition of steering sensor is detected. See steering sensor type documentation.	Cycle key switch.
100	1	Internal Software Fault 1	▪ Internal software error/s.	Internal error.	Restore Eeprom default and cycle key switch.
101	4	Internal Software Fault 2	▪ Internal software error/s.	Internal error.	Restore Eeprom default and cycle key switch.
102	4	Internal Software Fault 3	▪ Internal software error/s.	Internal error.	Restore Eeprom default and cycle key switch.
103	1	Internal Hardware Fault 1	▪ Internal hardware error/s.	Internal error.	Cycle key switch.
104	1	Internal Hardware Fault 2	▪ Internal hardware error/s.	Internal error.	Cycle key switch.

Appendix A: Document history

Doc Release 1.1, June 12th 2013:

Corrected the descriptions of faults nr 57, 58, 59, 62 and 63.

Doc Release 1.2, July 2013:

Added fault 66 description.

Doc Release 2.0, December 2013:

Added tau net and dual traction faults.