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SV-iV5 User Manual

2.2-37 kW [200V] / 2.2-375kW [400V]

Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.

LS Industrial Systems

Chapter 9 – Troubleshooting and maintenance

9.1 Fault Display

⚠ CAUTION
When a fault occurs, the inverter turns off its output and displays the fault status described below. In this case, the cause must be corrected before the fault can be cleared. If protective function keeps active, it could lead to reduction in product life and damage to the equipment.

Protective function	Keypad display	Description
Over Current	OC-U OC-V OC-W	The inverter turns off its output when the output current of the inverter flows more than 200% of the inverter rated current.
Ground Fault Protection	Ground Fault	The inverter turns off its output when a ground fault occurs and the ground fault current is more than the internal setting value of the inverter. Over current trip function may protect the inverter when a ground fault occurs due to a low ground fault resistance
Over voltage protection	Over Voltage	The inverter turns off its output if the DC voltage of the main circuit increases higher than the rated value (200V class: 400V DC, 400V class: 820 V DC) when the motor decelerates or when regenerative energy flows back to the inverter due to a regenerative load. This fault can also occur due to a surge voltage generated at the power supply system.
Low Voltage Protection	Low Voltage	The inverter turns off its output if the DC voltage is below the detection level because insufficient torque or over heating of the motor can occurs when the input voltage of the inverter drops.
Overload Protection	Over Load	The inverter turns off its output if the output current of the inverter flows at 180% of the inverter rated current for more than the current limit time (S/W).
Inverter Overload	Inv OLT	The inverter turns off its output when the rated current of the inverter flows more than regulation level(150% for 1 minute-Inversely proportional to time).
Heat Sink Over Heat	InvOver Heat	The inverter turns off its output if the heat sink over heats due to a damaged cooling fan or an alien substance in the cooling fan by detecting the temperature of the heat sink.
	OHD Open *1)	The inverter turns off its output when OHD is opened and the heat sink is overheated.
Inverter NTC Thermistor Open	InvThem OP	When inverter NTC Thermistor is open, inverter stops its output.
Motor overheat	MotOver Heat	When motor temp exceeds 150℃ , inverter stops its output to protect motor from overheated.
Motor Thermistor Error	MotThem Err	When there is an error in Thermistor that measures the temperature of motor, inverter stops its output. (Error—NTC: open , PTC: short-circuit)
Electronic Thermal	E-Thermal	The internal electronic thermal of the inverter determines the over heating of the motor. If the motor is overloaded the inverter turns off the output. The inverter cannot protect the motor when driving a multi-pole motor or when driving multiple motors, so consider thermal relays or other thermal protective devices for each motor. Overload capacity: 150% for 1 min.
External fault B	Ext Trip-B	Use this function if the user needs to turn off the output by an external fault signal.

***1) It only comes under** SV2800~3750iV5

Protective function	Keypad display	Description
IGBT Short	Arm Short-U Arm Short-V Arm Short-W	Inverter output is stopped when IGBT Arm short or output short occurs. (Arm short-DB is only come under SV110~220iV5) (SV2800~3750iV5 are displayed as ArmShort without reference to UVW phases.)
Fuse Open	Fuse Open	The inverter turns off its output by opening the fuse when something is wrong with the main circuit IGBT to protect the wiring from being damaged from short currents
Encoder Error	Encoder Err	1) Displayed when Encoder signal fault occurs.(H/W) 2) Displayed when there is a discord of detection time standard of motor error of PAR-14.(S/W)
BX protection (Instant Cut Off)	BX	Used for the emergency stop of the inverter. The inverter instantly turns off the output when the BX terminal is turned ON, and returns to regular operation when the BX terminal is turned OFF. Take caution when using this function.
Motor overspeed	Over Speed	Displayed when motor rotates over 120% its rated speed.
Communication Error	COM Error CPU Error	This fault is displayed when the inverter cannot communicate with the keypad.
H/W Error	HW- Diag	Displayed when CPU has a problem, and then the inverter blocks the IGBT gating signals.
FAN Lock*1)	FAN Lock	The inverter turns off its output when there is an Fan Lock.
Encoder PowerError*1)	EPR	When there is an error in Encoder power source, the inverter turns off its ouput. Converted to initial screen and displayed “EPR” on the right upper side.

***1) It only comes under** SV2800~3750iV5

9.2 Monitoring Fault Condition

9.2.1 Monitoring fault display

Code	LCD display	Description
DIS_05	OC-U	Current fault displayed. (U-phase overcurrent)

- Check the current fault display before pressing reset key. pressing [PROG] key and [▲(Up)],[▼(Down)] shows operating status at the time of the fault such as output frequency, current, voltage, F/B value, torque current reference/actual value, dc link voltage, input/output terminal status, operating status and run time) and the fault contents. Press [ENT] key to exit. Pressing [RESET] key will store the value in DIS_05 [Last Fault1].

9.2.2 Monitoring previous faults

- Previous 2 faults are saved in DIS_05 “Last fault 1/2“. Last fault 1 is more recent fault than Last fault 2. Refer to “8.2.1 monitoring fault display” to check the fault contents.

Code	LCD display	Description
DIS_05	Last Fault1	Previous fault 1
DIS_05	Last Fault2	Previous fault 2

- DIS_05 “ Fault Clear” removes Last Fault1, Last Fault2 data.

9.3 Fault Reset

There are 3 ways to reset the inverter. After performing this, the number of automatic restart is initialized.

1) Use [RESET] key on the keypad.
2) Short the RST-CM terminal to reset.
3) Cycle the power (turn the power OFF and turn it ON).

9.4 Fault Remedy

9.4.1 Check the below diagnosis before troubleshooting.

1) Is the wiring of a motor and an inverter conducted correctly?

☞ Refer to Main Circuit Terminal

2) Is the Encoder-type jumper on I/O PCB set correctly?

☞ Refer to Encoder wiring

If encoder type is either Complementary or Open collector, slide JP4 switch to “OC” and slide JP2 switch to “P15”. If encoder type is Line Drive, slid the JP4 switch to “LD” and slide JP2 switch to “P5”.

Factory default: Line Drive Type

3) Is motor rotating direction set correctly?

☞ Refer to Monitoring Encoder operation. (Refer to 4-10p.)

STARVERT-iV5 defines Forward rotation when motor rotates in clockwise from the view of Rear Bracket (Motor FAN).

4) Is inverter operating correctly in no load condition?

☞ Refer to Operation via Keypad and Control Terminal

9.4.2 Check list before installation

Check (1) ~ (9) before installation. Check (10) ~ (16) when problem has occurred during use.

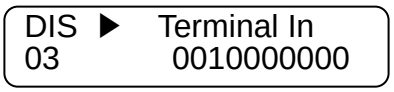
1) The Motor Does Not Rotate

① Is red lamp blinking ?

☞ Check whether other trips occur in DIS_05.

If fault occurs, press [RESET] key to clear trip status and try operation.

☞ Check whether BX (Emergency stop) signal is applied on keypad and input terminal defined as BX is ON in DIS_03. If so, release BX and try operation.



② RUN/STOP method is properly set ?

☞ Check FUN_01 RUN/STOP method setting matches the actual operation mode(RUN/STOP via keypad or terminal). If FUN_01 is set to terminal but operation is not performed, change it to keypad mode and try operation. If FUN_02 is set to Keypad but operation is not performed, change it to Terminal and try operation. If either way cannot work, refer to (6).

2) The motor does not rotate when Green lamp on [REV], [FWD] key is ON.

① Is inverter U, V, W output correctly wired to motor U, V, W output?

☞ Refer to Main circuit terminal

② Is the motor shaft jammed by brake or other mechanical devices?

☞ check the directly connected brake's relay on time and brake open time.

③ On DIS_01 PreRamp Ref, is speed reference displayed not "0"?

☞ set the desired speed reference if it is set to "0". If it is incorrectly set, refer to (7).

④ Is PAR_07 [motor rating] properly set?

☞ check the motor nameplate and setting matches.

⑤ Is PAR_16 [motor speed] properly set?

☞ check the motor nameplate and setting matches.

⑥ Is PAR_22 [motor rated current] properly set?

☞ check the motor nameplate and setting matches.

⑦ Is PAR_26 [motor flux current] properly set?

☞ If LG-OTIS vector motor is not used, consult LS representative or set the correct value in accordance with application. However, it cannot set to exceed PAR_22 [motor rated current]. Normally it is 30~40 % of rated

motor current.

⑧ Is PAR_21 [motor rated slip] properly set?

☞ check the motor nameplate and setting matches.

⑨ Is PAR_27 [Motor secondary time constant (Tr) properly set?

☞ if motor is not LG-OTIS vector motor, perform the Auto-tuning or set this correctly. If it is incorrectly set, inverter performance will be dramatically deteriorated.

⑩ Is PAR_19 [number of motor poles] properly set?

☞ check the motor nameplate and setting matches.

⑪ CON_28 [Torque limit setting] is set to " Kpd Kpd Kpd ". Is CON_29 ~ CON_31 setting correct?

☞ CON_29 ~ CON_31 marks upper limit in inverter output torque. For the application lower torque limit is required, when torque shortage occurs, increase this value a little. STARVERT-iV5 's overload capacity is 150%/1 min. when using torque limit over 150%, time and the number of use should be limited.

⑫ When CON_28[torque limit setting] Analog or Option, the corresponding input value is properly set?

☞ CON_28 is set to Analog, one of Ai1/Ai2/Ai3 should be defined as "Torque limit". If set to Option, refer to Option manual for proper setting.

3) Motor speed is not increasing while it is running.

① Is PAR_10 [number of Encoder pulse] set properly?

☞ factory default is 1024. If it is not OTIS vector motor, contact with Encoder maker.

② FUN_01 is set to "Keypad",FUN_02 to "Keypad1", FUN_12(Speed 0) to 100.0rpm and press [FWD] key but motor speed is not 100.0rpm. In this case, check for encoder wiring.

☞ If encoder wiring is disconnected or switched, it rotates only uni-direction with low speed (30.0 ~ 60.0rpm) and over 150% its rated current. Check the encoder wiring and whether wiring of defined terminal and motor encoder terminal is shorted.

③ If motor speed does not increase and keeps abnormally 30.0 ~ 60.0 rpm, stop the motor and switch the wiring of A and B phase of Encoder. Check whether motor rotating direction is reversed as seen in (4).

☞ In the case of Line Drive type encoder, wire A+, A- phase to B+, B- and B+, B- phase to A+, A-. Complementary / for the case of Open Collector type encoder, reverse the wiring of PA and PB.

Or switch the encoder direction in **PAR 11 (Enc Dir Set) and try RUN.**

4) Motor rotates in reverse direction.

☞ Switch the wiring of output phase V and W. Switch the wiring of encoder phase A and B as indicated in (3).

Or switch the encoder direction in PAR_11(Enc Dir Set) and try RUN.

5) Motor rotating direction cannot be changed.

① Is RUN/STOP setting proper?

☞ Check FUN_01 RUN/STOP command setting matches the actual operating mode. If FUN_01 is set to Terminal (Keypad) but operation cannot be made, change it to Keypad (Terminal). If it does not work, refer to 6)

② Is one of the terminal defined as FWD/REV Run Disable ON?

☞ Check one of DIO_01 ~ DIO_07 terminals is defined as “Prohibit FWD” or “Prohibit REV”. If so, check input terminal status in DIS_01 ~ DIS_03. If rotating direction is not changed, check the terminal is ON.

6) Keypad or terminal malfunctions.

① When [REV], [FWD], [STOP] key on the keypad is lit Red or Green

☞ Refer to 1) if RUN/STOP is not activated by Keypad or Terminal. If setting change is not available, PAR_04 may set to prohibit parameter write. To release this setting, enter 12 in PAR_04. If problem persists, contact LS representatives.

② When [STOP] key is blinking

☞ This marks trip condition or BX active status. Check any other trips occur in DIS_05. Reset the trip and try run. Check BX signal is ON on the keypad and input terminal signal in DIS_01 ~ DIS_03. Reset BX and try run.

③ When green lamp on [REV], [FWD] key is blinking

☞ It marks accel/decel is in operation. If inverter keeps operation in this condition, it means load capacity calculation is incorrect and exceeds inverter rating. Refer to (16).

7) Operating speed does not change during run.

① Is FUN_02 speed setting proper?

☞ Speed setting methods in STARVERT-iV5 are Analog input, Keypad and Option. Select appropriate one among them.

② Is DIS_01(PreRamp Ref) setting the correct value?

☞ Current speed ref. Values are displayed in DIS_01 ~ DIS_03. Check the displayed value matches the setting value. If speed is not variable, check the encoder. (Refer to (13))

③ Speed setting method is “Keypad” and speed ref displayed DIS_01 ~ DIS_03 is not correct.

☞ Check terminal setting in DIO_01 ~ DIO_07 defined as Multi-step speed setting.

④ When speed setting method is Analog and DIS_01 ~ DIS_03 display is not desired value

☞ Check one of Ai1 ~ Ai3 is defined as “Speed Ref.”.

8) Motor keeps rotating at OV condition when speed setting is via Analog input.

① When AIO_11 Definition of Ai1 input is set to “Speed Ref”

☞ Adjust the Ai1_Bias at AIO_14. (Setting unit: %)

The displayed value is speed command. Set the desired value (ex: 0.0%) and press [ENTER] key.

② Follow the same steps to check Ai2 ~ Ai3.

9) Motor detects speed reference but motor rpm is showing decreasing while motor is overheated or hunting.

① Check the motor wiring.

☞ There is a possibility of incorrect motor wiring when motor is 220V / 380V dual rating. Motor does not normally rotate when pole number setting is incorrect. However, motor may get damaged in case of miswiring. If this problem occurs, contact motor sales office. Refer to Power terminal description in this manual.

② Is motor capacity set correctly?

☞ Check PAR_07 motor rating selection is set the same as motor in use. See the nameplate for motor rating.

③ Is motor parameter set correctly?

☞ Motor parameters vary by manufacturer. STARVERT-iV5 setting is based on OTIS vector motor as default. Motor parameters should be changed when other makers' motor is used.

10) Nothing displayed on the LCD?

① Is the connection of inverter and keypad tight?

☞ Check the inverter and Keypad connection.

② Is input power turned on ?

☞ Check inverter power is applied. If nothing is displayed on the LCD in this condition, contact LS representatives.

11) Motor speed oscillates and speed is not constant during constant Run.

① Is encoder wired using twisted shield cable?

☞ encoder signal wiring should be conducted with Twisted Shield Cable. Otherwise, speed may oscillate at low speed (or high speed) due to encoder input noise, leading to motor vibration or abnormal motor sound at stop.

② Is the connection of inverter and motor and encoder grounding proper?

☞ Check the grounding of inverter and encoder is connected. This could occur when not connected. Fixed screw for the connection of encoder grounding and the inverter is located on the right bottom side of the control PCB. Loosen the fixed screw and insert the ground wire of the encoder and tighten the screw. (Refer to encoder wiring diagram). For grounding the motor, use G of the inverter Main terminal.

③ Connect inverter panel grounding connected with motor grounding to the building grounding.

☞ If not, incorrect motor speed may be input due to encoder input noise.

④ Is too large speed gain assigned to the inverter while motor load is light?

☞ Motor oscillates at stop when PI gain is set much larger than the actual load in CON_03 and CON_04.

Therefore, gain should be set accordingly. Responsiveness increases when P gain is set higher and I lower but system may become unstable. Gain value varies system but generally set **30 ~ 70%** for **P gain** and set **100 ~ 500ms** for **I gain.**

⑤ Increase PAR_13 Enc LPF setting value.

⑥ Is there slip present at the connection of encoder and motor shaft?

☞ Poor encoder and motor connection may generate slip. Check the connection is tight.

12) Parameter change is not saved.

☞ Turn the power off and turn it on. If problem persists, contact LS representatives.

13) "Fuse Open" trip occurs constantly.

① is the input (line) voltage normal?

☞ Check the line voltage input. If phase to phase unbalance exceeds 2%(greater than 6V for 380V input), an AC reactor should be provided. Otherwise, inverter may get damaged and A/S fee will be charged during Warranty period.

② is the phase sequence of the output terminal U, V, W correct?

☞ Check the level of the input signal.

③ Is the motor insulation damaged?

☞ Various types of malfunction occur when the insulation is damaged. In general, operation stops at a certain speed (and more), overload or "OC-U (V,W)" trip occurs during regenerating. Or motor overheating and rotating speed oscillates. This condition persists for a while and then "Fuse Open" trip occurs. It marks motor insulation is damaged. In this case, replace the motor.

14) Motor input current is too large.

① Check the motor wiring.

☞ Check the motor wiring for the use of 220V / 380V transition type motor. (Refer to Main circuit terminal)

② Are motor and inverter capacity set correctly?

③ Is the setting of motor constants appropriate?

☞ Refer to 2) and 9) and check the motor and inverter setting.

15) OC-U (V,W) trip occurs frequently during operation. (Motor input current is oscillating.)

① check the encoder installation.

☞ If encoder connection is poor, motor vibration affects encoder and incorrect encoder signal is input to the inverter. Vector inverter controls the speed from Encoder F/B value so it follows the input signal whether correct or not, increasing inverter current. If so, contact motor maker or encoder commission company.

② Is there no inverter output phase loss?

③ Is the motor insulation not damaged?

☞ Refer to 13) and check the inverter and motor.

16) Accel/Decel cannot be made properly and green lamp in [REV], [FWD] key is blinking.

(load and frequency reference signal is oscillating.)

① Check motor wiring.

② FUN_40 ~ FUN_47 Accel/Decel time and DIS_00 motor load.

☞ Blinking Green lamp marks motor is accelerating or decelerating. If the rotating speed oscillates and green lamp is blinking, it marks inverter output torque shortage due to mis-calculation of load. In this case, increase the torque limit to enable inverter to accelerate/decelerate within its rating. If load is set too high, it will shorten inverter life or damage to the unit.