



0.4~7.5kW(200V,400V)

# AC Variable Speed Drive

G100 Troubleshooting Manual

## Safety Instructions

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

# Quick Reference Table

The following table listed situations frequently encountered while working with inverters. Refer to the typical situations to quickly and easily locate solutions to your questions.

Situation	Reference
The motor is too noisy.	P. 30
I want to review recent fault trip and warning histories.	P. 14
The motor is producing too much heat.	P. 27
The cooling fan is not working.	P. 31
I want to know how I can keep the inverter when I am not using it.	P. 40
ERR message is displayed on the keypad.	P. 17
I want to initialize all parameters.	P. 13
I want to terminate the inverter.	P. 40
I want to review the input/output module.	P. 35
I want to change the fan when it exceeded the replacement period.	P. 38
I want to change the carrier frequency.	P. 12
I cannot set the parameters.	P. 26
The motor is not working.	P. 30
The motor stops when it is connected to the load or accelerated.	P. 28

<b>INTRODUCTION</b>	<b>3</b>
<b>PRODUCT IDENTIFICATION</b>	<b>4</b>
<b>ASSOCIATION MANUAL</b>	<b>4</b>
<b>SAFETY INFORMATION</b>	<b>5</b>
<b>REVISION RECORD</b>	<b>7</b>

# Contents



<b>1 BASIC CHECKLIST</b>	<b>8</b>
1.1 Before You Think It Failed	8
1.2 Basic Operations	10
1.3 Change Parameter	12
1.3.1 Change Carrier Frequency	12
1.3.2 Initialize All Parameters	13
1.4 Monitor Fault Trip	14
<b>2 TROUBLESHOOTING</b>	<b>16</b>
2.1 Trips and Warnings	16
2.1.1 Failure/Warning List	17
2.1.2 Troubleshooting Fault Trips	20
2.2 Troubleshooting Other Faults	25
<b>3 MAINTENANCE</b>	<b>31</b>
3.1 Regular Inspection List	31
3.1.1 Daily Inspections	32
3.1.2 Annual Inspections	33
3.1.3 Bi-Annual Inspections	33
3.1.4 Check Input/Output Module	34
3.1.5 Replace Cooling Fan	38
3.2 Storage and Disposal	39
3.2.1 Storage	39
3.2.2 Disposal	39

# Introduction

## Manual Composition

### 1 Basic Checklist

#### 1.1 Before You Think It Failed

#### 1.2 Basic Operations

#### 1.3 Change Parameter

1.3.1 Change Carrier Frequency

1.3.2 Initialize all Parameters

1.3.3 Read and Write Parameters

#### 1.4 Monitor Fault Trip



This section covers check points when there is a problem in the inverter.

Then check the parameter settings using basic operations and the trip records.

### 2 Troubleshooting



This section explains troubleshooting fault trips and other common faults.

If problems are not solved, please contact your vendor or LS ELECTRIC.

#### 2.1 Trips and Warnings

2.1.1 Failure/Warning List

2.1.2 Troubleshooting Fault Trips

#### 2.2 Troubleshooting Other Faults

### 3 Maintenance

#### 3.1 Regular Inspection List

3.1.1 Daily Inspections

3.1.2 Annual Inspections

3.1.3 Bi-annual Inspections

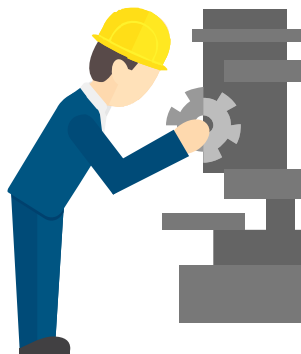
3.1.4 Check Input/Output Module

3.1.5 Replace Cooling Fan

#### 3.2 Storage and Disposal

3.2.1 Proper Storage of the Product

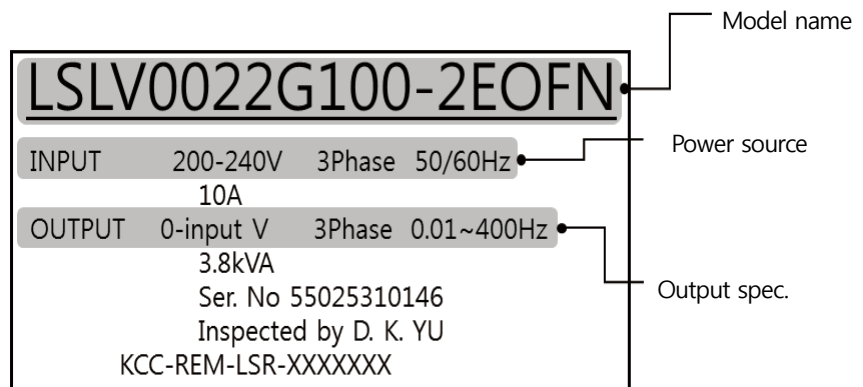
3.2.2 Proper Disposal of the Product



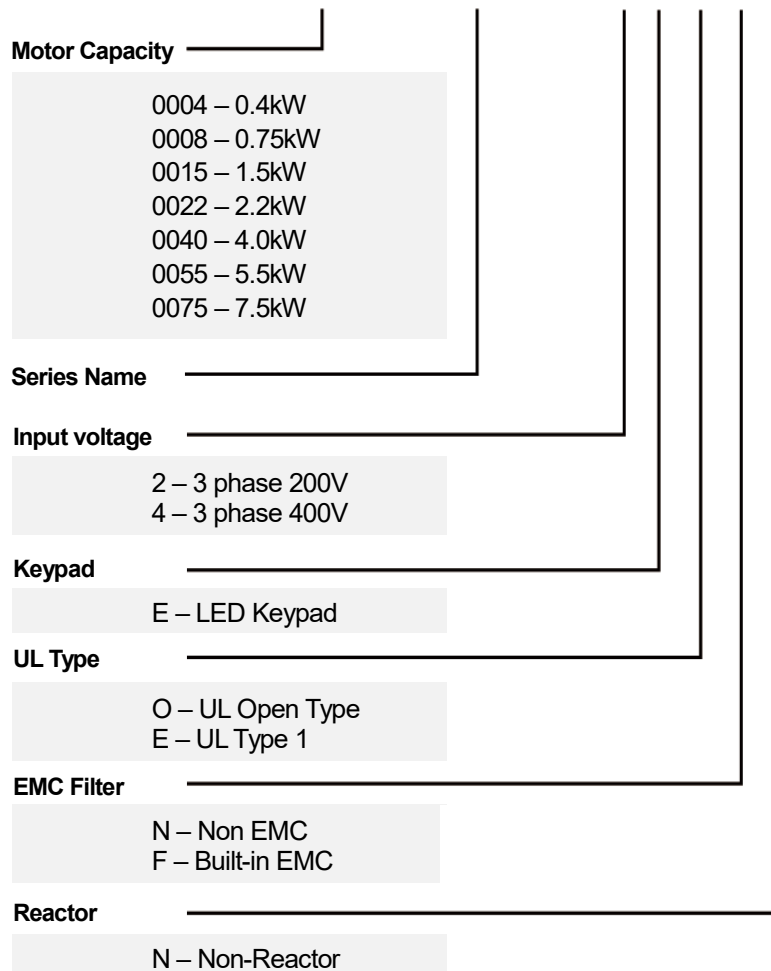
This section provides information on how to maintain the inverters on a regular basis for different time periods.

When there is a problem in the inverter, please check the input/output module. This is the basic method to check the hardware.

# Product Identification



## LSLV 0022 G100 - 2EOFN



# Association Manual

G100 user manual can be downloaded through LS ELECTRIC homepage.

Link : <https://www.ls-electric.com/support/download-center>

# Safety Information

Read and follow all safety instructions in this manual precisely to avoid unsafe operating conditions, property damage, personal injury, or death.

## Safety symbols in this manual

### Danger

Indicates an imminently hazardous situation which, if not avoided, will result in severe injury or death.

### Warning

Indicates a potentially hazardous situation which, if not avoided, could result in injury or death.

### Caution

Indicates a potentially hazardous situation that, if not avoided, could result in minor injury or property damage.

## Safety information

### Danger

- Do not open the cover of the equipment while it is on or operating. Likewise, do not operate the inverter while the cover is open. Exposure of high voltage terminals or charging area to the external environment may cause an electric shock. Do not remove any covers or touch the internal circuit boards (PCBs) or electrical contacts on the product when the power is on or during operation. Doing so may cause serious injury, death or serious property damage.
- Do not open the cover of the equipment even when the power supply to the inverter has been turned off unless it is necessary for maintenance or regular inspection. Opening the cover may lead to an electric shock even when the power supply is off.
- The equipment may hold charge long after the power supply has been turned off. Use a multi-meter to make sure that there is no voltage before working on the inverter, motor, or motor cable.

### Warning

- This equipment must be grounded for safe and proper operation.
- Do not supply power to a faulty inverter. If you find that the inverter is faulty, disconnect the power supply and have the Inverter repaired.
- The Inverter becomes hot during operation. Avoid touching the Inverter until it has cooled down to avoid burns.
- Do not allow external objects, such as screws, metal chips, debris, water, or oil to get inside the Inverter. Allowing external substances inside the Inverter may cause the Inverter to malfunction or ignite fire.
- Do not operate the Inverter with wet hands. Doing so may cause electric shock.

### Caution

- Do not modify the interior structure/components of the Inverter. Doing so will void the warranty.
- The Inverter is designed for 3-phase motor operation. Do not use the Inverter to operate 1-phase motor.
- Do not place heavy objects on top of electric cables. Doing so may damage the cable and cause an electric shock.

# Revision Record

Version	Date	Changed main contents	Reference Page
V1.0	2019.09	1. First edition	-

# 1 Basic Checklist

## 1.1 Before You Think It Failed

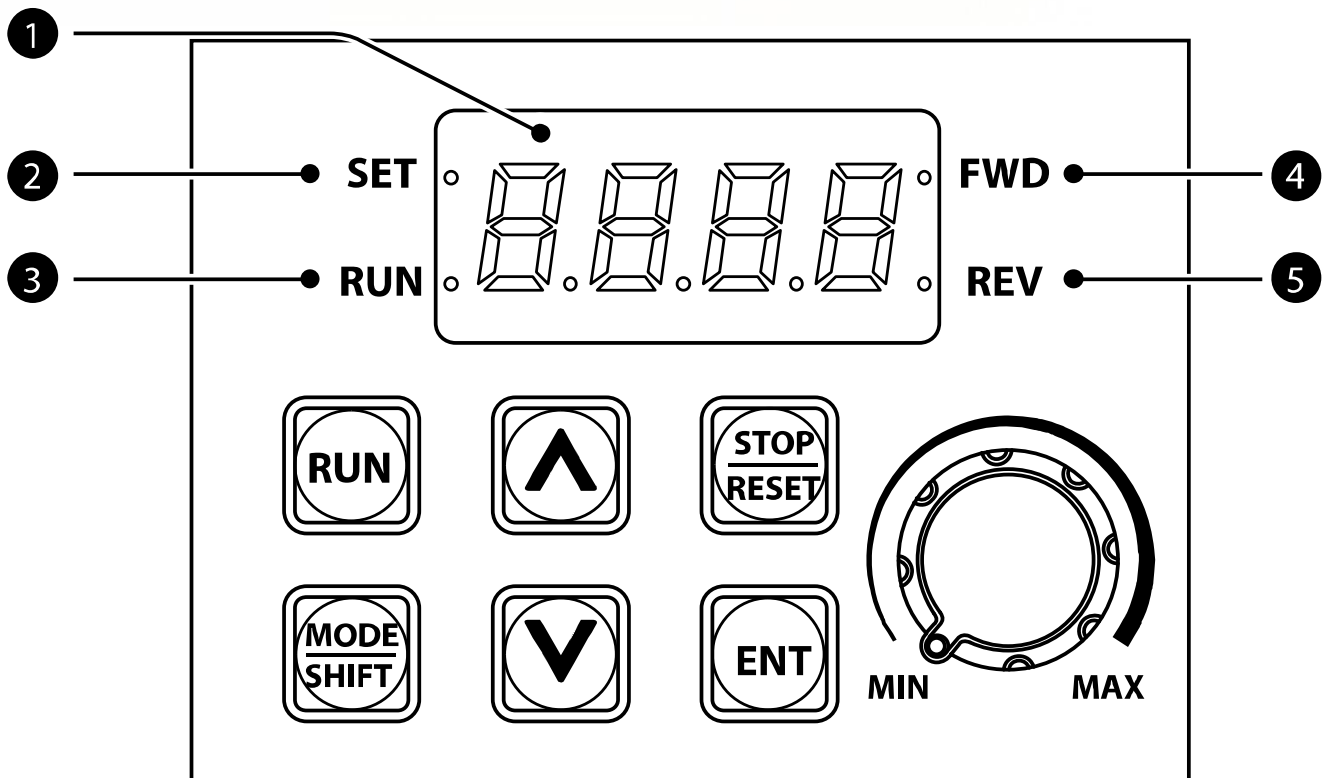
Items	Check Point	Result
Installed Environment / Input/Output voltage	Is the installed location appropriate?	
	Does the environment meet the inverters operating conditions?	
	Does the power source match the inverter's rated input?	
	Is the rated output of the inverter sufficient to supply the equipment?	
Power Terminal Wiring	Is the circuit breaker installed on the input side of the inverter?	
	Is the circuit breaker correctly rated?	
	Are the power source cables correctly connected to the R/S/T terminals of the inverter? (Caution: Connecting the power source to the U/V/W terminals may damage the inverter)	
	Are the motor output cables connected in the correct phase rotation (U/V/W)? (Caution: Motors will rotate in reverse direction if three phase cables are not wired in the correct rotation)	
	Are the cables used to connect power terminals correctly rated?	
	Is the inverter grounded properly?	
	Are the power terminal screws and the ground terminal screws tightened to their specific torques?	
	Are the overload protection circuits installed correctly on the motors (if multiple motors are running using one inverter)?	
	Is the inverter separated from the power source by a magnetic contactor (if a braking resistor is in use)?	
Are advanced-phase capacitors, surge protection and electromagnetic interference filters installed correctly? (These devices MUST NOT be installed on the output side of the inverter)		

Items	Check Point	Result
Control Terminal Wiring	Are STP (shielded twisted pair) cables used for control terminal wiring?	
	Is the shielding of the STP wiring properly grounded?	
	If 3-wire operation is required, are the multi-function input terminals defined prior to the installation of the control wiring connections?	
	Did you wire the control cables after setting the parameters?	
	Are the control cables properly wired?	
	Are the control terminal screws tightened to their specified torques?	
	Is the total cable length of all control wiring less than 165ft (50m)?	
	Is the total length of safety wiring less than 100ft (30m)?	
Miscellaneous	Are optional cards connected correctly?	
	Is there any debris left inside the inverter?	
	Are there any cables (contacting adjacent terminals) creating a potential short circuit risk?	
	Are the control terminal connections separated from the power terminal connections?	
	Have the capacitors been replaced if they have been in use for more than 2 years?	
	Has a fuse been installed for the power source?	
	Has a fuse been installed for the power source?	

## 1.2 Basic Operations

### ■ About the Keypad

The keypad is composed of two main components – the display and the operation (input) keys. Refer to the following illustration to identify part names and functions.



### ■ About the Display

The following table lists display part names and their functions.

No.	Name	Function
①	7-Segment Display	Displays current operational status and parameter information.
②	SET Indicator	LED flashes during parameter configuration and when the ESC key operates as the multi-function key.
③	RUN Indicator	LED turns on (steady) during an operation, and flashes during acceleration or deceleration.
④	FWD Indicator	LED turns on (steady) during forward operation.
⑤	REV Indicator	LED turns on (steady) during reverse operation.

The table below lists the way that the keypad displays characters (letters and numbers).

Display	Number/ character	Display	Number/ character	Display	Number/ character	Display	Number/ character
	0		A		K		U
	1		B		L		V
	2		C		M		W
	3		D		N		X
	4		E		O		Y
	5		F		P		Z
	6		G		Q		
	7		H		R		
	8		I		S		

## ■ Operation Keys

Key	Key name	Function Description
	[RUN]	Used to run the inverter.
	[STOP/RESET]	STOP: Stops the inverter. RESET: Resets the inverter if a fault or failure occurs.
	[▲], [▼]	Switches between codes, or increases or decreases parameter values.
	[MODE/SHIFT]	Moves between groups or moves to the digit on the left when setting the parameter. Press the MODE/SHIFT key once again on the maximum number of digits to move to the minimum number of digits.
	[ENTER]	Switches from the selected state of parameter to the input state. Edits parameter and apply change. Accesses the operation information screen during failure on the failure screen.
	[Volume]	Used to set the operation frequency.

\* Operates as ESC key if two keys out of [MODE/SHIFT] key, [▲] key and [▼] key are entered at the same time.

- Press ESC in the group navigation mode to go to the initial screen (the frequency display screen).
- Press ESC in the mode to change parameter to go to group navigation mode without saving.

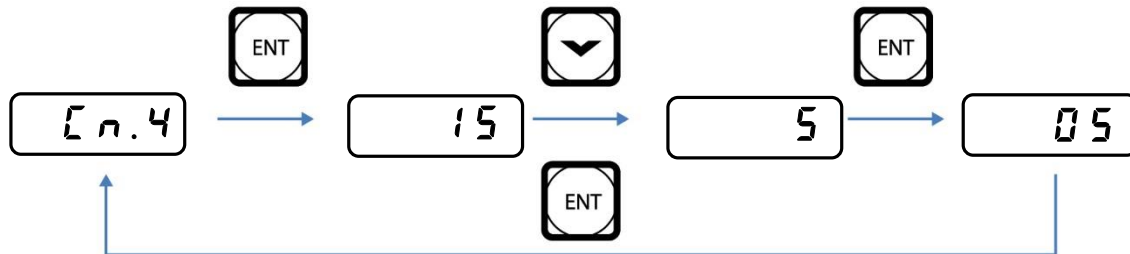
### ⚠ Caution

Install a separate emergency stop switch in the circuit. The [STOP/RESET] key on the keypad works only when the inverter has been configured to accept an input from the keypad.

## 1.3 Change Parameter

### 1.3.1 Change Carrier Frequency

The following example demonstrates how to configure carrier frequency by modifying CN.4 from 15Hz to 5 Hz. It is possible to configure the parameters for different codes in any other group in the same method.



Step	Instructions	Keypad Display
1	Shift to CN group 4 code.	Cn. 4
2	Press [ENT] key. Display shows 15 which is the current CN.4 code parameter value.	15
3	Press [▼] key multiple times until it becomes 5 (wanted value).	5
4	Press [ENT] key. The set parameter flickers.	05
5	Press [ENT] key again to save. Display shows CN.4. The parameter value has changed.	Cn. 4

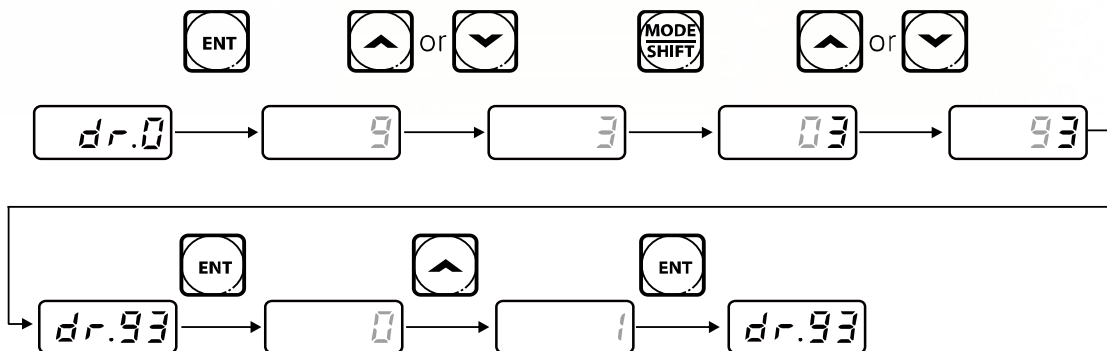
Adjust motor operational noise by changing carrier frequency settings. Power transistors (IGBT) in the inverter generate and supply high frequency switching voltage to the motor. The switching speed in this process refers to the carrier frequency. If the carrier frequency is set high, it reduces operational noise from the motor, and if the carrier frequency is set low, it increases operational noise from the motor.

There are advantages and disadvantages depending on carrier frequency setting.

Item	Carrier Frequency	
	LOW	HIGH
Motor noise	↑	↓
Motor temperature	↑	↓
Inverter heat Loss	↓	↑
High frequency	↑	↓
Inverter noise	↓	↑
Inverter leakage current	↓	↑

### 1.3.2 Parameter Initialization

The following example demonstrates parameter initialization using code dr.93 (Parameter Initialization) in the Drive group.



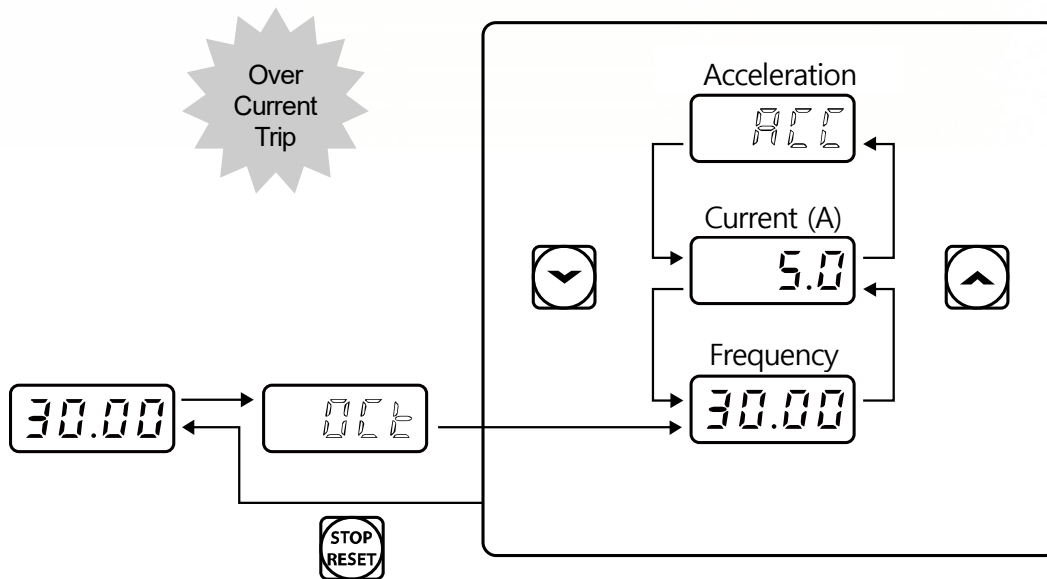
Step	Instructions	Keypad Display
1	Go to code 0 in the Drive group.	
2	Press the [ENT] key. The current parameter value "9" will be displayed.	
3	To make the target value "93", press the [▼] key to change the ones' place value to "3".	
4	Press the [MODE] key to move to the tens' place value.	
5	To make the target value "93", press the [▲] or [▼] key to change the tens' place value "9".	
6	Press the [ENT] key. Code dr.93 will be displayed.	
7	Press the [ENT] key once again. The current parameter value for code dr.93 is set to 0 (Do not initialize).	
8	Press the [▲] key to change the value to 1 (All Grp), and then press the [ENT] key. The parameter value will flash.	
9	Press the [ENT] key once again. Parameter initialization begins. Parameter initialization is complete when code dr.93 reappears on the display.	

#### Note

Following parameter initialization, all parameters are reset to factory default values. Ensure that parameters are reconfigured before running the inverter again after an initialization.

### 1.4 Monitor Fault Trip

The following shows an example procedure how to monitor trips in Operation group.

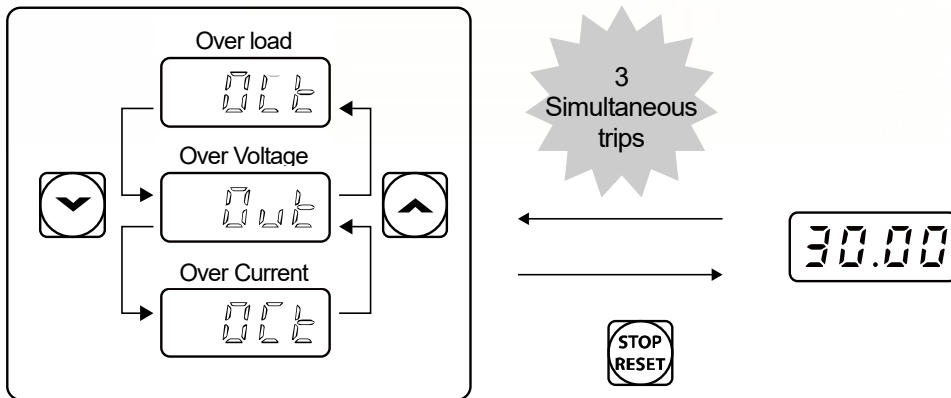


1	Refer to the example keypad display. An over current trip fault has occurred.	
2	Press the [ENT] key, and then the [▲] key. The operation frequency at the time of the fault (30.00 Hz) is displayed.	
3	Press the [▲] key. The output current at the time of the fault (5.0 A) is displayed.	
4	Press the [▲] key. The operation status at the time of the fault is displayed. ACC on the display indicates that the fault occurred during acceleration.	
5	Press the [STOP/RESET] key. The inverter resets and the fault condition is cleared. The frequency reference is displayed on the keypad.	

If a warning situation occurs while operating with the entered frequency, a display and the current screen will flash in 1 second intervals. Refer to 6.3 Under load Fault Trip and Warning on page 18 for more details.

■ **Multiple Failures at the same time**

It is possible to review the information of maximum 3 Trips when multiple trips occurred at the same time.

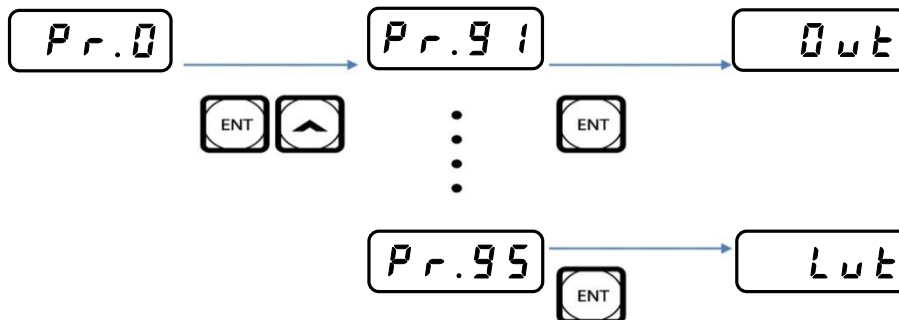


■ **Check Trip History**

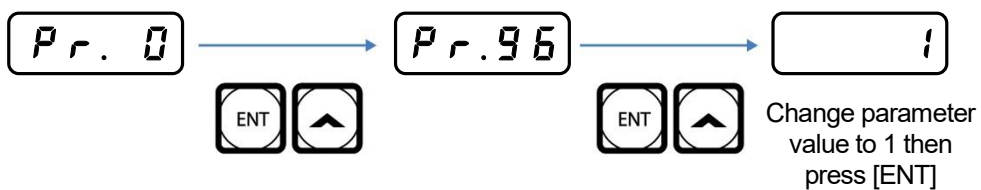
The table below is an example how to monitor trip history.

Group	Code	Code Description	Set value	Set range	Initial Value	Unit
Function Group 2	Pr91	Fault History 1	-			
				~		
	Pr95	Fault History 5	-			
	Pr96	Delete Fault History	-	0 ~ 1	0	

It is possible to save maximum 5 Trip information that occurred while operating. The figure below demonstrates how to review each Trip information.



■ **Delete Trip History**



# 2 Troubleshooting

This chapter explains how to troubleshoot when the protective functions, fault trips, warning signals, or a fault occurs while operating the inverter. If the inverter does not work as expected after following the suggested troubleshooting steps, please contact the LSIS Customer Service Center.

## 2.1 Trips and Warnings

The Inverter will stop operating or send out a warning signal when it detected a fault. The keypad will show brief information of the trip and warning signal. If the model is using the LCD keypad, the LCD will show detailed information.


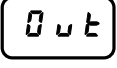
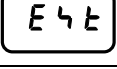
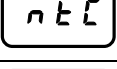
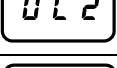

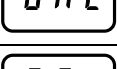
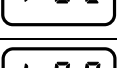
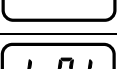
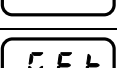
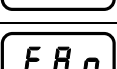
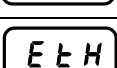
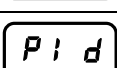
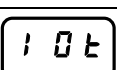
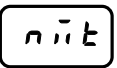

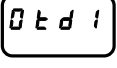

Up to 5 failures can be saved and can be found in code Pr.91. When there are more than 2 trips, the keypad display will show in the order of priority. The LCD will show in the order the fault occurred. Failure history is saved by either resetting the Inverter or when the inverter turns off due to low voltage failure. If the number of failures exceeds 5, the last 5 messages will be deleted automatically.



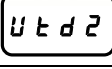
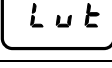
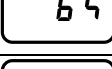
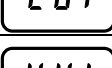

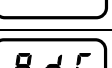
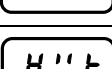
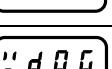


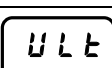
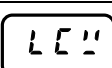
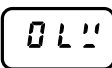

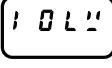

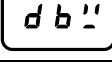

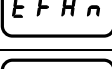
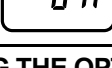
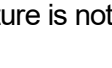
The following is how the fault conditions are categorized:

- **Level:** After the fault is corrected, the trip or warning signal disappears. The fault is not saved in the fault history.
- **Latch:** After the fault is corrected, the trip or warning signal disappears once the Inverter is reset.
- **Fatal:** After the fault is corrected, the trip or warning signal disappears when conducted the following procedure. Turn off the Inverter and wait until the charge indicator light goes off. Then, turn on the Inverter. If the Inverter still failed, please contact the supplier or LS ELECTRIC Customer Service Center.

## 2.1.1 Failure/Warning List

The following table shows a list of faults and warning signals that can occur while operating G100.

Category	KPD Display	Details	Page	
Critical	Latch	 (Over Current1)	Trip from overcurrent	P. 21
		 ((Over Voltage)	Trip from overvoltage	P. 22
		 (External Trip)	Trip from external signals	-
		 (NTC Open)	Trip from temperature sensors	P. 25
		 (Over Current2)	Trip from ARM short current	P. 22
		 (Option Trip-x*)	Option Trip *	-
		 (Over Heat)	Inverter overheat	P. 24
		 (Out Phase Open)	Trip from output phase open	P. 23
		 (In Phase Open)	Trip from input phase open	P. 23
		 (Inverter OLT)	Trip from Inverter Overload	P. 21
		 (Ground Trip**)	Trip from ground fault **	P. 22
		 (Fan Trip)	Trip from fan operation	P. 24
		 (E-Thermal)	Trip from overheat of motor	P. 20
		 (Pre-PID Fail)	Trip due to Pre-PID failure	-
		 (IO Board Trip)	Trip from IO Board connection	P. 24
		 (Ext-Brake)	Trip from External brake	-
		 (No Motor Trip)	Trip due to no motor	-
		 (Low Voltage2)	Low voltage during operation	-
 (Over torque trip1)	Trip from Over torque 1			

Category		KPD Display	Details	Page
		 (Under torque trip1)	Trip from Under torque 1	
		 (Over torque trip2)	Trip from Over torque 2	
		 (Under torque trip2)	Trip from Under torque 2	-
	Level	 (Low Voltage)	Trip due to low voltage	P. 23
		 (BX)	Trip from Emergency stop	-
		 (Lost Command)	Trip from lost command	-
	Fatal	  (EEP Err)	External memory error	P. 20
		  (ADC Off Set)	Analog input error	P. 20
		  (Watch Dog)	Trip from CPU watchdog	P. 20
Minor Failure	 (Over Load)	Trip from Motor overload	P. 20	
	 (Under Load)	Trip from Motor under load	P. 20	
Warning	 (Lost Command)	Warning for lost command	-	
	 (Over Load)	Warning for Motor overload	-	
	 (Under Load)	Warning for Motor under load	-	
	 (Inverter OLT)	Warning for Inverter overload	-	
	 (Fan Warning)	Warning for fan operation	-	
	 (DB Warn %ED)	Warning for braking resistance %	-	
	 (Retry Tr Tune)	Warning for TR turning retrieval		
	 (Fan Exchange)	Warning for fan exchange		
	 (Overheat Pre Alarm)	Warning for Inverter overheat		

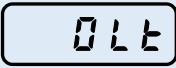
\* ONLY OCCURS WHEN USING THE OPTION BOARD.


\*\* The Ground Trip (GFT) feature is not provided in products under 4.0 kW except for 4.0 kW 200 V and

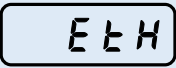
2.2 kW 200 V. An over current trip (OCT) or over voltage trip (OVT) may occur during low resistance grounding.

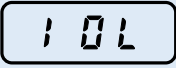
## 2.1.2 Troubleshooting Fault Trips


Refer to the following tables for solutions to fault trips or warnings.

Keypad Display		Type	Description
	Overload Trip	Latch	Occurs when the motor load exceeds the value that was set for the motor overload trip. Operation will resume after setting Pr.20 at a value other than 0.
Cause		Solution	
The load is greater than the motor's rated capacity.		Replace the motor and inverter with models that have increased capacity.	
The set value for the overload trip level (Pr.21) is too low.		Increase the set value for the overload trip level.	

Keypad Display		Type	Description
	Underload Trip	Latch	Occurs when the motor load is less than the value that was set for the motor underload level. Operation will resume after setting Pr.27 at a value other than 0.
Cause		Solution	
There is a motor-load connection problem.		Replace the motor and inverter with models with lower capacity.	
The set value for underload level (Pr.29, Pr.30) is less than the system's minimum load.		Reduce the set value for the underload level.	

Keypad Display		Type	Description
	Electric Thermal	Latch	Occurs depending on the inverse time (delay) to prevent overheat of the motor due to overload. Operation will resume after setting Pr.40 at a value other than 0.
Cause		Solution	
The motor has overheated.		Reduce the load or operation frequency.	
The inverter load is greater than the rated capacity.		Replace the inverter with a model that has increased capacity.	
The set value for electronic thermal protection is too low.		Set an appropriate electronic thermal prevention (ETH) level.	
The inverter has been operated at low speed for an extended duration.		Replace the motor with a model that supplies extra power to the cooling fan.	

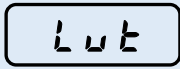
Keypad Display		Type	Description
	Inverter Overload Trip	Latch	It is an inverse time (delay) protective function to protect (prevent) the inverter from being overheated. Occurs when the output current is 150% of its rated current for 1 minute, and 200% for 4 seconds. The second condition (200%, 4 s) varies depending on the inverter capacity.
Cause		Solution	
The load is greater than the motor's rated capacity.		Replace the motor and inverter that has a bigger capacity.	
There is a fault with the output module (IGBT).		Refer to 3.1.4 Check Input/Output Module to identify the fault cause of the output module (IGBT). DO NOT operate the inverter. Contact the retailer or the LS ELECTRIC customer service center.	
The brake of the motor is too fast		Change the time interval of the brake	
The torque boost level is too high.		Reduce the torque boost level.	
Acc/Dec time is too short compared to the load inertia (GD2).		Increase Acc/Dec time.	
There is too much noise.		Decrease the carrier frequency value.	


Keypad Display		Type	Description
	Overcurrent Trip	Latch	Occurs when the Inverter output current exceeds 200% of the rated current
Cause		Solution	
Acc/Dec time is too short, compared to load inertia (GD2).		Increase Acc/Dec time.	
The inverter load is greater than the rated capacity.		Replace the inverter with a model that has increased capacity.	
The inverter supplied an output while the motor was idling.		Operate the inverter after the motor has stopped or use the speed search function (Cn.60).	
The mechanical brake of the motor is operating too fast.		Check the mechanical brake.	
A ground fault has occurred in the inverter output wiring.		Check the output wiring.	
There is a problem in the wiring between the inverter and the motor.		Check the output wiring as well as the recommended specifications of the wiring length, thickness, etc. Make sure that the total cable length between the inverter and the motor is less than 200m (50m for motors rated 3.7kW and lower).	
There is a fault with the output module (IGBT).		Refer to 3.1.4 Check Input/Output Module to identify the fault cause of the output module (IGBT). DO NOT operate the inverter. Contact the retailer or the LS ELECTRIC Customer Service Center..	


Keypad Display		Type	Description
	Overcurrent Trip2	Latch	Occurs when the DC circuit in the inverter detects an excessive short circuit current.
Problem		Solution	
Acc/Dec time is too short compared to the load inertia (GD2).		Increase Acc/Dec time.	
Output lead is short circuit.		Check the output wiring.	
There is a problem in the wiring between the inverter and the motor.		Check the output wiring as well as the recommended specifications of the wiring length, thickness, etc. Replace it if necessary.	
There is a fault with the output module (IGBT).		Refer to 3.1.4 Check Input/Output Module to identify the fault cause of the output module (IGBT). DO NOT operate the inverter. Contact the retailer or the LSIS Customer Service Center.	

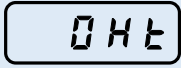
Keypad Display		Type	Description
	Ground fault Trip	Latch	Occurs when there is excessive current than the specific value due to a ground fault in the output. The ground fault detection current is different per inverter capacity.
Cause		Solution	
Ground fault occurred in the output lead.		Separate the output wiring and check whether the ground fault is present. Remove the ground fault.	
There is a problem in the wiring between the inverter and the motor.		Check the output wiring as well as the recommended specifications of the wiring length, thickness, etc. Replace it if necessary.	
The insulation of the motor is damaged.		Replace the motor.	

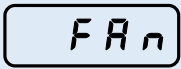
Keypad Display		Type	Description
	Overvoltage Trip	Latch	Occurs when voltage rate of the DC circuit is higher than the specific value.
Cause		Solution	
The input voltage is too high.		Determine if the input voltage is above the specified value.	
The actual DC link voltage is different from the value on the display.		Need to inspect the Hardware. Contact the retailer or the LSIS Customer Service Center.	
Deceleration time is too short for the load inertia (GD2).		Increase Acc/Dec time.	
There is a generative load at the inverter output.		Use the braking unit.	

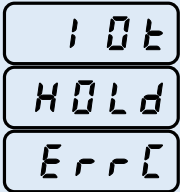
Keypad Display		Type	Description
	Low Voltage Trip	Level	Occurs when the DC circuit voltage is lower than the specified value.
Cause		Solution	
The input voltage is too low.		Determine if the input voltage is below the specified value.	
The actual DC link voltage is different from the value on the display.		Need to inspect the Hardware. Contact the retailer or the LS ELECTRIC Customer Service Center.	
There are blackout accidents.		Use speed search function (Cn.70).	
There is a problem with the input (R, S, T) wiring.		Rewire.	
The magnetic contactor connected to the power source has a faulty connection.		Replace the magnetic contactor.	
A load greater than the power capacity is connected to the system (e.g., a welder, direct motor connection, etc.).		Increase the power capacity.	

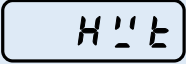
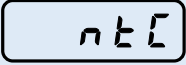
Keypad Display		Type	Description
	In Phase Open	Latch	Occurs when one of the three input phases is phase open. Operation will resume after setting Pr.05 bit 2 to 1.
Cause		Solution	
The magnetic contactor on the input side has a connection fault.		Check the magnetic contactor on the input side.	
The input wiring is faulty.		Check the input wiring.	
The DC link capacitor needs to be replaced.		Replace the DC link capacitor. Contact the retailer or the LS ELECTRIC customer service center.	

Keypad Display		Type	Description
	Out Phase Open	Latch	Occurs when one of the three output phases is phase open. Operation will resume after setting Pr.05 bit 1 to 1.
Cause		Solution	
There is a problem with the magnetic contactor in the output.		Check the magnetic contactor on the input side.	
The output wiring is faulty.		Check the output wiring.	

Keypad Display		Type	Description
	Overheat Trip	Latch	Occurs when the temperature of the heat sink exceeds the specific value.
Cause		Solution	
There is a problem with the cooling system.		Check whether there are any external substances (dust, etc.) in the air inlet, outlet or vent.	
The cooling fan has been operating for a long time		Change the cooling fan. (Refer to 3.1.5 Replace cooling fan)	
The ambient temperature is too high.		Keep the ambient temperature below 50°C.	

Keypad Display		Type	Description
	Fan Trip	Latch	Occurs when there is a problem with the cooling fan. Set Pr.79 to 0 to activate fan trip.
Cause		Solution	
There are external substances blocking the air vent.		Remove the external substances.	
The cooling fan needs to be replaced.		Change the cooling fan. (Refer to 3.1.5 Replace cooling fan)	

Keypad Display		Type	Description
	IO Board Trip	Latch	Occurs when the I/O Board or the communication card is not (or poorly) connected to the inverter.
Cause		Solution	
There is a communication problem with the loader that is connected to the inverter and the remote loader.		Check whether the communications line is properly connected.	

Keypad Display		Type	Description
	Hardware Trip	Fatal	Occurs when the inverter detects fault in the memory(EEPROM),analog-digital converter output( ADC Off set), CPU watchdog(Watch Dog-1, Watch Dog-2). - <b>EEP Err</b> : Problem with reading and writing parameters due to keypad or memory(EEPROM) fault. - <b>ADC Off Set</b> : Problem with the current detective devices (U/V/W terminal, current sensors, etc.)
	NTC Trip	Latch	Occurs when there is a problem with the thermal (detecting) sensors in IGBT.
Cause		Solution	
Hardware inspection is needed.		Contact the retailer or the LS ELECTRIC customer service center.	

## 2.2 Troubleshooting Other Faults

Refer to the following tables for solutions other than fault trips or warnings.

### Setting parameters is not working.

Problem	Solution
The inverter is operating (inverter mode).	Stop the inverter and change to program mode and set the parameters.
The parameter access level is incorrect.	Check the correct parameter access level and set the parameter.
The password is incorrect.	Check the password and disable the parameter lock by setting UL(unlock). Then set the parameter.
Low voltage is detected.	Check the power input to resolve the low voltage problem. Then set the parameter.

### The motor does not rotate.

Problem	Solution
The setting of the operation command source is incorrect.	Check the setting of the operation command source.
There is no power supplied to the R/S/T terminals.	Check the connections of R/S/T and U/V/W terminals.
The charge lamp is turned off.	Turn on the inverter.
The operation command (RUN) is off.	Turn on the operation command (RUN).
The motor is locked.	Unlock the motor or lower the load level.
The load is too high.	Operate the motor independently.
There is an input on the emergency stop signal.	Reset the emergency stop signal.
The wiring for the control circuit terminal is incorrect.	Check the wiring for the control circuit terminal.
The input option for the frequency command is incorrect.	Check the input option for the frequency command.
The input voltage or current for the frequency command is incorrect.	Check the input voltage and current for the frequency command.
The PNP/NPN mode is selected incorrectly.	Check the PNP/NPN mode.
The frequency command value is too low.	Check the frequency command value and set the command that is above minimum frequency.
The [STOP/RESET] was pressed.	The motor was stopped normally so run the inverter.
The motor torque is too low.	Change the operation modes (V/F, IM Sensorless). If the fault remains, replace the inverter that has bigger capacity.

**The motor rotates in the opposite direction to the command.**

Problem	Solution
The wiring of the motor output cable is incorrect.	Check whether the output side is wired correctly to the phase (U/V/W) of the motor.
The rotation signal connection between the control circuit terminal (forward/reverse rotation) and the forward/reverse rotation control panel is incorrect.	Check the forward/reverse rotation wiring.

**The motor only rotates in one direction.**

Problem	Solution
Reverse rotation prevention is selected.	Release/Remove the reverse rotation prevention setting and resume operation.
The reverse rotation signal is not input even though the 3-wire sequence was selected.	Check the input signal associated with the 3-wire operation.

**The motor is overheating.**

Problem	Solution
The load is too high.	Reduce the load. Increase the Acc/Dec time.
	Check the motor specifics and set to the correct values.
	Replace the motor and inverter appropriate to load capacity.
The ambient temperature of the motor is too high.	Lower the ambient temperature.
The phase-to-phase voltage of the motor is insufficient.	Use the motor that can withstand phase-to-phase voltage surges, greater than the maximum surge voltage.
	Only use motors suitable for inverter applications.
	Connect the AC reactor to the inverter output (Set the carrier frequency to 2kHz in code Cn.04).
The motor fan stopped. / The external substances are inside/blocking the fan.	Check the motor fan and remove any external substances (dust, debris, etc.).

**The motor stopped when accelerated or connected to load.**

Problem	Solution
The load is too high.	Reduce the load.
	Replace the motor and inverter appropriate to inverter capacity.

**The motor does not accelerate. / The acceleration time is too long.**

Problem	Solution
The frequency command is too low.	Change the setting accordingly.
The load is too high.	Reduce the load. Increase the acceleration time. Check the status of the mechanical brake.
The acceleration time is too long.	Change the setting accordingly.
The properties of the motor and inverter parameters are incorrect.	Change the parameters of the motor.
The stall prevention level during acceleration is low.	Change the stall prevention level.
The stall prevention level during operation is low.	Change the stall prevention level.
Starting torque is insufficient.	Change to vector control operation mode. If the fault still exists, replace the inverter that has a bigger capacity.

**Motor speed changes during operation.**

Problem	Solution
There is high variance in the load.	Replace the motor and inverter that has a bigger capacity.
The input voltage changes.	Reduce the input voltage variance (standard deviation).
The motor speed changes at a specific frequency.	Adjust the output frequency to avoid resonance.

**The motor rotation is different from the setting.**

Problem	Solution
The V/F pattern is set incorrectly.	Set a V/F pattern suitable for motor specification.

**The deceleration time is too long even with the Dynamic Breaking resistor connected to the motor.**

Problem	Solution
The deceleration time is set too long.	Change the setting accordingly.
The motor torque is insufficient.	If there is no problem with motor parameters, this is due to motor capacity. Replace the motor with a bigger capacity.
The load is higher than the internal torque limit (based on the rated current) of the inverter.	Replace the inverter with a bigger capacity.

**It is difficult to operate at under load applications.**

Problem	Solution
The carrier frequency is too high.	Reduce the carrier frequency in code Cn.04.
Inaccurate V/F value at low speed caused over-excitation.	Reduce the torque boost value to avoid over-excitation.

**The control unit is not working or noise is generated when the inverter is in operation.**

Problem	Solution
The switching inside the inverter caused noise.	Reduce the carrier frequency in code Cn.04.
	Install a micro surge filter in the inverter output.

**The earth leakage breaker is activated when the inverter is in operation.**

Problem	Solution
The earth leakage breaker is activated due to leaking current from the inverter.	Connect the inverter to the ground terminal.
	Check the ground resistance is less than 100 $\Omega$ for 200V and less than 10 $\Omega$ for 400V inverters.
	Check the capacity of the leakage breaker and connect properly based on the rated current of the inverter.
	Reduce the carrier frequency in code Cn.04.
	Make the cable length between the inverter and the motor as short as possible.

**The motor vibrates intensely and does not rotate normally.**

Problem	Solution
The phase-to-phase voltage of 3-phase power source is not balance.	Check the input voltage and stabilize the voltage.
	Check and test the insulation of the motor.

**The motor makes humming or loud noises.**

Problem	Solution
There is resonance between the motor's natural frequency and the carrier frequency.	Slightly change the carrier frequency in code Cn.04.
There is resonance between the motor's natural frequency and the inverter's output frequency.	Slightly increase or decrease the carrier frequency.
	Use the frequency jump function to avoid the frequency band where resonance occurs.

**The motor vibrates / hunts.**

Problem	Solution
The frequency input demand was externally set to analog command.	Change the input filter time constant ( <b>In.07</b> ) if there are interferences in the frequency command due to noise from the analog input side.
The wiring between the motor and inverter is too long.	Make sure that the total cable length between the inverter and the motor is less than 665ft (200m). (165ft (50m) for motors rated 4.0kW and lower).

**The motor does not stop completely when the inverter output stopped.**

Problem	Solution
The motor cannot decelerate sufficiently due to malfunction of the DC braking.	Adjust the DC braking parameter.
	Increase the set value for DC braking current.
	Increase the set value for the DC braking stopping time.
Free run stop was selected.	Change the stopping method to decelerating.

**The output frequency does not reach the target frequency.**

Problem	Solution
The target frequency is within the jump frequency range.	Set the target frequency higher than the jump frequency range.
The target frequency is higher than the upper limit of the frequency command.	Set the upper limit of the frequency command higher than the target frequency.
The stall prevention function is not working due to high load.	Replace the inverter with a bigger capacity.

**The cooling fan does not rotate.**

Problem	Solution
The control parameter for the cooling fan is set incorrectly.	Check the control parameter settings for the cooling fan.

# 3 Maintenance

This chapter covers regular inspections for different time periods, how to replace the cooling fan, and how to properly store and dispose Inverters. The surrounding environment highly affects the conditions of the inverters. Meaning, improper management will wear down the components and lead to malfunction. In order to prevent this from happening, please follow the recommended maintenance guidelines in this section.

## ⚠ Caution

- Read all safety instructions in this manual before inspecting the product.
- Make sure the power is off before cleaning the product.
- Clean the inverters with dry cloths. Using wet cloths, water, solvents, or detergents may lead to electric shock or damage to the product.

## 3.1 Regular Inspection List

### 3.1.1 Daily Inspections

Part	Category	Check points	Method	Standard	Equipment
All	Ambient environment	Is the ambient temperature and humidity appropriate within the range? Is there any dust or substances nearby?	Refer to 1.3 Installation & Wiring in the User Manual	Temperature: 10~40°C.  Humidity: Below 50%	Thermometer, hygrometer, recorder
	Complete Inverter	Is there any unusual vibration or noise?	Visual inspection	All clear	
	Power voltage	Are the input/output voltages in the normal range?	Voltage ratings between R/S/T phases in the inverter's terminal block	Refer to 11.1 Input and Output standards in the User Manual	Digital multimeter / Analog tester
Input/Output circuit	Smoothing capacitor	Is there any internal leakage?	Visual inspection	All clear	-
		Is the condenser swollen (change in shape)?			
Cooling system	Cooling fan	Is there any unusual vibration or noise?	Check by rotating the fan manually when the system is turned off	Rotate smoothly	-

Display	Measuring device	Is the display value normal?	Check the display value on the panel	Check the rated, managerial value	Voltmeter, ammeter, etc.
Motor	All	Is there any unusual vibration or noise?	Visual inspection	All clear	-
		Is there any unusual smell (odor)?	Check for overheat or damage		

### 3.1.2 Annual Inspections

Part	Category	Check points	Method	Standard	Equipment
Input/Output circuit	All	Megger test (between input/output terminals and earth terminal)	Disconnect the inverter wirings and short R/S/T/U/V/W terminals. Measure each terminal to the ground terminal using a Megger. (Refer to 3.1.4 Check Input/Output Module)	Above 5MΩ	DC 500V Megger
		Are there any loose parts in the device?	Tighten all screws	All clear	
		Are there any evidence of overheat?	Visual inspection		
	Conductor Connections /Cables	Are there any corroded cables?	Visual inspection	All clear	-
		Is there any damage on the wire clothing?			
	Terminal block	Is there any damage?	Visual inspection	All clear	-
	Smoothing condenser	Measure electrostatic capacity	Measure with capacity meter	Above 85% of the rated capacity	Capacity meter
	Relay	Is there any chattering noise during operation?	Visual inspection	All clear	-
Is there any damage on the contacts?		Visual inspection			

Part	Category	Check points	Method	Standard	Equipment
	Resistors	Is there any damage on the resistors?	Visual inspection	All clear	Digital multimeter / Analog tester
		Check disconnection	Remove one side and measure	Must be within $\pm 10\%$ of the rated resistance	
Control / Protection circuit	Check operation	Check imbalance of output voltage during operation	Measure voltage between output terminal U/V/W	Phase-to-phase voltage balance: Within 4V for 200V Within 8V for 400V	Digital multimeter / DC Voltmeter
		Is there any error in the display circuit after the sequence protection test?	Test inverter output protection at both short and open circuit conditions	Circuit must work according to the sequence	
Cooling system	Cooling fan	Are there any loose parts around the fan?	Tighten all screws	All clear	-
Display	Display device	Is the display value normal?	Check the command values on the display device	Specified values and manageable values must match	Voltmeter Ammeter

### 3.1.3 Bi-Annual Inspections

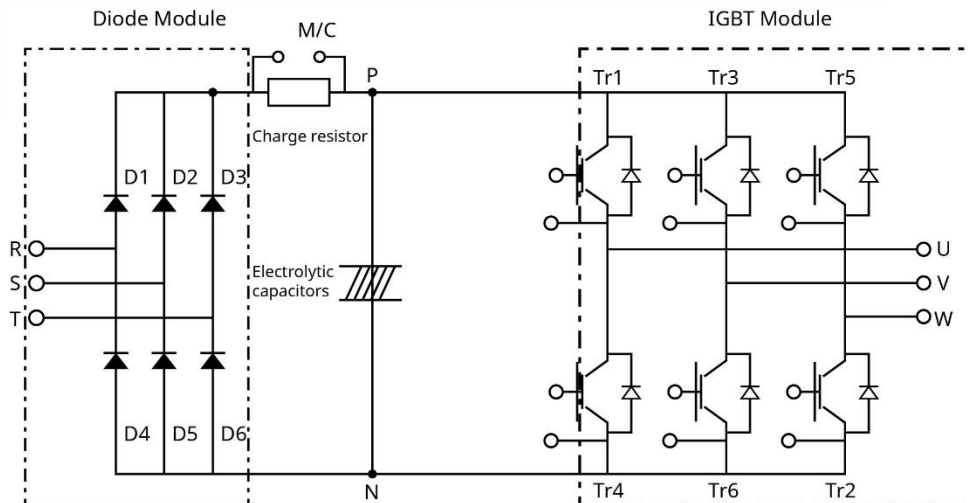
Part	Category	Check points	Method	Standard	Equipment
Motor	Insulation resistors	Megger test (between input/output terminals and earth terminal)	Disconnect the cables for terminals U/V/ W and test the wiring	Above 5M $\Omega$	DC 500V Megger

#### Caution

Do not run the Megger (Insulation Resistance Test) on the control circuit as it may lead to damage to the product.

### 3.1.4 Check Input/Output Module

#### How to check the diode module and IGBT module (0.4~7.5kW)



#### Testing method

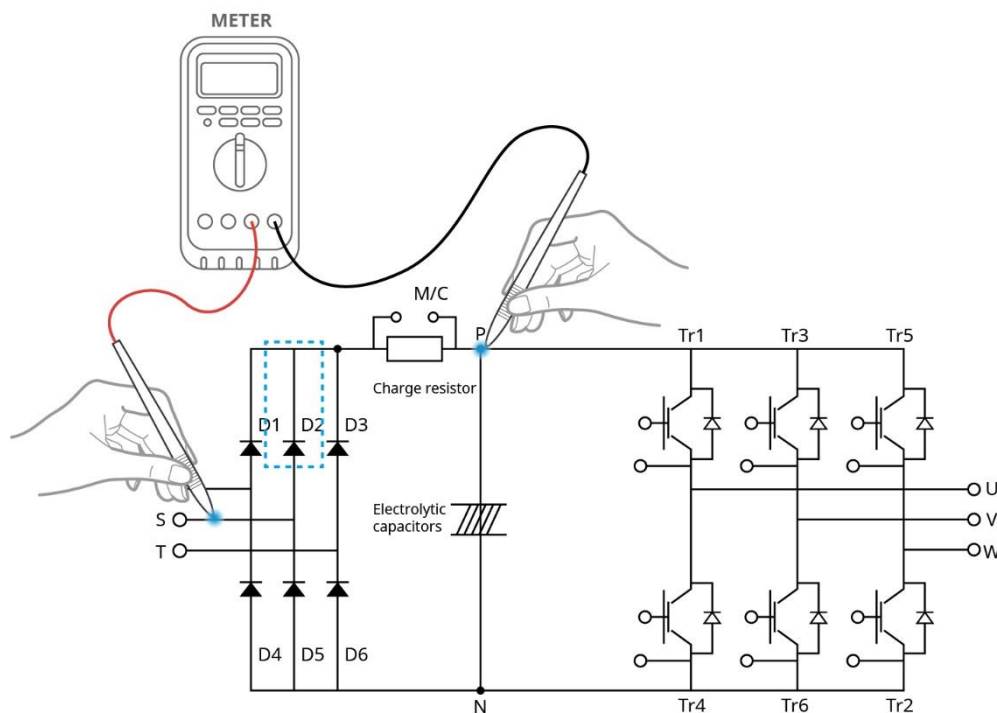
- 1) Disconnect all power cables (R,S,T) and motor output cables (U,V,W).
- 2) Before testing, check the discharge of electrolytic capacitor (DCP-DCN).
- 3) When the circuit is open, DMM will indicate high resistance (several MΩ). In some situations, the DMM may display a closed circuit (low resistance) and then show high resistance due to the capacitors. When the circuit is closed, the DMM shows resistance of several hundred kΩ or less.
- 4) Displayed values may not be constant as it depends on the module and tester type. The value measured between the phases is acceptable if the standard deviation is approximately  $\pm 10\%$ .

Module		Test Polarity		Check Value	Module		Test Polarity		Check Value
		+	-				+	-	
Diode	D1	R	P	Closed	D4	R	N	Open	
		P	R	Open		N	R	Closed	
	D2	S	P	Closed	D5	S	N	Open	
		P	S	Open		N	S	Closed	
	D3	T	P	Closed	D6	T	N	Open	
		P	T	Open		N	T	Closed	
IGBT	Tr1	U	P	Closed	Tr4	U	N	Open	
		P	U	Open		N	U	Closed	
	Tr3	V	P	Closed	Tr6	V	N	Open	
		P	V	Open		N	V	Closed	
	Tr5	W	P	Closed	Tr2	W	N	Open	
		P	W	Open		N	W	Closed	

## ■ Example) Checking diode module and IGBT module

### Checking Diode D2

- 1) Measure the resistance of D2 by placing the red lead (positive terminal of DMM) on S phase and the black lead (negative terminal of DMM) on P.
  - If the resistance indicated on DMM is several hundred k $\Omega$  or less, it is acceptable
- 2) Measure the resistance of D2 by placing the red lead from the positive terminal of DMM on P and the black lead from negative terminal of DMM on S phase.
  - If the resistance indicated on DMM is M $\Omega$ , it is acceptable.
- 3) Measure the resistance of other diodes in the same way.

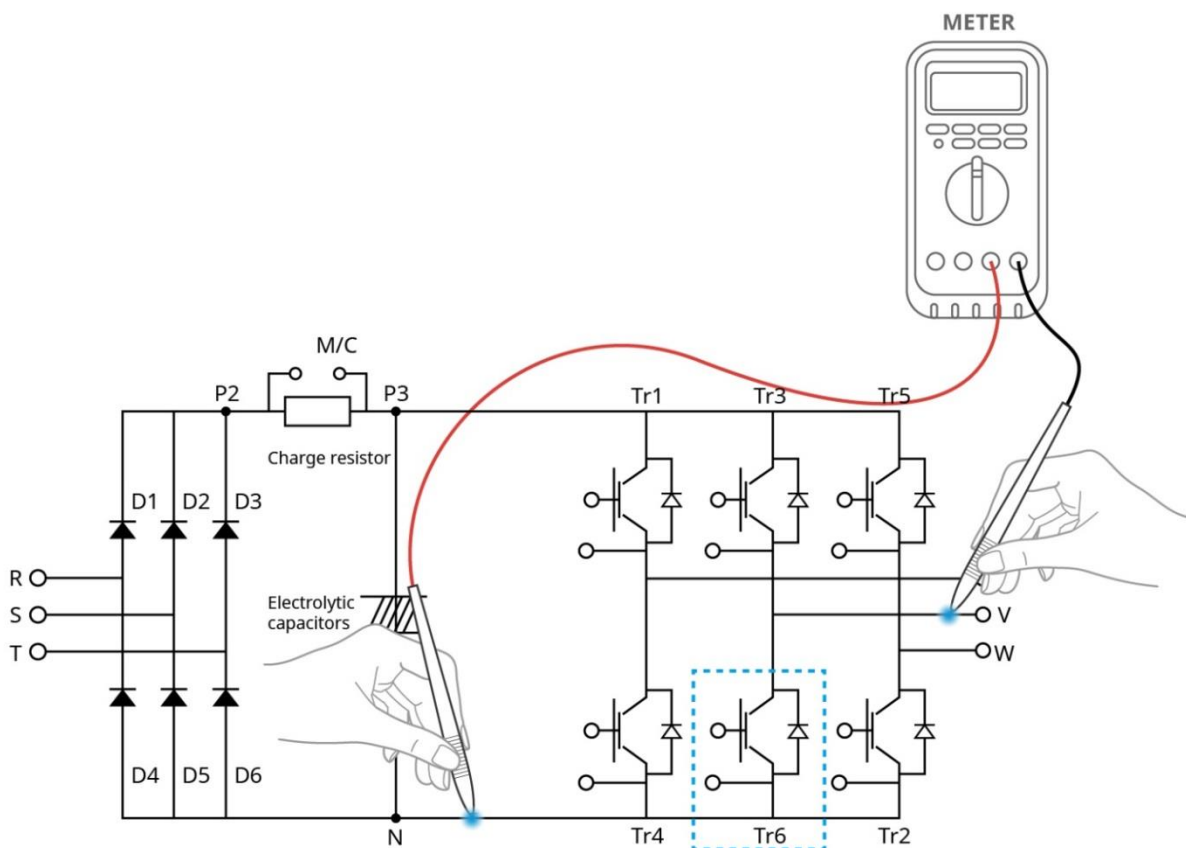


### ⚠ Caution

Before testing, check the discharge of electrolytic capacitor (DCP-DCN).

### Checking IGBT Tr6

- 1) Measure the resistance of Tr6 by placing the red lead (positive terminal of DMM) on N and the black lead (negative terminal of DMM) on V phase.
  - If the resistance indicated on DMM is several hundred  $k\Omega$  or less, it is acceptable.
- 2) Measure the resistance of Tr6 by placing the read lead (positive terminal of DMM) on V phase and the black lead (negative terminal of DMM) on N.
  - If the DMM indicates several  $M\Omega$ , it is acceptable.
- 3) Measure the resistance of other Tr in the same way.



#### ⚠ Caution

Before testing, check the discharge of electrolytic capacitor (DCP-DCN).

### 3.1.5 Replace Cooling Fan

If the inverter continued to operate after the cooling fan trip took place, a protective function will be activated due to overheat in the cooling fan. Increase in temperature may reduce the lifespan of major components. Make sure to solve the problem in the cooling fan before operating the inverter.

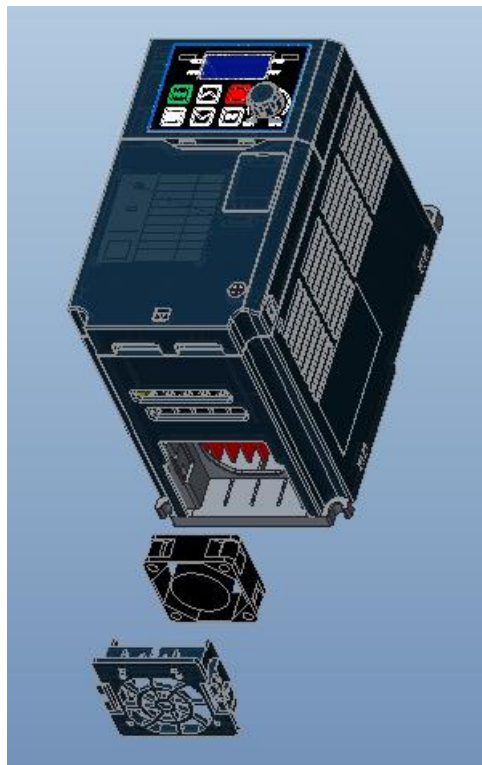
If the cooling fan has been operating longer than its (optimal) replacement period, this may lead to low performance of the inverter or the cause of inverter failure. The replacement period of the cooling fans is 3 years. Replace the old cooling fans with the new one.

The instruction replacing the cooling fan is categorized by capacity as shown in the table below.

Capacity
0.4~4.0 kW
5.5~7.5 kW

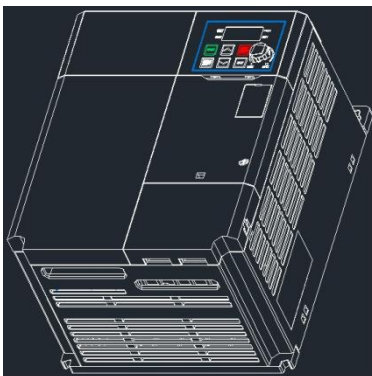
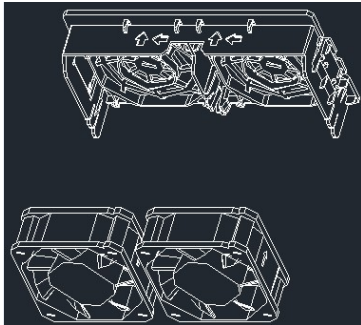
#### Replacement of 0.4kW~4kW

- 1) Remove the fan cover by pressing the hook located by the arrow.
- 2) Disconnect the fan wire and remove the fan from the inverter.



**Replacement of 5.5~22kW**

- 1) Remove the fan cover by pressing the hook located by the arrow.
- 2) Disconnect the fan wire and remove the fan from the inverter.

**⚠ Caution**

- Turn off the inverter before replacing the fan. There is a possibility of an electric shock due to the charge voltage. Wait until the inverter is fully discharged to replace the fan. (The time to discharge varies per capacity, in average 1~3 minutes after turning off the inverter).
- Make sure the fan wire and connect is not touching the blades. If touched it leads to malfunction of the inverter. Make sure the inverter is completely turned off before cleaning.
- After replacing the fan, assemble the fan. Before using the inverter, turn on the inverter and check the condition of the fan by its motion.
- Be careful of the direction of the fan.

## 3.2 Storage and Disposal

### 3.2.1 Storage

Store the products in the following conditions listed below (if not used for a long period of time).

- Store the product in the same appropriate environmental conditions as in operation.
- If the product will be stored more than 3 months, keep the ambient temperature between -10°C~30°C to prevent degradation of the electrolytic capacitor.
- The products should not be exposed to snow, rain, fog and dust.
- When packing the inverter, include a dehumidifier (e.g. silica gel) to keep the ambient temperature inside the package below 70% and prevent in contact with moisture.
- If the products will be left in a humid or dusty environment (construction sites or control panel) separate the products in a location that has the same appropriate environmental conditions as in operation.

### 3.2.2 Disposal

Categorize the inverters as general industrial waste when disposing the product. Note that there are recyclable raw materials in the product, such as packing materials and metalwork. For the sake of conservation of energy and resources, recycle whenever possible. Depending on the country, plastic may be recyclable. Please check the local environmental regulations for more details.

#### Caution

Capacitors lose their charging characteristics if not operated for a long time. In order to prevent this from happening, turn on the product and allow the device to operate for 30~60 minutes once a year. Note that operation should be conducted under no-load conditions.