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AC Variable Speed Drive

LSLV-iV5L series

User's Manual

5.5-22kW [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 ELECTRIC

This operation manual is intended for users with general knowledge of electrical theory and installation. Ensure that the end user and the maintenance technician receive this user manual.
* LSLV-iV5L is the official name for the iV5L series of inverters.

Before installing and using the LSLV-iV5L series inverter, carefully read this manual to understand the inverter's features and to learn the essential information required to properly install and operate the inverter. **User manuals for optional add-on boards**

The following is a list of user manuals that are supplied with the corresponding add-on boards. These optional add-on boards are compatible with the SV-iV5 and the LSLV-iV5L series products. You can download the PDF versions of these user manuals by visiting www.lselectric.co.kr (go to [Customer support]–[Download center]).

• iV5 EL (Elevevator) I/O option board User Manual (English)
• iV5 Sin/Cos Encoder option board User Manual (English)
• iV5 Sin/Cos EnDat encoder option board User Manual (English)

After reading this manual, store it in a location accessible to users at any time.

Safety information

Read and follow all safety instructions in this manual 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 which, if not avoided, could result in minor injury or property damage.

Safety information

⚠ Danger

- Do not open the equipment cover while it is on or operating. Likewise, do not operate the inverter while the cover is open. Contact with high voltage terminals or the charging area may result in an electric shock. Do not remove any covers or touch the printed circuit boards (PCBs) or electrical contacts when the power is on or during operation. Doing so may result in serious injury, death, or serious property damage.
- Do not open the equipment cover 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 result in an electric shock even when the power supply is off.
- The equipment may store a charge after the power supply has been turned off. Use a multimeter to make sure that there is no voltage present before working on the inverter, motor, or output cables.
- Supply earthing system: TT, TN not suitable for corner-earthed systems

- Wait at least 10 minutes before opening the covers and exposing the terminal connections. Before starting work on the inverter, test the connections to ensure all DC voltage has been fully discharged. Personal injury or death by electric shock may result.

⚠ Warning

- Do not install this equipment on or near combustible material. Doing so may cause a fire.
- This equipment must be electrically grounded for safe and proper operation.
- Do not use or supply power to a faulty inverter. If the inverter is faulty, disconnect the power supply and arrange for qualified technical support.
- The inverter will become hot during normal operation. To avoid burns, do not touch the inverter until it has cooled.
- Do not allow foreign objects, such as screws, metal filings, debris, water, or oil to enter the inverter. Foreign objects inside the inverter may cause the inverter to malfunction or result in a fire.
- Do not touch the inverter with wet hands. Doing so may result in electric shock.

⚠ Caution

- Do not modify the inverter. Doing so will void the warranty.
- The inverter is designed to operate 3-phase motors. Do not use the inverter to operate single phase motors.
- Do not place heavy objects on top of electric cables. Doing so may damage the cable and result in electric shock.

Note

The maximum allowable prospective short-circuit current at the inverter's input connection is specified in IEC 60439-1 as 100 kA. The drive is rated for a power supply capable of delivering up to 100 kA RMS at the drive's maximum rated voltage.

Table of contents

About the LSLV-iV5L inverter series

This instruction manual includes information required to perform installation, test run, and basic operation of the LSLV-iV5L inverter. The LSLV-iV5L inverter provides precision vector control of motor speed and torque while driving 3-phase induction and synchronous motors.

Main features

The following are the main features of the LSLV-iV5L inverter series:

- IGBT type inverter, a speed sensor (encoder) can be installed for vector control

- Open-loop speed control (V/F, slip compensation mode)

- Closed-loop speed control (synchronized speed mode)

- Error detection for hardware or software encoder

- Power system redundancy and emergency backup power

- Designed specifically for load lifting applications (elevators)

1 Preparing the installation

This chapter provides details about product identification, part names, correct installation procedures, and cable specifications. To install the inverter correctly and safely, carefully read and follow these instructions.

⊙ Caution

To safely transport the inverter for installation:

- Do not stack product packages in excess of allowed weight, or allowed number of layers.
- Do not open the packaging during transportation.

1.1 Product identification

The LSLV-iV5L inverter comes from a product range suitable for various drive capacities and power supplies. Each model in the range has its specifications detailed on the rating plate. Check the rating plate before installing the product to ensure that the product meets your requirements. For more detailed product specifications, refer to *8.1 Input and output specifications* on page *169.*

Note

Check the product name, open the packaging, and then confirm that the product is free from defects. Contact your supplier if you have any questions about your product.
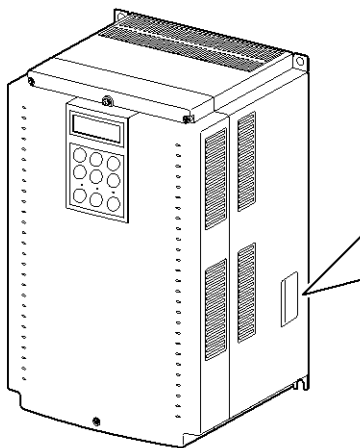
LSLV⬜⬜⬜⬜iV5L-4CNNN

INPUT	380-480V	3 Phase
	16A	50/60Hz
OUTPUT	0-Input V	3 Phase
	⬜⬜A	0-3600 rpm
	⬜⬜HP / ⬜⬜kW (D)	
	Ser. NO 550⬜⬜⬜⬜⬜⬜⬜	

Inspected by H.S.LEE
KCC-REM-LSR-XXXXXXX

LSis — Made in KOREA

- Model name
- Power source specifications
- Output specifications
- Rated output current and operation frequency
- Output capacity
- Serial number

LSLV⬜⬜⬜⬜ iV5L - 4CNNN

Motor capacity

0055 - 5.5kW
0075 - 7.5kW
0110 - 11kW
0150 - 15kW
0185 - 18.5kW
0220 - 22kW

Series name

Input voltage
4 - 3-phase 400V

Keypad type
C - LCD Keypad

UL type
N - Non UL Type

EMC filter
F - Built-in EMC
N - Non EMC

Reactor
D - Biilt-in DCL
N - Non DCL

1.2 Part names

The diagram below displays names for the inverter's parts. Details may vary between inverter models.

Keypad

Front cover

Control terminal block

Cable guide

Cooling fan

Bottom view
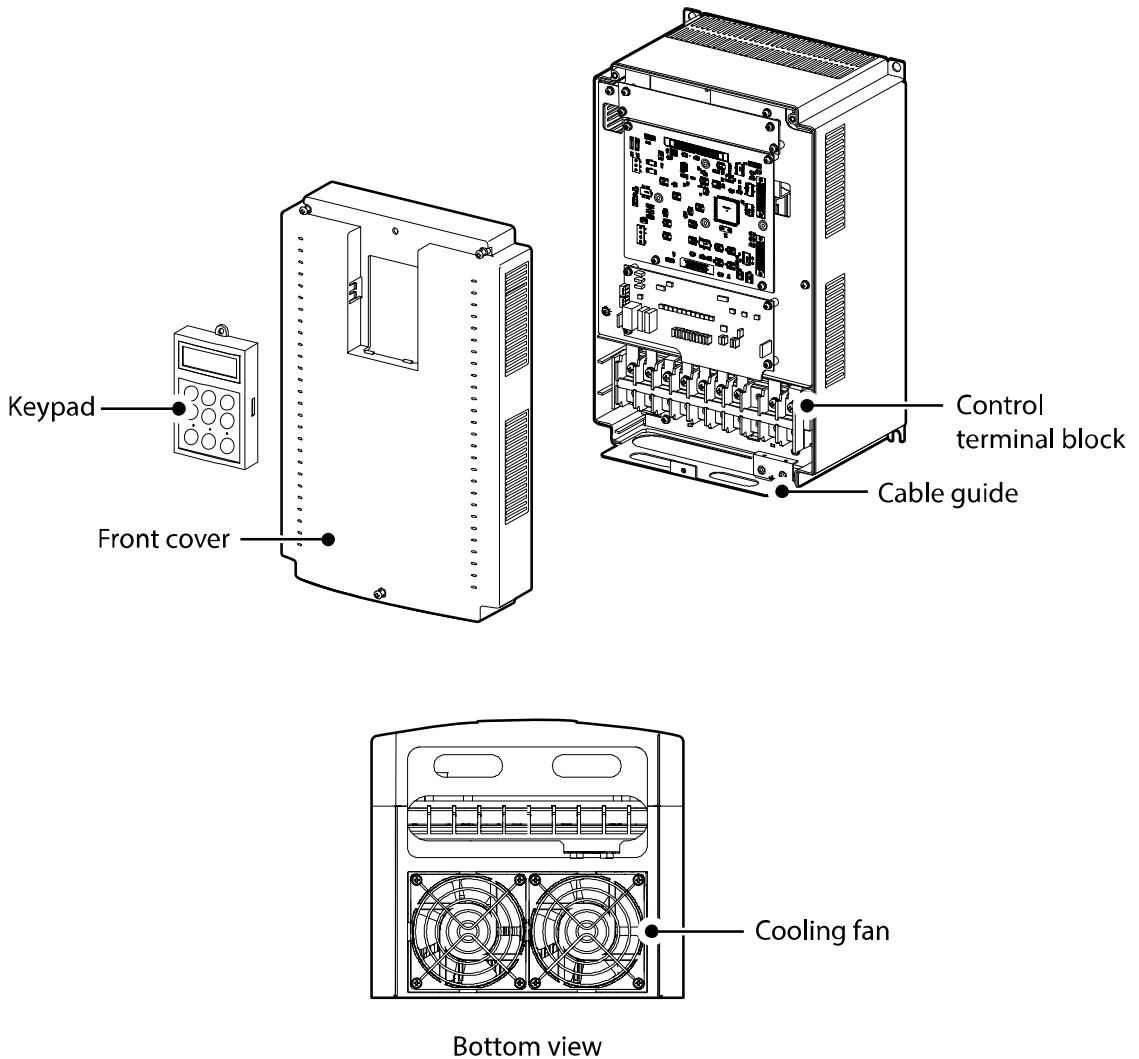
1.3 Installation considerations

Inverters contain various precision, electronic components. The installation environment can significantly impact the lifespan and reliability of the product. The table below details the ideal operation and installation conditions for the inverter.

Item	Description
Ambient humidity	90% relative humidity (no condensation)
Storage temperature	- 4–149 °F (-20–65℃)
Environmental factors	An environment free from corrosive or flammable gases, oil residue, and dust.
Altitude/vibration	Less than 3,280 ft (1,000 m) above sea level / less than 0.6 G (5.9 m/sec2)
Air pressure	70 –106 kPa

* The ambient temperature is measured at a point 2″ (50 mm) from the surface of the inverter.

Min.
2″
(50 mm)

Min.
2″
(50 mm)
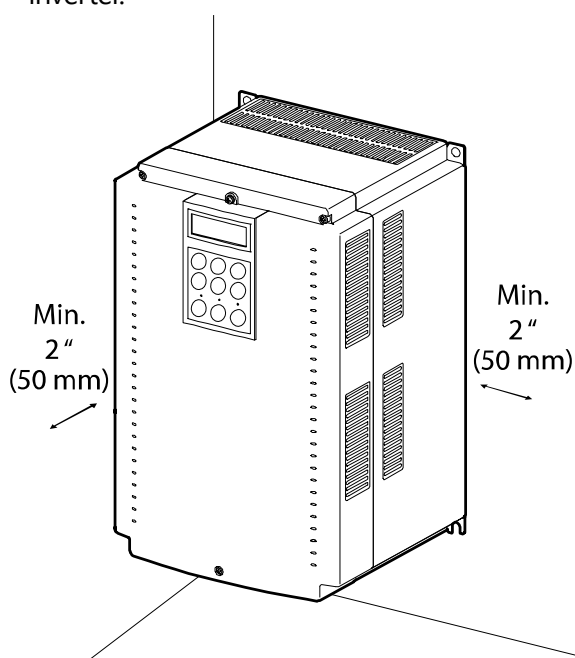
⊙ Caution

Do not allow the ambient temperature to exceed the allowable range while operating the

inverter.

1.4 Selecting and preparing a site for installation

When selecting an installation location consider the following points:

- The inverter must be installed on a wall that can support the inverter's weight.
- The location must be free from vibration. Vibration can adversely affect the operation of the inverter.
- Do not install the inverter in a location exposed to direct sunlight, high temperature, or high humidity.
- Do not install the inverter near oil residue, flammable gas, or dust. Install the inverter in a clean location or inside an equipment cabinet. The air flow must be clean and free of conductive dust.
- The inverter can become very hot during operation. Install the inverter on a surface that is fire-resistant or flame-retardant and with sufficient clearance around the inverter to allow air to circulate. The illustrations below detail the minimum installation clearances.

Min.
2″ (50 mm)

Min.
2″ (50 mm)

Min. 2″ (50 mm)

Plan view

Min. 4″ (100 mm)

Min. 4″ (100 mm)
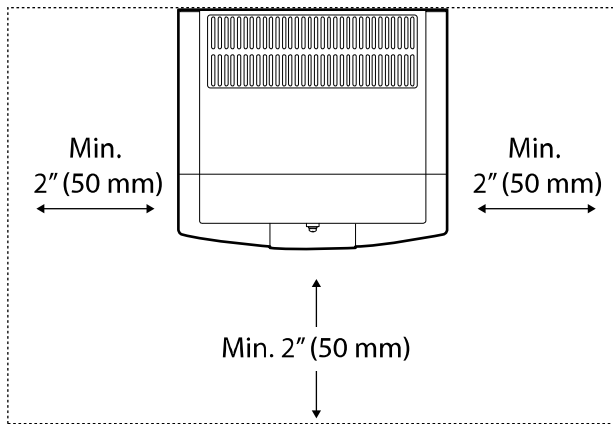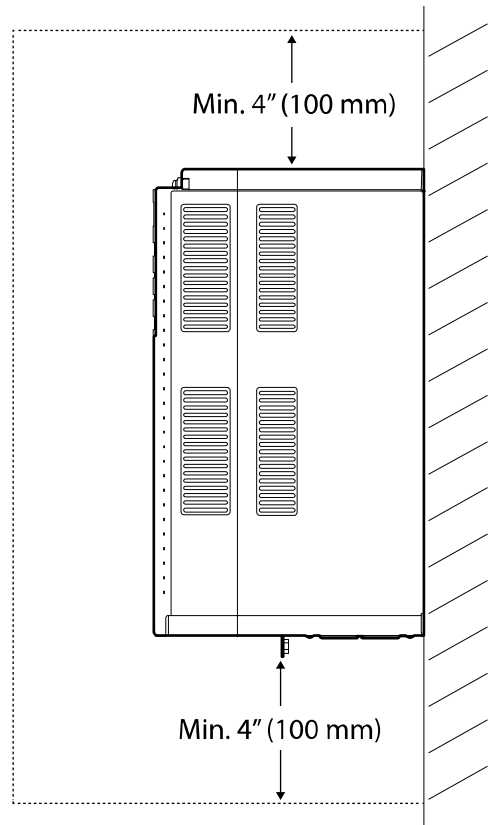
Side elevation

- Ensure sufficient air circulation is provided around the inverter when it is installed. If the inverter is to be installed inside a cabinet, enclosure, or equipment rack, allow for the position of the inverter's cooling fan and the ventilation grilles. The cooling fan must be positioned to efficiently transfer the heat generated by the inverter's operation.
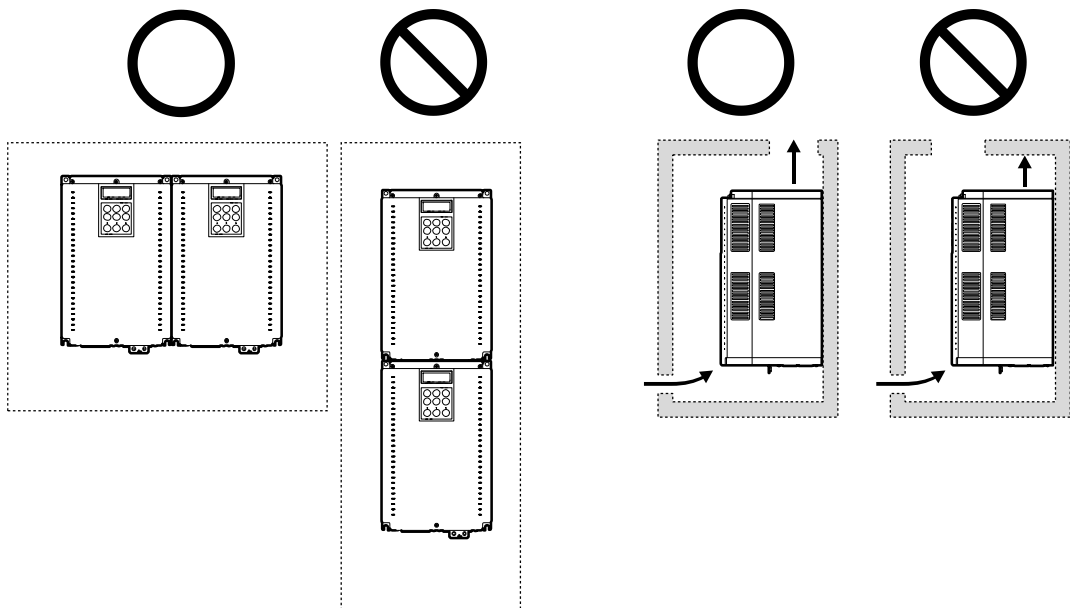
⚠ Caution

- Do not expose the inverter to rain, snow, fog, or dust.
- Do not block the inverter's air vents. Doing so may cause the inverter to overheat.

- If you are installing multiple inverters in one location, arrange them side-by-side.
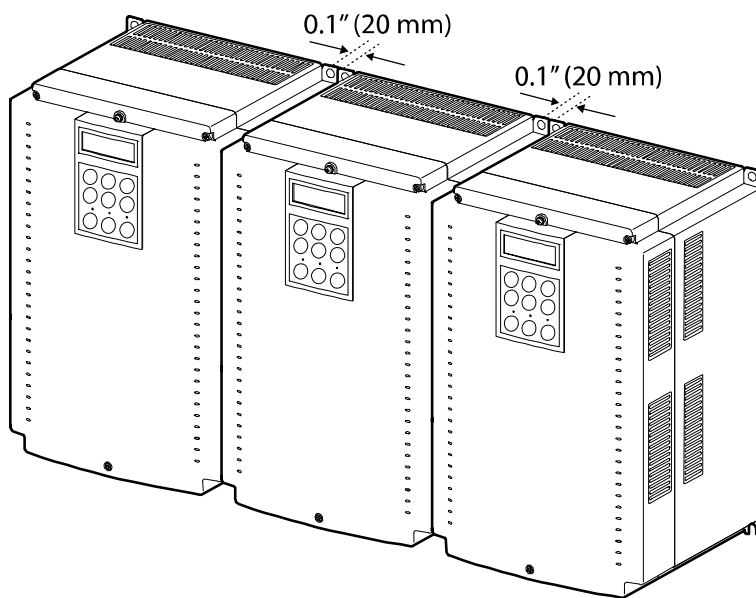
- If you are installing multiple inverters of different ratings, provide sufficient clearance to meet the clearance specifications for the inverter with the highest rating.

Min. 4″ (100 mm)

Min. 2″ (50 mm)

Min. 2″ (50 mm)

Min 4″ (100 mm)
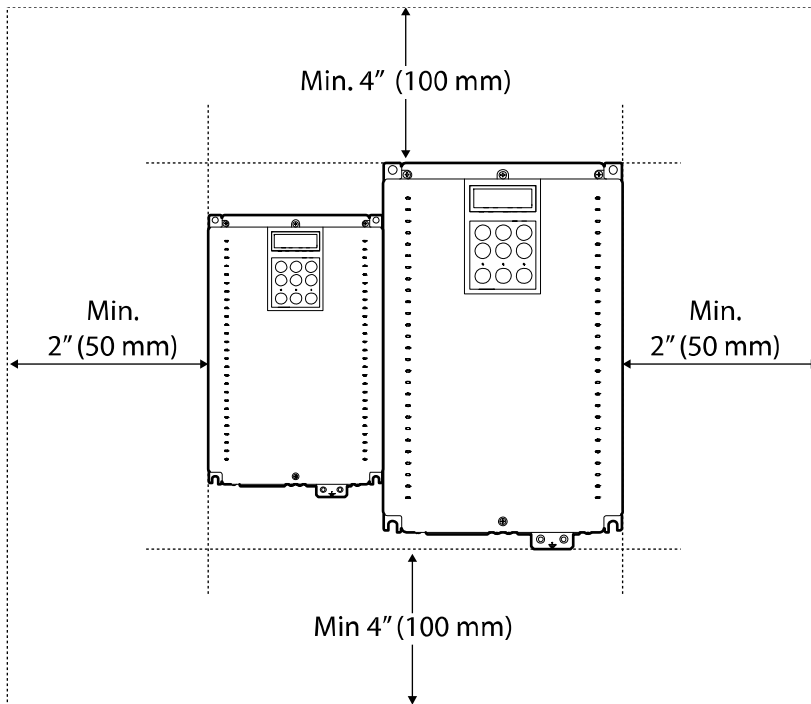
1.5 Cable selection

When you install power and control cables for the inverter, use cables that meet the required specifications for the safe and reliable operation of the product. Refer to the following information to assist you with cable selection.

⚠ Caution

- Use mains power cables with sufficient cross-sectional area to prevent voltage drop exceeding 2%.
- Use copper cables rated at 600 V, 75 ℃ for mains power wiring.
- Use copper cables rated at 300 V, 75 ℃ for control circuit wiring.
- The inverters in the range between 5,5kW and 22kW must be grounded with industrial connector according to IEC 60309.
- The minimum size of the protective earthing conductor shall comply with the local safety regulations for high protective earthing conductor current equipment.
- Only one conductor per terminal should be simultaneously connected
- The accessible connections and parts listed below are of protective class 0. It means that the protection of these circuits relies only upon basic insulation and becomes hazardous in the event of a failure of the basic insulation. Therefore, devices connected to these circuits must provide electrical-shock protection as if the device was connected to supply mains voltage. In addition, during installation these parts must be considered, in relation with electrical-shock, as supply mains voltage circuits.

  [Class 0 circuits]

  ➔ RUN/STOP COMMAND : FX, RX, BX, RST, CM

  ➔ MULTI FUNCTION INPUT : P1-P7, CM

  ➔ ANALOG INPUT : AI1, AI2, AI3

  ➔ ANALOG OUTPUT : AO1, AO2

- CONTACT : OC1, EG, A1, B1, A2, B2, 30A, 30B, 30C

Ground and power cable specifications

Load (kW)	Ground cable	Power cables (input and output)			
	mm²	mm²		AWG	
		R/S/T	U/V/W	R/S/T	U/V/W

Load (kW)		Ground cable	Power cables (input and output)			
3-Phase 400 V	5.5	4	4	4	10	10
	7.5		4	4	10	10
	11	10	6	6	8	8
	15		10	10	6	6
	18.5	16	16	16	4	4
	22		16	16	4	4

Control cable specifications

Cross-sectional area/diameter	
mm²	AWG
0.2-0.8	18–26

* Use STP (Shielded Twisted Pair) cables for control wiring.

2 Installing the inverter

This chapter describes the physical and electrical installation of the iV5 inverter, including mounting and wiring the product. Refer to the flowchart and the basic configuration diagram provided below to understand the procedures and installation instructions to be followed to install the product correctly.

Installation flowchart

The following flowchart lists the installation sequence. The steps cover equipment installation and testing. More information about each step is referenced in the steps.

Select and identify an appropriate inverter (*p. 1*)

Select an installation location (*p. 4*)

Mount the inverter (*p. 15*)

Connect the ground cable (*p. 22*)

Connect the mains power and control cables (*p. 23*)

Perform post-installation checks (*p.41*)

Start up the inverter

Configure inverter parameters (*p. 59*)

Test the inverter (*p. 50*)
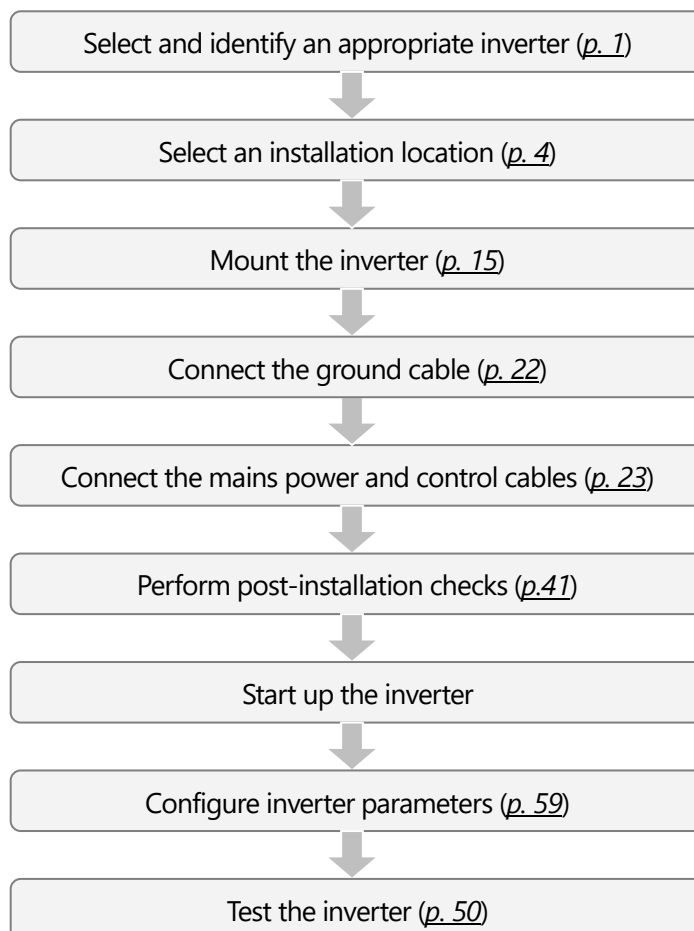
⊘ Caution

Synchronous motors may not operate properly without a parameter tuning (pole position estimation, especially).

Basic configuration diagram

The reference diagram below shows the configuration for a typical system including the inverter and peripheral devices.

Before installing the inverter, ensure that the product is suitable for the application (power rating, capacity, etc). Ensure that all of the required peripherals and optional devices (resistor brakes, contactors, noise filters, etc.) are available. For more details on peripheral devices, refer to *8.4 Peripheral devices* on page *174*.
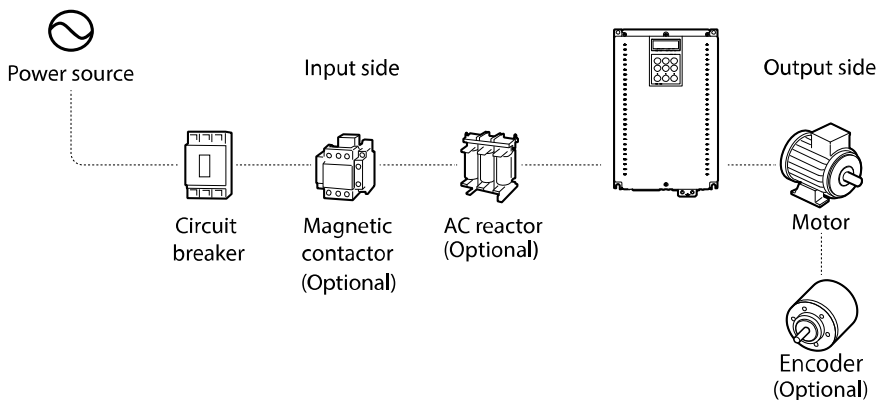
⊘ Caution

- Diagrams in the manual are sometimes drawn with covers or circuit breakers removed to show a more detailed view of the installation arrangements. Ensure that all covers and circuit breakers are installed before operating the inverter.
- Do not use the magnetic contactor on the input side of the inverter to start or stop the inverter.
- Install an additional safety device, such as an emergency brake to prevent the inverter losing control if it is damaged.
- Install a separate emergency stop switch. The STOP key on the keypad works only when the keypad is connected to the inverter.
- When the inverter powers up, high levels of current are present that can affect the circuit. Ensure that correctly rated circuit breakers are installed to operate the circuit safely while the inverter powers up.

- Reactors can be installed to improve power factor. If the input power exceeds 600 kVA, reactors can be installed within 32.8 ft (10 m) of the power supply. Refer to *8.5 Fuse and reactor specifications* on page *175* and ensure that reactors meet the specifications.

2.1 Mounting the inverter

Follow the procedures below when mounting the inverter on a wall or inside an equipment cabinet. Before installing the inverter, ensure that the space meets the clearance specifications and that there are no obstacles that will restrict air flow.

Select a wall or equipment cabinet suitable to support the inverter. Refer to *8.3 External dimensions* on page *173* and confirm the dimensions for the mounting holes.

1 Identify the position where the inverter will be mounted and then use a pencil to mark the top of the inverter.

2 Use a spirit level and draw a horizontal line on the mounting surface at the pencil mark. Mark the two top mounting points on the line.

3 Measure down the mounting surface to the position of the lower mounting points. Use the spirit level again and draw another horizontal line on the mounting surface. Mark the two lower mounting points on the line.

4 Drill holes for the two upper and two lower mounting points. If fixing is not available, insert wall anchors into the four holes. Insert and start to tighten the two lower mounting bolts. Do not fully tighten the bolts at this time.

5 Mount the inverter on the two lower bolts and then fully tighten them.
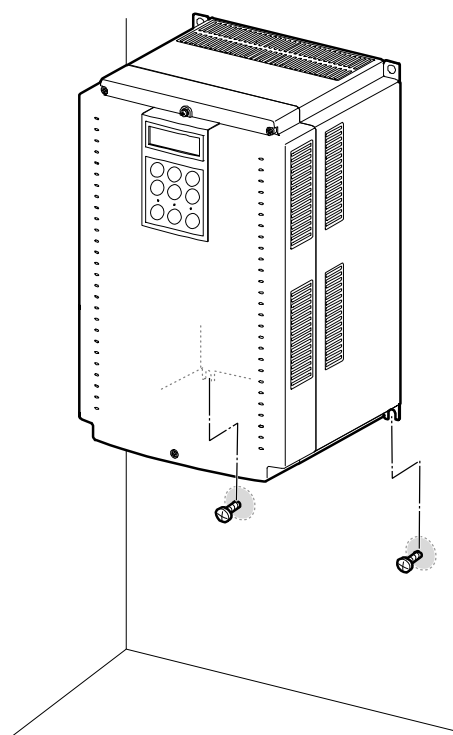
6 Use one hand to support the inverter against the mounting surface and insert and tighten one of the upper mounting bolts. Then, insert and tighten the other upper mounting bolt.
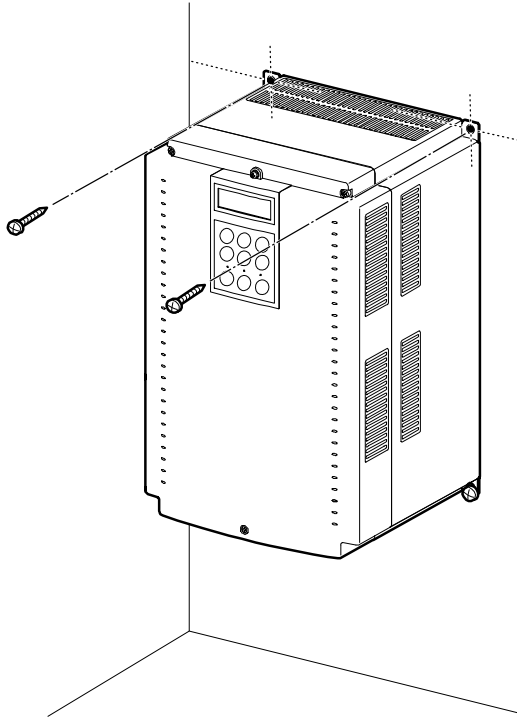
ⓘ Caution

• Do not expose the inverter to rain, snow, fog, or dust.
• Do not block the inverter's air vents. Doing so may cause the inverter to overheat.

> ⚠ Caution
>
> - Do not use the covers or plastic fittings on the outside of the inverter to lift the inverter. If the cover or plastic fitting breaks, the inverter may drop and cause injury or damage. Always use appropriate lifting devices when moving the inverter.
> - Inverter equipment can be heavy and bulky. Use appropriately rated equipment to lift and transport the inverter.
> - Do not install the inverter on the floor, or mount it sideways. The inverter must be installed vertically on a wall or inside a cabinet, with its rear side flat against the mounting surface. Mount the inverter upright on a wall and secure it using bolts to ensure that it does not move.
>
>
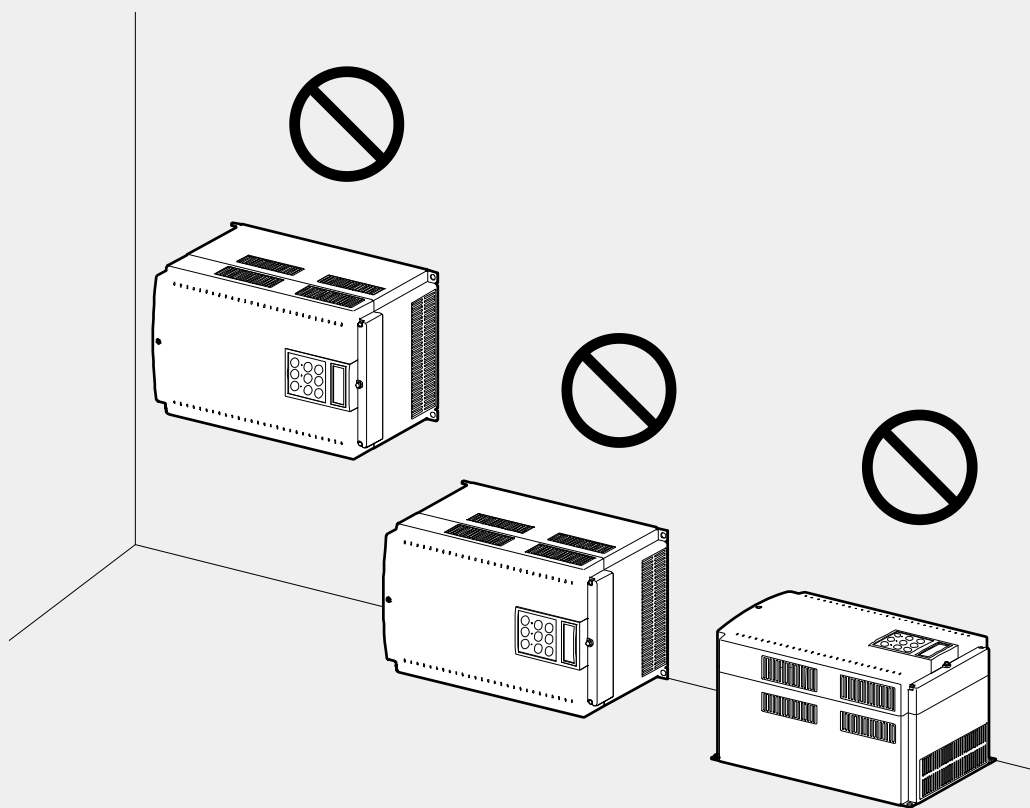
2.2 Cable connections

Open the front cover and connect the ground cable. Connect appropriately rated cables to the power and control terminal blocks.

Read the following information carefully before making cable connections. All warning instructions must be followed.

⚠ Warning

- All cables must be installed by certified technicians.
- Do not modify cable connections, or install/uninstall optional add-on boards while the inverter is operating.

⊘ Caution

- Mount the inverter before connecting cables. Before installation, ensure that the inverter is not connected to a power source.
- Use cables of specified ratings or higher and run the cables according to the recommended cable length. Using inferior cables may result in fire or electric shock.
- Ensure no metal debris, such as wire offcuts, remain inside the inverter. Metal debris in the inverter may cause inverter failure.
- Tighten terminal screws to their specified torque. Loose terminal screws may result in cable disconnection, cause a short circuit, or inverter failure. Refer to page _175_.
- Do not place heavy objects on top of electric cables. Heavy objects may damage the cable and result in electric shock.
- Install a reactor if the input voltage to the inverter produces imbalance between the phases. High frequency emission from the inverter's power source may overheat and damage phase advance capacitors or alternators.
- Use mains power cables with sufficient cross-sectional area to prevent voltage drop exceeding 2%.
- Use copper cables rated at 600 V, 167°F (75°C) for mains power wiring.
- Use copper cables rated at 300 V, 167°F (75°C) for control circuit wiring.
- If cable connections are worked on after the inverter is installed, ensure the inverter keypad display and the charge lamp under the terminal cover is turned off before commencing work. The inverter may store an electric charge after the power supply has been turned off.

Note

Do not disconnect the motor cable while the inverter output is alive. Improper cable disconnection may lead to product damage.

Step 1 Front cover

The front cover must be removed to access the cable connections. Refer to the following procedures to remove the front cover. The steps to remove the cover may vary depending on the inverter model.

1 Loosen the keypad screw and the three front cover screws. Remove the keypad and cover by pulling it away from the inverter.
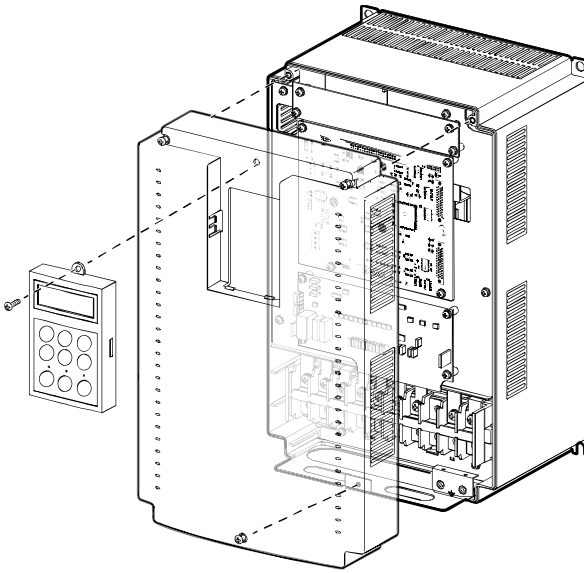
2 Follow the instructions that follow when connecting the grounding, mains power, and control cables to the terminal blocks. For cable specifications, refer to *1.5 Cable selection* on page *10*.

Step 2 Ground connection

Remove the front cover. Then, follow the instructions below to connect the inverter's ground cable.

1   Locate the ground terminal and connect an appropriately rated ground cable to the terminals. Refer to *1.5 Cable selection* on page *10* to determine the correct grounding cable for your installation.

Note

- Connect the ground cables to the ground terminals. Do not connect the ground cables to the inverter's case bolts.
- Use cables with as large cross-sectional area as possible for grounding. Ground cables must meet or exceed the specifications listed in the *1.5 Cable selection* on page *10*. Keep the ground cable as short as possible and ground termination as close as possible to the inverter.

5.5–7.5 kW (3-Phase)
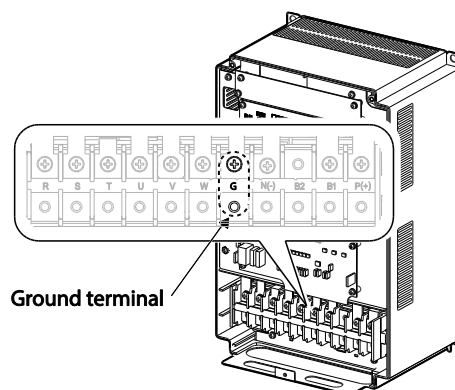
Ground terminals

11–22 kW (3-Phase)
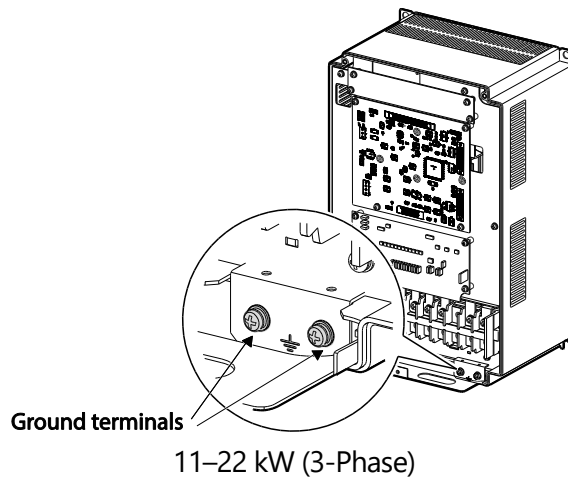
2 Connect the other end of all ground cables to an earth (ground) terminal.

Note

The product requires Class 1 grounding. Resistance to ground must be ≤ 10 Ω.

⚠ Warning

- Install ground connections for the inverter and the motor in accordance with the local codes and specifications to ensure safe and accurate operation. Using the inverter and the motor without the specified grounding connections may result in electric shock.
- This product can cause a D.C current in the protective earthing condcutor. If a RCD or monitoring (RCM) device is used for protection, only RCD or RCM of Type B is allowed on supply side of this product.

Step 3 Power terminal wiring

The following diagram shows the terminal layout on the power terminal block. Refer to the detailed descriptions to understand the function and location of each terminal before making wiring connections. Ensure that the cables selected meet or exceed the specifications in *1.5 Cable selection* on page *10* before installing them.

🛈 Caution

- Tighten the terminal screws to the rated torque. Loose or over tightened terminal screws may cause short circuits and equipment malfunction.

Installation

- Use copper stranded cables only. Power cables must be rated at 600 V, 167°F (75℃) and control circuit cables rated at 300 V, 167°F (75℃).
- For the inverter control circuit, use STP (Shielded Twisted Pair) cables. Do not route the control cables in the same conduit where the power cables are routed.
- Incoming power cables must be connected to the R, S, and T terminals. Connecting incoming power cables to other terminals will cause internal damage to the inverter. Motor cables must be connected to the U, V, and W terminals. The correct phase rotation is not necessary.
- Do not install phase advance capacitors in the inverter output and uninstall them if they had been previously installed. Phase advance capacitors in the inverter output causes inverter overcurrent fault trip.
- B1 and B2 terminals on the main terminals block are for connecting braking resistors only. Do not connect any other device to these terminals.

5.5–7.5 kW (3-Phase)
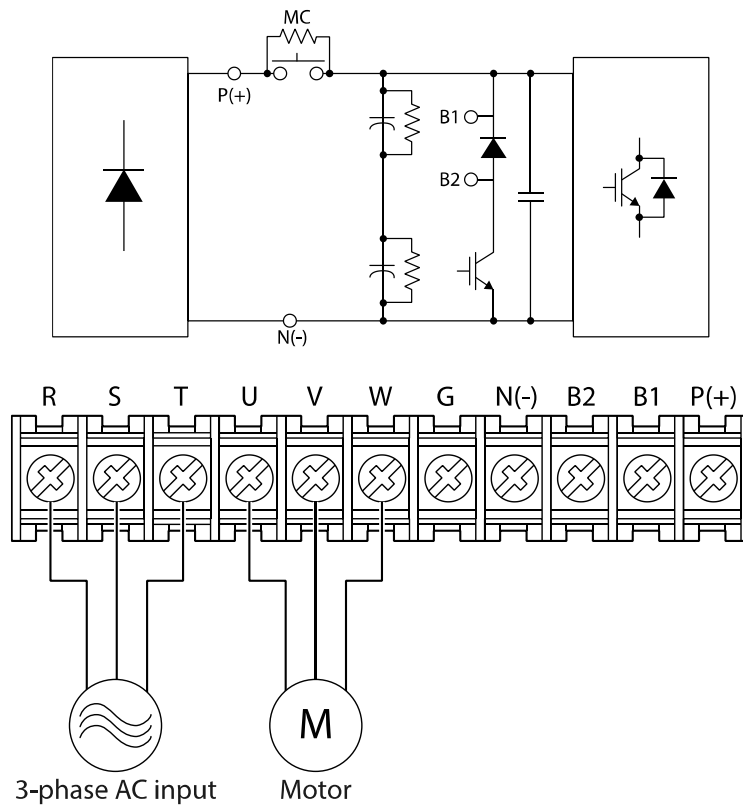
3-phase AC input   Motor

Power terminal descriptions

Terminal	Name	Description
R/S/T	AC power input terminals	3-phase AC power connections.
U/V/W	Motor output terminals	3-phase motor (induction motor, synchronous motor) wiring connections.
G	Ground terminal	Inverter frame ground connection ($\perp$).
B1/B2	Brake resistor terminals	Brake resistor wiring connections.
P (+)	DC link terminal P(+)	DC link wiring connections.
N (-)	DC link terminal N(-)	

Note

Installation

Apply a DC input to the P (+) and N (-) terminals to operate the inverter on DC current input.

11–22 kW (3-Phase)
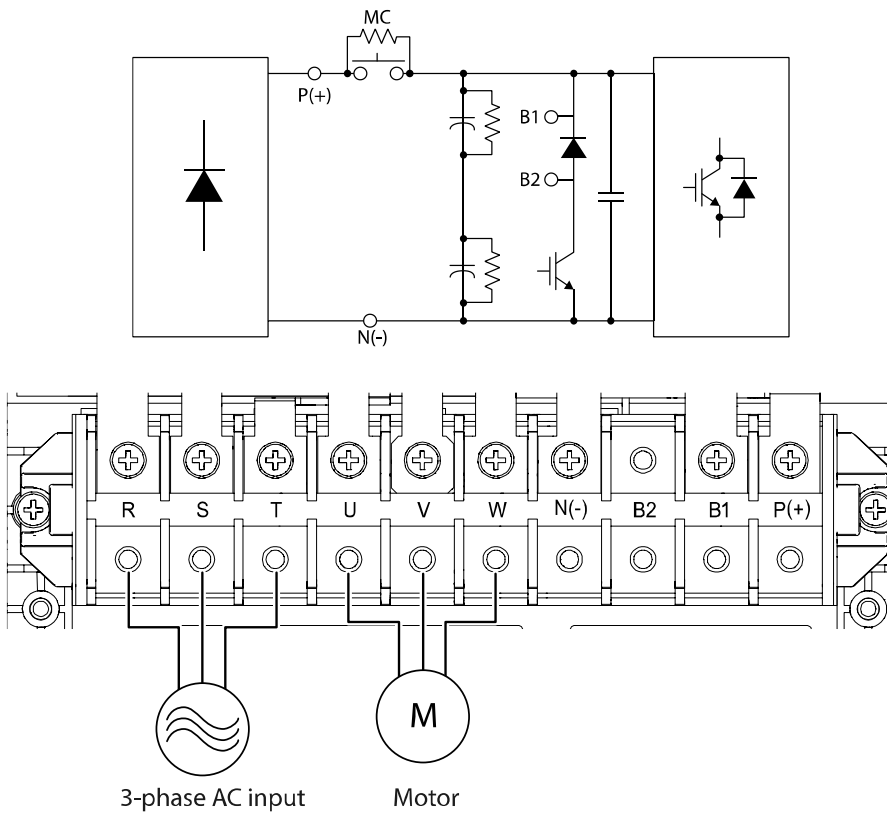
3-phase AC input   Motor

Power terminal descriptions

Terminal	Name	Description
R/S/T	AC power input terminals	3-phase AC power connections.
U/V/W	Motor output terminals	3-phase motor (induction and synchronous motor) wiring connections.
B1/B2	Brake resistor terminals	Brake resistor wiring connections.
P (+)	DC link terminal P(+)	DC link common connections.
N (-)	DC link terminal N(-)	

Note

- Apply a DC input to the P (+) and N (-) terminals to operate the inverter on DC current input.
- Use STP cables to connect remotely located motors to the inverter. Do not use 3 core cables.
- Make sure that the total cable length does not exceed 328 ft (100 m).
- Long cable runs can cause reduced motor torque in low frequency applications due to voltage drop. Long cable runs also increase a circuit's susceptibility to stray capacitance and may trigger overcurrent protection devices or result in the malfunction of equipment connected to the inverter.
- Voltage drop is calculated by using the following formula:
  Voltage drop (V) = [√3 X cable resistance (mΩ/m) X cable length (m) X current (A)] / 1000
- Use cables with the largest possible cross-sectional area to ensure that voltage drop is minimized over long cable runs. Lowering the carrier frequency and installing a micro surge filter may also help to reduce voltage drop.
- The permitted cable lengths for the combinations of motor type and switching frequency are listed in the table below.

Motor type	Motor switching frequency	Maximum cable length
Induction	2.5-5 kHz	< 330 ft (100 m)
Induction	2.5-10 kHz	< 165 ft (50 m)
Synchronous	2.5-5 kHz	< 330 ft (100 m)
Synchronous	2.5-8 kHz	< 165 ft (50 m)

⚠ Warning

Do not connect power to the inverter until the inverter is completely installed and the inverter is ready to operate. Doing so may result in electric shock.

⊘ Caution

- Power supply cables must be connected to the R, S, and T terminals. Connecting power cables to other terminals will damage the inverter.
- Use insulated ring lugs when connecting cables to the R/S/T and U/V/W terminals.
- The inverter's power terminal connections can cause harmonics that may interfere with other communication devices located near to the inverter. To reduce interference, the

installation of noise filters or line filters may be required.
- To avoid circuit interruption or damage to connected equipment, do not install phase-advanced condensers, surge protection, or electronic noise filters on the output side of the inverter.
- To avoid circuit interruption or damage to connected equipment, do not install magnetic contactors on the output side of the inverter.

Step 4 Control circuit connections

The illustrations below show the detailed layout of the control circuit connections and the control board switches. Ensure that the control cables meet the required specifications and refer to the detailed information provided below and *1.5 Cable selection* on page *10* before installing and connecting control circuits.
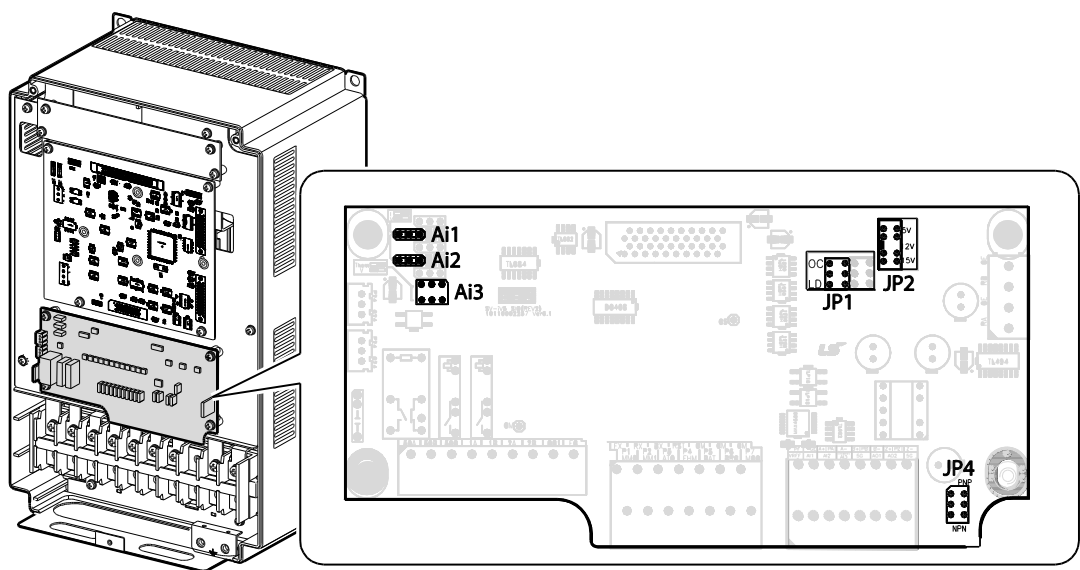
Jumper labels and descriptions

Jumper	Description	Default setting
Ai1	Analog input 1 selection jumper (Left: Voltage input, Right: Current input)	Left: Voltage input
Ai2	Analog input 2 selection jumper (Left: Voltage input, Right: Current input)	Left: Voltage input

Jumper	Description	Default setting
Ai3	Analog input 3 selection jumper (Left: Voltage input, Right: Motor NTC)	Left: Voltage input
JP1	Encoder type selection jumper (Up: OC (Open collector), Down: LD (Lin drive))	Down: LD
JP2	Encoder power supply selection jumper (5 V: 5 V encoder power supply, 12 V: 12 V encoder power supply, 15 V: 15 V encoder power supply)	5 V
JP4	NPN/PNP mode selection switch (Up: PNP, Down: NPN)	Down: NPN

Power terminal and control terminal wiring diagram

Power Terminal Block

Braking resistor (optional)

MCCB ACR MC

3-Phase
AC input
(50/60 Hz)

R

S

T

G

B1

B2

LSLV-iV5L

U

V

W

G

IM

Control Terminal Block 1 Note 1)

Auxiliary power
for the control
terminal block
(220 V)
(50/60 Hz)

Isolating transformer

AC1

AC2

24 V

FX

Forward operation/stop command

Reverse operation/stop command   RX

Emergency stop   BX

Fault reset   RST

Multifunction input 1   P1(MM0)

Multifunction input 2   P2(MM1)

Multifunction input 3   P3(ATO)

Multifunction input 4   P4(FHM)

Multifunction input 5   P5(BAT)

Multifunction input 6   P6(BRC)

Multifunction input 7   P7(MCC)

Common terminal   CM

Multifunction
input

Potentiometer
10 kΩ, 1/2 W

Standard voltage (+10 V)   VREF

Analog input
(10 - -10 V)
(-10 - 10 V)
(0-10 V)
(10-0 V)
(0-20 mA)
(20-0mA)
(Motor NTC)

Analog input 1   AI1

Analog input 2   AI2

Analog input 3   AI3

Common terminal   5G

Encoder
(Line drive)

Shielded
cable

E

Input power (+5 V)   PE

Common terminal (0 V)   GE

Encoder phase A input   A+
A-

Encoder phase B input   B+
B-

Open collector output

RA   Encoder output phase -A

GE   Encoder output common terminal

RB   Encoder output phase -B

GE   Encoder output common terminal

AO1   Analog output 1

AO2   Analog output 2

5G   Common terminal

Analog output
(-10 - 10 V)
(10 - -10 V)
(0-10 V)
(10-0 V)

30A
30C   Fault terminal output
30B   (- AC 250 V, 1 A)
(- DC 30 V, 1 A)

1A
1B   Multifunction terminal output
2A   (- AC 250 V, 1 A)
2B   (- DC 30 V, 1 A)

OC1   Multifunction
open collector output
EG   (24 V, 50 mA)

Control Terminal Block 2

SA

STO input Note 2)   SB

SC

S+
S-   RS-485
Communication input
5G485

Note)   ● : Power terminal block,   ○ : Control terminal block

Note1) Used to run the control circuit on a separate auxiliary power source (220 VAC), without the main power supply.

Note2) STO (Safety Torque OFF) input terminal

⊙ Caution

Install an isolation transformer (rated for > 100 VA) for the auxiliary control power source.
Otherwise, the inverter may be damaged.

CN2

CN1

CN2

24P 24G

SA SB SC

TMS320F28335

ON OFF

ON OFF

Terminating resister: ON (Default)

Terminating resister: OFF

CN4

CNG

LSLV-IV5L Control
5.5 ~ 22kW-4
10110003799 Ver.11

CN5

TL082

TL084

E.S.D
SV-IV5 SIO(REV2)
10110002237 Ver6.1

DG408

5V
12V
15V

OC
LD

G5

RA GE RB GE

TL494

PNP

NPN

30A 30B 30C 1A 1B 2A 2B OC1 EG

FX RX BX RST CM CM CM
P1 P2 P3 P4 P5 P6 P7
MMO MM1 ATO EHM BAT BEC MCC

PE GE A+ PA A- B+ PB B- Z+ PZ Z-
VREF AI1 AO2 AI2 5G AO1 AO2 5G
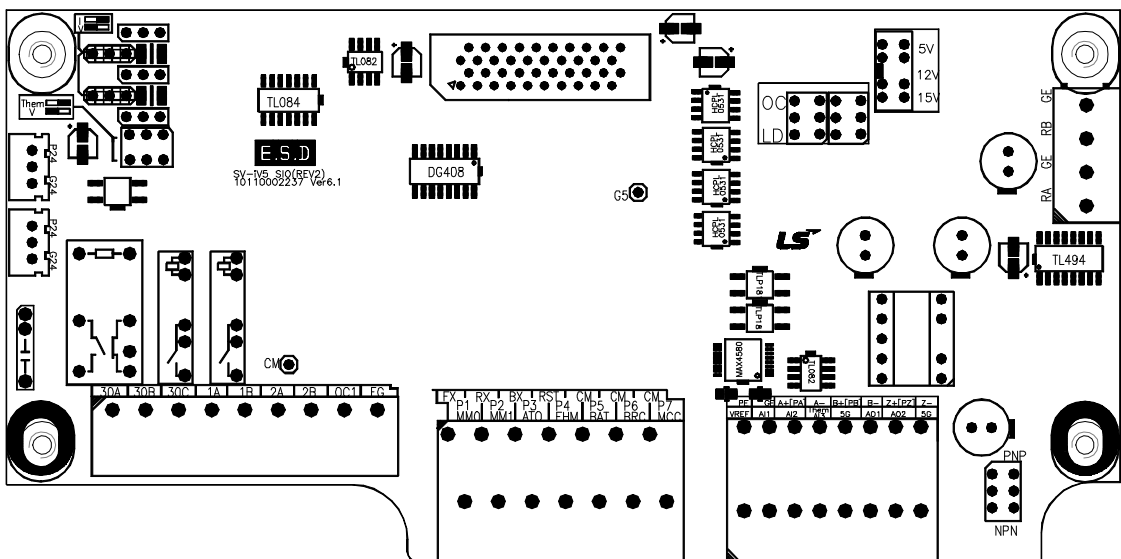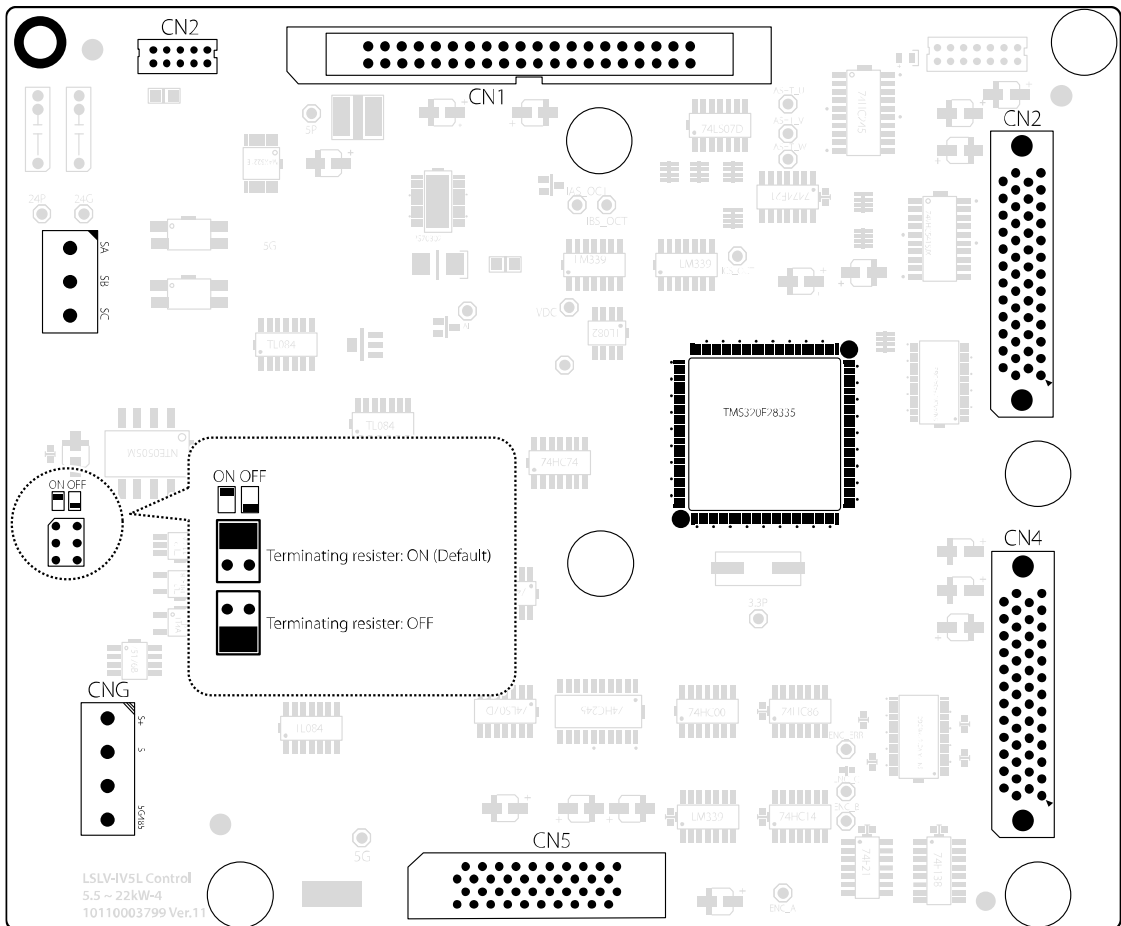
Control board labels and descriptions

Function	Label	Name	Description	
Control board	CN1	SMPS connector	Connects to Drive SMPS.	
	CN2	Keypad connector	Connects to keypad.	
	CN3	Option board and D/A card	Use these connectors when using option boards.	
	CN4			
	CN5	SIO board connector	Connects to SIO board.	
	CN6	Communication terminal	Terminals for the built-in 485 communication.	
			S+/S-	Connects the communication cable.
			5G485	Connects the communication ground cable.
	J2	Communication terminating resister switch	Turns the terminating resister ON when connected to the end of communication line. Up: Terminating resister ON Down: Terminating resister OFF ※ Initial setting: Up (terminating resister ON)	
	TB2	Safety terminal	Hardware connection terminal for the Safety function. The inverter operates normally when SA-SC and SB-SC are connected, and the trip occurs when disconnected.	
			SA/SB	Terminal for Safety A/B connection. The SAFETY A/B trip occurs when disconnected from GND.
			SC	Terminal for Safety trip detection.

Input terminal labels and descriptions

Function	Label	Name	Description
Multifunction terminal configuration	FX	Forward operation/stop command	Stops when FX and RX are ON/OFF at the same time.
	RX	Reverse operation/stop command	
	BX	Emergency stop	Includes free run stop and deceleration stop.
	RST	Fault clearance	Fault status clears when the inverter is ON after the cause of the fault is removed.
	P1 (MM0) P2 (MM1) P3 (AT0) P4 (FHM) P5 (BAT) P6 (BRC) P7 (MCC)	Multifunction input terminals	Configurable for multifunction input.
	CM	Common	Common terminal for analog terminal input and output. Function is ON when each multifunction terminal and CM terminal are connected in NPN input mode.
Analog input configuration	VREF	Potentiometer for analog input	Used to setup or modify a frequency reference via analog voltage or input current. Maximum output voltage: 10 V Potentiometer: 1–10 k Ω
	Ai1	Voltage input	Used for input voltage and current applications, or motor NTC. Set jumper to change between voltage, current, or motor NTC input. • For input voltage Ai1, Ai2, Ai3: left side • For input current
	Ai2	Current input	
	Ai3/Them	Voltage input Motor NTC input	

Function	Label		Name	Description
				Ai1, Ai2: right side
				• For input motor NTC
				Ai3: right side
	5G		Common	Common terminal for analog terminal input.
Encoder input configuration	PE		Encoder power Note 1)	+15 V open collector power.
	GE			0 V
	A+	A-	Encoder Phase A power	Phase A and B signals for the line drive encoder.
	B+	B-	Encoder Phase B power	Set the JP2 switch on the I/O board to "P5" and the JP4 switch to "LD".
	PE		Encoder power	+15 V open collector power.
	GE			0 V
	PA		Encoder Phase A power	Phase A and B signals for the complementary and open collector encoder.
	PB		Encoder Phase B power	Set the JP2 switch on the I/O board to "P15" and the JP4 switch to "OC".
	Z+ (PZ)		Encoder Phase Z power	Available only when using an encoder that provides a Phase Z pulse.
				Line drive type:
				Using Z+ and Z-.
				Set JP5 to "LD".
	Z-			Open collector output:
				Using PZ.
				Set JP5 to "OC".

Note1) Connect positive encoder power (+) to PE terminal, and negative (-) to GE terminal.

Output/communication terminal labels and descriptions

Function	Label	Name	Description
Encoder output	RA	Encoder output Phase - A	The encoder output signals at Phases A and B are open collector outputs.
	GE	Encoder output common	
	RB	Encoder output Phase - B	
	GE	Encoder output common	
Analog output	AO1	Analog output 1	Output voltage range: - -10 V–10 V - 10 V– -10 V - 0 V– 10 V - 10 V– 0 V. Select one of the following: - Analog input value - Command before and after acceleration/deceleration - Speed control input command - Motor speed - Speed deviation - Motor speed follow-up - Speed control output - Torque bias - Forward direction torque limit - Reverse direction torque limit - Torque limit during regeneration - Torque command - Torque current command - Torque current - Speed command - Speed current command - Speed current - Q-axis current control output - D-axis current control output - D-axis voltage
	AO2	Analog output 2	

Function	Label		Name	Description
				- Q-axis voltage - Output current - Output voltage - Output power - DC-link voltage - Motor temperature (NTC) - Inverter temperature.
	5G		Common	Common terminal for analog terminal inputs.
Output contacts	1A	1B	Multifunction output contact 1 (Form A contact)	Select one of the following: - Inverter operation available - Zero velocity detection - Speed detection - Speed detection (non-polar) - Speed arrival - Timer output
	2A	2B	Multifunction output contact 2 (Form A contact)	
	OC 1	EG	Multifunction open collector output	- Low voltage alert - In operation - In regeneration - Motor overheat alert - Inverter overheat alert - Speed agreement - Torque detection - Torque limit detection - Overheat alert - Stopping - MC output - Fan fault - ALLS status - At constant speed, brake output
	30A		Fault signal (Form A contact)	Output signal is generated when a fault occurs. Does not output when the emergency stop is activated.
	30B		Fault signal (Form B contact)	
	30C		Common	Common terminal for output contacts A and B.
Switch	JP1		Input pulse encoder	LD (Line Drive) / OC (open collector or

Function	Label	Name	Description
			complementary)
	JP2	Input voltage encoder	Select between DC +5 V, DC +12 V, and DC +15 V.
	JP4 Note 1)	PNP/NPN input mode	Select PNP/NPN input mode.

Note 1) Example of encoder output connection
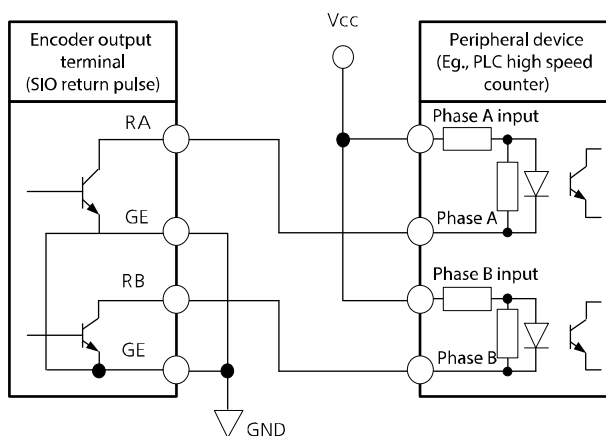
⊘ Caution

The encoder output is in open collector type. Consider the input circuit configurations when making the cable connections. The following is an example for using the encoder output as the input to an LS ELECTRIC high-speed counter module for PLCs.

Note

- Use shielded cable or plastic insulated cable for all control circuit connections.
- Use twisted shield cable if the length of circuit is long.
- Use 0.2 to 0.8 mm^2 (18 to 26 AWG) cables.
- When tightening bolts, do not allow the torque to exceed 5.2 lb-in.
- The auxiliary relay terminal output 1 and 2 must be below AC 250 V/1 A and DC 30 V/1 A.
- The trip output relay terminal must be below AC 250 V/1 A and DC 30 V/ 1A.
- The open collector output 1 and encoder output must be below 24 V/100 mA.
- While running control circuits, ensure that the total cable length does not exceed 165 ft (50 m).
- Ensure that the length of any safety related circuits does not exceed 100 ft (30 m).
- Do not run the control cable with the mains power cable inside the terminal block area. If

the control cable crosses a mains power cable, they must cross each other at a right angle.
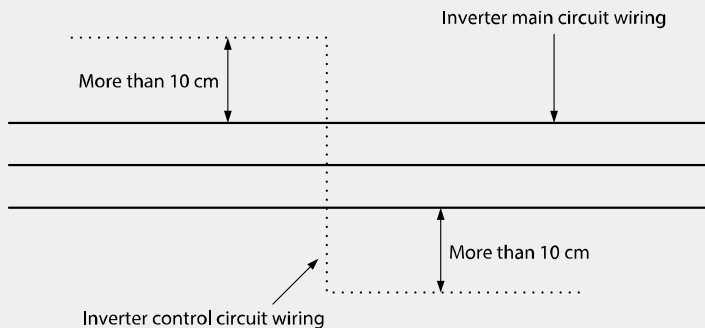
Step 5 Auxiliary power terminals

The LSLV-iV5L inverter includes an auxiliary power terminal block. The auxiliary terminals enable the control board to operate without mains power (R/S/T) using auxiliary control power (220 V AC). The following diagram shows the terminals on the auxiliary power terminal block. Refer to the detailed descriptions to understand the functions and locations of the terminals before connecting cables.

⊙ Caution

• Separate auxiliary power and mains power circuits, and connect auxiliary power circuits via an isolating transformer.
• Use insulated cable lugs for all auxiliary power cable connections.
• Use cables with a cross-sectional area greater than 0.5 mm^2 (20 AWG).

Auxiliary power terminal block

5.5–7.5 kW (3-Phase)
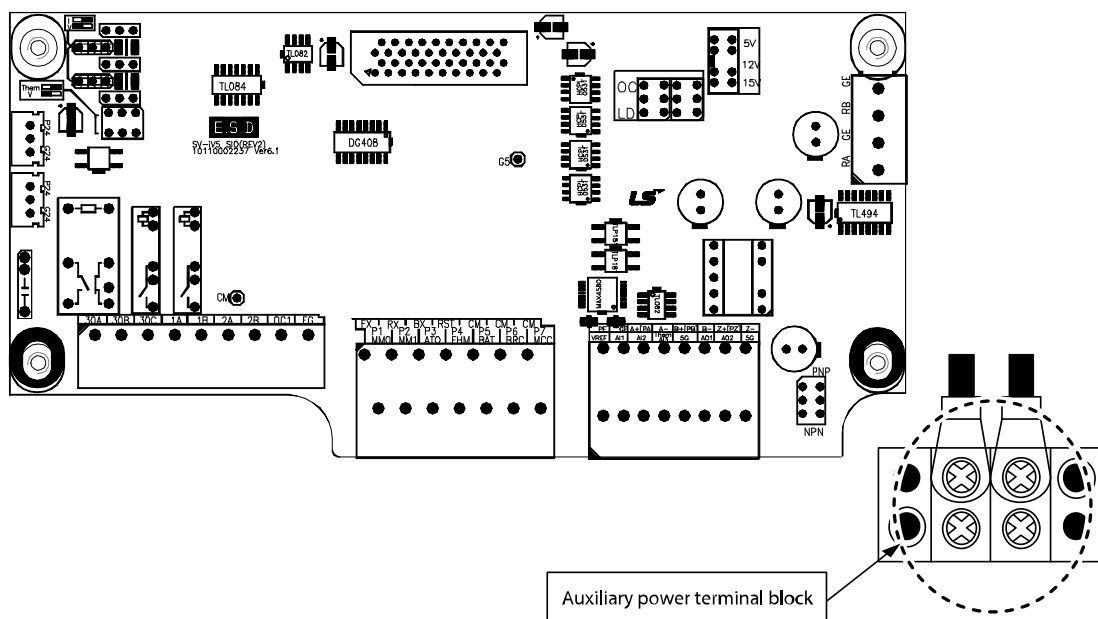
Auxiliary power terminal block
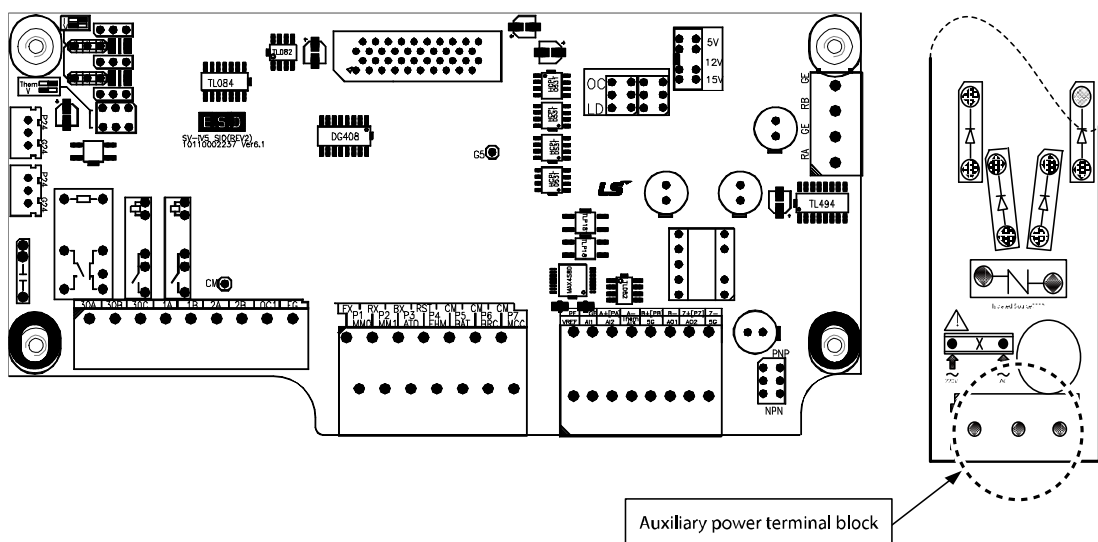
11–22 kW (3-Phase)

Auxiliary power terminal labels and descriptions

Label	Name	Description	Voltage

Label	Name	Description	Voltage
AC1 AC2	Auxiliary input voltage	Used to connect to single phase AC input voltage.	220 V (-10-+10%), 50/60 Hz

Installation

Step 6 Encoder wiring and jumper settings

Install an encoder on the motor's rotor or on a spindle that rotates at the same speed as the motor's rotor. Refer to the diagrams below for the jumper settings and encoder connections (Eg., Line side of a motor, or the other side of the motor axis from a traction machine). If there is a slip between the motor and encoder axis, the motor may generate severe vibration, or it may not operate at all.

+15 V Complementary or open collector

PE	GE	A+[PA]	A-	B+[PB]	B-	Z+[PZ]	Z-
VREF	AI1	AI2	NTC AI3	5G	AO1	AO2	5G

STP cable

+5 V Line drive

+5 V Line Drive [LD]

STP cable

PE	GE	A+[PA]	A-	B+[PB]	B-	Z+[PZ]	Z-
VREF	AI1	AI2	NTC AI3	5G	AO1	AO2	5G
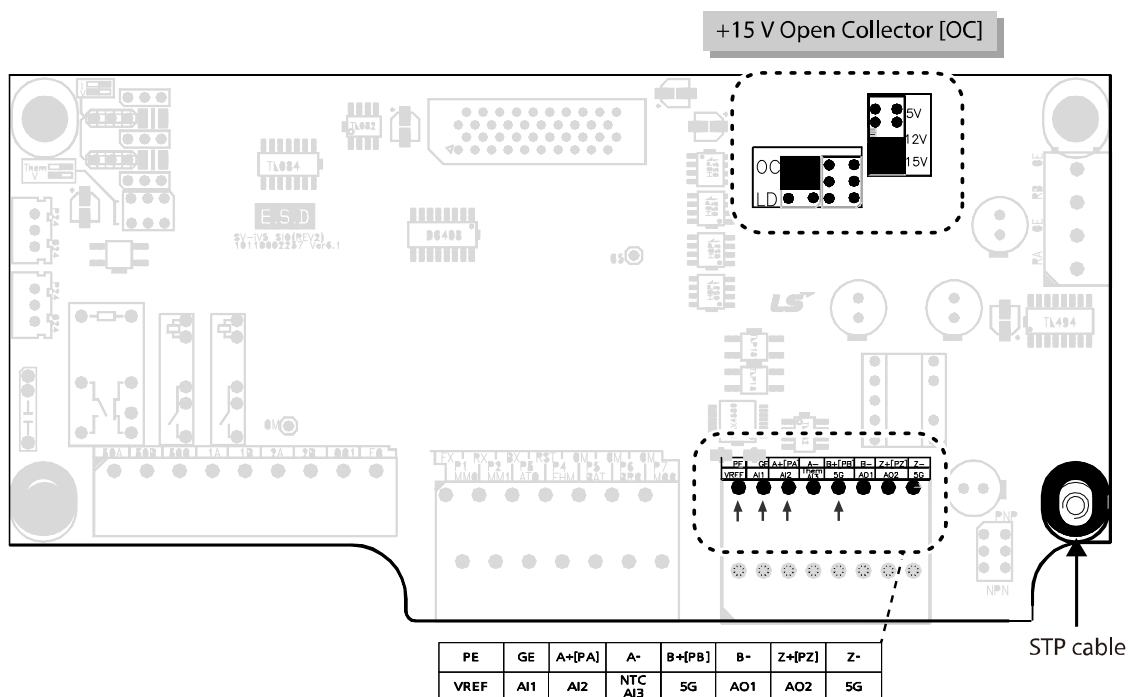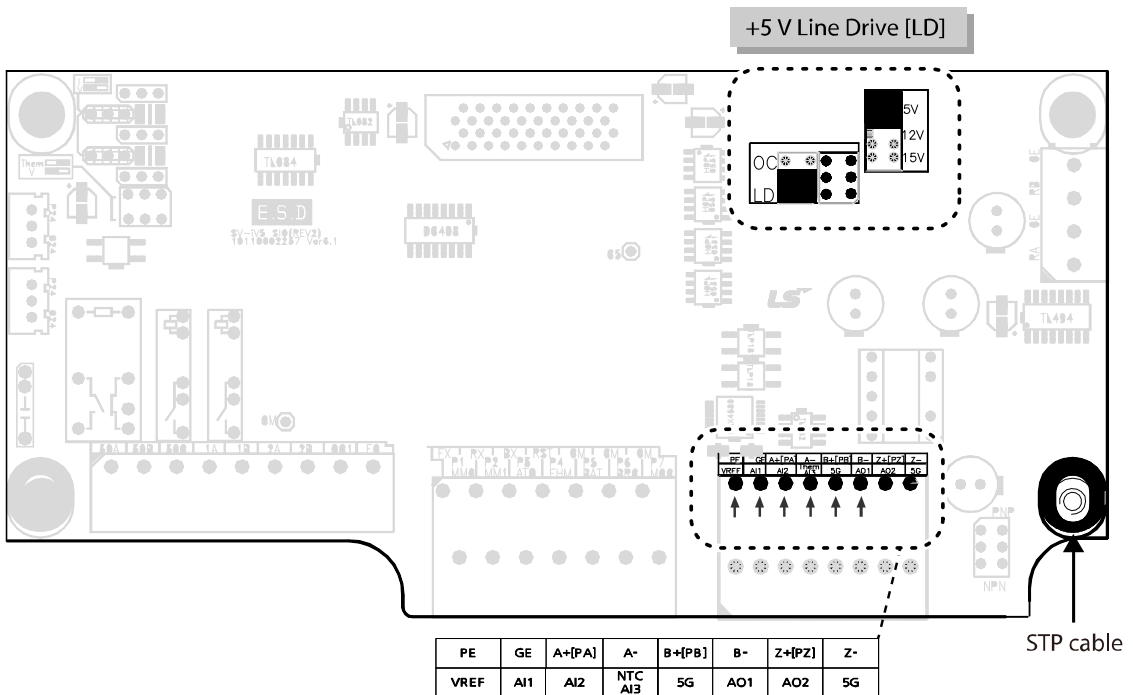
⊘ Caution

Ensure that the encoder type is properly set before operating the inverter. Do not change the encoder type settings while the inverter is operating. Doing so may adversely affect the system and the inverter operation may stop with a fault trip.

Note

- The motor may operate incorrectly or vibrate if the rotor and the encoder's spindle are not connected correctly.
- Use STP cables and connect the shielding to the PCB's grounding screw.
- Do not run encoder signal cables near inverter mains power cables. Electronic interference may affect encoder output signals.

Installation

Step 7 Analog input jumper settings

After installing an encoder, set the analog input jumper.

The default analog input setting is voltage input.

AI1, AI2
Voltage input: Left
Current input: Right

AI3
Voltage input: Left
Motor NTC/PTC input: Right
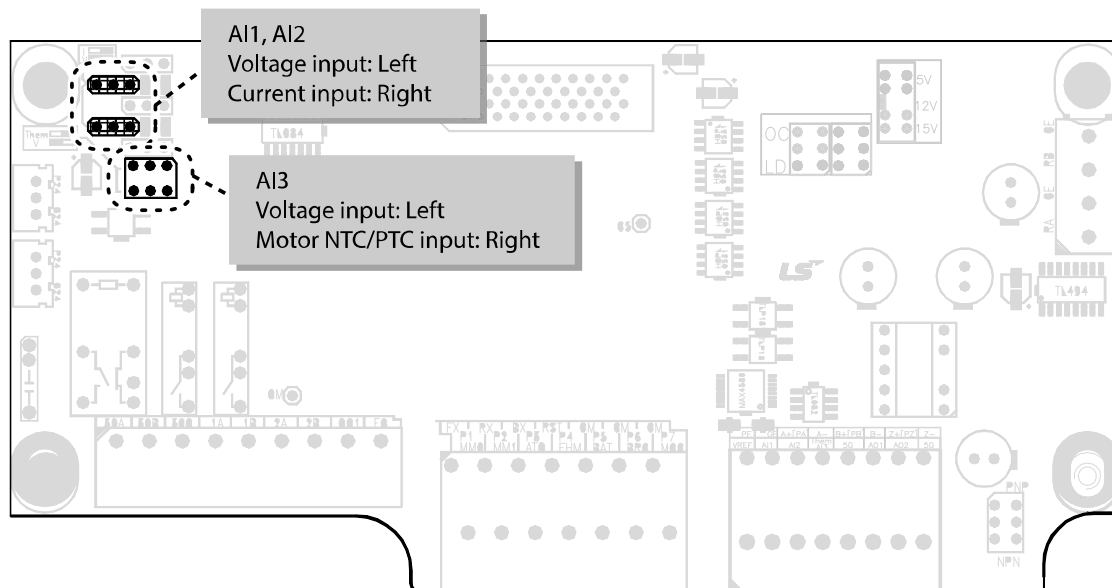
Caution

- Do not change the analog input jumper settings while the inverter is running. Doing so may change the inverter's reference speed or input value at the terminals.
- The motor NTC input is available only when using HIGEN motors.

Step 8 PNP/NPN mode selection

The LSLV-iV5L inverter supports PNP (Source) and NPN (Sink) modes to sequence input current at the terminal. Select an appropriate mode to suit the circuit by switching the PNP/NPN jumper (JP4) on the control board. Refer to the following information for more details.

PNP mode (Source)

Select PNP mode at the PNP/NPN jumper (JP4). The default setting is NPN mode. CM is the common ground terminal for all analog inputs at the terminal block and P24 is the internal DC 24 V supply. If you are using an external DC 24 V supply, build a circuit that connects the external power supply (-) and the CM terminal.

The guaranteed input voltages in the PNP mode (when using an external DC 24 V supply) are DC 19 to 25.2 V when the inverter is ON and below DC 7 V when the inverter is OFF.
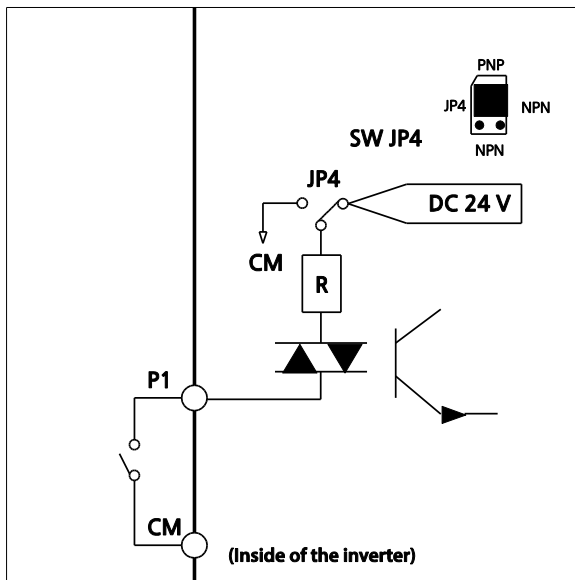
NPN mode (Sink)

Select NPN mode at the PNP/NPN jumper (JP4). The default setting is NPN mode. CM is the common ground terminal for all analog inputs at the terminal block and P24 is the DC 24 V internal power supply.
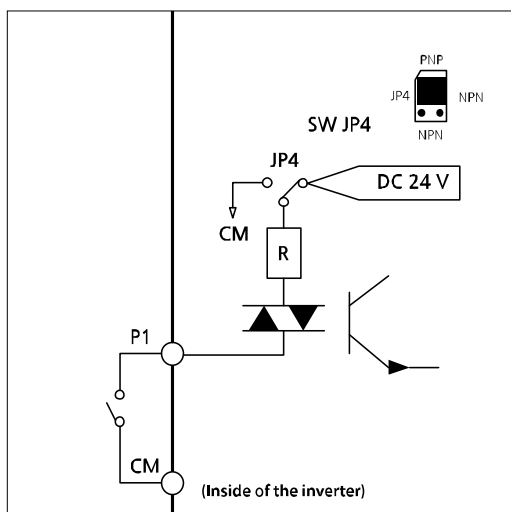
Caution

Do not change the PNP/NPN input jumper settings while the inverter is running. Doing so may change the inverter's input value at the terminals.

Step 9 Replacing the front cover

Replace the front cover immediately after work on the inverter is completed.

2.3 Post-installation checklist

After completing the installation, check the items in the table below to make sure that the inverter has been safely and correctly installed.

Item	Description	Page ref.	Result
Installation location/I/O power rating verification	Is the location for the inverter installation appropriate?	_p. 4_	
	Does the operating environment meet the inverter's specifications?	_p. 5_	
	Does the main power supply meet the inverter's rated input?	_p. 169_	
	Is the inverter's rated output sufficient to supply the equipment? (In certain circumstances, insufficient output will result in degraded performance.)	_p. 169_	
Electrical connections	Is a circuit breaker installed on the input side of the inverter?	_p. 13_	
	Is the circuit breaker correctly rated?	_p. 174_	
	Are the incoming power cables correctly connected to the inverter's R/S/T terminals? (Caution: connecting the incoming power supply to the U/V/W terminals may damage the inverter.)	_p. 23_	
	Are the motor output cables connected in the correct phase rotation (U/V/W)? (Caution: motors will rotate in the reverse direction if the phase rotation is incorrect.)	_p. 23_	
	Are the incoming power cables rated correctly?	_p. 10_	
	Is the inverter grounded correctly?	_p. 22_	
	Are the power terminal screws and the ground terminal screws tightened to the specified torque?	_p. 23_	
	Is overload protection installed correctly in the motor circuits (if multiple motors are supplied from one inverter)?	-	
	Is the inverter separated from the power source by a	_p. 13_	

Installation

Item	Description	Page ref.	Result
	magnetic contactor (if a braking resistor is in use)?		
Control circuit connections	Are STP cables used for all control circuit wiring?	-	
	Is the shielding of all STP cables properly grounded?	-	
	If 3-wire operation is required, confirm the multifunction input terminals are defined before control cables are connected?	*p. 29*	
	Are the control cables properly connected?	*p. 29*	
	Are the control terminal screws tightened to the specified torque?	*p. 175*	
	Is the total cable length of all control cables < 165 ft (100 m)?	*p. 38*	
	Is the total length of safety cables < 100 ft (30 m)?	*p. 38*	
Miscellaneous	Are optional circuit boards connected correctly?	-	
	Is there any debris inside the inverter?	-	
	Check cable connections for short circuit risks, such as conductors contacting adjacent terminals?	-	
	Are the control circuit connections separated from the mains power connections?	-	
	Have the capacitors been in use for more than two years? If so, replace them.	-	
	Has a fuse been installed in the main power supply circuit?	*p. 175*	
	Are the connections to the motor separated from other connections?	-	

Note

STP cables have a highly conductive, shielded screen around the twisted pairs. STP cables protect conductors from electromagnetic interference.

2.4 Test run

After the post-installation checklist has been completed, perform a test-run of the inverter.

1 Supply mains power to the inverter. Ensure that the keypad display light is on.

2 Select the command source.

3 Set a frequency reference and then check the following:

- If Ai1 or Ai2 is selected as the frequency reference input, confirm that the jumper is over the left pin and that the frequency changes when the input voltage changes.
- If Ai1 or Ai2 is selected as the frequency reference input, confirm that the jumper is over the right pin and that the frequency changes when the input current changes.
- If Ai3 is selected as the frequency reference input, confirm that the jumper is over the left pin and that the frequency changes when the input voltage changes.

4 Set the acceleration and deceleration times.

5 Start the motor and check the following:

- Ensure that the motor rotates in the correct direction (refer to the note below).
- Ensure that the motor accelerates and decelerates for the set time and that the motor speed reaches the frequency reference.

⚠ Warning

To avoid electrocution, ensure that the MCCBs and MCs are turned off before connecting power to the inverter.

Note

- When the forward (FX) signal is ON, the motor should rotate counterclockwise when viewed from the load side of the motor. If the motor rotates in the reverse direction, switch the cables at the U and V terminals.
- For a safe operation, install and use micro-surge filters for the products operating with 400 V class motors. Otherwise, ensure that all 400 V class motors operated with this product have reinforced insulation. Micro-surge voltage inside the motor may result in motor damage.

Verifying motor rotation

1   Set FUN_01 to 'Keypad'.

2   Set FUN_02 to 'Keypad 1'.

3   Set a frequency reference.

4   Press [FWD] on the keypad to operate the inverter in the forward direction.

5   Observe the motor's rotation from the load side and ensure that the motor rotates counterclockwise.
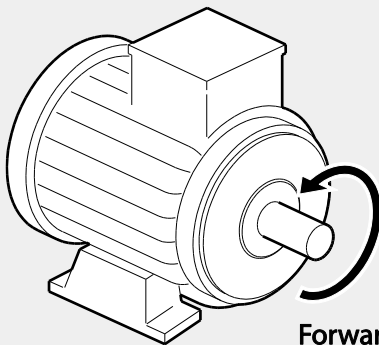
Forward operation

⊙ Caution

•   Before operating the inverter for the first time, check the control cables to ensure that all cables are connected properly, and no damages to the cables or short circuit conditions exist.

•   Check the parameter settings before running the inverter. Parameter settings may need to be adjusted depending on the load.

•   To avoid damaging the inverter, do not supply the inverter with an input voltage that exceeds the rated voltage for the equipment.

•   Before running the motor at maximum speed, confirm the motor's rated capacity. As inverters can be used to easily increase motor speed, use caution to ensure that motor speed does not inadvertently exceed the motor's rated capacity.

3 Performing basic operations

This chapter describes the keypad layout, keypad functions, and introduces the parameter groups and codes required to perform basic operations. The chapter also outlines the basic operation of the inverter before advancing to more complex operations. Examples are provided to demonstrate the inverter's operation.

3.1 About the keypad

The keypad has two main components – the operation keys and the display.

On the Keypad display, you can view the parameter setting values. It displays up to 32 alphanumeric characters.

3.1.1 Operation keys

The table below lists the names and functions of the keypad's operation keys.
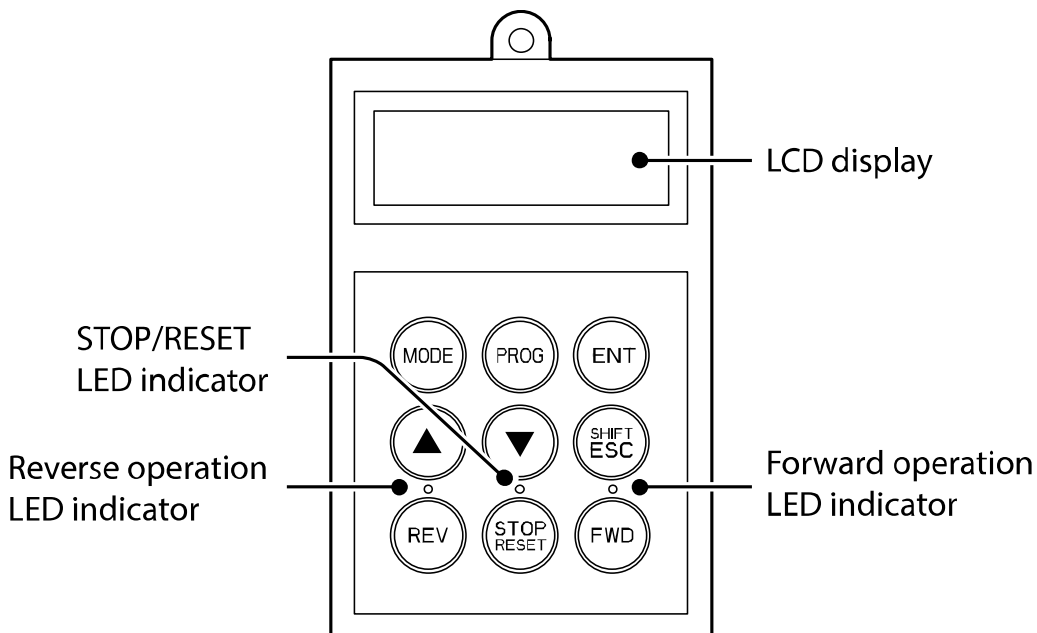
Key	Name	Description
(MODE)	[MODE]	Switches between groups. Moves to upper codes in a group.
(PROG)	[PROG]	Changes parameter values.
(ENT)	[ENT]	Switches between modes. Saves parameter values.
(▲) (▼)	[UP] [DOWN]	Switches between codes, or increases or decreases parameter values.
(SHIFT ESC)	[SHIFT/ESC]	Moves to the default screen. In settings mode, moves the cursor to the next digit position.
(REV)	[REV]	Starts reverse operation.
(STOP RESET)	[STOP/RESET]	Stops the current operation. (Valid when FUN_01 is set to "Keypad".) Clears fault status.
(FWD)	[FWD]	Starts forward operation.

Basic Ops.

3.1.2 About the display

Speed and Speed (Sync) mode display
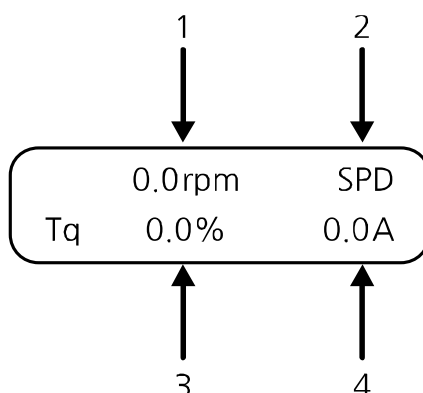
The following table lists the names and functions of the items displayed in this mode. Refer to the corresponding number in the illustration above.

No	Name	Description
1	Motor speed	Displays motor speed in rpm.
2	Motor control mode	Displays one of the following motor control modes: SPD: Speed control mode BX: Emergency stop status BAT: Battery operation mode
3	Torque	Displays the generated torque when the motor operates at its full rated output.
4	Inverter output current	Displays the effective output current of the inverter.

V/F and Slip Comp mode display


```
      1        2              3
      │        │              │
      ↓        ↓              ↓
   ┌─────────────────────────────┐
   │  DIS ▶ T/K          0.0 A    │
   │  00    STP        60.00HZ    │
   └─────────────────────────────┘
      ↑        ↑              ↑
      │        │              │
      4        5              6
```

The following table lists the names and functions of the items displayed in this mode. Refer to the corresponding number in the illustration above.

No.	Name	Description
1	Parameter group	Displays the parameter group.
2	Operation/speed commands	Displays the operation and speed commands. Operation commands T: Terminal command K: Keypad command O: Internal RS-485 communication command Speed commands K: Keypad command A: Analog command O: Internal RS-485 communication command
3	Inverter output current	Displays the effective output current of the inverter.
4	Code number	Displays the code number.
5	Operating status	Displays the current operating status: STP: Stop FWD: Forward operation REV: Reverse operation
6	Target frequency/operating frequency	Displays the target frequency at stop condition and displays the output frequency during operation.
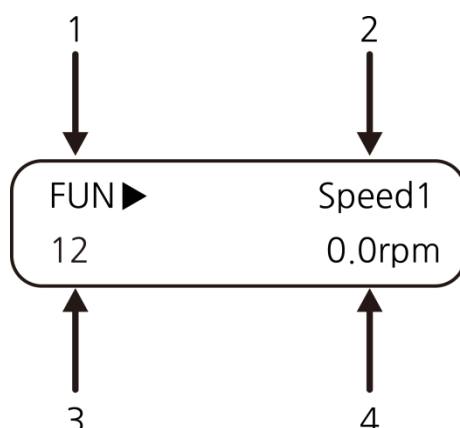
Basic Ops.

Group display

The following table lists the names and functions of the items displayed in this mode. Refer to the corresponding number in the illustration above.

No.	Name	Description
1	Parameter group	Displays one of following parameter groups: DIS, PAR, DIO, AIO, FUN, CON, E/L[Note 1], PRT, COM, M2[Note 2], USR.
2	Code type	Displays the code type to setup.
3	Code number	Displays the code number to setup.
4	Code data and unit	Displays the code data and unit to setup.

Note 1) Displays only when "PAR_08" is set to "Elevator" and an EL I/O card is installed.

Note 2) Displays only when Motor 2 is configured for use at the multifunction inputs (P1-P3).

3.1.3 Control menu

The LSLV-iV5L inverter's control menu has the following groups.

Group	Display	Description
Display	**DIS**	Configure display settings for motor speed, motor control mode, torque, inverter output, current, user selection display, and fault status display.
Parameter	**PAR**	Configure parameter settings, including parameter initialization, parameter read/write/lock/password settings, motor constants, auto-tuning, switching frequency, and control mode.
Digital input/output	**DIO**	Configure digital input/output settings, including digital input and output parameters.
Analog input/output	**AIO**	Configure analog input/output settings, including analog input and output parameters.
Function	**FUN**	Configure function settings, including operation frequency, operation method, stop method, and acceleration/deceleration time and pattern.
Elevator operation	**E/L** Note 1)	Configure elevator operation function settings. The elevator operation group (E/L) appears on the keypad only when "PAR_08" is set to "Elevator" and an EL I/O card is installed.
Control	**CON**	ASR PI Gain
Protection	**PRT**	Configure parameters related to inverter faults.
Communication	**COM**	Configure communication features for RS-485 and other communication options.
Motor 2	**M2** Note 2)	Configure secondary motor features. M2 appears on the keypad only when a second motor is configured for use at the multifunction inputs (P1-P3).
User	**USR**	Configure user macro settings.

- The groups in bold in the Display column are default parameter groups.
- Note1) Displayed when an optional add-on board is installed. Refer to the user manual supplied with the add-on board.

Basic Ops.

- Note2) Displayed when one of the multifunction inputs in DIO group has been set to "2nd Motor." The second motor operation does not work when the inverter control mode is set to Speed (Sync).

3.2 Using the keypad

The keypad enables movement between groups and codes. It also enables users to select and configure functions. At code level, you can set parameter values, turn specific functions on or off, and decide how functions will be used. Refer to 5 _Table of functions_ on page _82_ to find the functions you need.

3.2.1 Group and code selection

The example below shows how to switch between groups and codes.

1 Press [MODE] to move to the group you require.

2 Move up and down through the codes using [▲] or [▼] until you locate the code that you require.
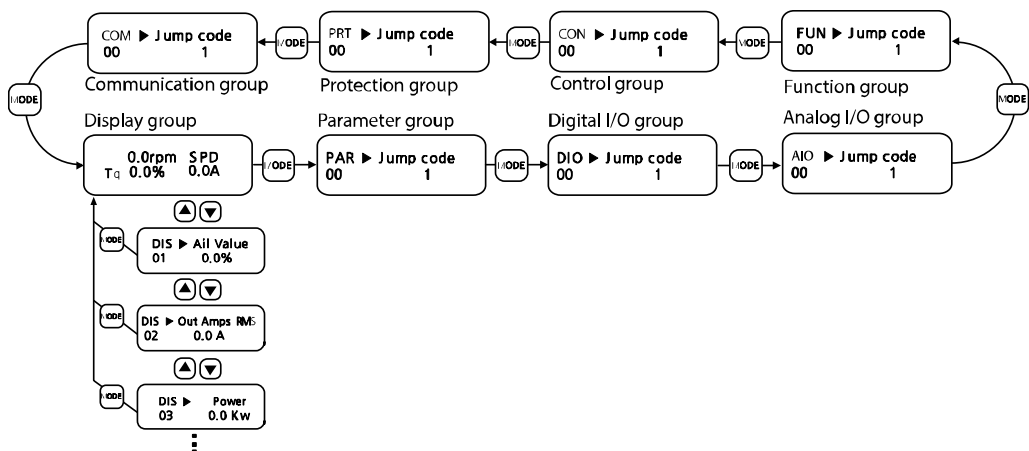
Note

For some settings, pressing [▲] or [▼] will not increase or decrease to the next numerical code. Code numbers may be skipped or not be displayed as certain codes have been intentionally left blank or reserved for new functions to be added in the future. Also, some features are hidden because functions for a certain code have been disabled.

3.2.2 Navigating directly to different codes

The following example shows how to navigate to code PAR_56 from the initial code in the group (PAR_00). This example applies to all groups.

Step	Instruction	Keypad display
1	Go to the first code of the parameter group (PAR_00).	
2	Press [PROG].	
3	Press [SHIFT/ESC], [▲], or [▼] until '56' is displayed.	
4	Press [ENT]. PAR_56 screen is displayed. If you select an unavailable code, details for the next available code are displayed.	PAR ▶ Rs 56 0.346 ohm

Read-only parameters cannot be changed. The parameter values for those parameters with "read-only during operation" attribute cannot be changed during an inverter operation.

3.2.3 Setting parameter values

Enable or disable features by setting or modifying parameter values for different codes. Directly enter values, such as frequency references, supply voltages, and motor speeds. The instructions below list the steps to set or modify parameter values.

1 Select the group and code to configure or modify.

2 Press [PROG].

The cursor will flash.

3 Press [SHIFT/ESC], [▲], or [▼] to adjust the value.

4 Press [ENT] to save the changes.

Note

Each code's parameter values have default features and a specified range.

3.2.4 Setting parameter labels

Set labels for the parameters in groups, such as DIS (Display), DIO (Multifunction input/output), and AIO (Analog input/output).

The following is an example to label DIO_02 to "Speed-L."

Step	Keypad instructions	Keypad display
1	Set PAR 07 to 'V/F.'	-
2	Select a group and code you want to set a label for.	-
3	Select a label.	DIO ▶　　　P2 Define 02　　　Speed-**L**
4	Press [ENT].	DIO ▶　　　P2 Define 02　　　Speed-L

Note

You cannot set labels for parameters with '#' next to the parameter number.

3.2.5 Configuring acceleration time on the keypad

The following example demonstrates how to modify the ACC (acceleration time) value from 10 seconds to 15 seconds in the operation group.

Step	Keypad instructions	Keypad display
1	Press [MODE] to move to FUN group.	FUN ▶ Jump Code 00 1
2	Press [PROG], and then press [SHIFT/ESC], [▲], or [▼] until '41' is displayed.	FUN ▶ Jump Code 00 41
3	Press [ENT]. The current acceleration time is displayed.	FUN ▶ Acc Time-1 41 10.00 sec
4	Press [PROG]. The cursor appears.	FUN ▶ Acc Time-1 41 █ 10.00
5	Press [SHIFT/ESC] to move the cursor.	FUN ▶ Acc Time-1 41 1̲0.00 sec
6	Press [▲] or [▼] to change the value.	FUN ▶ Acc Time-1 41 1̲5.00 sec
7	Press [ENT] to save the changes. The cursor disappears.	FUN ▶ Acc Time-1 41 15.00 sec

Basic Ops.

3.3 Confirming the encoder operation

3.3.1 Definition of forward and reverse operations

When looking at the motor from the load side, the motor rotates counterclockwise in the forward operation.
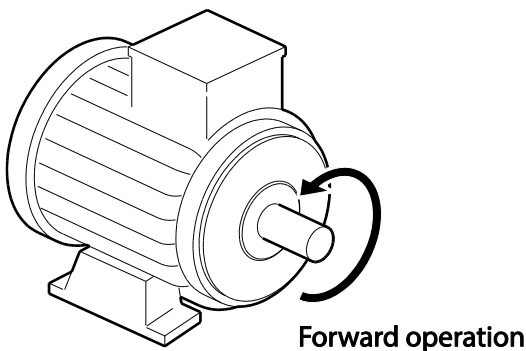
Forward operation

3.3.2 Confirming the forward and reverse operations

Forward operation

Confirm that the speed display in the initial display group screen is positive (+) when the inverter is ON and rotating the motor's spindle.

```
    +[][].[]rpm    SPD

Tq        %         A
```

Reverse operation

Confirm that the speed display in the initial display group screen is nagative (-) when the inverter is ON and rotating the motor's spindle.

```
     -[][].[]rpm    SPD

Tq        %         A
```

Note

- When "0.0 rpm" is keep displayd or (+) and (-) are displayed reversly, confirm the encoder connections.
- When you are not able to manually rotate the motor, see *3.4 Operating the inverter with the keypad* or *3.5 Operating the inverter using the control terminal block*.

3.4 Operating the inverter with the keypad

3.4.1 Setting parameter values for keypad operation

Step	Keypad instructions	Keypad display
1	Set FUN 01 to 'Keypad'.	FUN ▶ Run/Stop Src 01 Keypad
2	Set FUN 02 to 'Keypad 1'.	FUN ▶ Run/Stop Src 02 Keypad1
3	Press [▲] to adjust the operation speed.	FUN ▶ Spped 0 12 100.0rpm

Basic Ops.

3.4.2 Forward and reverse operations

Low speed operation

Configure FUN12 to '100.0 rpm' and then follow the instructions in the table below.

Direction	Keypad instructions	Keypad display
Forward	Press [FWD] on the keypad. The motor speed '+100.0 rpm' is displayed as the motor speed.	+100.0rpm SPD Tq % A
Reverse	Press [REV] on the keypad. The motor speed '-100.0 rpm' is displayed as the motor speed.	-100.0rpm SPD Tq % A

When selecting low speed from the keypad, the operating status for various current encoder and motor connections are listed in the table below.

Encoder/Motor connections	Keypad command	Direction of motor rotation	Speed display on the keypad	Torque display on the keypad	Operation status
Encoder and motor connection is normal.	FWD	Forward	+100.0 rpm	Lower than +10%	Normal
	REV	Reverse	-100.0 rpm	Lower than -10%	
Encoder connection has been changed.	FWD	Forward	-10 - -40 rpm	150% (torque limit)	Abnormal
	REV	Reverse	10-40 rpm	-150% (torque limit)	
Motor connection has been changed.	FWD	Forward	-10 - -40 rpm	150% (torque limit)	Abnormal
	REV	Reverse	10-40 rpm	-150% (torque limit)	
Encoder and motor	FWD	Forward	+100.0 rpm	Lower than +10%	Abnormal

Encoder/Motor connections	Keypad command	Direction of motor rotation	Speed display on the keypad	Torque display on the keypad	Operation status
connections have been changed.	REV	Reverse	-100.0 rpm	Lower than -10%	

If the encoder's Phase A and B are reversed or the motor connection has been changed, reverse the positions of Phase A and B, or change the connections at the inverter's output.

The torque display on the keypad is based on no load operation.

High speed operation

Configure FUN12 to '1000.0 rpm' and then follow the instructions in the table below.

Direction	Keypad instructions	Keypad Display
Forward	Press [FWD] on the keypad. '+1000.0 rpm' is displayed as the motor speed.	+1000.0rpm SPD Tq % A
Reverse	Press [REV] on the keypad. '-1000.0 rpm' is displayed as the motor speed.	-1000.0rpm SPD Tq % A

3.5 Operating the inverter using the control terminal block

3.5.1 Setting parameter values for control terminal block operation

Step	Keypad instructions	Keypad display
1	Set FUN 01 to 'Terminal 1'.	FUN ▶ Run/Stop Src 01　　　Terminal 1
2	Set FUN 02 to 'Analog'.	FUN ▶ Spd Ref Sel 02　　　Analog
3	Set the maximum motor speed.	PAR ▶ Max Speed 11　　　1800.0 rpm
4	Define Ai1.	AIO ▶ Ai1 Define 01　　　Speed Ref
5	Select a range for the Ai1 input source: 　- 　-10–10 V / 10–-10 V 　- 　0–10 V / 10–0 V 　- 　0–20 mA / 20–0 mA	AIO ▶ Ai1 Source 02

3.5.2 Cable connections for potentiometer speed control

The diagram below shows the cable connections to use when a potentiometer is connected to Ai1.
Connect the potentiometer to the VREF, Ai1, and 5G terminals on the control terminal block.

Potentiometer
(1/2 W, 10 kΩ)
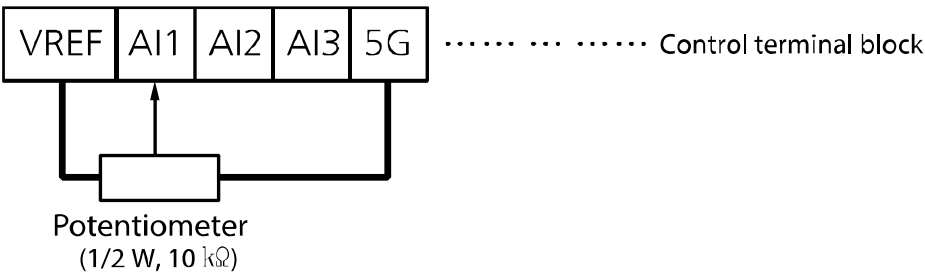
3.5.3 Adjusting the analog input bias and gain

Adjusting the Out Y1 (bias) for analog inputs

Step	Instruction	Keypad display
1	Connect the voltage source (0 V) or current source (0 mA) to the multifunction analog inputs Ai1–5G on the standard input/output board.	-
2	When a potentiometer is connected, adjust the resistance to the minimum value.	-
3	From the initial screen, press [PROG]. The input/output proportion that the controller detects is displayed at the top right of the screen. The configured bias value is displayed at the bottom right of the screen.	AIO ▶ AI1 0.18% 04 Bias 0.00%
4	Press [▲] to adjust the value.	AIO ▶ AI1 0.00% 04 Bias 0.18%

Basic Ops.

Step	Instruction	Keypad display
5	Press [ENT] to save the value. The saved value is displayed.	AIO ▶ AI1 Out Y1 04　　　0.18％

Adjusting the Out Y2 (gain) for analog inputs

Step	Instruction	Keypad display
1	Connect the voltage source (10 V) or current source (20 mA) to the multifunction analog inputs Ai1–5G on the standard input/output board.	-
2	When a potentiometer is connected, adjust the resistance to the maximum value.	-
3	From the initial screen, press [PROG]. The input/output proportion that the controller detects is displayed at the top right of the screen. The configured bias value is displayed at the bottom right of the screen.	AIO ▶ AI1 98.00％ 06 Gain　100.00％
4	Press [▲] to adjust the value.	AIO ▶ AI1 0.00％ 06 Gain　102.00％
5	Press [ENT] to save the value. The saved value is displayed.	AIO ▶ AI1 Out Y2 06　　　102.00％

3.5.4 Operating in forward and reverse directions

FX operation from the control terminal block

1 Connect an input voltage (0 V) across Ai1 and 5G.

2   If a potentiometer is connected, adjust the resistance to the minimum value.

3   Close the motor circuit by connecting the FX and CM terminals together at the control terminal block, and then confirm that '+0.0 rpm' is displayed as the motor speed.

4   Gradually increase the voltage at Ai1 and then confirm that the motor speed increases.

5   If a potentiometer is connected, gradually increase the resistance value.

6   Remove the connection between the FX and CM terminals to open the motor circuit.

Basic Ops.

RX operation from the control terminal block

1 Connect an input voltage (0V) across Ai1 and 5G.

2 If a potentiometer is connected, adjust the resistance to the minimum value.

3 Close the motor circuit by connecting the RX and CM terminals together at the control terminal block, and then confirm that '-0.0 rpm' is displayed as the motor speed.

4 Gradually increase the voltage at Ai1 and then confirm that the motor speed increases.

5 If a potentiometer is connected, gradually increase the resistance value.

6 Remove the connection between the RX and CM terminals to open the motor circuit.

Operation status according to the encoder when operating at low speed via the control terminal block

Encoder/Motor connections	Keypad command	Direction of motor rotation	Speed display on the keypad	Torque display on the keypad	Operation status
Encoder and motor connection is normal.	FWD	Forward	+100.0 rpm	Lower than +10%	Normal
	REV	Reverse	-100.0 rpm	Lower than -10%	
Encoder connection has been changed.	FWD	Forward	-10 - -40 rpm	150% (torque limit)	Abnormal
	REV	Reverse	10-40 rpm	-150% (torque limit)	
Motor connection has been changed.	FWD	Forward	-10 - -40 rpm	150% (torque limit)	Abnormal
	REV	Reverse	10-40 rpm	-150% (torque limit)	
Encoder and motor connections have been changed.	FWD	Forward	+100.0 rpm	Lower than +10%	Abnormal
	REV	Reverse	-100.0 rpm	Lower than -10%	

If Phase A and B of the encoder are reversed or the motor connections have been changed, reverse the Phase A and B connections, or change the inverter output connection.

The torque display on the keypad is based on no load operation.

Example of an operation (1) Speed reference from the keypad + run signal at the terminal block

Operation conditions

- Control mode: Speed control (Speed)
- Speed reference: Set the speed to 1,500 rpm from the keypad
- Acceleration/deceleration time: 10 sec. / 20 sec.
- Run command: RUN/STOP command at the terminal block

Wiring diagram

Parameter setting

Step	Procedure	Function code	Discription
1	Set the RUN/STOP command source	FUN_01	Set Run/Stop Src to "Terminal 1."
2	Set the speed reference source	FUN_02	Set Speed Ref Sel to "Keypad 1."
3	Set speed reference	FUN_12	Set Speed 0 to "1500.0 (rpm)"
4	Set acc/dec times	FUN_41 FUN_41	Set the acceleration time (FUN_41) to "10.00 (Sec)," and the deceleration time (FUN_42) to "20.00 (Sec)."
5	Run FX operation at the terminal block	-	When the FX terminal input is ON, the inverter accelerates the motor for 10 seconds, and then runs it at 1,500 rpm, in the forward direction. When the input is OFF, the inverter decelerates the motor for 20 seconds, and then stops.
6	Run RX operation at the terminal block	-	When the RX terminal input is ON, the inverter accelerates the motor for 10 seconds, and then runs it at 1,500 rpm,in the reverse direction. When the input is OFF, the inverter decelerates the motor for 20 seconds, and then stops.

Example of an operation (2) Speed reference from the potentiometer (Ai1) + run signal at the terminal block

Operation conditions

- Control mode: Speed control (Speed)
- Speed reference: Set the speed to 1,500 rpm using the potentiometer (connected to Ai1).
- Acceleration/deceleration time: 10 sec. / 20 sec.
- Run command: RUN/STOP command at the terminal block

Basic Ops.

Wiring diagram

Parameter setting

Step	Procedure	Function code	Discription
1	Set the RUN/STOP command source	FUN_01	Set Run/Stop Src to "Terminal 1."
2	Set the speed reference source	FUN_02	Set Speed Ref Sel to "Analog."
3	Define analog input	AIO_01	Set Ai1 Define to "Speed Ref."
4	Define analog input type	AIO_02	Set Ai1 Source to "0 -> 10 V."
5	Set the speed reference	DIS_01	Adjust the potentiometer to set PreRamp Ref (DIS_01) to "1500.0 (rpm)"
6	Set acc/dec times	FUN_41 FUN_42	Set the acceleration time (FUN_41) to "10.00 (Sec)," and the deceleration time (FUN_42) to "20.00 (Sec)."

Step	Procedure	Function code	Discription
7	Run FX operation at the terminal block	-	When the FX terminal input is ON, the inverter accelerates the motor for 10 seconds, and then runs it at 1,500 rpm, in the forward direction. When the input is OFF, the inverter decelerates the motor for 20 seconds, and then stops it.
8	Run RX operation at the terminal block	-	When the RX terminal input is ON, the inverter accelerates the motor for 10 seconds, and then runs it at 1,500 rpm, in the reverse direction. When the input is OFF, the inverter decelerates the motor for 20 seconds, and then stops it.

4 Basic and advanced features

4.1 Introduction of basic features

Feature	Description	Page ref.
Speed reference source configuration at the keypad	Setup or modify a speed reference using the keypad.	<u>*p. 62*</u>
Speed reference source configuration at the terminal block (input voltage)	Enable, setup, or modify speed reference input voltage at terminals Ai1–Ai3.	<u>*p. 62*</u>
Speed reference source configuration at the terminal block (input current)	Enable, setup, or modify speed reference input current at terminals Ai1– Ai2.	
Speed reference source configuration for RS-485 communication	Enable, setup, or modify speed reference communication signals from upper level controllers, such as PLCs or PCs.	
Multistep speed configuration	Configures multistep speed operations by defining the terminal input.	
Command source configuration for terminal block inputs	Configures the inverter to accept inputs at the FX/RX terminals.	<u>*p. 66*</u> <u>*p. 68*</u>
Command source configuration for RS-485 communication	Configures the inverter to accept communication signals from upper level controllers, such as PLCs and PCs.	
Motor rotation control	Configures the inverter to limit a motor's direction of rotation.	
Automatic start-up at power-on	Configures the inverter to start operating at power-on. In this configuration, the inverter begins to run and the motor accelerates as soon as power is supplied to the inverter. To use this feature, the operation command	

Feature
Introduction

Feature	Description	Page ref.
	terminals at the terminal block must be enabled.	
Automatic restart after a fault trip condition is reset	Configures the inverter to resume operation when the inverter is reset following a fault trip. In this configuration, the inverter starts to run again and the motor accelerates when the inverter is reset following a fault trip condition. To use this feature, the operation command terminals at the terminal block must be enabled.	
Acc/Dec time configuration based on maximum speed	Configures the acceleration and deceleration times for a motor based on a defined maximum speed.	
Acc/Dec time configuration based on speed reference	Configures acceleration and deceleration times for a motor based on a defined speed reference.	
Multistage Acc/Dec time configuration at the multifunction terminals	Configures multistage acceleration and deceleration times for a motor based on defined parameters at the multifunction terminals.	
Acc/Dec pattern configuration	Enables modification of the acceleration and deceleration gradient patterns. Basic patterns include linear and S-curve.	
Encoder error detection configuration	Configures the inverter to detect hardware encoder errors.	
Encoder software error detection configuration	Configures the inverter to detect acceleration errors during the operation due to connection changes between the encoder and motor.	
Output voltage adjustment	Adjusts the output voltage to the motor when the power supply to the inverter differs from the motor's rated input voltage.	
Accelerating start	Accelerating start is the standard motor starting method. Typically, motors accelerate to a target frequency in response to a run command. Other start or acceleration conditions may also be defined.	-
Deceleration stop	Deceleration stop is the standard stopping method for motors. After receiving a stop command, the motor	

Feature	Description	Page ref.
	decelerates to 0 Hz and stops. Other stop or deceleration conditions may also be defined.	
Free-run stop	Configures a stop command that stops the inverter output to the motor. The motor will free-run, slows down, and then stops.	
Reverse the multifunction terminal input	Reverses the input terminal position from Form A contact to Form B contact.	
Multifunction input terminal time	Configures the input terminal time constant to improve tolerance to electronic interference.	-
Reversing the multifunction terminal output	Reverses the output terminal from Form A contact to Form B contact.	

4.2 Introduction of advanced features

Task	Description	Page ref.
Jog	The Jog feature allows users to temporarily override the current settings and manually operate the inverter. The inverter operates based on a set of predefined parameter settings for Jog operation that are active while the Jog command button is pressed.	
MOP up-down	Uses upper and lower limit value output signals from control devices (such as a flow meter) to provide Acc/Dec commands to motors.	
3-wire	Latches a push button input signal in a 3- wire system to operate the inverter.	
Dwell	Provides constant torque while braking is applied or released for lifting loads such as elevators.	
Auto-tuning	Automatically adjusts motor control parameters to optimize the performance of the inverter's control mode.	

Task	Description	Page ref.
Auto restart	Automatically restarts the inverter when a trip condition is released following an inverter stoppage due to the activation of a protective function (fault trip).	
Second motor	Switches operation between two motors that are connected to one inverter. The second motor is configured to operate via the input terminals defined for the second motor.	
Timer	Turn on or off a multifunction output, including connected relays, after a specific time.	
Disable soft start (SoftStartCnCl)	Bypass the selected acceleration/deceleration time and accelerate/decelerate in the shortest time.	
Speed controller gain switch	Select between two PI controller combinations.	
Speed controller P/PI switch	Switch the speed controller from PI control to P control.	
Speed command switch	Select either an external analog input or the rated speed as the speed controller's calculation method.	-
Pre-excitation	Improve response characteristics during motor acceleration.	
Using maximum torque	Set the torque limit to the maximum value.	
Using torque bias	Apply a torque bias.	
Using the battery operation mode	Operate the motor using the battery power supply when the main power supply is unavailable, eg. during a power failure.	
Disable low voltage trip detection	Detect hardware errors, except for low voltage trips, by operating the control board using auxiliary power before turning on the main power supply.	
Brake control	Enable or disable the braking system.	
Short floor operation	Improve elevator floor position when operating an elevator up and down short distances.	
Low voltage 2	Detects low voltage trips when an instantaneous interruption occurs during operation.	

Task	Description	Page ref.
MC ON/OFF control	Enable or disable the magnetic contactor installed as safety device in the inverter's output circuit.	
Auto load cell configuration	Simplify the load cell's configuration for initial elevator commissioning.	
Anti rollback control	Compensates for load in the initial load when the load cell is not used.	
Preventing speed overshoot	Prevents speed overshoot during elevator operation.	
Initial pole position estimation	Detects the initial pole position of a synchronous motor	
Anti-hunting	Prevents mechanical resonance while motors are operating.	
ALLS (Automatic Light Load Search)	Detects light load conditions when the battery power supply is operating and directs the elevator to the nearest floor.	

Introduction Feature

5 Table of functions

5.1 Display (DIS) group

* SV: Speed for Async, V/F: V/F, Slip: Slip Compensation, SPfS: Speed Mode for Sync, EL: EL Mode for Async, ELfS: EL Mode for Sync

* O: Displayed, X: Not displayed, #: Not available

On the Keypad, "#" indicates not available and "" indicates a duplicate setting.

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
DIS_00	-	Motor speed/ control mode/ torque/ output current	0.0 rpm SPD Tq 0.0% 0.0A				O	O	O	O	O	O
DIS_01	-	User define 1	Ai1 Value		%	PreRamp Ref	O	O	O	O	O	O
			Ai2 Value		%		O	O	O	O	O	O
			Ai3 Value		%		O	O	O	O	O	O
			PreRamp Ref		rpm		O	O	O	O	O	O
			PostRamp Ref		rpm		O	O	O	O	O	O
			ASR Inp Ref		rpm		O	O	O	O	O	O
			Output Freq		Hz		O	O	O	O	O	O
			Motor Speed		rpm		O	O	O	O	O	O
			Speed Dev		rpm		O	X	X	O	O	O
			ASR Out		%		O	X	X	O	O	O
			Torque Bias		%		O	X	X	O	O	O
			PosTrq Limit		%		O	X	X	O	O	O

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
			NegTrq Limit		- %		○	X	X	○	○	○
			RegTrq Limit		%		○	X	X	○	○	○
			Torque Ref		%		○	X	X	○	○	○
			IqeRef		A		○	X	X	○	○	○
			Iqe		A		○	○	○	○	○	○
			Flux Ref		%		○	X	X	○	○	○
			Ide Ref		A		○	X	X	○	○	○
			Ide		A		○	○	○	○	○	○
			ACR_Q Out		V		○	X	X	○	○	○
			ACR_D Out		V		○	X	X	○	○	○
			VdeRef		V		○	○	○	○	○	○
			VqeRef		V		○	○	○	○	○	○
			Out Amps RMS		A		○	○	○	○	○	○
			Out Volt RMS		V		○	○	○	○	○	○
			Power		kW		○	○	○	○	○	○
			DC Bus Volt		V		○	○	○	○	○	○
			MotTemp NTC		deg		○	○	○	○	○	○
			Inv Temp		deg		○	○	○	○	○	○
			Ctrl Mode				○	○	○	○	○	○
			Run Time		Sec		○	○	○	○	○	○
			Terminal In		Bit		○	○	○	○	○	○
			Terminal Opt		Bit		○	○	○	○	○	○
			Terminal Out		Bit		○	○	○	○	○	○
			Run Status				○	○	○	○	○	○
			PhInOpenLvl		%		○	○	○	○	○	○

Function
Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
			Iup/Ium		A		X	X	X	○	X	○
			Ivp/Ivm		A		X	X	X	○	X	○
			Iwp/Iwm		A		X	X	X	○	X	○
DIS_02	-	User define 2	Refer to DIS_01.			DC Bus Volt	○	○	○	○	○	○
DIS_03	-	User define 3	Refer to DIS_01.			Terminal In	○	○	○	○	○	○
DIS_05	7005	Fault status[Note 1]	Faults				○	○	○	○	○	○
DIS_06	7506	Software version	SW Version				○	○	○	○	○	○
DIS_10	710A	User group display	User Grp Disp	0 (Not Used)		0 (Not Used)	○	○	○	○	○	○
				1 (Dis+User Grp)								
				2 (Display All)								

- Note 1) When accessing DIS-05 via the communication, fault status is not displayed and only deleting communication history is available.

5.2 Parameter (PAR) group

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
PAR_00	-	Jump to codes	Jump Code	1–98			○	○	○	○	○	○
PAR_01	7201	Reset to default setting	Para. init	0 (No)	Msg	0 (No)	○	○	○	○	○	○
				1 (All Groups)			○	○	○	○	○	○
				2 (DIS)			○	○	○	○	○	○
				3 (PAR)			○	○	○	○	○	○
				4 (DIO)			○	○	○	○	○	○
				5 (AIO)			○	○	○	○	○	○
				6 (FUN)			○	○	○	○	○	○
				7 (CON)			○	○	○	○	○	○
				8 (E/L)			#	#	#	#	○	○
				9 (PRT)			○	○	○	○	○	○
				10 (COM)			○	○	○	○	○	○
				11 (M2)			○	○	○	#	○	#
				13 (USR)			○	○	○	○	○	○
PAR_02	-	Read all codes	Para. read	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○
PAR_03	-	Write all codes	Para. write	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○
PAR_04	7204	Lock codes	Para. lock	0–255		0	○	○	○	○	○	○
PAR_05	-	Password	Password	0–9999		0	○	○	○	○	○	○
PAR_07	7207	Control mode options	Control Mode	2 (Speed)	Msg		○	○	○	○	○	○
				4 (V/F)			○	○	○	○	○	○
				5 (Slip comp)			○	○	○	○	○	○

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
				6 (Speed for sync) Note 8)			○	○	○	○	○	○
PAR_08	7208	Application	Application	0 (General vector)	Msg	0	○	○	○	○	○	○
				1 (Elevator)			○	X	X	○	○	○
PAR_09	7209	Motor capacity Note 1)	Motor select	0 (2.2)	Msg	7.5	○	○	○	○	○	○
				1 (3.7)			○	○	○	○	○	○
				2 (5.5)			○	○	○	○	○	○
				3 (7.5)			○	○	○	○	○	○
				4 (11.0)			○	○	○	○	○	○
				5 (15.0)			○	○	○	○	○	○
				6 (18.5)			○	○	○	○	○	○
				7 (22.0)			○	○	○	○	○	○
				8 (User Define) Note 1)			○	○	○	○	○	○
PAR_10	720A	User defined motor capacity	User MotorSel	2.2–22.0	Msg	7.5	○	○	○	○	○	○
PAR_11	720B	Maximum speed	Max Speed	10.0–3600.0 Note 2)	rpm/Hz	1800.0	○	○	○	○	○	○
PAR_12	720C	Minimum speed	Min Speed	0.5–10.00 Note3)	Hz	0.5	X	○	○	X	○	X
PAR_13	720D	Base frequency	Base Freq	30.00–120.00	Hz	60.00	X	○	○	X	X	X
PAR_14	720E	Base speed	Base Speed	10.0–3600.0	rpm	1800.0	○	X	X	○	○	○
PAR_15	720F	Rated voltage	Rated Volt	240–560	V	440	○	○	○	○	○	○

Code	Comm. address	Name	Keypad display	Range		Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
PAR_16	7210	Motor pole number	Pole Number	2–128			4	○	○	○	○	○	○
PAR_17	7211	Motor efficiency	Efficiency	70.0–100.0		%	86.0	○	○	○	X	○	○
PAR_18	7212	Motor rated slip	Rated-Slip	10–250		rpm	70	○	○	○	X	○	X
PAR_19	7213	Motor rated current	Rated-Curr	1.0–1000.0		A	19.7	○	○	○	○	○	○
PAR_20	7214	Input voltage	AC In Volt	320–480		V	380	○	○	○	○	○	○
PAR_21	7215	Switching frequency	PWM Freq	Induction motor	2.5–10.0	kHz	8.0	○	○	○	○	○	○
				Sync. motor	2.5–8.0								
PAR_22	7216	Motor cooling options	Cooling Mtd	0 (Self-cool) 1 (Forced-cool)			1 (Forced-cool)	○	○	○	○	○	○
PAR_23	7217	Encoder type	Enc Type	0 (Normal) 1 (EnDat) 2 (Sin/Cos)			0 (Normal)	X	X	X	○	X	○
PAR_24	7218	Encoder pulse number	Enc Pulse	360–32768			1024	○	○	○	○	○	○
PAR_25	7219	Encoder directions	Enc Dir Set	0 (A Phase Lead) 1 (B Phase Lead)			0 (A Phase Lead)	○	○	○	○	○	○
PAR_26	721A	EnDat directions Note 4)	EnDat Dir	0 (CW) 1 (CCW)			0 (CW)	X	X	X	○	X	○

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
PAR_27	721B	Encoder scale [Note 5]	Enc Scale	0 (x1) 1 (x16) 2 (x32) 3 (x64)		0	○	○	○	○	○	○
PAR_28	721C	Encoder tuning [Note 4]	Enc Tuning	0 (No) 1 (Yes)		0	X	X	X	○	X	○
PAR_31	721F	Auto-tuning options [Note 6]	AutoTune Type	0 (Rotational) 1 (Standstill)		1(Standstill)	○	○	○	○	○	○
PAR_32	7220	If tuning error protection P gain	Kp for If	1–1000		20	○	X	X	X	○	X
PAR_33	7221	If tuning error protection I gain	Ki for If	1–1000		40	○	X	X	X	○	X
PAR_34	7222	Motor inertia tuning options	Inertia Tune	0 (No) / 1 (Yes)		0 (No)	○	X	X	X	○	X
PAR_35	7223	Acc/dec time inertia tuning	J Spd Time	0.500–10.000	sec	0.500	○	X	X	X	○	X
PAR_36	7224	Inertia LPF	Inertia LPF	0.010–50.000	msec	0.100	○	X	X	X	○	X
PAR_41	7229	Induction motor auto-tuning options	AsynAuto Tune	PAR_31=0 0 (None) 1 (ALL1) 2 (ALL2)	Msg	None	○	○	○	X	○	X

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
				3 (Encoder Test) 4 (Rs Tuning) 5 (Lsigma) 6 (Flux Curr) 7 (Ls Tuning) 8 (Tr Tuning)								
				PAR_31=1								
				0 (None) 1 (ALL 1) 4 (Rs Tuning) 5 (Lsigma) 8 (if/Tr/Ls Tune)								
PAR_42	722A	Number of detected initial pole positions	ReDet Num	0–65535		0	X	X	X	○	X	○
PAR_43	722B	Average number of detected initial pole positions	DetAve Num	1–30		5	X	X	X	○	X	○
PAR_44	722C	Voltage at detected pole positions	MagDet Volt	5–500	V	60	X	X	X	○	X	○
PAR_45	722D	Pole position detection current	MagDet Curr	10–150	%	40	X	X	X	○	X	○
PAR_46	722E	Ld Lq detection level	TuneLvl_LdLq	20.0–50.0	%	33.3	X	X	X	○	X	○
PAR_47	722F	Ld Lq detection frequency	TuneHz_LdLq	100.0–200.0	%	150.0	X	X	X	○	X	○

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
PAR_51	7233	Synchronous motor auto-tuning options	SynAuto Tune	0 (None) 1 (All) 2 (Rs Tuning) 3 (Ld/Lq Tuning) 4 (Mag Pole Est)	Msg	None	X	X	X	○	X	○
PAR_52	7234	Motor flux current	Flux-Curr	0.0–70% of [PAR_19]	A		○	○	○	X	○	X
PAR_53	7235	Rotor time constant	Tr	30–3000	msec		○	○	○	X	○	X
PAR_54	7236	Motor stator inductance	Ls	0.00–500.00	mH		○	○	○	X	○	X
PAR_55	7237	Leakage factor	Lsigma	0.00–300.00	mH	Varies depending on the motor capacity	○	○	○	X	○	X
PAR_56	7238	Motor stator resistance	Rs	0.000–15.000	ohm		○	○	○	○	○	○
PAR_57	7239	Motor inertia constant	Inertia	0.001–60.000	kg·m^2		○	○	○	○	○	○
PAR_58	723A	Motor D-axis inductance	Ld	0.00–500.00	mH		X	X	X	○	X	○

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
PAR_59	723B	Motor Q-axis inductance	Lq	0.00–500.00	mH		X	X	X	○	X	○
PAR_60	723C	Initial pole position	Init Theta	0–360	deg	0	X	X	X	○	X	○

- Note 1) A motor capacity that exceeds the inverter capacity cannot be selected.
- Note 2) PAR_10 (UserMotorSel) is displayed when PAR_09 (Motor select) is set to "User Define".
- Note 3) Max Speed is 3600.0 rpm in "Speed" mode, and 30.00–120.00 Hz in "V/F" and "Slip Compensation" modes.
- Note 4) Min Speed is available when the control mode is "V/F" or "Slip Compensation". When FUN_23 is selected to "Yes", the maximum value that can be set for Min Speed is the value set in FUN_24.
- Note 5) This option is displayed only when PAR-23 is set to "EndatMode".
- Note 6) Refer to the user manual supplied with the Sin/Cos encoder. This option is available in "Speed" mode.
- Note 7) This option is not displayed during battery supply operations.
- Note 8) Speed (for Sync) feature is not available when selecting the second motor feature.
- The Elevator message in PAR_08 is available when the ELIO card is installed to the inverter.
- PAR_35 is available when PAR_34 (Inertia Tune) is set to "Yes".
- PAR_23 is available when the optional encoder is installed.

Function
Table

5.3 Digital input and output (DIO) group

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
DIO_00	-	Jump to codes	Jump Code	1–98			○	○	○	○	○	○
DIO_01	7301	Define multi-function input terminal P1	P1 Define	0 (Not Used)	Msg	0 (Not Used)	○	○	○	○	○	○
				1 (Speed-L)			○	○	○	○	○	○
				2 (Speed-M)			○	○	○	○	○	○
				3 (Speed-H)			○	○	○	○	○	○
				4 (Jog Speed)			○	○	○	○	○	○
				5 (MOP Up)			○	○	○	○	○	○
				6 (MOP Down)			○	○	○	○	○	○
				7 (MOP Clear)			○	○	○	○	○	○
				8 (MOP Save)			○	○	○	○	○	○
				9 (2nd Motor)			○	○	○	#	○	#
				10 (Xcel-L)			○	○	○	○	○	○
				11 (Xcel-H)			○	○	○	○	○	○
				12 (3-Wire)			○	○	○	○	○	○
				13 (EXT Trip-B)			○	○	○	○	○	○
				14 (Prohibit FWD)			○	○	○	○	○	○
				15 (Prohibit REV)			○	○	○	○	○	○
				17 (Timer Input)			○	○	○	○	○	○
				18 (SoftStrtCncl)			○	#	#	○	#	#
				19 (ASR Gain Sel)			○	#	#	○	○	○
				20 (ASR P/PI Sel)			○	#	#	○	○	○
				21 (Flux Ref Sel)			○	#	#	#	○	#
				22 (PreExcite)			○	#	#	#	○	#
				24 (Use Max Trq)			○	#	#	○	○	○

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
				25 (Use Trq Bias)			○	#	#	○	○	○
				26 (A3 Safety)			○	○	○	○	○	○
				27 (LVT Disable)			○	○	○	○	○	○
				28 (Battery Run)			○	○	○	○	○	○
DIO_02	7302	Define multi-function input terminal P2	P2 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○
DIO_03	7303	Define multi-function input terminal P3	P3 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○
DIO_04	7304	Define multi-function input terminal P4	P4 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○
DIO_05	7305	Define multi-function input terminal P5	P5 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○
DIO_06	7306	Define multi-function input terminal P6	P6 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○
DIO_07	7307	Define multi-function input terminal P7	P7 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○
DIO_08	7308	Reverse operation for multi-	Neg Func. In	00000000000–11111111111	bit	00000000 000	○	○	○	○	○	○

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
		function terminal input										
DIO_09	7309	Low-pass filter time constant for multi-function terminal input	Terminal LPF	0–2000	msec	5	○	○	○	○	○	○
DIO_10	730A	Reverse operation for multi-function output	Neg Func. Out	000–111	bit	000	○	○	○	○	○	○
DIO_11	730B	Define multi-function aux output AX1	AX1 Define	0 (Not Used)		0 (Not Used)	○	○	○	○	○	○
				1 (INV Ready)			○	○	○	○	○	○
				2 (Zero Spd Det)			○	#	#	○	○	○
				3 (Spd Det)			○	○	○	○	○	○
				4 (Spd Det(ABS))			○	○	○	○	○	○
				5 (Spd Arrival)			○	○	○	○	○	○
				6 (Timer Out)			○	○	○	○	○	○
				7 (LV Warn)			○	○	○	○	○	○
				8 (Run)			○	○	○	○	○	○
				9 (Regenerating)			○	#	#	○	○	○
				10 (Mot OH Warn)			○	○	○	○	○	○
				11 (Inv OH Warn)			○	○	○	○	○	○
				12 (Spd Agree)			○	#	#	○	○	○
				13 (Trq Det)			○	#	#	○	○	○
				14 (Trq Lmt Det)			○	#	#	○	○	○
				15 (OverLoad)			○	○	○	○	○	○
				16 (Stop)			○	○	○	○	○	○

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
				17 (MC on/off)			○	○	○	○	○	○
				18 (FAN Status)			○	○	○	○	○	○
				19 (ALLS Status)			○	○	○	○	○	○
				20 (Steady)			○	○	○	○	○	○
				21 (Brake Output)			○	○	○	○	#	#
DIO_12	730C	Define multi-function aux output AX2	AX2 Define	Same as DIO_11		0 (Not Used)	○	○	○	○	○	○
DIO_13	730D	Define multi-function aux output OC1	OC1 Define	Same as DIO_11		0 (Not Used)	○	○	○	○	○	○
DIO_16	7310	Fault relay terminal (A, B, C)	Relay Mode	000-111	bit	011	○	○	○	○	○	○
DIO_17	7311	Zero-speed detection level	ZSD Level	0.0–480.0	rpm	10.0	○	X	X	○	○	○
DIO_18	7312	Zero-speed detection band	ZSD Band	0.1–10.0	%	0.5	○	X	X	○	○	○
DIO_19	7313	Speed detection level	SD Level	-3600–3600	rpm	0	○	○	○	○	○	○
DIO_20	7314	Speed detection band	SD Band	0.1–10.0	%	0.5	○	○	○	○	○	○
DIO_21	7315	Speed arrival detection band	SA Band	0.1–10.0	%	0.5	○	○	○	○	○	○
DIO_22	7316	Equal speed	SEQ Band	0.1–10.0	%	0.5	○	X	X	○	○	○

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
		detection band										
DIO_23	7317	Torque detection level	TD Level	0.0–250.0	%	0.0	○	X	X	○	○	○
DIO_24	7318	Torque detection band	TD Band	0.1–10.0	%	0.5	○	X	X	○	○	○
DIO_25	7319	Timer On delay	TimerOn Dly	0.1–3600.0	sec	0.1	○	○	○	○	○	○
DIO_26	731A	Timer Off delay	TimerOff Dly	0.1–3600.0	sec	0.1	○	○	○	○	○	○
DIO_28	731C	MC On delay[Note 1)]	MC On Time	100–60000	msec	1000	○	○	○	○	○	○
DIO_29	731D	MC Off delay [Note 1)]	MC Off Time	100–60000	msec	1000	○	○	○	○	○	○
DIO_30	731E	Brake open delay[Note 3)]	BK On Delay	0–FUN_11	msec	0	X	○	○	X	X	X
DIO_31	731F	Brake open time [Note 2)]	BKOpen Time	0.01–30.00	sec	0.00	○	○	○	○	○	○
DIO_32	7320	Brake open speed [Note 2)]	BKOpen Spd	0.0–500.0	rpm	0.0	○	○	○	○	○	○
DIO_33	7321	Brake open current [Note 2)]	Release Curr	0.0–15.0	%	2.0	○	○	○	X	○	X
DIO_34	7322	Brake off delay [Note 2)]	BK Off Delay	0–FUN_11	msec	0	○	○	○	○	○	○
DIO_36	7324	Brake close speed [Note 2)]	BKClose Spd	0.0–500.0	rpm	0.0	○	○	○	○	○	○

- Note 1) This option is displayed when AX1, AX2, or OC1 is set to "MC on/off".
- Note 2) This option is displayed when AX1, AX2, or OC1 is set to "Brake output".
- Note 3) This option is displayed when AX1, AX2, or OC1 is set to "Brake output" and the stop method is set to DC-Brake.

5.4 Analog input and output (AIO) group

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS	Page ref.
AIO_00	-	Jump to codes	Jump Code	1–81			○	○	○	○	○	○	
AIO_01	7401	Define multi-function analog input Ai1	Ai1 Define	0 (Not Used)	Msg	0 (Not Used)	○	○	○	○	○	○	
				1 (Speed Ref)			○	○	○	○	○	○	
				5 (Flux Ref)			○	#	#	#	○	#	
				6 (Torque Bias)			○	#	#	○	○	○	
				7 (Torque Limit)			○	#	#	○	○	○	
				8 (Use Mot NTC) Note 1)			○	○	○	○	○	○	
AIO_02	7402	Define multi-function analog input Ai1 input source Note 2)	Ai1 Source	0 (-10 → 10 V) 1 (10 → -10 V) 2 (0 → 10 V) 3 (10 → 0 V) 4 (0 → 20 mA) 5 (20 → 0 mA)	Msg	0 (-10 → 10V)	○	○	○	○	○	○	
AIO_03	7403	Define multi-function analog input Ai1 minimum voltage	Ai1 In X1	AIO_07– AIO_05	%	0.00	○	○	○	○	○	○	

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
		Note 2)											
AIO_04	7404	Define multi-function analog input Ai1 min. voltage bias Note 2)	Ai1 Out Y1	AIO_08–AIO_06	%	0.00	○	○	○	○	○	○	
AIO_05	7405	Define multi-function analog input Ai1 maximum voltage Note 2)	Ai1 In X2	0.00–100.00	%	100.00	○	○	○	○	○	○	
AIO_06	7406	Define multi-function analog input Ai1 maximum voltage gain Note 2)	Ai1 Out Y2	0.00–250.00	%	100.00	○	○	○	○	○	○	
AIO_07	7407	Define multi-function analog input Ai1 minimum voltage Note 3)	Ai1 -In X1	AIO_09– AIO_03	%	0.00	○	○	○	○	○	○	

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
AIO_08	7408	Define multifunction analog input Ai1 min. voltage bias Note 3)	Ai1 -Out Y1	AIO_10– AIO_04	%	0.00	○	○	○	○	○	○	
AIO_09	4709	Define multi-function analog input Ai1 maximum voltage Note 3)	Ai1 -In X2	-100.00–0.00	%	-100.00	○	○	○	○	○	○	
AIO_10	740A	Define multi-function analog input Ai1 max. voltage gain Note 3)	Ai1 -Out Y2	-250.00–0.00	%	-100.00	○	○	○	○	○	○	
AIO_11	740B	Ai1 input LPF time constant Note 2)	Ai1 LPF	0–2000	msec	0	○	○	○	○	○	○	
AIO_12	740C	Define multi-function analog input Ai1 lost command conditions Note 2)	Ai1 Wbroken	0 (None) 1 (Half x1) 2 (Less than x1)	Msg	0 (None)	○	○	○	○	○	○	

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
AIO_13	740D	Define multi-function analog input Ai2	Ai2 Define	Refer to AIO_01–12									
AIO_14	740E	Multi-function analog input Ai2 input source	Ai2 Source										
AIO_15	740F	Multi-function analog input Ai2 minimum voltage	Ai2 In X1										
AIO_16	7410	Multi-function analog input Ai2 minimum voltage bias	Ai2 Out Y1										
AIO_17	7411	Multi-function analog input Ai2 maximum voltage	Ai2 In X2										

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
AIO_18	7412	Multi-function analog input Ai2 maximum voltage gain	Ai2 Out Y2										
AIO_19	7413	Multi-function analog input Ai2 - minimum voltage	Ai2 -In X1										
AIO_20	7414	Multi-function analog input Ai2 - minimum voltage bias	Ai2 -Out Y1										
AIO_21	7415	Multi-function analog input Ai2 - maximum voltage	Ai2 -In X2										

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
AIO_22	7416	Multi-function analog input Ai2 - maximum voltage gain	Ai2 -Out Y2										
AIO_23	7417	Ai2 input LPF time constant	Ai2 LPF										
AIO_24	7418	Multi-function analog input Ai2 lost command conditions	Ai2 Wbroken										
AIO_25	7419	Define multi-function analog input Ai3	Ai3 Define	Refer to AIO_01 Motor NTC is available 8 (Use Mot NTC)		0 (Not Used)	○	○	○	○	○	○	
AIO_26	741A	Multi-function analog input Ai3 input source	Ai3 Source	0 (-10 → 10 V) 1 (10 → -10 V) 2 (0 → 10 V) 3 (10 → 0 V)	Msg	0 (-10 → 10 V)	○	○	○	○	○	○	

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
AIO_27	741B	Multi-function analog input Ai3 minimum voltage	Ai3 In X1	Refer to AIO_03–12									
AIO_28	741C	Multi-function analog input Ai3 minimum voltage bias	Ai3 Out Y1										
AIO_29	741D	Multi-function analog input Ai3 maximum voltage	Ai3 In X2										
AIO_30	741E	Multi-function analog input Ai3 maximum voltage gain	Ai3 Out Y2										
AIO_31	741F	Multi-function analog input Ai3 - minimum	Ai3 -In X1										

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
		voltage											
AIO_32	7420	Multi-function analog input Ai3 - minimum voltage bias	Ai3 -Out Y1										
AIO_33	7421	Multi-function analog input Ai3 - maximum voltage	Ai3 -In X2										
AIO_34	7422	Multi-function analog input Ai3 - maximum voltage gain	Ai3 -Out Y2										
AIO_35	7423	Ai3 input LPF time constant	Ai3 LPF										
AIO_36	7424	Multi-function analog input Ai3 lost command conditions	Ai3 Wbroken										

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
AIO_37	7425	Multi-function analog input lost command time	Time out	0.1–120.0	sec	1.0	○	○	○	○	○	○	
AIO_38	7426	Analog input lost command options	Ai Lost Comm	0 (None)	Msg	None	○	○	○	○	○	○	
				1 (Free Run)									
				2 (Decel)									
AIO_40	7428	Define multi-function analog output AO1	AO1 Define	0 (Not Used)	Msg	0 (Not Used)	○	○	○	○	○	○	
				1 (Ai1 Value)			○	○	○	○	○	○	
				2 (AI2 Value)			○	○	○	○	○	○	
				3 (AI3 Value)			○	○	○	○	○	○	
				4 (PreRamp Ref)			○	○	○	○	○	○	
				5 (PostRamp Ref)			○	○	○	○	○	○	
				6 (ASR Inp Ref)			○	○	○	○	○	○	
				7 (Output Freq)			○	○	○	○	○	○	
				8 (Motor Speed)			○	#	#	○	○	○	
				10 (Speed Dev)			○	#	#	○	○	○	
				11 (ASR Out)			○	#	#	○	○	○	
				12 (Torque Bias)			○	#	#	○	○	○	
				13 (PosTrq Limit)			○	#	#	○	○	○	
				14 (NegTrq Limit)			○	#	#	○	○	○	
				15 (RegTrq Limit)			○	#	#	○	○	○	

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
				17 (IqeRef)			○	#	#	○	○	○	
				18 (Iqe)			○	#	#	○	○	○	
				19 (Flux Ref)			○	#	#	#	○	#	
				20 (IdeRef)			○	#	#	○	○	○	
				21 (Ide)			○	#	#	○	○	○	
				22 (ACR_Q Out)			○	#	#	○	○	○	
				23 (ACR_D Out)			○	#	#	○	○	○	
				24 (VdeRef)			○	○	○	○	○	○	
				25 (VqeRef)			○	○	○	○	○	○	
				26 (Out Amps RMS)			○	○	○	○	○	○	
				27 (Out Volt RMS)			○	○	○	○	○	○	
				28 (Power)			○	○	○	○	○	○	
				29 (DC Bus Volt)			○	○	○	○	○	○	
				33 (MotNTC Temp)			○	○	○	○	○	○	
				34 (Inv Temp)			○	○	○	○	○	○	
AIO_41	7429	Define multi-function analog output AO1 output source Note 4)	AO1 Source	0 (-10 → 10 V) 1 (10 → -10 V) 2 (0 → 10 V) 3 (10 → 0 V)	Msg	0 (-10 → 10 V)	○	○	○	○	○	○	

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
AIO_42	742A	Define multi-function analog output AO1 bias Note 4)	AO1 Bias	0.0–AIO_43	%	0.0	○	○	○	○	○	○	
AIO_43	742B	Define multi-function analog output AO1 gain Note 4)	AO1 Gain	0.0–500.0	%	100.0	○	○	○	○	○	○	
AIO_44	742C	Define multi-function analog output AO1 -bias Note 4)	AO1 -Bias	AIO_45–0.0	%	0.0	○	○	○	○	○	○	
AIO_45	742D	Define multi-function analog output AO1 -gain Note 4)	AO1 -Gain	0.0–-500.0	%	-100.0	○	○	○	○	○	○	

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPFS	EL	ELfS	Page ref.
AIO_46	742E	Define multi-function analog output AO1 absolute value Note 4)	AO1 ABS	0 (No) / 1 (Yes)	Msg	0 (No)	○	○	○	○	○	○	
AIO_47	7432	Define multi-function analog output AO2	AO2 Define										
AIO_48	7433	Define multi-function analog output AO2 output source Note 5)	AO2 Source	Refer to AIO_41–46									
AIO_49	7434	Define multi-function analog output AO2 bias Note 5)	AO2 Bias										

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS	Page ref.
AIO_50	7435	Define multi-function analog output AO2 gain Note 5)	AO2 Gain										
AIO_51	7436	Define multi-function analog output AO2 - bias Note 5)	AO2 -Bias										
AIO_52	7437	Define multi-function analog output AO2 - gain Note 5)	AO2 -Gain										
AIO_53	7438	Define multi-function analog output AO2 absolute value Note 5)	AO2 ABS										

- Note 1) This option is displayed with "AI3Define" only. It is not available with "Ai1Define" or "AI2Define" settings.
- Note 2) This option is not displayed when AIxDefine (x=0,1, 2) is set to "Not Used".
- Note 3) This option is displayed only when AIxDefine (x=0,1, 2) is not set to "Not Used" and AIxSource (x=0,1, 2) is set to "Bipolar".
- Note 4) This option is not displayed when AO1Define is set to "Not Used".
- Note 5) This option is not displayed when AO2Define is set to "Not Used".

5.5 Function (FUN) group

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
FUN_00	-	Jump to codes	Jump code	1–85			○	○	○	○	○	○
FUN_01	7501	RUN/STOP command source	Run/Stop Src	0 (Terminal 1) 1 (Terminal 2) 2 (Keypad) 4 (Int485)	Msg	0 (Terminal 1)	○	○	○	○	○	○
FUN_02	7502	Speed reference source	Spd Ref Sel	0 (Analog) 1 (Keypad1) 2 (Keypad2) 4 (Int485)	Msg	1 (Keypad1)	○	○	○	○	X	X
FUN_03	7503	Stop options	Stop mode	0 (Decel)	Msg	0 (Decel)	○	○	○	○	X	X
				1 (Free-run)			○	○	○	○	X	X
				2 (DC-Brake)			#	○	○	#	X	X
FUN_06	7506	DC-braking frequency Note 1)	DcBr Freq	0.5–60.00	Hz	5.00	X	○	○	X	X	X
FUN_07	7507	Block time before DC-braking Note 1)	DcBlk Time	0.01–60.00	sec	0.10	X	○	○	X	X	X
FUN_08	7508	DC-braking amount Note 1)	DcBr Value	0–200	%	10	X	○	○	X	X	X
FUN_09	7509	DC-braking time Note 1)	DcBr Time	0.1–60.0	sec	1.0	X	○	○	X	X	X
FUN_10	750A	DC-start value Note 1)	DcSt Value	0–200	%	10	X	○	○	X	X	X
FUN_11	750B	DC-start time Note 1)	DcSt Time	0.0–60.0	sec	0	X	○	○	X	X	X
FUN_12	750C	Multistep speed 0 Note 2)	Speed 0	0.0–PAR_11	rpm	0.0	○	○	○	○	○	○

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
FUN_13	750D	Multistep speed 1 Note 2)	Speed 1	0.0–PAR_11	rpm	0.0	○	○	○	○	○	○
FUN_14	750E	Multistep speed 2 Note 2)	Speed 2	0.0–PAR_11	rpm	0.0	○	○	○	○	○	○
FUN_15	750F	Multistep speed 3 Note 2)	Speed 3	0.0–PAR_11	rpm	0.0	○	○	○	○	○	○
FUN_16	7510	Multistep speed 4 Note 2)	Speed 4	0.0–PAR_11	rpm	0.0	○	○	○	○	○	○
FUN_17	7511	Multistep speed 5 Note 2)	Speed 5	0.0–PAR_11	rpm	0.0	○	○	○	○	○	○
FUN_18	7512	Multistep speed 6 Note 2)	Speed 6	0.0–PAR_11	rpm	0.0	○	○	○	○	○	○
FUN_19	7513	Multistep speed 7 Note 2)	Speed 7	0.0–PAR_11	rpm	0.0	○	○	○	○	○	○
FUN_20	7514	JOG speed Note 2)	Jog Speed	0.0–PAR_11	rpm	100.0	○	○	○	○	X	X
FUN_21	7515	Dwell speed Note 2)	Dwell Speed	0.0–PAR_11	rpm	100.0	○	○	○	○	X	X
FUN_22	7516	Dwell time	Dwell Time	0.00–100.00	sec	0.00	○	○	○	○	X	X
FUN_23	7517	Frequency limit	Speed Limit	0(No) 1(Yes)	Msg	0	X	○	○	X	X	X
FUN_24	7518	Frequency low limit Note 3)	Spd Limit L	0–FUN_25	Hz	0.5	X	○	○	X	X	X
FUN_25	7519	Frequency high limit Note 3)	Spd Limit H	FUN_24–MaxFreq	Hz	60.00	X	○	○	X	X	X
FUN_26	751A	Frequency jump	Jump Speed	0 (No) 1 (Yes)	Msg	0	X	○	○	X	X	X

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
FUN_27	751B	Jump frequency low limit1 Note 4)	Jump Lo 1	0.00–FUN_28	Hz	10.00	X	○	○	X	X	X
FUN_28	751C	Jump frequency high limit1 Note 4)	Jump Hi 1	FUN_27–FUN_29	Hz	15.00	X	○	○	X	X	X
FUN_29	751D	Jump frequency low limit2 Note 4)	Jump Lo 2	FUN_28–FUN_30	Hz	20.00	X	○	○	X	X	X
FUN_30	751E	Jump frequency high limit2 Note 4)	Jump Hi 2	FUN_29–FUN_31	Hz	25.00	X	○	○	X	X	X
FUN_31	751F	Jump frequency low limit3 Note 4)	Jump Lo 3	FUN_30–FUN_32	Hz	30.00	X	○	○	X	X	X
FUN_32	7520	Jump frequency high limit3 Note 4)	Jump Hi 3	FUN_31–PAR_11	Hz	35.00	X	○	○	X	X	X
FUN_33	7521	Acc/dec reference speed	Acc/Dec Ref	0 (Max Speed) 1 (Ref Speed)		0 (Max Speed)	○	○	○	○	X	X
FUN_36	7524	S-curve gradient at acceleration 1	Acc S Start	0.0–50.0	%	0.0	○	○	○	○	○	○
FUN_37	7525	S-curve gradient at acceleration 2	Acc S End	0.0–50.0	%	0.0	○	○	○	○	○	○
FUN_38	7526	S-curve	Dec S Start	0.0–50.0	%	0.0	○	○	○	○	○	○

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
		gradient at deceleration 1										
FUN_39	7527	S-curve gradient at deceleration 2	Dec S End	0.0–50.0	%	0.0	○	○	○	○	○	○
FUN_40	7528	Acc/dec time scale	Time scale	0 (0.01 sec) 1 (0.1 sec)		0 (0.01 sec)	○	○	○	○	○	○
FUN_41	7529	Acceleration time 1	Acc Time-1	0.00–600.0	sec	2.00	○	○	○	○	○	○
FUN_42	752A	Deceleration time 1	Dec Time-1	0.00–600.0	sec	2.00	○	○	○	○	○	○
FUN_43	752B	Acceleration time 2	Acc Time-2	0.00–600.0	sec	3.00	○	○	○	○	○	○
FUN_44	752C	Deceleration time 2	Dec Time-2	0.00–600.0	sec	3.00	○	○	○	○	○	○
FUN_45	752D	Acceleration time 3	Acc Time-3	0.00–600.0	sec	4.00	○	○	○	○	○	○
FUN_46	752E	Deceleration time 3	Dec Time-3	0.00–600.0	sec	4.00	○	○	○	○	○	○
FUN_47	752F	Acceleration time 4	Acc Time-4	0.00–600.0	sec	5.00	○	○	○	○	○	○
FUN_48	7530	Deceleration time 4	Dec Time-4	0.00–600.0	sec	5.00	○	○	○	○	○	○
FUN_49	7531	Zero-speed deceleration time options	Use 0 Dec T	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○
FUN_50	7532	Zero-speed deceleration time	0 Dec Time	0.00–600.00	sec	3.00	○	○	○	○	○	○

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
FUN_51	7533	Emergency stop deceleration time	BX Time	0.0–6000.0	sec	0.0	○	○	○	○	X	X
FUN_52	-	Emergency stop terminal filter time	BX Termi LPF	0.0–2000	msec	0	○	○	○	○	○	○
FUN_53	7535	Motor pre-excitation time	PreExct Time	0–10000	msec	0	○	X	X	X	X	X
FUN_54	7536	Hold time at zero-speed	Hold Time	10–10000	msec	1000	○	X	X	○	X	X
FUN_55	7537	Power-on run options	Power-on Run	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	X	X
FUN_56	7538	Short floor operation speed	ShortFlr Spd	0.0–PAR_11	rpm	0.0	○	○	○	○	X	X
FUN_57	7539	Short floor operation time	ShortFlrTime	0.00–100.00	sec	0.00	○	○	○	○	X	X
FUN_58	753A	Anti-hunting regulator options	NewAHR Sel	0 (No) 1 (Yes)			X	○	○	X	X	X
FUN_59	753B	Anti-hunting regulator P gain	NewAHR Pgain	0.00–100.00		3.00	X	○	○	X	X	X
FUN_60	753C	AHR start frequency	AHRLow Freq	0–60.00	Hz	300	X	○	○	X	X	X
FUN_61	753D	AHR end frequency	AHRHi Freq	FUN_60–PAR_11	Hz	70.00	X	○	○	X	X	X

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
FUN_67	7543	Battery operation speed Note 5)	Batt. Speed	DIO_32–200.0	rpm	50.0	○	○	○	○	○	○
FUN_68	7544	Battery input voltage Note 5)	Batt. Volt	12–PAR_15	V	48	○	○	○	○	○	○
FUN_69	7545	Automatic Light Load Search options Note 5)	ALLS Enable	0 (No) 1 (Yes)	Msg	No	○	○	○	○	○	○
FUN_70	7547	Hold time at FX/RX direction switching Note 6)	ALLS DirChgT	1.0–10.0	sec	5.0	○	○	○	○	○	○
FUN_71	7546	Light load search time Note 6)	ALLS Time	FUN_72– 10.00	sec	5.0	○	○	○	○	○	○
FUN_72	7548	Light load detection time Note 6)	ALLS LoadCkT	1.0–5.0	sec	2.0	○	○	○	○	○	○
FUN_73	7549	Load cell options	Use LoadCell	Yes/No		No	○	X	X	○	○	○
FUN_74	754A	Full-load climb torque Note 7)	FullLoad Trq	-250.0–250.0	%	100.0	○	X	X	○	○	○
FUN_75	754B	Full-load climb AI Note 7)	FullLoad AI	-100.0–100.0	%	100.0	○	X	X	○	○	○
FUN_76	754C	No-load descent torque Note 7)	Noload Trq	-250.0–250.0	%	0.0	○	X	X	○	○	○
FUN_77	754D	No-load descent AI Note 7)	Noload AI	-100.0–100.0	%	0.0	○	X	X	○	○	○

- Note 1) This option is displayed when FUN_03 is set to "DC-Brake".
- Note 2) When control mode is set to "V/F" or "Slip Compensation", the range is 0.50–120.00 Hz.
- Note 3) This option is displayed when FUN_23 is set to "Yes".

- Note 4) This option is displayed when FUN_26 is set to "Yes".
- Note 5) This option is displayed when one of the multifunction inputs is set for battery operation.
- Note 6) This option is displayed when FUN_69 is set to "Yes".
- Note 7) This option is displayed when FUN_73 is set to "Yes".

5.6 Control (CON) group

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
CON_00	-	Jump to codes	Jump Code	1–99			○	○	○	○	○	○
CON_02	7602	Speed controller gain ratio	ASR PI Ratio	1.0–500.0	%	20.0	X	X	X	○	X	○
CON_03	7603	Speed controller proportional gain 1	ASR P Gain1	0.1–500.0	%	50.0	○	X	X	○	○	○
CON_04	7604	Speed controller integral time 1	ASR I Gain1	0–50000	msec	300	○	X	X	○	○	○
CON_05	7605	Speed controller input LPF time constant 1	ASR LPF1	0–20000	msec	0	○	X	X	○	○	○

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
CON_06	7606	Speed controller proportional gain 2	ASR P Gain2	0.1–500.0	%	50.0	○	X	X	○	○	○
CON_07	7607	Speed controller integral time 2	ASR I Gain2	0–50000	msec	300	○	X	X	○	○	○
CON_08	7608	Speed controller input LPF time constant 2	ASR LPF2	0–20000	msec	0	○	X	X	○	○	○
CON_09	7609	Overshoot prevention gain	ASR FF Gain	0–1000	%	0	X	X	X	○	X	○
CON_10	760A	Ramp time at speed controller gain switching	ASR RAMP	10–10000	msec	1000	○	X	X	○	○	○
CON_11	760B	Speed controller gain switching speed	ASR TarSpd	0.0–3600.0	rpm	0.0	○	X	X	○	○	○
CON_33	7621	Torque limit source options	Trq Lmt Src	0 (Kpd Kpd Kpd) 1 (Kpd Kpd Ax) 2 (Kpd Ax Kpd) 3 (Kpd Ax Ax) 4 (Ax Kpd Kpd) 5 (Ax Kpd Ax) 6 (Ax Ax Kpd) 7 (Ax Ax Ax)		0 (Kpd Kpd Kpd)	○	X	X	○	○	○

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPFS	EL	ELfS
				9 (485 485 485)								
CON_34	7622	FX torque limit	Pos Trq Lmt	0.0–250.0	%	150.0	○	X	X	○	○	○
CON_35	7623	RX torque limit	Neg Trq Lmt	0.0–250.0	%	150.0	○	X	X	○	○	○
CON_36	7624	Regeneration torque limit	Reg Trq Lmt	0.0–250.0	%	150.0	○	X	X	○	○	○
CON_37	7625	Torque bias options	Trq Bias Src	0 (None) 1 (Analog) 2 (Keypad) 4 (Int485)		0 (None)	○	X	X	○	○	○
CON_38	7626	Torque bias amount	Trq Bias	-150.0–150.0	%	0.0	○	X	X	○	○	○
CON_39	7627	Torque bias compensation for friction loss	Trq Bias FF	-150.0–150.0	%	0.0	○	X	X	○	○	○
CON_40	7628	Torque balance amount	Trq Balance	0.0–100.0	%	50.0	○	X	X	○	○	○
CON_41	7629	Torque boost options [Note 1]	Torque Boost	0 (Manual) 1 (Auto torque boost)		Varies depending on the control mode [Note 2]	X	○	○	X	X	X
CON_42	762A	Forward torque boost [Note 1]	Fwd Boost	0.0–20.0	%	2.0	X	○	○	X	X	X
CON_43	762B	Reverse torque boost	Rev Boost	0.0–20.0	%	2.0	X	○	○	X	X	X

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPFS	EL	ELfS
		Note 1)										
CON_45	762D	Auto torque boost filter Note 1)	ATB FilterGain	1–10000		200	X	○	○	X	X	X
CON_46	762E	Auto torque boost motor voltage gain Note 1)	voltGainAtb M	0–300.0	%	15.0	X	○	○	X	X	X
CON_47	762F	Auto torque boost generating voltage gain Note 1)	voltGainAtb G	0–300.0	%	10.0%	X	○	○	X	X	X
CON_48	7630	V/F pattern Note 1)	V/F pattern	0 (Linear) 2 (User V/F)		0	X	○	○	X	X	X
CON_49	7631	User frequency 1 Note 3)	User Freq 1	0.00– CON_51	Hz	15.00	X	○	○	X	X	X
CON_50	7632	User voltage 1 Note 3)	User Volt 1	0–100	%	25	X	○	○	X	X	X
CON_51	7633	User frequency 2 Note 3)	User Freq 2	CON_49 – CON_53	Hz	30.00	X	○	○	X	X	X
CON_52	7634	User voltage 2 Note 3)	User Volt 2	0–100	%	50	X	○	○	X	X	X
CON_53	7635	User frequency 3 Note 3)	User Freq 3	CON_51 – CON_55	Hz	45.00	X	○	○	X	X	X
CON_54	7636	User voltage 3 Note 3)	User Volt 3	0–100	%	75	X	○	○	X	X	X
CON_55	7637	User frequency 4	User Freq 4	CON_53	Hz	60.00	X	○	○	X	X	X

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
		Note 3)		– PAR_11								
CON_56	7638	User voltage 4 Note 3)	User Volt 4	0–100	%	100	X	○	○	X	X	X
CON_57	7639	Output voltage adjustment	Volt Control	40–150	%	100	X	○	○	X	X	X
CON_63	763F	Slip compensation frequency	SlipCompFreq	0–120.00	Hz	5.00	X	X	○	X	X	X
CON_64	7640	Slip compensation motoring gain H	SlipGain_MH	0–5000		500	X	X	○	X	X	X
CON_65	7641	Slip compensation generating gain H	SlipGain_GH	0–5000		500	X	X	○	X	X	X
CON_66	7642	Slip compensation gain switching frequency	SlipGainFrq	0–120.00	Hz	0.5	X	X	○	X	X	X
CON_67	7643	Slip compensation motoring gain L	SlipGain_ML	0–3000		100	X	X	○	X	X	X
CON_68	7644	Slip compensation generating gain L	SlipGain_GL	0–3000		100	X	X	○	X	X	X
CON_69	7645	Slip compensation filter time constant	Slip Filter	100–10000	msec	500	X	X	○	X	X	X

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
CON_71	7647	Anti rollback time	ARF Time	0–10000	msec	0	X	X	X	○	X	○
CON_72	7648	Anti rollback speed Pgain	ARF ASR P	1–3000	%	100	X	X	X	○	X	○
CON_73	7649	Anti rollback speed I gain	ARF ASR I	0–50000	msec	5	X	X	X	○	X	○
CON_74	764A	Anti rollback position gain	ARF APR P	1–10000	%	200	X	X	X	○	X	○

- Note 1) This mode is displayed when the control mode is "V/F" or "Slip Comp".
- Note 2) The default setting when the control mode is "V/F" is "0 (Manual)" and the default setting when the control mode is "Slip Comp" is "1 (Auto Torque Boost)".
- Note 3) This option is displayed when CON_48 is set to "User V/F". This option is displayed when M2 V/F in M2_32 is set to "User V/F" and the multifunction input is selected to second motor.

5.7 Protection (PRT) group

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
PRT_00	-	Jump to codes	Jump code	1–34		1	○	○	○	○	○	○
PRT_01	7801	E-thermal options	ETH Select	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○
PRT_02	7802	E-thermal 1 min level Note 1)	ETH 1 min	PRT_03–200	%	150	○	○	○	○	○	○
PRT_03	7803	E-thermal continuous operation level Note 1)	ETH Cont	50–PRT_02 (150% max)	%	100	○	○	○	○	○	○
PRT_04	7804	Reset restart options	RST Restart	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○
PRT_05	7805	Number of restart attempts	Retry Number	0–10		0	○	○	○	○	○	○
PRT_06	7806	Delay before retry	Retry Delay	0.0–60.0	sec	1.0	○	○	○	○	○	○
PRT_07	7807	Hold time after stop Note 2)	Restart Time	0.00–10.00	sec	0.00	○	○	○	○	○	○
PRT_08	7808	EnDat options fault / pole position detection settings	EnDat Func	1111–0000	bit	0011	X	X	X	○	X	○
PRT_09	7809	Encoder error check options	Enc Err Chk	0 (No) 1 (Yes)		1 (Yes)	○	X	X	○	○	○

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V\F	Slip	SPfS	EL	ELfS
PRT_10	780A	Encoder LPF time constant	Enc LPF	0–100	msec	1	○	X	X	○	○	○
PRT_11	780B	Motor error detection time	EncFaultTime	0.00–10.00	sec	0.00	○	X	X	○	○	○
PRT_12	780C	Motor error reference speed	EncFaultPerc	0.0–50.0	%	25.0	○	X	X	○	○	○
PRT_13	780D	Speed deviation detection level	SpdErrLevel	0–100	rpm	Async: 100 / Sync: 10	○	X	X	○	○	○
PRT_14	780E	Speed deviation detection time	SpdErrTime	0–1000	msec	Async: 100 / Sync: 10	○	X	X	○	○	○
PRT_15	780F	Overspeed error detection level	OverSpdLevel	100.0–130.0	%	110.0	○	X	X	○	○	○
PRT_16	7810	Overspeed error detection time	OverSpd Time	0.00–2.00	sec	0.00	○	X	X	○	○	○
PRT_17	7811	Missing input phase detection	PhInOpenChk	Yes/No		No	○	○	○	X	○	X
PRT_18	7812	Missing input phase detection voltage level Note 3)	PhInOpenLvl	2–100	V	3	○	○	○	○	○	○

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPFS	EL	ELfS
PRT_19	7813	Missing output phase detection	PhOutOpenChk	Yes/No		No	○	○	○	○	○	○
PRT_20	7814	Overload warning level	OL Level	30–250	%	150	○	○	○	○	○	○
PRT_21	7815	Overload warning time	OL Time	0–30	sec	10	○	○	○	○	○	○
PRT_22	7816	Overload fault trip options	OLT Select	0 (No) / 1 (Yes)		1 (Yes)	○	○	○	○	○	○
PRT_23	7817	Overload fault trip level Note 4)	OLT Level	30–250	%	180	○	○	○	○	○	○
PRT_24	7818	Overload fault trip time Note 4)	OLT Time	0–60	sec	60	○	○	○	○	○	○
PRT_25	7819	Inverter overheat detection temperature Note 5)	IH Warn Temp	5.5/7.5 kW: 50-110	deg	95	○	○	○	○	○	○
				11–22 kW: 50–85	deg	75						
PRT_26	781A	Inverter overheat detection band	IH Warn Band	0–10	deg	5	○	○	○	○	○	○
PRT_27	781B	Motor overheat detection temperature	MH Warn Temp	75–130	deg	120	○	○	○	○	○	○
PRT_28	781C	Motor overheat detection temperature band	MH Warn Band	0–10	deg	5	○	○	○	○	○	○

Function Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	V|F	Slip	SPFS	EL	ELfS
PRT_29	781D	Low Voltage 2 options	LV2 Enable	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○
PRT_30	781E	A3 start time Note 6)	A3 StartTime	0–6000	msec	1500	○	○	○	○	○	○
PRT_31	781F	A3 stop time Note 6)	A3 StopTime	0–6000	msec	1500	○	○	○	○	○	○
PRT_32	7820	Cooling fan control	Fan Control	0 (During Run) 1 (Always On) 2 (Temp Control)	Msg	0	○	○	○	○	○	○
PRT_33	7821	Cooling fan fault trip options	Fan Trip Mode	0 (Trip) 1 (Warning)	Msg	1 (Warning)	○	○	○	○	○	○
PRT_34	7822	Safety options	Safety Type	0 (Latch) 1 (Level)	Msg	0 (Latch)	○	○	○	○	○	○

- Note 1) This option is displayed when PRT_02 is set to "Yes".
- Note 2) This option is displayed when FUN_03 is set to "Free-Run".
- Note 3) This option is displayed when PRT-17 is set to "Yes".
- Note 4) This option is displayed when PRT-22 is set to "Yes".
- Note 5) For 5.5/7.5 kW inverters, the range is 50–110 and the default setting is 95.
- Note 6) This option is displayed when a multifunction input terminal is set to "A3 Safety".

5.8 Communication (COM) group

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
COM_00	-	Jump to codes	Jump Code	1–37		1	○	○	○	○	○	○
COM_32	7920	Built-in RS 485 inverter station ID	Int485 St ID	1–250		1	○	○	○	○	○	○
COM_33	7921	Built-in RS 485 comm. speed	Int485 Baud	0 (1200 bps) 1 (2400 bps) 2 (4800 bps) 3 (9600 bps) 4 (19200 bps) 5 (38400 bps)	Msg	3 (9600 bps)	○	○	○	○	○	○
COM_34	7922	Built-in RS 485 comm. options	Int485 Mode	0 (8None/1Stop) 1 (8None/2Stop) 2 (8Even/1Stop) 3 (8Odd/1Stop)	Msg	0 (8None/1 Stop)	○	○	○	○	○	○
COM_35	7923	Built-in RS 485 time delay	Int485 Delay	2–1000	msec	5	○	○	○	○	○	○
COM_36	7924	Built-in RS 485 lost command options	Int485 LostC	0 (None) 1 (FreeRun) 2 (Decel)	Msg	0 (None)	○	○	○	○	○	○
COM_37	7925	Built-in RS 485 lost command decision time	Int485 LostT	1.0–30.0	sec	1.0	○	○	○	○	○	○

Function Table

5.9 Second motor (M2) group [Note 1)]

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
M2_00	-	Jump to codes	Jump Code	1–36		1	○	○	○	X	○	X
M2_01	7A01	Second motor control mode	M2 Cntl Mode	2 (Speed) 4 (V/F) 5 (Slip Comp)		2 (Speed)	○	○	○	X	○	X
M2_02	7A02	Second motor capacity	Motor select	0 (2.2) 1 (3.7) 2 (5.5) 3 (7.5) 4 (11.0) 5 (15.0) 6 (18.5) 7 (22.0) 8 (UserDefine)	kW	3 (7.5)	○	○	○	X	○	X
M2_03	7A03	Second motor user defined motor capacity	UserMotor Sel [Note 2)]	2.2 –22	kW	7.5	○	○	○	X	○	X
M2_04	7A04	Second motor maximum speed	M2 Max Spd	10.0–3600.0	rpm/Hz	1800.0	○	○	○	X	○	X
M2_05	7A05	Second motor minimum speed	M2 Min Spd	0.01–10.00	Hz	0.50	○	X	X	X	○	X
M2_06	7A06	Second motor multistep	M2 Spd 0	0.0–M2_02	rpm/Hz	0.0	○	○	○	X	○	X

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
		speed 0										
M2_07	7A07	S-curve gradient for second motor acceleration 1	M2 Acc S St	0.0–50.0	%	0.0	○	○	○	X	○	X
M2_08	7A08	S-curve gradient for second motor acceleration 2	M2 Acc S Ed	0.0–50.0	%	0.0	○	○	○	X	○	X
M2_09	7A09	S-curve gradient for second motor deceleration 1	M2 Dec S St	0.0–50.0	%	0.0	○	○	○	X	○	X
M2_10	7A0A	S-curve gradient for second motor deceleration 2	M2 Dec S Ed	0.0–50.0	%	0.0	○	○	○	X	○	X
M2_11	7A0B	Second motor acc/dec time scale	Time scale2	0 (0.01 sec) 1 (0.1 sec)		0 (0.01 sec)	○	○	○	X	○	X
M2_12	7A0C	Second motor acceleration time	M2 Acc time	0.00–6000.0	sec	10.00	○	○	○	X	○	X
M2_13	7A0D	Second motor	M2 Dec time	0.00–6000.0	sec	10.00	○	○	○	X	○	X

Function
Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
		deceleration time										
M2_14	7A0E	Second motor base frequency	M2 BaseFreq	0.00–120.00	Hz	120.00	X	○	○	X	○	X
M2_15	7A0F	Second motor base speed	M2 BaseSpd	300.0–3600.0	rpm	1800.0	○	X	X	X	○	X
M2_16	7A10	Second motor rated voltage	M2 R-Volt	300–528	V	380	○	○	○	X	○	X
M2_17	7A11	Second motor number of poles	M2 Pole #	2–12		4	○	○	○	X	○	X
M2_18	7A12	Second motor efficiency	M2 Mot Eff.	70–100	%	Varies depending on the motor capacity	○	○	○	X	○	X
M2_19	7A13	Second motor rated slip	M2 R-Slip	10–250	rpm/Hz		○	○	○	X	○	X
M2_20	7A14	Second motor rated current	M2 R-Curr	1.0–1000.0	A		○	○	○	X	○	X
M2_21	7A15	Second motor flux current	M2 Flx Cur	0.0–70% of M2_20	A		○	○	○	X	○	X
M2_22	7A16	Second motor rotor time constant	M2 Mot Tr	30–3000	msec		○	○	○	X	○	X

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VlF	Slip	SPfS	EL	ELfS
M2_23	7A17	Second motor stator inductance	M2 Mot Ls	0.00–500.00	mH		○	○	○	X	○	X
M2_24	7A18	Second motor leakage factor	M2 Mot sLs	0.00–300.00	mH		○	○	○	X	○	X
M2_25	7A19	Second motor stator resistance	M2 Mot Rs	0.000–15.000	ohm		○	○	○	X	○	X
M2_26	7A1A	Second motor inertia constant	Inertia	0.001–60.000	kg·m^2	0.072	○	○	○	X	○	X
M2_27	7A1B	Second motor cooling options	M2 Cool Mtd	0 (Self-cool) 1 (Forced-cool)		1 (Forced-cool)	○	○	○	X	○	X
M2_28	7A1C	Second motor encoder pulse number	M2 Enc #	360–4096		1024	○	○	○	X	○	X
M2_29	-	Second motor encoder direction	M2 Enc Dir	0 (A Phase Lead) 1 (B Phase Lead)		0 (A Phase Lead)	○	○	○	X	○	X
M2_30	7A1E	Second motor encoder error check options	M2 Enc chk	0 (No) / 1 (Yes)		1 (Yes)	○	○	○	X	○	X

Function
Table

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
M2_31	7A1F	Second motor encoder LPF time constant	M2 Enc LPF	0–100	msec	1	○	○	○	X	○	X
M2_32	7A20	Second motor V/F mode	M2 V/F	0 (Linear) 2 (User V/F)	Msg	0	X	○	○	X	○	X
M2_33	7A21	Forward torque boost	M2 F-boost	0.0–20.0	%	2.0	X	○	○	X	○	X
M2_34	7A22	Reverse torque boost	M2 R-boost	0.0–20.0	%	2.0	X	○	○	X	○	X
M2_35	7A23	Second motor E-thermal 1 min. level Note 3)	M2 ETH 1min	M2_36–150	%	150	○	○	○	X	○	X
M2_36	7A24	Second motor E-thermal continuous operation level Note 3)	M2 ETH cont	50–M2_35	%	100	○	○	○	X	○	X

- Note 1) This option is displayed when one of the multifunction input terminals is set to "2nd Motor". M2 function is not available when control mode is set to "Speed (Sync)".
- Note 2) M2_03 (user defined motor capacity) is displayed when M2_02 (motor capacity) is set to "User Define".
- Note 2) This option is displayed when PRT_01 (ETH Select) is set to "Yes".

5.10 User (USR) group

Code	Comm. address	Name	Keypad display	Range	Unit	Default setting	SV	VVF	Slip	SPfS	EL	ELfS
USR_00	-	Jump to codes	Jump Code	1–67[Note 1]			○	○	○	○	○	○
USR_01	-	Reset parameter settings to application specific default values	Macro Init	User Define E/L		User Define	○	○	○	○	○	○
USR_02	-	Save user data	User Save	No / Yes		No	○	○	○	○	○	○
USR_03	-	Load user data	User Recall	No / Yes		No	○	○	○	○	○	○
USR_04	-	User group data	User Grp				○	○	○	○	○	○

▪ Note1) Only previously defined codes between USR_04–USR_67 can use the Jump Code feature.

Function Table

6 Troubleshooting

This chapter explains how to resolve a problem when the inverter's protective functions, fault trips, or other faults occur. If the inverter does not work normally after following the troubleshooting steps, contact the LS ELECTRIC customer service center.

6.1 Fault trips

When the inverter detects a fault, it stops operating (trips) or sends a message. Also, when a trip occurs, the keypad displays brief information.

Detailed information can be viewed at PRT-90. If more than two trips occur at approximately the same time, the keypad displays information for the higher priority fault first. The [Up], [Down], [Left], and [Right] cursor keys on the keypad can be used to view fault trip information. Fault conditions can be categorized as follows:

- Level: When the fault is corrected, the trip or warning signal disappears and the fault is not saved in the fault history.
- Latch: When the fault is corrected and a reset input signal is provided, the trip warning signal disappears.
- Fatal: When the fault is corrected, the fault trip or warning signal disappears only after the user turns off the inverter, waits until the charge indicator light goes off, and turns the inverter on again. If the fault condition is still present after powering on the inverter again, contact the supplier or the LS ELECTRIC customer service center.

Fault trips

LCD display	Priority Note 1)	Type	Description
Over Current	4	Latch	Displayed when inverter output current exceeds the specified fault current.
Ground Fault	3	Latch	Displayed when a ground fault occurs in the inverter's output, and current flow to ground exceeds the specified level.
Over Voltage	5	Latch	Displayed when the internal DC voltage

LCD display	Priority Note 1)	Type	Description
			exceeds the specified value (820 VDC).
Low Voltage	9	Level	Displayed when the internal DC voltage is less than the specified value (360 VDC).
Over Load	12	Latch	Displayed when the inverter's output current exceeds the specified motor rated current and overload trip time.
Inv OLT	16	Latch	Displayed when the inverter has detected an overload and resultant overheating condition based on inverse time-limit thermal characteristics. Allowable overload rates for the inverter are 150% for 1 min.
InvOver Heat	10	Latch	Displayed when the temperature of the inverter heat sink exceeds the specified value.
InvThem OP	19	Latch	Displayed when the inverter thermistor detects a low temperature.
MotOver Heat	18	Latch	Displayed when the motor temperature exceeds 130℃.
MotThem Err	20	Latch	Displayed when a motor thermistor error occurs in the inverter thermistor.
E-Thermal	11	Latch	Displayed when internal electronic protection detects a high temperature condition at the motor.
External-B	14	Latch	Displayed when an external fault signal is generated.
Arm Short Arm Short-DB	1	Latch	Displayed when IGBT Arm or output fault occurs. Arm Short-DB is only displayed on the 11-22 kW models.
Fuse Open	2	Latch	Displayed when circuit protection is activated by an IGBT fault.
Encoder Err	8	Latch	Displayed when an encoder signal error occurs.

Trouble-shooting

LCD display	Priority Note 1)	Type	Description
			Displayed when an inconsistent motor error time is detected when compared to the PRT_11 setting.
BX	-	Latch	Displayed when the inverter output is blocked by a signal from the multifunction terminal.
Over Speed	21	Latch	Displayed when the motor speed exceeds the specified maximum speed.
COM Error	-	Fatal	Displayed when communication between the inverter and the keypad is unavailable.
HW-Diag	13	Latch	Displayed when a CPU error is detected.
EEP Error	-	Latch	Displayed when a data saving error occurs.
FAN Error	6	Latch	Displayed when a cooling fan error is detected.
BatRun Fault	7	Latch	Displayed when operation signals are lost during a battery power operation.
Input PO	17	Latch	Displayed when a single phase of a 3-phase power supply is interrupted while the inverter is under load.
Output PO	15	Latch	Displayed when the inverter does not produce an output current.
SpdDev Err	26	Latch	Displayed when the difference between the motor speed and command speed is more than the specified value.
Low Voltage2	24	Latch	Displayed when the internal DC voltage is less than the specified value during inverter operation.
SAFETY A/B	25	Latch Level	Displayed when there is a safety terminal wiring fault on the control board. The response can be set at either Latch or Level.

LCD display	Priority Note 1)	Type	Description
A3 Safety	23	Latch	Displayed when an A3 Safety error is detected at a multifunction input.
ADC Error	27	Fatal	Displayed when current calibration is incorrect when power is initially supplied to the inverter.
Flr/FHM Data	22	Latch	Displayed when a floor height data error is detected or a floor height measurement failure occurs. Available only when the exclusive elevator mode is used.
SINCOS Open	28	Latch	Displayed when EnDat signals Sin-, Cos-, Sin+, and Cos+ are not connected to a single or multiple lines.
ENDAT ERROR	29	Latch	Displayed when EnDat signals for the Clock or Data lines are not connected or a communication error is detected.

Note 1) The display priority when multiple trip occurs. Smaller number has higher priority.

6.2 Confirming the fault status and fault history

6.2.1 Confirming the fault status and storing the fault information

Code	Display	Description
DIS_05	Fan Error	The current fan error status is displayed.

1   Press the [PROG] key and then press the [▲] or [▼] to confirm the operation information before the fault trip occurs and the fault information is displayed.

2   Press the [ENT] key to close the information screen.

3   Press the [RESET] key to store the information to DIS_05.

Only one current fault information is displayed. When multiple faults occur simultaneously, the fault that has higher prioprity (smaller number) is displayed. The information that is stored in the fault history is irrelevant to the priority.

6.2.2 Confirming the fault history

"DIS_05" stores up to two fault histories, and the "Last Fault 1" is the most recent fault trip.

Code	Display	Description
DIS_05	Last Fault 1	Fault history 1
DIS_05	Last Fault 2	Fault history 2

6.3 Resetting fault trips

Follow one of the instructions below to reset the inverter:

• From the keypad, press the [RESET] key.

• From the inverter's control terminal, close the circuit between the RST and CM terminals.

- Turn OFF the inverter, and then turn it ON again.

6.4 Troubleshooting when a fault trip occurs

When a problem occurs, confirm the followings first.

- Are the motor and the inverter connected properly?
    - Refer to page *23*.
- Is the encoder type jumper in the inverter's I/O PCB set correctly?
    - Refer to page *42*.
  If the encoder is complementary or open collector type, set JP1 to "OC" and JP2 to "P15". If the encoder is line drive type, set JP1 to "LD" and JP2 to "P5".
  The initial setting is line drive type.
- Is direction of the motor rotation correct?
    - Refer to page *62*.
  When looking at the motor from the motor's fan, the motor rotates clockwise in the forward operation.
- Is the inverter tested sufficiently in a no load status?
    - Refer to page *63* and *66*.

When a fault trip or warning occurs due to a protection function, refer to the following table for possible causes and remedies.

Type	Cause	Remedy
Over Current	Acc/Dec time is too short, compared to load inertia (GD^2).	Increase Acc/Dec time.
	The inverter load is greater than the rated capacity.	Replace the inverter with a model that has increased capacity.
	The mechanical brake of the motor is operating too fast.	Check the mechanical brake.
Ground Fault	A ground fault has occurred in the inverter output wiring.	Check the output wiring.
	The motor insulation is damaged.	Replace the motor.
Over Voltage	Deceleration time is too short for the load inertia (GD^2).	Increase the deceleration time.
	A generative load occurs at the inverter output.	Use the braking unit.
	The input voltage is too high.	Determine if the input voltage is

Type	Cause	Remedy
		above the specified value.
Low Voltage	The input voltage is too low.	Determine if the input voltage is below the specified value.
	A load greater than the power capacity is connected to the system (a welder, direct motor connection, etc.).	Increase the power capacity.
	The magnetic contactor connected to the power source has a faulty connection.	Replace the magnetic contactor.
Low Voltage2	The input voltage has decreased during the operation.	Determine if the input voltage is below the specified value.
	An input phase-loss has occurred.	Check the input wiring.
	The power supply magnetic contactor is faulty.	Replace the magnetic contractor.
Over Load	The load is greater than the motor's rated capacity.	Ensure that the motor and inverter have appropriate capacity ratings.
	The set value for the overload trip level is too low.	Increase the set value for the overload trip level.
Inv OLT	The load is greater than the rated motor capacity.	Replace the motor and inverter with models that have increased capacity.
	The set value for the overload trip level is too low.	Increase the set value for the overload trip level.
InvOver Heat	There is a problem with the cooling system.	Determine if a foreign object is obstructing the air inlet, outlet, or vent.
	The inverter cooling fan has been operated for an extended period.	Replace the cooling fan.
	The ambient temperature is too high.	Keep the ambient temperature below 50℃.
InvThem OP	The ambient temperature is too low.	Keep the ambient temperature over-10℃.
	An error has been detected on the	Contact the retailer or the LS

Type	Cause	Remedy
	internal temperature sensor.	ELECTRIC customer service center.
MotOver Heat	There is a problem with the cooling system for the motor.	Determine if a foreign object is obstructing the air inlet, outlet, or vent.
MotThem Err	There is a problem with the motor Thermistor.	Determine if the motor's thermistor operates correctly.
E-Thermal	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 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.
External-B	The external fault B signal is connected.	Determine if the external fault B signal is connected.
Arm Short Arm Short-DB	The IGBT is damaged.	Replaced the power board. Contact the retailer or the LS ELECTRIC customer service center.
	The wiring is disconnected during the inverter operation.	Determine if the output short circuit has occurred. When using synchronous motors, determine if the 3-phase input short circuit has occurred.
Fuse Open	The inverter input fuse is open.	Replace the fuse. Contact the retailer or the LS ELECTRIC customer service center.
Encoder Err	The encoder power is not connected.	Determine if the power that meets the encoder requirements is connected.
	The encoder wiring is incorrect.	Determine if the encoder is wired correctly.

Type	Cause	Remedy
BX	The BX signal is connected.	Determine if the BX signal is connected.
		Reset the inverter power.
Over Speed	An error has been detected on speed control.	Check the encoder wiring and the UVW output.
		Tune the encoder at PAR 28.
		Adjust the speed control response.
	The over speed error detection level and time is low.	Increase the over speed error detection level and time.
COM Error CPU Error	The keypad cable connection is bad.	Determine if the keypad cable is connected correctly.
	An error has been detected on control board communication.	Reset the inverter power.
	The OS for the control board has not been installed correctly.	Download the OS for the control board.
Input PO	A contact failure has been occurred to the magnetic contactor for the output side.	Check the magnetic contactor for the output side.
	The output wiring is bad.	Determine if the output wiring is correct.
Output PO	A contact failure has been occurred to the magnetic contactor for the input side.	Check the magnetic contactor for the input side.
	The input wiring is bad.	Determine if the input wiring is correct.
	The time to replace the DC link capacitor has come.	Replace the DC link capacitor. Contact the retailer or the LS ELECTRIC customer service center.

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Type	Cause	Remedy
SpdDev Err	An error has been detected on the speed controller.	Check the encoder wiring and the UVW output.
		Tune the encoder at PAR 28.
	The response from the speed controller is high.	Decrease the speed control response.
	The response from the speed controller is low.	Increase the speed control response.
	An error has been detected on opening break and MC.	Check the break operation.
		Check the MC operation.
	The speed deviation error level and time are low.	Increase the speed deviation error level and time.

6.5 Troubleshooting after a test run

Fault	Remedy
	If the LED flashes red:
	• Go to DIS-05, check for trip errors, and if a trip has occurred reset the inverter.
	• Check for BX terminal input signals received at DIS_03. If an input signal is ON, change it to OFF and try starting the motor.
	DIS ▶ Terminal In **03 00100000000**
	Confirm that the command source is set correctly.
	• If the inverter does not operate via terminal input, try to operate it using the keypad.
	• If these steps do not resolve the faults refer to Item 5 in this table.
The motor does not rotate.	If the [REV] and [FWD] keys are illuminated green:
	• Confirm the inverter output connections (U, V, W) are in the correct phase rotation.
	• Confirm that a braking device is not preventing motor operation.
	• Check the brake settings and the brake relay settings.
	• Confirm the pre-ramp reference (DIS_01) is not set to "0." Refer to Item 6 in this table for more information about setting the speed reference.
	• Confirm the motor capacity (PAR_09) is set correctly.
	• Confirm the motor base speed (PAR_14) is set correctly.
	• Confirm the motor rated current (PAR_194) is set correctly.
	• Confirm the motor flux current (PAR_52) is set correctly (30-40% of the value at PAR_19).
	• Confirm the motor rated slip (PAR_18) is set correctly.
	• Confirm the motor time constant (PAR_53) is set correctly (Note: inverter efficiency will decrease significantly if this is incorrect).
	• Confirm the number of motor poles (PAR_16) is set correctly.
	• If CON_33 is set at the keypad, are CON_34–CON_36 (torque limits) set correctly?
	• If an analog torque limit is set at CON_33, is the input configured correctly? [Note: at least one of the parameters (Ai1–Ai3) must be set

Fault	Remedy
	for analog input.]
Motor rotates but does not accelerate.	Check the encoder pulse setting at PAR_24. • The default setting is "1024" for HIGEN vector motors. If a different type of motor is connected, contact the encoder manufacturer and request the correct pulse setting. Set FUN_01 to "Keypad", FUN_02 to "Keypad1", and FUN_12 (Speed 0) to 100.0 rpm. Then, press [FWD] to check if the motor rotates. If the motor does not rotate, check the encoder cable connection. • If the encoder cables are connected incorrectly, the motor will rotate at low speed (30-60 rpm), the current can get as high as 150% of the rated current, and the motor will rotate in one direction only. If the motor is rotating too slowly (30–60 rpm), stop the motor and swap the positions of the A and B phase cables at the encoder terminals. Confirm that the direction of rotation is correct. If the direction of rotation is reversed refer to Item 3 in this table. • For line-drive encoders, connect the A+ and A- cables to the B+ and B- phases, and the B+ and B- cables to the A+ and A- phases. Or, change the encoder direction at Par_25 (Enc Dir Set) and try again.
Motor speed is correct but the direction of rotation is wrong.	Swap the V and W phase cables at the inverter output terminals and the A and B phases at the encoder terminals. Or, change the encoder direction at PAR_25.
Motor direction of rotation does not change.	Confirm the RUN and STOP commands have been configured correctly. • Confirm the command source set at FUN_01 is correct. • If the current command source is terminal input, change it to keypad input. Check that the motor's direction of rotation is correct. • If the current command source is keypad input, change it to terminal input. Check that the motor's direction of rotation is correct. • Refer to Item 5 in this table for more information if the motor operates abnormally when either of these settings are used. Confirm that the run prevention function is defined using the multifunction inputs.

Fault	Remedy
	• Check if the parameter settings for the multifunction inputs at DIO_01–DIO_07 are set to "Prohibit FRD" or "Prohibit REV." If either prohibition function is set, compare the input condition at DIS_01–DIS_03 when the corresponding contact terminal is ON and the direction of rotation cannot be changed.
Keypad or terminal input does not respond.	If the [REV], [FWD], or [STOP] keys on the keypad are illuminated red or green: • Refer to Item 1 in this table if the keypad or terminal input commands do not respond correctly. If you cannot modify settings, keypad or terminal input protection may be enabled at PAR_04. To disable keypad or terminal input protection, set PAR_04 to "12". • If you still cannot save changes, an internal component fault may have occurred. Contact LS ELECTRIC for technical support. If the [STOP] key on the keypad is illuminated red and is flashing: • A trip or emergency stop condition has occurred. Check the current fault trip status at DIS_05. If a fault trip condition exists, clear the error condition, reset the fault trip, and try to operate the inverter again. • Check if the BX (emergency stop) signal is illuminated at the top right side of the keypad. If it is, check the status of the inputs at DIS_01–DIS_03 to see if the BX signal input is ON. If the [REV] or [FWD] key on the keypad is illuminated green and is flashing: • A flashing key indicates that the inverter is accelerating or decelerating. If the motor operates constantly in this state, the applied load is too high for the inverter's capacity. Refer to Item 15 in this table for more information.
Motor speed does not change correctly during operation.	Confirm the speed command settings at FUN_02 are correct. • LSLV-iV5L inverters operate according to the speed commands received at analog input terminals, keypad, or the internal RS-485 communication board. Confirm that the correct speed references are displayed at DIS_01 (PreRamp Ref). • DIS_01–DIS_03 displays the current speed references received from

Fault	Remedy
	the installation. If the motor speed does not change to the same speed shown on the inverter's display, check the encoder (refer to Item 12 in this table).
0 V analog input signals do not stop the motor.	If AIO_01 (Ai1 define) is set to "Speed Ref": • Adjust the percentage settings (%) at AIO_04 (Ai1 Out Y1) and AIO_08 (Ai1-Out Y1). Adjust the values so that a 0 V input signal generates a 0.0% output, and then press [Enter]. Check the settings for inputs Ai2 and Ai3 and adjust the settings as required.
Speed estimation is initially successful but over time the motor starts to overheat or hunt, and the speed decreases.	Check the motor connections. • If the motor supports 220 V and 380 V input, ensure that the connections are configured for the correct input voltage. • The motor will not operate if the number of poles is set incorrectly. Power supply connection faults generally result in motor damage. If you suspect the wrong voltage has been connected, contact the manufacturer or supplier of the motor. Refer to the terminal block section in this manual for the correct motor wiring connections. Confirm that the motor rating is set correctly. • Check the motor rating set at PAR_09. To confirm the rating, refer to the rating plate on the motor. Confirm that the motor parameters are set correctly. • Motor parameters vary for different manufacturers. The inverter's default motor parameter settings are based on HIGEN vector motor specifications. For motors other than HIGEN vector motors, enter parameter settings based on the specifications of the motor to be used in the installation before operating it.
No display on the keypad.	Check that the inverter is turned on. Check the connection between the inverter and the keypad. • If there is no display on the keypad when the inverter is turned on, and the cable connection appears to be serviceable, contact LS ELECTRIC for technical support.

Fault	Remedy
The motor speed fluctuates when it should be operating at constant speed.	Confirm that shielded twisted pair (STP) cables are used for all control signal circuits. • STP cables must be used for the encoder signal connection because non-STP cables are susceptible to electronic interference. Electronic interference can affect encoder input signals and can cause speed variation during low speed operations. Variations during high speed operation can also occur if the level of electronic interference is high. The resultant speed fluctuations can affect the motor by generating vibration and sound when the inverter stops. Confirm that the inverter, the motor, and the encoder are correctly grounded. • Inspect and test the ground connection between the inverter and the encoder. If the ground connection is not connected correctly, the inverter may operate abnormally. Check the ground connection at the bottom right of the inverter's control PCB. Loosen the ground connector and then retighten it. (For more information, refer to the encoder connection section in this manual). Ensure that the motor's ground terminal is connected directly to the ground terminal at the inverter power terminal block. Ground the motor and the inverter casing to the building's earthing system. • Electronic interference at the encoder input can cause motor speed variations if the inverter is not connected to the building's earthing system. Check the speed gain settings if the motor is under-loaded. • If excessive speed PI gains are set at CON_03 and CON_04, the motor may vibrate when the inverter stops operating. High proportional gain settings and low integral gain settings can also be used to achieve faster responses. However, the system may become unstable if the proportional gain is set too high or low. In general, a setting in the 30–70% range is recommended for integral gain, and 100–500 msec for proportional gain. Increase the encoder's low pass filter setting at PRT_10 (ENC LPF).

Fault	Remedy
	Check for slip at the motor shaft and the encoder. • Slip can occur between the motor shaft and the encoder depending on the type of encoder installation. A mechanical connection between the encoder and the motor shaft may be required to prevent slip.
The inverter does not save parameters used in the previous operation.	If the inverter does not save parameter changes when the inverter shuts down, contact LS ELECTRIC for technical support.
"Fuse open" faults occur regularly.	Check the inverter's 3-phase power connections. • Measure the voltage for each incoming phase and confirm there is no voltage imbalance. If the level of imbalance exceeds 2% of the nominal voltage (6 V for 380 V supply), an AC reactor should be installed. If an AC reactor is not installed, the inverter may be damaged. Damage to the inverter caused by power supply imbalance is not covered by the product warranty. Service fees will be charged for repairs due to power supply imbalance even within the warranty period. Check that the inverter output cables are correctly connected at the motor. Check for motor insulation damage. • Various symptoms may occur if the motor insulation is damaged. Motor speed may be restricted, excessive load may be applied to the motor, and frequent overcurrent fault trips may occur during regeneration. Also, motor insulation faults can result in regular instances of motor over-temperature and vibration. These symptoms can be present for a period before the "Fuse Open" fault trip occurs. • If these symptoms continue, it is likely that the motor insulation is damaged and the motor will need to be replaced.

Fault	Remedy
Motor input current is too high.	Check the connections at the motor. • Confirm the incoming power supply connections and verify the voltage rating is correct for the motor especially if it supports 220 V and 380 V. Confirm the inverter parameter settings for inverter capacity and motor rating. Confirm the motor time constant settings are correct. • Refer to Items 1 and 8 in this table and perform all required checks for the inverter and the motor.
Overcurrent fault trips occur regularly (high input current fluctuations).	Check that the encoder is properly installed on the motor. • The encoder can move while the motor operates if it is not securely mounted on the motor. Vector motors require accurate feedback signals from the encoder to perform the specified operation. If the encoder position slips, inaccurate motor feedback is provided by the encoder and can result in the motor operating incorrectly and high levels of output current. If this situation occurs, contact the motor manufacturer or the encoder installer. • If a synchronous motor is used, overcurrent fault trips can occur if the inverter fails to locate the motor's rotation position. Refer to the auto-tuning section of this manual for more information. Test the motor's insulation. • Refer to Item 12 in this table.
The [FWD] and [REV] keys flash, and ACC/DEC functions do not operate correctly (the motor is unable to sustain the load or ACC/DEC operation is delayed).	Check the cable connections. Confirm the acceleration and deceleration times at FUN_41–FUN_48 and confirm the motor's load at DIS_00. • - The [FWD] and [REV] keys flash when the motor accelerates or decelerates. If the keys continue to flash during the motor operation, motor torque is too low for the applied load and the motor is unable to operate at constant speed. If this occurs, increase the torque limit to within the motor rating. Applying excessive load to the motor may reduce the inverter's life or damage the inverter. Contact LS ELECTRIC for technical support.

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6.6 Troubleshooting other faults

When faults other than those identified as fault trips or warnings occur, the table below lists possible causes and remedies.

Fault	Cause	Remedy
Parameters cannot be set.	The inverter is running (driving mode).	Stop the inverter, switch to program mode and set the parameter.
	The password is incorrect.	Confirm the password, disable the parameter lock, and then set the parameter.
The motor is not rotating.	The emergency stop signal is activated.	Reset the emergency stop.
	The operating command is set incorrectly.	Check the operating command setting.
	The control circuit connections are incorrect.	Check the control circuit connections.
	The frequency command is set incorrectly.	Check the frequency command setting.
	The input voltage or current for the frequency is incorrect.	Check the input voltage or current for the frequency.
	The PNP/NPN mode is selected incorrectly.	Check the PNP/NPN mode setting.
	[STOP] is pressed.	Check that the inverter is in a normal condition and resume operation.
	Motor torque is too low.	Increase the torque limit to allow the inverter to accelerate or decelerate to the rated value.
The motor rotates in the opposite direction to the command.	The inverter's output connections for the motor are incorrect.	Check the inverter's output connections.
	The forward/reverse rotation control circuit connections between the inverter and the control panel are incorrect.	Check the forward/reverse rotation control circuit connections.

Fault	Cause	Remedy
The motor rotates in only one direction.	Reverse rotation prevention is selected.	Turn off reverse rotation prevention.
	The reverse rotation signal is not provided even when a 3-wire sequence is selected.	Check the input signal for the 3-wire operation and adjust as necessary.
The motor is overheating.	The load is too heavy.	Reduce the load. Increase the Acc/Dec time.
		Check the motor parameters and set the correct values.
		Replace the motor and the inverter with models that are rated for the load.
	The ambient temperature of the motor is too high.	Lower the ambient temperature of the motor.
	The phase-to-phase voltage of the motor is insufficient.	Use motors that can operate at the maximum and minimum level of the phase-to-phase voltage range.
		Only use motors designed to operate with inverters.
		Connect the AC reactor to the inverter output (set the carrier frequency to 2.5 kHz).
	The motor fan has stopped or the fan is obstructed with debris.	Check the motor fan and remove any foreign objects.
The motor stops during acceleration or when connected to load.	The load is too high.	Reduce the load.
		Replace the motor and the inverter with models that are rated for the load.
The motor does not accelerate.	The load is too high.	Reduce the load and increase the acceleration time. Check the

Fault	Cause	Remedy
/The acceleration time is too long.		mechanical brake status.
	The acceleration time is too long.	Change the acceleration time.
	The inverter parameters are set incorrectly for the motor.	Change the motor related parameters.
The motor deceleration time is too long even with a Dynamic Braking (DB) resistor connected.	The deceleration time is set too long.	Change the deceleration time.
	Motor torque is too low.	If motor parameters are normal, an underrated motor is the likely cause. Replace the motor with a model with increased capacity.
	The load is too high for the inverter's rated torque limit.	Replace the inverter with a model with increased capacity.
During inverter operation, a control unit malfunction occurs or switching noise can be heard.	Switching inside the inverter causes the noise.	Change the carrier frequency to the minimum value.
		Install a surge filter in the inverter output.
During inverter operation, the earth leakage circuit breaker activates.	An earth leakage circuit breaker interrupts power supply if current flows to ground during inverter operation.	Ensure the inverter is connected to ground.
		Check that the ground resistance is less than 10Ω.
		Check the rating and connections of the earth leakage circuit breaker.
		Reduce the carrier frequency.
		Ensure the cable length between the inverter and the motor is as short as possible.
The motor vibrates	The 3-phase power supply is out of balance.	Check the input voltages and balance the phases.

Fault	Cause	Remedy
severely and does not rotate normally.		Check and test the motor's insulation.
The motor hums or makes loud noises.	Resonance occurs between the motor frequency and the carrier frequency.	Increase or decrease the carrier frequency slightly.
	Resonance occurs between the motor frequency and the inverter output frequency.	Increase or decrease the carrier frequency slightly.
		Increase or decrease the command speed slightly.
The motor vibrates or hunts.	The frequency input command is supplied via an external, analog signal.	If operation is affected by electronic interference on the analog input side, change the input filter time constant (AIO 11, 23, 35).
	The cable between the inverter and the motor is too long.	Ensure that the cable length between the inverter and the motor is less than 100 m.
The motor does not come to a complete stop when the inverter output stops.	The motor cannot decelerate sufficiently because the regenerated load is too heavy to stop.	Increase the deceleration time.
		Install a braking resistor.
	The free run option has been selected.	Change the stop method to deceleration stop.
The output frequency does not increase to the frequency reference.	The frequency reference exceeds the upper limit of the frequency command.	Set the upper frequency limit higher than the frequency reference.
The motor is not operating and there is no voltage at the output terminals.	The frequency command source setting is incorrect.	Set the frequency command source correctly.
	The operation command source setting is incorrect.	Set the operation command source correctly.
	Power is not supplied to the R, S, and T terminals.	Check the R, S, T to U, V, W connections.
	Output power is not available and the	Turn on the power.

Fault	Cause	Remedy
	power lamp is not lit.	
	The RUN command is not on.	Turn on the RUN command.
The motor is not operating and there is voltage at the U, V, and W terminals.	The motor is obstructed.	Remove the obstruction and reduce the load.
	The load is too high.	Test the motor by operating it independent of the inverter.
The motor operates in reverse.	The output terminals (U, V, W) are connected incorrectly at the inverter.	Connect the inverter output to the motor input with the correct phase sequence.
	The input terminals (U, V, W) are connected incorrectly at the motor.	
	The control circuit terminals are configured incorrectly.	Ensure FWD is set when operating in the forward direction, and REV when operating in the reverse direction.
The motor does not accelerate.	The load is too high.	Reduce the load.
The motor speed fluctuates during operation.	The change of load is too high.	Replace the motor and the inverter with models that are rated for the load.
	The voltage fluctuates.	Avoid changes of load and voltage during operation.
	Speed fluctuations occur at a specific frequency range.	Adjust the output frequency.
The motor speed is not correct.	The maximum speed setting is not correct.	Set the speed settings according to the motor's specification.

7 Maintenance

This chapter covers general maintenance tasks and explains how to replace the cooling fan, the regular inspections to be made, and how to store and dispose of the product.

An inverter is vulnerable to environmental conditions and faults also occur due to component wear and tear. To prevent breakdowns, please follow the maintenance recommendations in this section.

Routine and regular inspections are required to keep the product in a good working condition at all times. Inspect the parts for deterioration and replace the parts as necessary.

If the following conditions exist at the installation site, more frequency regular inspections may be required:

- High ambient temperature
- Frequent on/off conditions
- Unstable power source
- Excessive shocks and vibrations at the installation site
- Corrosive gas, flammable gas, oil residue, dust, salts, and metal powders at the installation site

> ⊘ Caution
>
> - Before you inspect the product, read all safety instructions contained in this manual.
> - Before you clean the product, ensure that the power is off.
> - Use a clean, dry cloth to clean the inverter. Using a wet cloth, water, solvents, or detergents may result in electric shock or damage to the product.
>   ESD (Electrostatic discharge) from the human body may damage sensitive electronic components on the PCB. Therefore, be extremely careful not to touch the PCB or the components on the PCB with bare hands while you work on the I/O PCB.
>   To prevent damage to the PCB from ESD, touch a metal object with your hands to discharge any electricity before working on the PCB, or wear an anti-static wrist strap and ground it on a metal object.
> - Do not install or remove add-on boards while the inverter is operating.
> - Immediately place circuit boards on a conductive material after removing them from the inverter for maintenance or repair. Otherwise, static charge may damage the circuit board components.

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• A failure of element that used in the inverter is unpredictable, and the failure of element may cause a power fuse failure or a fault trip. If you suspect a failure of element, contact the LS ELECTRIC customer center (1544-2080).

Note

• Keep the inverter turned off when it is not being used.
• Keep the inverter clean during operation.
• Do not use cleaning agents containing substances such as benzene, toluene, and alcohol. Doing so may damage the exterior coat of the product.
• Do not use detergents or cleaning solutions when cleaning around the LED indicators. The inverter may malfunction if the liquid leaks into the circuit board.
• The lifespan of the electronic components on the control board is unpredictable. If you think the product failed due to an internal component failure, contact the LS ELECTRIC service technicians for technical support.

7.1 Regular inspections

7.1.1 Daily inspection

Inspection area	Item	Details	Method	Standard	Required equipment
All	Ambient environment	Is the ambient temperature and humidity within the design range? Is there any dust or are there foreign objects present?	Refer to *1.3 Installation considerations* on page *4*.	No icing (ambient temperature: -10 - +40). No condensation (ambient humidity below 50%)	Thermometer, hygrometer
	Inverter	Are there any abnormal vibrations or	Visual inspection	No abnormality	None

Inspection area	Item	Details	Method	Standard	Required equipment
		noises?			
	Voltage	Are the input and output voltages normal?	Measure voltages between the R/ S/ T terminals.	-	Digital multimeter
Input/Output circuit	Capacitor	Is there any leakage from the capacitor?	Visual inspection	No abnormality	-
		Is the capacitor swollen?			
Cooling system	Cooling fan	Are there any abnormal vibrations or noises?	Turn off the system and check operation by rotating the fan manually.	Fan rotates smoothly	-
	Inverter, Motor	Is there excessive heat generated?	Check if the inverter or motor is overloaded.	No abnormality	Thermometer Screwdriver
			Tighten all screws.		
			Check if the inverter's heat sink or motor is dirty.		
			Check the ambient temperature.		
Display	Measuring device	Are the values shown on the display correct?	Check the display value on the panel.	Check and manage specified values.	Voltmeter, ammeter, etc.

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Inspection area	Item	Details	Method	Standard	Required equipment
Motor	All	Are there any abnormal vibrations or noises?	Visual inspection	No abnormality	-
			Check for overheating or damage.		
		Is there an abnormal smell?	Check all electrical connections.		
			Check the level of vibration at the motor.		
			Tighten all screws.		

7.1.2 Annual inspection

Inspection area	Item	Details	Method	Standard	Equipment
Input/ Output circuit	All	Perform insulation resistance test between the input/output terminals and the ground terminal.	Disconnect the inverter and short the R/S/T/U/V/W terminals. Measure from each terminal to the ground terminal using a Megger.	Resistance must be more than 5 MΩ	DC 500 V Megger
		Are any terminal or components loose inside the inverter?	Tighten all screws.	No abnormality	
		Is there any evidence of overheating components?	Visual inspection		
	Cable connections	Are there any corroded cables?	Visual inspection	No abnormality	-
		Is there any damage to cable insulation?			
	Terminal block	Is there any damage?	Visual inspection	No abnormality	-
	Smoothing condenser	Measure electrostatic capacity.	Test with capacity meter.	Rated capacity over 85%	Capacity meter
	Relay	Is there any relay chatter during operation?	Auditory inspection	No abnormality	-
		Is there any	Visual		

Maintenance

Inspection area	Item	Details	Method	Standard	Equipment
		damage to the contacts?	inspection		
	Braking resistor	Is there any damage at the resistor?	Visual inspection	No abnormality	Digital multimeter / analog tester
		Is there an open circuit?	Disconnect one side of the resistor and measure with a tester.	Must be within ±10% of the rated value of the resistor.	
	Diode, IGBT	Is there any dust or foreign objects present?	Visual inspection	Remove any foreign objects or dust. Use dry air to clear the dust.	-
	Circuit board	Is there any abnormal smell, discoloration, corrosion, dust, or oil residue present?	Visual inspection	Clean the circuit board with an antistatic cloth. If the circuit board is still dirty, replace the circuit board.	-
				Do not use solvents on the circuit board.	
		Is the connector connected securely?		Remove dust with dry air.	
				Reconnect the connectors.	
				Replace the	

| Inspectio n area	Item	Details	Method	Standard	Equipment
				inverter when parts that cannot be repaired or replaced are damaged.	
Control circuit protection	Operation check	Check for output voltage imbalance during inverter operation.	Measure the voltage between the inverter output terminals U/ V/ W.	Balance the voltage between phases to within 8 V.	Digital multimeter or DC voltmeter
		Does the sequence protection test identify any keypad display errors?	Test the protection for the inverter output in both short and open circuit conditions.	The circuit must operate according to the sequence.	
Cooling system	Cooling fan, Cooling fins	Are any parts of the fan loose?	Check all connected parts and tighten all screws.	No abnormality	-
		Is there any dust present on the cooling fan or the cooling fins?	Visual inspection	No dust	
Display	Display device	Is the display value normal?	Check the command value on the display device.	Specified and managed values must match.	Voltmeter, Ammeter, etc.

7.1.3 Biannual inspection

Inspection area	Item	Details	Method	Standard	Equipment
Main cirquit	All	Megger test (between the input, output, and earth terminals)	Disconnect the inverter, connect the R, S, T, U, V, and W, and then measure between these terminals and the earth with a megger tester.	Must be above 5 MΩ	DC 500 V Megger
Motor	Insulation resistance	Megger test (between the input, output, and earth terminals)	Disconnect the cables from the U/V/W terminals and test the wiring.	Must be above 5 MΩ	DC 500 V Megger

⊘ Caution

Do not perform insulation resistance tests on control circuits as it may result in damage to the inverter and other control devices.

7.2 Diode module and IGBT inspection
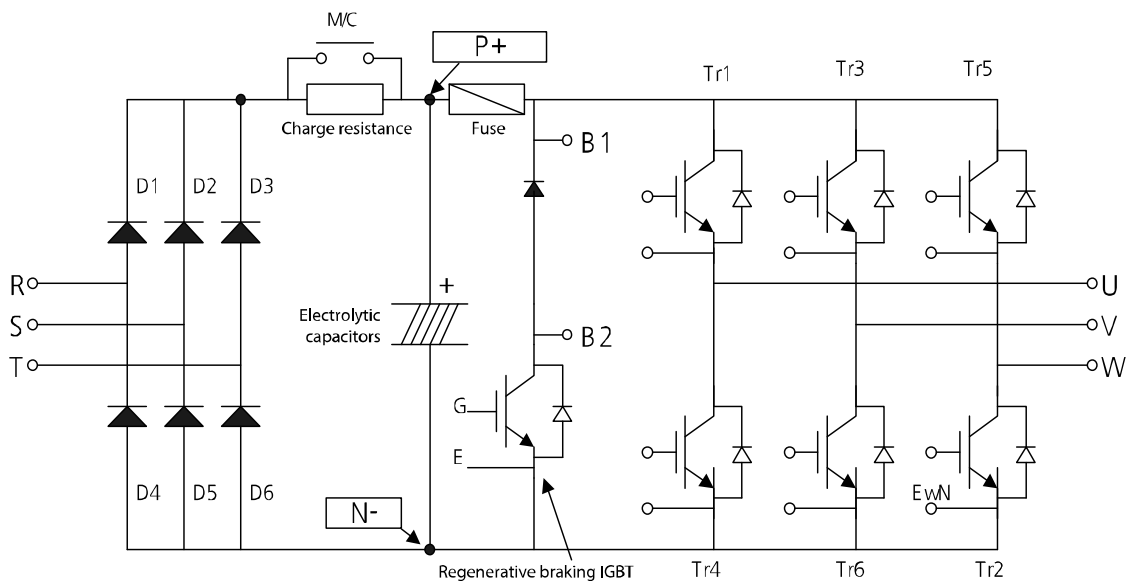
1   Remove the power cables (R, S, T) and the motor output cables (U, V, W).

2   Confirm that the electrolytic capacitors are fully discharged.

3   Check the feedthrough status at the inverter terminals (R, S, T, U, V, W, B1, and N) by measuring the resistance between each terminal using a multimeter.

   If current is flowing between the terminals, a low resistance value (Ω) is measured. If current is not flowing between the terminals, a high resistance value (M Ω) is measured.

> ⊘ **Caution**
>
> If the capacitors are not fully discharged, a low resistance value may be measured even if current is not flowing in the circuit. This may result in incorrect diagnostic procedures.

4   Refer to the circuit diagram above and test the components on the printed circuit board. Measure the resistance at the terminals indicated on the circuit diagram.

7.3 Replacement cycle and maintenance of major components

The inverter consists of many electronic components including semiconductor components. Refer to the following table for the recommended replacement cycle to prevent inverter deterioration and faults.

Component name	Standard replacement cycle	Symptom	Replacement method
Cooling fan	2-3 years	Poor rotation	Replace with a new component.
DC link capacitor	2 years	Capacity reduction	Replace with a new component.
Controller smoothing capacitor	5 years	Capacity reduction	Replace with a new component.
Control board relay	-	Faulty operation	Replace with a new component.
Braking resistor	-	Capacity reduction	Replace with a new component.

7.4 Storage and disposal

7.4.1 Storage

If you are not using the product for an extended period, store it in the following way:

- Store the product in the same environmental conditions as specified for operation (Refer to *1.3 Installation considerations* on page *4*.).
- When storing the product for a period longer than 3 months, store it between -10 ˚C and 30 ˚C, to prevent deterioration of the electrolytic capacitor.
- Do not expose the inverter to snow, rain, fog, or dust.
- Package the inverter in a way that prevents contact with moisture. Keep the moisture level below 70% in the package by including a desiccant, such as silica gel.
- Do not store the inverter in dusty or humid environments. If the inverter is installed in an unsuitable environment (for example, a construction site) and the inverter will be unused for an extended period, remove the inverter and store it in a suitable place.

7.4.2 Disposal

When disposing of the product, categorize it as general industrial waste. Recyclable materials are included in the product. The packing materials and all metal parts can be recycled. For the disposal of other materials, contact the local authorities for guidance.

⚠ Caution

If the inverter has not been operated for a long time, capacitors lose their charging characteristics and are depleted. To prevent depletion, turn on the product once a year and allow the device to operate for 30-60 min. Run the device under no-load conditions.

8 Technical specifications

8.1 Input and output specifications

Model iV5L-4			055	075	110	150	185	220
Motor capacity		HP	7.5	10	15	20	25	30
		kW	5.5	7.5	11	15	18.5	22
Rated output	Rated power (kVA)		9.1	12.2	18.3	22.9	29.0	34.3
	Rated current (A)		12	16	24	30	39	45
	Output speed		0–3600 rpm					
	Output voltage (V)		0-380 V (480 V)					
Rated input	Working voltage (V)		3-Phase 380–480 VAC (-10%–+10%)					
	Input frequency		50–60 Hz (±5%)					
	Rated Current (A)		17.5	24	28	35	46	53
Weight (kg (lbs))			7.7 (16.9)	7.7 (16.9)	13.7 (30.2)	13.7 (30.2)	20.3 (44.7)	20.3 (44.7)

- The standard motor capacity is based on a standard 4-pole motor.
- 400 V inverters are designed for a 440 V supply voltage.
- The maximum output voltage cannot exceed the input voltage.
- If the input voltage is greater than 480 V, apply input voltage derated by 10% from the rated input voltage. Also, install an AC reactor in the power input side if the voltage imbalance between the phases is greater than 2%. [Voltage imbalance [%] = Max voltage [V] - Min voltage [V] / Three-phase average voltage [V] x 67 (IEC 61800-3 (5.2.3)]

8.2 Product specification details

Item			Description	
Circuit system			Voltage type inverter with IGBT	
Control	Control method		Induction motor	Speed (sensored), V/F control, Slip compensation.
			Synchronous motor	Speed (sensored)
	Speed control		Analog settings: ± 0.1 % (25 ±10℃) of max speed (1800 rpm) Digital settings: ± 0.1 % (0-40℃) of max speed (1800 rpm)	
	Speed setting resolution		Analog settings: ± 0.1 % of max speed Digital settings: 0.1 rpm	
	Speed control response speed		50 Hz	
	Overload capacity		Rated current: 150% 1 min.	
	Acceleration / Deceleration	Time settings	0.00-600.0 sec	
		Combination	4 acceleration/deceleration time choices	
		Pattern	Linear, S-Curve	
Braking	Braking method		Resistance discharge braking	
	Braking torque		150 %	
	Braking resistor		External braking resistor (installation required)	
Input	Speed configuration		Digital settings via the keypad Analog input settings	Multistep configurations via terminal contact input Option settings

Item		Description
Input	Analog input	3 channels (Ai1, AI2, AI3) -10 → 10 V, 10 → -10 V, 0 → 10 V, 10 → 0 V, 0 → 20 mA, 20 → 0 mA Motor NTC (only available on AI3) 5 choices of multifunction analog input AI3: Motor NTC can be used when using Higen motors
	Terminal contact input	FX, RX, BX, RST, P1, P2, P3, P4, P5, P6, P7 26 function options using the multifunction input terminals (P1-P7).
Output	Analog output	2 channels (AO1, AO2) -10 → 10 V, 10 → -10 V, 0 → 10 V, 10 → 0 V output 30 multifunction analog output options
	Terminal contact output	Multifunction terminal contact output: 2 channels (1A-1B, 2A-2B) Fault terminal contact output: 1 channel (30A-30C, 30B-30C)
	Open collector output	1 channel (OC1/EG)
Trip		Over Current, Ground Fault, Over Voltage, Low Voltage, Over Load, Inv OLT, InvOver Heat, InvThem OP, MotOver Heat, MotThem Err, E-Thermal, External-B, Arm Short, Arm Short-DB, Fuse Open, Encoder Err, BX, Over Speed, COM Error, HW-Diag, EEP Error, FAN Error, BatRUN Fault, Input PO, OUTput PO, SpdDev Err, Low Voltage 2, SAFETY A/B, A3 Safety, ADC Error, Flr/FHM Data, SINCOS Open, ENDAT ERROR

Specification

Item		Description
Alarm		Fan alarm, Inverter overheat alarm, Motor overheat alarm, Overload alarm
Working environment	Surrounding environment	Indoors, prevent contact with direct sunlight and corrosive gases (Pollution Degree 2 Environment).
	Ambient temperature	14℉-104℉ (-10℃-40℃) (no icing)
	Ambient humidity	Relative humidity less than 90% RH (condensation must not form)
	Cooling type	Forced fan cooling structure
	Protection structure	IP00
	Operation altitude/oscillation	No higher than 3,280 ft (1,000 m). Less than 5.9 m/sec^2 (0.6 G).

8.3 External dimensions

5.5–30 kW (3-phase)
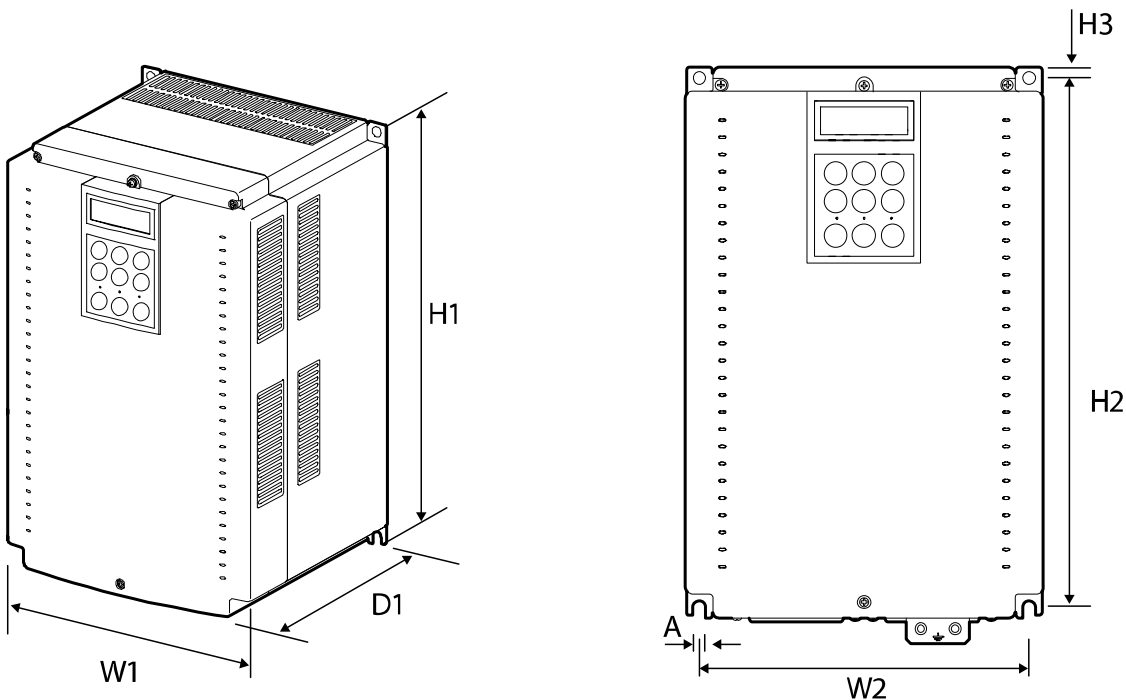
Units: inches (mm)

Item		W1	W2	H1	H2	D1	A
3-phase 400 V	LSLV055iV5L-4 LSLV075iV5L-4	7.87 (200)	7.09 (180)	13.97 (355)	13.38 (340)	7.95 (202)	0.24 (6)
	LSLV110iV5L-4 LSLV150iV5L-4	9.84 (250)	9.06 (230)	15.16 (385)	14.57 (370)	8.70 (221)	0.35 (9)
	LSLV185iV5L-4 LSLV220iV5L-4	11.97 (304)	11.18 (284)	18.11 (460)	17.52 (445)	10.00 (254)	0.35 (9)

Specification

8.4 Peripheral devices

Compatible circuit breakers, leakage circuit breakers, and magnetic contactors (manufactured by LS ELECTRIC).

Product (kW)		Circuit breaker		Leakage circuit breaker		Magnetic contactor	
		Model	Rated current	Model	Rated current	Model	Rated current
3-Phase 400 V	5.5	TD125U	30	EBS 33b	30	GMC-22	22
	7.5		30		30	GMC-32	32
	11		50	EBS 53b	50	GMC-40	40
	15		60	EBS 103b	60	GMC-50	50
	18.5		80		80	GMC-65	65
	22		100		100		65

Maximum allowed prospective short-circuit current at the input power connection is defined in IEC 60439-1 as 100 kA. The drive is suitable for use in a circuit capable of delivering not more than 100 kA RMS at the drive's maximum rated voltage.

The drive is suitable for use in a circuit capable of delivering not more than 35 kA rms symmetrical amperes at the drive maximum rated voltage, if it is protected with the recomended circuit breaker.

8.5 Fuse and reactor specifications

Products (kW)		AC input fuse		AC reactor		DC reactor	
		Current (A)	Voltage (V)	Inductance (mH)	Current (A)	Inductance (mH)	Current (A)
3-Phase 400 V	5.5	20	660 V	1.22	15	-	-
	7.5	30		1.14	20	-	-
	11	35		0.81	30	-	-
	15	45		0.61	38	-	-
	18.5	60		0.45	50	-	-
	22	70		0.39	58	-	-

※ The DC reactor specifications are not provided because terminals for the DC reator does not exist in the LSLV-iV5L.

⊘ Caution

Use Class H or RK5 UL listed input fuses and UL listed circuit breakers only. See the table above for the voltage and current ratings for the fuses and breakers.

8.6 Terminal screw specifications

Input/output terminal screw specifications

Product (kW)		Terminal screw size	Torque (Kgf·c m/Nm)
3-Phase 400 V	5.5	M4	7.1–12.2/0.7–1.2
	7.5		
	11	M5	30.6–38.2/3–3.8
	15		
	18.5	M6	61.2–91.8/6–9
	22		

Control circuit terminal screw specifications

Terminal	Terminal screw size	Torque(Kgf·cm/Nm)
FX/RX/BX/RST/P1–P7/CM	M2.6	4.0/0.4
Ai1–3/AO1/AO2/5G/ A1/B1/A2/B2/OC1/EG	M2	2.2–2.5/0.22–0.25

⚠ Caution

Apply the rated torque to the terminal screws. Loose or overtightened screws can cause short circuits and malfunctions. Use copper stranded cables only that are rated to 600 V, 194℉ (75℃) for mains power cables, and rated to 300 V, 167℉ (75℃) for control circuit cables.

8.7 Braking resistor specifications

The standard for braking torque is 150% and the working rate (%ED) is 5%. If the working rate is 10%, the rated capacity for braking resistance must be calculated at twice the standard.

Product (kW)		Resistance (Ω) [Note 1]	Rated capacity (W) [Note 2]
3-Phase 400 V	5.5	85	800
	7.5	60	1200
	11	40	2400
	15	30	2400
	18.5	20	3600
	22	20	3600

Note 1) ED is based on 100 seconds.

Note 2) Rated capacity is based on the self-cooled type.

8.8 Braking resistor connections

A temperature sensor is installed to the LS ELECTRIC braking resistor to prevent fire. Refer to the followings when using the braking resistor.

Terminals on the braking resistor	Terminals on the inverter	Operation
B1/B2	B1/B2	-
P7/CM	Define one of multifunction input terminals (P1–P7) on the control terminal as "external trip signal contact B".	The contact is ON in a room temperature and becomes OFF when overheated.

Specification

EC DECLARATION OF CONFORMITY

We, the undersigned,

Representative: **LS ELECTRIC Co., Ltd.**
   Address: **LS Tower, 127, LS-ro, Dongan-gu,**
                                                Anyang-si, Gyeonggi-do, 431-848,
                                                Korea

Manufacturer: **LS ELECTRIC Co., Ltd.**
   Address: **56, Samsung 4-gil, Mokchon-Eup,**
                                              Chonan, Chungnam, 330-845,
                                              Korea

Certify and declare under our sole responsibility that the following apparatus:

Type of Equipment: **Inverter (Power Conversion Equipment)**

Model Name: **LSLV-iV5L series**

Trade Mark: **LS ELECTRIC Co., Ltd.**

Conforms with the essential requirements of   the directives:

2006/95/EC Directive of the European Parliament and of the Council on the harmonisation of the laws
of Member States relating to Electrical Equipment designed for use within certain voltage limits

2004/108/EC Directive of the European Parliament and of the Council on the approximation of the laws
of the Member States relating to electromagnetic compatibility

Based on the following specifications applied:

> **EN 61800-3:2004**
> **EN 61800-5-1:2007**
> **EN 12015:2014(*)**
> **EN 12016:2014**

**and therefore complies with the essential requirements and provisions of the 2006/95/CE and
2004/108/CE Directives.**

Place: **Chonan, Chungnam,**
                                       <u>Korea</u>

문상천   2016. 1. 13

_____   (Signature /Date)

Mr. Sang Chun Moon / General Manager
(Full name / Position)

TECHNICAL STANDARDS APPLIED

UNE-EN 12015:2014 Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks – Emission.

(*) LSLV0185iV5L-4CNNN is C3 Class
(*) LSLV0220iV5L-4CNNN is C3 Class

UNE-EN 12016:2014 Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks – Immunity

EMI / RFI POWER LINE FILTERS
LS ELECTRIC inverters, iV5L series

VMC
vector motor control

RFI FILTERS

THE LS RANGE OF POWER LINE FILTERS **FF(Footprint)**, SERIES, HAVE BEEN SPECIFICALLY DESIGNED WITH HIGH FREQUENCY **LS INVERTERS**. THE USE OF LS FILTERS, WITH THE INSTALLATION ADVICE OVERLEAF HELP TO ENSURE TROUBLE FREE USE ALONG SIDE SENSITIVE DEVICES AND COMPLIANCE TO CONDUCTED EMISSION AND IMMUNITY STANDARS TO EN 50081 -> **EN61000-6-3;02 and EN61000-6-1-:02**

CAUTION

IN CASE OF A LEAKAGE CURRENT, PROTECTIVE DEVICE IS USED ON POWER SUPPLY. IT MAY BE FAULT AT POWER ON OR OFF.

IN AVOID THIS CASE, THE SENSE CURRENT OF PROTECTIVE DEVICE SHOULD BE LARGER THAN VALUE OF LAKAGE CURRENT AT WORST CASE IN THE BELOW TABLE.

RECOMMENDED INSTALLATION INSTRUCTIONS

To conform to the EMC directive, it is necessary that these instructions should be followed as closely as possible. Follow the usual safety procedures when working with electrical equipment. All electrical connections to the filter, inverter and motor must be made by a qualified electrical technician.

1-) Check the filter rating label to ensure that the current, voltage rating and part number are correct.

2-) For best results, the filter should be fitted as closely as possible to the incoming mains supply of the wiring enclousure, usually directly after the enclousures circuit breaker or supply switch.

3-) The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Care should be taken to remove any paint etc... from the mounting holes and face area of the panel to ensure the best possible earthing of the filter.

4-) Mount the filter securely.

5-) Connect the mains supply to the filter terminals marked LINE, connect any earth cables to the earth stud provided. Connect the filter terminals marked LOAD to the mains input of the inverter using short lengths of appropriate gauge cable.

6-) Connect the motor and fit the ferrite core (output chokes) as close to the inverter as possible. Armoured or screened cable should be used with the 3 phase conductors only threaded twice through the center of the ferrite core. The earth conductor should be securely earthed at both inverter and motor ends. The screen should be connected to the enclousure body via and earthed cable gland.

7-) Connect any control cables as instructed in the inverter instructions manual.

IT IS IMPORTANT THAT ALL LEAD LENGTH ARE KEPT AS SHORT AS POSSIBLE AND THAT INCOMING MAINS AND OUTGOING MOTOR CABLES ARE KEPT WELL SEPARATED.
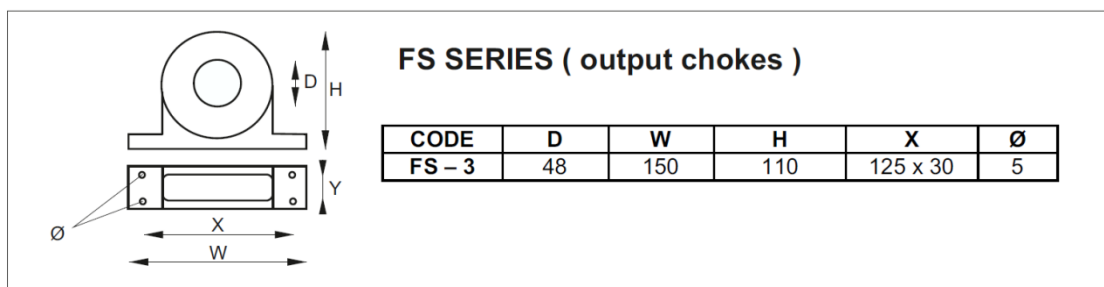
FF SERIES (Footprint)
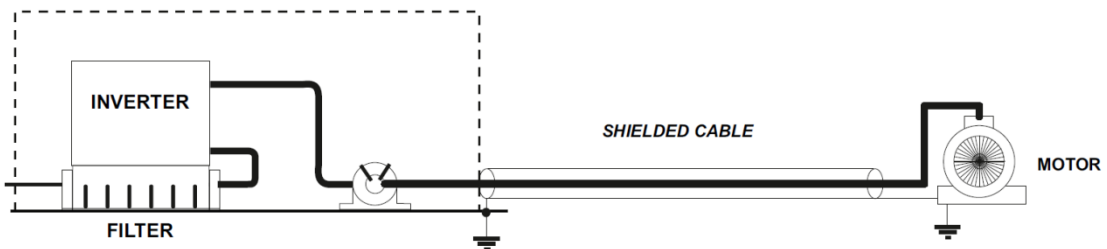
iV5 series / Footprint Filters

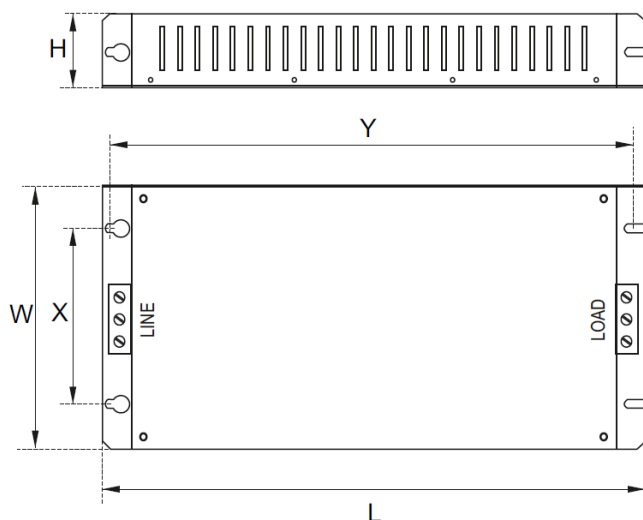| INVERTER	POWER	CODE	CURRENT	VOLTAGE	LEAKAGE CURRENT		DIMENSIONS L W H	MOUNTING Y X	WEIGHT	MOUNT	FIG.	OUTPUT CHOKES
THREE PHASE					NOM.	MAX.						
LSV0055iV5L-4	5.5kW	FFV5L-T030-3	30A	0-480VAC	0.5mA	27mA	400x200x60	384x155.5	2Kg.	M5	A	FS-3
LSV0075iV5L-4	7.5kW											
LSV0110iV5L-4	11kW	FFV5L-T051-3	51A	0-480VAC	0.5mA	27mA	430x250x65	404.5x180	2.5Kg.	M8	A	FS-3
LSV0150iV5L-4	15kW											
LSV0185iV5L-4	18.5kW	FFV5L-T060-3	60A	0-480VAC	0.5mA	27mA	505x304x65	480x234	2.8Kg.	M8	A	FS-3
LSV0220iV5L-4	22kW	FFV5L-T070-3	70A	0-480VAC	0.5mA	27mA	505x304x65	480x234	2.8Kg.	M8	A	FS-3

1) LSLV0055~0150 iV5L-4 EN 55011 CLASS B IEC/EN 61800-3 C2

2) LSLV0185~0220 iV5L-4 EN 55011 CLASS A IEC/EN 61800-3 C3

FS SERIES (output chokes)

CODE	D	W	H	X	Ø
FS – 3	48	150	110	125 x 30	5

DIMENSIONS

FF SERIES (Footprint)

FIG. A

H

Y

W X

LINE

LOAD

L

VMC
vector motor control

Vector Motor Control Ibérica S.L.
C/ Mar del Carib, 10
Pol. Ind. La Torre del Rector
08130 Santa Perpètua de Mogoda
(BARCELONA) ESPAÑA
Tel. (+34) 935 748 206
Fax (+34) 935 748 248
info@vmc.es
www.vmc.es

Specification

Product warranty

Warranty information

Fill in the warranty information on this page and keep it for future reference or when warranty service is required.

Product name	LS ELECTRIC Standard Inverter	Date of installation	
Model name	LSLV-iV5L	Warranty period	
Customer information	Name (or company)		
	Address		
	Contact Info.		
Retailer information	Name		
	Address		
	Contact info.		

Warranty period

The product warranty covers product malfunctions, under normal operating conditions, for 12 months from the date of installation. If the date of installation is unknown, the product warranty is valid for 18 months from the date of manufacture. Product warranty terms may vary depending on purchase or installation contracts.

Warranty service information

During the product warranty period, warranty service (free of charge) is provided for product malfunctions under normal operating conditions. For warranty service, contact an official LS ELECTRIC agent or service center.

Non-warranty service

A service fee will be charged in the following situations:

- intentional abuse or negligence
- power supply problems or faults caused by other appliances connected to the product
- natural disasters or utility faults (fire, flood, earthquake, gas accidents, etc.)
- modifications or repairs performed by unauthorized persons
- missing authentic LS ELECTRIC rating plates
- expired warranty period

Visit our website

Visit us at *http://www.lselectric.co.kr* for detailed service information.

CE mark

$C\epsilon$

The CE mark indicates that the products carrying this mark comply with European safety and environmental regulations. European standards include the Machinery Directive for machine manufacturers, We have confirmed that our products comply with EN 61800-5-1.

EAC mark

EHL

The EAC (EurAsian Conformity) mark is applied to the products before they are placed on the market of the Eurasian Customs Union member states.

It indicates the compliance of the products with the following technical regulations and requirements of the Eurasian Customs Union:

Technical Regulations of the Customs Union 004/2011 "On safety of low voltage equipment"

Technical Regulations of the Customs Union 020/2011 "On electromagnetic compatibility of technical products"

www.lselectric.co.kr

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