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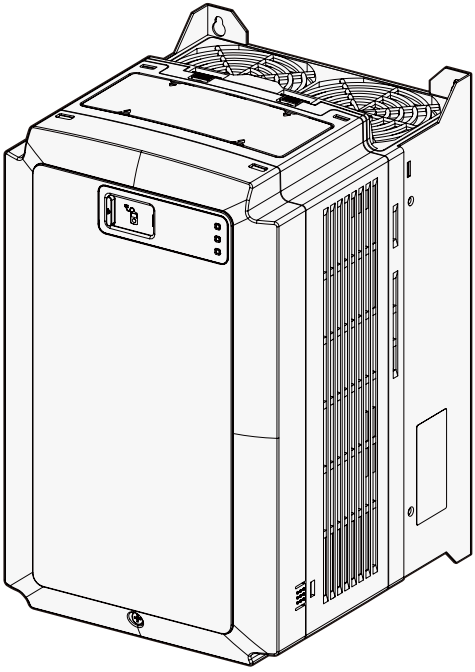
LS ELECTRIC strives to maximize your profits in gratitude for choosing us as your partner.

AC Variable Speed Drive

LSLV-L100 series

User's Maunal

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.

* L100 is the official name for the L100 series of inverters.

Before installing and using the L100 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 modules

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 L100 series products. You can download the PDF versions of these user manuals by visiting www.lselectric.co.kr.
(go to [SUPPORT & SERVICES]–[Download Center])

- L100 Incremental Pulse Encoder Add-on Module User Manual (English)
- L100 SIN/COS Encoder Add-on Module User Manual (English)
- L100 EnDat Encoder Add-on Module User Manual (English)
- L100 ELIO Add-on Module 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 precisely to avoid unsafe operating conditions, property damage, personal injury, or death.

Safety symbols in this manual

⚠ Danger

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

⚠ Warning

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

⚠ Caution

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

Safety information

⚠ Danger

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

Quick Reference Table

The following table contains situations frequently encountered by users while working with inverters. Refer to the typical and practical situations in the table to quickly and easily locate answers to your questions.

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The inverter or the motor does not seem to be working properly.	p. 334
What is auto-tuning?	p. 155
What are the recommended cable lengths?	p. 21 p. 31
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I want to review the recent history of fault trips and warnings.	p. 338
I want to use a potentiometer to change the inverter's operating frequency.	p. 68
I want to operate the inverter using a multistep speed configuration.	p. 217
The motor is running too hot.	p. 351 p. 151
I want to change the items that are monitored on the keypad.	p. 133 p. 135

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About the L100 series inverter

This instruction manual includes information required to perform installation, test run, and basic operation of the L100 inverter. The L100 inverter provides precision vector control of motor speed and torque while driving 3-phase induction and synchronous motors.

Main features

- IGBT type speed sensors (encoders) can be installed for vector control.
- Open-loop speed control in V/F and slip compensation modes
- Closed-loop speed control in Speed(IM)and Speed(PM)modes
- Error detection for hardware or software encoder
- Power system redundancy and emergency backup power
- Auto-tuning features: Rotational and stand-still auto tuning operations are available.

Application

The L100 series inverter has been specifically designed elevator applications

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:

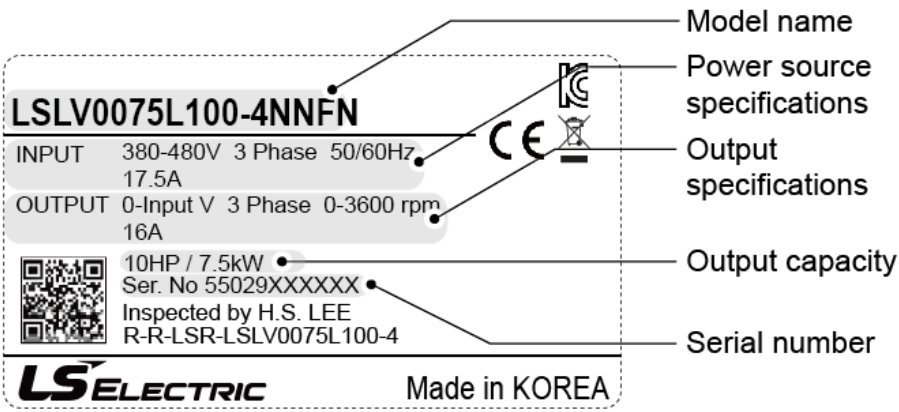
- Do not stack product packages in excess of allowed weight or allowed number of layers.
- Do not open the packaging during transportation.

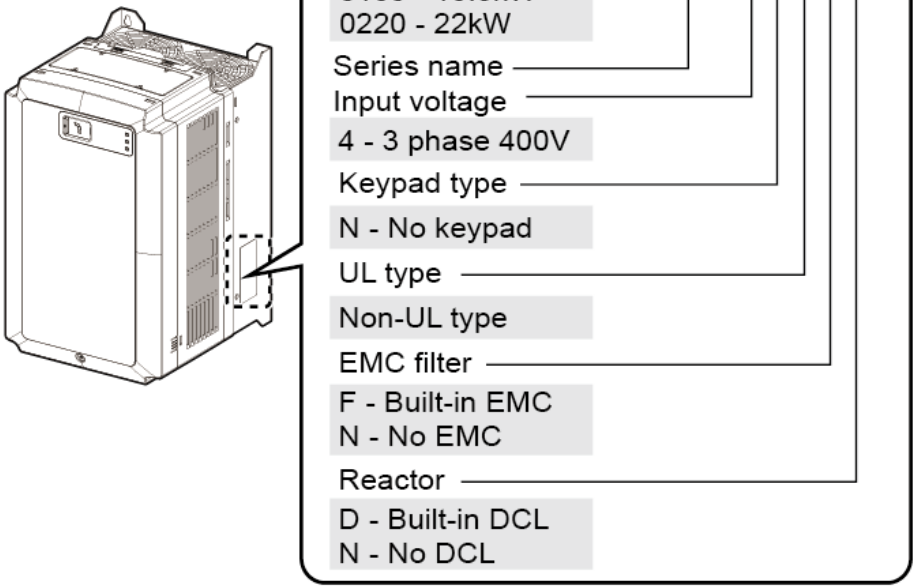
1.1 Product identification

The L100 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 *10.1 Input and output specifications* on page *368*.

Note

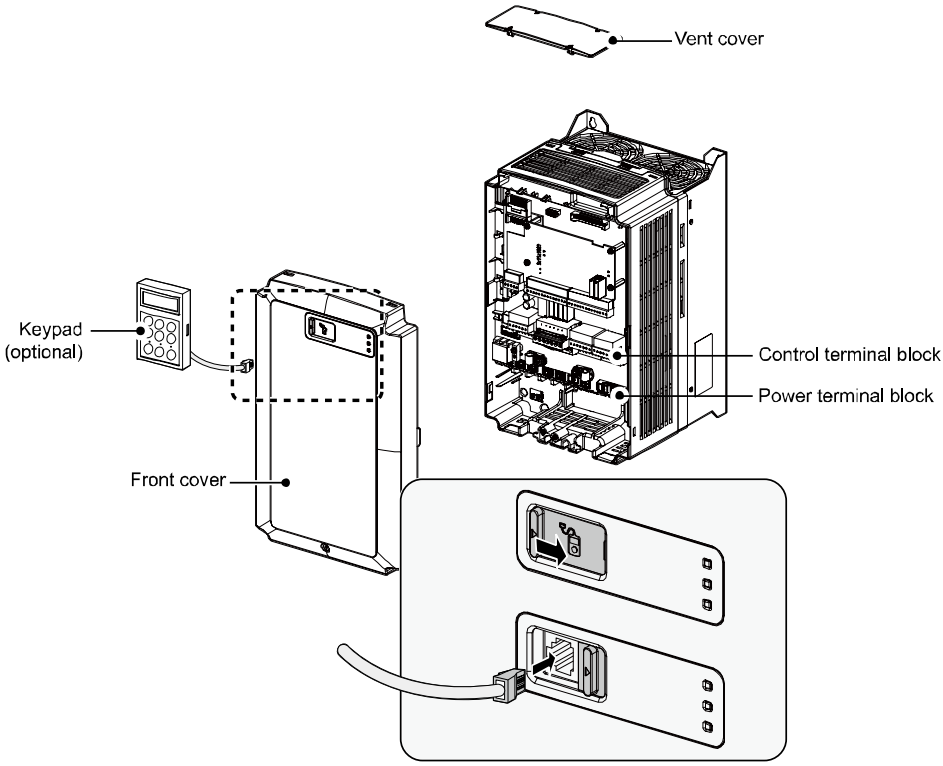
Check the product name, open the packaging, and then confirm that the product is free from defects. Contact your supplier if you have any questions about your product.


LSLV0075L100-4NNFN
INPUT 380-480V 3 Phase 50/60Hz
17.5A
OUTPUT 0-Input V 3 Phase 0-3600 rpm
16A
10HP / 7.5kW
Ser. No 55029XXXXXX
Inspected by H.S. LEE
R-R-LSR-LSLV0075L100-4
LS ELECTRIC
Made in KOREA
Model name
Power source specifications
Output specifications
Output capacity
Serial number


LSLV0075L100-4NNFN
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
N - No keypad
UL type
Non-UL type
EMC filter
F - Built-in EMC
N - No EMC
Reactor
D - Built-in DCL
N - No DCL

1.2 Part names

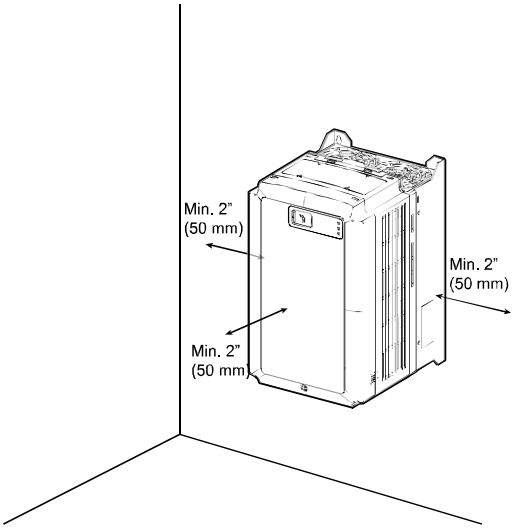
The diagram below displays names for the inverter's parts. Details may vary between inverter models.



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	95% relative humidity (no condensation)
Storage temperature	- 14–104 °F (-10–40°C)
Environmental factors	An environment free from corrosive or flammable gases, oil residue, and dust. Avoid exposure to direct sunlight.
Altitude/vibration	Less than 3,280 ft (1,000 m) above sea level / less than 1.0 G (9.8 m/sec2)
Air pressure	70 –106 kPa



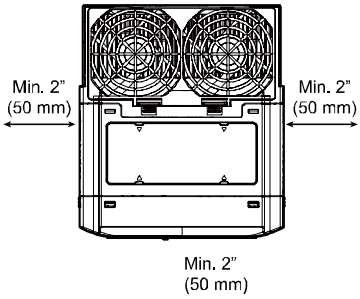
Caution

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

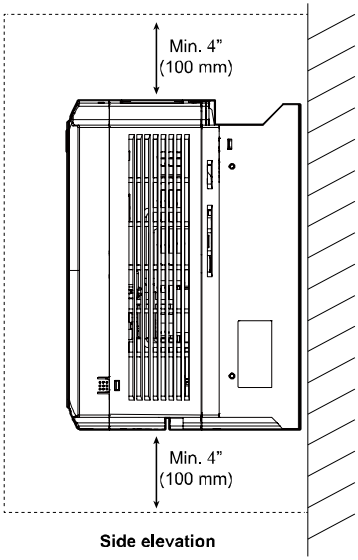
1.4 Selecting and preparing a site for installation

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.

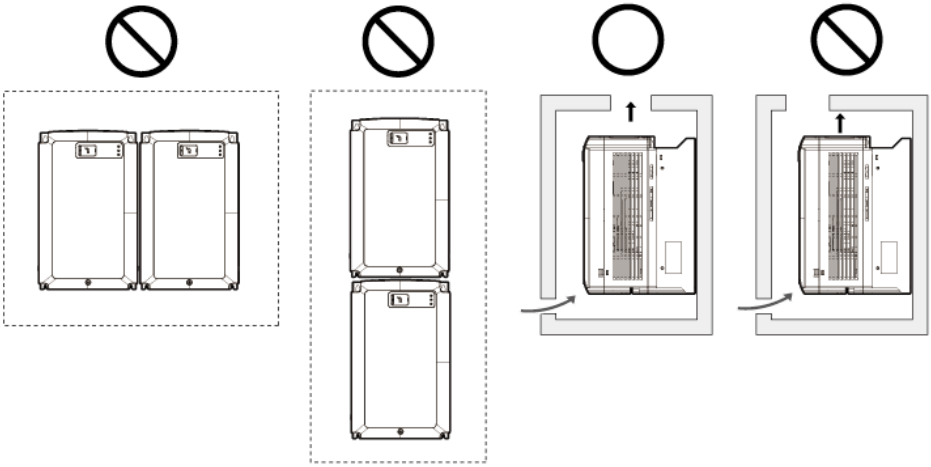


Plan view



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 install multiple inverters side-by-side.
- 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.

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 5.5 kW and 22 kW must be grounded with industrial connector according to IEC60309.
- 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 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 include those for:
  - RUN/STOP COMMAND: FX, RX, BX, RST, CM
  - MULTIFUNCTION INPUT: P1–P7, CM
  - ANALOG INPUT: V1, I1
  - ANALOG OUTPUT: AO1, AO2
  - ENCODER INPUT: PE, GE, A+, A-, B+, B-, PA, PB, Z+, Z-
  - ECONDER OUTPUT: RA, GE, RB, GE
  - CONTACT: A1, C1, A2, C2, A3, C3, A4, C4, 30A, 30B, 30C

Ground and power cable specifications

Load (kW)		Ground cable	Power cables (input and output)			
		mm^2	mm^2		AWG	
			R/S/T	U/V/W	R/S/T	U/V/W
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

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

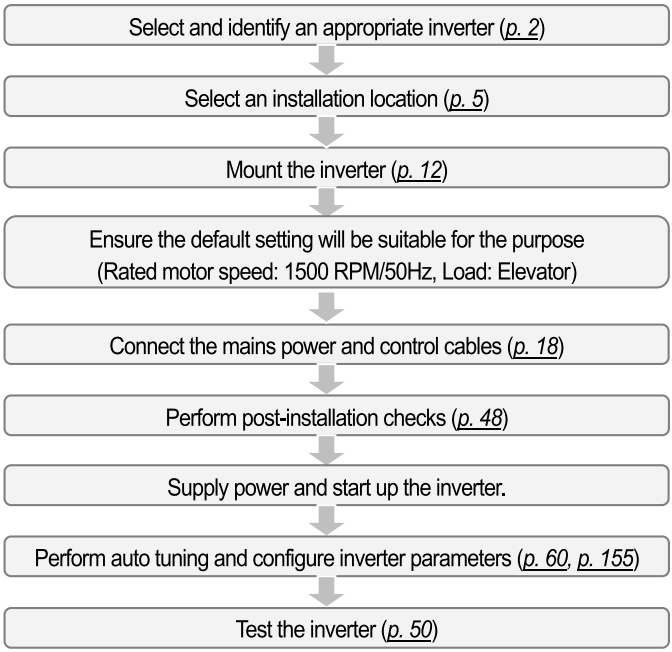
Cross-sectional area/diameter	
mm^2	AWG
0.2-0.8	18–26

2 Installing the Inverter

This chapter describes the physical and electrical installation of the L100 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.



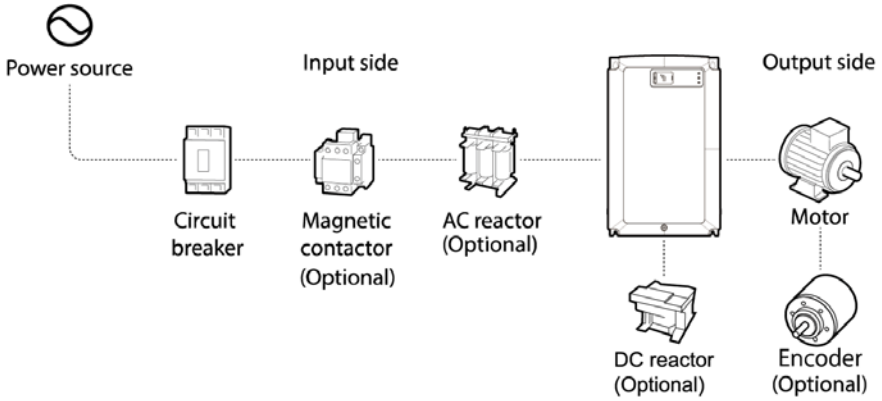
Caution

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 **10.4 Peripheral devices** on page *373*.



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 *10.5 Fuse and reactor specifications* on page *373* and ensure that reactors meet the specifications.

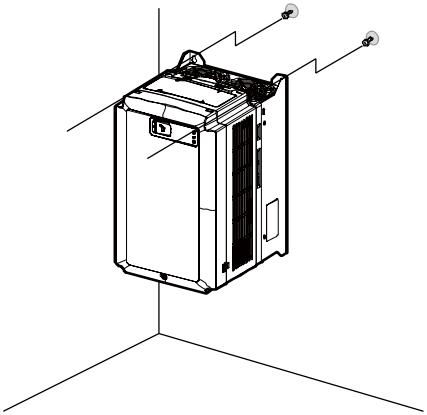
2.1 Mounting the inverter

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.

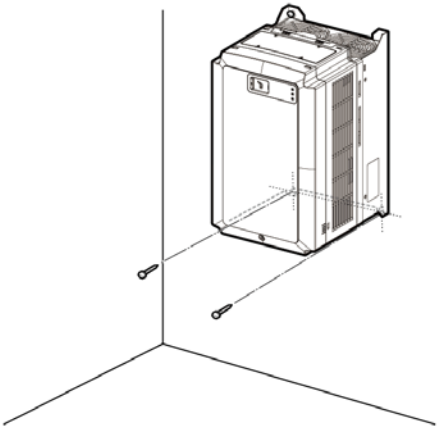
Select a wall or equipment cabinet suitable to support the inverter. Refer to *10.3 External dimensions* on page *372* and confirm the dimensions for the mounting holes.

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 top mounting bolts. Do not fully tighten the bolts at this time.

5 Mount the inverter on the two top 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 lower mounting bolts. Then, insert and tighten the other lower mounting bolt.

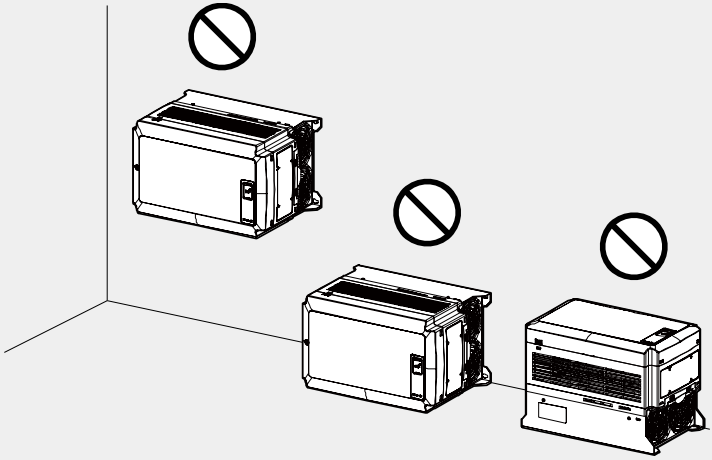


Caution

- 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 modules 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. For more details, refer to page *374*.
- 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.

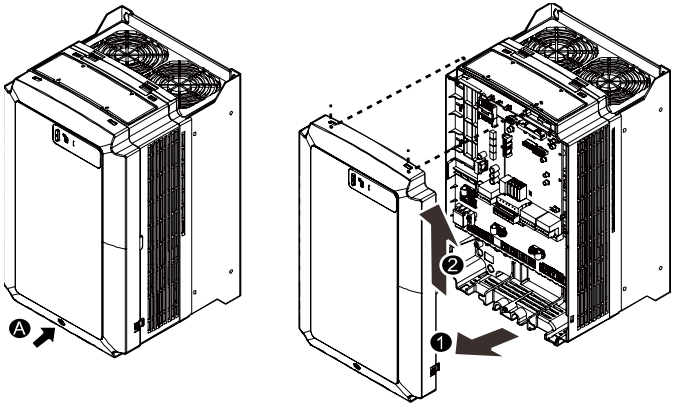
Note

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 front cover screw (A) and remove the front cover by pulling the bottom of it towards you (1) and lifting it (2).



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 *8*.

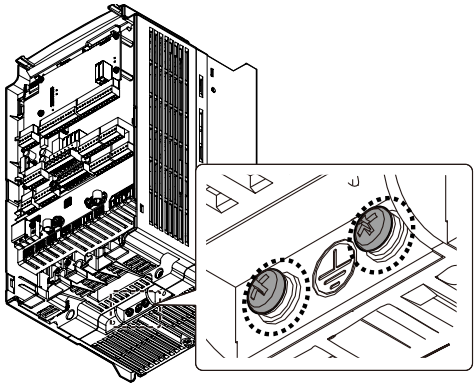
Step 2 Ground connection

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 *8* 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 8. Keep the ground cable as short as possible and ground termination as close as possible to the inverter.



2 Connect the other end of all ground cable to an earth (ground) terminal.

Note

The product requires special Class 3 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 DC current in the protective earthing conductor. If an RCD or monitoring (RCM) device is used for protection, only RCD or RCM of Type B is allowed on supply side of this product.
- Large amount of leakage current is generated around the inverter due to high-speed switching operation. The inverter and the motor must be properly grounded to prevent electric shock.

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 *8* before installing them.

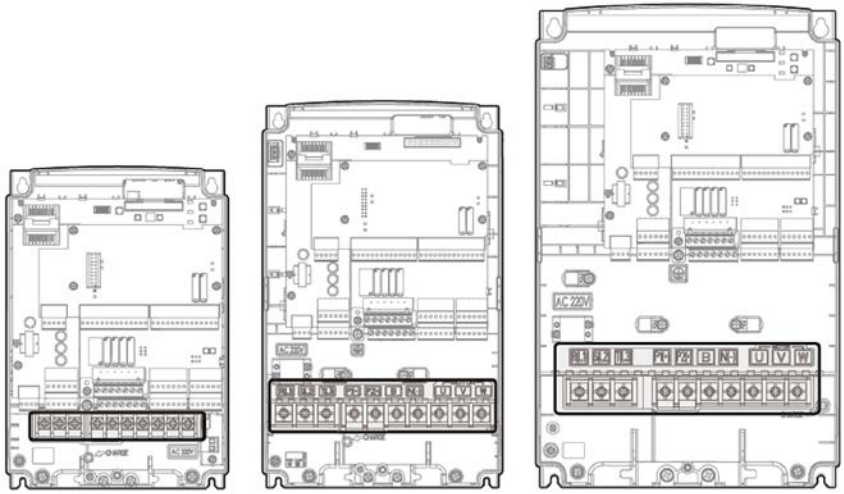
ⓘ Caution

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

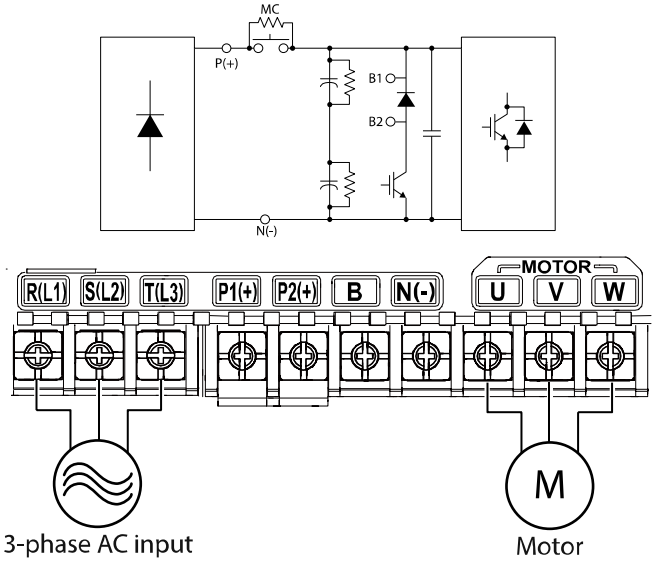
routed. Use a separate conduit for the control cables.

- 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.

Power terminal layout



5.5/7.5 kW 11/15 kW 18.5/22 kW



Power terminal descriptions

Terminal	Name	Description
R/S/T (L1/L2/L3)	AC power input terminals	3-phase AC power connection.
P1 (+)	DC link P(+) terminal	DC link wiring connections. (P1 and P2 terminals are jumped together when a DC reactor is not used)
P2 (+)	DC link P(+) terminal	
N (-)	DC link N(-) connection	Common terminal for DC link connection
B	Brake resistor terminal	Brake resistor wiring connection. (Connect a brake resistor to P2 and B terminals)
U/V/W	Output terminals to motor	3-phase motor (induction motor, synchronous motor) wiring connections.

Note

- Both P1 (+) and P2 (+) terminals are for DCP (+) connections.

- N (-) terminal is for DCN (-) connection. It is not a “neutral” contact.
- P2(+) and B terminals are for connecting a brake resistor only. Do not connect any other device P2(+) and B terminals.
- 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 switching frequency	Maximum cable length
3 – 5 kHz	< 330 ft (100 m)
3 – 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.

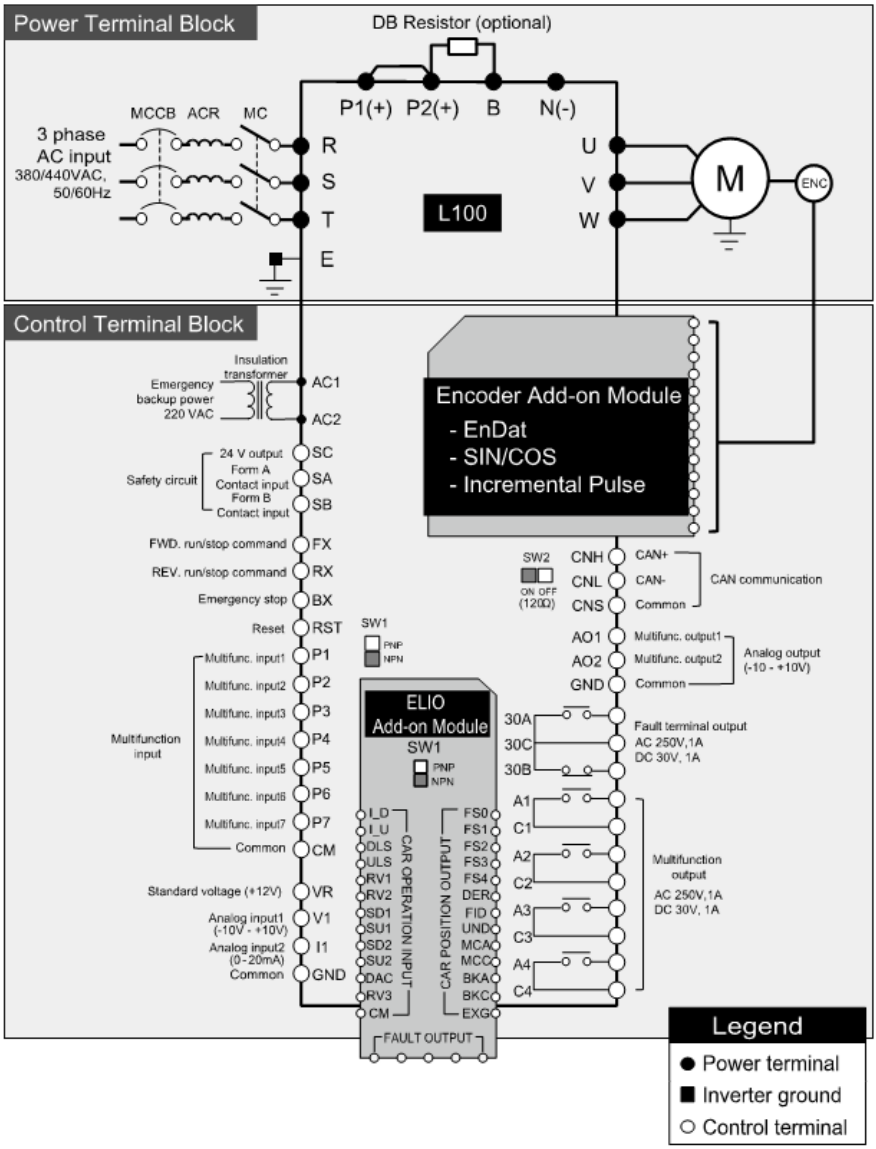
ⓘ Caution

- 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 *8* before installing and connecting control circuits.

Power terminal and control terminal wiring diagram



Caution

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

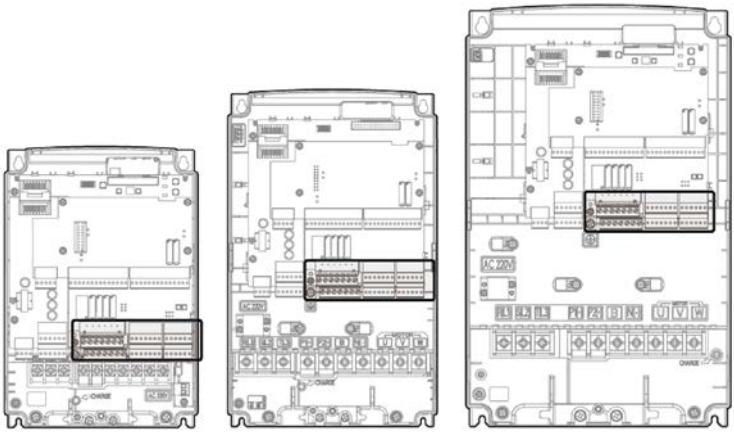
Control board labels

Function	Label	Name	Description
Control board	CN1	Terminal output	Connector for fault relay (30A, 30B, 30C), multifunction terminal output (A1/C1 – A4/C4), and safety circuit terminal input (SA, SB, SC)
	CN2	Terminal input	Connector for digital terminal input: FX, RX, BX, RST, P1 –P7
	CN3	Analog I/O	Connector for analog terminal input (V1, I1), analog terminals output (AO1, AO2), and CAN communication
	CN4	Add-on module connector	Use this connector when using add-on module boards.
	CN5	Keypad connector	Connects to keypad.
	CN6	Power board connector	Connects to power board.
	CN8	ELIO add-on module connector	Use this connector when using ELIO add-on module boards.
	SW1[Note1)]	Digital input NPN/PNP selection switch	NPN/PNP mode selection switch Up: PNP Down: NPN (default)
	SW2[Note2)]	Communication terminating resistor switch	Turns the terminating resistor (120 Ω) ON when the inverter is connected to the end of communication node. Left: Terminating resistor ON Right: Terminating resistor OFF (default)

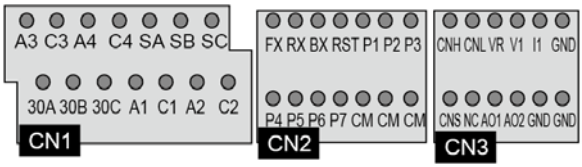
Note1) Refer to “Step 8 NPN/PNP mode selection for detailed information.

Note2) Refer to “Step 9 Setting terminating resistor” for detailed information.

Connector layout

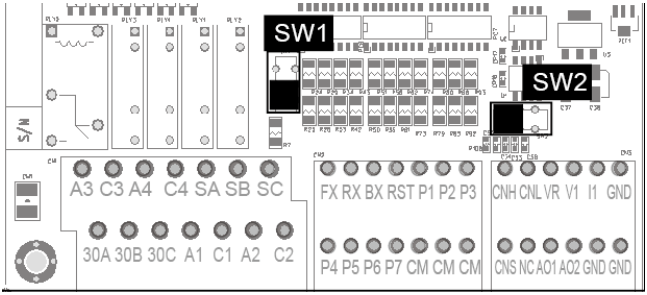


5.5/7.5 kW 11/15 kW 18.5/22 kW



Connector	Layout
CN1	A3 C3 A4 C4 SA SB SC 30A 30B 30C A1 C1 A2 C2
CN2	FX RX BX RST P1 P2 P3 P4 P5 P6 P7 CM CM CM
CN3	CHN CNL VR V1 I1 GND CNS NC AO1 AO2 GND GND

Jumper switch settings (PNP/NPN selection and terminating resistor)



Switch	Mode	Description
SW1[1)]	PNP	Operates with an external 24 V power supply.
	NPN	Operates internally connected to CM.
SW2[2)]	Terminating resistor On	Enables termination of CAN network.
	Terminating resistor Off	Disables termination of CAN network.

Note1) Refer to “Step 8 NPN/PNP mode selection” for detailed information.

Note2) Refer to “Step 9 Setting terminating resistor” for detailed information.

Detailed input terminal labels and descriptions

Function	Label	Name	Description
CN2 Terminal input	FX	Forward operation/stop command	In NPN input mode, operates when connected to CM terminal. Stops when FX and RX are ON/OFF at the same time.
	RX	Reverse operation/stop command	
	BX	Emergency stop	In NPN input mode, triggered when connected to CM terminal and operates a free run stop or deceleration stop. It does not provide a fault signal.
	RST	Fault clearance	Fault status clears when the inverter is ON after the cause of the fault is removed.

Function	Label	Name	Description
	P1 P2 P3 P4 P5 P6 P7	Multifunction input terminals	- Configurable for the following multifunction inputs: - Multi speed operation L/M/H - Acc/Dec time - Form B contact for external fault signal - Timer input - Cancel soft start - ASR gain switching - ASR P/PI switching - Flux command switching - Enable/disable max. torque - Enable/disable torque bias - A3 safety - Enable/disable battery operation - Disable low voltage trip detection
	CM	Common	Common terminal for analog terminal input and output. - In NPN mode, function is ON when each multifunction terminal and CM terminal are connected. - In PNP mode, function is ON when an external 24 V power source is connected to CM terminal.
CN1 Safety input	SA	Terminal for Safety Form A contact connection	Terminal for Safety Form A connection. Terminals SA and SC must be connected for inverter operation (disconnection triggers a protection feature).
	SB	Terminal for Safety Form B contact connection	Terminal for Safety Form B connection. Terminals SB and SC must be connected for inverter operation (disconnection triggers a protection feature).
	SC	Safety 24 V power	24 V power supply for safety A/B connections.
CN3 Analog input	VR	Potentiometer for analog input	Maximum output voltage: +12 V Potentiometer: 10 k Ω

Function	Label	Name	Description
configuration	V1	Voltage input	Used for voltage input applications: -10 – 10 V / 10 – -10 V, 0 – 10 V / 10 – 0 V
	I1	Current input	Used for current input applications: 0 – 20 mA / 20 – 0 mA
	GND	Common	Common terminal for analog terminal input.

Detailed output terminal labels and descriptions

Function	Label	Name	Description
CN3 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 - Flux command
	AO2	Analog output 2	

Function	Label		Name	Description
				- Flux current command - Flux current - Q-axis current control output - D-axis current control output - D-axis voltage - Q-axis voltage - Output current - Output voltage - Output power - DC-link voltage - Inverter temperature.
	GND		Common	Common terminal for analog terminal outputs.
CN1 Multifunction output	A1	C1	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 - Low voltage alert - In operation - In regeneration - Inverter overheat alert - Speed agreement - Torque detection - Torque limit detection - Overload alert - Stopping - MC output - Fan fault - ALLS status - At constant speed - Brake output
	A2	C2	Multifunction output contact 2 (Form A contact)	
	A3	C3	Multifunction output contact 3 (Form A contact)	
	A4	C4	Multifunction output contact 4 (Form A contact)	

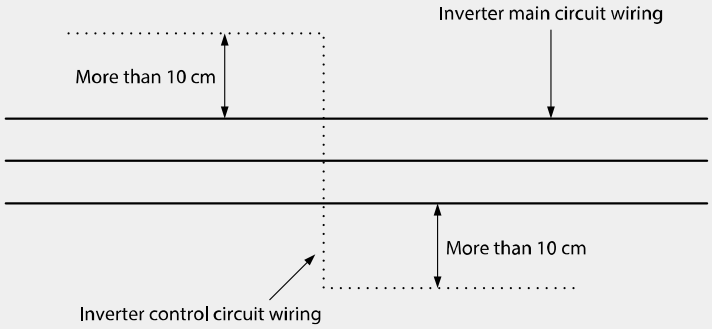
Function	Label	Name	Description
	30A	Fault signal (Form A contact)	Output signal is generated when a fault occurs. Does not output when the emergency stop is activated.
	30B	Fault signal (Form B contact)	
	30C	Common	Common terminal for output contacts A and B.

I/O terminals for CAN communication

Function	Label	Name	Description
CN3 Analog I/O (CAN I/O)	CNH	CAN HIGH	High, low, common signal terminals for CAN communication.
	CNL	CAN LOW	
	CNS	CAN COMMON	

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, 2, 3, and 4 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.

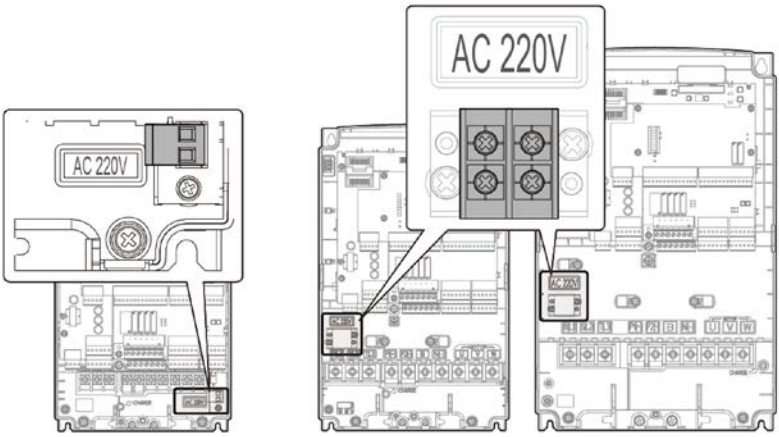


Step 5 Auxiliary power terminals

The L100 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).



5.5/7.5 kW 11/15 kW 18.5/22 kW

Auxiliary power terminal labels and descriptions

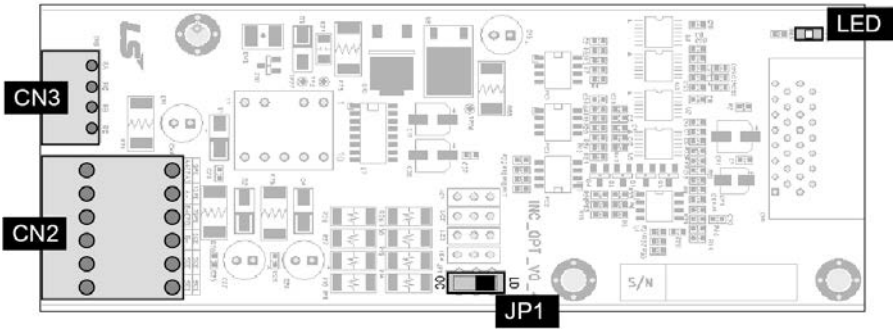
Label	Name	Description	Voltage
AC1 AC2	Auxiliary input voltage	Used to connect to single phase AC input voltage.	220 V (-10-+10%), 50/60 Hz

Step 6 Encoder add-on module settings

Install an encoder on the motor's rotor or on a spindle that rotates at the same speed as the motor's rotor (E.g. 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.

Refer to the User Manuals provided with the add-on modules for detailed information.

L100 Incremental Pulse Encoder add-on module



Connector layout

Connector	Layout					
CN2	5PE	12PE	15PE	GE	GE	GE
	A+[PA]	A-	B+[PB]	B-	GE	GE
CN3	RA	RG	RB	RG		

LED indications

LED Status	Indication
Normal	Flashes in 1 second intervals.
Abnormal configuration	Flashes in 0.5 second intervals.

Terminal block details

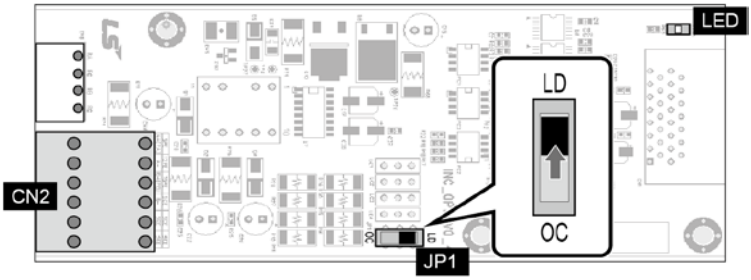
Item		Indication	Name	Description
Encoder signal	Input pulse (CN2)	5PE	+5 V power	+5 V line drive power for encoder
		12PE	+12 V power	+12 V open collector power for encoder
		15PE	+15 V power	+15V open collector power for encoder
		GE	Ground	Ground for encoder power
		A+ [PA] / A-	Encoder phase A signal	For a line drive encoder, connect output signal cables for phases A+ and A-. Open collector (or complementary) encoders utilize A+[PA] signals and GE.
		B+ [PB] / B-	Encoder phase B signal	For a line drive encoder, connect output signal cables for phases B+ and B-. Open collector (or complementary) encoders utilize B+[PB] signals and GE.
	Output pulse (CN3)	RA	Encoder phase A return signal	Terminal for encoder phase A return signal
		RB	Encoder phase B return signal	Terminal for encoder phase B return signal
		RG	Ground	Ground for encoder return signals

Note

- Be careful about the encoder's power specifications when connecting the cables. Faulty cable connections may damage the encoder.
- The LED indicator will flash in 1 second intervals if the cable connections and parameter settings are correct.

+5 V line drive settings: Switch (JP1) – LD (default)

Set JP1 switch to up (LD, Line Drive) and connect the following encoder cables to CN2 terminal block after checking the encoder signals: 5PE (+5 V), GE, A+[PA], A-, B+[PB], B-

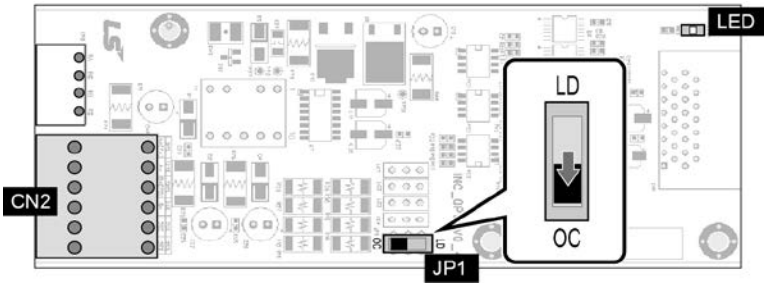


Caution

Correctly connect the wires according to the encoder's power specifications. Otherwise, the encoder may be damaged.

+12 V open collector (or complementary) settings: Switch (JP1) – OC

Set JP1 switch to down position (OC: Open Collector) and connect the following encoder cables to CN2 terminal block after checking the encoder signals: 12PE (+12 V), GE, A+[PA], B+[PB]

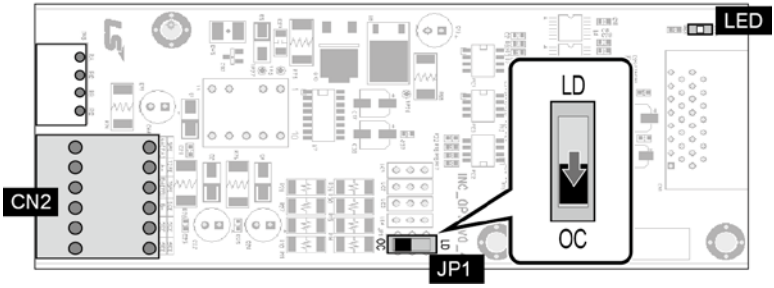


Caution

Correctly connect the wires according to the encoder's power specifications. Otherwise, the encoder may be damaged.

+15 V open collector (or complementary) settings: Switch (JP1) – OC

Set JP1 switch to down position (OC: Open Collector) and connect the following encoder cables to CN2 terminal block after checking the encoder signals: 15PE (+15 V), GE, A+[PA], B+[PB]



Caution

Correctly connect the wires according to the encoder's power specifications. Otherwise, the encoder may be damaged.

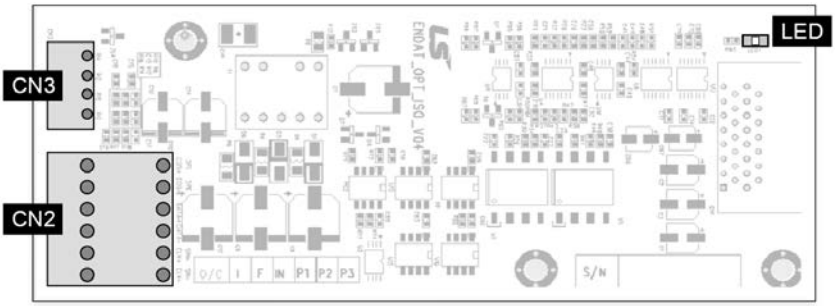
Caution

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.

L100 EnDat Encoder add-on module



Connector layout

Connector	Layout					
CN2	5PE	5PE	GE	GE	SIN+	SIN-
	COS+	COS-	DATA+	DATA-	CLK+	CLK-
CN3	RA	RG	RB	RG		

LED indications

LED Status	Indication
Normal	Flashes in 1 second intervals.
Abnormal configuration	Flashes in 0.5 second intervals.

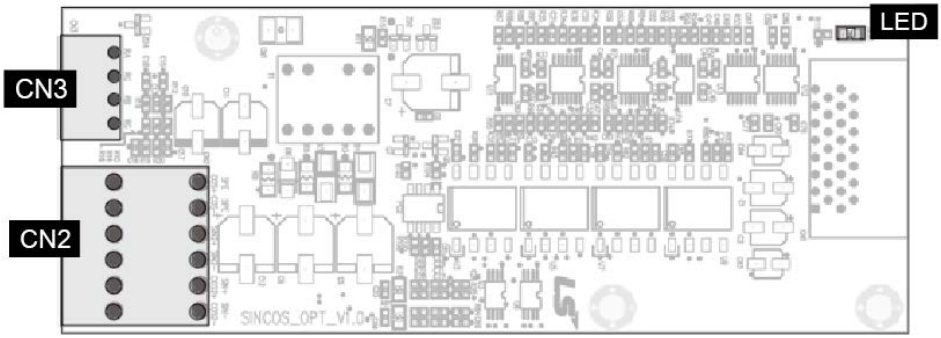
EnDat Specifications

Item	Specification
Encoder type	ECN413, ECN1313: EnDat2.2
Encoder pulse numbers	2048

Terminal block details

Item	Indication		Name	Description
EnDat Encoder input (CN2)	5PE		Encoder power	+5 V encoder power
	GE			0 V
	SIN+	SIN-	Encoder SIN signal	Encoder's SIN+/SIN- signal
	COS+	COS-	Encoder COS signal	Encoder's COS+/COS- signal
EnDat Communication (CN2)	DATA +	DATA -	Encoder data	Data input and output signals for receiving pole position data from the EnDat encoder. Used in ECN413 and ECN1313 encoders.
	CLK+	CLK-	Encoder clock	Clock signal for receiving data from the EnDat encoder. Used in ECN413 and ECN1313 encoders.
Encoder output (CN3)	RA		Encoder output phase A	Encoder A/B phase output signal Open collector output
	RB		Encoder output phase B	
	RG		Common output terminal	

L100 SIN/COS Encoder add-on module



Connector layout

Connector	Layout					
CN2	5PE	5PE	GE	GE	SIN+	SIN-
	COS+	COS-	SIN2+	SIN2-	COS2+	COS2-
CN3	RA	RG	RB	RG		

LED indications

LED Status	Indication
Normal	Flashes in 1 second intervals.
Abnormal configuration	Flashes in 0.5 second intervals.

SIN/COS specifications

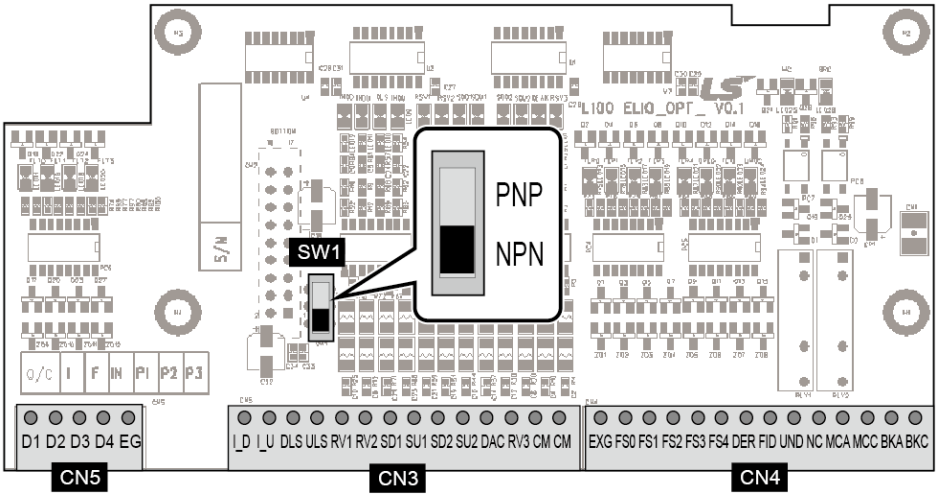
Item	Specification
Encoder type	ERN487, ERN1387
Encoder pulse numbers	2048

Terminal block details

Item	Indication		Name	Description
SIN/COS Encoder input (CN2)	5PE		Encoder power	+5 V encoder power
	GE			0 V
	SIN+	SIN-	Encoder SIN signal	Encoder's SIN+/SIN- signal
	COS+	COS-	Encoder COS signal	Encoder's COS+/COS- signal
	SIN2+	SIN2-	Encoder SIN2 signal	Encoder's SIN2+/SIN2- signal
	COS2+	COS2-	Encoder COS2 signal	Encoder's COS2+/COS2- signal
Encoder output (CN3)	RA		Encoder output phase A	Encoder A/B phase output signal Open collector output
	RB		Encoder output phase B	
	RG		Common output terminal	

Step 7 ELIO add-on module settings

Refer to the User Manual provided with the ELIO add-on module for detailed information.



Connector layout

Connector	Layout
CN3	LD LU DLS ULS RV1 RV2 SD1 SU1 SD2 SD2 DAC RV3 CM CM
CN4	EXG FS0 FS1 FS2 FS3 FS4 DER FID UND NC MCA MCC BKA BKC
CN5	D1 D2 D3 D4 EG

SW1 setting (PNP/NPN selection)

Mode	Description
PNP	Operates with an external 24 V power supply.
NPN	Operates internally connected to CM. (Default: NPN)

Terminal block details

Item	Indication	Name	Description
Elevator terminal input	I_D	Downside inductor signal	Downside inductor signal for detecting car position
	I_U	Upside inductor signal	Upside inductor signal for detecting car position
	DLS	Down Limit Switch	Car descent limit switch. Descending of a car is prohibited when the switch is turned on.
	ULS	Up Limit Switch	Car ascent limit switch. The car is prohibited from ascending when the switch is turned on.
	RV1	Reserved	
	RV2	Reserved	
	SD1	Downside Deceleration Switch 1	1st Deceleration Switch for forced deceleration while descending
	SU1	Upside Deceleration Switch 1	1st Deceleration Switch for forced deceleration while ascending
	SD2	Downside Deceleration Switch 2	2nd Deceleration Switch for forced deceleration while descending
	SU2	Upside Deceleration Switch 2	2nd Deceleration Switch for forced deceleration while ascending
	DAC	Deceleration approval signal	Deceleration approval signal for the controller
	RV3	Reserved	
	CM	COMMON	Turned ON when each terminal input is connected to CM (24G).
Elevator terminal output	EXG	COMMON	Common ground for each terminal output.
	FS0	Requested floor for stop / current floor bit 0	Data format for requested floor for stop / current floor (Floors 1 – 32) Bit4 Bit3 Bit2 Bit1 Bit0 FS4 FS3 FS2 FS1 FS0 Floor 1: OFF OFF OFF OFF OFF Floor 32: ON ON ON ON ON
	FS1	Requested floor for stop / current floor bit 1	
	FS2	Requested floor for stop / current floor bit 2	

<table>
<tr><th>Item</th><th>Indication</th><th>Name</th><th>Description</th></tr>
<tr><td rowspan="8"></td><td>FS3</td><td>Requested floor for stop / current floor bit 3</td><td rowspan="2"></td></tr>
<tr><td>FS4</td><td>Requested floor for stop / current floor bit 4</td></tr>
<tr><td>DER</td><td>Signal for requesting deceleration approval</td><td>When this signal is input, the controller outputs the deceleration approval signal (DAC) if the requested floor for a stop matches the calling floor.</td></tr>
<tr><td>FID</td><td>Floor identification signal</td><td>ON: Requested floor for a stop (previous floor), OFF: Current floor</td></tr>
<tr><td>UND</td><td>Deceleration signal</td><td>Turns ON when the motor is decelerating.</td></tr>
<tr><td>MCA/MCC</td><td>Contactor operation relay Form A contact</td><td>Operates the contactor for shutting down the inverter output.</td></tr>
<tr><td>BKA/BKC</td><td>Brake operation relay Form A contact</td><td>Operates the traction machine brake.</td></tr>
<tr><td rowspan="2">Fault output</td><td>D1</td><td>Fault information BIT0 (LSB)</td><td rowspan="2">Outputs 4-bit fault data when the inverter is malfunctioning. Elevator faults have priority in the output over inverter faults.
Set one of the multifunction outputs AX1 – AX4 to “E/L Fault” to distinguish elevator faults from inverter faults. When a fault occurs, it is an elevator fault if the multifunction terminal set to “E/L Fault” is ON; it is an inverter fault if the multifunction terminal set to “E/L Fault” is OFF.
<Output codes for elevator faults>
<table><tr><th>Fault</th><th>D4</th><th>D3</th><th>D2</th><th>D1</th></tr><tr><td>No Fault</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr></table></td></tr>
<tr><td>D2</td><td>Fault data BIT 1</td></tr>
</table>

Item	Indication	Name	Description				
	D3	Fault data BIT 2	FHM RUN Fail	OFF	OFF	OFF	ON
			Flr Data Fail	OFF	OFF	ON	OFF
			ChkSum Err	OFF	OFF	ON	ON
			NotRdy (E/L)	OFF	ON	OFF	OFF
			Decel	OFF	ON	OFF	ON
			Acc/Dec	OFF	ON	ON	OFF
			SDS Error	OFF	ON	ON	ON
			IND Reverved	ON	OFF	OFF	OFF
			Indicator Fail	ON	OFF	OFF	ON
			CmdSrc	ON	OFF	ON	OFF
			NotRdy (FHM)	ON	OFF	ON	ON
			<Output codes for inverter faults>				
	D4	Fault data BIT 3	**Fault**	**D4**	**D3**	**D2**	**D1**
			No Fault	OFF	OFF	OFF	OFF
			Arm Short	OFF	OFF	OFF	ON
			FAN Error	OFF	OFF	ON	OFF
			Ground Fault	OFF	OFF	ON	ON
			Over Current	OFF	ON	OFF	OFF
			Over Voltage	OFF	ON	OFF	ON
			Encoder Err EnDat Error	OFF	ON	ON	OFF
			Low Voltage Low Voltage2	OFF	ON	ON	ON
			Inv OverHeat	ON	OFF	OFF	OFF
			E-Thermal Over Load	ON	OFF	OFF	ON
			Input PO Output PO	ON	OFF	ON	OFF
			Ext.Trip-B	ON	OFF	ON	ON
			Inv. OLT	ON	ON	OFF	OFF

Item	Indication	Name	Description				
			Mag Det Err	ON	ON	OFF	ON
			InvThem OP	ON	ON	ON	OFF
			Over Speed Spd Dev Err	ON	ON	ON	ON
	EG	COMMON	Common ground for open collector outputs for faults.				

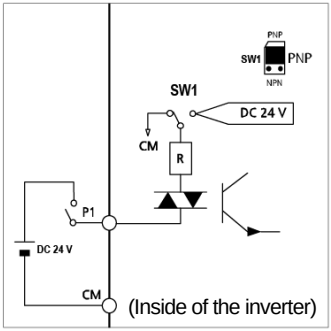
Step 8 PNP/NPN mode selection

The L100 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 switch (SW1) on the control board. Refer to the following information for more details. (Default: NPN)

PNP mode (Source)

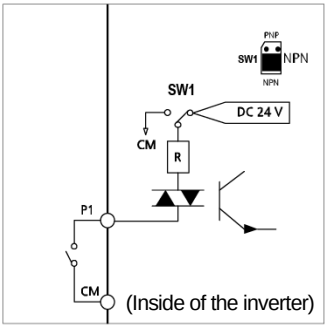
Select PNP mode at the PNP/NPN switch (SW1). The default setting is NPN mode. CM is the common ground terminal for all analog inputs at the terminal block and P24 is the internal DC 24 V supply. If you are using an external DC 24 V supply, build a circuit that connects the external power supply (-) and 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 switch (SW1). 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

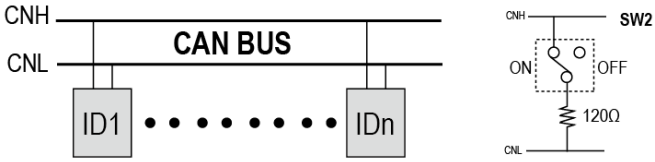
Do not change the PNP/NPN input switch settings while the inverter is running. Doing so may change the inverter's input value at the terminals.

Step 9 Setting terminating resistor

Application of terminating resistors allows for optimal impedance matching required for reliable network communication.

When multiple devices are connected to a CAN bus, apply terminating resistors (120 Ω) at both ends of the bus, for the devices that are the farthest apart.

Set SW2 on the control board to ON (left) to turn on the terminating resistor (default: OFF).



Step 10 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	Result
Installation location/I/O power rating verification	Is the location for the inverter installation appropriate?	p. 5	
	Does the operating environment meet the inverter's specifications?	p. 6	
	Does the main power supply meet the inverter's rated input?	p. 368	
	Is the inverter's rated output sufficient to supply the equipment? (In certain circumstances, insufficient output will result in degraded performance.)	p. 368	
Electrical connections	Is a circuit breaker installed on the input side of the inverter?	p. 11	
	Is the circuit breaker correctly rated?	p. 373	
	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. 18	
	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. 18	
	Are the incoming power cables rated correctly?	p. 8	
	Is the inverter grounded correctly?	p. 17	
	Are the power terminal screws and the ground terminal screws tightened to the specified torque?	p. 18	
	Is the inverter separated from the power source by a magnetic contactor (if a braking resistor is in use)?	p. 11	
Control circuit connections	Are STP cables used for all control circuit wiring?	-	
	Is the shielding of all STP cables properly grounded?	-	

Item	Description	Page	Result
	Are the control cables properly connected?	p. 22	
	Are the control terminal screws tightened to the specified torque?	p. 374	
	Is the total cable length of all control cables < 165 ft (50 m)?	p. 31	
	Is the total length of safety cables < 100 ft (30 m)?	p. 31	
Miscellaneous	Are optional add-on modules 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. 373	
	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 (V1) is selected as the frequency reference input, confirm that the frequency changes when the input voltage changes.
- If Ai2 (I1) is selected as the frequency reference input, confirm that the frequency changes when the input current 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

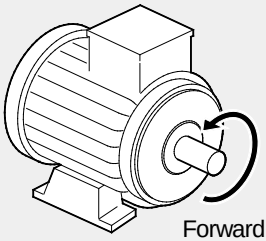
To avoid electrocution, ensure that the MCCBs and MCs are turned off before connecting power to the inverter.

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

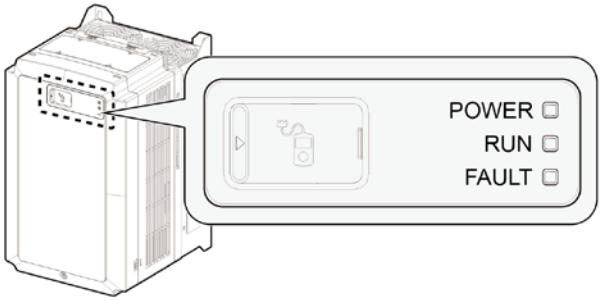
- Before operating the inverter for the first time, check the control cables to ensure that all cables are connected properly, and no damages to the cables or short circuit conditions exist.
- Check the parameter settings before running the inverter. Parameter settings may need to be adjusted depending 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.

Operation indicators

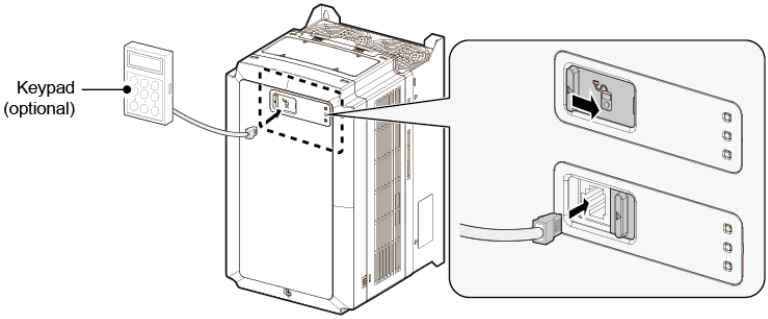
Refer to the following table for the operating status of the inverter.



Indicator	Color	Description
POWER	Green	Turns on when power is supplied to the control board.
RUN	Blue	Acc/Dec operation: Flashes in 0.5 second intervals. Constant speed operation: Turns on (solid).
FAULT	Red	Flashes in 0.5 second intervals when the inverter operation is abnormal.

Keypad connection

Refer to the following figure to connect a keypad to the inverter.



3.1 About the keypad

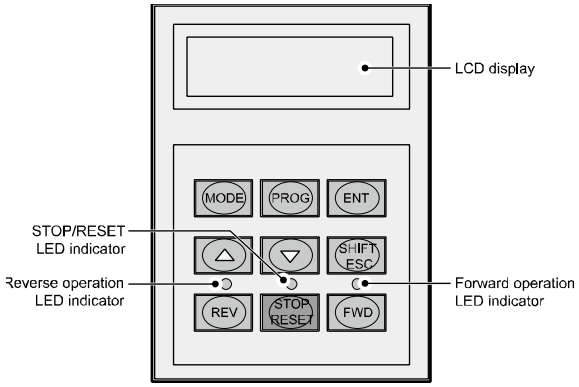
The keypad has two main components – the operation keys and the display.

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

3.1.1 Operation keys

Operation keys

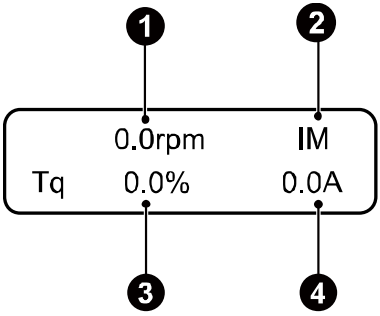
The table below lists the names and functions of the keypad's operation keys.



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. Flashes during acc/dec operations and stays turned on during a constant speed operation.
STOP RESET	[STOP/RESET]	Stops the current operation. (Valid when FUN_01 is set to "Keypad".) Clears fault status.Turns on when the operation is stopped and flashed during a fault.
FWD	[FWD]	Starts forward operation. Flashes during acc/dec operations and stays turned on during a constant speed operation.

3.1.2 About the display

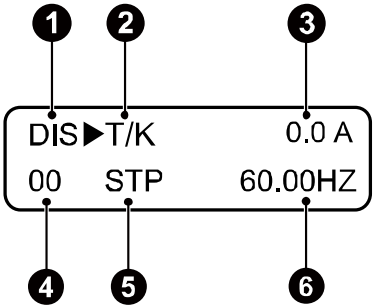
Speed(IM)and Speed(PM)mode display



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: - IM: Induction motor speed control mode - PM: Synchronous motor (permanent magnet motor) 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 (100%).
4	Inverter output current	Displays the effective output current of the inverter.

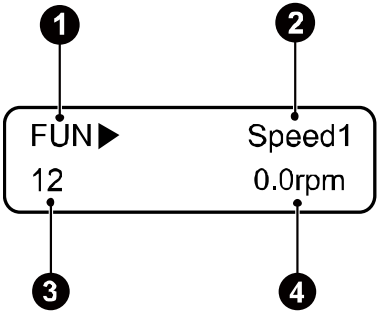
V/F and Slip Comp mode display



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	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: CAN communication command <Speed commands> - K: Keypad command - A: Analog command - O: CAN 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.

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, 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) Displayed only when an ELIO add-on module has been installed and "PAR_08" is set to "Elevator."

3.1.3 Control menu

The SV-L100 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 RS232 and CAN communication options.
User	USR	Configure user macro settings.

Note1) Displayed when an ELIO add-on module has been installed. Refer to the user manual supplied with the add-on module.

The groups in bold in the Display column are default parameter groups. Refer to *6 Detailed operation by function groups* on page *133* for details.

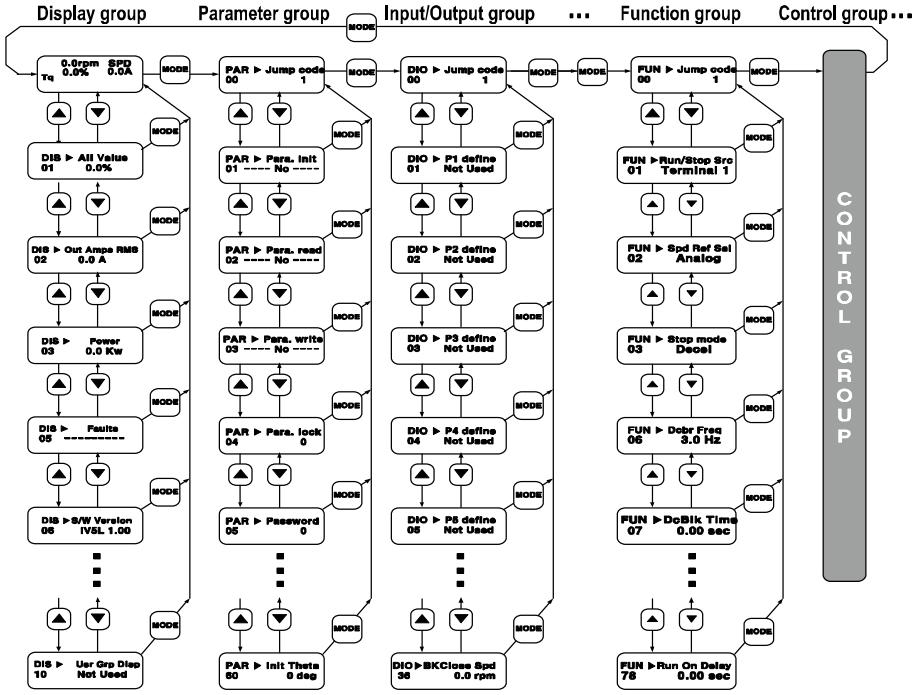
3.2 Using the keypad

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 *80* 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. Refer to 6 *Detailed operation by function groups* on page *133* for information about the features and ranges before configuring or modifying parameter values.

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).

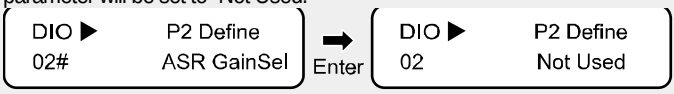
The following is an example to label DIO_02 to "Speed-L."

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.

For example, if you try to select "ASR GainSel" (not available in Slip Comp mode) for DIO_02 in Slip Comp mode, "#" will be displayed next to the selected code. If you press Enter to save the setting, the parameter will be set to "Not Used."



3.2.5 Configuring acceleration time on the keypad

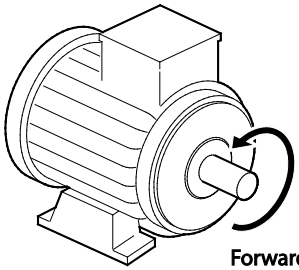
The following example demonstrates how to modify the ACC (acceleration time) value from 10 seconds to 15 seconds in the operation group.

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 10.00 sec
6	Press [▲] or [▼] to change the value.	FUN▶ Acc Time-1 41 15.00 sec
7	Press [ENT] to save the changes. The cursor disappears.	FUN▶ Acc Time-1 41 15.00 sec

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

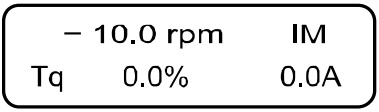
Forward operation

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

	+ 10.0 rpm	IM
Tq	0.0%	0.0A

Reverse operation

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



Note

- If "0.0 rpm" is displayed, or the (+) and (-) values are displayed reversely, confirm the encoder connections.
- If you cannot manually rotate the motor, refer to *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▶ Speed 0 12 100.0 rpm

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. “+100.0 rpm” is displayed as the motor speed.	+100.0 rpm IM Tq % A
Reverse	Press [REV] on the keypad. “-100.0 rpm” is displayed as the motor speed.	−100.0 rpm IM 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 connections are 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	Reverse	-10 - -40 rpm	150% (torque limit)	Abnormal
	REV	Forward	10-40 rpm	-150% (torque limit)	
Encoder and motor connections have been changed.	FWD	Reverse	+100.0 rpm	Lower than +10%	Abnormal
	REV	Forward	-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.	+1000.0 rpm IM Tq % A
Reverse	Press [REV] on the keypad. "-1000.0 rpm" is displayed as the motor speed.	-1000.0 rpm IM Tq % A

3.5 Operating the inverter using the control terminal block

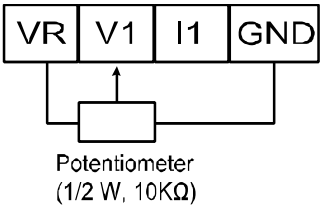
3.5.1 Setting parameter values for control terminal block operation

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 (analog input at V1).	AIO▶ Ai1 Define 01 Speed Ref
5	Select a range for the Ai1 input (V1) source: - -10–10 V / 10—10 V - 0–10 V / 10–0 V	AIO▶ Ai1 Source 02 0 -> 10 V

3.5.2 Cable connections for potentiometer speed control (V1 analog input)

The diagram below shows the cable connections to use when a potentiometer is connected to V1 analog input terminal.

Connect the potentiometer to the VR, V1, GND terminals on the control terminal block.



3.5.3 Adjusting the analog input bias and gain (V1 analog input)

Adjusting the Out Y1 (bias) for analog inputs

Step	Instruction	Keypad display
1	Connect the voltage source (0 V) to the multifunction analog input terminals V1 (I1) – GND on the control terminal block.	-
2	If 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 Out Y1 04 0.00% AIO ▶ AI1 0.18% 04 Bias 0.00%

Step	Instruction	Keypad display
4	Press [▲] or [▼] to adjust the AI input value to “0.00%.”	AIO ▶ AI1 0.00% 04 Bias -0.18%
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) to the multifunction analog input terminals V1 (Ai1) – GND on the on the control terminal block.	-
2	If 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 Out Y2 06 100 % AIO ▶ AI1 98.00% 06 Gain 100.00%
4	Press [▲] or [▼] to adjust the gain to “102.00%.”	AIO ▶ AI1 100.00% 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 the V1 and GND terminals.

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

2 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.

- In V/F and Slip Comp operation modes, the inverter will not operate at below the minimum speed set at PAR_12.

3 Gradually increase the voltage at V1 and then confirm that the motor speed increases (at DIS_01 PreRamp Ref).

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

4 Break the connection between the FX and CM terminals to open the motor circuit.

RX operation from the control terminal block

1 Connect an input voltage (0 V) across the V1 and GND terminals.

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

2 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.

- In V/F and Slip Comp operation modes, the inverter will not operate at below the minimum speed set at PAR_12.

3 Gradually increase the voltage at V1 and then confirm that the motor speed increases (at DIS_01 PreRamp Ref).

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

4 Break 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 connections are 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	Reverse	-10 - -40 rpm	150% (torque limit)	Abnormal
	REV	Forward	10-40 rpm	-150% (torque limit)	
Encoder and motor connections have been changed.	FWD	Reverse	+100.0 rpm	Lower than +10%	Abnormal
	REV	Forward	-100.0 rpm	Lower than -10%	

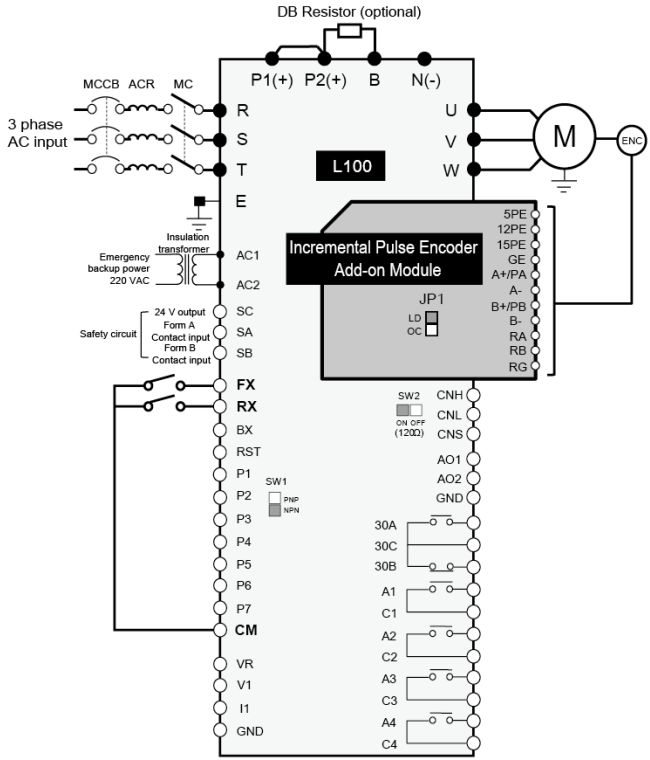
- If Phase A and B of the encoder are reversed or the motor connections have been changed, reverse the Phase A and B connections, or change the inverter output connection.
- The torque display on the keypad is based on no load operation.

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

Operation conditions

- Control mode: Speed control (PAR_07: Speed(IM))
- 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

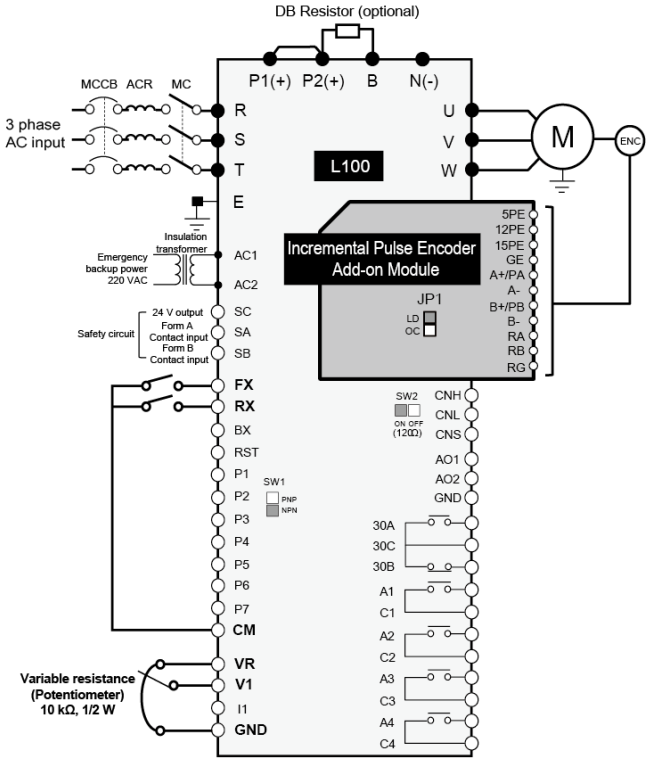
Step	Procedure	Func. code	Description
1	Set the RUN/STOP command source	FUN_01	Set Run/Stop Src to “Terminal 1.”
2	Set the speed reference source	FUN_02	Set Speed Ref Sel to “Keypad 1.”
3	Set speed reference	FUN_12	Set Speed 0 to “1500.0 (rpm)”
4	Set acc/dec times	FUN_41 FUN_41	Set the acceleration time (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. • Set SW1 to NPN mode.
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. • Set SW1 to NPN mode.
7	Add-on module	DIS_04	Displays “A/B Pulse.” (Line drive connection)
8	Number of encoder pulses	PAR_24	Set to “1024.”
9	Encoder direction	PAR_25	Set to “B Phase Lead.”

Example of an operation (2) Speed reference from the potentiometer (V1) + run signal at the terminal block

Operation conditions

- Control mode: (PAR_07: Speed(IM))
- Speed reference: Set the speed to 1,500 rpm using the potentiometer (connected to V1).
- Acceleration/deceleration time: 10 sec. / 20 sec.
- Run command: RUN/STOP command at the terminal block

Wiring diagram



Parameter setting

Step	Procedure	Function code	Description
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).”
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. - Set SW1 to NPN mode.
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. - Set SW1 to NPN mode.
9	Add-on module	DIS_04	Displays “A/B Pulse.” (Line drive connection)
10	Number of encoder pulses	PAR_24	Set to “1024.”
11	Encoder direction	PAR_25	Set to “B Phase Lead.”

4 Basic and advanced features

4.1 Introduction of basic features

Feature	Description	Page
Speed reference source configuration at the keypad	Setup or modify a speed reference using the keypad.	p. 63 p. 213 p. 214
Speed reference source configuration at the terminal block (input voltage)	Enable, setup, or modify speed reference input voltage at terminal V1.	p. 63 p. 213 p. 214
Speed reference source configuration at the terminal block (input current)	Enable, setup, or modify speed reference input current at terminals I1.	
Speed reference source configuration for CAN communication	Enable, setup, or modify speed reference communication signals from upper level controllers, such as PLCs or PCs.	p. 213 p. 214
Multistep speed configuration	Configures multistep speed operations by defining the terminal input.	p. 217
Command source configuration for terminal block inputs	Configures the inverter to accept inputs at the FX/RX terminals.	p. 67 p. 70
Command source configuration for CAN communication	Configures the inverter to accept communication signals from upper level controllers, such as PLCs and PCs.	p. 213 p. 214 p. 292
Acc/Dec time configuration based on maximum speed	Configures the acceleration and deceleration times for a motor based on a defined maximum speed.	p. 220
Acc/Dec time configuration based on speed reference	Configures acceleration and deceleration times for a motor based on a defined speed reference.	p. 220 p. 224
Multistage Acc/Dec time	Configures multistage acceleration and deceleration	

Feature	Description	Page
configuration at the multifunction terminals	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.	p. 221
Encoder error detection configuration	Configures the inverter to detect hardware encoder errors.	p. 280
Encoder software error detection configuration	Configures the inverter to detect acceleration errors during the operation due to connection changes between the encoder and motor.	p. 280
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.	p. 266
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 decelerates to 0 Hz and stops. Other stop or deceleration conditions may also be defined.	p. 214
Free-run stop	Configures a stop command that stops the inverter output to the motor. The motor will free-run, slow down, and then stop.	p. 214 p. 178
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.	p. 179

4.2 Introduction of advanced features

Task	Description	Page
Auto-tuning	Automatically adjusts motor control parameters to optimize the performance of the inverter's control mode.	p. 155
Timer	Turn on or off a multifunction output, including connected relays, after a specific time.	p. 172
Speed controller gain switch	Select between two PI controller combinations.	p. 248
Pre-excitation	Improve response characteristics during motor acceleration.	p. 176
Using torque bias	Apply a torque bias.	p. 254 p. 256
Using the battery operation mode	Operate the motor using the battery power supply when the main power supply is unavailable, e.g. during a power failure.	p. 178
ALLS (Automatic Light Load Search)	Detects light load conditions when the battery power supply is operating and directs the elevator to the nearest floor.	p. 237
Brake control	Enable or disable the braking system.	p. 187
Short floor operation	Improve elevator floor position when operating an elevator up and down short distances.	p. 230
Low voltage 2	Detects low voltage trips when an instantaneous interruption occurs during operation.	p. 130 p. 140
MC ON/OFF control	Enable or disable the magnetic contactor installed as safety device in the inverter's output circuit.	p. 179
Auto load cell configuration	Simplify the load cell's configuration for initial elevator commissioning.	p. 244
Anti rollback control	Compensates for load in the initial load when the load cell is not used.	p. 270
Preventing speed overshoot	Prevents speed overshoot during elevator operation.	p. 252

Task	Description	Page
Short floor operation	Improves the landing distance when the car is operated for a short distance in an elevator application.	p. 230
Initial pole position estimation	Detects the initial pole position of a synchronous motor	p. 164
Anti-hunting	Prevents mechanical resonance while motors are operating.	p. 233

5 Table of functions

5.1 Display (DIS) group

- IM: Speed(IM), V/F: Speed (V/F), Slip: Slip Compensation, PM: Speed (PM), ELIM: EL+IM, ELPM: EL+PM
- O: Displayed, X: Not displayed, #: Not available
- On the Keypad, "#" indicates not available and "*" indicates a duplicate setting.

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	VF	Slip	PM	ELIM	ELPM	Page
DIS_00	-	Speed reference, output current, operation status, output frequency	DIS▶T/K 0.0A 00 STP 0.00Hz			DIS▶T/K 0.0A 00 STP 0.00Hz	○	○	○	○	○	○	133
DIS_01	-	User define 1	Ai1 Value		%	Out Volt rms	○	○	○	○	○	○	135
			Ai2 Value		%		○	○	○	○	○	○	
			PreRamp Ref		rpm/Hz		○	○	○	○	○	○	
			PostRamp Ref		rpm/Hz		○	○	○	○	○	○	
			ASR Inp Ref		rpm/Hz		○	○	○	○	○	○	
			Output Freq		rpm/Hz		○	○	○	○	○	○	
			Motor Speed		rpm		○	x	x	○	○	○	
			Speed Dev		rpm		○	x	x	○	○	○	
			SpdDev Max		rpm		○	x	x	○	○	○	
			SpdDev Time		Sec		○	x	x	○	○	○	
			ASR Out		%		○	x	x	○	○	○	
			Torque Bias		%		○	x	x	○	○	○	
			PosTrq Limit		%		○	x	x	○	○	○	
			NegTrq Limit		-%		○	x	x	○	○	○	
			RegTrq Limit		%		○	x	x	○	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
			Torque Ref		%		○	x	x	○	○	○	
			IqeRef		A		○	x	x	○	○	○	
			Iqe		A		○	○	○	○	○	○	
			Flux Cur Ref		A		○	x	x	○	○	○	
			Ide Ref		A		○	x	x	○	○	○	
			Ide		A		○	○	○	○	○	○	
			ACR_D Out		V		○	x	x	○	○	○	
			ACR_Q Out		V		○	x	x	○	○	○	
			VdeRef		V		○	○	○	○	○	○	
			VqeRef		V		○	○	○	○	○	○	
			Out Amps RMS		A		○	○	○	○	○	○	
			Out Volt RMS		V		○	○	○	○	○	○	
			Power		kW		○	○	○	○	○	○	
			DC Bus Volt		V		○	○	○	○	○	○	
			Inv Temp		deg		○	○	○	○	○	○	
			Control Mode				○	○	○	○	○	○	
			Run Time		Sec		○	○	○	○	○	○	
			Terminal In		Bit		○	○	○	○	○	○	
			Terminal Opt		Bit		○	○	○	○	○	○	
			Terminal Out		Bit		○	○	○	○	○	○	
			Run Status				○	○	○	○	○	○	
			PhInOpenLvl		%		○	○	○	○	○	○	
			Iu Offset		A		○	○	○	○	○	○	
			Iv Offset		A		○	○	○	○	○	○	
			Iw Offset		A		○	○	○	○	○	○	
			Iup/Ium Note2)		A		x	x	x	○	x	○	
			Ivp/Ivm Note2)		A		x	x	x	○	x	○	
			Iwp/Iwm Note2)		A		x	x	x	○	x	○	
			Sc/EnDat Pos Note2)		Pulse		x	x	x	○	x	○	
			Theta Offset Note2)		Deg		x	x	x	○	x	○	
DIS_02	-	User define 2	Refer to DIS_01.			Inv Temp Note3)	○	○	○	○	○	○	135
DIS_03	-	User define 3	Refer to DIS_01.			DC Bus	○	○	○	○	○	○	135

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
						Volt							
DIS_04	7104	Display add-on board	Opt. Board	None A/B Pulse EnDat Sin/Cos		None	○	○	○	○	○	○	140
DIS_05	7105	Fault status Note 1)	Faults	-------		-------	○	○	○	○	○	○	140
DIS_06	7106	Software version	SW Version	L100 VX.XX			○	○	○	○	○	○	142
DIS_10	710A	User group display	User Grp Disp	0 (Not Used) 1 (Dis+UserGrp) 2 (Display All)		0 (Not Used)	○	○	○	○	○	○	142

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

Note 2) Displayed only when PAR_07 (Control Mode) is set to “Speed(PM).”

Note 3) The default value varies depending on the control mode.

V/F & Slip Comp: Inv Temp
Speed(IM): Flux Cur Ref
Speed(PM): Sc/EnDat Pos

5.2 Parameter (PAR) group

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
PAR_00	-	Jump to codes	Jump Code	1–60		1	○	○	○	○	○	○	143
PAR_01	7201	Reset to default setting	Para. Init	0 (No)		0 (No)	○	○	○	○	○	○	144
				1 (All Groups)			○	○	○	○	○	○	
				2 (DIS)			○	○	○	○	○	○	
				3 (PAR)			○	○	○	○	○	○	
				4 (DIO)			○	○	○	○	○	○	
				5 (AIO)			○	○	○	○	○	○	
				6 (FUN)			○	○	○	○	○	○	
				7 (CON)			○	○	○	○	○	○	
				8 (E/L)			#	#	#	#	○	○	
				9 (PRT)			○	○	○	○	○	○	
				10 (COM)			○	○	○	○	○	○	
				13 (USR)			○	○	○	○	○	○	
PAR_02	-	Read all codes	Para. Read	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○	145
PAR_03	-	Write all codes	Para. Write	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○	145
PAR_04	7204	Lock codes	Para. Lock	0–255		0	○	○	○	○	○	○	146
PAR_05	-	Password	Pass-word	0–9999		0	○	○	○	○	○	○	146
PAR_07	7207	Control mode options	Control Mode	2 (Speed(IM))		2(Speed (IM))	○	x	x	x	○	x	147
				4 (V/F)			x	○	x	x	x	x	
				5 (Slip Comp)			x	x	○	x	x	x	
				6 (Speed(PM)) Note 1)			x	x	x	○	x	○	
PAR_08	7208	Application	Application	0 (General Use)		0 (General Use)	○	○	○	○	○	○	148
				1 (Elevator) Note 2)			○	x	x	○	○	○	
PAR_09	7209	Motor capacity Note 3)	Motor Select	0 (2.2)		Varies by inverter	○	○	○	○	○	○	148
				1 (3.7)			○	○	○	○	○	○	
				2 (5.5)			○	○	○	○	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
				3 (7.5)		capacity	○	○	○	○	○	○	
				4 (11.0)			○	○	○	○	○	○	
				5 (15.0)			○	○	○	○	○	○	
				6 (18.5)			○	○	○	○	○	○	
				7 (22.0)			○	○	○	○	○	○	
				8 (User Define) Note 4)			○	○	○	○	○	○	
PAR_10	720A	User defined motor capacity	UserMotor Sel	5.5–22.0	kW	7.5	○	○	○	○	○	○	148
PAR_11	720B	Maximum speed	Max. Speed	30.00–120.00 / 10.0–3600.00 Note 5)	Hz/ rpm	60.00	○	○	○	○	○	○	149
PAR_12	720C	Minimum speed	Min. Speed	0.01–10.00 Note6)	Hz	0.5	x	○	○	x	x	x	149
PAR_13	720D	Base frequency	Base Freq	30.00–120.00 Note6)	Hz	60.00	x	○	○	x	x	x	150
PAR_14	720E	Sync. speed	Sync Speed	10.0–3600.0 Note7)	rpm	IM:1800.0 / PM:100.0	○	x	x	○	○	○	150
PAR_15	720F	Rated voltage	Rated Volt	300–528	V	380	○	○	○	○	○	○	150
PAR_16	7210	Motor pole number	Pole Number	2–128		4	○	○	○	○	○	○	150
PAR_17	7211	Motor efficiency	Efficiency	70.0–100.0	%	Varies by inverter capacity	○	○	○	○	○	○	150
PAR_18	7212	Motor rated slip	Rated-Slip	0.10–25.00/ 1.0–250.0	Hz/ rpm		○	○	○	x	○	x	150
PAR_19	7213	Motor rated current	Rated-Curr	1.0–1000.0	A		○	○	○	○	○	○	151
PAR_20	7214	Input voltage	AC In Volt	320–480	V	380	○	○	○	○	○	○	151
PAR_21	7215	Switching frequency	PWM Freq	3 – 8.0	kHz	8.0	○	○	○	○	○	○	151

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	VF	Slip	PM	ELIM	ELPM	Page
PAR_22	7216	Motor cooling options	Cooling Mtd	0 (Self-cool) 1 (Forced-cool)		1 (Forced-cool)	○	○	○	○	○	○	152
PAR_23	7217	Encoder type	Enc Type	0 (A/B Pulse) 1 (EnDat) 2 (Sin/Cos_All) 3 (Sin/Cos_1387)		0 (A/B Pulse)	x	x	x	○	x	○	154
PAR_24	7218	Encoder pulse number	Enc Pulse	360–32768		1024	○	○	○	○	○	○	152
PAR_25	7219	Encoder directions	Enc Dir Set	0 (A Phase Lead) 1 (B Phase Lead)		1 (B Phase Lead)	○	○	○	○	○	○	152
PAR_27	721B	Encoder scale	Enc Scale	0 (x1)		0 (x1)	○	○	○	x	○	x	
PAR_28	721C	Encoder tuning Note 8)	Sce Tuning	0 (No) 1 (Yes)		0	x	x	x	○	x	○	154
PAR_31	721F	Auto-tuning options Note 9)	AutoTune Type	0 (Rotational) 1 (Standstill)		1(Stand still)	○	○	○	○	○	○	157
PAR_32	7220	If tuning error protection P gain	Kp for If	0.001–1.000		0.020	○	x	x	x	○	x	157
PAR_33	7221	If tuning error protection I gain	Ki for If	0.001–1.000		0.040	○	x	x	x	○	x	157
PAR_34	7222	Motor inertia tuning options	Inertia Tune	0 (No) / 1 (Yes)		0 (No)	○	x	x	x	○	x	157
PAR_35	7223	Acc/dec	J Spd	0.500–	sec	0.500	○	x	x	x	○	x	157

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		time inertia tuning Note 10)	Time	10.000									
PAR_36	7224	Inertia LPF	Inertia LPF	0.010–50.000	ms	0.100	○	x	x	x	○	x	157
PAR_41	-	Induction motor auto-tuning options	IM AutoTune	PAR_31=0 0 (None) 1 (ALL1) 2 (ALL2) 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)		0 (None)	○	○	○	x	○	x	P. 157
PAR_43	722B	Average number of detected initial pole positions	DetAve Num	1–30		5	x	x	x	○	x	○	164
PAR_44	722C	Voltage at detected pole positions	MagDet Volt	5–200	V	80	x	x	x	○	x	○	164

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
PAR_45	722D	Pole position detection current	MagDet Curr	10–150	%	70	x	x	x	○	x	○	164
PAR_51		Synchronous motor auto-tuning options	PM AutoTune	0 (None) 1 (All) 2 (Rs Tuning) 3 (Ld/Lq Tuning) 4 (Mag Pole Det)		0 (None)	x	x	x	○	x	○	165
PAR_52	7234	Motor flux current	Flux-Curr	0.0–70% of [PAR_19]	A	Varies by motor capacity	○	○	○	x	○	x	168
PAR_53	7235	Rotor time constant	Tr	30–3000	ms		○	○	○	x	○	x	168
PAR_54	7236	Motor stator inductance	Ls	0.00–500.00	mH		○	○	○	x	○	x	168
PAR_55	7237	Leakage factor	Lsigma	0.00–300.00	mH		○	○	○	x	○	x	168
PAR_56	7238	Motor stator resistance	Rs	0.000–15.000	ohm		○	○	○	○	○	○	168
PAR_57	7239	Motor inertia constant	Inertia J	0.001–60.000	kg·m^2		○	○	○	○	○	○	168
PAR_58	723A	Motor D-axis inductance	Ld	0.00–500.00	mH		x	x	x	○	x	○	P. 168
PAR_59	723B	Motor Q-axis inductance	Lq	0.00–500.00	mH		x	x	x	○	x	○	P. 168
PAR_60	723C	Initial pole position	Init Theta	0–360	deg	0	x	x	x	○	x	○	168

Note 1) Select this option when a synchronous motor is used.

Note 2) The Elevator option in PAR_08 is available when the ELIO add-on module has been installed to the inverter.

Note 3) A motor capacity that exceeds the inverter capacity cannot be selected.

Note 4) PAR_10 (UserMotorSel) is displayed when PAR_09 (Motor select) is set to “User

Define."

Note 5) Max Speed is 10.0–3600.0 rpm in "Speed(IM)" mode, 30.00–120.00 Hz in "Slip Comp" mode, and 10.0–680.0 rpm in "Speed(PM)" mode.

Note 6) PAR_12 (Min_Speed) and PAR_13 (Base Freq) are displayed only in "V/F" and "Slip Comp" modes.

Note 7) PAR_14 (Sync Speed) is 10.0–3600.0 rpm in "Speed(IM)" mode, and 10.0–680.0 rpm in "Speed(PM)" mode.

Note 8) Displayed only when PAR-23 is set to "Endat, Sin/Cos_All, or Sin/Cos_1387."

Note 9) "Auto tuning" is not available during battery operations.

Note 10) Par_35 (Acc/dec time inertia tuning) is displayed when PAR_34 (Motor inertia tuning options) is set to "1 (Yes)."

5.3 Digital input and output (DIO) group

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
DIO_00	-	Jump to codes	Jump Code	1–36		1	○	○	○	○	○	○	171
DIO_01	7301	Define multi-function input terminal P1	P1 Define	0 (Not Used)		0 (Not Used)	○	○	○	○	○	○	172
				1 (Speed-L)			○	○	○	○	○	○	
				2 (Speed-M)			○	○	○	○	○	○	
				3 (Speed-H)			○	○	○	○	○	○	
				10 (Xcel-L)			○	○	○	○	○	○	
				11 (Xcel-H)			○	○	○	○	○	○	
				13 (EXT Trip-B)			○	○	○	○	○	○	
				17 (Timer Input)			○	○	○	○	○	○	
				19 (ASR Gain Sel)			○	#	#	○	○	○	
				22 (PreExcite)			○	#	#	#	○	#	
				25 (Use Trq Bias)			○	#	#	○	○	○	
				26 (A3 Safety)			○	○	○	○	○	○	
				28 (Battery Run)			○	○	○	○	○	○	
				29 (HighSpeed Run)			x	x	x	x	○	○	
				30 (manual Spd-L)[Note4]			x	x	x	x	○	○	
				31 (manual Spd-H)[Note4]			x	x	x	x	○	○	
				32 (FHM Run)[Note4]			x	x	x	x	○	○	
				33 (BaseFloor Run)[Note4]			x	x	x	x	○	○	
				34 (NearFloor Run)[Note4]			x	x	x	x	○	○	
				35 (Mot M/C State)[Note4]			x	x	x	x	○	○	
				36 (CarBrake State)[Note4]			x	x	x	x	○	○	
				37 (MagDet Run)[Note4]			x	x	x	x	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
				38 (2ndAutoRun) Note4)			x	x	x	x	○	○	
DIO_02	7302	Define multi-function input terminal P2	P2 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○	172
DIO_03	7303	Define multi-function input terminal P3	P3 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○	172
DIO_04	7304	Define multi-function input terminal P4	P4 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○	172
DIO_05	7305	Define multi-function input terminal P5	P5 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○	172
DIO_06	7306	Define multi-function input terminal P6	P6 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○	172
DIO_07	7307	Define multi-function input terminal P7	P7 Define	Refer to DIO_01		0 (Not Used)	○	○	○	○	○	○	172
DIO_08	7308	Reverse operation for multi-	Neg Func. In	00000000000 –11111111111	bit	00000 00000 0	○	○	○	○	○	○	178

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	VF	Slip	PM	ELIM	ELPM	Page
		function terminal input											
DIO_09	7309	Low-pass filter time constant for multi-function terminal input	Terminal LPF	0–2000	ms	5	○	○	○	○	○	○	178
DIO_10	730A	Reverse operation for multi-function output	Neg Func. Out	0000–1111	bit	0000	○	○	○	○	○	○	179
DIO_11	730B	Define multi-function aux output AX1	AX1 Define	0 (Not Used)		0 (Not Used)	○	○	○	○	○	○	179
				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)			○	#	#	○	○	○	
				11 (Inv OH Warn)			○	○	○	○	○	○	
				12 (Spd Agree)			○	#	#	○	○	○	
				13 (Trq Det.)			○	#	#	○	○	○	
				14 (Trq Lmt Det.)			○	#	#	○	○	○	
				15 (OverLoad)			○	○	○	○	○	○	
				16 (Stop)			○	○	○	○	○	○	
				17 (MC on/off)			○	○	○	○	○	○	
				18 (FAN			○	○	○	○	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	VF	Slip	PM	ELIM	ELPM	Page
				Status)									
				19 (ALLS Status)			○	○	○	○	○	○	
				20 (Steady)			○	○	○	○	○	○	
				21 (Brake Output)			○	○	○	○	#	#	
				22 (BFR/NFR Mode)[Note4]			x	x	x	x	○	○	
				23 (BFR/NFR End)[Note4]			x	x	x	x	○	○	
				24 (E/L Fault)[Note4]			x	x	x	x	○	○	
DIO_12	730C	Define multi-function aux output AX2	AX2 Define	Same as DIO_11		0 (Not Used)	○	○	○	○	○	○	179
DIO_13	730D	Define multi-function aux output AX3	AX3 Define	Same as DIO_11		0 (Not Used)	○	○	○	○	○	○	179
DIO_14	730E	Define multi-function aux output AX4	AX4 Define	Same as DIO_11		0 (Not Used)	○	○	○	○	○	○	179
DIO_16	7310	Fault relay terminal (A, B, C)	Relay Mode	00-11	bit	11	○	○	○	○	○	○	193
DIO_17	7311	Zero-speed detection level	ZSD Level	0.0–480.0	rpm	10.0	○	x	x	○	○	○	181
DIO_18	7312	Zero-speed detection band	ZSD Band	0.1–10.0	%	0.5	○	x	x	○	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
DIO_19	7313	Speed detection level	SD Level	- PAR_11– PAR_11	Hz/ rpm	0	○	○	○	○	○	○	181
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	○	○	○	○	○	○	182
DIO_22	7316	Equal speed detection band	SEQ Band	0.1–10.0	%	0.5	○	x	x	○	○	○	182
DIO_23	7317	Torque detection level	TD Level	0.0–250.0	%	0.0	○	x	x	○	○	○	185
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	○	○	○	○	○	○	183
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	100–50000	ms	1000	○	○	○	○	○	○	185
DIO_29	731D	MC Off delay Note 1)	MC Off Time	100–50000	ms	1000	○	○	○	○	○	○	
DIO_30	731E	Brake open delay Note 3)	BK On Delay	0.0–(FUN_11 - 0.1)	ms	0.0	x	○	○	x	x	x	187
DIO_31	731F	Brake open time Note 2)	BKOpen Time	0.01–30.00	sec	0.01	○	○	○	○	○	○	
DIO_32	7320	Brake open speed Note 2)	BKOpen Spd	PAR_12– 50.00/ 0.0–500.0	Hz/ rpm	0.1	○	○	○	○	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
DIO_33	7321	Brake open current Note 2)	Release Curr	0.0–150.0	%	20.0	○	○	○	x	○	x	
DIO_34	7322	Brake off delay Note3)	BK Off Delay	0.0–(FUN_09 - 0.1)	sec	0	X	○	○	X	X	X	
DIO_36	7324	Brake close speed Note 2)	BKClose Spd	PAR_12–50.00/ 0.0–500.0	Hz/ rpm	0.0	○	○	○	○	○	○	

Note 1) Displayed when AX1 – AX4 is set to “MC on/off”.

Note 2) Displayed when AX1 – AX4 is set to “Brake output”.

Note 3) Displayed when AX1 – AX4 is set to “Brake output” and FUN_03 (Stop mode) is set to “DC-Brake.”

- DIO_30 is displayed when the Fun_11 value has been defined.
- “DC-Brake” option is available only in “V/F” and “Slip Comp” control modes.

Note4) Displayed only when Elio add-on module has been installed.

5.4 Analog input and output (AIO) group

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	VF	Slip	PM	ELIM	ELPM	Page
AIO_00	-	Jump to codes	Jump Code	1–53			○	○	○	○	○	○	194
AIO_01	7401	Define multi-function analog input Ai1	Ai1 Define	0 (Not Used)		0 (Not Used)	○	○	○	○	○	○	195
				1 (Speed Ref)			○	○	○	○	○	○	
				6 (Torque Bias)			○	#	#	○	○	○	
AIO_02	7402	Define multi-function analog input Ai1 input source	Ai1 Source	0 (0 – 10 V) 1 (10 – 0 V) 2 (-10 – 10 V) 3 (10 – -10 V)		2 (-10 – 10V)	○	○	○	○	○	○	195
AIO_03	7403	Define multi-function analog input Ai1 minimum voltage	Ai1 In X1	AIO_07–AIO_05	%	0.00	○	○	○	○	○	○	195
AIO_04	7404	Define multi-function analog input Ai1 min. voltage bias	Ai1 Out Y1	AIO_08–AIO_06	%	0.00	○	○	○	○	○	○	200

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
AIO_05	7405	Define multi-function analog input Ai1 maximum voltage	Ai1 In X2	0.00–100.00	%	100.00	○	○	○	○	○	○	195
AIO_06	7406	Define multi-function analog input Ai1 maximum voltage gain	Ai1 Out Y2	0.00–250.00	%	100.00	○	○	○	○	○	○	195
AIO_07	7407	Define multi-function analog input Ai1 minimum negative voltage	Ai1 -In X1	AIO_09–AIO_03	%	0.00	○	○	○	○	○	○	195
AIO_08	7408	Define multifunction analog input Ai1 min. negative voltage bias	Ai1 -Out Y1	AIO_10–AIO_04	%	0.00	○	○	○	○	○	○	195
AIO_09	4709	Define multi-	Ai1 -In X2	-100.00–0.00	%	-100.00	○	○	○	○	○	○	195

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		function analog input Ai1 maximum negative voltage											
AIO_10	740A	Define multi-function analog input Ai1 max. negative voltage gain	Ai1 -Out Y2	-250.00–0.00	%	-100.00	○	○	○	○	○	○	195
AIO_11	740B	Ai1 input LPF time constant	Ai1 LPF	0–2000	ms	0	○	○	○	○	○	○	203
AIO_12	740C	Define multi-function analog input Ai1 lost command conditions	Ai1 Wbroken	0 (None) 1 (Half of x1) 2 (Below x1)		0 (None)	○	○	○	○	○	○	195
AIO_13	740D	Define multi-function analog input Ai2	Ai2 Define	0 (Not Used) 1 (Speed Ref)		0 (Not Used)	○	○	○	○	○	○	195
AIO_14	740E	Multi-function analog	Ai2 Source	0 (0 – 20 mA) 1 (20 – 0 mA)		0 (0 – 20 mA)							

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		input Ai2 input source											
AIO_15	740F	Multi-function analog input Ai2 minimum voltage	Ai2 In X1	-100.00 – AIO_17	%	0.00							
AIO_16	7410	Multi-function analog input Ai2 minimum voltage bias	Ai2 Out Y1	-100.00 – AIO_18	%	0.00							
AIO_17	7411	Multi-function analog input Ai2 maximum voltage	Ai2 In X2	0.00 – 100.00	%	100.00							
AIO_18	7412	Multi-function analog input Ai2 maximum voltage gain	Ai2 Out Y2	0.00 – 250.00	%	100.00							

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
AIO_23	7417	Ai2 input LPF time constant	Ai2 LPF	0 – 2000	ms	0	○	○	○	○	○	○	195
AIO_24	7418	Multi-function analog input Ai2 lost command conditions	Ai2 Wbroken	0 (None) 1 (Half of x1) 2 (Below x1)		0 (None)							
AIO_37	7425	Multi-function analog input lost command time	Time out	0.1–120.0	sec	1.0	○	○	○	○	○	○	204
AIO_38	7426	Analog input lost command options	Ai Lost Comm	0 (None) 1 (Free Run) 2 (Decel)		0 (None)	○	○	○	○	○	○	204
AIO_40	7428	Define multi-function analog output AO1	AO1 Define	0 (Not Used)		0 (Not Used)	○	○	○	○	○	○	206
				1 (Ai1 Value)			○	○	○	○	○	○	
				2 (AI2 Value)			○	○	○	○	○	○	
				4 (PreRamp Ref)			○	○	○	○	○	○	
				5 (PostRamp Ref)			○	○	○	○	○	○	
				6 (ASR Inp Ref)			○	○	○	○	○	○	
				7 (Output Freq)			○	○	○	○	○	○	
				8 (Motor Speed)			○	#	#	○	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
				10 (Speed Dev)			○	#	#	○	○	○	
				11 (ASR Out)			○	#	#	○	○	○	
				12 (Torque Bias)			○	#	#	○	○	○	
				13 (PosTrq Limit)			○	#	#	○	○	○	
				14 (NegTrq Limit)			○	#	#	○	○	○	
				15 (RegTrq Limit)			○	#	#	○	○	○	
				17 (IqeRef)			○	#	#	○	○	○	
				18 (Iqe)			○	#	#	○	○	○	
				19 (Flux Ref)			○	#	#	#	○	#	
				20 (IdeRef)			○	#	#	○	○	○	
				21 (Ide)			○	#	#	○	○	○	
				22 (ACR_D Out)			○	#	#	○	○	○	
				23 (ACR_Q Out)			○	#	#	○	○	○	
				24 (VdeRef)			○	○	○	○	○	○	
				25 (VqeRef)			○	○	○	○	○	○	
				26 (Out Amps RMS)			○	○	○	○	○	○	
				27 (Out Volt RMS)			○	○	○	○	○	○	
				28 (Power)			○	○	○	○	○	○	
				29 (DC Bus Volt)			○	○	○	○	○	○	
				34 (Inv Temp)			○	○	○	○	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
AIO_41	7429	Define multi-function analog output AO1 output source	AO1 Source	0 (0 – 10 V) 1 (10 – 0 V) 2 (-10 – 10 V) 3 (10 – -10 V)		0 (-10 – 10 V)	○	○	○	○	○	○	206
AIO_42	742A	Define multi-function analog output AO1 bias	AO1 Bias	0.0–AIO_43	%	0.0	○	○	○	○	○	○	206
AIO_43	742B	Define multi-function analog output AO1 gain	AO1 Gain	0.0–500.0	%	100.0	○	○	○	○	○	○	206
AIO_44	742C	Define multi-function analog output AO1 - bias	AO1 - Bias	AIO_45–0.0	%	0.0	○	○	○	○	○	○	206
AIO_45	742D	Define multi-function analog output AO1 - gain	AO1 - Gain	0.0 – -500.0	%	-100.0	○	○	○	○	○	○	206

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
AIO_46	742E	Define multi-function analog output AO1 absolute value	AO1 ABS	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○	206
AIO_47	742F	Define multi-function analog output AO2	AO2 Define	Refer to AIO_40		0 (Not Used)							
AIO_48	7430	Define multi-function analog output AO2 output source)	AO2 Source	0 (0 – 10 V) 1 (10 – 0 V) 2 (-10 – 10 V) 3 (10 – -10 V)		2 (-10 – 10 V)	○	○	○	○	○	○	206
AIO_49	7431	Define multi-function analog output AO2 bias	AO2 Bias	0.0–AIO_50	%	0.0	○	○	○	○	○	○	206
AIO_50	7432	Define multi-function analog output AO2 gain	AO2 Gain	0.0–500.0	%	100.0	○	○	○	○	○	○	206

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
AIO_51	7433	Define multi-function analog output AO2 - bias	AO2 - Bias	AIO_52–0.0	%	0.0	○	○	○	○	○	○	206
AIO_52	7434	Define multi-function analog output AO2 - gain	AO2 - Gain	0.0 – -500.0	%	-100.0	○	○	○	○	○	○	206
AIO_53	7435	Define multi-function analog output AO2 absolute value	AO2 ABS	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○	206

- AIO_02 – AIO_12 are available when AIO_01 is not set to “Not Used.”
- AIO_07 – AIO_10 are available when AIO_02 is set to “-10 – 10V” or “10 – -10V.”
- AIO_14 – AIO_18, AIO_23, and AIO_24 are available when AIO_013 is not set to “Not Used.”
- AIO_41 – AIO_46 are available when AIO_40 is not set to “Not Used.”
- AIO_48 – AIO_53 are available when AIO_47 is not set to “Not Used.”

5.5 Function (FUN) group

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
FUN_00	-	Jump to codes	Jump code	1–97			○	○	○	○	○	○	212
FUN_01	7501	RUN /STOP command source	Run/Stop Src	0 (Terminal 1) 1 (Terminal 2) 2 (Keypad) 4 (CAN)		0 (Terminal 1)	○	○	○	○	○	○	213
FUN_02	7502	Speed reference source	Spd Ref Sel	0 (Analog) 1 (Keypad1) 2 (Keypad2) 4 (CAN)		1 (Keypad1)	○	○	○	○	x	x	214
FUN_03	7503	Stop options	Stop mode	0 (Decel)		0 (Decel)	○	○	○	○	x	x	214
				1 (Free-run)			○	○	○	○	x	x	
				2 (DC-Brake)			#	○	○	#	x	x	
FUN_06	7506	DC-braking frequency Note 1)	DcBr Freq	PAR_12 – PAR_11	Hz	5.00	x	○	○	x	x	x	215
FUN_07	7507	Block time before DC-braking Note 1)	DcBlk Time	0.00–60.00	sec	0.00	x	○	○	x	x	x	215
FUN_08	7508	DC-braking amount Note 1)	DcBr Value	0–200	%	10	x	○	○	x	x	x	215

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
FUN_09	7509	DC-braking time Note 1)	DcBr Time	0.0–60.0	sec	1.0	x	○	○	x	x	x	215
FUN_10	750A	DC-start value Note 1)	DcSt Value	0–200	%	10	x	○	○	x	x	x	216
FUN_11	750B	DC-start time Note 1)	DcSt Time	0.0–60.0	sec	0	x	○	○	x	x	x	216
FUN_12	750C	Multistep speed 0 Note 2)	Speed 0	0.0–PAR_11	rpm/ Hz	0.0	○	○	○	○	○	○	217
FUN_13	750D	Multistep speed 1 Note 2)	Speed 1	0.0–PAR_11	rpm/ Hz	0.0	○	○	○	○	○	○	217
FUN_14	750E	Multistep speed 2 Note 2)	Speed 2	0.0–PAR_11	rpm/ Hz	0.0	○	○	○	○	○	○	217
FUN_15	750F	Multistep speed 3 Note 2)	Speed 3	0.0–PAR_11	rpm/ Hz	0.0	○	○	○	○	○	○	217
FUN_16	7510	Multistep speed 4 Note 2)	Speed 4	0.0–PAR_11	rpm/ Hz	0.0	○	○	○	○	○	○	217
FUN_17	7511	Multistep speed 5 Note 2)	Speed 5	0.0–PAR_11	rpm/ Hz	0.0	○	○	○	○	○	○	217
FUN_18	7512	Multistep speed 6 Note 2)	Speed 6	0.0–PAR_11	rpm/ Hz	0.0	○	○	○	○	○	○	217
FUN_19	7513	Multistep speed 7	Speed 7	0.0–PAR_11	rpm/ Hz	0.0	○	○	○	○	○	○	217

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		Note 2)											
FUN_26	751A	Frequency jump	Jump Speed	0 (No) 1 (Yes)		0 (No)	x	○	○	x	x	x	219
FUN_27	751B	Jump frequency low limit1 Note3)	Jump Lo 1	0.00–FUN_28	Hz	10.00	x	○	○	x	x	x	219
FUN_28	751C	Jump frequency high limit1 Note3)	Jump Hi 1	FUN_27–FUN_29	Hz	15.00	x	○	○	x	x	x	219
FUN_29	751D	Jump frequency low limit2 Note3)	Jump Lo 2	FUN_28–FUN_30	Hz	20.00	x	○	○	x	x	x	219
FUN_30	751E	Jump frequency high limit2 Note3)	Jump Hi 2	FUN_29–FUN_31	Hz	25.00	x	○	○	x	x	x	219
FUN_31	751F	Jump frequency low limit3 Note3)	Jump Lo 3	FUN_30–FUN_32	Hz	30.00	x	○	○	x	x	x	219
FUN_32	7520	Jump frequency high limit3 Note3)	Jump Hi 3	FUN_31–PAR_11	Hz	35.00	x	○	○	x	x	x	219
FUN_33	7521	Acc/dec reference speed	Acc/Dec Ref	0 (Max Speed) 1 (Ref Speed)		0 (Max Speed)	○	○	○	○	x	x	220

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
FUN_36	7524	S-curve gradient at acceleration 1	Acc S Start	0.0–50.0	%	0.0	○	○	○	○	○	○	221
FUN_37	7525	S-curve gradient at acceleration 2	Acc S End	0.0–50.0	%	0.0	○	○	○	○	○	○	221
FUN_38	7526	S-curve gradient at deceleration 1	Dec S Start	0.0–50.0	%	0.0	○	○	○	○	○	○	221
FUN_39	7527	S-curve gradient at deceleration 2	Dec S End	0.0–50.0	%	0.0	○	○	○	○	○	○	221
FUN_40	7528	Acc/dec time scale	Time scale	0 (0.01 sec) 1 (0.1 sec)		0 (0.01 sec)	○	○	○	○	○	○	221
FUN_41	7529	Acceleration time 1	Acc Time-1	0.00–600.0	sec	2.00	○	○	○	○	○	○	224
FUN_42	752A	Deceleration time 1	Dec Time-1	0.00–600.0	sec	2.00	○	○	○	○	○	○	224
FUN_43	752B	Acceleration time 2	Acc Time-2	0.00–600.0	sec	3.00	○	○	○	○	○	○	224
FUN_44	752C	Deceleration time 2	Dec Time-2	0.00–600.0	sec	3.00	○	○	○	○	○	○	224

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
FUN_45	752D	Acceleration time 3	Acc Time-3	0.00–600.0	sec	4.00	○	○	○	○	○	○	224
FUN_46	752E	Deceleration time 3	Dec Time-3	0.00–600.0	sec	4.00	○	○	○	○	○	○	224
FUN_47	752F	Acceleration time 4	Acc Time-4	0.00–600.0	sec	5.00	○	○	○	○	○	○	224
FUN_48	7530	Deceleration time 4	Dec Time-4	0.00–600.0	sec	5.00	○	○	○	○	○	○	224
FUN_51	7533	Emergency stop deceleration time	BX Time	0.0–6000.0	sec	0.0	○	○	○	○	x	x	226
FUN_52	7534	Emergency stop terminal filter time	BX Termi LPF	0.0–2000	ms	5.0	○	○	○	○	○	○	226
FUN_53	7535	Motor pre-excitation time	PreExct Time	0–10000	ms	0	○	x	x	x	x	x	228
FUN_54	7536	Hold time at zero-speed	Hold Time	10–10000	ms	1000	○	x	x	○	x	x	228
FUN_56	7538	Short floor operation speed	ShortFlr Spd	0.0–PAR_11	rpm/ Hz	0.0	○	○	○	○	x	x	230
FUN_57	7539	Short floor operation	ShortFlr Time	0.00–100.00	sec	0.00	○	○	○	○	x	x	230

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		time											
FUN_58	753A	Anti-hunting regulator options	New AHR Sel	0 (No) 1 (Yes)		1 (Yes)	x	○	○	x	x	x	233
FUN_59	753B	Anti-hunting regulator P gain	New AHR PGain	0.00–100.00		3.00	x	○	○	x	x	x	233
FUN_60	753C	AHR start frequency	AHR Low Freq	0–AHR end freq	Hz	3.00	x	○	○	x	x	x	233
FUN_61	753D	AHR end frequency	AHR Hi Freq	AHR start freq–100	Hz	60.00	x	○	○	x	x	x	233
FUN_67	7543	Battery operation speed Note4)	Batt. Speed	PAR_12 – 6.66/ 0.0 – 200.0	Hz/ rpm	50.0	○	○	○	○	○	○	234
FUN_68	7544	Battery input voltage Note4)	Batt. Volt	12–PAR_15	V	48	○	○	○	○	○	○	234
FUN_69	7545	Automatic Light Load Search options Note4)	ALLS Enable	0 (No) 1 (Yes)		No	○	○	○	○	○	○	237

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
FUN_70	7546	Hold time at FX/RX direction switching Note 6)	ALLS DirChgT	1.0–10.0	sec	5.0	○	○	○	○	○	○	237
FUN_71	7547	Light load search time Note5)	ALLS Time	FUN_72–10.00	sec	5.0	○	○	○	○	○	○	237
FUN_72	7548	Light load detection time Note5)	ALLS LoadCk T	1.0–FUN_71	sec	2.0	○	○	○	○	○	○	237
FUN_73	7549	Load cell options	Use LoadCell	0 (No) 1 (Yes)		0 (No)	○	x	x	○	○	○	241
FUN_74	754A	Full-load climb torque	FullLoad Trq	-250.0–250.0	%	100.0	○	x	x	○	○	○	241
FUN_75	754B	Full-load climb AI	FullLoad AI	-100.0–100.0	%	100.0	○	x	x	○	○	○	241
FUN_76	754C	No-load descent torque	Noload Trq	-250.0–250.0	%	-100.0	○	x	x	○	○	○	241
FUN_77	754D	No-load descent AI	Noload AI	-100.0–100.0	%	0.0	○	x	x	○	○	○	241
FUN_78	754E	Torque current ramp time	TrqRamp Time	1 – 1000	ms	1	○	x	x	○	○	○	241
FUN_94	755E	Use zero speed decelerati	Use 0 Dec T	0 (No) 1 (Yes)	-	0 (No)	○	x	x	○	○	○	241

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		on time											
FUN_95	755F	Zero speed deceleration time 1	0 Dec Time 1	0.00 – 600.00	sec	1.00	○	x	x	○	○	○	241
FUN_96	7560	Zero speed deceleration time 2	0 Dec Time 2	0.00 – 600.00	sec	3.00	○	x	x	○	○	○	241
FUN_97	7561	Zero speed deceleration target speed	0 Dec TarSpd	0.00 – PAR_11	rpm/ Hz	0.0	○	x	x	○	○	○	241

Note 1) Displayed when FUN_03 (Stop mode) 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) Displayed when FUN_26 (Jump Speed) is set to “Yes”.

Note 4) Displayed when one of the multifunction inputs is set for battery operation (Battery Run).

Note 5) Displayed when FUN_69 (ALLS Enable) is set to “Yes”.

- FUN_74 – FUN_78 are displayed when FUN_73 (Use LoadCell) is set to “Yes”.
- FUN_95 – FUN_97 are displayed when FUN_94 (Use 0 Dec T) is set to “Yes”.

5.6 Control (CON) group

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
CON_00	-	Jump to codes	Jump Code	1–92		1	○	○	○	○	○	○	247
CON_02	7602	Speed controller gain ratio	ASR PI Ratio	1.0–500.0	%	20.0	x	x	x	○	x	○	248
CON_03	7603	Speed controller proportional gain 1	ASR P Gain1	0.1–999.9	%	IM: 50.0 PM: 100.0	○	x	x	○	○	○	248
CON_04	7604	Speed controller integral time 1	ASR I Gain1	0–50000	ms	IM: 300 PM: 50	○	x	x	○	○	○	248
CON_05	7605	Speed controller input LPF time constant 1	ASR LPF1	0–20000	ms	0	○	x	x	○	○	○	248
CON_06	7606	Speed controller proportional gain 2	ASR P Gain2	0.1–500.0	%	IM: 50.0 PM: 100.0	○	x	x	○	○	○	248
CON_07	7607	Speed controller integral time 2	ASR I Gain2	0–50000	ms	IM: 300 PM: 50	○	x	x	○	○	○	248

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
CON_08	7608	Speed controller input LPF time constant 2	ASR LPF2	0–20000	ms	0	○	x	x	○	○	○	248
CON_09	7609	Overshoot prevention gain	ASR FF Gain	0–1000	%	0	x	x	x	○	x	○	252
CON_10	760A	Ramp time at speed controller gain switching	ASR Ramp	10–10000	ms	1000	○	x	x	○	○	○	248
CON_11	760B	Speed controller gain switching speed	ASR TarSpd	0.0–3600.0	rpm	0.0	○	x	x	○	○	○	248
CON_33	7621	Torque limit source options	Trq Lmt Src	0 (Kpd Kpd Kpd) 2 (CAN CAN CAN)		0 (Kpd Kpd Kpd)	○	x	x	○	○	○	253
CON_34	7622	FX torque limit	Pos Trq Lmt	0.0–250.0	%	150.0 ELIO:200.0	○	x	x	○	○	○	253
CON_35	7623	RX torque limit	Neg Trq Lmt	0.0–250.0	%	150.0 ELIO:200.0	○	x	x	○	○	○	253
CON_36	7624	Regeneration torque limit	Reg Trq Lmt	0.0–250.0	%	150.0 ELIO:200.0	○	x	x	○	○	○	253

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
CON_37	7625	Torque bias options	Trq Bias Src	0 (None) 1 (Analog) 2 (Keypad) 4 (CAN)		0 (None)	○	x	x	○	○	○	254
CON_38	7626	Torque bias amount	Trq Bias	-150.0–150.0	%	0.0	○	x	x	○	○	○	254
CON_39	7627	Torque bias compensation for friction loss	Trq Bias FF	-150.0–150.0	%	0.0	○	x	x	○	○	○	256
CON_40	7628	Torque balance amount	Trq Balance	0.0–100.0	%	50.0	○	x	x	○	○	○	256
CON_41	7629	Torque boost options Note 1)	Torque Boost	0 (Manual) 1 (Auto)		Varies by control mode Note 2)	x	○	○	x	x	x	257
CON_42	762A	Forward torque boost Note 1)	Fwd Boost	0.0–20.0	%	2.0	x	○	○	x	x	x	257
CON_43	762B	Reverse torque boost Note 1)	Rev Boost	0.0–20.0	%	2.0	x	○	○	x	x	x	257
CON_45	762D	Auto torque boost filter Note 1)	ATB FilterGain	1–10000	ms	200	x	○	○	x	x	x	259
CON_46	762E	Auto torque	voltGainAtbM	0–300.0	%	15.0	x	○	○	x	x	x	259

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		boost motor voltage gain Note 1)											
CON_47	762F	Auto torque boost generating voltage gain Note 1)	voltGainAtbG	0–300.0	%	10.0	x	○	○	x	x	x	259
CON_48	7630	V/F pattern Note 1)	V/F pattern	0 (Linear) 2 (User V/F)		0 (Linear)	x	○	○	x	x	x	263
CON_49	7631	User frequency 1 Note 3)	User Freq 1	0.00– CON_51	Hz	15.00	x	○	○	x	x	x	264
CON_50	7632	User voltage 1 Note 3)	User Volt 1	0–100	%	25	x	○	○	x	x	x	264
CON_51	7633	User frequency 2 Note 3)	User Freq 2	CON_49 – CON_53	Hz	30.00	x	○	○	x	x	x	264
CON_52	7634	User voltage 2 Note 3)	User Volt 2	0–100	%	50	x	○	○	x	x	x	264
CON_53	7635	User frequency 3 Note 3)	User Freq 3	CON_51 – CON_55	Hz	45.00	x	○	○	x	x	x	264
CON_54	7636	User voltage 3 Note 3)	User Volt 3	0–100	%	75	x	○	○	x	x	x	264
CON_55	7637	User	User Freq	CON_53	Hz	60.00	x	○	○	x	x	x	264

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		frequency 4 Note 3)	4	– PAR_11									
CON_56	7638	User voltage 4 Note 3)	User Volt 4	0–100	%	100	x	○	○	x	x	x	264
CON_57	7639	Output voltage adjustment	Volt Control	40–150	%	100	x	○	○	x	x	x	266
CON_63	763F	Slip compensation frequency	SlipComp ChgF	0–120.00	Hz	5.00	x	x	○	x	x	x	267
CON_64	7640	Slip compensation motoring gain H	SlipGain_ MH	0–1000	%	100	x	x	○	x	x	x	267
CON_65	7641	Slip compensation generating gain H	SlipGain_ ML	0–1000	%	100	x	x	○	x	x	x	267
CON_67	7643	Slip compensation motoring gain L	SlipGain_ GH	0–1000	%	10	x	x	○	x	x	x	267
CON_68	7644	Slip compensation generating gain L	SlipGain_ GL	0–1000	%	10	x	x	○	x	x	x	267

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
CON_69	7645	Slip compensation filter time constant	Slip Filter	10–10000	ms	500	x	x	○	x	x	x	267
CON_71	7647	Anti rollback time	ARF Time	0–10000	ms	0	x	x	x	○	x	○	270
CON_72	7648	Anti rollback speed Pgain	ARF ASR P	1–3000	%	100	x	x	x	○	x	○	270
CON_73	7649	Anti rollback speed I gain	ARF ASR I	1–50000	ms	5	x	x	x	○	x	○	270
CON_74	764A	Anti rollback position gain	ARF APR P	1–9999	%	200	x	x	x	○	x	○	270
CON_88	7658	q axis current controller P gain	ACR P Gain	10 – 2000	%	100	○	x	x	○	x	○	270
CON_89	7659	q axis current controller I gain	ACR I Gain	10 – 2000	%	100	○	x	x	○	x	○	270
CON_90	765A	d axis current controller P gain	ACRd P Gain	10 – 2000	%	100	○	x	x	○	x	○	270

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
CON_91	765B	d axis current controller I gain	ACRd I Gain	10 – 2000	%	100	○	x	x	○	x	○	270
CON_92	765C	Flux current level	FluxCurr Lvl	0.0 – 100.0	%	80.0	○	○	x	○	x	○	270

Note 1) Displayed when Par_07 (control mode) is set to “V/F” or “Slip Comp”.

Note 2) The default setting when the control mode is “V/F” is “0 (Manual”). The default setting when the control mode is “Slip Comp” is “1 (Auto Torque Boost)”.

Note 3) Displayed when CON_48 (V/F pattern) is set to “User V/F”.

5.7 Elevator (E/L) group

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
E/L_00	-	Jump to function code	Jump Code	1 –72		1	x	x	x	x	○	○	
E/L_01	7A01	Speed reference pattern type	Spd Ref Type	0 (DecelReq-D/B) 1 (DecelReq-T/B)		0 (DecelReq-D/B)	x	x	x	x	○	○	
E/L_02	7A02	Number of floors	Floor Number	1 – 32	FLOOR	32	x	x	x	x	○	○	
E/L_03	7A03	Rated car speed	Car Speed	10 – 420	m/m	60	x	x	x	x	○	○	
E/L_04	7A04	Motor speed at rated car speed	Motor Speed	20.0 – 3600.0	rpm	1500.0	x	x	x	x	○	○	
E/L_05	7A05	Direction of motor operation	UP Direction	0 (FX-CCW) 1 (FX-CW)		0 (FX-CCW)	x	x	x	x	○	○	
E/L_06	7A06	Rated acceleration speed	Rated Accel	0.10 – 1.00	m/sec^2	0.50	x	x	x	x	○	○	
E/L_07	7A07	Rated deceleration speed	Rated Decel	0.10 – 1.00	m/sec^2	0.50	x	x	x	x	○	○	
E/L_08	7A08	Acceleration start time	Acc Start T	0.50 – 2.50	sec	1.00	x	x	x	x	○	○	
E/L_09	7A09	Acceleration end time	Acc End T	0.50 – 2.50	sec	1.00	x	x	x	x	○	○	
E/L_10	7A0A	Deceleration start time	Dec Start T	0.50 – 2.50	sec	1.00	x	x	x	x	○	○	
E/L_11	7A0B	Deceleration end time	Dec End T	0.50 – 2.50	sec	1.00	x	x	x	x	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
E/L_12	7A0C	Distance for compensation of communication delay	CommDly Dist	100 – 1000	mm	400	x	x	x	x	○	○	
E/L_13	7A0D	Adjustment for deceleration start distance	DecStart Adj	-10 – 100	mm	0	x	x	x	x	○	○	
E/L_14	7A0E	Motor excitation time	PreExct Time	100 – 10000	ms	300	x	x	x	x	○	○	
E/L_15	7A0F	Brake release time	Brake Time	0 – 10000	ms	300	x	x	x	x	○	○	
E/L_16	7A10	Hold time at zero speed	Hold Time	0 – 10000	ms	300	x	x	x	x	○	○	
E/L_17	7A11	Hold time for a restart	Restart Time	1.00 – 100.00	sec	1.00	x	x	x	x	○	○	
E/L_18	7A12	Sensing plate length	Plate Length	E/L_19 – 1000.0	mm	200.0	x	x	x	x	○	○	
E/L_19	7A13	Distance between position sensor and sensing plate at floor level	Inductor Edge	0.0 – E/L_18	mm	20.0	x	x	x	x	○	○	
E/L_20	7A14	Car speed for floor height measuring	FHM/BF R Speed	0.0 – 60.0	m/m	15.0	x	x	x	x	○	○	
E/L_21	7A15	Floor height measuring	FHM DATA	0 – 321		0	x	x	x	x	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	VF	Slip	PM	ELIM	ELPM	Page
		result											
E/L_22	7A16	Car speed 1 for manual operation	Manual Spd1	0 .0– 60.0	m/m	15.0	x	x	x	x	○	○	
E/L_23	7A17	Car speed 2 for manual operation	Manual Spd2	0.0 – 60.0	m/m	10.0	x	x	x	x	○	○	
E/L_24	7A18	Car speed 3 for manual operation	Manual Spd3	0.0 – 60.0	m/m	3.0	x	x	x	x	○	○	
E/L_25	7A19	Acceleration for manual operation	MAN Accel.	0.01 – 5.00	m/sec^2	0.25	x	x	x	x	○	○	
E/L_26	7A1A	Deceleration for manual operation	MAN Decel.	0.01 – 5.00	m/sec^2	0.25	x	x	x	x	○	○	
E/L_27	7A1B	Acceleration start time for manual operation	ManAcc StartT	0.01 – 2.00	sec	0.50	x	x	x	x	○	○	
E/L_28	7A1C	Acceleration end time for manual operation	Man AccEnd T	0.01 – 2.00	sec	0.50	x	x	x	x	○	○	
E/L_29	7A1D	Deceleration start time for manual operation	ManDec StartT	0.01 – 2.00	sec	0.50	x	x	x	x	○	○	
E/L_30	7A1E	Deceleration end time for manual operation	Man DecEnd T	0.01 – 2.00	sec	0.50	x	x	x	x	○	○	
E/L_31	7A1F	Deceleration time for	ManZero Dec T	0.00 – 600.00	sec	2.00	x	x	x	x	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		manual operation											
E/L_32	7A20	Minimum distance compensation	DistComp.Min	0.0 – 2×E/L_19	mm	0.0	x	x	x	x	○	○	
E/L_33	7A21	Maximum distance compensation	DistComp.Max	0.0 – 100.0	mm	0.0	x	x	x	x	○	○	
E/L_34	7A22	Distance compensation at floor level Note 1)	DistComp.Lev	-E/L_19 – E/L_19	mm	0	x	x	x	x	○	○	
E/L_35	7A23	Car speed for creep operation Note 2)	Creep Speed	1.0 – 60.0	m/m	3.0	x	x	x	x	○	○	
E/L_36	7A24	Creep speed distance Note 2)	Creep Dist.	0 – 500	mm	50	x	x	x	x	○	○	
E/L_37	7A25	Distance for ending position control and starting zero speed deceleration Note 1)	D/B End Dist	0 – E/L_19	mm	0	x	x	x	x	○	○	
E/L_38	7A26	Zero speed deceleration time after position control	SpdZero Time	0.01 – 10.00	sec	2.00	x	x	x	x	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		ends[Note1)]											
E/L_39	7A27	Reversed operation for ELIO input signal	ELIO In Neg	000000000000 –111111111111	-	000000000000	x	x	x	x	○	○	
E/L_40	7A28	Inductor input filter time	IND Filter	0 – 50	ms	5	x	x	x	x	○	○	
E/L_41	7A29	SDS input filter time	SDS Filter	50 – 500	ms	250	x	x	x	x	○	○	
E/L_42	7A2A	Forced deceleration start speed for SDS-1 input	ForcedDecSpd	0.0 – 420.0	m/m	0.0	x	x	x	x	○	○	
E/L_43	7A2B	Deceleration for SDS-1 forced deceleration Note 3)	ForcedDecel	0.01 – 1.50	m/sec^2	1.50	x	x	x	x	○	○	
E/L_44	7A2C	Creep speed for forced deceleration Note 3)	ForcedCrpSpd	0.0 – 60.0	m/m	3.0	x	x	x	x	○	○	
E/L_45	7A2D	Zero speed wait time for forced deceleration Note 3)	Frcd.Dec Wait	0 – 10000	ms	300	x	x	x	x	○	○	
E/L_46	7A2E	Use SDS-2	Use FrcdDcl2	0 (No) 1 (Yes)		0 (No)	x	x	x	x	○	○	
E/L_47	7A2F	Forced deceleration	Frcd.Dec Spd2	0.0 – 420.0	m/m	0.0	x	x	x	x	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		start speed for SDS-2 input Note 4)											
E/L_50	7A32	Start condition for high-speed automatic operation	HighSpd Start	0 (Inductor ON) 1 (Always)	-	0 (Inductor ON)	x	x	x	x	○	○	
E/L_51	7A33	Acceleration start type	AccStart Type	0 (Linear) 1 (U-Curve)	-	0 (Linear)	x	x	x	x	○	○	
E/L_52	7A34	Startup acceleration compensation	StartupAccel	0.00 – 1.00	m/sec^2	0.00	x	x	x	x	○	○	
E/L_53	7A35	Startup acceleration compensation time	StartupAccT	0.01 – 5.00	sec	0.50	x	x	x	x	○	○	
E/L_54	7A36	Startup compensation wait time	Startup Wait	0.00 – 5.00	sec	0.50	x	x	x	x	○	○	
E/L_55	7A37	Wait time before stopping for base floor / nearest floor operation	BFR/NFR Wait	0.00 – 5.00	sec	0.30	x	x	x	x	○	○	
E/L_56	7A38	Source for calling the car	CallFlr Src	0 (External) 1 (Keypad)	-	0 (External)	x	x	x	x	○	○	
E/L_58	7A3A	Select information to display on	Display Sel.	0 (Car Spd (m/m)) 1 (Car Spd (M/S))		0 (Car Spd (m/m))	x	x	x	x	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	VF	Slip	PM	ELIM	ELPM	Page
		keypad		2 (Car Spd (RPM)) 3 (Car Position) 4 (Trq Output) 5 (Lmt.S/W State) 6 (Tuning Dist)									
E/L_59	7A3B	Reset car position	Clear Posi.	0 (No) 1 (Yes)		0 (No)	x	x	x	x	○	○	
E/L_60	7A3C	Show floor position	Show FlrPosi	1 – E/L_02	FLOOR	1	x	x	x	x	○	○	
E/L_61	7A3D	Set start condition for floor height measuring	FHM Start	0 (ID-OFF/IU-ON) 1 (DLS-ON/SD1-ON)	-	0 (ID-OFF/IU-ON)	x	x	x	x	○	○	
E/L_62	7A3E	Floor height measuring mode setting by keypad	KeyPad FHM	0 (No) 1 (Yes)		0 (No)	x	x	x	x	○	○	
E/L_63	7A3F	Upside direction distance compensation by floor	UpDir Level	-E/L_19 – E/L_19	mm	0	x	x	x	x	○	○	
E/L_64	7A40	Downside direction distance compensation by floor	DnDir Level	-E/L_19 – E/L_19	mm	0	x	x	x	x	○	○	
E/L_67	7A43	Secondary speed	2nd Auto Spd	30 – 60	m/m	30	x	x	x	x	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	VIF	Slip	PM	ELIM	ELPM	Page
		reference for automatic operation											
E/L_68	7A44	Secondary acceleration for automatic operation	2nd Rated Acc	0.10 – 1.00	m/s^2	0.50	x	x	x	x	○	○	
E/L_69	7A45	Secondary deceleration for automatic operation	2nd Rated Dec	0.10 – 1.00	m/s^2	0.50	x	x	x	x	○	○	
E/L_70	7A46	Free run speed	Free Run Spd	1 – 20	m/m	2	x	x	x	x	○	○	
E/L_71	7A47	MC On delay time	ELMC On Time	100 – 50000	ms	1000	x	x	x	x	○	○	
E/L_72	7A48	MC Off delay time	ELMC OffTime	100 – 50000	ms	1000	x	x	x	x	○	○	

Note 1) Displayed only when E/L_01 is set to “DecelReq-D/B.”
Note 2) Displayed only when E/L_01 is set to “DecelReq-T/B.”
Note 3) Displayed only when E/L_42 or E/L_47 is set to a value other than “0.”
Note 4) Displayed only when E/L_46 is set to “Yes.”

5.8 Protection (PRT) group

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
PRT_00	-	Jump to codes	Jump code	1–34		1	○	○	○	○	○	○	275
PRT_01	7801	E-thermal options	ETH Select	0 (No) 1 (Yes)		0 (No)	○	○	○	○	○	○	275
PRT_02	7802	E-thermal 1 min level Note1)	ETH 1 min	PRT_03 –200	%	150	○	○	○	○	○	○	275
PRT_03	7803	E-thermal continuous operation level Note1)	ETH Cont	50– PRT_02 (150% max)	%	100	○	○	○	○	○	○	275
PRT_07	7807	Hold time after stop Note2)	Restart Time	0.00–10.00	sec	0.00	○	○	○	○	○	○	278
PRT_08	7808	Sincos1387/EnDat fault & pole position detection settings	Sc/EnDat Fct	111–000	bit	011	x	x	x	○	x	○	279
PRT_09	7809	Encoder error check options	Enc Err Chk	0 (No) 1 (Yes)		1 (Yes)	○	x	x	○	○	○	280
PRT_10	780A	Encoder LPF time constant	Enc LPF	0–100	ms	1	○	x	x	○	○	○	280

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
PRT_11	780B	Encoder error detection time	EncFaultTime	0.00–10.00	sec	0.00 ELPM: 4.00	○	x	x	○	○	○	280
PRT_12	780C	Encoder error reference speed	EncFaultPerc	0.0–50.0	%	25.0 ELPM: 10.0	○	x	x	○	○	○	280
PRT_13	780D	Speed deviation detection level	SpdErrLevel	0–100	rpm	IM: 100 PM: 20	○	x	x	○	○	○	283
PRT_14	780E	Speed deviation detection time	SpdErrTime	0–1000	ms	500	○	x	x	○	○	○	283
PRT_15	780F	Overspeed error detection level	OverSpdLevel	100.0–130.0	%	110.0	○	x	x	○	○	○	284
PRT_16	7810	Overspeed error detection time	OverSpd Time	0.00–2.00	sec	1.00	○	x	x	○	○	○	284
PRT_17	7811	Missing input phase detection	PhInOpenChk	0 (No) 1 (Yes)		0 (No)	○	○	○	○	○	○	284
PRT_18	7812	Missing input phase detection voltage level Note3)	PhInOpenLvl	2–100	V	3.0	○	○	○	○	○	○	284
PRT_19	7813	Missing output	PhOutOpenChk	0 (No) 1 (Yes)		0 (No)	○	○	○	○	○	○	

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		phase detection											
PRT_20	7814	Overload warning level	OL Level	30–250	%	150	○	○	○	○	○	○	285
PRT_21	7815	Overload warning time	OL Time	0–30	sec	10	○	○	○	○	○	○	285
PRT_22	7816	Overload fault trip options	OLT Select	0 (No) / 1 (Yes)		1 (Yes)	○	○	○	○	○	○	287
PRT_23	7817	Overload fault trip level Note4)	OLT Level	30–250	%	180	○	○	○	○	○	○	287
PRT_24	7818	Overload fault trip time Note4)	OLT Time	0–60	sec	30	○	○	○	○	○	○	287
PRT_25	7819	Inverter overheat detection temperature Note5)	IH Warn Temp	50 – 110	deg	95	○	○	○	○	○	○	287
PRT_26	781A	Inverter overheat detection band	IH Warn Band	0–10	deg	5	○	○	○	○	○	○	287
PRT_27	781B	Motor overheat detection temperature	MH Warn Temp	75–130	deg	120	○	○	○	○	○	○	287
PRT_28	781C	Motor overheat detection temperat	MH Warn Band	0–10	deg	5	○	○	○	○	○	○	287

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
		ure band											
PRT_29	781D	Low Voltage 2 options	LV2 Enable	0 (No) / 1 (Yes)		0 (No)	○	○	○	○	○	○	288
PRT_30	781E	A3 start time Note5)	A3 StartTime	0–6000	ms	1500	○	○	○	○	○	○	288
PRT_31	781F	A3 stop time Note5)	A3 StopTime	0–6000	ms	1500	○	○	○	○	○	○	288
PRT_32	7820	Cooling fan control	Fan Control	0 (During Run) 1 (Always On) 2 (Temp Control)		0 (During Run)	○	○	○	○	○	○	289
PRT_33	7821	Cooling fan fault trip options	Fan Trip Mode	0 (Trip) 1 (Warning)		1 (Warning)	○	○	○	○	○	○	289
PRT_34	7822	Safety options	Safety Type	0 (Latch) 1 (Level)		0 (Latch)	○	○	○	○	○	○	290

Note 1) Displayed when PRT_02 is set to “Yes”.

Note 2) Displayed when FUN_03 is set to “Free-Run”.

Note 3) Displayed when PRT-17 is set to “Yes”.

Note 4) Displayed when PRT-22 is set to “Yes”.

Note 5) Displayed when a multifunction input terminal is set to “A3 Safety”.

5.9 Communication (COM) group

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
COM_00	-	Jump to codes	Jump Code	1–9		1	○	○	○	○	○	○	-
COM_01	7901	CAN station ID	CAN St ID	0x0800 – 0x0f00		0x0800	○	○	○	○	○	○	
COM_02	7902	CAN comm. Speed	CAN Baud	0 (125 kbps) 1 (250 kbps) 2 (500 kbps) 3 (1 Mbps)	bps	2 (500 kbps)	○	○	○	○	○	○	
COM_03	7903	CAN comm. Mode	CAN Mode	0 (CAN2.0B)		0 (CAN2.0B)	○	○	○	○	○	○	
COM_04	7904	RS232 station ID	RS232 St ID	1		1	○	○	○	○	○	○	
COM_05	7905	RS232 comm. Speed	RS232 Baud	0 (9600 bps)		0 (9600 bps)	○	○	○	○	○	○	
COM_06	7906	RS232 comm. Mode	RS232 Mode	0 (8None/1Stop)		0 (8None/1Stop)	○	○	○	○	○	○	
COM_07	7907	Delay time for comm. Response	COM Delay	2 – 1000	ms	5	○	○	○	○	○	○	
COM_08	7908	Operation mode for lost command	COM LostC	0 (None) 1 (FreeRun) 2 (Decel)		0 (None)	○	○	○	○	○	○	
COM_09	7909	Lost command decision time	COM LostT	1.0 - 30.0	sec	1.0	○	○	○	○	○	○	

5.10 User (USR) group

Code	Comm addr.	Name	Keypad display	Range	Unit	Default setting	IM	V/F	Slip	PM	ELIM	ELPM	Page
USR_00	-	Jump to codes	Jump Code	1–67[Note 1)]		1	○	○	○	○	○	○	297
USR_01	-	Reset parameter settings to application specific default values	Macro Init	0 (User Define) 1 (E/L)		0 (User Define)	○	○	○	○	○	○	297
USR_02	-	Save user data	User Save	0 (No) 1 (Yes)		0 (No)	○	○	○	○	○	○	297
USR_03	-	Load user data	User Recall	0 (No) 1 (Yes)		0 (No)	○	○	○	○	○	○	297
USR_04	-	User group data	User Grp				○	○	○	○	○	○	299

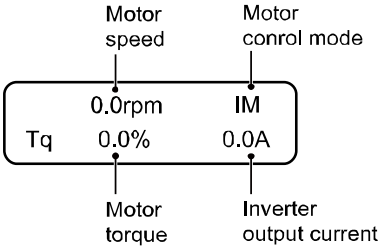
Note1) Only previously defined codes between USR_04–USR_67 can use the Jump Code feature.

6 Detailed operation by function groups

6.1 Display (DIS) group

6.1.1 DIS_00 (Motor operation monitoring)

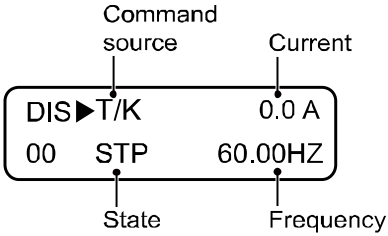
Motor operation monitoring is the default code displayed when the inverter is turned on. On the keypad, the motor speed, motor control mode, motor torque, and the output current from the inverter are displayed.



6.1.1.1 Display information for Speed(IM)and Speed(PM)mode operations

Code	Name	Unit	Description	
DIS_00	Motor speed	rpm	Actual motor speed	
	Motor control mode		IM/PM	Speed control mode (for induction/sync. motors)
			BX	Emergency stop state
			BAT	Operation on battery
	Motor torque	%	Motor torque as a percentage of the rated output	
	Inverter output current	A	Actual output current from the inverter	

6.1.1.2 Display information for V/F and Slip Comp mode operation



Code	Name	Description		
DIS_00	Command source	Operation command	T	Operation command by terminal input
			K	Operation command by keypad
			O	Operation command by CAN or RS232 communication
		Frequency command	A	Frequency command by analog input
			K	Frequency command by keypad
			O	Frequency command by CAN or RS232 communication
	Current	Actual output current from the inverter		
	State	STP		Inverter stopped
		FWD		Inverter operating in forward direction
		REV		Inverter is operating in reverse direction
	Frequency	Output frequency (when the inverter is operating) / frequency reference (when the inverter is stopped)		

6.1.2 User defined information (DIS_01, 02, 03)

You can configure codes DIS_01, 02, and 03 to choose to display on the keypad one of the following information listed in the following table.

By default, DIS_01 is set to “Out Volt rms,” DIS_02 to “Flux Cur Red,” and DIS_03 to “DC Bus Volt.”

Code	Keypad display	Name	Unit	Description
DIS_01 - DIS_03	Ai1 Value – Ai2 Value	Multi-function analog	%	Multifunction analog input value is displayed in a percentage (10 V/100%, 20 mA /100%)
	PreRamp Ref	Speed reference before acceleration or deceleration	Hz/rpm	Displays motor rpm reference before an acceleration/deceleration routine.
	PostRamp Ref	Speed reference after acceleration or deceleration	Hz/rpm	Displays motor rpm reference after an acceleration/deceleration routine.
	ASR Inp Ref	Speed controller input reference	Hz/rpm	Displays the actual reference that is given to the speed controller.
	Output Freq	Output frequency	Hz/rpm	Displays the inverter output frequency.
	Motor Speed	Motor Rotation speed	rpm	Displays the actual motor rotation speed.
	Speed Dev	Speed deviation	rpm	Displays the difference between the speed reference and the actual motor rotation.
	ASR Out	Speed controller output	%	Displays the speed controller output in a percentage to the rated torque.
	Torque Bias	Torque bias	%	Displays the torque bias in a percentage to the rated torque.
	PosTrq Limit	Forward torque limit	%	Displays the forward torque limit in a percentage to the rated torque.

Code	Keypad display	Name	Unit	Description
	NegTrq Limit	Reverse torque limit	- %	Displays the reverse torque limit in a percentage to the rated torque.
	RegTrq Limit	Torque limit at regeneration	%	Displays the torque limit at regeneration in a percentage to the rated torque.
	IqeRef	Torque current (Q-axis current) Reference	A	Displays the torque current reference in a percentage to the rated torque.
	Iqe	Torque current (Q-axis current)	A	Displays the actual torque current in a percentage to the rated torque.
	Flux Cur Ref	Flux reference	%	Displays the flux current reference in a percentage to the rated flux. Set an appropriate flux current at Par_52. Flux level changes according to the flux control result at high speed operation and is reflected to the flux current reference accordingly.
	IdeRef	Direct axis (D-axis) current reference	A	Displays the direct axis (D-axis) current reference for the rated direct axis current.
	Ide	Direct axis (D-axis) current	A	Displays the actual direct axis (D-axis) current for the rated direct axis current.
	ACR_Q Out	Q-axis current controller output	V	Displays the Q-axis current controller output.
	ACR_D Out	D-axis current controller output	V	Displays the D-axis current controller output.
	VdeRef	D-axis voltage reference	V	Displays the D-axis voltage reference.
	VqeRef	Q-axis voltage reference	V	Displays the Q-axis voltage reference.

<table>
<tr><th>Code</th><th>Keypad display</th><th>Name</th><th>Unit</th><th>Description</th></tr>
<tr><td></td><td>Out Amps RMS</td><td>Output current</td><td>A</td><td>Displays the effective inverter output current (root-mean-square).</td></tr>
<tr><td></td><td>Out Volt RMS</td><td>Output voltage</td><td>V</td><td>Displays the effective inverter output voltage (root-mean-square).</td></tr>
<tr><td></td><td>Power</td><td>Output power</td><td>kW</td><td>Displays the motor output power.</td></tr>
<tr><td></td><td>DC Bus Volt</td><td>DC link voltage</td><td>V</td><td>Displays the inverter DC link voltage.</td></tr>
<tr><td></td><td>Inv Temp</td><td>Inverter temperature</td><td>deg</td><td>Displays the inverter heat sink temperature.</td></tr>
<tr><td></td><td>Control Mode</td><td>Control mode</td><td></td><td>Displays the control mode in use (Speed(IM), V/F, Slip Comp, Speed(PM)).</td></tr>
<tr><td></td><td>Run Time</td><td>Operation time</td><td></td><td>Displays the duration of inverter’s operation since the power-on.</td></tr>
<tr><td></td><td>Terminal In</td><td>Input terminal status</td><td>bit</td><td>Displays the ON (1)/OFF (0) status of the input terminal.
<table>
<tr><th>Input terminal</th><th>FX</th><th>RX</th><th>BX</th><th>RST</th><th>P1</th></tr>
<tr><td>0 (OFF)
1 (ON)</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td></tr>
<tr><td>P2</td><td>P3</td><td>P4</td><td>P5</td><td>P6</td><td>P7</td></tr>
<tr><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td></tr>
</table></td></tr>
<tr><td></td><td>Terminal Out</td><td>Output terminal status</td><td>bit</td><td>Displays the ON (1)/OFF (0) status of the relay terminal output and fault relay.
<table>
<tr><th>Output terminal</th><th>AX1</th><th>Ax2</th><th>AX3</th><th>Ax4</th><th>30A (30B)</th></tr>
<tr><td>0 (OFF)
1 (ON)</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Code</th><th>Keypad display</th><th>Name</th><th>Unit</th><th>Description</th></tr>
<tr><td></td><td>Terminal Opt</td><td>Command via network communication status</td><td>bit</td><td>Displays the network command communication status.
<table>
<tr><td>Input terminal</td><td>Stop</td><td>FX</td><td>RX</td><td>RST</td><td>BX</td></tr>
<tr><td>0 (OFF)
1 (ON)</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td></tr>
</table>
<table>
<tr><td>P1</td><td>P2</td><td>P3</td><td>P4</td><td>P5</td><td>P6</td><td>P7</td></tr>
<tr><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td><td>0/1</td></tr>
</table></td></tr>
<tr><td></td><td>Run Status</td><td>Operation status</td><td></td><td>Displays the inverter operation status.</td></tr>
<tr><td></td><td>PhInOpenLvl</td><td>Input phase open detection level</td><td>A</td><td>Displays the input phase open detection level value for the input phase open detection function that can be turned on at PRT_18 PhInOpenLvl.</td></tr>
<tr><td></td><td>Iu Offset</td><td>U phase output current offset</td><td>A</td><td>Displays hardware offset for U phase current feedback while the power is supplied.</td></tr>
<tr><td></td><td>Iv Offset</td><td>V phase output current offset</td><td>A</td><td>Displays hardware offset for V phase current feedback while the power is supplied.</td></tr>
<tr><td></td><td>Iw Offset</td><td>W phase output current offset</td><td>A</td><td>Displays hardware offset for W phase current feedback while the power is supplied.</td></tr>
<tr><td></td><td>IuP
IuM</td><td>Synchronous motor phase current average</td><td>A</td><td>This parameter is used for initial pole position estimation. It is displayed only when Speed(PM)mode is in use, to show the motor phase current.
• IuP: U phase + value
• IuM: U phase – value</td></tr>
</table>

Code	Keypad display	Name	Unit	Description
	IvP IvM	Synchronous motor phase current average	A	This parameter is used for initial pole position estimation. It is displayed only when Speed(PM)mode is in use, to show the motor phase current. • IvP: V phase + value • IvM: V phase – value
	IwP IwM	Synchronous motor phase current average	A	This parameter is used for initial pole position estimation. It is displayed only when Speed(PM)mode is in use, to show the motor phase current. • IwP: W phase + value • IwM: W phase – value
	Sc/EnDat Pos	SinCos/Endat encoder position	Pulse	Displays SinCos/Endat encoder position when Speed(PM)mode is in use.
	Theta Offset	Thetha offset	Deg	Displays theta offset position when Speed(PM)mode is in use.

6.1.3 Display add-on module (option board, DIS_04)

This code displays the type of add-on module that is installed to the inverter.

Code	Keypad display	Name	Description	
DIS_04	Opt. Board	Display add-on module (option board) information	None	No add-on board
			A/B Pulse	Incremental encoder add-on module
			EnDat	EnDat Encoder add-on module
			Sin/Cos	SIN/COS Encoder add-on module

6.1.4 Fault status display (DIS_05)

This code may be configured to display the current fault status, trip history (2 most recent faults) and the number of previous faults (it may also be used to clear the number of faults). At DIS_05, press [SHIFT/ESC] to change the setting values.

Code	Keypad display	Name	Description
DIS_05	Faults	Current fault condition	Displays the inverter trip information. When the inverter is operating without fault, "————————" is displayed.
	Last Fault1	Previous fault condition1	For more information, refer to *8.1 Fault trips* on page *334*.
	Last Fault2	Previous fault condition2 (the fault before Last Fault1)	
	Fault Count	Total number of faults	Displays the total number of fault since the last initialization.
	Fault Clear	Initialize fault count	Initializes the total fault count to "0."

Press [PROG] and [▲] / [▼] before pressing [RESET] to see the following conditions at the time of the fault: Speed reference, speed feedback, output frequency, output current and voltage, Q-axis current reference and the actual value, DC-link voltage, input terminal status, output terminal status, operation

status, and duration.

Press [ENT] to return to the main screen. The current fault is saved as “Last Fault1” when you press [RESET]. For more information, refer to *8 Troubleshooting* on page *334*.

Fault status display types

No	Fault trips	Keypad display	No	Fault trips	Keypad display
1	Short circuit at the IGBT	Arm Short	15	Inverter overload	Inv. OLT
2	Ground fault protection	Ground Fault	16	Input phase open	Input PO
3	Overcurrent trip	Over Current	17	Inverter thermal sensor fault	InvThem OP
4	Overvoltage trip	Over Voltage	18	Motor Overspeed	Over Speed
5	FAN error	FAN Error	19	Floor data-related fault	Flr/FHM Data
6	Battery operation fault	BatRun Fault	20	Slow down switch fault	SDS Error
7	Encoder fault	Encoder Err	21	A3 safety fault	A3 Safety
8	Low voltage trip	Low Voltage	22	LV2 (Low voltage 2) fault	Low Voltage 2
9	Inverter overheat	InvOver Heat	23	Safety fault	SAFETY A/B
10	E-thermal protection trip	E-Thermal	24	Speed deviation fault	Spd Dev Err
11	Overload trip	Over Load	25	ADC fault	ADC Error
12	H/W fault trip	HW-Diag	26	EnDat add-on module data clock configuration fault	ENDAT Error
13	External trip-	External-B	27	PM pole detection	Mag Det Error

No	Fault trips	Keypad display	No	Fault trips	Keypad display
	terminal B			fault	
14	Output phase open	Output PO	28	Data save fault	EEP Error

Note

If multiple fault trips occur at the same time, fault trips with higher priority are displayed first (fault trips with smaller numbers have higher priority). Check the fault trip history to view the rest of the fault trips.

6.1.5 Software version display (DIS_06)

This code is used to display the current version and date of the inverter software.

6.1.6 User group display options (DIS_10)

You may select frequently accessed codes to create a user group.

When configuring the user group display, there are three options available depending on the parameter setting at DIS_10: Do not display User group / Show Display group and User Group only / Show all code groups including User group.

Code	Keypad display	Name	Description	
DIS_10	Usr Grp Disp	User group display options	Not Used	Do not display User group.
			Dis+Usr Grp	Show Display group and User Group only. When this option is selected, you can access other codes by manually switching to the codes in the User group, or by changing the parameter setting to allow display of other code groups.
			Display ALL	Show all code groups including User group.

6.2 Parameter (PAR) group

6.2.1 Jump code (PAR_00)

PAR_00 code is used to directly access a certain code.

The following is an example of jumping directly to PAR_56 from PAR_00 code.

1 Press [PROG].

2 Use [SHIFT/ESC], [▲], or [▼] to change the code number to “56”.

3 Press [ENT] to access PAR_56 code. If an invalid code number is entered, the next available code number is automatically selected.



Note

After jumping directly to a code, you can move to other codes by pressing [▲] or [▼].

6.2.2 Parameter-related settings

6.2.2.1 Parameter initialization (PAR_01)

Parameter initialization resets all inverter parameter settings to the default settings. Parameter initialization is available for selected groups or for all the groups. After an initialization, make sure to configure the parameters to values that are appropriate for the operating condition of the site. Also, the motor capacity must be re-configured at PAR_09 (Motor Select).

Code	Keypad display	Name	Range	Unit	Default setting
PAR_01	Para. init	Initialize to default setting	0 (No) 1 (All Groups) 2 (DIS) 3 (PAR) 4 (DIO) 5 (AIO) 6 (FUN) 7 (CON) 8 (E/L) 9 (PRT) 10 (COM) 13 (USR)		0 (No)

Note

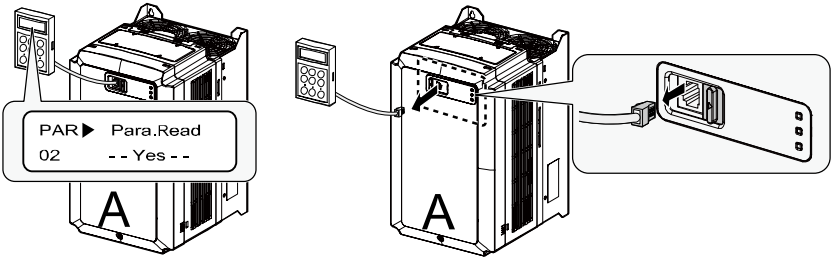
Configure the parameter settings again after performing a parameter initialization. All parameter settings revert to the factory default after an initialization.

6.2.2.2 Duplicating parameter settings (PAR_02, 03)

Using the keypad, you can copy (read) the parameter settings of a certain inverter and paste (write) them into multiple inverters.

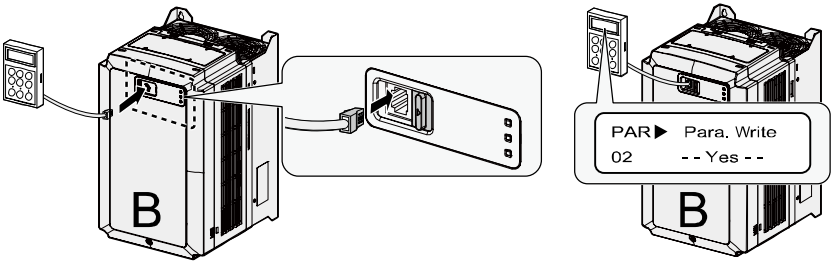
1 On the inverter that has the parameter settings to duplicate (A), set PAR_02 (Read all codes) to “Yes”.

- All the parameter settings are copied into the keypad for duplication.



2 Remove the keypad from the inverter and install it on another inverter to which the parameter settings will be written to (B), and then set PAR_03 (Write all codes) to “Yes”.

- All the parameter settings stored in the keypad are copied into the other inverter.



Note

To duplicate the parameter settings between the inverters, the source and target inverters must have the same software version. Otherwise, a software version error message (“VER. Err”) will be displayed, and the process will not be completed.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_02	Para. Read	Read all codes	0 (No) 1 (Yes)		0 (No)
PAR_03	Para. Write	Write all codes	0 (No) 1 (Yes)		0 (No)

Note

After parameter setting duplication, re-configure each code in DIS and USR groups. All the parameter settings for the codes in DIS and USR groups will revert to the default settings after duplication.

⚠ Caution

Parameter duplication affects the motor parameters. After parameter duplication, ensure that the motor-related parameters are set correctly.

6.2.2.3 Prohibiting modification of codes (PAR_04)

Set PAR_04 to “12” to lock all codes to prohibit modification. To unlock the codes and allow modification, set PAR_04 to “12” once again.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_04	Para. lock	Lock all codes	0–255		0

6.2.2.4 Setting the password (PAR_05)

Set and use a password to prevent unauthorized access to codes. Set PAR_05 to any 4-digit number other than “0000” and restart the inverter to allow the change to take effect.

When a password is set, only the codes in Display group are displayed on the keypad. In display group, you can press the [Mode] key to jump directly to PAR_05.

- To gain access to other groups, press [Mode] to display password input screen (PAR_05). Once a correct password is entered, all the other codes become accessible again.
- Set PAR_05 to “0” to disable the password option.

The master password for the inverter is “5052”. Use the master password to disable the password option and gain access to the codes in case you cannot remember the password. Upon entering the master code, PAR_05 is set to “0” and automatically disables the password option.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_05	Password	Password	0–255		0

6.2.3 Motor-related settings

6.2.3.1 Control mode options (PAR_07)

The L100 inverter provides speed control modes such as “Speed(IM)” and “Speed (PM)” beside the open-loop control modes such as “V/F” and “Slip Comp.”

To operate the inverter in speed control mode (Speed(IM) or Speed(PM)), a speed feedback device (encoder) must be installed.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_07	Control Mode	Control mode options	2 (Speed(IM))		4 (V/F)
			4 (V/F)		
			5 (Slip Comp)		
			6 (Speed(PM))		

6.2.3.2 Application mode options (PAR_08)

Set the inverter application mode to suit your needs. The L100 inverters may be configured for general vector (General Use) mode, as well as for elevator application (Elevator) mode.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_08	Application	Application mode options	General Use Elevator Note1)		General Use

Note 1) Displayed when ELIO add-on module (elevator I/O board) has been installed.

6.2.3.3 Motor capacity settings (PAR_09) / Motor capacity user define (PAR_10)

Select correct motor capacity before operating the inverter. The default motor capacity value is set at the factory as one that is equivalent to the inverter capacity.

Once a motor capacity is selected, appropriate motor parameter values for the motor is automatically configured (based on the Higen vector motor specifications).

To use capacity settings for a motor other than those provided by the inverter, set PAR_09 to “User Define,” and set PAR_10 to define your own.

After user-defining the motor capacity, set PAR_52–PAR_59 codes to the values provided on your motor’s rating plate and run auto-tuning. You must use the parameter values obtained from the auto-tuning when setting the user defined motor capacity.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_09	Motor select	Motor capacity settings	2.2–22.0 User Define	kW	A capacity equivalent to the inverter capacity

Code	Keypad display	Name	Range	Unit	Default setting
PAR_10	UserMotorSel	User-defined motor capacity	2.2–22.0	kW	7.5

6.2.3.4 Setting the maximum motor speed (PAR_11)

Set PAR_11 to define the maximum motor speed. The maximum motor speed is the maximum output for the maximum speed reference.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_11	Max. Speed	Maximum motor speed	V/F, Slip : 30.00-120.00 IM : 10.0-3600.0 PM : 10.0-680.0	Hz rpm rpm	V/F, Slip : 60.00 IM : 1800.0 PM : 100.0

6.2.3.5 Setting the minimum motor speed (PAR_12)

This code is displayed when PAR_07 is set to “V/F” or “Slip Comp” mode. Once the minimum motor speed is set, the inverter only operates when it receives a speed reference that is equal to, or greater than this minimum motor speed. If a speed reference smaller than the minimum motor speed is received during operation, the inverter recognizes it as a stop command, and performs a decelerating stop.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_12	Min. Speed	Minimum motor speed	0.5–10.00	Hz	0.5

6.2.3.6 Setting the motor base frequency (PAR_13)

A base frequency is the inverter's output frequency (in Hz) at its rated voltage. Refer to the motor's rating plate to set this parameter value. This parameter is required for V/F and slip compensation control mode operations.

6.2.3.7 Setting the motor synchronization speed (PAR_14)

This parameter is required for speed control mode (Speed(IM) or Speed(PM)) operations. A synchronization speed is the motor speed (in rpm) at the inverter's rated voltage.

For a 4-poled 60 Hz induction motor, the synchronization speed is 1800 rpm (= 120 x 60 [frequency] / 4 [pole number]).

For a PM motor, refer to the motor's rating plate to set this parameter value (in rpm).

6.2.3.8 Setting the rated motor voltage (PAR_15)

Refer to the motor's rating plate to set this parameter value.

6.2.3.9 Setting the motor pole number (PAR_16)

Refer to the motor's rating plate to set this parameter value. The pole number affects the motor speed (rpm).

6.2.3.10 Setting the motor efficiency (PAR_17)

Refer to the motor's rating plate to set this parameter value. Use the default setting if the value is not specified on the motor's rating plate.

6.2.3.11 Setting the motor rated slip (PAR_18)

For an induction motor, refer to the motor's rating plate to set this parameter value. The rated slip value provides information on the deviation between the

motor speed set at PAR_14 and the actual operating speed.

For example, if a 4-poled motor operates at 1750 rpm with 60 Hz inverter output, the rated slip is 50 (1800 [= 120 x 60 / 4] - 1750).

6.2.3.12 Setting the motor rated current (PAR_19)

Refer to the motor's rating plate to set this parameter value.

6.2.3.13 Setting the input voltage (PAR_20)

Use this code to set the inverter input voltage. The value set at PAR_20 is used to decide wether to enable or diable low voltage protection.

During inverter operation, the width of ripple grows as the inverter output increases while a phase is missing. A low voltage trip may occur if the input voltage is low when the ripple reaches its lower end. To prevent such a problem, you can set this code to the inverter's input voltage and activate a phase missing protection instead of a low voltage trip.

6.2.3.14 Setting the switching frequency (PAR_21)

Set PAR_21 to a value between 3–8.0 (kHz) to define the inverter's switching frequency.

Adjust the switching frequency to reduce the operation noise, or to avoid overheating problems.

A lower switching frequency increases the operation noise but lowers the inverter temperature and decreases the inverter noise and leakage current.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_21	PWM Freq	Switching frequency setting	3 – 8	kHz	8.0

6.2.3.15 Setting the motor cooling options (PAR_22)

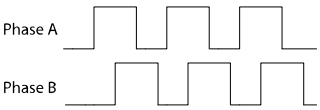
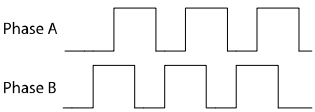
Set PAR_22 to select the cooling options for a motor. Motor cooling options are used to determine the motor overload (PRT_01, ETH). Set it to “Self-cool” for a self-cooling motor, and “Forced-cool” for a forced cooling motor.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_22	Cooling Mtd	Motor cooling options	0 (Self-cool) 1 (Forced-cool)		1 (Forced-cool)

6.2.3.16 Setting the encoder-related parameters: Input pulse number and direction (PAR_24–25) / Error detection and LPF (PR_09–10)

Set PAR_24 (Encoder pulse number) to define the number of input pulse for the encoder that is installed at the motor.

PAR_25 (Encoder directions) enables you to choose to advance phase A or phase B while the motor is rotating in the forward direction. It provides an easy solution to rearrange the phase order (encoder phases A/B, or motor phases U/V/W) without physically re-doing the cable wiring when the phase connections are not made correctly.

Code	Name	Settings	Description	Encoder pulse (FX operation)
PAR_25	Encoder directions	A Phase Lead	• Phase A is advanced during FX operation. • Phase B is advanced during RX operation.	
		B Phase Lead	• Phase B is advanced during FX operation. • Phase A is advanced during RX operation.	

Note

- If PRT_09 (Encoder error detection) is set to “Yes,” encoder fault trips occur when open circuits or wiring errors are detected. The detection function does not work with open collector encoders. Set PRT_09 to “No,” if an open collector type encoder is installed.
- Adjust PRT_10 (Encoder LPF time) to reduce the interference if the encoder receives noisy pulse input.
- Incorrect encoder-related parameter setting may lead to abnormal speed control and frequent overcurrent and overvoltage fault trips. For detailed information, refer to *8 Troubleshooting* on page *334*.

Code	Keypad display	Name	Range	Unit	Default
PAR_24	Enc Pulse	Encoder pulse number	360–32767		1024
PAR_25	Enc Dir Set	Encoder direction	0 (A Phase Lead) 1 (B Phase Lead)		B Phase Lead
PRT_09	Enc Err Chk	Encoder error detection	0 (No) 1 (Yes)		1 (Yes)
PRT_10	Enc LPF	Encoder LPF time	0–100	ms	1

6.2.3.17 Setting the encoder types (PAR_23), encoder scale (PAR_27), and encoder tuning options (PAR_28)

Set PAR_23 to define the encoder types in Speed(PM) control mode. PAR_28 is displayed only when the encoder type is set to “EnDat” or “Sin/Cos”. PAR_27 is displayed only when Speed(IM) control mode is in use.

For details, refer to the instruction manuals that are provided with the Sin/Cos and EnDat encoder add-on modules.

Keypad display	Description
PAR▶ Enc Type 23 A/B Pulse	This setting is used for A/B pulse encoders in Speed(PM)control mode.
PAR▶ Enc Type 23 EnDat	This setting is used for HEIDENHAIN ECN413 and ECN1313 encoders. Use this option if an EnDat add-on module has been installed (Check the installed add-on module at DIS_04).
PAR▶ Enc Type 23 Sin/Cos_All	This setting is used for HEIDENHAIN ECN413, ECN1313, ERN487, and ERN1387 encoders. Use this option if a SIN/COS add-on module (without Sin2/Cos2 signal) or EnDat add-on module (without Data/Clock signal) has been installed (Check the installed add-on module at DIS_04).
PAR▶ Enc Type 23 Sin/Cos_1387	This setting is used for HEIDENHAIN ERN487 and ERN1387 encoders. Use this option if a SIN/COS add-on module has been installed (Check the installed add-on module at DIS_04).

Code	Keypad display	Name	Range	Unit	Settings
PAR_23	Enc Type	Encoder type	0 (A/B Pulse) 1 (EnDat) 2 (Sin/Cos_All) 3 (Sin/Cos_1387)		0 (A/B Pulse)
PAR_27	Enc Scale	Encoder scale	0 (x1)		0 (x1)
PAR_28	Sce Tuning	Encoder tuning options	0 (No) 1 (Yes)		0 (No)

6.2.4 Auto-tuning

Auto-tuning is used to estimate an induction motor's stator resistance (Rs), stator inductance (Ls), leakage factor (Lsigma), flux current (Flux-Curr), and rotor time constant (Tr). For a synchronous motor, auto-tuning is used to estimate the stator resistance (Rs), d/q-axis inductance (Ld, Lq), and the pole position.

There are two types of auto-tuning procedures. Rotating tuning requires motor operation, while static tuning does not. For an induction motor, both types may be used if it is set for speed control mode, and in other control modes, only static auto-tuning can be used. For synchronous motors, static auto-tuning must be used regardless of the control modes.

6.2.4.1 Setting the motor/encoder parameter for auto-tuning

Motor parameters required for vector control can only be obtained when correct motor information is provided. Such information includes the motor's capacity, sync speed, rated voltage, pole number, efficiency, rated slip, rated current, and the encoder pulse number.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_09	Motor Select	Motor capacity	2.2–22.0	kW	7.5
PAR_10	UserMotorSel	User-define motor capacity	2.2–22.0	kW	7.5
PAR_14	Sync Speed	Motor synchronization speed	100.0–3600.0	rpm	1800.0
PAR_15	Rated Volt	Motor rated voltage	120–560	V	380
PAR_16	Pole Number	Motor pole number	2–12		4
PAR_17	Efficiency	Motor efficiency	0.0–100.0	%	87.5
PAR_18	Rated-Slip	Motor rated slip	10.0–250.0/ 1.0–25.0	rpm/ Hz	Varies by motor capacity
PAR_19	Rated-Curr	Motor rated Current	1.0–1000.0	A	
PAR_24	Enc Pulse	Encoder pulse number	360–32768		1024

Use PAR_09 to select a motor capacity. To use a motor whose capacity is not given for selection, set it to “User Define,” which brings up PAR_10 (User-define motor capacity) options, where the motor capacity can be manually entered.

PAR_14 (Motor sync Speed) is used to set the motor speed at which the inverter outputs its rated voltage. The rated speed must be set within the range of the motor’s maximum speed.

- Set the motor sync speed and rated voltage as they read on the motor’s rating plate. When operating a 4-pole standard motor, the sync speed is 60 Hz (1,800 rpm).

$$\text{rpm} = \frac{120 \times \text{Base_Frequency}}{\text{Pole_number}}, \quad 1{,}800\ \text{rpm} = \frac{120 \times 60\ \text{Hz}}{4}$$

- Motor rated slip (PAR_18) is the difference between the motor sync speed and motor rated speed (PAR_14) (motor rated speed = sync speed [PAR_14] – rated slip [PAR-18]).
- By default, PAR_15 (Motor rated voltage) is set as 380 (V) at the factory. Refer to the motor’s rating plate for the rated input voltage. The rated voltage must be set correctly. The setting value is provided to the voltage controller to prevent voltage saturation. Also, it affects the measurement of flux current during an auto-tuning.
- Set PAR_17 (Motor efficiency) only if the motor efficiency information is given on the rating plate (do not modify it if it is not specified on the rating plate).
- For PAR_18 (Motor rated slip), subtract “motor rated speed” from ”motor sync speed” on the rating plate, and enter the resulting value.
  - For example, if the motor sync speed is 1,800 (rpm) and the rated speed is 1,740 (rpm), the rated slip is 60 (rpm).

6.2.4.2 Running a rotating auto-tuning for induction motors

Preparation

Caution

Before running a rotating auto-tuning, disconnect and remove the machinery that is connected to the motor axis, and leave the motor unloaded. Unintended operation of the machinery during tuning may lead to personal injury and/or mechanical damage. A braking resistor must be connected to the inverter when running an auto-tuning. Abrupt accelerations and decelerations are required to find an optimal rotor time constant.

Setting the parameters for auto-tuning

Code	Keypad display	Name	Range	Unit	Setting
PAR_31	AutoTuneType	Auto-tuning options	0 (Rotational) 1 (StandStill)	-	0 (Rotational)
PAR_32	Kp for If	If tuning error protection p gain	0.001–1.000	-	0.020
PAR_33	Ki for If	If tuning error protection I gain	0.001–1.000	-	0.040
PAR_34	Inertia Tune	Motor inertia tuning options	0 (No) 1 (Yes)		0 (No)
PAR_35	J Spd Time	Inertia tuning acc/ dec time	0.500–10.000	sec	0.500
PAR_36	Inertia LPF	Inertia low pass filter	0.010–50.000	ms	0.100
PAR_41	IM AutoTune	Induction motor auto-tuning option	0 (None) 1 (ALL1) 2 (ALL2) 3 (Encoder Test) 4 (Rs Tuning) 5 (Lsigma) 6 (Flux Curr)	-	0 (None)

Code	Keypad display	Name	Range	Unit	Setting
			7 (Ls Tuning) 8 (Tr Tuning) 9 (InertiaTuning)		

- The L100 inverter provides 9 different types of rotating auto-tuning.
- "ALL2" type auto-tuning detects stator resistance (Rs), leakage factor (Lsigma), flux current, rotor time constant (Tr), stator inductance (Ls) and inertia values.
- If you perform the "ALL1" type auto-tuning, "ALL2" tuning is performed after the encoder test.

Note

- "Inertia Tuning" options are available only when PAR_34 is set to "Yes".
- Rotor time constant (Tr) can be correctly estimated only after stator resistance (Rs), leakage factor (Lsigma), and stator inductance (Ls) values are obtained through an auto-tuning.
- Adjust PAR_32 (If tuning Error protection P gain) and PAR_33 (If tuning error protection I gain) parameter values if errors occur during an excitation current tuning. Increase the PAR_35 (Inertia tuning acc/dec time) parameter value if a high inertial load is connected to the motor. Increase the PAR_36 (Inertia LPF) parameter value if a large amount of fluctuation is observed with high inertia loads.
- The FWD and REV operation indicators on the keypad flash simultaneously during an auto-tuning.
- Auto-tuning is based on a motor sync speed of 1,800 rpm.

Auto-tuning types	Description
None	Do not perform auto-tuning.
ALL1	Perform auto-tuning in the order of Rs, Lsigma, flux current, Ls, and Tr tuning after completing an encoder test.
ALL2	Perform auto-tuning in the order of Rs, Lsigma, flux current, Ls, and Tr tuning without an encoder test.

Encoder Test	Tests the encoder wiring connections by rotating the motor at 1,500 rpm in the forward direction.
Rs Tuning	Determines motor stator resistance without rotating the motor.
Lsigma	Determines motor leakage factor (Lsigma) without rotating the motor.
Flux Curr	Determines flux current by rotating the motor at 1,500 rpm.
Ls Tuning	Determines stator inductance by rotating the motor at 1,500 rpm.
Tr Tuning	Determines rotor time constant after accelerating and decelerating the motor multiple times. Elapsed time may vary each time it is performed. Rotor time constant tuning must be performed after stator resistance (Rs), leakage factor (Lsigma), stator inductance (Ls) values are obtained.
Inertia Tuning	Determines the inertia value by rotating the motor at 1/3 of its sync speed (600 rpm), to forward and reverse directions.

Keypad operation for a rotating auto-tuning

Keypad display	Description	Tuning time
PAR▶ AutoTuneType 31 Rotational	At PAR_31, set the auto-tuning option to "Rotational".	-
PAR▶ IM AutoTune 41 ALL1 PAR▶ IM AutoTune 41 Enc Testing	At PAR_41, set auto-tuning mode to "ALL1". • Auto-tuning begins immediately, and a test is performed to check the encoder wiring connections by rotating the motor at 1,500 rpm in the forward direction.	30–35 sec
PAR▶ IM AutoTune 41 Rs Tuning	Determines motor stator resistance without rotating the motor.	10–20 sec
PAR▶ IM AutoTune 41 sL Tuning	Determines motor leakage factor without rotating the motor.	5–20 sec

Keypad display	Description	Tuning time
PAR▶ IM AutoTune 41 If Tuning	Determines flux current by rotating the motor at 1,500 rpm.	30–60 sec
PAR▶ IM AutoTune 41 Ls Tuning	Determines stator inductance by rotating the motor at 1,500 rpm.	50–60 sec
PAR▶ IM AutoTune 41 Tr Tuning	Determines rotor time constant after accelerating and decelerating the motor multiple times. Elapsed time may vary each time it is performed. Abrupt accelerations and decelerations are required to find an optimal rotor time constant. Therefore, a braking resistor must be connected to the inverter when running an auto-tuning. Otherwise, overvoltage trip faults may occur during the tuning process.	20–60 sec
PAR▶ IM AutoTune 41 None PAR▶ IM AutoTune 41 [] [] Error	After obtaining the values required, PAR_41 is automatically changed to “None” to stop auto-tuning. Error message will be displayed if correct values cannot be obtained. If this happens, ensure that all the motor and encoder parameters were entered correctly, and then repeat the auto-tuning procedure. If an error message persists, stop the auto-tuning procedure and contact LS ELECTRIC technical service: www.lselectric.co.kr	Total time elapsed: 3–5 min

6.2.4.3 Running static auto-tuning for induction motors

Preparation

Before running a static auto-tuning, fix the motor axis so that it won't move during the auto-tuning. Accurate values can be obtained only when the motor axis is in a static condition.

Setting the parameters for auto-tuning

Code	Keypad display	Name	Range	Setting
PAR_31	AutoTuneType	Auto-tuning options	0 (Rotational) 1 (StandStill)	1 (StandStill)
PAR_41	IM AutoTune	Induction motor auto-tuning option	0 (None) 1 (ALL1) 4 (Rs Tuning) 5 (Lsigma) 8 (If/Tr/Ls Tune)	0 (None)

The L100 inverter provides 4 different types of static auto-tuning. The "ALL1" type auto-tuning detects stator resistance (Rs), leakage factor (Lsigma), If, stator inductance (Ls), rotor time constant (Tr) - it does not perform a test on the encoder or an inertia tuning.

At PAR_41, each option (Rs Tuning, Lsigma, If/Tr/Ls Tune, Inertia Tuning) may be used to identify the individual value of the relevant parameter.

Auto-tuning type	Description
None	Do not perform auto-tuning.
ALL1	Performs auto-tuning in the order of Rs, Lsigma, and If/Tr/Ls tuning (test on the encoder is not performed).
Rs Tuning	Determines motor stator resistance without rotating the motor.
Lsigma	Determines motor leakage factor (Lsigma) without rotating the motor.
If/Tr/Ls Tune	Determines motor flux current, rotor time constant, and stator inductance at the same time by applying direct current to the motor, without rotating the motor axis.

Note

The FWD and REV operation indicators on the keypad flash simultaneously during auto-tuning.

Keypad operation for a static auto-tuning

Keypad display	Description	Tuning time
PAR▶ AutoTuneType 31 StandStill	At PAR_31, set the induction motor auto-tuning option to “StandStill”.	-
PAR▶ IM AutoTune 41 ALL1	At PAR_41, set auto-tuning mode to “ALL1”. Auto-tuning begins immediately.	-
PAR▶ IM AutoTune 41 Rs Tuning	Determines motor stator resistance without rotating the motor.	20–30 sec
PAR▶ IM AutoTune 41 Lsigma	Determines motor leakage factor without rotating the motor.	5–10 sec
PAR▶ IM AutoTune 41 If/Tr/Ls Tune	Determines motor flux current, rotor time constant, and stator inductance at the same time by applying direct current to the motor, without rotating the motor axis.	15–60 sec
PAR▶ IM AutoTune 41 None PAR▶ IM AutoTune 41 [] [] Error	After obtaining the values required, PAR_41 is automatically changed to “None” to stop auto-tuning. If correct values cannot be obtained, and error message will be displayed. If this is the case, ensure that all the motor and encoder parameters were entered correctly, and then repeat the auto-tuning procedure. If an error message persists, stop the auto-tuning procedure and contact LS ELECTRIC technical service: www.lselectric.co.kr	Total time elapsed: 1–2 min

6.2.4.4 Detecting the initial pole position of a synchronous motor

The following table explains the parameter setting for initial pole position detection which is required for operating a synchronous motor. The result can be viewed at DIS_08.

Code	Keypad display	Name	Range	Unit	Setting
PAR_43	DetAve Num	Number of detections for average	1–30		5
PAR_44	MagDet Volt	Pole position detection voltage	5–200	V	80
PAR_45	MagDet Curr	Pole position detection current	10–150	%	70

Preparation

If this is the first pole position detection, and if PAR_23 (Enc Type) is set to “A/B Pulse,” follow the steps listed below.

Note

If PAR_23 (Enc Type) is set to “EnDat,” “Sin/Cos_All,” or “Sin/Cos_1387,” refer to the instruction manual that is supplied with the Sin/Cos EnDat encoder add-on module.

1. Set the speed reference to “0 (rpm)”.
2. Keep the brake in the held position during operation.
3. Check the initial angle detected on the keypad (DIS_08), and then stop the operation.
4. Repeat step 3 for 5 times.
5. Initial pole position detection is successful if the difference of the angles displayed at DIS_08 is less than 5 degrees. If the difference is more than 5 degrees, repeat the steps 1 through 5 after adjusting PAR_44 (Pole detection voltage) and PAR_45 (Pole detection current).

Number of detections for average (PAR_43)

PAR_43 is used to set the number of detections for calculating the average. It is recommended to use the default setting for PAR_43. Using lower setting values shortens the elapsed time for pole detection, but it may result in lower credibility.

Note

Some motors require higher setting values than the default setting for accurate pole position detection.

Pole position detection voltage (PAR_44) and current (PAR_45)

PAR_44 and PAR_45 are used to configure the voltage and current for pole position detection. When detecting the pole position, lower voltage decreases the noise. The current level for PAR_45 is set as a percentage of the motor's rated current (PAR_19).

6.2.4.5 Running static auto-tuning for synchronous motors

Preparation

Before running a static auto-tuning, fix the motor axis so that it won't move during auto-tuning. Accurate values can be obtained only when the motor axis is in a static condition.

Setting the parameters for auto-tuning

Code	Keypad display	Name	Range	Unit	Setting
PAR_31	AutoTuneType	Auto-tuning options	0 (Rotational) 1 (StandStill)	-	1 (StandStill)
PAR_43	DetAve Num	Number of detections for average	1–30		5
PAR_44	MagDet Volt	Pole position detection voltage	5–200	V	80
PAR_45	MagDet Curr	Pole position detection current	10–150	%	70

Code	Keypad display	Name	Range	Unit	Setting
PAR_51	PM AutoTune	Auto-tuning options for synchronous motors	0 (None) 1 (All) 2 (RsTuning) 3 (Ld/Lq Tuning) 4 (Mag Pole Det)	0 (None)	

Static auto-tuning is used for synchronous motors to obtain the motor's stator resistance (Rs), d/q-axis inductance (Ld, Lq), and the initial pole position.

Auto-tuning type	Description
None	Do not perform auto-tuning.
ALL	Determines motor stator resistance and d/q-axis inductance (Ld, Lq) without rotating the motor.
Rs Tuning	Determines motor stator resistance without rotating the motor.
Ld/Lq Tuning	Determines motor d/q-axis inductance (Ld, Lq) without rotating the motor.
Mag Pole Det	Estimates initial pole position of the synchronous motor.

Note

The FWD and REV operation indicators on the keypad flash simultaneously during auto-tuning.

Keypad operation for a static auto-tuning for a synchronous motor

Keypad display	Description	Tuning time
PAR▶ AutoTuneType 31 StandStill	When auto-tuning synchronous motors, only "Standstill" option is available.	-

Keypad display	Description	Tuning time
PAR▶ PM AutoTune 51 ALL	Determines motor stator resistance and d/q-axis inductance (Ld, Lq) without rotating the motor.	Approximately 90 sec
PAR▶ PM AutoTune 51 Rs Tuning	Determines motor stator resistance without rotating the motor.	Approximately 30 sec
PAR▶ PM AutoTune 51 Ld/Lq Tuning	Determines motor d/q-axis inductance (Ld, Lq) without rotating the motor.	Approximately 60 sec
PAR▶ PM AutoTune 51 Mag Pole Det	Estimates initial pole position of the synchronous motor by applying DC current, without rotating the motor.	Approximately 5 sec
PAR▶ PM AutoTune 51 None PAR▶ PM AutoTune 51 [] [] Error	After obtaining the values required, PAR_51 automatically changes to “None” to stop auto-tuning. Error message will be displayed if correct values cannot be obtained. If this happens, ensure that all the motor and encoder parameters were entered correctly, and then repeat the auto- tuning procedure. If an error message persists, stop the auto-tuning procedure and contact LS ELECTRIC technical service: www.lselectric.co.kr	Total time elapsed: 1–2 min

ⓘ Caution

Make sure to perform an auto-tuning before operating a synchronous motor with an inverter. Parameter values related to a synchronous motor and its initial pole position may affect the inverter’s control ability.

6.2.4.6 Motor constant

Auto-tuning ensures that correct motor parameters are used for operation. The following table lists motor parameters required for proper operation.

For induction motors, the default parameter values are set based on Higen vector motors. For synchronous motors, there are no preset default values.

If a synchronous motor is connected to the inverter, use the values provided by the manufacturer, or use the parameter values obtained from an auto-tuning.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_52	Flux-Curr	Motor flux current	0.0–70% of motor rated current	A	Varies by motor capacity (Induction motor)
PAR_53	Tr	Rotor time constant	30–3000	ms	
PAR_54	Ls	Motor inductance	0.00–500.00	mH	
PAR_55	Lsigma	Motor leakage factor (Lsigma)	0.00–300.00	mH	
PAR_56	Rs	Motor stator resistance	0.000–15.000	ohm	Varies by motor capacity (Induction/synchronous motor)
PAR_57	Inertia J	Motor inertia factor	0.001–60.000	kg·m^2	Varies by motor capacity (Induction motor)
PAR_58	Ld	Motor d-axis inductance	0.01–500.00	mH	Varies by motor capacity (Synchronous motor)
PAR_59	Lq	Motor q-axis inductance	0.01–500.00	mH	
PAR_60	Init Theta	Initial pole position	0–360	deg	

Note

- Press [STOP] anytime during auto-tuning to interrupt the process.
- If the encoder test fails during rotating auto-tuning of an induction motor, stator resistance (Rs) tuning is not performed and an error (“Encoder Err”) is displayed. If this happens, press [Reset] and run the encoder test again. Check the encoder for wiring errors and other faults if the encoder error persists.
- Rotor time constant (Tr) tuning may fail multiple times before it is performed successfully. Repeat the tuning process 2, 3 times if failure occurs.

6.2.4.7 Auto-tuning error messages

Keypad display	Description and solution
PAR▶ IM AutoTune 41 Enc Error	Occurs when the difference between the speed reference and the encoder feedback speed exceeds motor’s rated slip, or when the encoder phase A or B is open. Check the encoder power terminals (PE and GE) for proper connection to the A and B phases.
PAR▶ IM AutoTune 41 Enc AB Chgd	Occurs when the encoder’s phases A and phase B, or the motor’s phases U, V, W are connected in a wrong order. Check the wiring for correct wiring orders, or change the encoder direction to “B Phase Lead” at PAR_25.
PAR▶ IM AutoTune 41 Rs Error	Occurs when the detected motor stator resistance is out of the normal range of 0.002 –10Ω. Check the wiring between the inverter and the motor, or check if the motor has not been burnt. This error may occur when the motor capacity is too small for the inverter.
PAR▶ IM AutoTune 41 sL Error	Occurs when the detected motor leakage factor exceeds 100 mH. Check the wiring between the inverter and the motor, or check if the motor has not been burnt.
PAR▶ IM AutoTune 41 If Error	Occurs when the motor speed exceeds 1,650 rpm (on an 1,800 rpm motor) during flux current tuning, or when the inverter fails to detect the flux current for a long time. Check the motor pole number and the wiring condition between the inverter and the motor.

Keypad display	Description and solution
PAR▶ IM AutoTune 41 Ls Error	Occurs when the motor speed exceeds 1,650 rpm (on an 1,800 rpm motor) during stator inductance tuning, or when the inverter fails to detect the stator inductance for a long time. Check the motor pole number and the wiring condition between the inverter and the motor.
PAR▶ IM AutoTune 41 PAR 53 DOWN	Occurs if the motor time constant is set too long at PAR_52 during a rotor time constant tuning. Decrease the value at PAR_53 by 30% and try again.
PAR▶ IM AutoTune 41 PAR 53 UP	Occurs if the motor time constant is set too short at PAR_53 during a rotor time constant tuning. Increase the value at PAR_53 by 30% and try again.
PAR▶ PM AutoTune 51 Rs Error	Occurs when the detected synchronous motor stator resistance is out of the normal range of 0.002 –10Ω. Check the wiring between the inverter and the motor, or check if the motor has not been burnt. This error may occur when the motor capacity is too small for the inverter.
PAR▶ PM AutoTune 51 Ld/Lq Error	This error may occur when the motor capacity is too small for the inverter.

6.3 Digital input and output (DIO) group

6.3.1 Jump code (DIO_00)

DIO_00 is used to move directly to a code.

The following is an example of Jumping directly to DIO_05.

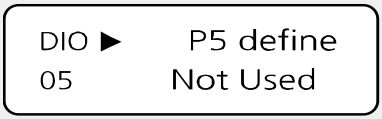
1 Press [PROG].

2 Press [SHIFT/ESC], [▲], or [▼] to change the code to DIO_05.

3 Press [ENT] to move directly to DIO_05.

Note

- If the code you entered is not available, then the closest code to it will be accessed.



- After the jump, you can press [▲] or [▼] to move to other codes.

6.3.2 Multifunction digital input terminal

6.3.2.1 Defining the multifunction digital input terminal P1–P7 (DIO_01–DIO_07)

Codes DIO_01 to DIO_07 are used to define the multifunction digital input terminals P1to P7. The following table lists the functions available for these multifunction digital input terminals.

Only one function may be assigned to one terminal at a time, and the setting cannot be changed during operation. If you try to assign a function to more than one terminal, the setting will not be saved on the second terminal, and its original function will be retained.

Multifunction terminal settings may not be changed during an operation, and their utilization may be restricted depending on the control mode set at PAR_07

No	Fault trips	Keypad display	PAR_07 Control Mode			
			Speed(IM)	V/F	Slip Comp	Speed (PM)
1	Speed-L	Multistep speed-L	O	O	O	O
2	Speed-M	Multistep speed-M	O	O	O	O
3	Speed-H	Multistep speed-H	O	O	O	O
10	Xcel-L	Multistep acc/dec-L	O	O	O	O
11	Xcel-H	Multistep acc/dec-H	O	O	O	O
13	Ext Trip-B	External trip B terminal	O	O	O	O
17	Timer Input	Timer input	O	O	O	O
19	ASR Gain Sel	ASR gain switching	O	X	X	O
22	PreExcite	Pre-excitation	O	X	X	X
25	Use Trq Bias	Use torque bias	O	X	X	O
26	A3 Safety	Use auxiliary reference	O	O	O	O

No	Fault trips	Keypad display	PAR_07 Control Mode			
			Speed(IM)	V/F	Slip Comp	Speed (PM)
29	Battery Run	Enable battery operation	O	O	O	O

Performing multistep speed (H, M, L) operations

When you set multifunction input terminals P1–P7 to “Speed-L”, “Speed-M”, or “Speed-H,” the combination of the terminal inputs is used as the speed reference to run the commands (multispeed 0–7) that are defined at codes FUN_12 through FUN_19.

When multifunction input terminal P1, P2, and P3 are set to Speed-L, Speed-M, and Speed-H respectively, the following operation becomes available.

Code	Keypad display	Name	Range	Unit	Parameter setting
DIO _01	P1 define	Define multifunction Input terminal P1 input	-	-	Speed-L
DIO _02	P2 define	Define multifunction input terminal P2 input	-	-	Speed-M
DIO _03	P3 define	Define multifunction input terminal P3 input	-	-	Speed-H

The following table lists the multistep speed by the combination of terminals P1, P2, and P3. If multispeed 0 is selected (terminals P1, P2, P3 are OFF), one of the three sources is used as the speed reference: Digital input set by the keypad (FUN_12: Speed 0), analog input at the terminal block, or network communication signal.

P1	P2	P3	Speed
OFF	OFF	OFF	Speed reference source set at FUN_02
ON	OFF	OFF	FUN_13 (Speed 1)
OFF	ON	OFF	FUN_14 (Speed 2)
ON	ON	OFF	FUN_15 (Speed 3)

P1	P2	P3	Speed
OFF	OFF	ON	FUN_16 (Speed 4)
ON	OFF	ON	FUN_17 (Speed 5)
OFF	ON	ON	FUN_18 (Speed 6)
ON	ON	ON	FUN_19 (Speed 7)

XCEL-L / XCEL-H

For details, refer to FUN_41–48 (Acceleration/Deceleration time 1–4).

Code	Keypad display	Description	Unit	Default setting
				2.2–37 kW
FUN_41	Acc Time-1	Acceleration time 1	sec	2.00
FUN_42	Dec Time-1	Deceleration time 1	sec	2.00
FUN_43	Acc Time-2	Acceleration time 2	sec	3.00
FUN_44	Dec Time-2	Deceleration time 2	sec	3.00
FUN_45	Acc Time-3	Acceleration time 3	sec	4.00
FUN_46	Dec Time-3	Deceleration time 3	sec	4.00
FUN_47	Acc Time-4	Acceleration time 4	sec	5.00
FUN_48	Dec Time-4	Deceleration time 4	sec	5.00

External fault trip signal terminal B (Ext Trip-B)

When this function is set, if the signal is turned off during an operation, the inverter turns off its output and performs a free-run stop. Inverter External fault trip signal at terminal B (Ext Trip-B) is displayed on the keypad, and the [STOP] indicator flashes.

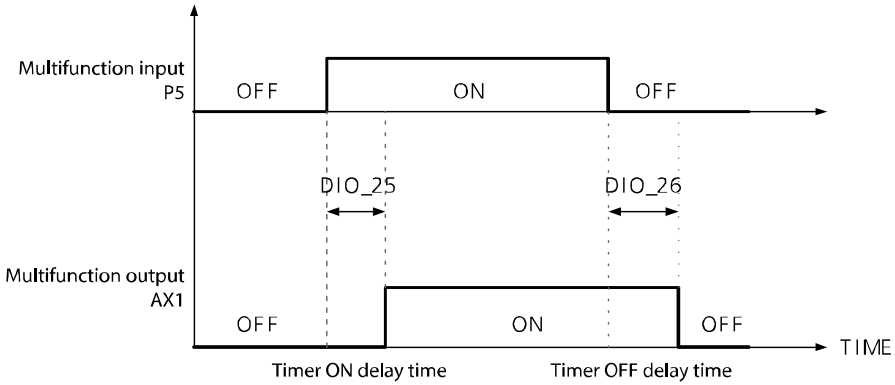
This function may be set to receive a latch-type external fault trip signal.

Timer input

When multifunction input terminals P1–P7 are set to receive timer input signal, “Timer ON delay time (DIO_25)” and “Timer OFF delay time (DIO_26)” may be defined and applied to the inverter output.

The following is an example when DIO_05 (multifunction input terminal P5) is set for timer input, and DIO_11 (AX1, multifunction aux output terminal) is set for timer output.

Code	Keypad display	Name	Range	Unit	Parameter setting
DIO_05	P5 Define	Define multifunction input terminal P5	-	-	Timer Input
DIO_11	AX1 Define	Define multifunction auxiliary output terminal AX1	-	-	Timer Out
DIO_25	TimerOn Dly	Timer ON delay time	0.1–3600.0	sec	-
DIO_26	TimerOff Dly	Timer OFF delay time	0.1–3600.0	sec	-



ASR gain switching (ASR Gain Sel)

The speed PI controller uses one of the two P/I gain combinations depending on the ASR gain switching option (“ASR Gain Sel”) that are set at the multifunction input terminals.

The following is an example where multifunction input terminal P5 is set for the ASR gain switching.

Code	Keypad display	Name	Range	Unit	Parameter setting
DIO_05	P5 Define	Define multifunction input terminal P5			ASR Gain Sel
CON_03	ASR P Gain1	Speed controller proportional gain 1	0.1–500.0	%	P5: OFF
CON_04	ASR I Gain1	Speed controller integral time 1	0–50000	ms	
CON_05	ASR LPF1	Speed controller input LPF time constant 1	0–20000	ms	
CON_06	ASR P Gain2	Speed controller proportional gain 2	0.1–500.0	%	P5: ON
CON_07	ASR I Gain2	Speed controller integral time 2	0–50000	ms	
CON_08	ASR LPF2	Speed controller input LPF time constant 2	0–20000	ms	

Pre-excitation (PreExcite)

In pre-excitation, a voltage is supplied to the motor stator and generates a magnetic field inside the motor before it operates. The addition of flux to the motor’s stator prepares the motor and enhances its acceleration response.

Set a multifunction input terminal to “PreExcite” to enable pre-excitation. While a pre-excitation signal is input, no-load current is provided to the motor to create a flux.

Torque bias options (Use Trq Bias)

When a multifunction input (P1–P7) is set to “Use Trq Bias”, torque bias is applied to the operation whenever the relevant input terminal is turned ON. To disable torque bias (“0”), turn OFF the signal to the terminal.

Set CON_37 (Trq Bias Src) to define the input source (terminal or location).

Code	Keypad display	Name	Range	Setting value
CON_37	Toq Bias Src	Input source for torque bias	None	Disable use of torque bias.
			Analog	AIO_01 (Ai1 Define): “Torque Bias” AIO_02 (Ai1 Source): “0–10V” (voltage input at V1 terminal) AIO_06 (Ai1 Out Y2): “200%” CON_40 (Trq Bias): “100%”
			Keypad	Use the setting at CON_38 (Trq Bias)
			CAN	Use the setting for CAN option

Caution

The setting at CON_37 alone can enable the torque bias without additional input if multifunction terminals are not configured as the input source (Use Trq Bias).

A3 safety terminal

You can set one of the multifunction input terminals to receive “A3 Safety” signal. Signal to the input enables or disables the PWM output of the inverter.

For more details, refer to *6.8 Protection (PRT) group* on page *275*.

Operation by battery power (Battery Run)

When the inverter is used to operate elevators, battery power may be used as the emergency power source if power failure occurs during elevator operation.

For more details, refer to *6.5.10 Setting the operation speed and input voltage for battery operation* on page *234*.

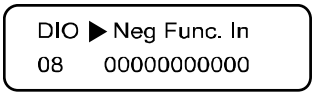
6.3.2.2 Reversing the multifunction terminal input (DIO_08)

Multifunction input terminals are “Form A” contacts by default. The DIO_08 parameter is used to change the contact type to “Form B” by setting the binary code for each terminal to “1.”

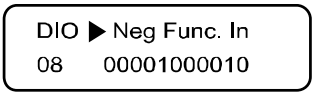
When the contact type for a terminal is changed, the setting is maintained until it is modified again by the user.

Note that setting the external trip B terminal to a “Form B” contact makes it work as the external trip A terminal.

On the keypad display, the binary digits as they appear from left to right represent the contact type for the FX, RX, BX, RST, P1, P2, P3, P4, P5, P6, and P7 terminals.



[P1-P7: Form A contact]



[P1, P6: Form B contact]

6.3.2.3 Setting the LPF (Low pass filter) time constant for terminal input (DIO_09)

The low pass filter is used to reduce the level of electronic signal interference. The setting at DIO_09 configures the responsiveness of the input terminals (FX, RX, BX, RST, and P1–P7). Increasing the time constant decreases the responsiveness of the input terminal and decreasing it increases the responsiveness. The approximate response time of a terminal can be calculated by: Setting value × 2.5 ms

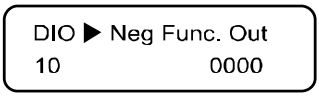
6.3.3 Multifunction digital output terminal

6.3.3.1 Reversing the multifunction auxiliary output terminals (DIO_10)

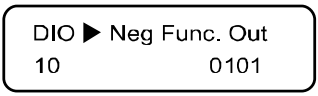
Multifunction auxiliary output terminals are “Form A” contacts by default. The DIO_10 parameter is used to change the contact type to “Form B” by setting the binary code that corresponds to the terminal to “1.”

When the contact type for a terminal is changed, the setting is maintained until it is modified again by the user.

On the keypad display, the binary digits as they appear from left to right represent the contact type for the AX1, AX2, AX3, and AX4 terminals.



[AX1 - AX4: Form A contact]



[AX1, AX3: Form B contact]

6.3.3.2 Setting the multifunction auxiliary output terminals (DIO_11–14)

Codes DIO_11 to DIO_14 are used to assign functions to the multifunction auxiliary output terminals. Once the conditions are met for the functions, outputs are made at the corresponding terminals.

No.	Parameter setting	Description	No.	Parameter setting	Description
1	INV Ready	Inverter ready	13	Trq Lmt Det. Note 1)	Torque limit detection
2	Zero Spd Det Note 1)	Zero-speed detection	14	OverLoad	Overload warning
3	Spd Det.	Speed detection	15	Stop	Stop operation in progress
4	Spd Det(ABS)	Speed detection (non-polar)	16	MC on/off	MC signal output
5	Spd Arrival	Reference speed	17	FAN Status	Fan failure status

No.	Parameter setting	Description	No.	Parameter setting	Description
		reached			
6	Timer Out	Timer output	18	ALLS Status	ALLS operation status
7	LV Warn	Low voltage warning	19	Steady	Steady operation
8	Run	In operation	20	Brake Output	Brake output
9	Regenerating	Regeneration in progress	21	BFR/NFR Mode Note2)	Refer to the User Manual provided with ELIO add-on module.
10	INV OH Warn	Inverter overheat warning	22	BFR/NFR End Note2)	
11	Speed Agree Note 1)	Speed agreement	23	E/L Fault Note 2)	
12	Trq Det. Note 1)	Torque detection			

Note 1) Available in “Speed(IM)” or “Speed (PM)” control modes only.

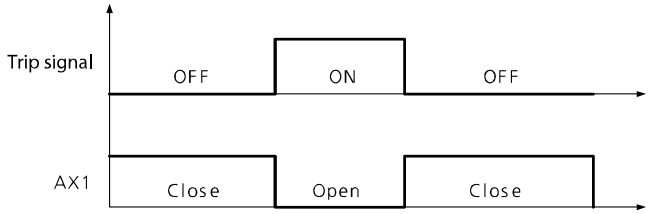
Note2) Displayed only when ELIO add-on module had been installed and PAR_08 is set to “Elevator.”

Not Used

This setting is used to disable the multifunction digital output.

INV Ready

This setting allows the multifunction terminal to output a signal to inform the user that the inverter is ready for operation. The output circuit opens when a fault trip occurs.



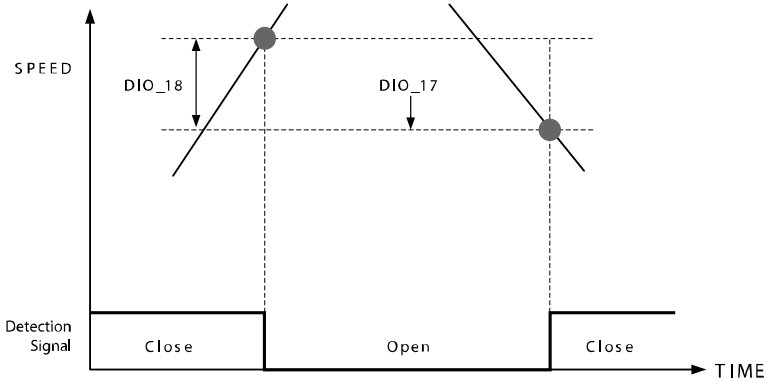
The “INV Ready” signal is output during a run on battery power as well. When the inverter is running on battery, the inverter is still operable although the DC_Link voltage is low.

Zero Spd Det

This setting is used to detect the motor's zero-speed.

Code	Keypad display	Name	Range	Unit	Default setting
DIO_17	ZSD Level	Zero-speed detection level	0.0–480.0	rpm	10
DIO_18	ZSD Band	Zero-speed detection band	0.1–10.0	%	0.5

The setting value for DIO_18 (ZSD Band) is expresses in a percentage of the motor's maximum speed (PAR_11).

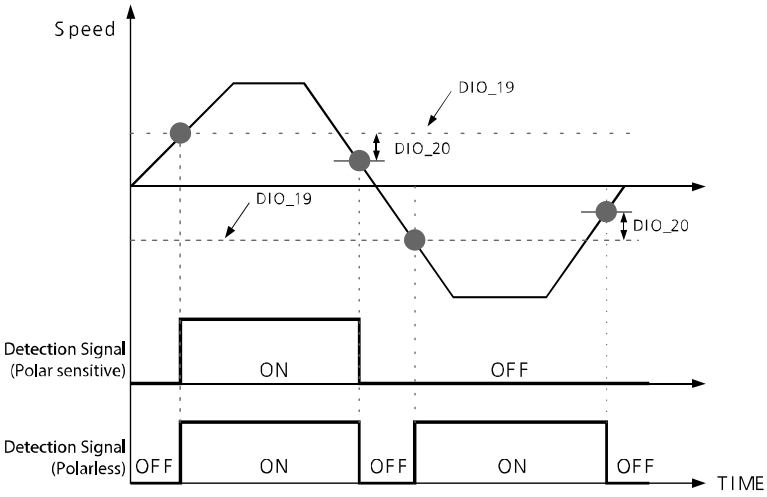


Spd Det. / Spd Det. (ABS)

This setting is used to detect a certain motor speed. Depending on the setting, the detection speed may either be non-polar or polar sensitive.

Code	Keypad display	Name	Range	Unit	Default setting
DIO_19	SD Level	Speed detection level	-PAR_11-PAR_11	Hz /rpm	0
DIO_20	SD Band	Speed detection band	0.1–10.0	%	0.5

The setting value for DIO_20 (SD Band) is expresses in a percentage of the motor's maximum speed (PAR_11).



Reference speed acquisition (Spd Arrival)

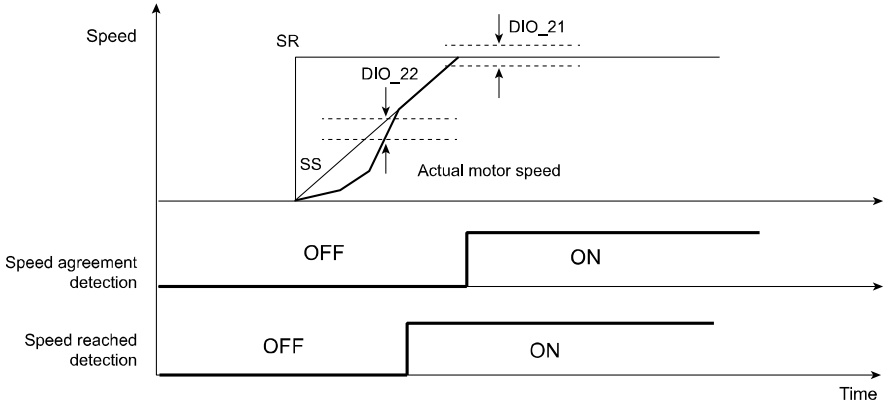
This setting is used to detect if the motor speed has reached its speed reference.

Code	Keypad display	Name	Range	Unit	Default setting
DIO_21	SA Band	Reference speed reached detection band	0.1–10.0	%	0.5

Reference speed agreement (Spd Agree)

This setting is used to detect if the motor speed deviates from the reference during acceleration or deceleration.

Code	Keypad display	Name	Range	Unit	Default setting
DIO_22	SEQ Band	Speed agreement band	0.1–10.0	%	0.5

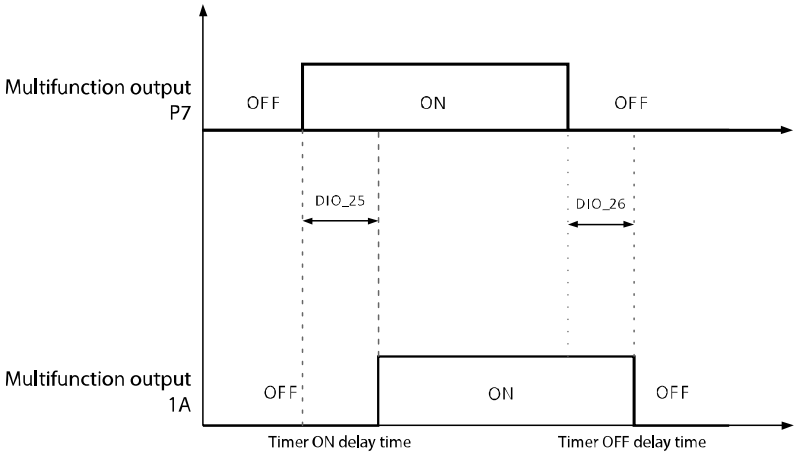


Timer output

This setting is used to assign a timer output function to one of the multifunction output terminals. DIO _25 (timer ON delay time) and DIO _26 (timer OFF delay time) are used to set the delay time for this output signal.

The following table lists an example of multifunction input and output terminal settings when DIO_07 is set as the timer input and DIO_08 is set as the timer output, and the diagram below explains the inverter operation.

Code	Keypad display	Name	Range	Unit	Parameter setting
DIO_07	P7 Define	Define multifunction input terminal P7			Timer Input
DIO_11	AX1 Define	Define multifunction auxiliary output terminal AX1 (A1, C1)			Timer Out
DIO_25	TimerOn Dly	Timer ON delay time	0.1–3600.0	sec	0.1
DIO_26	TimerOff Dly	Timer OFF delay time	0.1–3600.0	sec	0.1



LV Warn

This setting is used to output a signal when the inverter's DC link voltage drops below the low voltage limit.

Run

This setting is used to output a signal during inverter operation.

Regenerating

This setting is used to output a signal when regeneration is in progress. This setting is not available when the control mode is set to "V/F," or "Slip Comp".

Inv OH Warn

This setting is used to output a signal when the inverter is overheated. Refer to *6.8.12 Inv OH Warn* on page *287* for more information.

Trq Det.

This setting is used to detect a certain torque.

Code	Keypad display	Name	Range	Unit	Default setting
DIO_23	TD Level	Torque detection level	0.0–250.0	%	0.0
DIO_24	TD Band	Torque detection band	0.1–10.0	%	0.5

Trq Lmt Det

This setting is used to detect the torque limit output by the speed controller.

Stop

This setting is used to output a signal when the inverter is in a stop state.

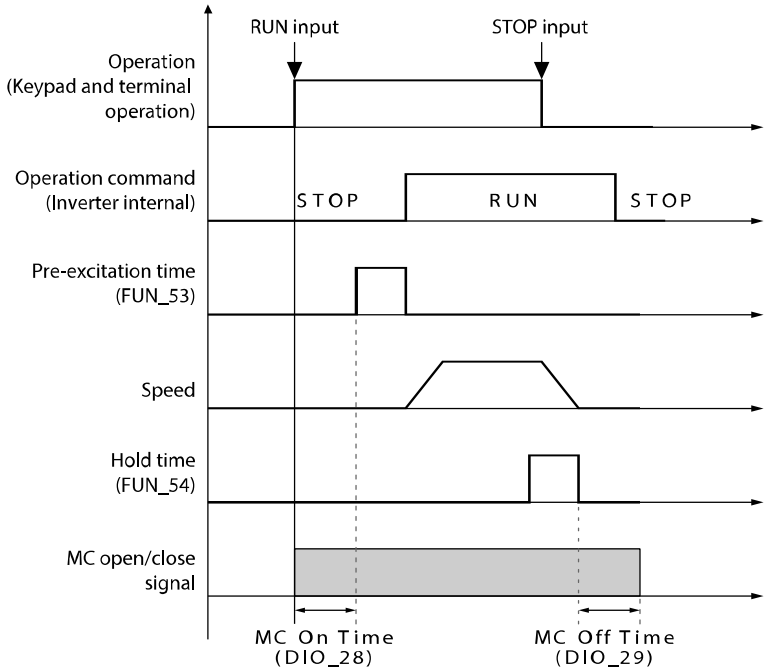
Controlling magnetic contactors (MC On/Off)

The DIO group controls settings for the magnetic contactor (MC) when an MC is installed and utilized on the inverter output. The MC settings ensure that the MC is engaged (ON) before the inverter starts the operation and disengaged (OFF) after the inverter completes the operation.

The FWD and REV indicators flash when the “MC On Time,” and “MC Off Time” commands are being used.

The following table lists the time setting values available for the MC on/off control. When this function is not used, the delay times are automatically set to “0” (MC On Time=0, MC Off Time=0).

Code	Keypad display	Name	Range	Unit	Default setting
DIO_28	MC On Time	MC on delay time	100–50000	ms	1000
DIO_29	MC Off Time	MC off delay time	100–50000	ms	1000



Caution

Do not operate magnetic contactors (On or Off) while the inverter is operating. Inverter protection features may be operated, resulting in interruption of inverter and elevator operation.

FAN Status

This setting is used to output a signal when a fan warning is turned on, or a fan failure occurs. Refer to *6.8.15 Fan fault* on page *289* for more information.

ALLS Status

This setting is used to output a signal when the inverter is running an ALLS operation.

Steady

This setting is used to output a signal when the inverter is operating at a fixed speed.

Brake Output

This setting is used to output brake on (engaged) or brake off (released) signals.

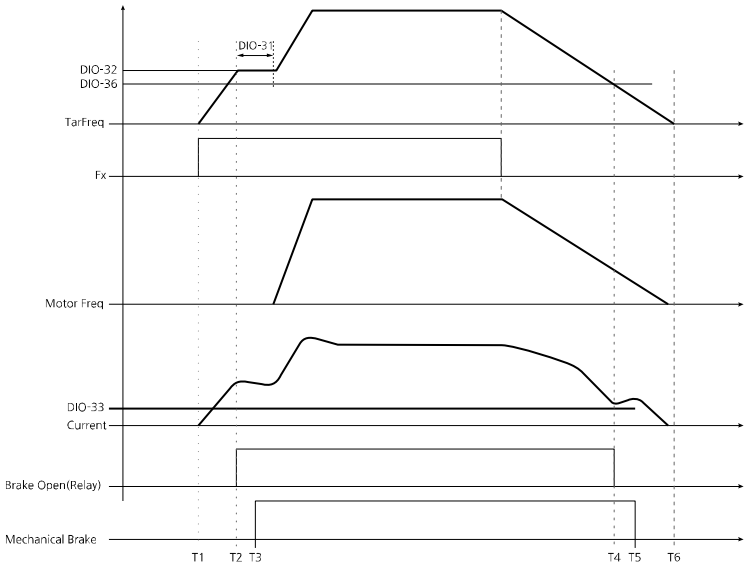
Code	Keypad display	Name	Range	Unit	Default setting
FUN-03	Stop mode	Stop options	0 (Decel) 1(Free-run) 2 (Dc-brake)		0 (Decel)
FUN-06	DcBr Freq	DC braking frequency	PAR_12– PAR_11	Hz	5.00
FUN-07	DcBlk Time	PWM output block time before DC braking	0–6000	ms	0
FUN-08	DcBr Value	DC braking value	0–200	%	10
FUN-09	DcBr Time	DC braking time	0.1–60.0	sec	1.0
FUN_10	Dcst Value	DC amount at start-up	0–200	%	10
FUN_11	Dcst Time	DC braking time at start-up	0.0–60.0	sec	60.0
DIO-30	BK On Delay	Brake output on delay time	0.0 – (FUN_11 - 0.1)	sec	0.0
DIO-34	BK Off Delay	Brake output off delay time	0.0 – (FUN_09 - 0.1)	sec	0.0
DIO_11– DIO_13	AX1/Ax2/AX3/ AX4 Define	Define multifunction output terminal	0–21 (Brake Output)		0 (Not Used)
DIO-31	BKOpen Time	Brake open time	0.01–30.00	ms	0.01
DIO-32	BKOpen Spd	Brake open speed	PAR_12- 50.00/ 0.0-500.0	Hz /rpm	0.50/0.0

Code	Keypad display	Name	Range	Unit	Default setting
DIO-33	Release Curr	Brake release current	0.0–150.00	%	20.0
DIO-36	BKClose Spd	Braking closing speed	PAR_12-50.00/ 0.0-500.0	Hz /rpm	0.50/0.0
FUN-53	PreExct Time	Motor pre-excitation time	0–10000	ms	0
FUN-54	Hold Time	Hold time	10–10000	ms	1000

Note

DIO_33 (brake release current) value is expressed in a percentage to the motor's rated current.

Braking operation in "V/F" and "slip compensation" modes

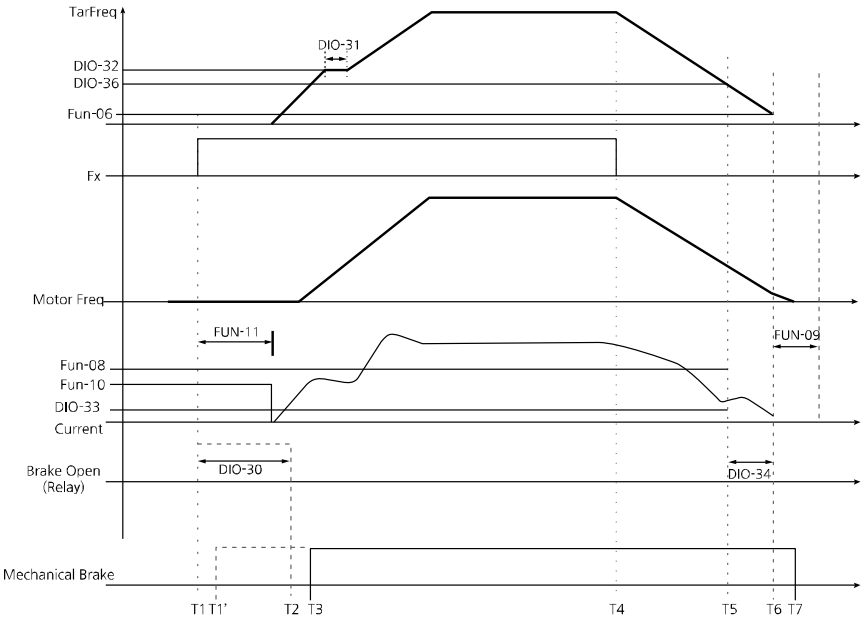


When a forward operation command is given at T1 on the timeline, if the output frequency is greater than the brake open speed set at DIO-32, and if the output

current is greater than the value set at DIO-33, the brake open signal is output (T2 on the timeline). From there on, the frequency is maintained for the time set at DIO-31, and then the acceleration continues to the frequency reference.

- The mechanical brake is disengaged slightly later at T3 on the timeline. Mechanical brakes in general have slight delays when they operate.
- During deceleration, if the output frequency reaches the brake close (engage) level set at DIO-36, and if the output current is greater than the 90% of value set at DIO-33, the break open signal is turned off (T4).
- The mechanical brake is engaged at T5 due to the mechanical delay.

Braking operation in "V/F," or "slip compensation+ DC start" and "DC braking" modes



If DIO_30 (BK On Delay) is not set, a brake open signal is sent as soon as an operation command is sent (T1 on the graph above).

DIO_30 (BK On Delay) can be set to delay the brake open time from T1 to T2

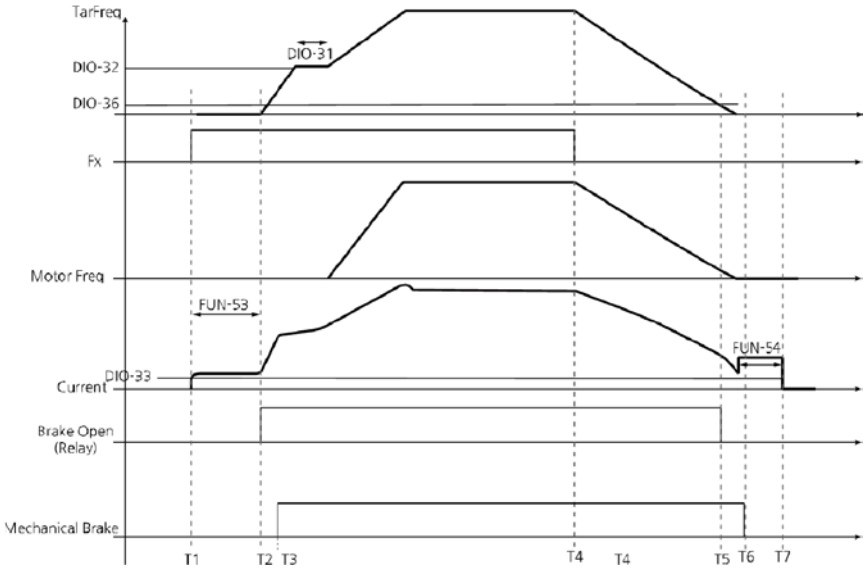
when the output current is greater than the value set at DIO_33. This can be used to enable the brake to open at the end of the DC start phase. Or, at any stage after the elevator is in a position that it will not descend from if the brake is disengaged.

- When an operation command is received, the inverter provides the amount of DC current set at FUN_10 (DcSt Value) for the time set at FUN_11. Then, the inverter accelerates until it reaches the speed set at DIO_32 (BK Open Speed), maintains the speed for the time set at DIO_31, and accelerates again until the frequency reference is reached.
- When the operation command is turned off, the inverter decelerates (T4). If the output frequency reaches the brake close speed set at DIO_36 (BKClose Spd)and if the current exceeds 90% of the brake release current set at DIO_33, the brake open signal stops (T5 on the graph).

DIO_34 (BK Off Delay) can be used to adjust the brake opening time. The brake open signal OFF time can be adjusted from T5 to T6 on the graph.

- When the inverter output frequency reaches the frequency set at FUN_06, the inverter output is blocked for the time set at FUN_07. Then, the amount of DC current set at FUN_08 is applied for the time set at FUN_09.
- If the DC braking frequency exceeds the frequency during brake closing, the DC braking value set at DIO_36 (BK Close Spd) is applied when the brakes are closed. If the brake closing frequency exceeds the DC brake frequency, a brake close signal is sent when the frequency set at DIO_36 (BK Close Spd) is reached, and DC braking is applied at the frequency set at FUN_06 (Dcbr Freq).

Braking operation in “Speed(IM)” mode



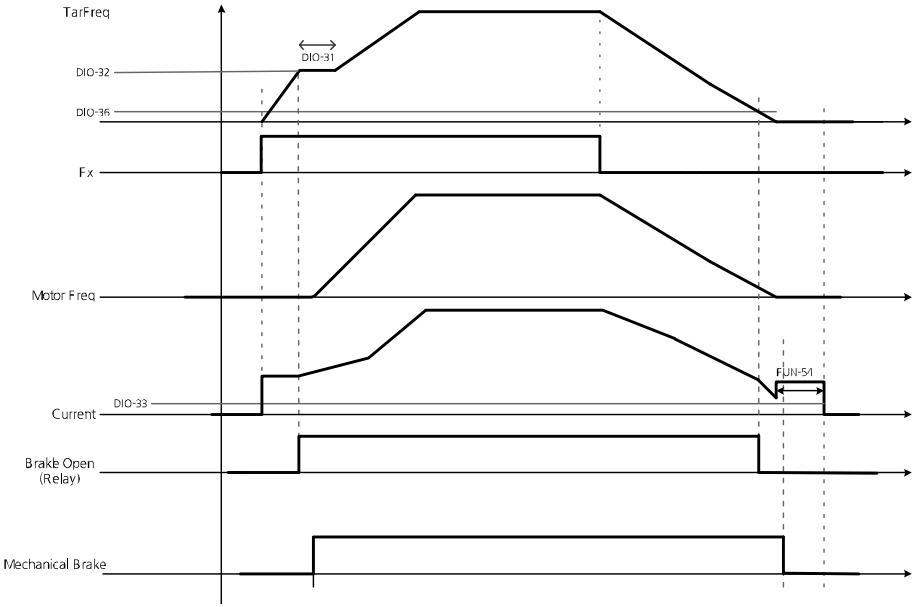
When an operation command is received at T1, the inverter supplies flux current to the motor for the time set at FUN_53.

A brake open signal is received when the output current is greater than the amount set at DIO_33 at T2, and after a mechanical delay, the brakes are released at T3 as illustrated in the graph above.

- When the inverter’s output frequency reaches the frequency set at DIO_32, the frequency is maintained for the time set at DIO_31. Then, the motor accelerates until it reaches the frequency reference. Once the frequency reference is reached, the inverter maintains the speed and continues to operate.
- When the operation command is turned off, the inverter decelerates at T4 as illustrated in the graph above. If the output frequency reaches the brake closing frequency set at DIO_36 (BKClose Spd) and the current exceeds 90% of the brake release current set at DIO_33, the brake signal is turned off at T5 in the graph above. The brakes are applied until T6 because of mechanical delay.

- When the inverter output frequency is “0,” the inverter is operated at zero-speed for the time set at FUN_54 (Hold Time) and fully stops at T7 as illustrated in the graph above.

Braking operation in “Speed(PM)” mode



The basic braking operation in “Speed(PM)” mode is identical to that used in “Speed(IM)” mode, with one exception. Pre-excitation is not required because synchronous motors do not require the injection of flux current.

Caution

In the control mode other than “Speed(PM)”, brake open signal is forced to become Off if the output current becomes less than 90% of the set brake open current value even when the brake open signal is On and operating normally.

Fault output relay options (DIO_16)

Relays 30A, 30B, and 30 C receive fault output signals when the inverter has a fault. The individual bits can be set for low voltage and other inverter fault trip conditions.

Code	Keypad display	Name	Range	Unit	Default setting
DIO_16	Relay Mode	Fault relay mode (A, B, C terminals)	00–11		11

Code	Bit 1 (Inverter fault trip)	Bit 0 (LVT)
DIO_16	0/1	0/1

Bit	Setting	Description
Bit 0 (LVT)	0	No LVT output signal
	1	LVT output signal
Bit 1 (Inverter trip)	0	No inverter trip output signal
	1	Inverter trip output signal (excludes LVT)

6.4 Analog input and output (AIO) group

6.4.1 Jump code (AIO_00)

AIO_00 code is used to directly access a certain code.

The following is an example of jumping directly to AIO_13 from AIO_00 code.

4 Press [PROG].

5 Use [SHIFT/ESC], [▲], or [▼] to change the code number to “13”.

6 Press [ENT] to access code AIO 13. If an invalid code number is entered, the next available code number is automatically selected.



Note

After jumping directly to a code, you can move to other codes by pressing [▲] or [▼].

6.4.2 Multifunction analog input

6.4.2.1 Multifunction analog input terminals AIO_01–12 (settings, input options, minimum input, bias, maximum input, gain, low pass filter time constant, and lost command conditions for Ai1 [=V1])

Ai1 (V1) analog input terminal allows –10–10 V voltage inputs. It can be defined for one of the following.

Bit	Setting	Description
Speed Ref	Speed reference	The speed reference becomes ±100% of the motor's maximum speed when the input signal is ±10 V.
Torque Bias	Torque bias	The torque bias becomes ±100% of the motor's rated torque when the input signal is ±10 V. The available range is -250–250% of the motor's rated torque, depending on gain and bias settings.

Only one function may be assigned to one terminal at a time. If you try to assign a function to more than one terminal, the setting will not be saved on the second terminal, and its original function will be retained.

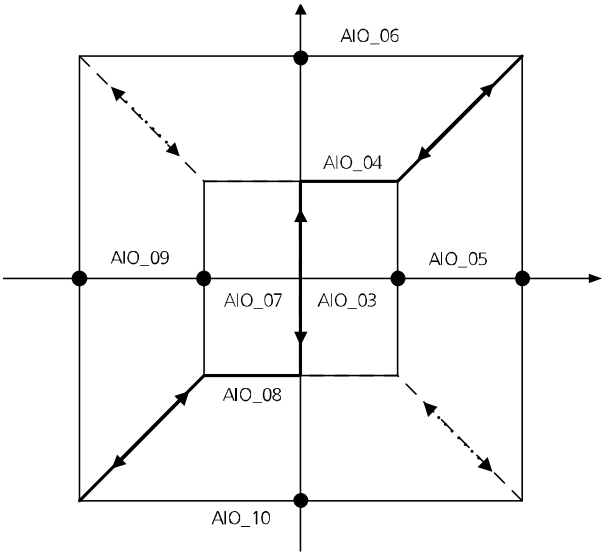
If an analog input terminal that was previously defined is defined again for another function, the previously set values will be initialized to "0".

The following table lists the functions available for multifunction analog input terminals.

Code	Keypad display	Function	Range	Unit	Description
AIO_01	Ai1 Define	Define multifunction analog input Ai1	0 (Not Used) 1 (Speed Ref) 6 (Torque Bias)		Defines types of multifunction analog input Ai1 (V1).
AIO_02	Ai1 Source	Input source for multifunction analog input Ai1	0 (0 – 10 V) 1 (10 – 0 V) 2 (-10 – 10 V) 3 (10 – -10 V)		Defines input options of multifunction analog input Ai1 (V1).
AIO_03	Ai1 In X1	Minimum value for multifunction analog input Ai1	AIO_07 –AIO_05	%	Sets the minimum amount of analog Input (based on 0 V input).
AIO_04	Ai1 Out Y1	Minimum input bias for multifunction analog input Ai1	AIO_08 –AIO_06	%	Defines the value set at AIO_01 based on the analog input at AIO_03
AIO_05	Ai1 In X2	Maximum input for multifunction analog input Ai1	0.00–100.00	%	Defines the maximum input value for analog input.
AIO_06	Ai1 Out Y2	Maximum input gain for multifunction analog input Ai1	0.00–250.00	%	Defines the value set at AIO_01 based on the analog input at AIO_05.

Code	Keypad display	Function	Range	Unit	Description
AIO_07	Ai1 In -X1	Minimum negative input for multifunction analog input Ai1	AIO_09 –AIO_03	%	Defines the minimum negative value for the analog input (based on 0 V input).
AIO_08	Ai1 Out -Y1	Minimum negative input bias for multifunction analog input Ai1	AIO_10 –AIO_04	%	Defines the value set at AIO_01 based on the analog input at AIO_07.
AIO_09	Ai1 In -X2	Maximum negative input for multifunction analog input Ai1	-100.00–0.00	%	Defines the maximum negative value for the analog input.
AIO_10	Ai1 Out -Y2	Maximum negative input gain for multifunction analog input Ai1	-250.00–0.00	%	Defines the value set at AIO_01 based on the analog input at AIO_09.
AIO_11	Ai1 LPF	Ai1 input low-pass filter time constant	0–2000	ms	Defines the low-pass filter time constant for the analog input.
AIO_12	Ai1 Wbroken	Lost command for multifunction analog input Ai1	0 (None) 1 (Half of x1) 2 (Below x1)		Defines the lost command conditions for the analog input Ai1.

AIO_03 expresses the minimum voltage input that can be recognized by the inverter in a percentage to the maximum input voltage (10 V). For example, if AIO_03 is set to 20%, this stands for 2 V in voltage. If AIO_04 is set to 0%, any input to the analog input terminal that is smaller than 2 V is not regarded as an effective input.



<Analog input concept diagram>

AIO_03 is used to define the range of voltage input at the analog input terminals. In general, AIO_03 is set to 0%, and AIO_05 is set to 100%. However, for those analog input devices that generate chattering with 0% AIO_03 setting value, you may adjust the value to avoid the chattering.

When the main controller receives voltage input at the analog input terminal, inaccuracy of the analog input or output devices may create deviations in the signals. AIO_04 and AIO_06 are similar to bias and gain settings which are used to correct the deviation in the inverter's main controller. Codes AIO_07 through AIO_10 are identical to AIO_03 through AIO_06 in their functions, except that these codes are for negative analog input values.

As it is represented in the concept diagram, not only does the L100 inverter allow analog inputs in quadrant I & III, it also allows inputs in quadrant II & IV, depending on the settings at AIO_02. By defining codes AIO_03 through AIO_10, inputs expressed in broken lines become available.

6.4.2.2 Analog input terminals AIO_13–24 (settings, input options, minimum input, bias, maximum input, gain, low pass filter time constant, and lost command conditions for Ai2 [=I1])

Ai2 (I1) analog input terminal allows 0–20 mA current inputs.

The following table lists the functions available for analog input terminals.

Code	Keypad display	Function	Range	Unit	Description
AIO_13	Ai2 Define	Define analog input Ai2	0 (Not Used) 1 (Speed Ref)		Defines types of analog input Ai2 (I1)
AIO_14	Ai2 Source	Input source for analog input Ai2	0 (0 – 20 mA) 1 (20 – 0 mA)		Defines input options of analog input Ai2 (I1).
AIO_15	Ai2 In X1	Minimum value for analog input Ai2	0	%	Sets the minimum amount of analog Input (based on 0 mA input).
AIO_16	Ai2 Out Y1	Minimum input bias for analog input Ai2	0	%	Defines the speed based on the analog input at AIO_15
AIO_17	Ai2 In X2	Maximum input for analog input Ai2	100.00	%	Defines the maximum input value for analog input.
AIO_18	Ai2 Out Y2	Maximum input gain for analog input Ai2	100.00	%	Defines the speed based on the analog input at AIO_17
AIO_23	Ai2 LPF	Ai2 input low-pass filter time constant	0–2000	ms	Defines the low-pass filter time constant for the analog input.

Code	Keypad display	Function	Range	Unit	Description
AIO_24	Ai2 Wbroken	Lost command for analog input Ai2	0 (None) 1 (Half of x1) 2 (Below x1)		Defines the lost command conditions for the analog input Ai2.

AIO_15 expresses the minimum current input that can be recognized by the inverter in a percentage to the maximum input current (20 mA). For example, if AIO_15 is set to 20%, this stands for 4 mA in current. If AIO_15 is set to 0%, any input to the analog input terminal that is smaller than 4 mA is not regarded as an effective input.

AIO_15 is used to define the range of current input at the analog input terminals. In general, AIO_16 is set to 0%, and AIO_18 is set to 100%. However, for those analog input devices that generate chattering with 0% AIO_15 setting value, you may adjust the value to avoid the chattering.

When the main controller receives current inputs at the analog input terminals, inaccuracy of the analog input or output devices may create deviations in the signals. AIO_16 and AIO_18 are similar to bias and gain settings which are used to correct the deviation in the inverter's main controller.

6.4.2.3 Adjusting bias and gain using the keypad (Out Y1 and Out Y2)

Setting the bias at AIO_04 (Ai1 Out Y1)

Connect voltage or current input source to multifunction analog terminals V1 through GND, and set AIO_03 to 0%. Provide 0 V input, and then follow the instructions below to adjust analog input bias.

Key operation	Keypad display	Description
-	AIO ▶ Ai1 Out Y1 04 0.00%	Initial LCD display

Key operation	Keypad display	Description
PROG	AIO ▶ Ai1 0.18% 04 Bias 0.00%	Press [PROG]. The first line on the display shows the input/output ratio in a percentage, which is calculated at the controller. The second line shows the currently set bias value.
▲	AIO ▶ Ai1 0.00% 04 Bias 0.18%	To adjust the bias so that 0.00% output is made with 0 V input, press [▲] until 0.00% is displayed in the first line.
ENT	AIO ▶ Ai1 Out Y1 04 0.18%	After adjusting the bias, press [ENT] to save it.

Setting the gain at AIO_06 (Ai1 Out Y2)

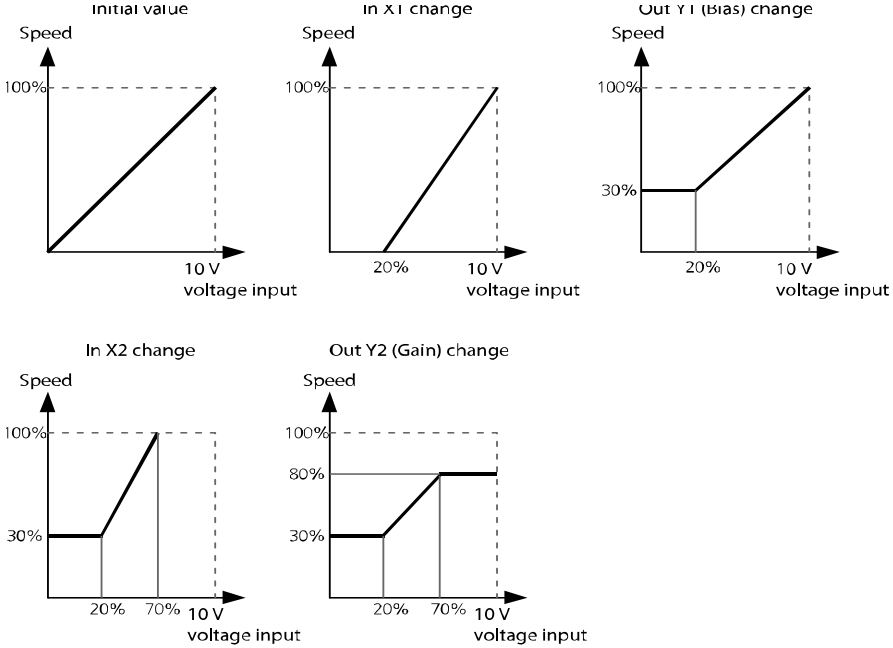
Connect voltage input source to multifunction analog terminals V1 through GND, and set AIO_05 to 100%. Provide 10 V input, and then follow the instructions below to adjust analog input gain.

Key operation	Keypad display	Description
-	AIO ▶ Ai1 Out Y2 06 100.00%	Initial LCD display
PROG	AIO ▶ Ai1 98.00% 06 Gain 100.00%	Press [PROG]. The first line on the display shows the input/output ratio in a percentage, which is calculated at the controller. The second line shows the currently set gain value.
▲	AIO ▶ Ai1 100.00% 06 Gain 102.00%	To adjust the gain so that 100.00% output is made with 10 V input, press the [▲] until 102.00% is displayed in the second line.

Key operation	Keypad display	Description
ENT	AIO ▶ Ai1 Out Y2 06 102.00%	After adjusting the gain, press [ENT] to save it.

You can set other analog input bias and gain values including codes AIO_08 and AIO_10 using the procedures as provided above.

For the multifunction analog inputs, if In X1 is set to 20%, In X2 to 70%, Out Y1 to 30%, and Out Y2 to 80%, the change in the outputs to 0–10 V analog inputs are as follows.



6.4.2.4 Lost command conditions for multifunction analog input Ai1 (AIO_12)

The following table lists lost command options available for multifunction analog input terminal V1.

Code	Keypad display	Function	Range	Unit	Description
AIO_12	Ai1 Wbroken	Lost command conditions for multi-function analog input Ai1	0 (None)		Do not use analog input lost command options.
			1 (half of x1)		Analog input lost command is decided when analog input based on AIO_02 (Ai1 source) is in the following range. 0 → 10 V: 0–(AIO_03 Ai1 In X1)/2 10 → 0 V: 0–(AIO_03 Ai1 In X1)/2 -10 → 10 V: (AIO_07 Ai1 -In X1)/2 – (AIO_03 Ai1 In X1)/2 10 → -10 V: (AIO_07 Ai1 -In X1)/2 – (AIO_03 Ai1 In X1)/2
			2 (Below x1)		Analog input lost command is decided when analog input based on AIO_02 (Ai1 source) is in the following range. 0 → 10 V: 0–(AIO_03 Ai1 In X1) 10 → 0 V: 0–(AIO_03 Ai1 In X1) -10 → 10 V: (AIO_07 Ai1 -In X1) – (AIO_03 Ai1 In X1) 10 → -10 V: (AIO_07 Ai1 -In X1) – (AIO_03 Ai1 In X1)

6.4.2.5 Lost command conditions for multifunction analog input Ai2 (AIO_24)

The following table lists lost command options available for multifunction analog input terminal I1.

Code	Keypad display	Function	Range	Unit	Description
AIO_24	Ai2 Wbroken	Lost command	0 (None)		Do not use analog input lost command options.

<table>
<tr><th>Code</th><th>Keypad display</th><th>Function</th><th>Range</th><th>Unit</th><th>Description</th></tr>
<tr><td></td><td></td><td rowspan="2">conditions for multi-function analog input Ai2</td><td>1 (half of x1)</td><td></td><td>Analog input lost command is decided when analog input based on AIO_14 (Ai2 source) is in the following range.<table><tr><td>0 → 20 mA</td><td>0–(AIO_15 Ai2 In X1)/2</td></tr><tr><td>20 → 0 mA</td><td>0–(AIO_15 Ai2 In X1)/2</td></tr></table></td></tr>
<tr><td>2 (Below x1)</td><td></td><td>Analog input lost command is decided when analog input based on AIO_02 (Ai1 source) is in the following range.<table><tr><td>0 → 20 mA</td><td>0–(AIO_15 Ai2 In X1)</td></tr><tr><td>20 → 0 mA</td><td>0–(AIO_15 Ai2 In X1)</td></tr></table></td></tr>
</table>

6.4.2.6 Multifunction analog input command lost command decision time (AIO_37 Time out)

AIO_37 (Time Out) is used to define the time values to make analog input lost command decisions. The inverter decides that the command is lost after the time set has been elapsed.

Code	Keypad display	Function	Range	Unit	Description
AIO_37	Time out	Multi-function analog input lost command decision time	0.1–120.0	sec	If the conditions for multifunction analog input lost command is met, and is maintained for the set time, the inverter decides that the command is lost.

The lost command decision time set at AIO_37 applies to analog input terminal parameters at AIO_12 and AIO_24. When multifunction analog input is lost, the inverter performs a deceleration stop or a free-run stop according to the parameter setting at AIO_38.

6.4.2.7 Operation when multifunction analog input command is lost (AIO_38 Ai Lost Comm)

AIO_38 is used to define the inverter operation when the analog input command is lost. If the lost command conditions are met, and if the condition is maintained

for the time set at AIO_37 (Time Out), the inverter decides that the analog input command is lost.

For multifunction analog input lost command conditions and the decision time, refer to *6.4 Analog input and output (AIO) group* on page *194*.

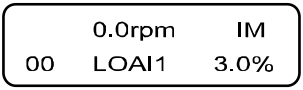
If the inverter operation is stopped due to a lost command, the inverter does not restart automatically when the lost command condition is released. If the inverter is run by terminal block inputs, the forward operation command must be turned off, and then turned on again for the operation to begin again. If it is run by the keypad, the FWD or REV keys must be pressed again.

Code	Keypad display	Function Range	Unit	Description
AIO_38	Lost Command	0 (None)	-	Continue operation when a multifunction analog input lost command happens.
		1(Free-run)	-	Perform a free-run stop when a multifunction analog input lost command happens.
		2 (Decel)	-	Perform a deceleration stop when a multi-function analog input lost command happens.

When a lost command takes place, an “LOAI [input terminal #]” message is displayed on the keypad. The percentage value in the second line shows the analog input value. Adjust this value to make it stay out of range of the lost command conditions to make the message disappear and change the status of the inverter operable.



[V/F, Slip Comp mode]



[Speed(IM) mode]

6.4.3 Analog output

6.4.3.1 Defining the multifunction analog output terminal and setting output options, bias, gain, and an absolute value (AIO_40–53)

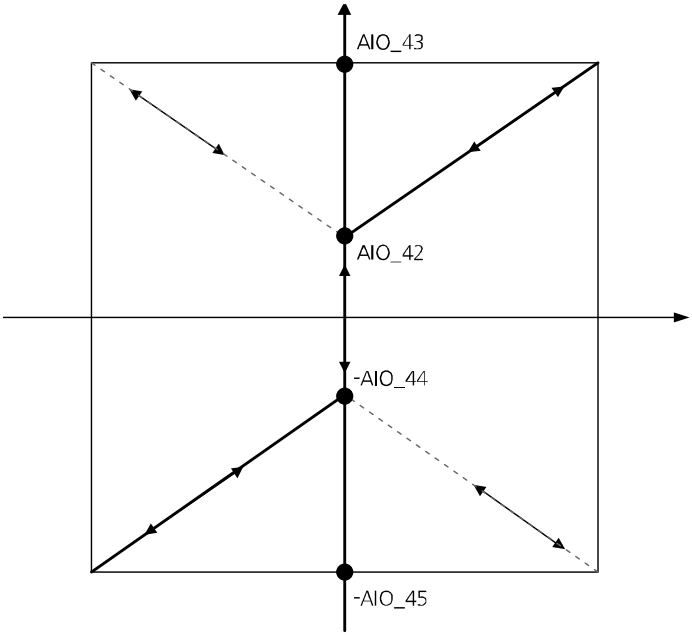
The L100 inverter provides two analog output terminals that can be user defined for various use.

The output signal range is -10 V–+10 V, and the output types are as follows.

Code	Keypad display	Function	Range	Unit	Description
AIO_40	AO1 Define	Define multifunction analog output AO1			Defines the type of multifunction analog output AO1.
AIO_41	AO1 Source	Multifunction analog output AO1 output range	0(0 – 10 V) 1(10 – 0 V) 2(-10 – 10 V) 3(10 – -10 V)		Defines output range for multifunction analog output AO1.
AIO_42	AO1 Bias	Multifunction analog output AO1 bias	0–AIO_43	%	Defines bias for multifunction analog output AO1.
AIO_43	AO1 Gain	Multifunction analog output AO1 gain	0.0–500.0	%	Defines gain for multifunction analog output AO1.
AIO_44	AO1 -Bias	Multifunction analog output AO1 bias	AIO_45–0	%	Defines negative bias for multifunction analog output AO1.
AIO_45	AO1 -Gain	Multifunction analog output AO1 gain	-500.0 –0	%	Defines negative gain for multifunction analog output AO1.
AIO_46	AO1 ABS	Multifunction analog output AO1 absolute value	0(No) / 1(Yes)		Allows the analog output AO1 to always provide positive outputs.

The same setting options provided above are available for other multifunction analog output terminals.

The following is a concept diagram that explains the analog outputs. By defining AO1 Source, outputs in the dotted line become available.



<Analog output concept diagram>

The following table lists the type and setting for multifunction analog outputs.

Output types	Description	Output signal level
Ai1 Value	Analog input value	+10 V: 10 V
Ai2 Value	Analog input value	+10 V: 20 mA
PreRamp Ref	Speed command before acceleration/deceleration	+10 V: MaxSpeed
PostRamp Ref	Speed command after acceleration/deceleration	+10 V: MaxSpeed
ASR Inp Ref	Speed controller input command	+10 V: MaxSpeed
Output Freq	Output frequency	+10 V: MaxSpeed
Motor Speed Note1)	Motor speed	+10 V: MaxSpeed
Speed Dev Note1)	Speed deviation	+10 V: Rated slip x 2
ASR Out Note1)	Speed controller output	+10 V: 250%
Torque Bias Note1)	Torque bias	+6 V: 150%
PosTrq Limit Note1)	Forward torque limit	10 V: 250%
NegTrq Limit Note1)	Reverse torque limit	10 V: 250%
RegTrq Limit Note1)	Torque limit at regeneration	10 V: 250%
IqeRef Note1)	Torque current reference	+10 V: 250% of the rated torque current
Iqe Note1)	Torque current	+10 V: 250% of the rated torque current
Flux Cur Ref Note2)	Recommended flux current reference	10 V: Rated inverter current x 1
IdeRef Note1)	Flux current reference	+10 V: Rated flux current x 2
Ide Note1)	Flux current	+10 V: Rated flux current x 2
ACR_D Out Note1)	D-axis current controller output	+10 V: 600
ACR_Q Out Note1)	Q-axis current controller output	+10 V: 600

Output types	Description	Output signal level
VdeRef	D-axis voltage	+10 V: 600
VqeRef	Q-axis voltage	+10 V: 600
Out Amps RMS	Output current	10 V: Inverter rated current x 2
Out Volt RMS	Output voltage	+10 V: 600
Power	Output power	+10 V: Rated output x 2
DC Bus Volt	DC-link voltage	10 V: 1000 V
Inv Temp	Inverter temperature	+10 V: 150℃

Note 1) Available only when the control mode is set to “Speed(IM),” or “Speed(PM)” at PAR_07.
Note 2) Available only when the control mode is set to “Speed(IM)” at PAR_07.

6.4.3.2 Adjusting bias and gain using the keypad

Setting the bias at AIO_42 (AO1 bias)

Follow the procedures below to set the analog output bias for AO1. Actual output is made when the output exceeds the bias value.

Key operation	Keypad display	Description
-	AIO ▶ AO1 Bias 42 0.0%	Initial LCD display
PROG	AIO ▶ AO1 0.0% 42 Bias 0.0%	Press [PROG]. The first line on the display shows the output ratio in a percentage, which is calculated at the controller. The second line shows the currently set bias value.
▲	AIO ▶ AO1 30.0% 42 Bias 30.0%	To adjust the bias so that the actual output is made when the output exceeds 30.0%, press the [▲] until 30.0% is displayed in the first line.

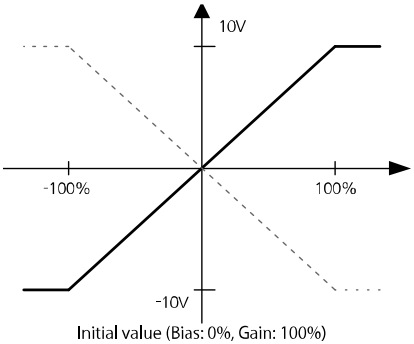
Key operation	Keypad display	Description
ENT	AIO ▶ AO1 Bias 42 30.0%	After adjusting the bias, press [ENT] to save it.

Setting the gain at AIO_43 (AO1 gain)

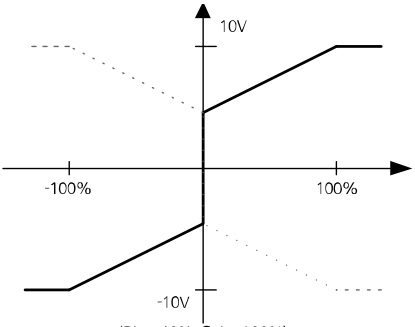
Follow the procedures below to set the analog output gain for AO1 to adjust the output gradient where the maximum output value is 10 V.

Key operation	Keypad display	Description
-	AIO ▶ AO1 Gain 43 100.0%	Initial LCD display
PROG	AIO ▶ AO1 30.0% 43 Gain 100.0%	Press [PROG]. The first line on the display shows currently set bias value. The second line shows the currently set gain value.
▲	AIO ▶ AO1 30.0% 43 Gain 200.0%	To adjust the gain so that a 10V output is made when the gain exceeds 200.0%, press [▲] until 200.0% is displayed in the first line.
ENT	AIO ▶ AO1 Gain 43 200.0%	After adjusting the gain, press [ENT] to save it.

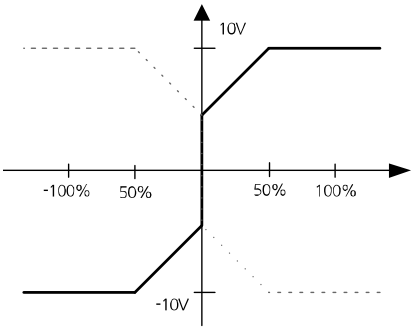
Examples of multifunction analog outputs to -10–10 V analog inputs depending on different bias and gain settings are as follows.



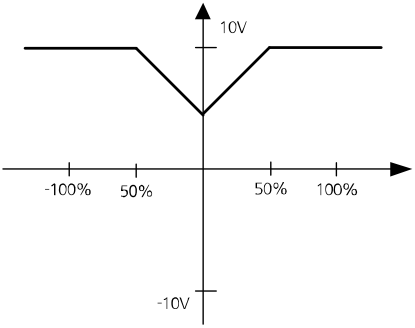
Initial value (Bias: 0%, Gain: 100%)



(Bias: 40%, Gain: 100%)



(Bias: 40%, Gain: 200%)



(Bias: 40%, Gain: 200%), Absolute value

Caution

- Analog output may fluctuate when the inverter starts. These analog output characteristics must be considered when an inverter is used in a control system.
- Analog output values outside the inverter's operable range are regarded as invalid.

6.5 Function (FUN) group

6.5.1 Jump code (FUN_00)

FUN_00 code is used to directly access a certain code.

The following is an example of jumping directly to FUN_02 from FUN_00 code.

1. Press [PROG].
2. Use [SHIFT/ESC], [▲], or [▼] to change the code number to “02”.
3. Press [ENT] to access FUN_02 code. If an invalid code number is entered, the next available code number is automatically selected.



Note

After jumping directly to a code, you can move to other codes by pressing [▲] or [▼].

6.5.2 Selecting the command source

6.5.2.1 Setting the run/stop command source (FUN_01)

The L100 inverter provides four different options for run and stop commands: two terminal input options (terminal 1 and 2) that uses digital input FX/RX, keypad input, and network input utilizing CAN or RS232 communication. The default setting for the input option is the analog terminal input using terminal 1.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_01	Run/Stop Src	RUN/STOP command source	0 (Terminal 1) 1 (Terminal 2) 2 (Keypad) 4 (CAN)		0 (Terminal 1)

Terminal inputs: Terminal 1 and terminal 2

Run/stop command source	Input settings		Operation command
Terminal 1	FX	ON	Forward operation command
		OFF	Stop command
	RX	ON	Reverse operation command
		OFF	Stop command
Terminal 2	FX	ON	Operation command
		OFF	Stop command
	RX	ON	Set reverse
		OFF	Set forward

When voltage is used for speed reference, positive voltage is used for forward operation and negative voltage is used for reverse operation. The following table lists the motor's rotating directions depending on the voltage operation command signals.

Analog speed signal range	FX / FWD / Network FWD command	RX / REV / Network REV command
0 – +10 V	Forward	Reverse
-10 – 0 V	Reverse	Forward

6.5.2.2 Setting the operation speed (FUN_02)

The L100 inverter provides four different options for operation speed commands: digital input via the keypad ("Keypad1"), digital input via the keypad ("Keypad2"), analog terminal input, and network input utilizing the CAN communication.

When "Keypad1" is selected for speed reference, set FUN_12 (Speed 0) to the required speed reference using the [▲] and [▼], and then press [ENT] to apply it.

When "Keypad2" is selected, the speed reference is applied as soon as it is set on the keypad, without pressing [ENT].

Code	Keypad display	Name	Range	Unit	Default setting
FUN_02	Spd Ref Src	Speed reference source	0 (Analog) 1 (Keypad 1) 2 (Keypad 2) 4 (CAN)	-	Keypad 1

6.5.2.3 Setting the stop mode options (FUN_03)

FUN_03 (Stop Mode) is used to select stop mode options.

If "Decel" is selected for the stop mode, the motor decelerates based on the "deceleration time1" set at FUN_42 before it fully stops. If it fails to stop within the deceleration time, the motor free-runs after deceleration.

If “Free-run” is selected, the motor performs a free-run without deceleration.

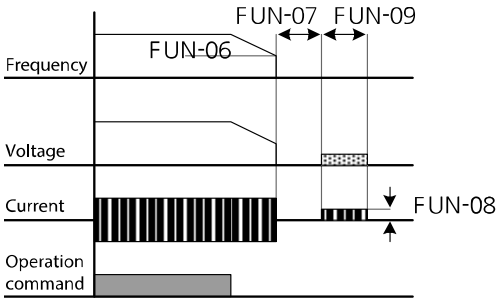
If “DC-Brake” is selected, DC voltage is injected into the motor during deceleration to brake and stop it. This option is available only when the control mode is set to “V/F”, or “Slip Comp.” Refer to FUN_06–FUN_09 for information about using the DC brake.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_03	Stop Mode	Stop mode options	0(Decel) 1(Free-run) 2(DC-Brake)		Decel

6.5.3 DC-braking stop (FUN_06–FUN_09)

Codes FUN_06 through FUN_09 are used to set the DC-braking options. When a stop command is given, the inverter decelerates the motor. During motor deceleration, when the operation frequency reaches the DC-braking frequency set at FUN_06, DC voltage is provided to the motor and stops it.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_06	Dcbr Freq	DC braking start frequency	PAR_12–PAR_11	Hz	1.00
FUN_07	Dcblk Time	Output block time before DC braking	0.00–60.00	sec	0.00
FUN_08	Dcbr Value	DC braking amount	0–200	%	10
FUN_09	Dcbr Time	DC braking time	0.0–60.0	sec	1.0

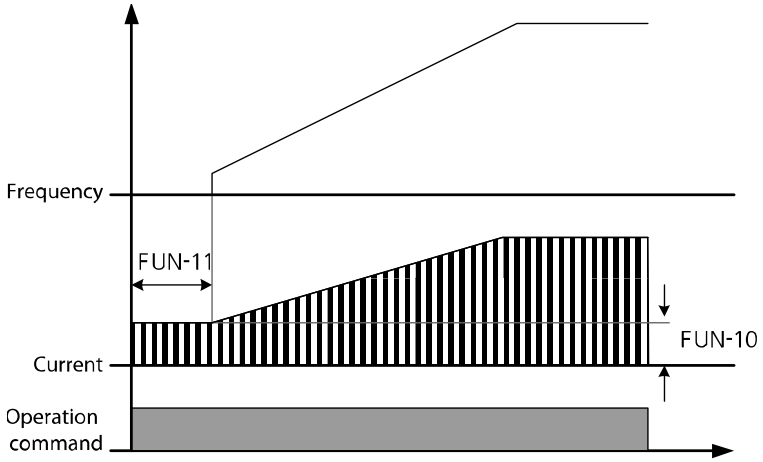


6.5.4 Start after DC-braking: Dc-Start (FUN_10–FUN_11)

FUN_10 and FUN_11 are used to set options when stopping the motor using DC-braking, and then restarting it. DC voltage is applied to the motor for a set time to stop it, and then the inverter accelerates the motor from its stopped state.

This function is useful in the operations where the motor has to be fully stopped before it runs again, and the motor is still rotating from the previous operation.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_10	Dcst Value	DC-braking amount for start after DC-barking	0–200	%	10
FUN_11	Dcst Time	DC-braking time for start after DC-braking	0.0–60.0	sec	0.0



If a DC-braking amount that exceeds the inverter's rated current is set for this operation, the DC-braking amount is limited to the inverter's rated current.

Caution

- While using “DC-braking stop” or “start after DC-braking,” if a DC-braking amount that exceeds the inverter’s rated current is set, the DC-braking amount is limited to the inverter’s rated current. The motor may be overheated and be damaged, or an inverter overload fault trip (IOLT) may occur if the DC-braking amount is set too great, or if the DC-braking time is set too long. If motor overheating or inverter overload fault trip occurs, decrease the DC-braking amount or time.
- DC-braking is available only when FUN_03 (Stop mode) is set to “DC-Brake”.

6.5.5 Setting the speed reference for multistep operations

6.5.5.1 Multistep speed 0–7 (FUN_12–19)

When the multifunction input terminals are set for multispeed operation, the speed reference is decided by a combination of multifunction terminal inputs (P1–P7).

The following table lists the multistep speed by a combination of inputs at terminals P1, P2, P3, and P4.

P1 (Speed-L)	P2 (Speed-M)	P3 (Speed-H)	Speed
OFF	OFF	OFF	Speed reference by the setting at FUN_12 or V1/ I1 analog input
ON	OFF	OFF	FUN_13 (Multistep speed1)
OFF	ON	OFF	FUN_14 (Multistep speed2)
ON	ON	OFF	FUN_15 (Multistep speed3)
OFF	OFF	ON	FUN_16 (Multistep speed4)
ON	OFF	ON	FUN_17 (Multistep speed5)
OFF	ON	ON	FUN_18 (Multistep speed6)

P1 (Speed-L)	P2 (Speed-M)	P3 (Speed-H)	Speed
ON	ON	ON	FUN_19 (Multistep speed7)

If multistep speed 0 (P1, P2, P3 are all turned off) is selected, digital input on the keypad, analog input at the terminal block, or the network input via CAN or RS232 communication terminals may be used as the speed reference depending on the frequency reference source settings.

Jog operation takes priority over other operations. If jog operation signal is received at terminal P4, all other terminal inputs are ignored, and jog operation is performed based on the jog speed set at FUN_20.

The following table lists the range of multistep speed references and the default settings.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_12	Speed 0	Multispeed 0	0.0–PAR_11	Hz/rpm[Note1)]	0.0
FUN_13	Speed 1	Multispeed 1	0.0–PAR_11	Hz/rpm[Note1)]	0.0
FUN_14	Speed 2	Multispeed 2	0.0–PAR_11	Hz/rpm[Note1)]	0.0
FUN_15	Speed 3	Multispeed 3	0.0–PAR_11	Hz/rpm[Note1)]	0.0
FUN_16	Speed 4	Multispeed 4	0.0–PAR_11	Hz/rpm[Note1)]	0.0
FUN_17	Speed 5	Multispeed 5	0.0–PAR_11	Hz/rpm[Note1)]	0.0
FUN_18	Speed 6	Multispeed 6	0.0–PAR_11	Hz/rpm[Note1)]	0.0
FUN_19	Speed 7	Multispeed 7	0.0–PAR_11	Hz/rpm[Note1)]	0.0

Note 1) Speed unit: “Hz” is used in “V/F” or “Slip Comp” operation modes. “rpm” is used in “Speed(IM)” or “Speed(PM)” operation modes. Set values are automatically converted according to the speed units (rpm and Hz).

- PAR_11 is used to setup the maximum motor speed.

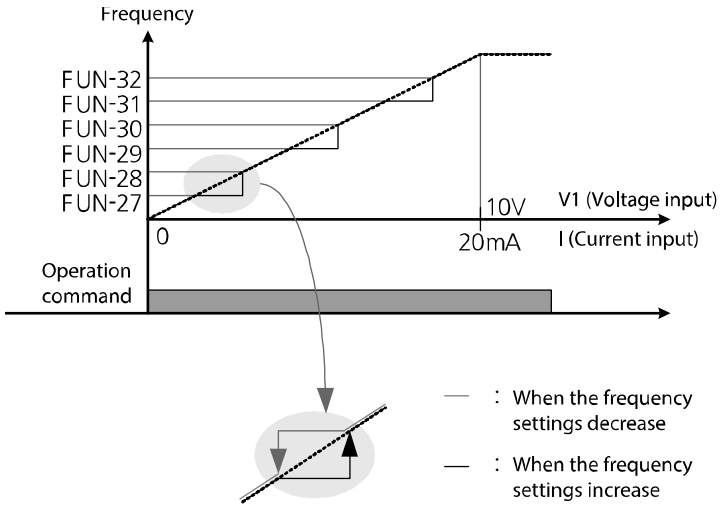
6.5.6 Frequency jump (Jump Freq)

Frequency jump is used to avoid mechanical resonance of the inverter, with other devices. The inverter will not accept frequency settings that are within a preset frequency jump band during acceleration or deceleration.

Any frequency that belongs in the jump frequency ranges cannot be used as the inverter's frequency reference.

If jump frequencies are reached during acceleration, the inverter maintains the frequency jump low limit, and then resumes acceleration when the speed reference (via digital, analog, CAN, or RS232 input) gets out of the jump frequency.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_27	Jump Lo 1	Jump frequency low limit 1	0.00–FUN_28	Hz	10.00
FUN_28	Jump Hi 1	Jump frequency high limit 1	FUN_27–FUN_29	Hz	15.00
FUN_29	Jump Lo 2	Jump frequency low limit 2	FUN_28–FUN_30	Hz	20.00
FUN_30	Jump Hi 2	Jump frequency high limit 2	FUN_29–FUN_31	Hz	25.00
FUN_31	Jump Lo 3	Jump frequency low limit 3	FUN_30–FUN_32	Hz	30.00
FUN_32	Jump Hi 3	Jump frequency high limit 3	FUN_31–PAR_11	Hz	35.00

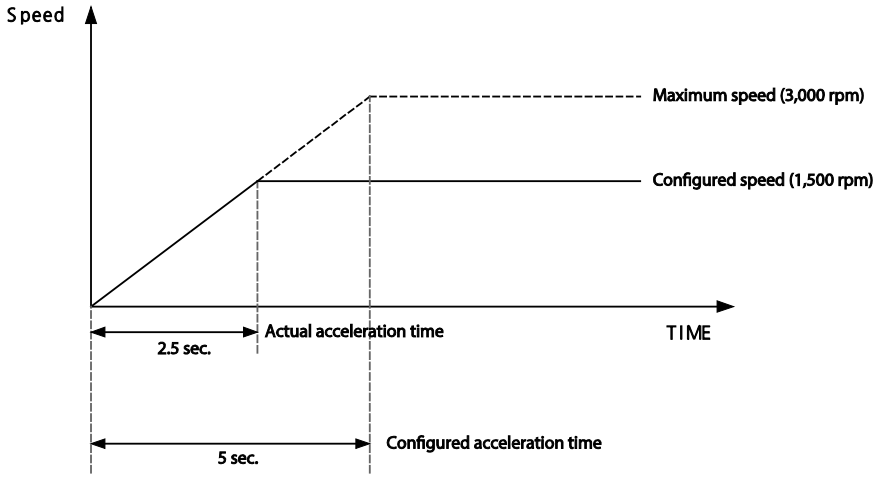


6.5.7 Setting acceleration and deceleration patterns and times

6.5.7.1 Setting acceleration/deceleration speed reference (FUN_33)

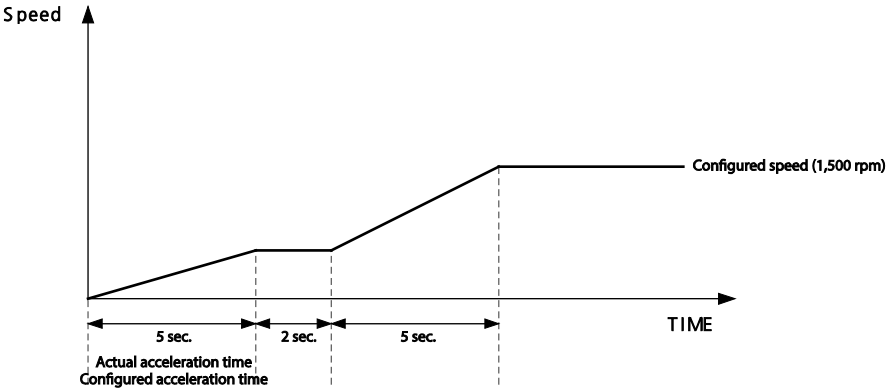
FUN_33 is used to define acceleration and deceleration time based on the motor maximum speed or speed reference.

For example, when FUN_33 is set to “Max Speed”, if motor maximum speed is set to 3,000 rpm, and the acceleration time is set to 5 seconds, acceleration time taken for the motor to reach 1,500 rpm becomes 2.5 seconds.



When FUN_33 is set to “Ref Speed,” the acceleration and deceleration times can be configured based on the time taken to reach the next speed reference regardless of the motor maximum speed.

For example, for a multistep operation of 2 speeds (500 and 1,500 rpm), if acceleration time is set to 5 seconds, the operation can be illustrated as shown in the figure below.



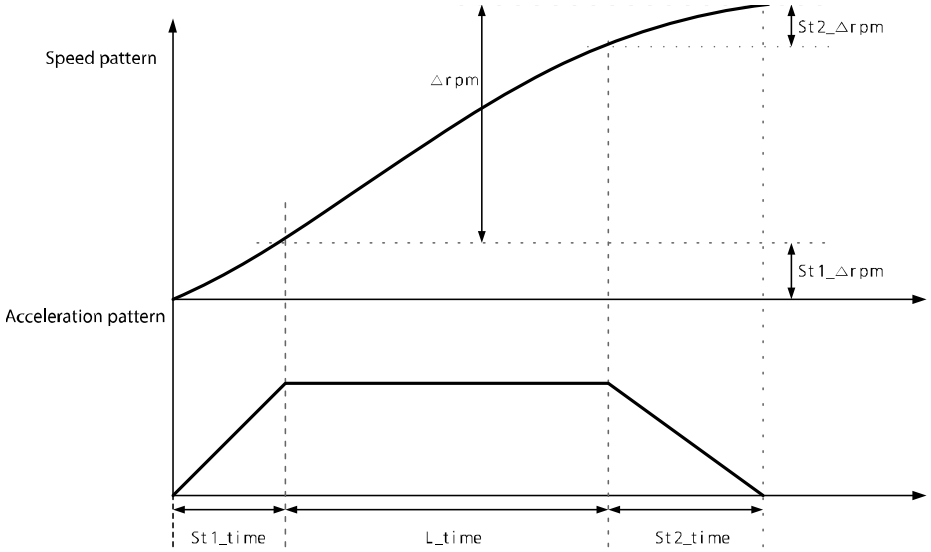
6.5.7.2 S-curve acceleration/deceleration pattern 1–2 (FUN_36–39)

Acceleration/deceleration gradient level patterns can be configured to enhance and smooth the inverter's acceleration and deceleration curves. While linear pattern features a linear increase or decrease to the output frequency, at a fixed rate, an S-curve pattern provides a smoother and more gradual increase or decrease of output frequency, ideal for lift-type loads or elevator doors, etc.

Acceleration/deceleration patterns can be defined by the parameter settings listed in the following table. Codes FUN_36–FUN_39 define the curvature. Codes FUN_36 and FUN_37are for acceleration, while FUN_38, FUN_39 are for deceleration.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_36	Acc S Start	S-curve rate at acceleration 1	0.0–50.0	%	0.0
FUN_37	Acc S End	S-curve rate at acceleration 2	0.0–50.0	%	0.0
FUN_38	Dec S Start	S-curve rate at deceleration 1	0.0–50.0	%	0.0
FUN_39	Dec S End	S-curve rate at deceleration 2	0.0–50.0	%	0.0

Examples of S-curve acceleration/deceleration patterns are as follows.



Basic formula

- St1_time = AccTime * (S-curve rate deceleration 1/ 50.0%)
- St2_time = AccTime * (S-curve rate at acceleration 2/ 50.0%)
- St1_Δrpm = St1_time * (MaxSpeed / AccTime) * 0.5
- St2_Δrpm = St2_time * (MaxSpeed / AccTime) * 0.5

Calculation 1

When Δrpm ≥ (St1_Δrpm + St2_Δrpm), where Δrpm is the difference between the current speed and the speed reference:

- L_time = (Δrpm–St1_Δrpm–St2_Δrpm) x (AccTime / MaxSpeed)
- Total acceleration time = St1_time + L_time + St2_time

Calculation 2

When Δrpm < (St1_Δrpm + St2_Δrpm), where Δrpm is the difference between the current speed and the speed reference:

- St1'_time = √{ [Δrpm x AccTime^2 x St1_time^2] / [25 x MaxSpeed x (St1_time + St2_time)] }
- St2'_time = √{ [Δrpm x AccTime^2 x St2_time^2] / [25 x MaxSpeed x (St1_time + St2_time)] }
- Total acceleration time = St1'_time + St2'_time
  - MaxSpeed is set at PAR_11
  - AccTime is set at FUN_41, 43, 45, 47
  - St1_Δrpm: S-curve acceleration setting 1 (FUN_36) is used when accelerating, and S-curve deceleration setting 2 (FUN_39) is used when decelerating.
  - St2_Δrpm: S-curve acceleration setting 2 (FUN_37) is used when accelerating, and S-curve deceleration setting 2 (FUN_38) is used when decelerating.
  - St1_time: St1_Δrpm section
  - St2_time: St2_Δrpm section

S-curve acceleration gradient 1 (FUN_36)

Sets the gradient level as acceleration starts when using an S-curve acceleration pattern. The gradient is for the first half of the acceleration section.

When the speed reference is 60 Hz and the maximum frequency is 60 Hz, if FUN_36 is set to 50%, S-curve acceleration gradient 1 is used for the 0–30 Hz section of the acceleration.

S-curve acceleration gradient 2 (FUN_37)

Sets the gradient level as acceleration ends when using an S-curve acceleration pattern. The gradient is for the second half of the acceleration section.

When the speed reference is 60 Hz and the maximum frequency is 60 Hz, if FUN_37 is set to 50%, S-curve acceleration gradient 2 is used for the 30–60 Hz section of the acceleration.

S-curve deceleration gradient 1 (FUN_38)

Sets the gradient level as deceleration starts when using an S-curve deceleration pattern. The gradient is for the first half of the deceleration section.

When the speed reference is 60 Hz and the maximum frequency is 60 Hz, if FUN_38 is set to 50%, S-curve deceleration gradient 1 is used for the 60–30 Hz section of the deceleration.

S-curve deceleration gradient 2 (FUN_39)

Sets the gradient level as deceleration ends when using an S-curve deceleration pattern. The gradient is for the second half of the acceleration section.

When the speed reference is 60 Hz and the maximum frequency is 60 Hz, if FUN_39 is set to 50%, S-curve acceleration gradient 2 is used for the 30–0 Hz section of the deceleration.

6.5.7.3 Acceleration/deceleration times 1–4 (FUN_41–48)

You can define 4 different acceleration or deceleration times to use with the selected patterns.

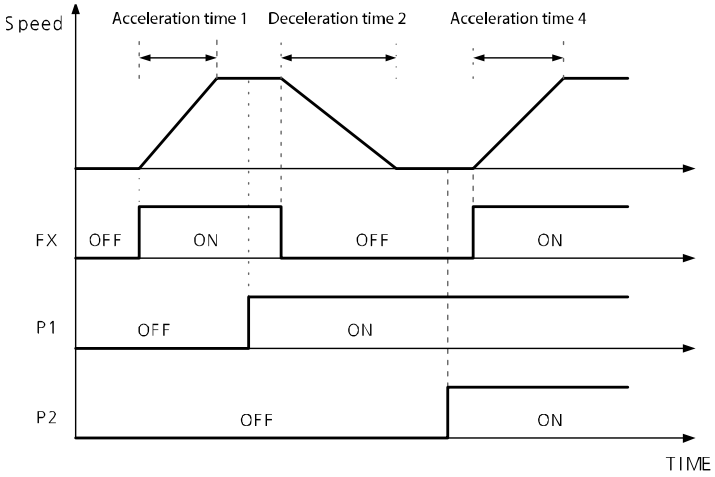
Code	Keypad display	Name	Range	Unit	Default setting
FUN_41	Acc Time-1	acceleration time 1	0.00–600.00	sec	2.00
FUN_42	Dec Time-1	deceleration time 1	0.00–600.00	sec	2.00
FUN_43	Acc Time-2	acceleration time 2	0.00–600.00	sec	3.00
FUN_44	Dec Time-2	deceleration time 2	0.00–600.00	sec	3.00
FUN_45	Acc Time-3	acceleration time 3	0.00–600.00	sec	4.00
FUN_46	Dec Time-3	deceleration time 3	0.00–600.00	sec	4.00
FUN_47	Acc Time-4	acceleration time 4	0.00–600.00	sec	5.00
FUN_48	Dec Time-4	deceleration time 4	0.00–600.00	sec	5.00

Set the multifunction input terminals for acceleration/deceleration time selection

to switch between the acceleration or deceleration times.

The following is an example where multifunction input terminals P1 and P2 are used for acceleration/deceleration time selection.

Code	Keypad display	Name	Range	Unit	Parameter setting
DIO_01	P1 Define	Defines P1 input			Xcel–L
DIO_02	P2 Define	Defines P2 input			Xcel–H



The following is an example of setting multifunction terminals P1, P2, and P3 to switch between the acceleration/deceleration times, and to use the soft start cancel function.

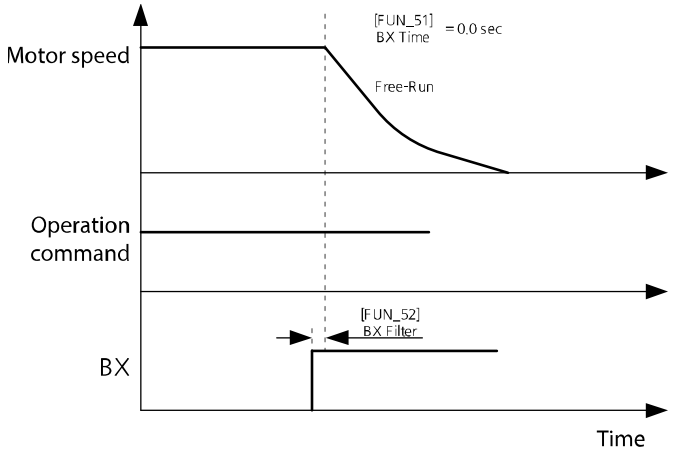
P1 (Xcel-L)	P2 (Xcel-H)	P3 (SoftStartCncl)	Acc/Dec time
OFF	OFF	OFF	Acceleration/Deceleration 1
ON	OFF	OFF	Acceleration/Deceleration 2
OFF	ON	OFF	Acceleration/Deceleration 3
ON	ON	OFF	Acceleration/Deceleration 4
X	X	ON	Fastest Acceleration/Deceleration available

6.5.7.4 Emergency stop deceleration time (FUN_51) and emergency stop terminal input low pass filter (FUN_52)

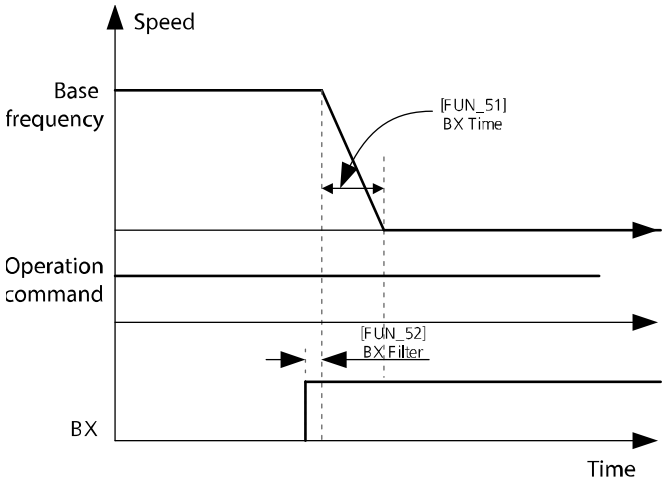
If any emergency arises during operation, you can use the BX (emergency stop) signal input at the terminal block to stop the motor operation immediately. Once the BX input is provided, the motor decelerates based on the “Emergency stop deceleration gradient” set at FUN_51, and then it stops. If the motor cannot complete a full-stop within the set time, it continues to perform a free-run stop. If you need to allow to motor to free run as soon as the BX signal input is provided, set FUN_51 to “0”.

Also, set the time constant for the low pass filter at FUN_52 (BX Termi LPF) to avoid noise interference if the noise level is high at the installation site.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_51	BX Time	Emergency stop deceleration time	0.0–6000.0	sec	0.0
FUN_52	BX Termi LPF	Emergency stop terminal input low pass filter	0–2000	ms	0



<BX time (FUN_51) set to “0”>



< BX time (FUN_51) set to a value other than “0”>

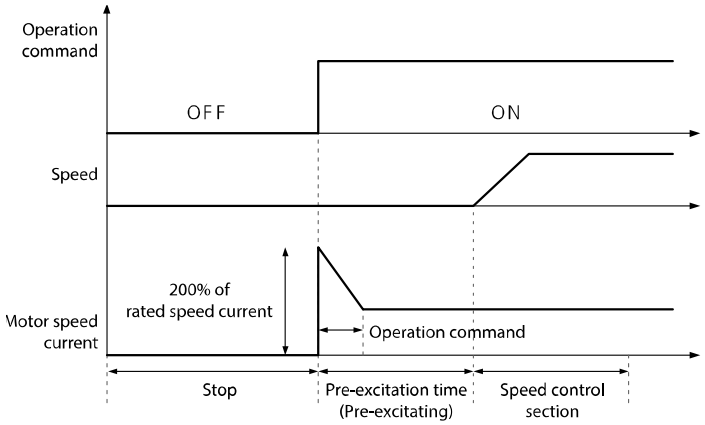
6.5.7.5 Setting the Motor Pre-excite time (FUN_53)

Pre-excitation refers to a process where power is supplied to the coils in the motor to magnetize them before the motor rotation begins. Because pre-excitation creates flux in a motor by magnetizing the coils and gets the motor ready to run, it enhances motor's acceleration response in a system where a high starting torque is required.

During pre-excitation, the [FWD] and [REV] indicators flash simultaneously.

- The pre-excite time set at FUN_53 is used only when FUN_02 (Spd Ref Sel) is set to "Keypad1", or "Keypad2".

Code	Keypad display	Name	Range	Unit	Default setting
FUN_53	PreExct Time	Motor Pre-excite time	0–10000	ms	0



6.5.7.6 Zero-speed time after a stop (FUN_54)

FUN_54 (Hold time) is used to set the time for the motor to stay at the zero-speed after a deceleration stop. When the motor is running a load with high inertia, this function can prevent a motor movement by the residual inertia.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_54	Hold Time	Zero-speed time after a stop	10–10000	ms	1000

6.5.7.7 Acceleration/deceleration time scale (FUN_40)

FUN_40 (Acc/dec time scale) is used when the precise acceleration/deceleration time is need depending on the characteristics of load or the maximum acceleration/deceleration time needs to be increased.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_11	Time Scale	Acc/dec time scale	0 (0.01 sec) 1 (0.1 sec)		0 (0.01 sec)

The parameters that acceleration/deceleration time scale is applied is as follows.

Code	Keypad display	Name	Code	Keypad display	Name
FUN_41	Acc Time-1	Acceleration time 1	FUN_45	Acc Time-3	Acceleration time 3
FUN_42	Dec Time-1	Deceleration time 1	FUN_46	Dec Time-3	Deceleration time 3
FUN_43	Acc Time-2	Acceleration time 2	FUN_47	Acc Time-4	Acceleration time 4
FUN_44	Dec Time-2	Deceleration time 2	FUN_48	Dec Time-4	Deceleration time 4

6.5.8 Setting parameters for short floor operations (FUN_56, FUN_57)

When the multistep speed operation is used to control elevator speed, repeated short trip patterns can reduce the overall riding quality of the elevator. Use the inverter's 'Short Floor' function to improve elevator speed control FUN_56 (ShortFlr speed) and FUN_57 (ShortFlr time).

The inverter's short floor control is for acceleration speed only and is not available in the features dedicated for elevators that use ELIO.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_56	ShortFlr Spd	Short floor operation speed	0.0–PAR_11	Hz /rpm	0.00
FUN_57	ShortFlrTime	Short floor operation time	0.00–100.00	sec	0.00

For example, when multifunction input terminals P1 and P2 are set to "Speed-L" and "Speed-M," and if FUN_12 and FUN_13 are set with smaller values the setting at FUN_56, and the setting at FUN_14 is greater than the settings at FUN_56, the following operation becomes available. (Set FUN_57 to "0" or other fixed value).

Example 1: Elevator running speed is less than the short floor speed and the short floor speed is not set at "0".

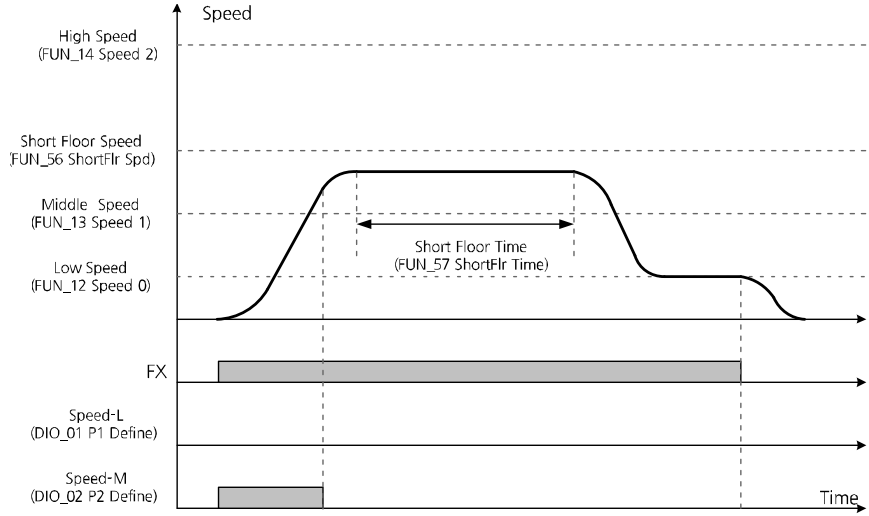
When the motor starts and accelerates in the forward direction and multifunction input P2 is ON, a new speed reference is calculated if the signal at P2 is OFF. If the new speed reference is less than the speed set at FUN_56 (ShortFlr Spd), the motor accelerates to the new speed reference and maintains the speed for the time set at FUN_57.

After the operation time has elapsed, the motor runs at the speed set at FUN_12.

Use the following formula to calculate the new speed reference.

- New speed reference = Current speed + ([FUN_04] x [FUN_37])

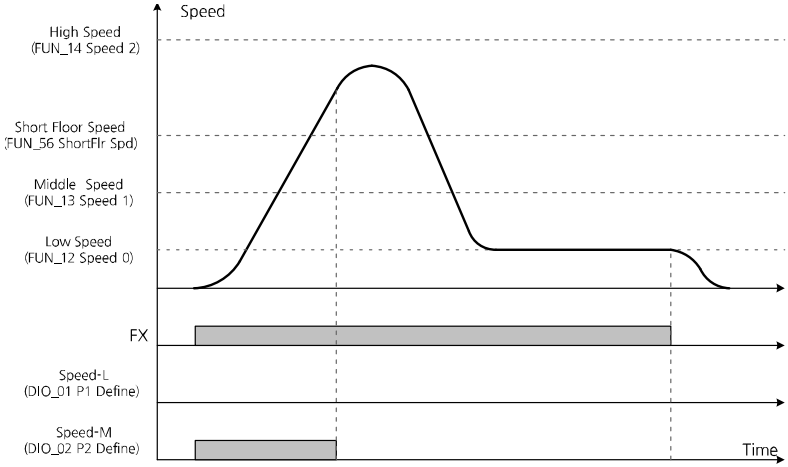
If FUN_37 is set to "0", the current speed becomes the new speed reference.



Example 2: Elevator running speed is higher than the short floor speed and the short floor speed is not set at “0”.

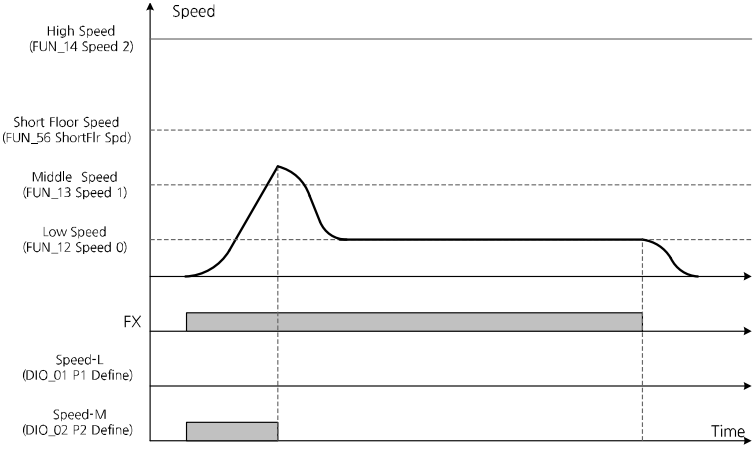
When the motor starts and accelerates in the forward direction while multifunction input P2 is ON, a new speed reference is calculated when the signal at P2 is turned OFF at a higher speed than the speed set at FUN_56 (ShortFlr Spd). After the motor speed reaches the newly calculated speed reference, the motor decelerates to the new speed reference set at FUN_12. If the FX signal is OFF, the motor stops.

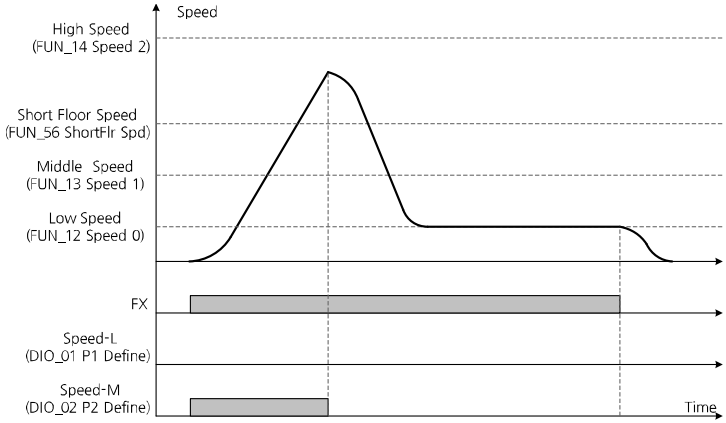
Use the formula in the previous example to calculate the new speed reference command.



Example 3: Elevator running speed is less than the short floor speed, or it is higher than the short floor speed and the short floor time is set to “0”.

If FUN_57 is set to “0”, the motor decelerate from the current speed regardless of the setting at FUN_56, without applying the S-curve gradient. Then, it operates again at the speed set at FUN_12. Turning the FX signal OFF stops the motor. The new deceleration speed reference changes to the current operation speed.





6.5.9 Setting parameters for anti-hunting regulator

During inverter operation, current hunting (distortion or oscillation of current) by mechanical resonance or other factors may adversely affect the load system. Set the anti-hunting regulation parameters to avoid it.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_58	AHR Sel	Anti-hunting regulator options	0 (No) / 1 (Yes)	-	1 (Yes)
FUN_59	AHR PGain	Anti-hunting regulator P gain	0.00–100.00	-	50.00
FUN_60	AHR Low Freq	Anti-hunting regulator start frequency	0–60.00	Hz	3.00
FUN_61	AHR Hi Freq	Anti-hunting regulator end frequency	FUN_60–PAR_11	Hz	60.00

Anti-hunting regulator options (FUN_58)

Set the parameter to enable or disable the anti-hunting regulator function.

Anti-hunting regulator P gain (FUN_59)

Higher AHR (anti-hunting regulator) proportional gain enhances the responsiveness of the system and provides good hunting prevention. However, unstable current conditions may result if you set it too high.

Anti-hunting regulator start/end frequency (FUN_60/FUN_61)

FUN_60 and 61 are used to define the minimum and maximum frequency where the AHR function will operate.

6.5.10 Setting the operation speed and input voltage for battery operation

Battery operation is an emergency measures to continue the inverter operation using the external battery when the power source is interrupted due to blackout or other reasons.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_67	Batt. Speed	Battery operation speed	PAR_12 - 6.66 / 0-200.0	Hz /rpm	1.66
FUN_68	Batt. Volt	Battery input voltage	12–PAR_15	V	48
DIO_04	P4 Define	Define P4 function	Battery Run		

FUN_67 and FUN_68 are displayed only when one of the multifunction inputs DIO_01 –07 is set for “Battery Run”.

FUN_67 is used to define the operation speed during the emergency operation on battery power.

FUN_68 is used to define the battery input voltage during the emergency operation on battery power.

To enable the inverter operation on battery, turn on the signal at the multifunction input that is set for the battery operation (“Battery Run”). The inverter runs on battery based on the speed set at FUN_67, and the low voltage fault trip level is

lowered.

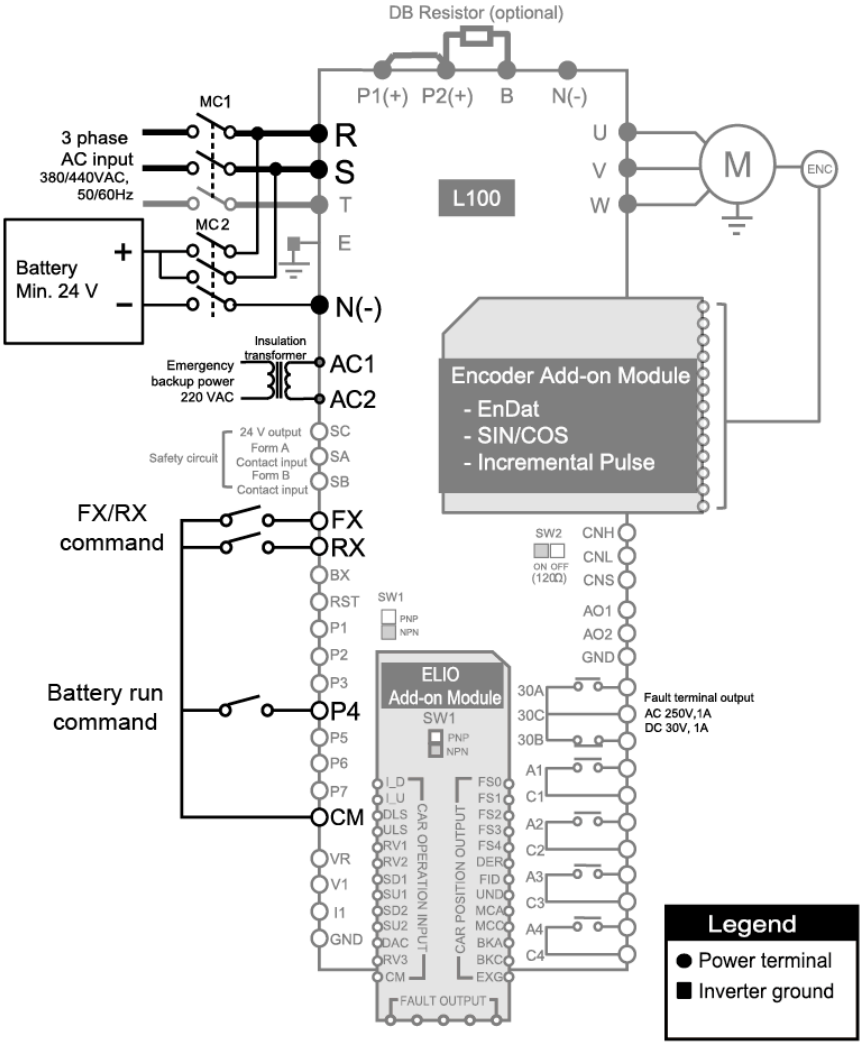
To resume normal operation utilizing a commercial power source (380–440 Vac), turn off the signal at the multifunction input that is set for the battery operation ("Battery Run"). The inverter runs on the original power source and all other operating conditions will be reverted.

Additional wiring connections are required for battery operation.

- Run cables from two of the input terminals (R, S, or T) to the battery's positive terminal via a magnetic contactor.
- At the main input terminals, connect the DCN terminal N (-) to the battery negative terminal.
- Supply UPS input voltage (220 V) to terminals AC1 and AC2.

Caution

- To prevent inverter damage, an isolating transformer (100 VA) must be installed in the control board of the auxiliary power supply.
- When the battery power is off, inverter may be damaged if the main power returns to on before the Low Voltage trip occurs. Turn on the main power after the Low Voltage trip occurs when the battery power is off.
- For battery operation, the battery power always must be on when the auxiliary power is connected, and the auxiliary power must be off after the battery power turns off.



- During operation on battery, the current operation mode and “BAT” are displayed alternately on the top right corner of the keypad display.
- If a multifunction output is set to “INV Ready,” the relevant terminal is turned off during a battery operation.

- After the power source is switched to battery, it takes about two seconds to release the fault trip and adapt the internal voltage until the inverter is ready for operation.
- If the voltage drops below 53% of the setting value at FUN_68, a low voltage fault trip occurs.
- When operating the inverter on battery, take the battery capacity into consideration and operate the inverter slower than usual.
- When setting the battery operation speed (FUN_67), the battery voltage (FUN_68), sync speed (PAR_14), and motor rated voltage (PAR_15) must be considered.

Before switching the battery power to mains power, de-energize the battery's magnetic contactor and stop the battery input signal. Then, supply mains power after a low voltage trip occurs.

6.5.11 ALLS (Automatic light load search) (FUN_69–FUN_72)

When the inverter is running on battery, the ALLS function is used to move the elevator to the next closest floor that reduces the load. Set FUN-69 (ALLS Enable) to "1 (Enabled)" to activate this function.

If the battery run signal is OFF while the inverter is operating via the battery supply, a fault trip occurs at the inverter.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_69	ALLS Enable	ALLS options	0 (No) 1 (Yes)		0 (No)
FUN_70	ALLS DirChgT	Hold time at internal FX, RX switching	1.0–10.0	sec	5.0
FUN_71	ALLS Time	Light load search time	(FUN-72)–10.0	sec	5.0
FUN_72	ALLS LoadCkT	Light load checking time	1.0–5.0	sec	2.0

ALLS options (FUN_69)

Enable or disable ALLS options. This option is available only when a multifunction input is set to “Battery Run”.

Hold time at internal FX, RX switching (FUN_70)

When ALLS is enabled, set the hold time (zero-speed time) for direction switching.

Light load search time (FUN_71)

When ALLS is enabled, set the load search time for the constant operations in FX/RX directions.

Light load checking time (FUN_72)

Sets the time period for the inverter to detect light load during the light load search time set at Fun_71.

When forward operation has a lighter load:

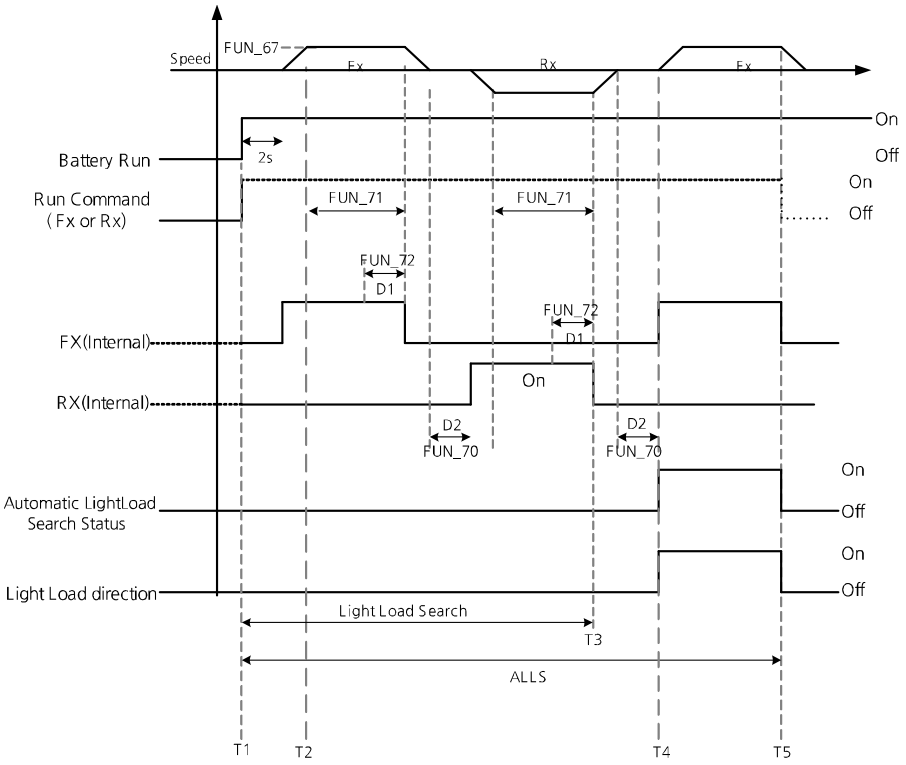
The graph below shows an example of an ALLS. In the example, the forward operation has a lighter load than the reverse operation.

A forward or a reverse ALLS operation is run two seconds after an ALLS [T1] starts.

When the output frequency reaches the value set at FUN_67 (T2), the operation speed is maintained for the time set at FUN_71. During this time, a load detection is performed for the time set at FUN_72 (D1 section). After the time set at FUN_71 has elapsed, the motor decelerates and stops. The motor remains in the stopped condition for the time set at FUN_70 (D2 section), and then another load detection is performed in the other rotational direction until it reaches T3.

- When the FX/RX operation is complete, the motor stops for the time set at FUN_70 (T4). Then, the motor runs in the direction with the least load.
- If a stop command is received during ALLS (T5), the motor decelerates and

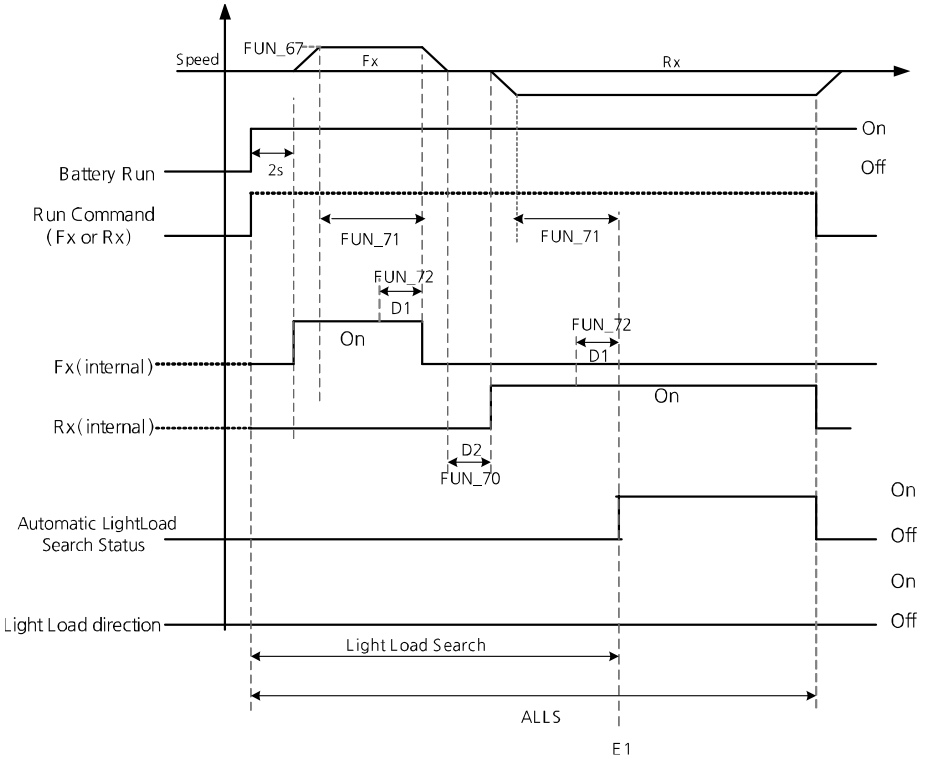
stops.



< When forward operation has a lighter load>

When reverse operation has a lighter load:

The graph below shows an example of an ALLS. In the example, the reverse operation has a lighter load than the forward operation. The operating principle is identical to an ALLS when the forward operation has a lighter load. However, once the inverter detects that the reverse direction has a lighter load (E1), an ALLS starts in the reverse direction without stopping the motor.



< When reverse operation has a lighter load >

Loss of battery run signal during ALLS:

The battery run signal must be ON and FUN_69 (ALLS Enable) must be set to "YES" for ALLS to run. If the battery run signal is OFF during ALLS, the inverter output is immediately blocked, the motor decelerates at free-run, and then stops.

Caution

If the battery run signal is OFF during ALLS, a "BatRun Fault" occurs.

6.5.12 Automatic load cell calculation

Automatic load cell calculations allow for easy configuration of related parameters when an improvement is required to correct operational problems including roll-backs. When you operate the inverter with a load cell, full-load climbing and no-load descending operations must be performed to correctly configure the related parameters.

6.5.12.1 Preparing a load cell calculation

1. Connect the load cell output (0–10 V) to V1-GND terminal.
2. Ensure that the load cell signals are correctly output during inverter operation.
3. If any incorrect load cell signals are noticed, eliminate signal noise to correct it.

Keypad display	Description
AIO ▶ Ai1 Define 01 Torque Bias	Set AiO_01 to "Torque Bias".
AIO ▶ Ai1 Source 02 0 ~ 10V	Set AIO_02 to "0–10 V".
	For AIO_03 through AIO–10, use the default setting values unless adjustments are necessary.

Keypad display	Description
AIO ▶ Ai1 LPF 11 50ms	Set AIO_11 to 50ms, and then adjust the time value based on the presence of noise interference.

6.5.12.2 Full-load climbing operation

1. Move the elevator to the bottom floor, and load with its maximum capacity to make it fully loaded.
2. Set the manual operation speed reference to “0 rpm” to perform a climbing operation.
3. Refer to the following table and write down the values that are displayed on the keypad.

Keypad display	Description
DIS ▶ Ai1 Value 01 100%	Move to DIS_01 and press [PROG]. The cursor flashes. Press [▲] until “Ai1 Value” is displayed. Then, note the value that is displayed.
0.0 rpm IM Tq 100% 50A	**<For a multistep speed operation mode>** Set the manual operation speed reference to “0.0 rpm”. Then, record the torque that is displayed.
Tq 100% MAN UP --F 50A	**<For an ELIO mode operation>** Set the manual operation speed reference to “0.0 rpm”. Then, record the torque that is displayed. To display the torque on the keypad, E/L_58 (Display Sel) must be set to “Trq Output”.

6.5.12.3 No-load descending operation

1. Move the elevator to the top floor, and unload it to make it a no-load condition.
2. Set the manual operation speed reference to “0 rpm” to perform a descending operation.
3. Refer to the following table and write down the values that are displayed on the keypad.

Keypad display	Description
DIS ▶ Ai1 Value 01 0.0%	Move to DIS_01 and press [PROG]. The cursor flashes. Press [▲] until “Ai1 Value” is displayed. Then, note the value that is displayed.
0.0 rpm IM/PM Tq -100% 50A	**<For a multistep speed operation mode>** Set the manual operation speed reference to “0.0 rpm”. Then, write down the torque that is displayed.
Tq -100.0% MAN DN --F 50A	**<For an ELIO mode operation>** Set the manual operation speed reference to “0 rpm”. Then, write down the torque that is displayed. To display the torque on the keypad, E/L_58 (Display Sel) must be set to “Trq Output”.

6.5.12.4 Keypad input

1 Set CON_37 (Trq Bias Src) to “Analog”.

Keypad display	Description
CON ▶ Trq Bias Src 37 Analog	Set CON_37 (Trq Bias Src) to “Analog.

2 Set FUN_73 (Use LoadCell) to “Yes”. Input the torque and Ai1 values for full-load climb at FUN_74–77. AIO_06 and CON_40 will be automatically set.

Code	Keypad display	Name	Range	Unit	Default setting
FUN_73	Use LoadCell	Use auto loadcell	0 (No)/1 (Yes)		1 (Yes)
FUN_74	FullLoad Trq	Full-load climb torque	-250.0–250.0	%	100.0
FUN_75	FullLoad Ai	Full-load climb Ai1	-100.0 –100.0	%	100.0
FUN_76	No load Trq	No-load descent torque	-250.0–250.0	%	-100.0
FUN_77	No load Ai	No-load descent Ai1	-100.0 –100.0	%	0.0
FUN_78	TrqRamp Time	Torque current clime time	1–1000	ms	1

3 Check the following parameter setting values for correct calculation.

Keypad display	Description
AIO ▶ Ai Out Y2 06 200.0%	Formula: 100 x (Climb torque – Descent torque) ÷ (Climb Ai1 –descent Ai1)
CON ▶ Trq Balance 40 100.0%	Formula: ABS (No-load descent torque) – (AIO_06 x [No-load descent Ai1]) /100

Note

For correct calculation results, the analog input terminal Ai1 must be used when using the automatic load cell calculation.

6.5.13 Setting zero-speed deceleration time (FUN_94–FUN_97)

Codes FUN_95, FUN_96, and FUN_97 become available when FUN_94 (Use zero speed deceleration time) is set to “1 (Yes).”

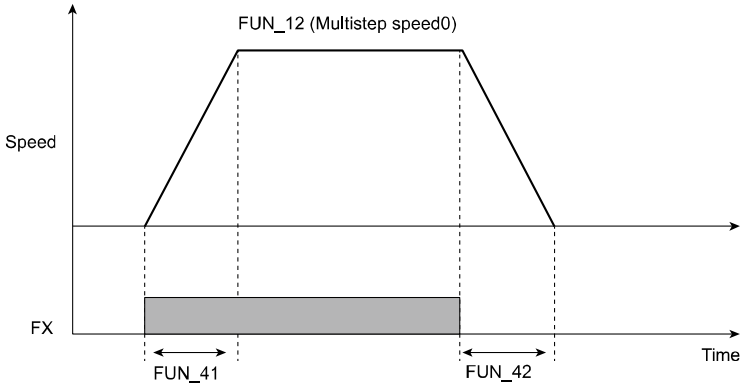
If the motor speed (Multistep speed0 set at FUN_12) is greater than the speed set at FUN_97 (Zero speed deceleration target speed), the motor decelerates and stops using the time set at FUN_95 (Zero speed deceleration time1).

If the motor speed (Multistep speed0 set at FUN_12) is smaller than the speed set at FUN_97 (Zero speed deceleration target speed), the motor decelerates and stops using the time set at FUN_96 (Zero speed deceleration time2).

Code	Keypad display	Name	Range	Unit	Default setting
FUN_94	Use 0 Dec T	Use zero speed deceleration time	0 (No) 1 (Yes)	-	0 (No)
FUN_95	0 Dec Time 1	Zero speed deceleration time 1	0.00 – 600.00	Sec	1.00
FUN_96	0 Dec Time 2	Zero speed deceleration time 2	0.00 – 600.00	Sec	3.00
FUN_97	0 Dec TarSpd	Zero speed deceleration target speed	0.00 – PAR_11	Hz /rpm	0.0

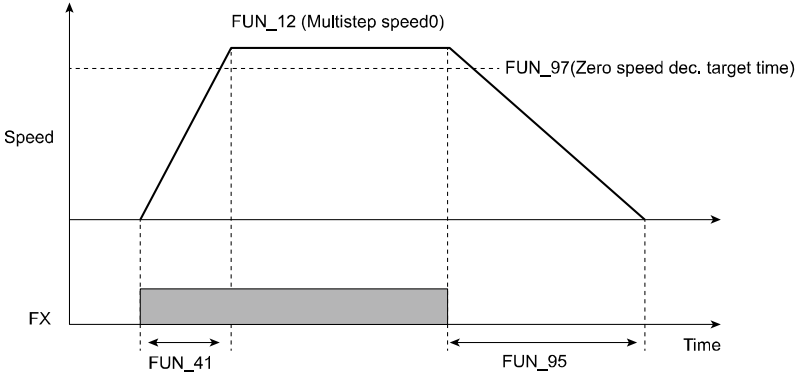
When FUN_94 (Use zero speed deceleration time) is set to “0 (No)”

The motor decelerates and stops using the time set at FUN_42 (Deceleration time1).

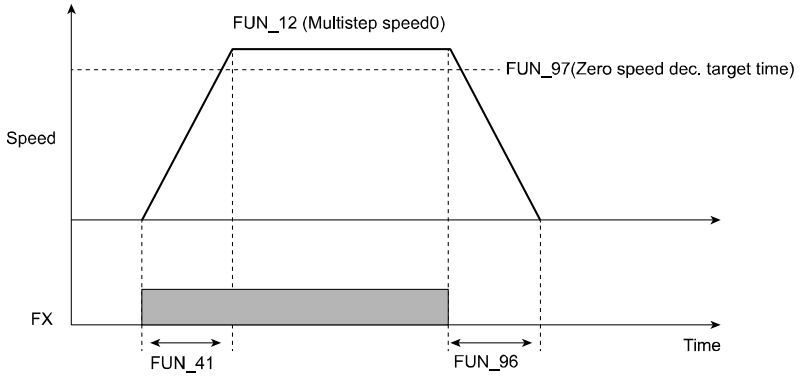


When FUN_94 (Use zero speed deceleration time) is set to "1 (Yes)"

If FUN_12(Multistep speed0) > FUN_97 (Zero speed deceleration target speed): The motor decelerates and stops using the time set at FUN_95 (Zero speed deceleration time1).



If FUN_12(Multistep speed0) < FUN_97 (Zero speed deceleration target speed): The motor decelerates and stops using the time set at FUN_96 (Zero speed deceleration time2).



6.6 Control (CON) group

6.6.1 Code jumping - accessing certain codes directly (CON_00)

CON_00 code is used to directly access a certain code.

The following is an example of jumping directly to CON_03 from CON_00 code.

1. Press [PROG].
2. Use [SHIFT/ESC], [▲], or [▼] to change the code number to “03”.
3. Press [ENT] to access CON_03 code. If an invalid code number is entered, the next available code number is automatically selected.



Note

After jumping directly to a code, you can move to other codes by pressing [▲] or [▼].

6.6.2 Speed controller PI ratio

Code	Keypad display	Name	Range	Unit	Parameter setting
CON_02	ASR PI Ratio	Speed controller gain ratio	1.0–500.0	%	20.0

CON_02 is only used with a synchronous motor.

6.6.3 Speed controller (Automatic Speed Regulator: ASR)

Speed controller PI gain 1 (CON_03–04)/Speed Controller PI gain 2 (CON_06–07)

When you switch two types of speed controller PI gain, LPF time constant (speed command value) also changes according to the selected gain. If the multifunction input terminal is set to OFF, the gain1 and LPF time constant are selected. If the multifunction input terminal is set to ON, the gain2 and LPF time constant are selected.

The following table lists the examples of code settings when multifunction terminal P4 is set for ASR PI Gain switching.

Code	Keypad display	Name	Range	Unit	Default setting
DIO_04	P4 define	Multifunction input terminal P4 Definition			ASR Gain Sel

You can set speed PI controller to P gain or I gain according to the “ARS Gain Sel” of the multifunction input terminal.

Code	Keypad display	Name	Range	Unit	Default setting	
CON_03	ASR P Gain1	Speed Controller proportional gain 1	0.1–500.0	%	Induction motor	50.0
					Synchronous motor	100.0
CON_04	ASR I Gain1	Speed Controller integral time 1	0–50000	ms	Induction motor	300
					Synchronous motor	50
CON_06	ASR P Gain2	Speed Controller proportional gain 2	0.1–500.0	%	Induction motor	50.0
					Synchronous motor	100.0
CON_07	ASR I Gain2	Speed Controller integral time 2	0–50000	ms	Induction motor	300
					Synchronous motor	50

Speed controller LPF time constant 1(CON_05)/Speed Controller LPF time constant 2 (CON_08)

The following table lists the examples of LPF time constant code settings.

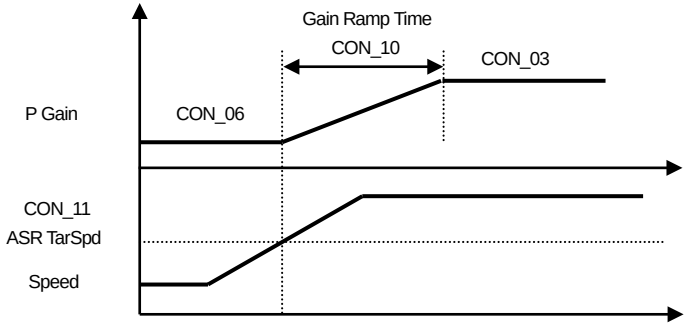
Code	Keypad display	Name	Range	Unit	Default setting
CON_05	ASR LPF1	ASR input LPF time constant 1	0–20000	ms	0
CON_08	ASR LPF2	ASR input LPF time constant 2	0–20000	ms	0

Speed controller gain switching ramp time (CON_10)/Speed Controller gain switching Speed (CON_11)

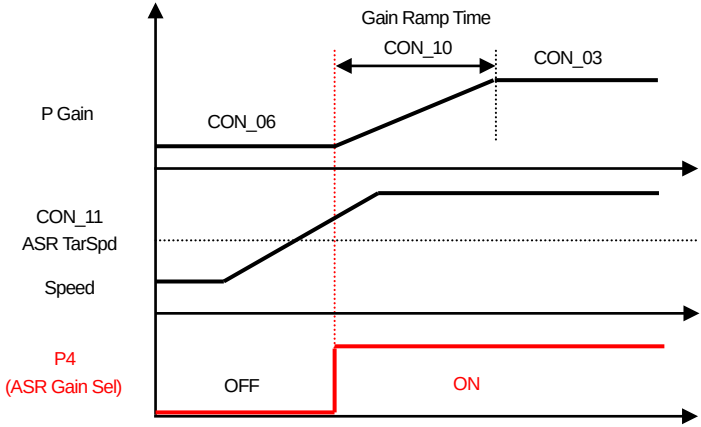
This function prevents a shock applied to the system due to a sudden change between P gain and I gain while switching ARS gain. When another value except for 0 is entered for CON_11 and the inverter's speed exceeds the entered value, the P gain changes to Ramp, and the P gain 2 changes to the P gain 1.

When the multifunction input terminal is set to "ARS Gain Sel" and the terminal is on, the speed gain switching activates. When the terminal is off, the speed gain switching deactivates.

Code	Keypad display	Name	Range	Unit	Default setting
CON_10	ASR Ramp	Speed controller gain switching ramp time	10–10000	ms	1000
CON_11	ASR TarSpd	Speed controller gain switching speed	0.0–PAR_11	rpm	0.0



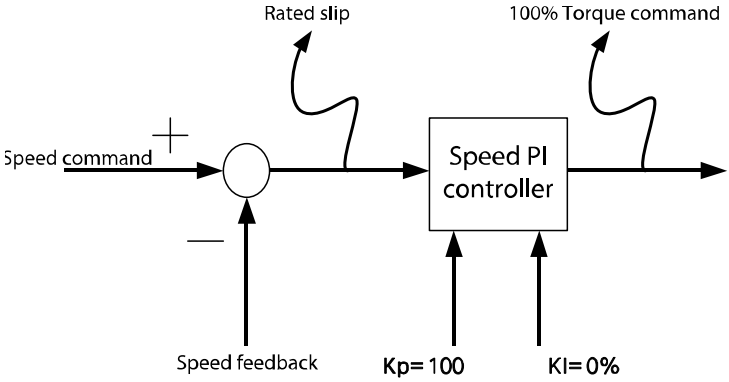
<When ASR Gain Sel has not been set>



<When ASR Gain Sel has been set>

How to set proportional gain and integral time of speed controller

The proportional gain (%) of speed controller is scaled to have the same value of the torque reference (%) when the speed error is rated slip. The integral time is the time it takes until the output torque changes from 0 to 100% when the speed error is rated slip. When the proportional gain is 100% and the speed error is rated slip, the speed controller output has the same value of 100% torque.



<Speed Controller response set>

The response time must be checked after each parameter adjustment.

E.g.) Check the response after adjusting CON_02 – Check the response after adjusting CON_03

Option	CON_02 Note1)	CON_03	CON_04	Description
To speed up the response	Slower	Faster	Slower	The respond times speed up, but the system is unstable, and the motor vibration and overshoot are increased.
To slow down the response	Faster	Slower	Faster	Motor vibration and overshoot are decreased, but the response times speed down.

Note 1) Displayed only when the operation mode (PAR_07) is set to “Speed (PM).”

6.6.4 Overshoot Prevention

This function prevents the motor’s feedback speed from overshooting.

overshoot prevention gain (CON_09)

If a value other than ‘0’ is set at CON_09, the overshoot prevention function is active. The overshoot rate for motor feedback speed varies based on the motor’s inertia set at (PAR_57).

Code	Keypad display	Name	Range	Unit	Default setting
CON_09	ASR FF Gain	Overshoot prevention gain	0–1000	%	0

6.6.5 Torque-related parameters

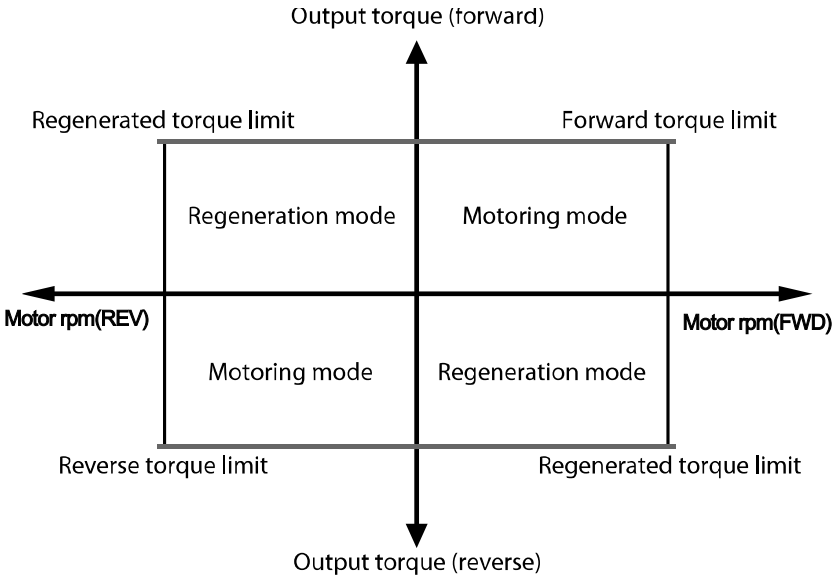
The torque limit definition, forward/backward/ regenerated torque limit (CON_33–36)

Because the motor's torque output is calculated internally in the vector control, the torque limit can be set within a specific value. Use this function when you want to permit the torque within a specific limit or when you want a certain amount of regenerated energy.

The torque limit can be set differently by Forward, Reverse, or Regeneration mode which is changed according to the motor operation type.

Each operation mode may be configured to take inputs from the function code settings and CAN communication.

Code	Keypad display	Name	Range	Unit	Default setting
CON_33	Trq Lmt Src	Torque limit definition	See below		Kpd Kpd Kpd



Torque limit definition

The torque limit value is set according to the CON_33 code value.

CON_33 code setting	Forward torque limit	Reverse torque limit	Regeneration torque limit
0 (Kpd Kpd Kpd)	CON_34	CON_35	CON_36
8 (CAN CAN CAN)	Forward torque limit	Reverse torque limit	Regeneration torque limit

Vx is the value set as the torque limit from the terminal block Analog input.

The torque current standard

The torque current standard is used to transform torque reference input into current reference. The torque current standard is calculated from the motor's rated current and flux current. By default, the motor's rated current and flux current are set for HEIGEN vector motors based on the motor capacity set at PAR_09.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_09	Motor Select	Motor capacity option	2.2–22.0	kW	Varies by motor capacity.
PAR_19	Rated-Curr	Motor rated current	1.0–1000.0	A	
PAR_52	Flux-Curr	Motor flux current	0.0 – 70% of PAR_19	A	

Torque bias options (CON_37)/torque bias value (CON_38)

When CON_37 is set to "1 (Analog)," torque bias is provided via analog inputs (AIO_01, Torque bias). When CON_37 is set to "2 (Keypad)" or "4 (CAN)," torque bias is provided via keypad input (CON_38, Torque bias value) or input from CAN communication.

When you use the multifunction terminal block input, 0–10 V voltage input is converted and used as 0–200% input value. Torque bias can also be adjusted by setting gain and bias values.

Code	Keypad display	Name	Range	Unit	Default setting
CON_37	Trq Bias Src	Torque bias option	0 (None) 1 (Analog) 2 (Keypad) 4 (CAN)		0 (None)
CON_38	Trq Bias	Torque bias value	-150.0–150.0	%	0.0

Torque bias options

When one of the multifunction input terminals P1–P7 is set to “Use Trq Bias,” torque bias is enabled or disabled when input signal to the multifunction input terminal is turned On or Off.

The following table lists an example of code setting when multifunction terminal P5 is set for this function.

Code	Keypad display	Name	Range	Unit	Default setting
DIO_05	P5 Define	Multifunction input terminal P5 Definition			Use Trq Bias

Select the source of torque bias by configuring CON_37(Trq Bias Src) and define the relevant codes as follows.

Code	Keypad display	Name	Range	Application
CON_37	Trq Bias Src	Torque bias options	0 (None)	Torque bias is not used.
			1 (Analog)	Set the following codes: AIO_01(Ai1 Define): “Torque Bias” AIO_02(Ai1 Source): “0–10V” (voltage input to V1 terminal) AIO_06(Ai1 Out Y2): “200%” CON_40(Trq Balance): 100%
			2 (Keypad)	Set CON_38(Trq Bias)
			4 (CAN)	Set CAN communication

Caution

If one of the multifunction input terminals P1–P7 has NOT been set to “Use Trq Bias,” setting CON_37 alone can immediately begin applying torque bias to the operation.

Torque bias compensation for loss by friction (CON_39)

This is the torque bias to compensate the loss by friction. Because the loss by friction is changed by the motor’s rotation direction, the torque bias is added by multiply the sign according to the rotation direction.

Code	Keypad display	Name	Range	Unit	Default setting
CON_39	Trq Bias FF	torque bias compensation for loss by friction	-150.0–150.0	%	0.0

Torque balance value (CON_40)

Use a load cell to balance the amount of load torque feedback while operating lift-type loads. When a load cell is used, the compensation is made based on the load cell’s output torque from the balanced state of the load. Balance the load of the lift and the counterweight to be exactly even, and then adjust the value at CON_40 to 100%. The value that appears when you press [PROG] on the keypad is the load cell voltage input to the inverter. Press [▲] or [▼] to adjust the percentage (%) to make this value the reference for compensation.

Code	Keypad display	Name	Range	Unit	Default setting
CON_40	Trq Balance	Torque balance value	0.0–100.0	%	50.0

6.6.6 Torque boost

Torque boost enables users to adjust output voltage at low speed or during motor start. This feature increases low speed torque or improves motor starting properties by manually increasing output voltage. Manual torque boost is suited for loads that require high starting torque, such as elevators.

6.6.6.1 Manual torque boost

When the inverter control mode is set to V/F or slip comp, the inverter controls the open loop. To prevent situations where users cannot start the inverter due to insufficient torque, users can set a torque boost values and provide additional voltage to the inverter. The additional voltage is generated at a fixed ratio of a frequency.

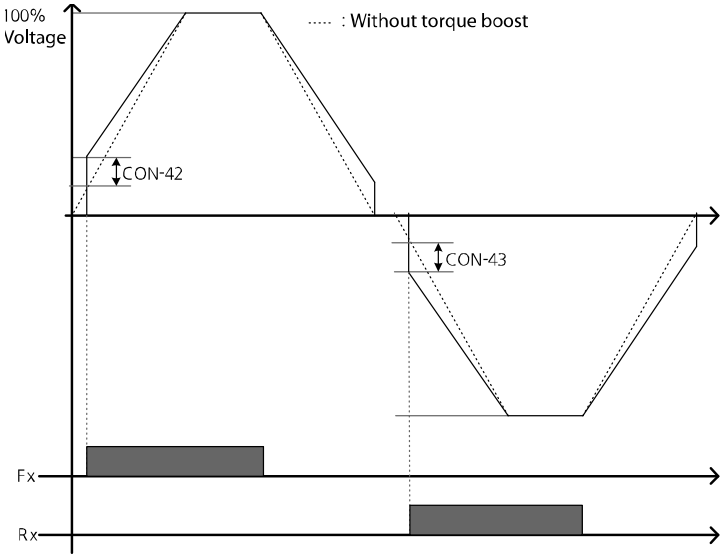
Code	Keypad display	Name	Range	Unit	Default setting
CON-41	Torque boost	Torque boost method	0 (Manual) 1 (Auto)		0 (Manual)
CON-42	Fwd boost	Forward torque boost	0.0–20.0	%	2.0
CON-43	Reverse boost	Reverse torque boost	0.0–20.0	%	2.0

Forward torque boost (CON_42)

When the inverter rotates the motor in the forward direction, this function adjusts the level of torque boost.

Reverse torque boost (CON_43)

When the inverter rotates the motor in the reverse direction, this function adjusts the level of torque boost.



Manual torque boost adjusts the inverter output based on the setting values regardless of the amount of the load.

Caution

- Excessive torque boost will result in failures due to motor overheat or overcurrent.
- An overcurrent trip may occur also when the load is heavy and the torque boost is low.

6.6.6.2 Auto torque boost

Auto torque boost can be used when CON_41 is set to “1 (Auto).” Auto torque boost enables the inverter to automatically calculate the amount of output voltage required for torque boost based on the amount of load. It automatically compensates for the amount of load unlike manual torque boost that adjusts the inverter output regardless of the amount of the load. Auto torque boost adjusts the output voltage based on the ATB Gain_M and ATB Gain_G values at CON_46 and CON_47. It is used when the torque is insufficient for motor starting or in overcurrent conditions.

Code	Keypad display	Name	Range	Unit	Default setting
CON-41	Torque boost	Torque boost method	0 (Manual) 1 (Auto)		0 (Manual)
CON-42	Fwd boost	Forward torque boost	0.0–20.0	%	2.0
CON-43	Reverse boost	Reverse torque boost	0.0–20.0	%	2.0
CON-45	ATB Filter Gain	Auto torque boost filter gain	1–10000	ms	200
CON-46	ATB Gain M	Auto torque boost motoring voltage gain	0–300.0	%	15.0
CON-47	ATB Gain G	Auto torque boost regeneration voltage gain	0–300.0	%	10.0

Auto torque boost filter gain (CON_45)

The filter gain used to calculate the auto torque boost value.

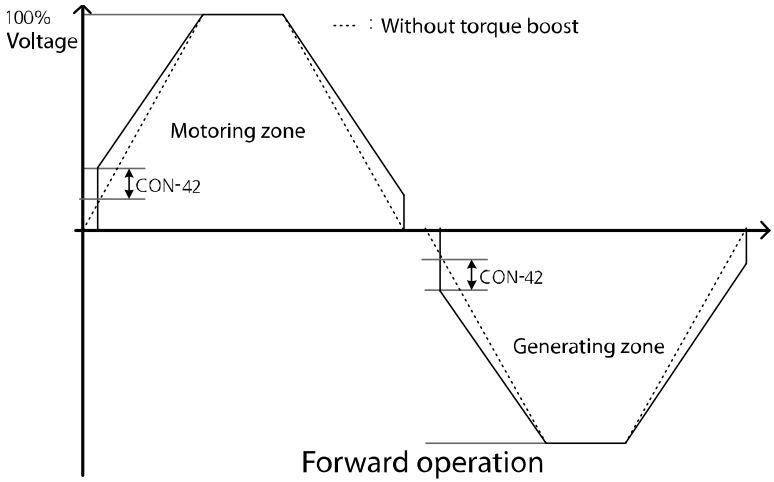
Auto torque boost motoring voltage gain (CON_46)

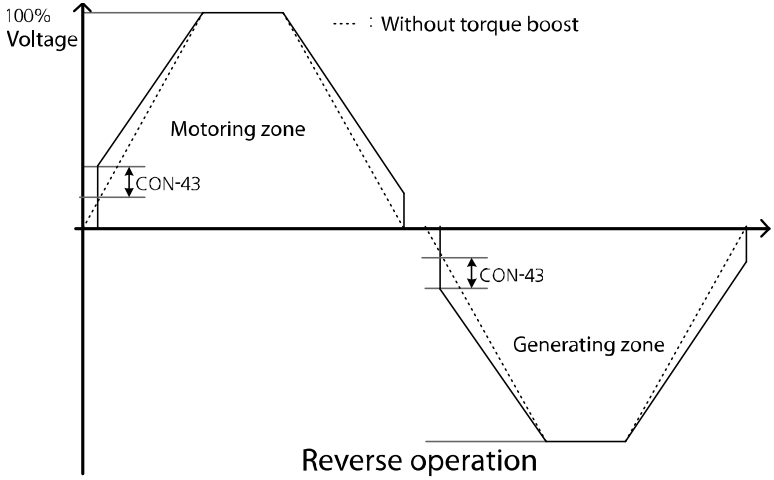
The voltage gain used to calculate the motoring auto torque boost value.

Auto torque boost regeneration voltage gain (CON_47)

This is the voltage gain used to calculate the regeneration auto torque boost value.

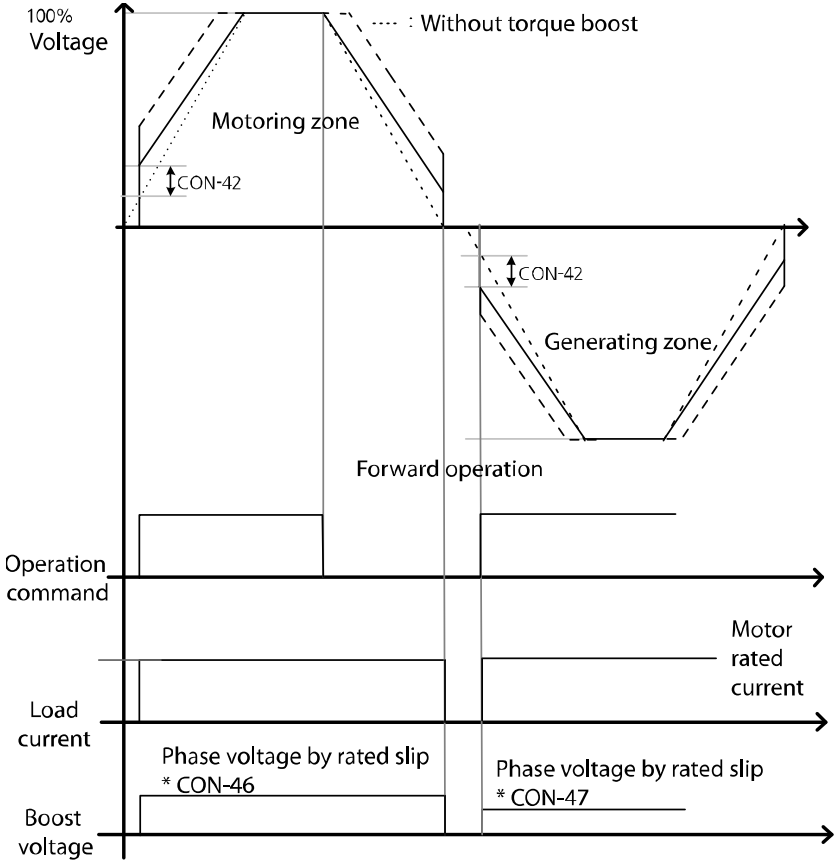
When not loaded

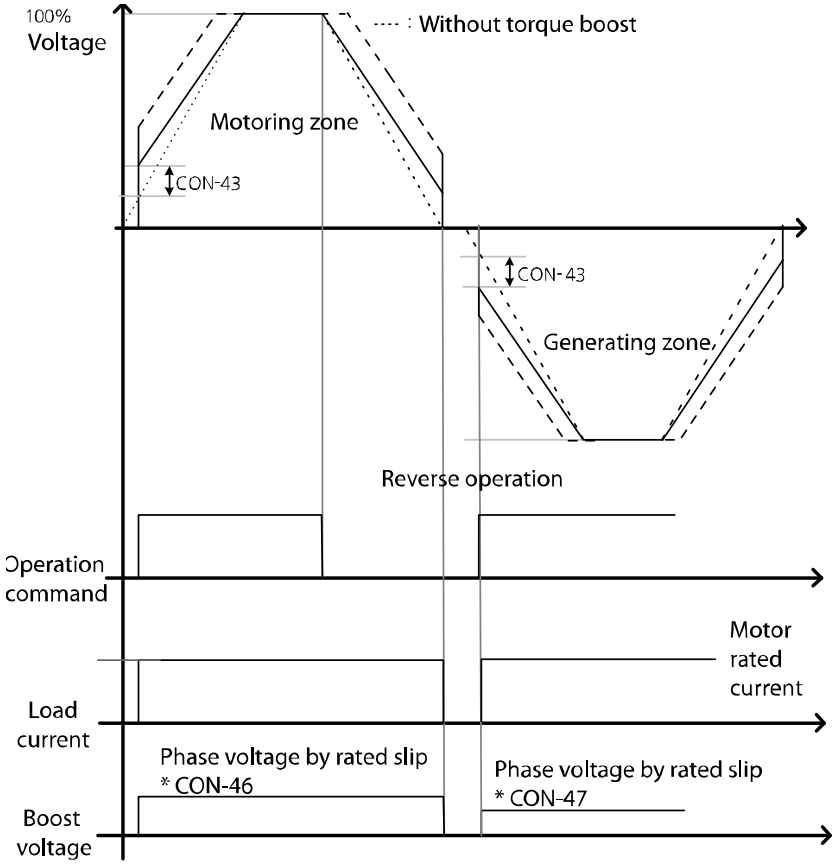




When not loaded, the additional voltage for the auto torque boost is 0. It is same as the normal manual boost value.

When loaded





The graph above shows the auto torque boost wave when a load is applied. When loaded, voltage compensation varies depending on the operation direction and motoring operation.

When the control mode is set to “Slip Comp”, the CON_41 Torque Boost mode is automatically configured to Auto.

The current hunting may occur if the value in CON_42 and CON 43 are different when using the torque boost while not loaded.

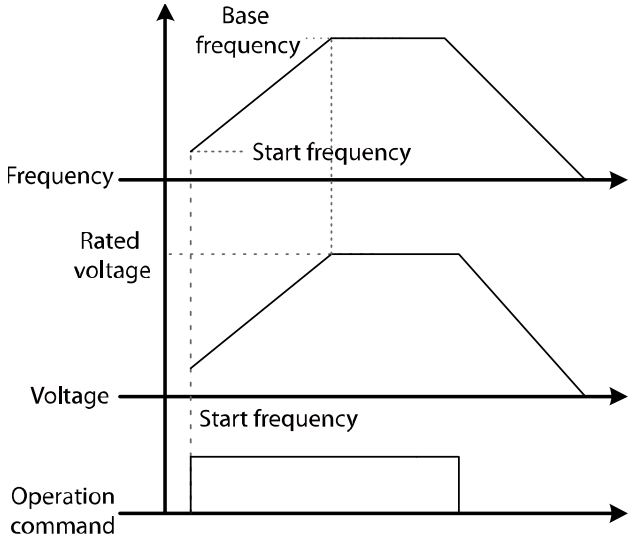
6.6.7 V/F (Voltage/Frequency) control

V/F control is used to configure the inverter's output voltages, gradient levels, and output patterns to achieve a target output frequency. The amount of torque boost used during low frequency operations can also be adjusted.

6.6.7.1 V/F voltage pattern

CON_48 V/F pattern: Linear

A linear V/F pattern configures the inverter to increase or decrease the output voltage at a fixed rate based on the V/F ratio, according to the increase or decrease of the operating frequency.

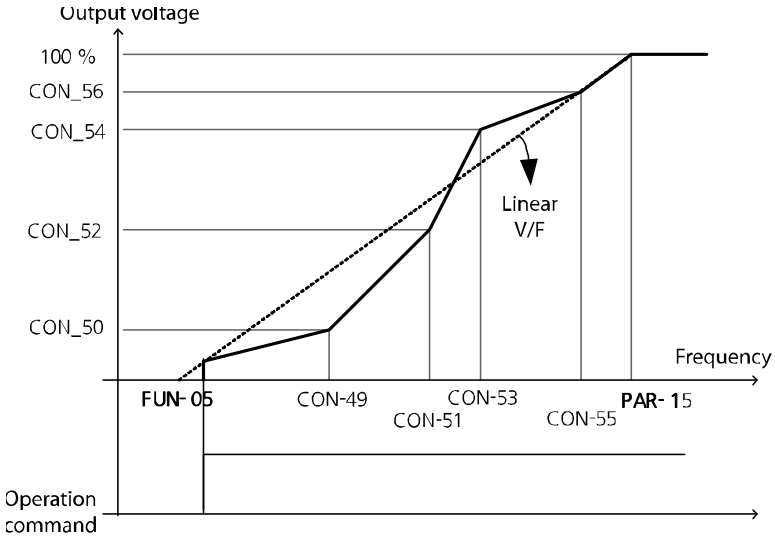


6.6.7.2 User V/F pattern (User V/F)

You can set the configuration of user-defined V/F patterns to suit the load characteristics of special-purpose motors.

Code	Keypad display	Name	Range	Unit	Default setting
CON-48	V/F pattern	Output voltage pattern for output frequency	0 (Linear) 2 (User V/F)		0 (Linear)
CON-49	User freq 1	User freq 1	0–CON_51	Hz	15.00
CON-50	User volt 1	User volt 1	0–100	%	25
CON-51	User freq 2	User freq 2	CON_49–CON_53	Hz	30.00
CON-52	User volt 2	User volt 2	0–100	%	50
CON-53	User freq 3	User freq 3	CON_51–CON_55	Hz	45.00
CON-54	User volt 3	User volt 3	0–100	%	75
CON-55	User freq 4	User freq 4	CON_55–PAR_11	Hz	60.00
CON-56	User volt 4	User volt 4	0–100	%	100

When the base frequency, minimum frequency, and motor rated voltage are set in the inverter, and users want to generate the V/F voltage pattern after setting the user V/F, users should set CON_49–CON_56. When the setting is entered, the inverter generates the user-defined voltage values for a specific frequency when the operation command is ON.



For induction motors, a pattern that deviates sharply from linear V/F pattern must not be used. Patterns that deviates sharply from linear V/F pattern can result in insufficient motor torque or over-excitation and cause motor overheating. When a user V/F pattern is in use, torque boost does not operate.

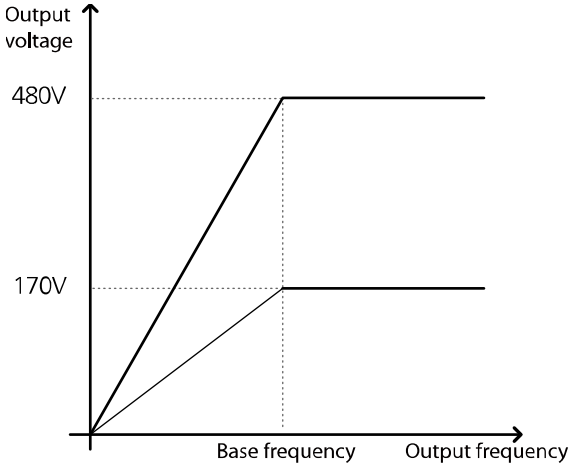
Caution

When the control mode is V/F, or Slip Comp, the direction cannot be changed during operation. To change the current direction, stop the inverter and allow the operation command in the required direction.

6.6.8 Motor output voltage control (CON_57)

When the input power and rated motor voltage are different, enter the voltage displayed on the motor's nameplate to configure the motor voltage. The configured voltage value becomes the output voltage for the base frequency.

If the frequency is higher than the base frequency and the input voltage is higher than the parameter setting, the inverter regulates it and supplies the rated voltage to the motor. However, if the frequency is higher than the base frequency and the input voltage is lower than the rated motor voltage, the inverter supplies the input voltage to the motor.



6.6.9 Slip compensation

Slip refers to the difference between the set frequency (synchronous speed) and the motor rotation speed. As the load increases, difference between the set frequency and the motor rotation speed can occur. Slip compensation is used for loads that experience speed variations and require compensating speed.

Code	Keypad display	Name	Range	Unit	Default setting
CON_63	SlipCompFreq	Slip compensation operation frequency	0.00–120.00	Hz	5.00
CON_64	SlipGain_MH	Slip compensation motoring gain H	0–1000	%	100.0
CON_65	SlipGain_ML	Slip compensation monitoring gain L	0–1000	%	100.0
CON_67	SlipGain_GH	Slip compensation generation gain H	0–1000	%	100
CON_68	SlipGain_GL	Slip compensation generation gain L	0–1000	%	100
CON_69	Slip Filter	Slip compensation filter time constant	10–10000	ms	500
PAR-07	Control Mode	Control mode	2 (Speed(IM)) 4 (V/F) 5 (Slip Comp) 6 (Speed(PM))		2 (Speed(IM))
PAR-12	Min Speed	Inverter output minimum frequency	0.10–10.0	Hz	0.50
PAR-13	Base Freq	Inverter base frequency	30.00–120.00	Hz	60.00
PAR-15	Rated Volt	Motor rated voltage	300–528	V	380
PAR-18	Rated Slip	Motor rated slip	0.10–25.00	Hz	1.66
PAR-19	Rated Curr	Motor rated current	0–Motor rated Current	A	15
PAR-52	Flux-Curr	Excitation current	0–Motor rated	A	6.3

Code	Keypad display	Name	Range	Unit	Default setting
		(Motor no load current)	Current		
CON-48	V/F pattern	Output voltage pattern	0 (linear) 2 (User V/F)		0 (Linear)
CON-41	Torque boost	Torque boost method	0 (Manual) 1 (Auto)		1 (Auto)
CON-42	Fwd boost	Forward torque boost	0.0–20.0	%	2.0
CON-43	Reverse boost	Reverse torque boost	0.0–20.0	%	2.0
CON-45	ATB Filter Gain	Auto torque boost filter gain	1–10000	ms	200
CON-46	ATB Gain M	Auto torque boost reverse voltage gain	0.0–300.0	%	15.0
CON-47	ATB Gain G	Auto torque boost regeneration voltage gain	0.0–300.0	%	10.0

Slip compensation starting frequency (CON_63)

Set the frequency to use when slip compensation starts.

Slip compensation motoring gain (CON_64, CON_65)

Set values for motoring gain when the output frequency exceeds the slip compensation gain frequency. Gain values can be individually set for reverse and regeneration operation.

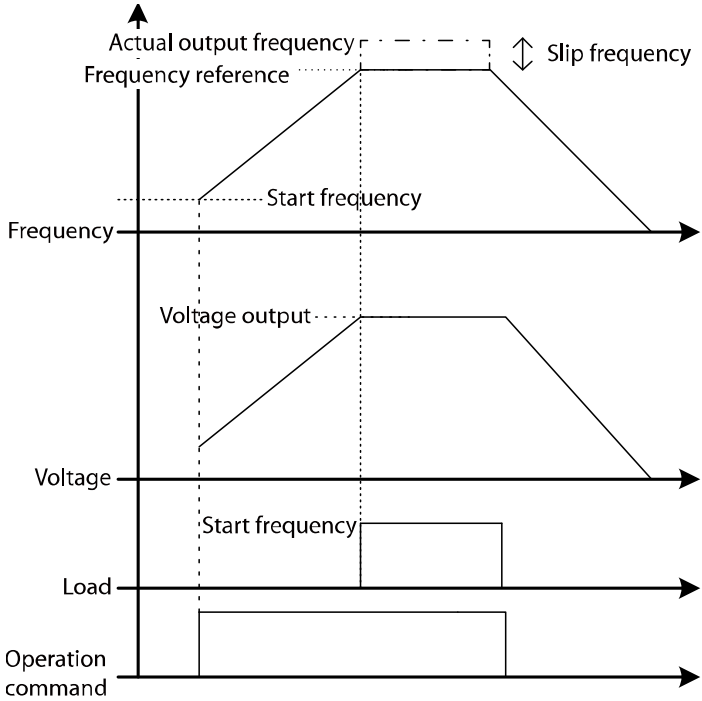
Slip compensation generation gain (CON_67, CON_68)

Set values for generation gain when the output frequency is lower than the slip compensation gain frequency.

Slip compensation filter time constant (CON_69)

Slip compensation filter time constant refers to the filter time constant used for calculating the required current for slip compensation.

If load is allowed after reaching the target frequency:



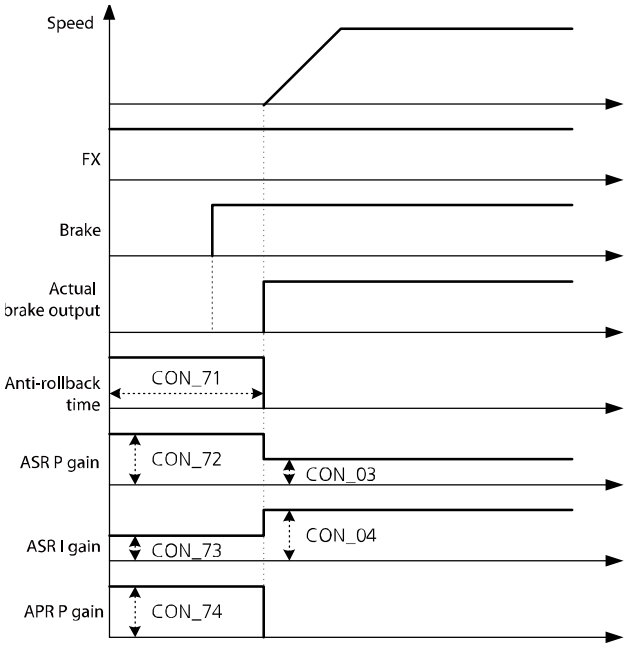
When the motor is not loaded and the target frequency is reached, the inverter outputs the combined frequency of the user-defined target frequency and slip frequency.

Caution

When the control mode is V/F or Slip Comp, the direction of rotation cannot be changed during operation. To change the direction of rotation, stop the motor and configure the operation command for the desired direction.

6.6.10 Anti Rollback Function

Use this function to prevent roll back and to maintain the starting torque. The function does this by compensating for initial load without using the loadcell while elevator is operated.



Anti Rollback time (CON_71)

If a value other than '0' is set at CON_71 Anti-Rollback Time, the anti-rollback function is active.

Code	Keypad display	Name	Range	Unit	Default setting
CON_71	ARF Time	Anti rollback time	0–10000	ms	0

Anti Rollback speed controller P/I gain (CON_72–73)

When anti-rollback is active, Speed Controller P/I gain can be set.

The value set at CON_72 must be higher than the value set at CON_03. Increase the setting value if rollback occurs and decrease it if vibration and noise occur.

Enter a value at CON_73 that is less than the value set at CON_04. Decrease the setting value if rollback occurs and increase it if vibration and noise occur.

Code	Keypad display	Name	Range	Unit	Default setting
CON_72	ARF ASR P	Anti rollback ASR P gain	1–3000	%	100
CON_73	ARF ASR I	Anti rollback ASR I gain	1–50000	ms	5

Anti Rollback location control P gain (CON_74)

Set the location controller P gain for anti-rollback. Increase the setting value if rollback occurs and decrease it if vibration and noise occur.

Code	Keypad display	Name	Range	Unit	Default setting
CON_74	ARF APR P	Anti rollback APR P gain	1–9999	%	200

Motor inertia value (PAR_57)

Enter a value for motor inertia. When an inertia value is shown on the motor's rating plate, enter the rated value. If an inertia value is not shown, adjust the settings based on anti-rollback performance.

Code	Keypad display	Name	Range	Unit	Default setting
PAR_57	Inertia	Motor inertia number	0.001–60.000	kgm^2	Asynch: 0.072 Synch: 5.000

Note

The motor can generate noise based on the anti-rollback settings for APR and ASR gain.

6.6.11 Automatic current regulator (ACR))

Use this function to control the torque current and flux current. The following parameters may be used to adjust the amount of gains that have already been calculated. The current controller gain is affected by motor parameter settings.

q axis current regulator P/I gain (CON_88–89)

Set the q axis P/I gain of the current regulator to adjust the torque current (q-axis current).

Code	Keypad display	Name	Range	Unit	Default setting
CON_88	ACR P Gain	q axis current controller P gain	10–2000	%	100
CON_89	ACR I Gain	q axis current controller I gain	10–2000	%	100

d axis current regulator P/I gain (CON_90–91)

Set the d axis P/I gain of the current regulator to adjust the flux current (d-axis current).

Code	Keypad display	Name	Range	Unit	Default setting
CON_90	ACRd P Gain	d axis current controller P gain	10–2000	%	100
CON_91	ACRd I Gain	d axis current controller I gain	10–2000	%	100

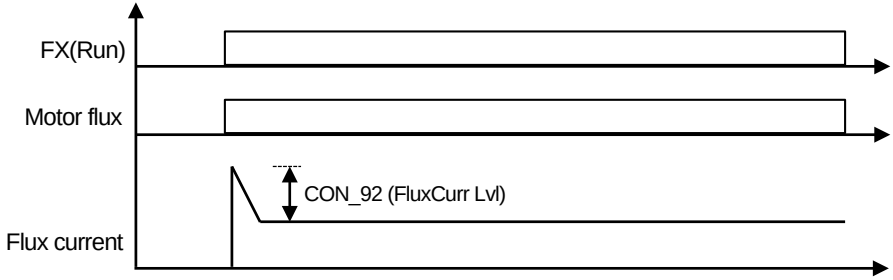
6.6.12 Flux current level control

To facilitate proper speed control at the start of a motor operation, the motor flux must be quickly established. For this, the output current of the inverter may be controlled based on the motor flux current (PAR_52, Flux-Curr).

Flux current level (CON_92)

Decrease the value set at CON_92 (FluxCurr Lvl) if an overcurrent trip occurs when the motor starts up. An overcurrent trip may occur at the motor startup if the flux current level is set too high.

Code	Keypad display	Name	Range	Unit	Default setting
CON_92	FluxCurr Lvl	Flux current level	0.0–100.0	%	80.0



6.7 Elevator (E/L) group

Refer to the User Manual provided with ELIO (Elevator I/O) add-on module for detailed information.

6.8 Protection (PRT) group

6.8.1 Jump code (PRT_00)

PRT_00 code is used to directly access a specific code.

The following is an example for jumping directly to PRT_03 from PRT_00 code.

1. Press [PROG].
2. Use [SHIFT/ESC], [▲], or [▼] to change the code number to “03”.
3. Press [ENT] to access PRT_03 code. If an invalid code number is entered, the next available code number is automatically selected.



Note

After jumping directly to a code, you can move to other codes by pressing [▲] or [▼].

6.8.2 Motor thermal protection (I^2T)

Use this function to protect the motor from overheating without adding an external thermal relay. By calculating the motor’s theoretical temperature rise based on various parameters and considering the motor’s load current conditions, this function decides whether or not the motor is overheated. When thermal protection is activated, the inverter output is blocked and a trip message appears.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_01	ETH Select	Electronic thermal on/off	0 (No)		No

Code	Keypad display	Name	Range	Unit	Default setting
			1 (Yes)		
PRT_02	ETH 1 Min	Electronic thermal one minute rating	PRT_03–200	%	150
PRT_03	ETH Cont	Electronic thermal continuous rating	50–PRT_02 (150% max)	%	100
PAR_19	Rated-Curr	Motor rated current	1.0–1000.0	A	-
PAR_22	Cooling Mtd	Motor cooling fan type	0 (Self-cool) 1 (Forced-cool)		Forced-cool

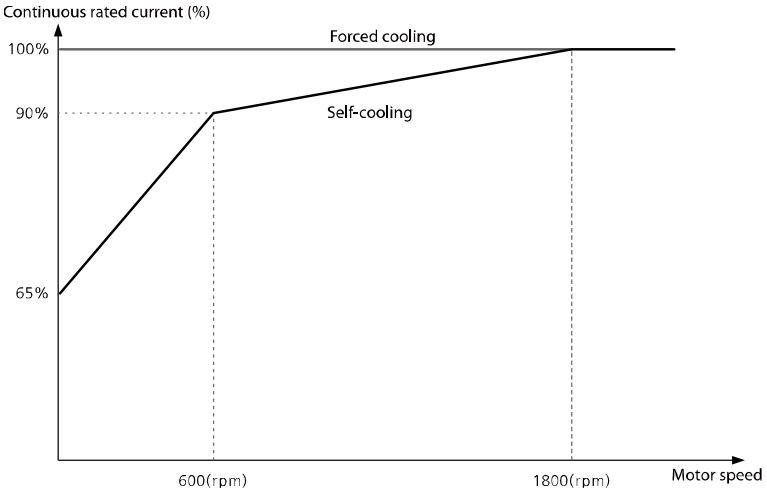
The electronic thermal level is a ratio (%) to “Motor rated Current” set at PAR_19.

“Electronic thermal one minute rating” (PRT_02) is the magnitude of input current that is supplied to the motor for one minute until the motor is considered as overheated.

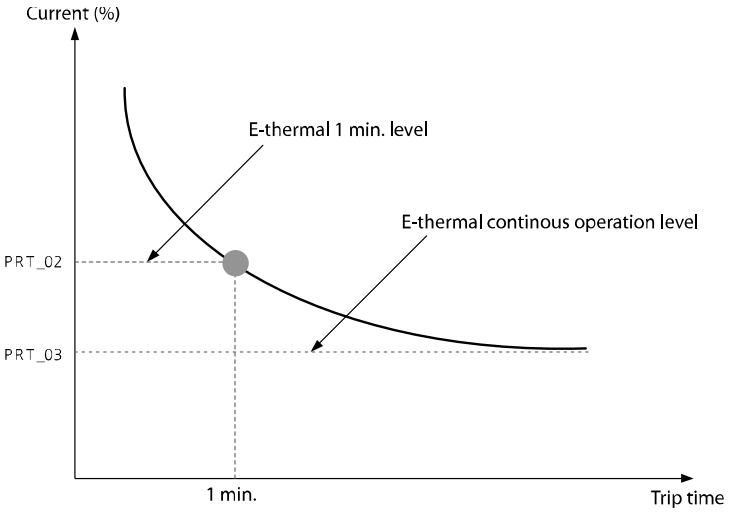
“Electronic Thermal continuous rating” (PRT_03) is the magnitude of input current that the motor is not overheated when the current is continuously supplied to the motor. In general, it is set as the motor’s rated current (100%), and it must be set to a lower value than the value of Electronic Thermal one minute rating. The motor continuously operates to the configured value.

“Motor cooling fan type” (PRT_22) is for setting the motor’s cooling fan type for the electronic thermal function.

- Self-cool: Select the Self-cool mode when operating the cooling fan attached to the motor axis. This mode is for universally designed induction motors. In this case, the cooling capacity greatly decreases when the motor is operated at low speed. The motor overheats rapidly at lower speed. Therefore, depending on the motor speed, the electric thermal function operates with reduced continuous rated current set at "ETH Cont" (PRT_02) as shown in the graph below.
- Forced-cool: Select the Forced-cool mode when operating a cooling fan independently, with a separate power supply. The continuous rated current set at "ETH Cont" (PRT_03) is applied regardless of the motor speed.



Continuous rated current derating by operation frequency (based on a 4-pole, 60 Hz motor).



E-thermal inverse time characteristics curve

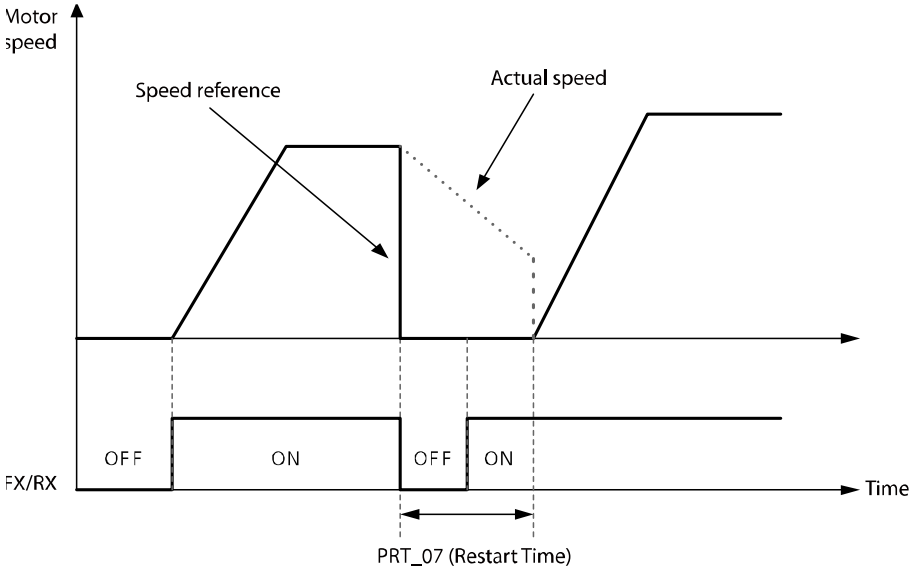
When the inverter output current changes due to the load variation or frequent acceleration/deceleration, the motor protection is possible because I2T is calculated and accumulated.

6.8.3 Restart delay time after stop command

This function only operates when stop mode (FUN_03) is set to free-run. The PRT_07 (Restart Time) option is only available for this function and this function only operates when operating the inverter using the control terminal block.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_07	Restart Time	Restart delay time after stop command	0.00–10.00	sec	0.00
FUN_03	Stop mode	Stop mode	0 (Decel) 1 (Free-run) 2 (DC-Brake)		0 (Decel)

When this function is used, even if a subsequent input command is received after the stop command, the inverter operation will not be resumed until the restart delay time set at PRT_07 (Restart Time) has been elapsed.



6.8.4 EnDat add-on module-related function setting

PRT_08 is used to set EnDat add-on module related fault trip functions. When an EnDat encoder is used, an initial pole position estimation is performed based on this configuration after a trip or power reset.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_08	Sc/EnDat Func	SinCos_1387/EnDat module error and initial pole position estimation setting	111–000	bit	011

Bit 0: 'EnDat Error' setting (EnDat mode only)

When you set Bit 0 to "1" at PRT-08, a communication error occurs if EnDat add-on module 's clock or data input signal cable is not connected. The inverter outputs "EnDat Error" while the inverter is in stopped state.

Bit 1: Initial pole position estimation after a fault reset (Endat/SinCos_387 mode only)

When you set Bit 1 to "1" at PRT-08, an initial pole position estimation is performed upon the first operation after a fault reset.

Bit 2: Initial pole position estimation after power reset (Endat/SinCos_387 mode only)

When you set Bit 2 to "1" at PRT-08, an initial pole position estimation is performed upon the first operation after the inverter's power reset.

6.8.5 Encoder error detection

If the encoder is disconnected or there is a connection error when “Detection of encoder error” at PRT-09 is set to “Yes”, the inverter detects the encoder error. For open-collector encoders, set PRT-09 to “No” as encoder error detection is not available for this type of encoders.

If electronic interference distorts the encoder’s input wave, adjust the “Encoder LPF time constant” setting at PRT-10 to reduce the distortion.

When the encoder settings are not accurate, normal speed control does not work. And the inverter frequently generates trips such as “over current” or “over voltage”. If this happens, refer to *8 Troubleshooting* on page *334*.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_09	Enc Err Chk	Detection of encoder error	0 (No) 1 (Yes)		1 (Yes)
PRT_10	Enc LPF	Encoder LPF time constant	0–100	ms	1

6.8.6 Software encoder error detection (PRT_11–12: Detection time of encoder error, encoder error based on the speed rate)

Accurate motor speed detection is critical for motor speed control when an encoder is installed. Correct encoder connection and motor connection are required to ensure accurate speed control. If the motor operation is maintained even after input signal errors such as an encoder disconnection occurred, or if the motor is operated while the encoder or motor cables are incorrectly connected, the motor may not operate properly. Also, the resultant high current flow may result in motor damage. It is essential to ensure that encoder error and connection problems are closely monitored.

The L100 inverter detects encoder error with hardware diagnosis (when PRT_09 is set to “Yes”). This is for checking the status of encoder pulse input (input pulse) to detect the hardware damage by some reason such as a disconnection of encoder. However, error of connection cannot be detected only with hardware diagnosis. Set PAR_31 to "Rotational" and perform an encoder test when

performing the auto-tuning. By this procedure, you can rotate the motor to check speed value for detecting connection error.

There are types of loads that do not allow arbitrary rotation of motor, such as elevator loads. In such cases, the encoder test described above may be not be available. When it is difficult to perform the encoder test, you can enable the software encoder error detection to detect the connection errors.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_11	EncFaultTime	Motor error detection time	0.00–10.00	sec	0.00 ELPM: 4.00
PRT_12	EncFaultPerc	Motor error standard speed rate	0.0–50.0	%	25.0 ELPM:10.0
PAR_18	Rated-Slip	Motor rated slip	10–250	rpm	Varies by motor capacity

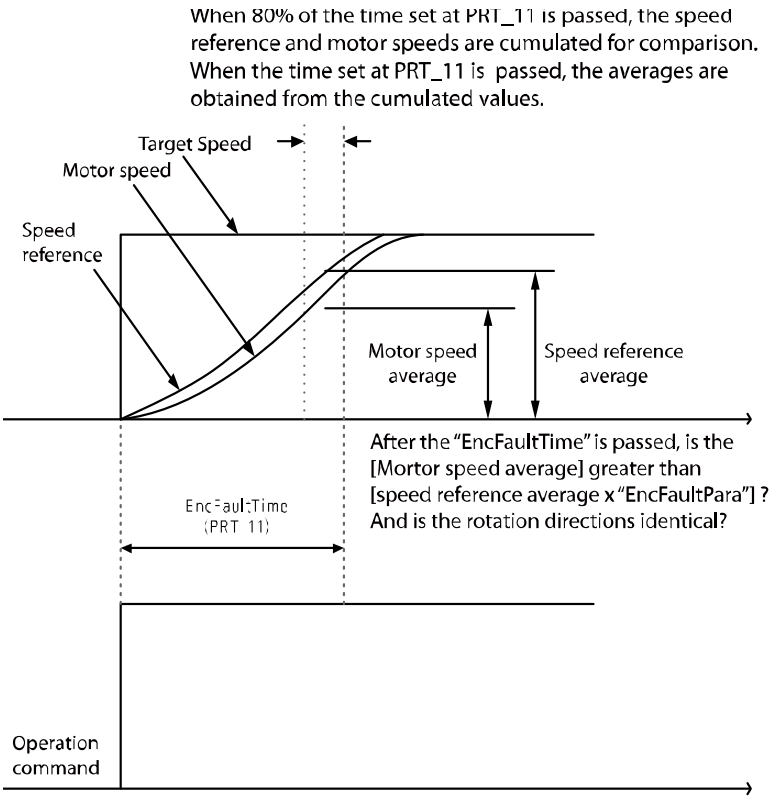
If the encoder or motor cable connection is incorrect, abnormal current exceeding the torque limit current may result, affecting the acceleration. Software encoder error detection is used to detect input pulse errors or improper acceleration caused by cable connection problems. The graphs below illustrate how this function works. When the time set at PRT_11 elapses, it checks the rate of acceleration for the existing motor speed and compares it with the target speed, and the rotation direction of the motor. An error occurs if the acceleration rate is too low, or the motor's rotating direction is incorrect.

The software encoder error detection does not operate during an auto-tuning. It only works when the control mode is set to speed control mode (when PAR_07 is set to Speed(IM) or Speed(PM)), and "EncFaultTime" is set to a value except for 0.

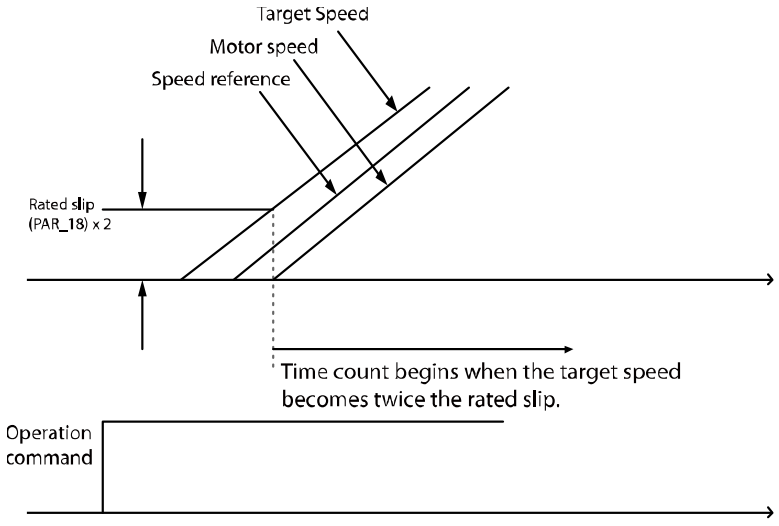
The software encoder error detection compares the motor speed with "EncFaultPerc" multiplied by the speed reference to detect encoder errors. Therefore, error detection is only available during an acceleration after the "EncFaultTime". The software encoder error detection does not operate if the motor is decelerated due to a target speed change or the inverter operation is stopped before the "EncFaultTime" is elapsed.

The encoder error detection is performed only once after an operation begins, only when the target speed is more than twice the rated slip, after the motor speed has exceeded twice the rated slip.

For example, when the target speed is 500 (rpm) and the rated slip is 40 (rpm), the detection starts at the point when the target speed becomes 80 (rpm).



(a) when FUN_02 is set to "Keypad1" or "Keypad2"



(b) when FUN_02 is set to "Analog" or "Up/down"

6.8.7 Speed deviation error settings

Speed deviation errors output an error signal when a deviation occurs between the command speed and the true motor speed. The deviation must be present for longer than the duration set at PRT_14 (Speed deviation detection time) and more than the speed set at PRT_13 (speed deviation detection level that is calculated as a percentage of PAR_14 [Motor sync speed]). The default settings that are used depend on the type of motor.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_13	SpdErrLevel	Detection level of speed deviation	0–100	rpm	Asynch: 100 Synch: 20
PRT_14	SpdErrTime	Detection time speed deviation	0–1000	ms	500

Note

- "Spd Dev Err" may occur depending on the system when operating the inverter to drive an induction motor. In such a case, adjust the setting at PRT_13 or PRT_14.
- To disable the speed deviation detection error feature, set one of PRT_13 and PRT_14 to "0."

6.8.8 Overspeed fault detection (Over Speed)

This function detects faults when the motor rotation exceeds prescribed rotation speed and enables detection level and time.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_15	OverSpdLevel	Detection level of over-speed fault	100.0–130.0	%	110.0
PRT_16	OverSpd Time	Detection time of over-speed fault	0.00–2.00	sec	1.00

Detection level of over-speed fault is 100 % based on the motor's maximum speed of PAR_11.

It detects over-speed fault (over speed) after the motor has operated at a greater speed than what is set at PRT_15 (Detection level of over-speed fault) for the set time set at PRT_16 (Detection time of over-speed fault).

If the detection time for over-speed fault is 0.00 (sec) and the speed becomes higher than the fault detection level, then the over–speed fault (Over Speed) is detected.

6.8.9 Input/output phase open detection

These functions detect the disconnection of input and output power cables. If an input open-phase error occurs when there are no missing connections, set PRT_18 to a higher value. For more information about the setting criteria, refer to "PhInOpenLvl" settings for DIS_01–DIS_03 codes. Set PRT_18 to a value

equivalent to 150 % of the “PhInOpenLvl” setting value at a maximum load.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_17	PhInOpenChk	Input phase open detection	0 (No) 1 (Yes)		0 (No)
PRT_18	PhInOpenLvl	Input phase open detection voltage level	2–100	V	3
PRT_19	PhOutOpenChk	Output phase open detection	0 (No) 1 (Yes)		0 (No)

Output phase open detection is not available for synchronous motors.

6.8.10 Overload

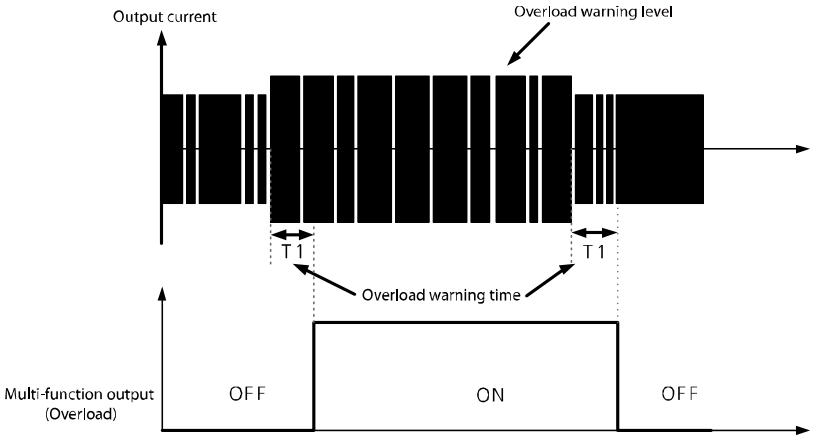
An overload signal is provided when the output current is higher than the overload warning level during an inverter operation (based on the motor rated current).

Refer to the overload warning level and time that are set at PRT_20 and PRT_21 codes.

Overload warning level (PRT_20), Overload warning time (PRT_21)

When the inverter’s output current is maintained above the value set at PRT_20 during the period set at PRT_21, the inverter sends a warning signal. When the current drops below the overload warning level after an overload warning is triggered, the overload warning signal changes to OFF after a set period.

The overload warning signal is operated via the multifunction auxiliary output terminals (A1–A4). Set one of the multifunction auxiliary output terminals at DIO_11– DIO_14 (multifunction output terminals AX1– AX4) to “OverLoad” to enable this function. When an overload condition occurs, the inverter continues to operate, and the overload warning signal is provided via the multifunction auxiliary output terminal.



Code	Keypad display	Name	Range	Unit	Default setting
PRT_20	OL Level	Overload warning level	30–250	%	150
PRT_21	OL Time	Overload warning time	0–30	sec	10

Note

The overload warning level is set as a percentage of the motor's rated current.

6.8.11 Overload limit selection, level, time (PRT_22–24)

When the output current of the inverter is maintained above the overload control level during an overload time limit, the inverter cuts off the output and displays a trip message. PRT_22–24 (Overload limit) function cuts off the inverter's output and displays the inverter's output. This function is for detecting load errors, such as, a motor failure, system failure, and other mechanical failures.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_22	OLT Select	Overload limit selection	0 (No) / 1 (Yes)	-	1 (Yes)
PRT_23	OLT Level	Overload limit level	30–250	%	180
PRT_24	OLT Time	Overload limit time	0–60	sec	30

Note

The overload warning level is set as a percentage of the motor's rated current.

6.8.12 Inv OH Warn

When the temperature of the inverter's heat sink exceeds the reference temperature, a signal is sent. The inverter overheat function detects if the temperature of the heat sink of the inverter is exceeds the set detection level.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_25	IH Warn Temp	Inverter overheat detection temperature	50–110	°C	95
PRT_26	IH Warn Band	Inverter overheat detection range	0–10	°C	5

6.8.13 Low Voltage2 (LV2) function

When this feature is enabled, the inverter blocks the output and displays “Low Voltage2” error message if the main power supply is interrupted and a low voltage situation occurs. Unlike “Low Voltage” trip, which is automatically released as soon as the normal voltage is recoverd, “Low Voltage2” trip status remains until it is cleared by the user, even after the voltage recovers to a normal range. The trip record is not saved after a reset.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_29	LV2 Enable	Low Voltage2 activation	0 (No) 1 (Yes)		0 (No)

6.8.14 A3 Safety

This function enables or disables PWM output of the inverter according to the signals at multifunction input terminals defined for A3 Safety signals.

Code	Keypad display	Name	Range	Unit	Default setting
PRT_30	A3 StartTime	A3 signal input delay section when operated	0–60000	ms	1500
PRT_31	A3 Stop Time	A3 signal input delay section when stopped	0–60000	ms	1500
DIO_01–07	P1–P7 define	Multifunction input settings	0–29 (26: A3 Safety)		0 (Not Used)

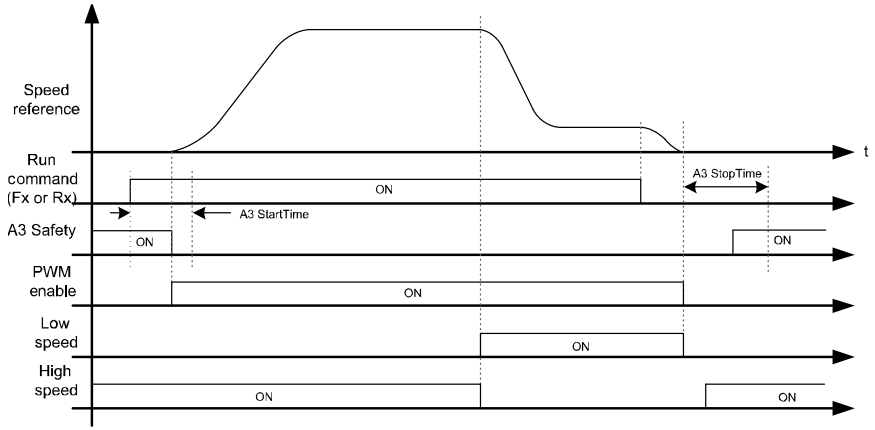
Basic operation

To increase PWM Output and Speed, the A3 Safety multifunction input terminal should be set to OFF within the time limit set at [PRT-30 A3 StartTime] after an operation command is received. If the A3 Safety multifunction input terminal is not OFF, an "A3 Safety" fault will occur. If A3 Safety is ON during the operation, PWM stops, the motor decelerates at free-run and stops, and then an "A3 Safety" fault occurs.

After a normal stop (a status that inverter voltage output becomes OFF after the stop operation by user settings), the A3 Safety multifunction input terminal should be ON within the time limit set at [PRT-30 A3 StartTime]. If A3 Safety is not ON, an "A3 Safety" fault occurs.

If you turn off and then on the inverter power when "A3 Safety" fault has occurred, the fault status is maintained regardless of the Multifunction input A3 Safety. To turn off the fault, use the keypad reset button or RST of the terminal block.

The graph below shows the basic movement sequence of A3 Safety.



6.8.15 Fan fault

You can decide the inverter's inner fan is operating or not according to the user settings.

Code	Keypad display	Name	Range	Unit	Default setting
PRT-32	FAN Control	FAN operation setting	0 (During Run) 1 (Always ON) 2 (Temp Control)		0 (During Run)
PRT-33	FAN Trip Sel	FAN Trip setting	0 (Trip) 1 (Warning)		1 (Warning)

Code	Keypad display	Name	Range	Unit	Default setting
DIO-11–14	AX1–AX4 Define	Multifunction Output option setting	0– 21 (18: Fan Faults)		0 (Not Used)

Basic operation of FAN depending on the settings (PRT_32)

- During Run: Operate FAN when PWM Output occurs, and turn OFF the FAN when the PMW Output is cut off and after 60 seconds after the temperature is reduced to 55℃.
- Always ON: Always operate the FAN when the power above LV Level is provided to the inverter.
- Temp Control:

- Operates the FAN when the module's internal temperature is 75℃ or higher, and stops the FAN when the temperature is 65℃ or lower.

FAN fault depending on the settings (PRT_33)

When a fan fault occurs, user can set the fan fault type between a warning ("FAN Warning" if the inverter is operated continuously) and Fault ("FAN Fault", Motor Free Run stop). Warning and trips are detected under the same condition by different methods.

6.8.16 Safety Torque Off (STO)

This function cuts off the output based on an input signal coming from an external source via terminals [SA] and [SB]. The two terminals provide a dual safety mechanism when an emergency occurs.

Code	Keypad display	Name	Range	Unit	Default setting
PRT-34	Safety Sel	STO type selection	0 (Latch) 1 (Level)		0 (Latch)

Latch (PRT_34)

If the Safety Relay is open, the inverter output stops and “SAFETY A (or B)” is ON. If the inverter was in operating when the Safety Relay opened, a free-run stop occurs regardless of the setting at [FUN-03 Stop Mode]. If the [SA] input signal is open, power supply to the inverter's internal PWM buffer is cut off. If [SB] input signal is open, output from the inverter’s internal PWM buffer is blocked, then the PWM output is blocked at the DSP. If a safety fault occurs, perform a reset via keypad or terminal block inputs to manually clear the fault after the [SA] and [SB] relays are closed.

Level (PRT_34)

If the Safety Relay is open, the inverter output stops and “SAFETY A (or B)” is ON. If the inverter was in operating when the Safety Relay opened, a free-run stop occurs regardless of the setting at [FUN-03 Stop Mode]. If the [SA] input signal is open, the PWM output signal is blocked at the inverter’s DSP. If [SB] input signal is open, output from the inverter’s internal PWM buffer is blocked, then the PWM output is blocked at the DSP. The safety fault will be automatically cleared when the [SA] and [SB] relays are closed.

6.9 Communication (COM) group

Communication group consists of parameter codes related to the inverter's network communication functions via CAN and RS232 protocols.

6.9.1 Jump code (COM_00)

COM_00 code is used to directly access a specific code.

The following is an example for jumping directly to COM_03 from COM_00 code.

1. Press [PROG].
2. Use [SHIFT/ESC], [▲], or [▼] to change the code number to "03".
3. Press [ENT] to access COM_03 code. If an invalid code number is entered, the next available code number is automatically selected.

Note

After jumping directly to a code, you can move to other codes by pressing [▲] or [▼].

6.9.2 Setting Station ID for CAN communication (COM_01)

Set the station ID of the inverter for CAN communication.

Only one of the following values are available for the station ID: 0x0800, 0x0900, 0x0A00, 0x0B00, 0x0C00, 0x0D00, 0x0E00, and 0x0F00

The station ID cannot be duplicated on the same network. Before setting the station ID, ensure that it is not used by another device on the network.

If the inverter is the last device connected to the network, enable the terminating resistor by setting SW2 on the inverter's control board to ON position.

Code	Name	Keypad display	Range	Unit	Default setting
COM_01	CAN station ID	CAN St ID	0x0800 – 0x0f00		0x0800

6.9.3 Setting CAN communication speed (COM_02)

Use this code to set CAN network communication speed.

Check the communication speed for the network before setting this code. All devices connected to the same network must have identical communication speed.

Code	Name	Keypad display	Range	Unit	Default setting
COM_02	CAN comm. Speed	CAN Baud	0 (125 kbps) 1 (250 kbps) 2 (500 kbps) 3 (1 Mbps)	bps	2 (500 kbps)

6.9.4 Setting CAN communication mode (COM_03)

Use this code to set CAN network communication mode.

Code	Name	Keypad display	Range	Unit	Default setting
COM_03	CAN comm. Mode	CAN Mode	0 (CAN2.0B)		0 (CAN2.0B)

6.9.5 Setting Station ID for RS232 communication (COM_04)

Set the station ID of the inverter for RS232 communication. Only station ID #1 is

available (default).

Prepare a dedicated connection cable for the keypad. RS232 communication requires operation via the keypad connector.

Code	Name	Keypad display	Range	Unit	Default setting
COM_04	RS232 station ID	RS232 St ID	1		1

6.9.6 Setting RS232 communication speed (COM_05)

Use this code to set RS232 network communication speed (default: 9600 bps).

Code	Name	Keypad display	Range	Unit	Default setting
COM_05	RS232 comm. Speed	RS232 Baud	0 (9600 bps)		0 (9600 bps)

6.9.7 Setting RS232 communication mode (COM_06)

Use this code to set RS232 network communication mode (data frame type). The following communication mode is available for RS232 communication: 8 data bits, no parity, 1 stop bit.

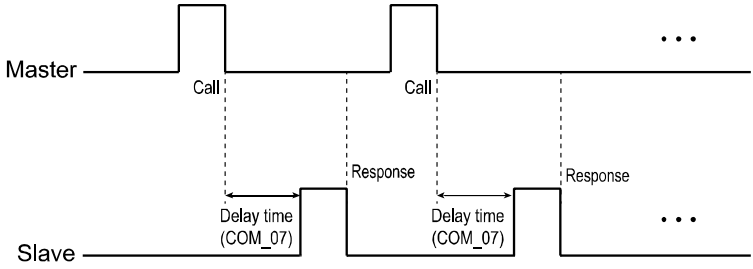
Code	Name	Keypad display	Range	Unit	Default setting
COM_06	RS232 comm. Mode	RS232 Mode	0 (8None/1Stop)		0 (8None/1Stop)

6.9.8 Setting response delay time (COM_07)

Use this code to set the delay time for the inverter to respond to calls from the master device. The inverter responses to the calls after the time set at COM_07 has elapsed. This function is used for a system with slow slave units that cannot

provide immediate responses, for smooth network communication between the master and slave devices.

Code	Name	Keypad display	Range	Unit	Default setting
COM_07	Delay time for comm. Response	COM Delay	2 – 1000	ms	5



6.9.9 Setting protection against lost command (COM_08, COM_09)

Set this code to define the criteria for a lost command situation due to an interruption of network communication, and the protection function against it.

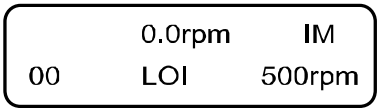
Code	Name	Keypad display	Range	Unit	Default setting
COM_08	Operation mode for lost command	COM LostC	0 (None) 1 (FreeRun) 2 (Decel)		0 (None)
COM_09	Lost command decision time	COM LostT	1.0 – 30.0	sec	1.0

When the “operation mode for lost command” has been set at COM_08 and loss of communication is maintained for the “lost command decision time” set at COM_09, the inverter performs the following operation.

Setting	Keypad display	Description
0	None	No protection feature is provided. Inverter drives the motor using the previous speed reference. (Lost command function is not used.)
1	FreeRun	Inverter output stops and the motor performs free run.
2	Decel	Inverter decelerates the motor to a stop.

For this function to operate, the command source at FUN_01 (Run/Stop Src) must be set to “CAN.”

The following screen is displayed on the keypad when the network communication is lost for the set time at COM_09. The speed in rpm in the second row indicates the currently set speed reference.



6.10 User (USR) group

You can create a new group with the frequently used group’s codes.

You can also use group codes made for specific application.

6.10.1 Jump code (USR_00)

USR_00 code is used to directly access a specific code.

The following is an example for jumping directly to USR_03 from COM_00 code.

1 Press [PROG].

2 Use [SHIFT/ESC], [▲], or [▼] to change the code number to “03”.

3 Press [ENT] to access USR_03 code. If an invalid code number is entered, the next available code number is automatically selected.



Note

After jumping directly to a code, you can move to other codes by pressing [▲] or [▼].

6.10.2 Definition of macro

USR _01 (Macro Init)

Define the initialization of code type for each user-defined application.

Code	Keypad display	Name	Range	Unit	Default setting
USR_01	Macro Init	User macro definition	User Define E/L		User Define

When USR_01 is set to “User Define”, all user-defined codes from USR_04 to USR_67 are initialized to “P1 Define”.

When “E/L” is set, the code types are initialized as listed in the table below. In this case, USR_59–USR_67 codes that are set as “Undefined” or “Not Used” will not be displayed and only the last code (USR_67) will be displayed to indicate that these codes are not defined for use.

Function code	Setting	Function code	Setting	Function code	Setting
USR_04	DIO_01	USR_26	PAR_24	USR_48	FUN_43
USR_05	DIO_02	USR_27	PAR_25	USR_49	FUN_44
USR_06	DIO_03	USR_28	PAR_26	USR_50	FUN_45
USR_07	DIO_04	USR_29	PAR_27	USR_51	FUN_46
USR_08	DIO_05	USR_30	FUN_01	USR_52	FUN_47
USR_09	DIO_06	USR_31	FUN_02	USR_53	FUN_49
USR_10	DIO_07	USR_32	FUN_03	USR_54	FUN_50
USR_11	DIO_11	USR_33	FUN_12	USR_55	FUN_51
USR_12	DIO_12	USR_34	FUN_13	USR_56	CON_03
USR_13	PAR_11	USR_35	FUN_14	USR_57	CON_04
USR_14	PAR_07	USR_36	FUN_15	USR_58	CON_05
USR_15	PAR_12	USR_37	FUN_16	USR_59	Not Used
USR_16	PAR_13	USR_38	FUN_17	USR_60	Not Used
USR_17	PAR_14	USR_39	FUN_19	USR_61	Not Used
USR_18	PAR_15	USR_40	FUN_33	USR_62	Not Used
USR_19	PAR_16	USR_41	FUN_36	USR_63	Not Used
USR_20	PAR_17	USR_42	FUN_37	USR_64	Not Used
USR_21	PAR_18	USR_43	FUN_38	USR_65	Not Used
USR_22	PAR_19	USR_44	FUN_39	USR_66	Not Used
USR_23	PAR_20	USR_45	FUN_40	USR_67	Not Used
USR_24	PAR_22	USR_46	FUN_41		
USR_25	PAR_23	USR_47	FUN_42		

USR_02 (User Save)

Save the user code and code number defined by the user for the group.

USR_03 (User Recall)

Display the user code and code number that the user previously saved at "USR_02".

Code	Keypad display	Name	Range	Unit	Default setting
USR_02	User Save	User macro save	0 (No) 1 (Yes)		0 (No)
USR_03	User Recall	User macro recall	0 (No) 1 (Yes)		0 (No)

6.10.3 User code definition (USR_04–67)

Press [PROG] to display the type and code mode of currently set user code. Change the code numbers to navigate through different functions.

If code description is "User Grp" and description is "Not Used", press [PROG] one more time to change the code description.

You can define and save up to 64 user group code. Set the unused codes to "Not Used" to hide them.

The following illustration shows the different screens that are displayed when you change a code for a user group.

Step	Instruction	Keypad display
1	Press [PROG] twice.	

Step	Instruction	Keypad display
2	Press [SHIFT/ESC] to change the group. The group names will rotate in the following order: PAR, DIO, AIO, CON, E/L[Note 1)], PRT, COM, DIS, and PAR.	USR ▶ Max Speed 04 PAR 11 ▮
3	Press [▲] or [▼] to change the code, and then press [ENT] to save the code.	USR ▶ Base Speed 04 PAR 14 ▮ USR ▶ Base Speed 04 1800.0 rpm
4	Press [PROG], press [▲] or [▼] to change the value, and then press [ENT] to save the value.	USR ▶ Base Speed 04 3600.0 rpm

Note 1) Displayed only when Elio add-on module has been installed and PAR-08 is set to "Elevator."

7 Communication features

This section explains how to remotely control the inverter with a computer using the RS232 communication feature. To use RS232 communication, connect the communication cables and set the communication parameters on the inverter. Refer to the communication protocols and parameters to configure and use RS232 communication.

Caution

Read this manual thoroughly before installing and operating the inverter. User may be injured or other devices may be damaged if the directions in this manual are not followed correctly.

7.1 RS232 communication standards

The L100 products exchange data with PLCs and computers using the RS232 communication protocol. The RS232 communication standard provides an interface that is strongly resistant to electronic interference. Refer to the following table for information about the communication standard.

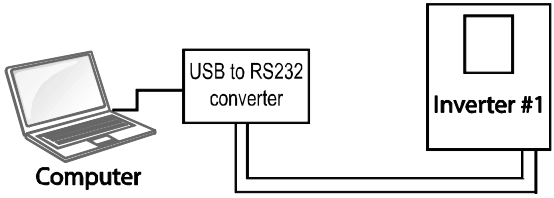
Item	Standard
Communication method/ transmission type	RS232/RS232
Inverter model	LSLV-L100 Series
Number of connected inverters	1
Transmission distance	34 ft (10 m) maximum / recommended transmission distance is within 24 ft (7 m)]
Recommended cable	24 AWG (0.75 mm^2), STP cable
Cable connection	Connected to the master device
Communication speed	Up to 9,600 bps
Communication control	Asynchronous communications system

Item	Standard
Communication system	Half duplex system
Character system	LS INV 485: ASCII
Stop bit length	1-bit
Sum check	2 bytes
Parity check	None

7.2 RS232 communication system configuration

In an RS232 communication system, the computer is the master device and the inverter is a slave device. When a computer is used as the master, the RS232 converter must be installed to the computer to allow it to communicate with the inverter. Converter specifications and performance may vary depending on the manufacturer, but the basic functions are identical. Refer to the manufacturer's user manual for details about the features and specifications of the converter.

Connect the cables and configure the communication parameters on the inverter by referring to the following communication system configuration.



7.2.1 Communication cable connections

Make sure that the inverter is turned off completely, and then connect the RS232 communication cable to the communication terminal of the control board. You can connect only one inverter to a PC. Use STP cables for the connection.

It is recommended that the cable length is less than 24 ft (7 m) to ensure stable

communication. If cable lengths exceed the maximum (34 ft [10 m]), install a signal repeater to enhance communication distance. A repeater makes the communication circuit less susceptible to electronic interference.

7.2.2 Communication memory map

Communication area	Memory map	Details
5 Series compatible common area	0h0000–0h00FF	5 series compatible area
iS7 communication common area	0h0300–0h037F	Inverter monitoring area
	0h0380–0h03DF	Inverter control area
	0h03E0–0h03FF	Inverter memory control area
L100 communication common area	0h0500–0h05FF	Common area dedicated for L100

7.3 Network protocols

7.3.1 LS INV 485 protocol

The slave device (inverter) responds to read and write requests from the master device (computer).

Request

ENQ	Station ID	CMD	Data	SUM	EOT
1 byte	2 bytes	1 byte	n bytes	2 bytes	1 byte

Normal response

ACK	Station ID	CMD	Data	SUM	EOT
1 byte	2 bytes	1 byte	n bytes	2 bytes	1 byte

Error response

NAK	Station ID	CMD	Data	SUM	EOT
1 byte	2 bytes	1 byte	n bytes	2 bytes	1 byte

- A request starts with ENQ and ends with EOT.
- A normal response starts with ACK and ends with EOT.
- An error response starts with NAK and ends with EOT.
- A station ID indicates the inverter number and is displayed as a two-byte ASCII-HEX string that uses characters 0-9 and A-F.
- CMD: Uses uppercase characters (returns an IF error if lowercase characters are encountered)—refer to the table below.

Character	ASCII-HEX	Command
'R'	52h	Read
'W'	57h	Write
'X'	58h	Request buffer monitoring registration
'Y'	59h	Perform buffer monitoring registration

- Data: ASCII-HEX (for example, when the data value is 3000: 3000 → '0''B''B''8'h → 30h 42h 42h 38h)
- Error code: ASCII-HEX (20h–7Fh)
- Transmission/reception buffer size: Transmission=39 bytes, Reception=44 bytes
- Monitor registration buffer: 8 words
- SUM: A check for communication errors.
- SUM=a total of the lower 8-bit values for station ID, command and data (station ID+CMD+data) in ASCII-HEX.
  - For example, a command to read an address from address 3000: SUM='0'+'1'+'R'+'3'+'0'+'0'+'0'+'1' = 30h+31h+52h+33h+30h+30h+30h+31h = 1A7h (the control value is not included: ENQ, ACK, NAK, etc).

ENQ	Station ID	CMD	Address	Number of addresses	SUM	EOT
05h	'01'	'R'	'3000'	'1'	'AC'	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	2 bytes	1 byte

ASCII code table

HEX	DEC	ASCII	HEX	DEC	ASCII	HEX	DEC	ASCII	HEX	DEC	ASCII
00h	0	NUL	20h	32	SP	40h	64	@	60h	96	`
01h	1	SOH	21h	33	!	41h	65	A	61h	97	a
02h	2	STX	22h	34	"	42h	66	B	62h	98	b
03h	3	ETX	23h	35	#	43h	67	C	63h	99	c
04h	4	EOT	24h	36	$	44h	68	D	64h	100	d
05h	5	ENQ	25h	37	%	45h	69	E	65h	101	e
06h	6	ACK	26h	38	&	46h	70	F	66h	102	f
07h	7	BEL	27h	39	'	47h	71	G	67h	103	g
08h	8	BS	28h	40	(	48h	72	H	68h	104	h
09h	9	HT	29h	41	)	49h	73	I	69h	105	i
0Ah	10	LF	2Ah	42	*	4Ah	74	J	6Ah	106	j
0Bh	11	VT	2Bh	43	+	4Bh	75	K	6Bh	107	k
0Ch	12	FF	2Ch	44	,	4Ch	76	L	6Ch	108	l
0Dh	13	CR	2Dh	45	-	4Dh	77	M	6Dh	109	m
0Eh	14	SO	2Eh	46	.	4Eh	78	N	6Eh	110	n
0Fh	15	SI	2Fh	47	/	4Fh	79	O	6Fh	111	o
10h	16	DLE	30h	48	0	50h	80	P	70h	112	p
11h	17	DC1	31h	49	1	51h	81	Q	71h	113	q
12h	18	DC2	32h	50	2	52h	82	R	72h	114	r
13h	19	DC3	33h	51	3	53h	83	S	73h	115	s
14h	20	DC4	34h	52	4	54h	84	T	74h	116	t
15h	21	NAK	35h	53	5	55h	85	U	75h	117	u
16h	22	SYN	36h	54	6	56h	86	V	76h	118	v
17h	23	ETB	37h	55	7	57h	87	W	77h	119	w

HEX	DEC	ASCII	HEX	DEC	ASCII	HEX	DEC	ASCII	HEX	DEC	ASCII
18h	24	CAN	38h	56	8	58h	88	X	78h	120	x
19h	25	EM	39h	57	9	59h	89	Y	79h	121	y
1Ah	26	SUB	3Ah	58	:	5Ah	90	Z	7Ah	122	z
1Bh	27	ESC	3Bh	59	;	5Bh	91	[	7Bh	123	{
1Ch	28	FS	3Ch	60	<	5Ch	92	\	7Ch	124	|
1Dh	29	GS	3Dh	61	=	5Dh	93	]	7Dh	125	}
1Eh	30	RS	3Eh	62	>	5Eh	94	^	7Eh	126	~
1Fh	31	US	3Fh	63	?	5Fh	95	_	7Fh	127	DEL

Note

Broadcasting

A broadcast sends commands simultaneously to all inverters connected to the network. When commands are sent from station ID 255, each inverter responds to the command regardless of the station ID. However, no response is issued for commands transmitted via broadcast.

7.3.2 Read protocol details

Read Request

Reads successive “n” words from address XXXX.

ENQ	Station ID	CMD	Address	Number of addresses	SUM	EOT
05h	‘01’–’ 1F’	‘R’	‘XXXX‘	‘1’–‘8’ = n	‘XX’	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	2 bytes	1 byte

Total bytes = 12. Characters are displayed inside single quotation marks (‘ ’).

Read normal response

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01'–'1F'	'R'	'XXXX'	'XX'	04h
1 byte	2 bytes	1 byte	n + 4 bytes	2 bytes	1 byte

Total bytes = (7 x n x 4): 39 maximum

Read error response

NAK	Station ID	CMD	Error code	SUM	EOT
15h	'01'-'1F'	'R'	'**'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes = 9

7.3.3 Write protocol details

Write request

ENQ	Station ID	CMD	Address	Number of addresses	Data	SUM	EOT
05h	'01'–'1F'	'W'	'XXXX'	'1'–'8' = n	'XXXX…'	'XX'	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	n x 4 bytes	2 bytes	1 byte

Total bytes = (12 + n x 4): 44 maximum

Write normal response

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01'–'1F'	'W'	'XXXX…'	'XX'	04h
1 byte	2 bytes	1 byte	n x 4 bytes	2 bytes	1 byte

Total bytes = (7 + n x 4): 39 maximum

Write Error Response

NAK	Station ID	CMD	Error Code	SUM	EOT
15h	'01'–'1F'	'W'	'**'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes = 9

7.3.4 Error codes

Code	Abbreviation	Description
ILLEGAL FUNCTION	IF	The requested function cannot be performed because the corresponding function at the slave does not exist.
ILLEGAL DATA ADDRESS	IA	The received parameter address is invalid at the slave.
ILLEGAL DATA VALUE	ID	The received parameter data is invalid at the slave.
WRITE MODE ERROR	WM	Writing (W) a parameter was attempted that does not allow writing (read-only parameters or when writing is prohibited during operation).
FRAME ERROR	FE	The frame size does not match.

7.3.5 Common parameter compatibility

The table below lists common parameters used with the iS5, iG5, iG5A series inverters.

Comm. address	Parameter	Scale	Unit	R/W	Bit assignments by model	
0000h	Inverter model			R	12: LSLV-L100	
0001h	Inverter capacity		kW	R	4: 5.5 kW, 5: 7.5 kW, 6: 11 kW, 7: 15 kW, 8: 18.5 kW, 9: 22 kW	
0002h	Inverter input voltage			R	1: 400 V	
0003h	Version			R	(E.g.) 0h0100: Version 1.00	
					(E.g.) 0h0101: Version 1.01	
0004h	Reserved				-Note 1)	
0005h	Reserved				-Note 1)	
0006h	Operation command and multifunction input			R/W	B0	Stop
					B1	FX operation
					B2	RX operation
					B3	Reset
					B4	BX
					B5	Reserved
					B6	Reserved
					B7	Reserved
					B8	P1
					B9	P2
					B10	P3
					B11	P4
					B12	P5
					B13	P6

Comm. address	Parameter	Scale	Unit	R/W	Bit assignments by model	
					B14	P7
					B15	Reserved
0007h	Acceleration time	0.1	sec	R/W		
0008h	Deceleration time	0.1	sec	R/W		
0009h	Output current	0.1	A	R		
000Ah	Output frequency	0.01	Hz	R		
000Bh	Output voltage	1	V	R		
000Ch	DC link voltage	1	V	R		
000Dh	Output power	0.1	kW	R		
000Eh	Operation status			R	B0	Stopped
					B1	FX operation
					B2	RX operation
					B3	Fault trip
					B4	Accelerating
					B5	Decelerating
					B6	Speed reached
					B7	Inverter ready
					B8	Stopping
					B9	FX rotation
					B10	Torque limit reached
					B11	FX operation command
					B12	RX operation command
					B13	Reserved
					B14	Reserved
					B15	Reserved
000Fh	Fault trip information	-	-	R	B0	Overcurrent (OCT U, V, W)

Comm. address	Parameter	Scale	Unit	R/W	Bit assignments by model	
					B1	Overvoltage (OV)
					B2	Reserved
					B3	BX
					B4	Low voltage (LV)
					B5	Reserved
					B6	Ground fault (GF)
					B7	Inverter overheat (IOH)
					B8	E-Thermal (ETH)
					B9	Overload (OLT)
					B10	H/W-diag
					B11	External-B (EXT-B)
					B12	Arm short (Arm short U, V, W)
					B13	Reserved
					B14	Encoder error
					B15	Inverter overload (IOLT)
0010h	Input terminal information	-	-	R	B0	FX
					B1	RX
					B2	BX
					B3	RST
					B4	Reserved
					B5	Reserved
					B6	Reserved
					B7	Reserved
					B8	P1
					B9	P2
					B10	P3

Comm. address	Parameter	Scale	Unit	R/W	Bit assignments by model	
					B11	P4
					B12	P5
					B13	P6
					B14	P7
					B15	Reserved
0011h	Output terminal information	-	-	R	B0	30A-30C
					B1	A1-C1
					B2	A2-C2
					B3	A3-C3
					B4	A4-C4
					B5	Reserved
					B6	Reserved
					B7	Reserved
					B8	Reserved
					B9	Reserved
					B10	Reserved
					B11	Reserved
					B12	Reserved
					B13	Reserved
					B14	Reserved
					B15	Reserved
0012h	Analog input 1	0.1	%	R	-100.0% (0xFC18)–100.0% (0x03E8)	
0013h	Analog input 2	0.1	%	R	-100.0% (0xFC18)–100.0% (0x03E8)	
0014h	Reserved					
0015h	Motor rotation speed	1	rpm	R	Displays the existing motor rotation speed (in V/F and Slip Comp. control	

Comm. address	Parameter	Scale	Unit	R/W	Bit assignments by model
					modes, displays output frequency in rpm).
001Dh	Speed reference 1	1/0.1	rpm/ Hz	R	When the control mode is Speed(IM)/Speed(PM): Target speed reference When the control mode is V/F or Slip Comp.: Ramp frequency reference
001Eh	Speed reference 2	1/0.1	rpm/ Hz	R	When the control mode is Speed(IM)/Speed(PM): Ramp speed reference When the control mode is V/F or slap Comp.: Ramp frequency reference
001Fh	Speed controller input reference	1	rpm	R	Speed controller speed reference
0020h	Motor speed	1	rpm	R	Actual speed of motor
0023h	Excitation current	0.1	%	R	The ratio (%) to the rated excitation current
0024–0026h	Reserved	-	-	-	-
0027h	Inverter temperature	1	℃	R	Inverter temperature

Note 1) NAK is received if an unused address is read.

7.3.6 iS7 expansion common parameters

Address	Parameter	Scale	Unit	R/W	Bit assignments	
0300h	Inverter model			R	0012h: LSLV-L100	
0301h	Inverter		kW	R	4055h: 5.5 4075h: 7.5 40B0h: 11 40F0h: 15 4125h: 18.5 4160h: 22	
0302h	Inverter input voltage/ power supply/ cooling			R	400V 3-phase forced-cooling: 0431h	
0303h	Inverter s/w version			R	E.g.) 0x0100: Version 1.00 0x0101: Version 1.01	
0304h	Reserved				Note 1)	
0305h	Inverter operation status			R	B0	0: Stopped
					B1	1: FX operation
					B2	2: RX operation
					B3	3: Reserved
					B4	1: Reserved 2: Accelerating
					B5	3: Steady 4: Decelerating
					B6	5: Decel stopping 6: Reserved
					B7	7: Reserved 8: Reserved
					B8	Reserved
					--	
					B11	
					B12	0: Normal 8: Fault
					B13	
					B14	
					B15	
0306h	Inverter frequency source			R	B0	[Frequency reference source] 0: Keypad speed 1–4: Reserved
					B1	
					B2	

Address	Parameter	Scale	Unit	R/W	Bit assignments	
					B3	5: Analog 6-25: Reserved 26-32: Multistep 33-127: Reserved
					B4	
					B5	
					B6	
					B7	
					B8	[Command source] 0: Keypad 1: Reserved 2: Reserved 3: Reserved 4: Terminal block 5–127: Reserved
					B9	
					B10	
					B11	
					B12	
					B13	
					B14	
					B15	
0307h	Keypad s/w version			R	E.g.) 0x0100: Version 1.00 0x0101: Version 1.01	
0308h	Keypad title version			R	E.g.) 0x0100: Version 1.00 0x0101: Version 1.01	
0309h -030Fh	Reserved					
0310h	Output current	0.1	A	R		
0311h	Output frequency	0.01	Hz	R		
0312h	Output rpm	1	rpm	R		
0313h	Motor feedback speed	1	rpm	R	-32768 rpm - 32767 rpm (directional)	
0314h	Output voltage	1	V	R		

Address	Parameter	Scale	Unit	R/W	Bit assignments	
0315h	DC Link voltage	1	V	R		
0316h	Output power	0.1	kW	R		
0317h	Output torque	0.1	%	R		
0318h -0319h	Reserved					
031Ah	Motor 1 number of poles			R	Motor 1 number of poles	
031Bh	Motor 2 number of poles			R	Motor 2 number of poles	
031Ch	Selected motor number of poles			R	Selected motor's number of poles	
031Dh	Hz/rpm selection			R	0: Hz 1: rpm	
031Eh -031Fh	Reserved					
0320h	Digital input			R	B0	FX
					B1	RX
					B2	BX
					B3	RST
					B4	P1
					B5	P2
					B6	P3
					B7	P4
					B8	P5
					B9	P6
					B10	P7
					B11	Reserved
					B12	Reserved
					B13	Reserved

Address	Parameter	Scale	Unit	R/W	Bit assignments	
					B14	Reserved
					B15	Reserved
0321h	Digital output			R	B0	Fault output (30A – 30B)
					B1	Relay 1 (A1 – C1)
					B2	Relay 2 (A2 – C2)
					B3	Relay 3 (A3 – C3)
					B4	Relay 4 (A4 – C4)
					B5	Reserved
					B6	Reserved
					B7	Reserved
					B8	Reserved
					B9	Reserved
					B10	Reserved
					B11	Reserved
					B12	Reserved
					B13	Reserved
					B14	Reserved
					B15	Reserved
0322h	Reserved					
0323h	Selected motor			R	0: Motor 1 / 1: Motor 2	
0324h	Ai1	0.01	%	R	Analog input 1 (standard I/O)	
0325h	AI2	0.01	%	R	Analog input 2 (standard I/O)	
0326h	Reserved					
0327h	Reserved					
0328h	AO1	0.01	%	R	Analog output 1 (standard I/O)	
0329h	AO2	0.01	%	R	Analog output 2 (standard I/O)	
032Ah -032Fh	Reserved					
0330h	Latch type trip info-1			R	B0	Overload
					B1	Reserved
					B2	Inverter overload
					B3	E-Thermal
					B4	Ground fault
					B5	Output missing phase

Address	Parameter	Scale	Unit	R/W	Bit assignments	
					B6	Input missing phase
					B7	Overspeed
					B8	Reserved
					B9	NTC
					B10	Overcurrent
					B11	Overvoltage
					B12	External-B
					B13	Reserved
					B14	Overheat
					B15	Reserved
0331h	Latch type trip info -2			R	B0	Reserved
					B1	Encoder error
					B2	Reserved
					B3	FAN error
					B4	Reserved
					B5	Reserved
					B6	Reserved
					B7	Reserved
					B8	Reserved
					B9	Reserved
					B10	Reserved
					B11	Reserved
					B12	Reserved
					B13	A3 safety
					B14	LV2
					B15	Battery fault
0332h	Level type trip info			R	B0	Reserved
					B1	LV
					B2	Lost command
					B3	Reserved
					B4	Reserved
					B5	Reserved
					B6	Reserved
					B7	Reserved
					B8	Reserved
					B9	Reserved

Address	Parameter	Scale	Unit	R/W	Bit assignments	
					B10	Reserved
					B11	Reserved
					B12	Reserved
					B13	Reserved
					B14	Reserved
					B15	Reserved
0333h	HW-diag				B0	H/W diag
					B1	Reserved
					B2	Reserved
					B3	Reserved
					B4	Reserved
					B5	Reserved
					B6	Reserved
					B7	Reserved
					B8	Reserved
					B9	Reserved
					B10	Reserved
					B11	Reserved
					B12	Reserved
					B13	Reserved
					B14	Reserved
					B15	Reserved
0334h -033Fh	Reserved					
0340h	On time days		day	R	Total number of days the inverter has been powered on.	
0341h	On time minutes		min	R	Total minutes left after On time days is calculated.	
0342h	Run time date		day	R	Total number of days the inverter has been operating.	
0343h	Run time minutes		min	R	Total minutes left after Run time days is calculated.	
0344h	Reserved					
0345h	Reserved					
0346h -037Fh	Reserved					

Address	Parameter	Scale	Unit	R/W	Bit assignments	
0380h	Frequency command	0.01	Hz	R/W	Frequency command E.g.) Input: 0x03E8 (=1000) Output: 10 Hz (4-pole motor, 300 rpm)	
0381h	rpm command	1	rpm	R/W	rpm command (Set FUN_02 to "CAN") E.g.) Input: 0x03E8 (=1000) Output: 1000 rpm (4-pole motor, 33.33 Hz)	
0382h	Run command			R/W	B0	0: Stop 1: Run
					B1	0: RX 1: FX
					B2	RST (0➔1: Trip reset)
					B3	BX (0➔1: Free-run stop)
					B4	Reserved
					B5	Reserved
					B6	Reserved
					B7	Reserved
					E.g.) FX run command: 0003h, RX run command: 0001h BX, RST commands are write-only (read as "0") FUN_01 must be set to "CAN"	
0383h	Acc time	0.1	sec	R/W	Set the acceleration time	
0384h	Dec time	0.1	sec	R/W	Set the deceleration time	
0385h	Reserved					
0386h	Digital output			R	B0	Fault relay (30A-30B)
					B1	Relay 1 (A1 – C1)
					B2	Relay 2 (A2 – C2)
					B3	Relay 3 (A3 – C3)
					B4	Relay 4 (A4 – C4)
					B5	Reserved
					B6	Reserved
					B7	Reserved
					B8	Reserved
					B9	Reserved
					B10	Reserved
					B11	Reserved
					B12	Reserved
					B13	Reserved
					B14	Reserved

Address	Parameter	Scale	Unit	R/W	Bit assignments
					B15 Reserved
0387h -0389h	Reserved				
038Ah	Motor rated current	0.1	A	R/W	PAR_19 Rated-Curr
038Bh	Inverter rated voltage			R	400: 400 V
038Ch -0390Fh	Reserved				
0391h	Fwd pos torque limit	0.1	%	R/W	FX motoring torque limit Note 1)
0392h	Fwd neg torque limit	0.1	%	R/W	FX regeneration torque limit Note 1)
0393h	Rev pos torque limit	0.1	%	R/W	RX motoring torque limit Note 1)
0394h	Rev neg torque limit	0.1	%	R/W	RX regeneration torque limit Note 1)
0395h	Torque bias	0.1	%	R/W	Torque bias Note 2)
0396h -039Dh	Reserved				

Note 1) Writable only when CON_33 is set to “CAN CAN CAN” and readable even when CON_33 is not set to “CAN CAN CAN.”

Note 2) Writable only when CON_37 is set to “CAN” and readable even when CON_37 is not set to “CAN.”

7.3.7 L100 (iV5L) common parameters

Address	Parameter	Scale	Unit	R/W	Bit assignments	
0500h	Command via option board			R/W	B0	Stop
					B1	FX
					B2	RX
					B3	RST
					B4	BX
					B5	Reserved
					B6	Reserved
					B7	Reserved
					B8	P1
					B9	P2
					B10	P3
					B11	P4
					B12	P5
					B13	P6
					B14	P7
					B15	Reserved
0501h	Multifunction output[Note 1)]		bit	R/W	Bit 1: Ax1	
					Bit 2: Ax2	
					Bit 3: Ax3	
					Bit 4: Ax4	
0502h	Define speed command			R/W	Define reference	
0503h	Define Acc time		sec	R/W	Define Acc time	
0504h	Define Dec time		sec	R/W	Define Dec time	
0506h	FX torque limit	0.1	%	R/W	Define FX torque limit	
0507h	RX torque limit	0.1	%	R/W	Define RX torque limit	
0508h	Regeneration torque limit	0.1	%	R/W	Define regeneration torque limit	
0509h	Torque bias	0.1	%	R/W	Define torque bias amount	

050Ah	No-load current Note 2)		A	R/W	Define no-load current
050Bh	Iu Offset	0.01	A	R	Offset current for U phase inverter output
050Ch	Iv Offset	0.01	A	R	Offset current for V phase inverter output
050Dh	Iw Offset	0.01	A	R	Offset current for W phase inverter output
050Eh	Stoppable floor (Car)			R	Stoppable floor info. (Car)
050Fh	ELIO Input Signal			R/W	Bit 0: ELIO deceleration permission signal (upper level controller→inverter)
0510h	ELIO Output Signal			R	Bit 0: ELIO deceleration permission request signal (inverter→upper level controller)
0527h	Warning info.		bit	R	Bit 0: Fan fault warning
					Bit 1: Inverter overheat warning
					Bit 2: Motor overheat warning
					Bit 3: Overload warning
0528h	Additional fault info. (latch 1)		bit	R	Bit 0: Fan fault
					Bit 1: Battery signal is lost during a battery operation
					Bit 2: Reserved
					Bit 3: Input phase missing
					Bit 4: Output phase missing
					Bit 5: Inverter NTC Thermistor open
					Bit 6: Reserved
					Bit 7: Motor overspeed
					Bit 8: Floor height fault
					Bit 9: Forced Dec switch fault
					Bit 10: A3 fault
					Bit 11: Lv2 fault
					Bit 12: Safety A fault
					Bit 13: Safety B fault
					Bit 14: ADC error

					Bit 15: Pole position estimation fault
0529h	Additional fault info. (latch 2)		bit	R	Bit 0: EnDat option board fault
052Bh	Current floor (Car)			R	Current floor info. (Car)
0530h	Dedicated terminal block info		bit	R	Bit 0: FX
					Bit 1: RX
					Bit 2: BV
					Bit 3: RST

Note 1) Set the multifunction output terminals (DIO_11 - DIO_14) to “Not Used” to use them via network communication. Otherwise, the inverter uses the output terminal(s) for the set functions and multifunction output via network communication becomes unavailable.

Note 2) The no-load current reference uses a defined percentage of the value set at PAR_52. The value set at PAR_52 stands for 100% of the value, and it can be set to a value less than 100%.

7.4 CAN Communication features

This section explains how to remotely control the inverter with a computer using the CAN communication feature.

Caution

Read this manual thoroughly before installing and operating the inverter. User may be injured or other devices may be damaged if the directions in this manual are not followed correctly.

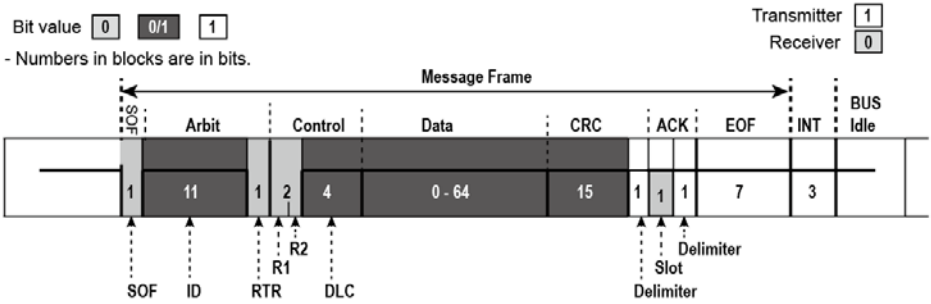
7.4.1 CAN communication standards

The L100 products can exchange data with PLCs and computers using the CAN communication protocol.

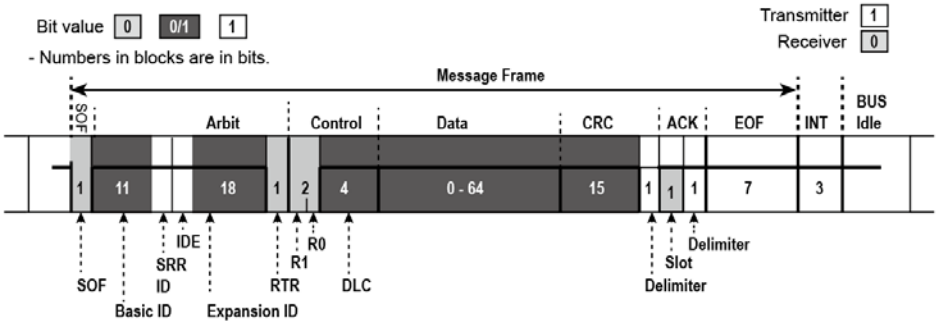
Item	Standard
Communication protocol	CAN (ISO 11898) Ver. 2.0B Active
Communication ID	0x0800,0x0900,0x0A00, 0x0B00, 0x0C00, 0x0Doo, 0x0E00, 0x0F00
Number of connected inverters	8 maximum
Transmission speed	CAN High Speed 125 kbps, 250 kbps, 500 kbps, 1 Mbps
Transmission distance	334 ft (100 m) maximum
Recommended cable	RJ 45 cable (LAN cable)
Topology	Bus type (terminating resistance: 120Ω)
Communication type	Master–Slave

CAN message frame versions

CAN 2.0A



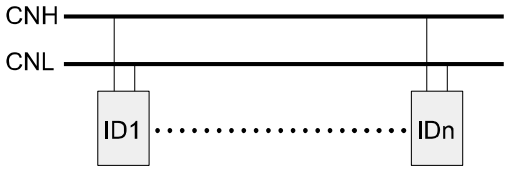
CAN 2.0B



7.4.2 CAN communication system configuration

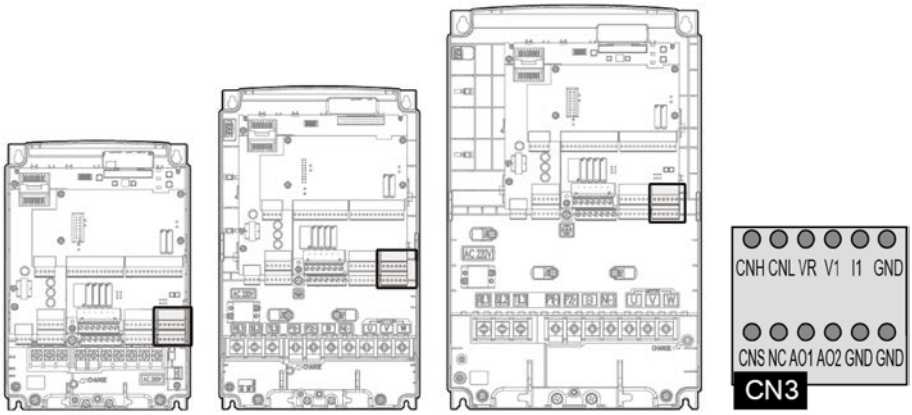
7.4.2.1 Communication cable connections

Make sure that the inverter is turned off completely, and then connect the CAN communication cable to the communication terminal of the control board.



7.4.2.2 Control board terminals and terminating resistor

Refer to the following figure for the location and layout of the CAN signal terminals on the control board.



5.5/7.5 kW 11/15 kW 18.5/22 kW

Connector	Layout					
CN3	CHN	CNL	VR	V1	I1	GND
	CNS	NC	AO1	AO2	GND	GND

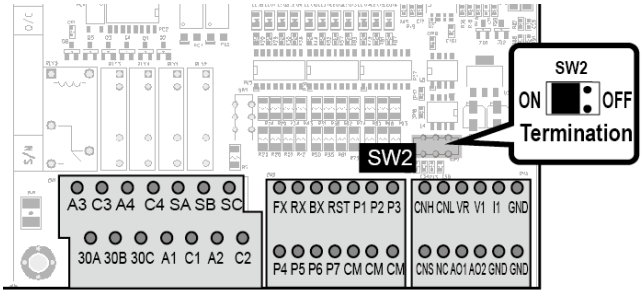
Detailed CAN signal terminal specifications are as follows:

Connector	Indication	Description
CN3	CNH	HIGH signal terminal for CAN communication
	CNL	LOW signal terminal for CAN communication
	CNS	COMMON ground terminal for CAN communication

7.4.2.3 Enabling terminating resistor

If the inverter is the last device connected to the network, the terminating resistor must be enabled for proper network communication.

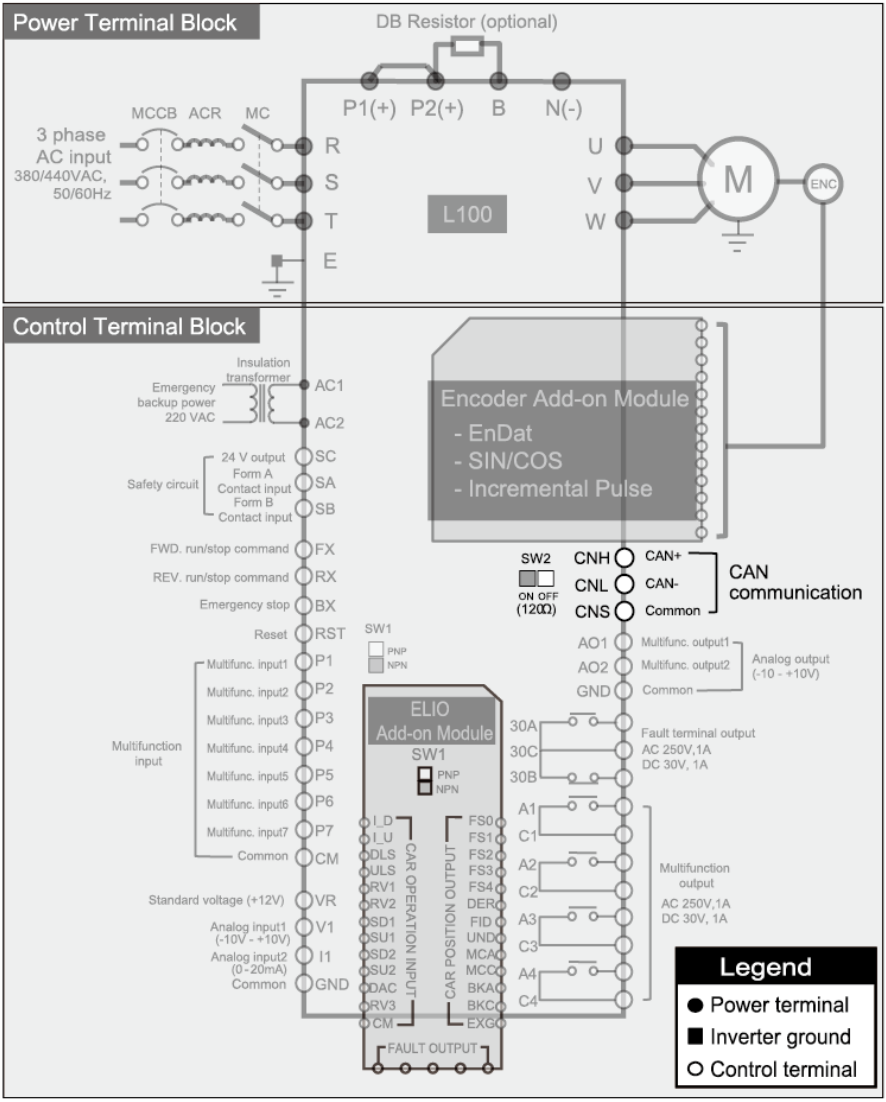
Refer to the following figure and set SW2 on the control board to enable or disable the terminating resistor (120Ω).



Switch	Mode	Description
SW2	Terminating resistor On	Enables termination of a CAN network.
	Terminating resistor Off	Disables termination of a CAN network.

7.4.2.4 Wiring diagram

Refer to the following diagram for CAN network cable connections.



7.4.2.5 CAN read protocol details

Parameter Read Request: RxData [8].

0	1	2	3	4	5	6	7
ENQ (0x05)	“R” (0x52)	Address Low byte	Address High byte	EOT (0x04)	-	-	-

Parameter Read Response (Normal): TxData [8].

0	1	2	3	4	5	6	7
ACK (0x06)	“R” (0x52)	Address Low byte	Address High byte	Data Low byte	Data High byte	EOT (0x04)	-

Parameter Read Response (Abnormal): TxData [8].

0	1	2	3	4	5	6	7
NAK (0x15)	“R” (0x52)	Address Low byte	Address High byte	Data 0xFF	Data 0xFF	EOT (0x04)	-

7.4.2.6 CAN write protocol details

Parameter Write Request: RxData [8].

0	1	2	3	4	5	6	7
ENQ (0x05)	“W” (0x57)	Address Low byte	Address High byte	Data Low byte	Data High byte	EOT (0x04)	-

Parameter Write Response (Normal): TxData [8].

0	1	2	3	4	5	6	7
ACK (0x06)	“W” (0x57)	Address Low byte	Address High byte	Data Low byte	Data High byte	EOT (0x04)	-

Parameter Write Response (Abnormal): TxData [8].

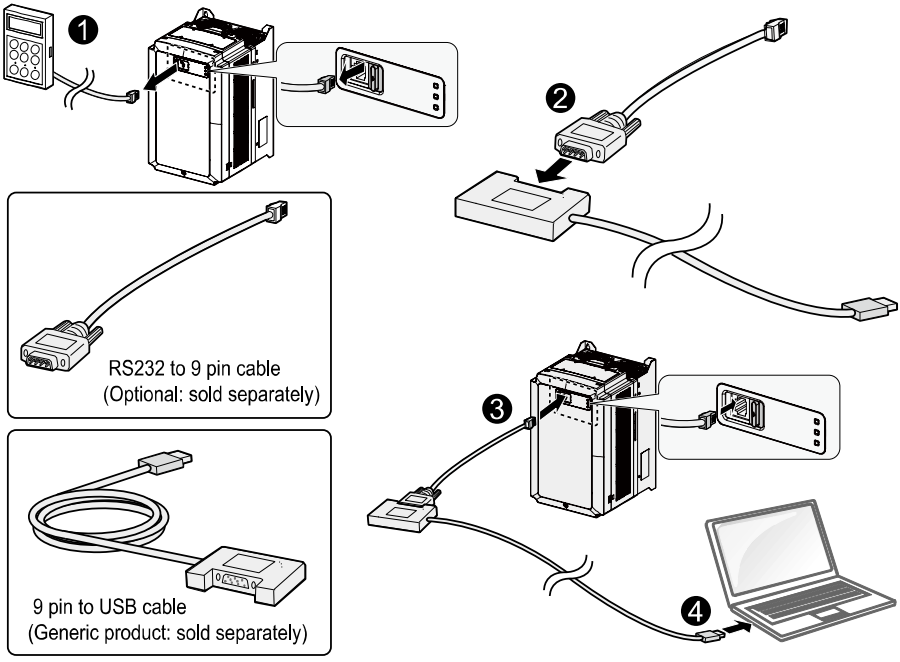
0	1	2	3	4	5	6	7
NAK (0x15)	“W” (0x57)	Address Low byte	Address High byte	Data 0xFF	Data 0xFF	EOT (0x04)	-

7.5 Cable configuration for DriveView application

LS Electric DriveView may be used to monitor, read, or write the inverter parameters.

To utilize DriveView, a PC must be connected to the keypad connector on the inverter (A PC for utilizing DriveView and the keypad cannot be simultaneously connected to the inverter).

The following cable connection is required before you can start utilizing DriveView. Remove the keypad cable from the inverter and connect cables for DriveView configuration.



Cable configuration for DataView utilizes keypad connector pins #3, #4, and #7 (pins for RS232 connection). Detailed pin configurations are as follows:

Keypad connector pins	D-SUB (9-pin connector) pins	Description
#3 (TXD)	#2 (RXD)	For data transmission signal
#4 (RXD)	#3 (TXD)	For data reception signal
#7 (GND)	#5 (GND)	Common ground

8 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.

8.1 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 DIS_05. 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
Arm Short	1	Latch	Displayed when IGBT Arm or output fault occurs.

LCD display	Priority Note 1)	Type	Description
Ground Fault	2	Latch	Displayed when a ground fault occurs in the inverter's output, and current flow to ground exceeds the specified level.
Over Current	3	Latch	Displayed when inverter output current exceeds the specified fault current.
Over Voltage	4	Latch	Displayed when the internal DC voltage exceeds the specified value (820 VDC).
FAN Error	5	Latch	Displayed when a cooling fan error is detected.
BatRun Fault	6	Latch	Displayed when battery operation signals are lost during a battery power operation.
Encoder Err	7	Latch	Displayed when an encoder signal error occurs. (H/W detection) Displayed when an inconsistent encoder error time is detected when compared to the PRT_11 setting. (S/W detection)
Low Voltage	8	Level	Displayed when the internal DC voltage is less than the specified value (360 VDC).
InvOver Heat	9	Latch	Displayed when the temperature of the inverter heat sink exceeds the specified value.
E-Thermal	10	Latch	Displayed when internal electronic protection detects a high temperature condition at the motor.
Over Load	11	Latch	Displayed when the inverter's output current exceeds the specified motor rated current and overload trip time.
HW-Diag	12	Latch	Displayed when a CPU error is detected.
External-B	13	Latch	Displayed when an external fault signal is generated.
Output PO	14	Latch	Displayed when the inverter does not produce an output current.

LCD display	Priority Note 1)	Type	Description
			This feature is not available in Speed(PM) mode.
Inv OLT	15	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.
Input PO	16	Latch	Displayed when a single phase of a 3-phase power supply is interrupted while the inverter is under load.
InvThem OP	17	Latch	Displayed when an open circuit is detected in the thermistor inside the inverter.
Over Speed	18	Latch	Displayed when the motor speed exceeds the specified maximum speed.
Flr/FHM Data	19	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.
SDS Error	20		ELIO add-on module input sequence error during an elevator operation. Refer to the Use Manual provided with ELIO add-on module for details.
A3 Safety	21	Latch	Displayed when an A3 Safety error is detected at a multifunction input.
Low Voltage2	22	Latch	Displayed when the power supply to the inverter is cut off during an inverter operation and the power supply is resumed before the inverter is completely turned off. A reset is required to clear this error.
SAFETY A/B	23	Latch Level	Displayed when there is a safety terminal wiring fault on the control board. The response can be

LCD display	Priority Note 1)	Type	Description
			set at either Latch or Level.
SpdDev Err	24	Latch	Displayed when the difference between the motor speed and command speed is more than the specified value.
ADC Error	25	Fatal	Displayed when current calibration is incorrect when power is initially supplied to the inverter.
Mag Det Err	26	Latch	Displayed when the power source to the motor is is cut off for longer than 10 seconds during a magnetic pole detection of a PM motor, or when the magnetic pole detection is incomplete.
EnDat ERROR	27	Latch	Displayed when EnDat signals for the Clock or Data lines are not connected or a communication error is detected.
EEP Error	28	Latch	Displayed when a data saving error occurs.
BX	29	Latch	Displayed when the inverter output is blocked by a signal from the multifunction terminal.
COM Error	30	Fatal	Displayed when communication between the inverter and the keypad is unavailable.

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

8.2 Confirming the fault status and fault history

8.2.1 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 priority (smaller number) is displayed. The information that is stored in the fault history is irrelevant to the priority.

8.2.2 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

8.3 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.

8.4 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 18.
- Is the encoder type jumper on the add-on module set correctly?
  - Refer to page 33.
  - If the encoder is line drive type, set JP1 to "LD". If the encoder is complementary or open collector type, set JP1 to "OC" and ensure that the encoder power source has been correctly connected (check 5 V/12 V/15 V terminal connections on the add-on module terminal block).
- Is direction of the motor rotation correct?
  - Refer to page 63.
  - When looking at the motor from the motor's fan, the motor rotates clockwise in the forward operation.
- Has the inverter been tested sufficiently in a no load status?
  - Refer to page 64 and 67.

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.

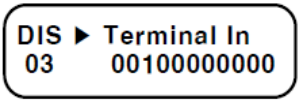
Type	Cause	Remedy
	The inverter load is greater than the rated capacity.	Replace the inverter with a model that has increased capacity.
	The mechanical brake of the motor is operating too fast.	Check the mechanical brake.
Ground Fault	A ground fault has occurred in the inverter output wiring.	Check the 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 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.

Type	Cause	Remedy
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 40℃.
InvThem OP	The ambient temperature is too low.	Keep the ambient temperature over-10℃.
	An error has been detected on the internal temperature sensor.	Contact the retailer or the LS ELECTRIC customer service center.
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	The IGBT is damaged.	Replaced the power board. Contact the retailer or the LS ELECTRIC customer service center.
	A short circuit has occurred in the output wiring during the inverter operation.	Determine if the output short circuit has occurred. When using synchronous motors, determine if the motor 3-phase

Type	Cause	Remedy
		input short circuit has occurred.
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.
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. Refer to *0 Setting the encoder types (PAR_23), encoder scale (PAR_27), and encoder tuning options (PAR_28)* on page *154* for details.
		Adjust the speed control response. Refer to *6.6.3 Speed controller (Automatic Speed Regulator: ASR)* on page *248* for details.
	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.
Output PO	A contact failure has been occurred to the magnetic contactor for the output side.	Check the magnetic contactor for the output side.

Type	Cause	Remedy
	The output wiring is bad.	Determine if the output wiring is correct.
Input 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.
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. Refer to *6.2.4 Auto-tuning* on page *155* for details.
	The response from the speed controller is high.	Decrease the speed control response. Refer to *6.6.3 Speed controller (Automatic Speed Regulator: ASR)* on page *248* for details.
	The response from the speed controller is low.	Increase the speed control response. Refer to *6.6.3 Speed controller (Automatic Speed Regulator: ASR)* on page *248* for details.
	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.
Mag Det Err	Power is not output to the motor or the run command has been turned Off during a magnetic pole detection.	Check the cable connection between the inverter and the motor. If an MC has been installed between the inverter and the motor, ensure that the main contacts of the MC are closed (On).

8.5 Troubleshooting after a test run

Fault	Remedy
(1) The motor does not rotate and the LED flashes red.	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.  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 the inverter does not operate using keypad input, try to operate it via terminal input. • If these steps do not resolve the problem, refer to Item 6 in this table.
(2) The motor does not rotate and the [REV] and [FWD] keys are illuminated green.	If the [REV] and [FWD] keys are illuminated green: • Confirm the inverter output connections (U, V, W) are in the correct phase rotation (see wiring diagram). • 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 7 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_19) 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.

Fault	Remedy
	• Confirm the motor time constant (PAR_53) is set correctly (Note: inverter efficiency will decrease significantly if this setting is incorrect). • Confirm the number of motor poles (PAR_16) is set correctly. • If CON_33 is set to “Kpd Kpd Kpd,”, are CON_34–CON_36 (torque limits) set correctly? [Note: CON_34–CON_36 define the torque limit of the inverter. Adjust the torque limit If it has been set too low. The L100 inverters can withstand 150% output for 1 minute. The use time and frequency must be limited if the inverter will be operated in excess of its limits.]
(3) 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.

Fault	Remedy
	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.
(4) 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.
(5) 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 6 in this table for more information if the motor operates abnormally after following the instructions provided above.
(6) 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 the retailer or the LS ELECTRIC customer service center.

Fault	Remedy
	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.
(7) Motor speed does not change correctly during operation.	Confirm the speed command settings at FUN_02 are correct. • The L100 inverters operate according to the speed commands received at analog input terminals, keypad, or via CAN or RS232 communication. Confirm that the correct speed references are displayed at DIS_01 (PreRamp Ref). • DIS_01–DIS_03 displays the current speed references. If the motor speed does not change to the same speed shown on the inverter's display, check the encoder (refer to Item 13 in this table). If the keypad is the command source and the speed (displayed at DIS_01–DIS_03) is not the correct, check the input to the multifunction terminals defined for multistep speed operation (among multifunction inputs DIO_01–DIO_07).

Fault	Remedy
	If analog input is the command source and the speed (displayed at DIS_01–DIS_03) is not the correct, ensure that one of the two analog inputs (Ai1 or Ai2) has been set to “Speed Ref.”
(8) 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 setting for Ai2 input and adjust the setting as required.
(9) The operation speed follows the reference speed 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.

Fault	Remedy
(10) 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 customer support center for technical support.
(11) 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 left 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.

Fault	Remedy
	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 ms for proportional gain. Increase the encoder's low pass filter setting at PRT_10 (ENC LPF). 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.
(12) 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 the retailer or the LS ELECTRIC customer service center.
(13) 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 9 in this table and perform all required checks for the inverter and the motor.

Fault	Remedy
(14) 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 rotator position. Refer to the auto-tuning section of this manual for more information. Test the motor's insulation. • Refer to Item 13 in this table.
(15) 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 the retailer or the LS ELECTRIC customer service center.

8.6 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 (BX).
	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.
The motor is overheating.	The load is too heavy.	Reduce the load. Increase the Acc/Dec time.

Fault	Cause	Remedy
		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 3 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 acceleration time is too long.	The load is too high.	Reduce the load and increase the acceleration time. Check the 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	The deceleration time is set too long.	Change the deceleration time.

Fault	Cause	Remedy
deceleration time is too long even with a Dynamic Braking (DB) resistor connected.	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 micro surge filter (MSF) 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 severely and does not rotate normally.	The 3-phase power supply is out of balance.	Check the input voltages and balance the phases.
		Check and test the motor's insulation.
The motor hums or makes loud noises.	Resonance occurs between the motor's mechanical natural frequency and the carrier frequency.	Increase or decrease the carrier frequency slightly.

Fault	Cause	Remedy
	Resonance occurs between the motor's mechanical natural frequency and the inverter output frequency.	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 power lamp is not lit.	Turn on the power.
	The RUN command is not on.	Turn on the RUN command.
The motor is not operating and	The motor is obstructed.	Remove the obstruction and reduce the load.

Fault	Cause	Remedy
there is voltage at the U, V, and W terminals.	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.

9 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.
- 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 retailer or the LS ELECTRIC customer service center.

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.

9.1 Regular inspections

9.1.1 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 5.	No icing (ambient temperature: -10 - +40). No condensation (ambient humidity below 90%)	Thermometer, hygrometer
	Inverter	Are there any abnormal vibrations or noises?	Visual inspection	No abnormality	None
	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	-

Inspection area	Item	Details	Method	Standard	Required equipment
	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.
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.		

9.1.2 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	Auditory inspection	No abnormality	-

Inspection area	Item	Details	Method	Standard	Equipment
		operation?			
		Is there any damage to the contacts?	Visual 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	

Inspection area	Item	Details	Method	Standard	Equipment
				connectors.	
				Replace the 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	Specified and managed values must	Voltmeter, Ammeter, etc.

Inspection area	Item	Details	Method	Standard	Equipment
			display device.	match.	

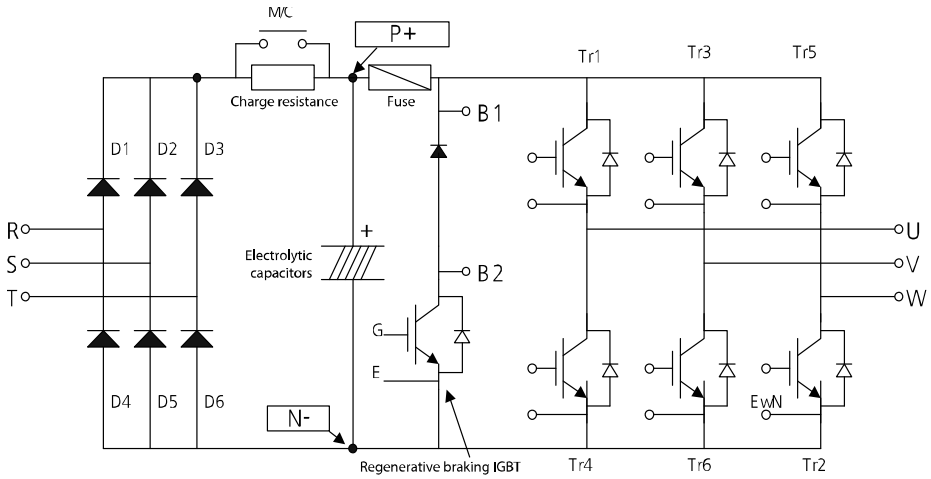
9.1.3 Biannual inspection

Inspection area	Item	Details	Method	Standard	Equipment
Main circuit	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.

9.2 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, P2, 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.

9.3 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.

9.4 Storage and disposal

9.4.1 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 5).
- 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.

9.4.2 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.

10 Technical specifications

10.1 Input and output specifications

LSLV□□□□L100-4NNFN			0055	0075	0110	150	0185	0220
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	29.7	34.3
	Rated current (A)		12	16	24	30	39	45
	Output speed		Induction motor: 0–3600 (rpm)					
			Synchronous motor: 0–680 (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)		12.9	17.5	26.5	33.4	43.6	50.7
Weight (lbs. [kg])			7.3 [3.3]	7.5 [3.4]	10.2 [4.6]	10.6 [4.8]	16.6 [7.5]	17.7 [8.0]

- 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)]

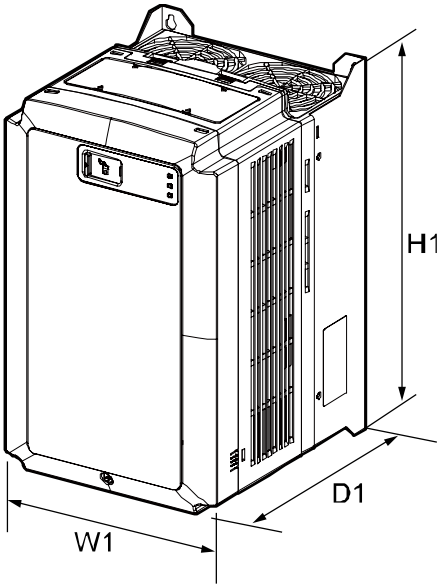
10.2 Product specification details

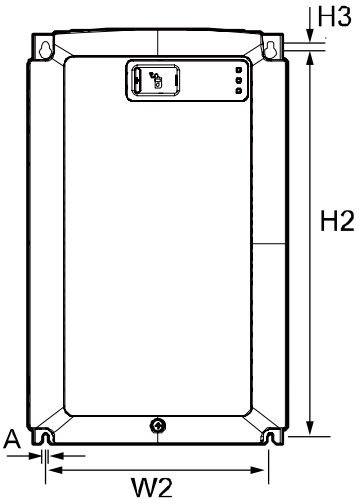
Item			Description	
Circuit system			Voltage type inverter with IGBT	
Control	Control method		Induction motor (IM)	- Speed (sensored) - V/F control - Slip compensation
			Synchronous motor (PM)	Speed (sensored)
	Speed control		Induction motor (IM)	Analog settings: ± 0.1 % (25 ±10℃) of max speed (1800 rpm) Digital settings: ± 0.1 % (0-40℃) of max speed (1800 rpm)
			Synchronous motor (PM)	Analog settings: ± 0.1 % (25 ±10℃) of max speed (680 rpm) Digital settings: ± 0.015 % (0-40℃) of max speed (680 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 %	

Item		Description	
	Braking resistor	External braking resistor (installation required)	
Input	Speed configuration	- Digital settings via the keypad - Analog input settings	- Multistep configurations via terminal input - Speed control via optional add-on modules
	Analog input	2 channels (V1, I1) 0 → 10 V, 10 → 0 V, -10 → 10 V, 10 → -10 V 0 → 20 mA, 20 → 0 mA 2 choices for multifunction analog input: speed or torque bias	
	Terminal contact input	FX, RX, BX, RST, P1, P2, P3, P4, P5, P6, P7 Various functions may be assigned to 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 Various multifunction analog output options	
	Terminal contact output	Multifunction terminal contact output: 4 channels (A1-C1, A2-C2, A3-C3, A4-C4) Fault terminal contact output: 1 channel (30A-30C, 30B-30C)	
Protective functions (Trip)		Over Current, Ground Fault, Over Voltage, Low Voltage, Over Load, Inv OLT, InvOver Heat, InvThem OP, E-Thermal, External-B, Arm Short, Encoder Err, BX, Over Speed, COM Error, HW-Diag, EEP Error, FAN Error, BatRUN Fault, Input PO, Output PO, SpdDev Err, SAFETY A/B, A3 Safety, ADC Error, Flr/FHM Data, EnDat Error	
Protective functions (Alarm)		Fan alarm, Inverter overheat alarm, Overload alarm	
Working environm	Surrounding environment	Indoors, prevent contact with direct sunlight and corrosive gases (Pollution Degree 2 Environment).	

Item		Description
ent	Ambient temperature	14°F-104°F (-10°C-40°C, no icing)
	Ambient humidity	Relative humidity less than 95% RH (no condensation)
	Cooling type	Forced fan cooling structure
	Protection structure	IP00
	Operation altitude/oscillation	No higher than 3,280 ft (1,000 m). Less than 9.8 m/sec^2 (1.0 G).

10.3 External dimensions





Units: inches (mm)

Item		W1	W2	H1	H2	D1	A
3-phase 400 V	LSLV0055L100-4 LSLV0075L100-4	6.30 (160)	5.39 (137)	9.13 (232)	8.54 (217)	7.16 (181)	0.20 (5)
	LSLV0110L100-4 LSLV0150L100-4	7.09 (180)	6.18 (157)	11.42 (290)	10.79 (274)	8.07 (205)	0.20 (5)
	LSLV0185L100-4 LSLV0220L100-4	8.66 (220)	7.64 (194)	13.78 (350)	13.03 (331)	8.78 (223)	0.24 (6)

10.4 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	30A	EBS 33b	30A	MC-32a	32A
	7.5		30A		30A	MC-32a	32A
	11		50A	EBS 53b	50A	MC-40a	40A
	15		60A	EBS 103b	60A	MC-50a	50A
	18.5		80A		80A	MC-65a	65A
	22		100A		100A		

The drive is suitable for use in a circuit capable of delivering no more than 35 kA rms symmetrical amperes at the drive maximum rated voltage, if it is protected with the recommended circuit breaker.

10.5 Fuse and reactor specifications

Products (kW)		Model type	AC input fuse		AC reactor		DC reactor	
			Current	Voltage	Inductance	Current	Inductance	Current
3-Phase 400 V	5.5	LSLV055L100-4	32 A	600 V	1.12 mH	19 A	3.20 mH	17 A
	7.5	LSLV075L100-4	35 A		0.78 mH	27 A	2.50 mH	25 A
	11	LSLV110L100-4	50 A		0.59 mH	35 A	1.90 mH	32 A
	15	LSLV150L100-4	63 A		0.46 mH	44 A	1.40 mH	41 A
	18.5	LSLV185L100-4	70 A		0.40 mH	52 A	1.00 mH	49 A
	22	LSLV220L100-4	100 A		0.30 mH	68 A	0.70 mH	64 A

The peripheral devices cannot be used if the symmetrical current exceeds 35 kA at the drive maximum rated voltage.

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.

10.6 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
V1, I1/AO1/AO2/CM/ A1/A2/A3/A4/C1/C2/C3/C4/GND	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, 167°F (75°C) for mains power cables, and rated to 300 V, 167°F (75°C) for control circuit cables.

10.7 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.

10.8 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.

Terminal type	Terminals on the braking resistor	Terminals on the inverter	Operation
Power	B1/B2	P2(+), B	-
Control	T1, T2	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.

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-L100 series
Trademark:	LS ELECTRIC Co., Ltd.

Conforms with the essential requirements of the directives:

2014/35/EU 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

2014/30EC 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 61800-3:2018
EN 61800-5-1:2007(2nd Edition)

and therefore complies with the essential requirements and provisions of the 2014/35/EU and 2014/30EC Directives.

Place: Chonan, Chungnam,

Korea

문상준 / 2020. 5. 19

(Signature /Date)

Mr. Chun Sang Moon / **General Manager**

(Full name / Position)

EMI / RFI POWER LINE FILTERS
LS ELECTRIC inverters, L100 series

RFI FILTERS

THE LS RANGE OF POWER LINE FILTERS **FLD(Standard)** 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 STANDARDS TO EN 50081.

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 instructionsshould be followed as closely as possible. Follow the usual safetyprocedures when working with electrical equipment. All electricalconnections 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 andpart 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 themounting dimensions of the filter. Care should be taken to remove any paintetc... from the mounting holes and face area of the panel to ensure the bestpossible earthing of the filter.

4 Mount the filter securely.

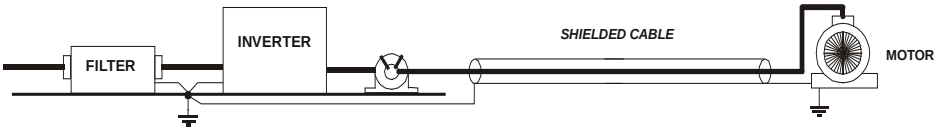
5 Connect the mains supply to the filter terminals marked LINE, connect anyearth cables to the earth stud provided. Connect the filter terminals markedLOAD to the mains input of the inverter using short lengths of appropriategauge cable.

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 MOTORCABLES ARE KEPT WELL SEPARATED.

FLD SERIES (standard)



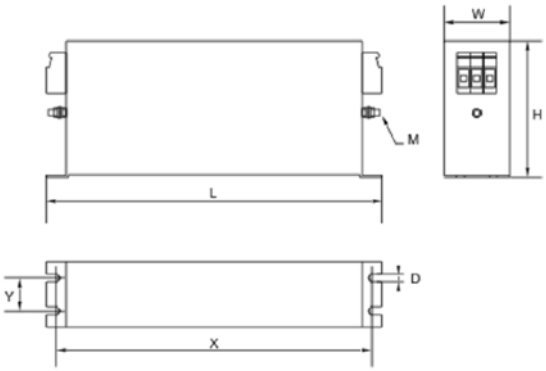
INVERTER	POWER	CODE	CURRENT	VOLTAGE	LEAKAGE CURRENT	DIMENSIONS L W H	MOUNTING Y X	WEIGHT	MOUNT	FIG	OUTPUT CHOKE
THREE PHASE					NOM. MAX.						
0055-4	5.5kW	FLD 3100	100A	220-480VAC	0.5mA 27mA	330 x 80 x 220	55 x 314	5.5Kg	---	A	FS – 3
0075-4	7.5kW	FLD 3100	100A	220-480VAC	0.5mA 27mA	330 x 80 x 220	55 x 314	5.5Kg	---	A	FS – 3
0110-4	11kW	FLD 3100	100A	220-480VAC	0.5mA 27mA	330 x 80 x 220	55 x 314	5.5Kg	---	A	FS – 3
0150-4	15kW	FLD 3100	100A	220-480VAC	0.5mA 27mA	330 x 80 x 220	55 x 314	5.5Kg	---	A	FS – 3
0185-4	18.5kW	FLD 3100	100A	220-480VAC	0.5mA 27mA	330 x 80 x 220	55 x 314	5.5Kg	---	A	FS – 3
0220-4	15kW	FLD 3100	100A	220-480VAC	0.5mA 27mA	330 x 80 x 220	55 x 314	5.5Kg	---	A	FS – 3

LSLV0055~0220L100-4 EN 55011 CLASS B IEC/EN 61800-3 C2

DIMENSIONS

FLD Series (Standard)

FIG.A



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

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 Lift Inverter	**Date of installation**	
Model name	LSLV-L100	**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.

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

http: //www.lselectric.co.kr for detailed service information.

CE mark

CE

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

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