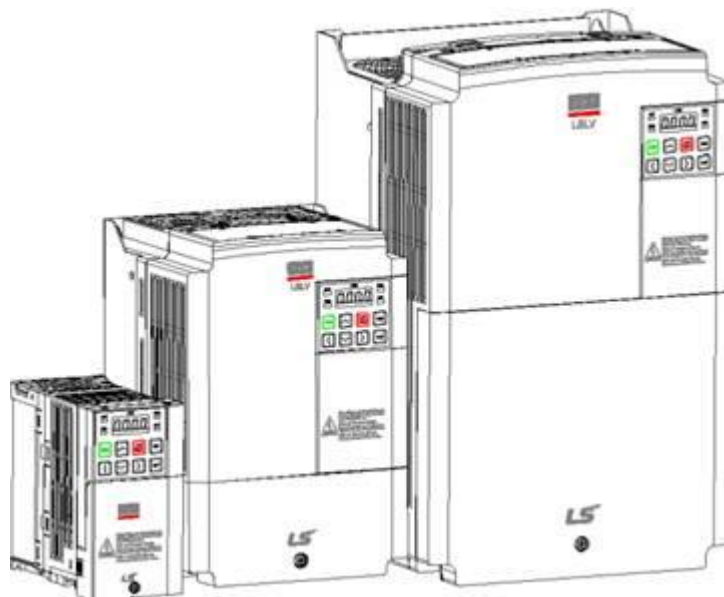


AC Variable Speed Drive

0.4 -22 kW [200, 400V]

LSLV-S100 User Manual



Safety Precautions

- Please read the Safety Precautions before using this product.
- After using this manual, please place it in a location where people can easily find it.

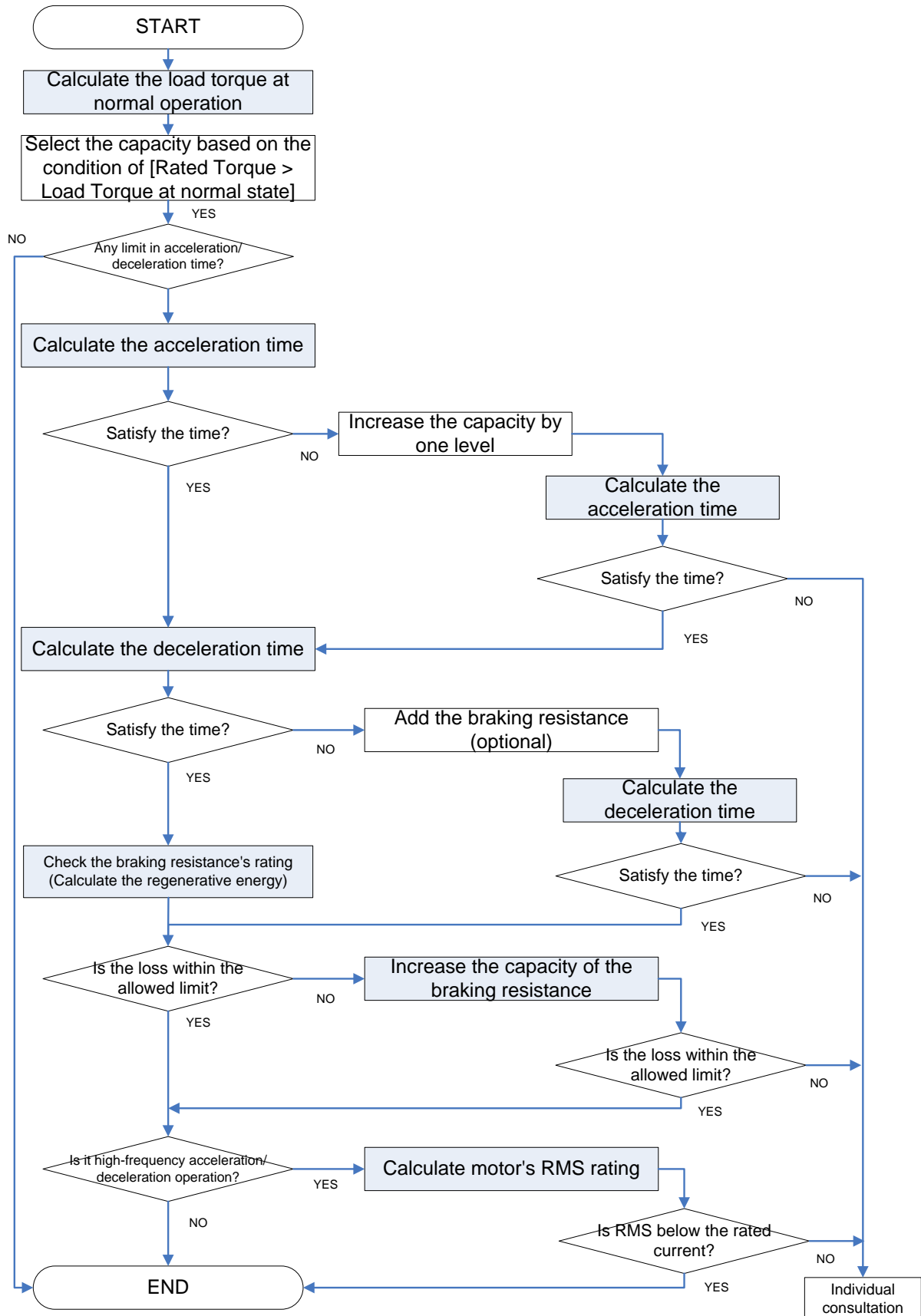
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About This Manual

This manual explains the specifications, installation, operation, features and maintenance of LSLV-S100 series inverter for users with basic knowledge on the inverter.

Before using LSLV-S100 series inverter, please read this manual and [understand](#) the functionality, performance, installation and usage of the product. In addition, please ensure that the end user and maintenance manager have read this manual.



Product Capacity Selection Process



Safety Precautions

Safety Precautions help you prevent accidents before they happen and allow you to use the inverter safely and properly. Make sure to adhere to all Safety Precautions outlined in this manual.



There are two types of warning labels: Warning and Caution. These labels mean the following:

Precaution		Definition
	Warning	Warning labels alert users to the possibility of serious injuries or death from failure to follow the instructions provided.
	Caution	Caution labels alert users to the possibility of minor injuries or damage to the inverter from failure to follow the instructions provided.


The icons displayed on the inverter and in the manual mean the following:

Notes
Even Caution labels can warn users of potentially serious results depending on the situation.

The icons displayed on the inverter and in the manual mean the following:

Icon	Definition
	Danger: there is the possibility of accidents occurring.
	Danger: there is the possibility of an electric shock.

After reading the manual, please place it in a location where people can easily find it. Please read this manual carefully to ensure LSLV-S100 inverter is used safely and effectively.

 Warning
<ul style="list-style-type: none"> ▪ THIS INVERTER MUST BE EARTHED/ GROUNDED! ▪ Do not open the cover while the power is on or at any time during operation. Otherwise, it may result in an electric shock. ▪ Do not operate the inverter while the cover is open. Exposing the High voltage terminal or charging area to the external environment may result in an electric shock. ▪ Do not open the cover even when the power supply has been switched off. This excludes necessary maintenance or regular inspection. Opening the cover may result in an electric shock even if the power supply is off. The inverter may hold a charge long after the power supply has been switched off.

- Do not conduct maintenance or inspection without first ensuring that the DC voltage of the inverter has been fully discharged. To ensure this, use a voltage tester at least ten minutes after the power supply has been cut off.
Otherwise, it may result in an electric shock. (DC 30V or less)
- Do not operate switches on the inverter with wet hands.
Otherwise, it may result in an electric shock.
- Do not use the inverter if the cable has been damaged.
Otherwise, it may result in an electric shock.
- Do not place a heavy object on the cable.
Placing heavy object on the cable could damage its sheath and may result in an electric shock.

 **Caution**

- **Equipment is intended for installation in closed electrical operating areas only.**
- Do not install the product near any flammable materials.
- Mounting the inverter on or near flammable materials may start a fire.
- Switch off the power supply to a faulty inverter.
- Failure to switch off the power supply to a faulty inverter may start a fire.
- Do not touch the inverter while the power supply is on or within ten minutes of switching the power supply off.
- Touching the inverter may result in a burn because of its high operating temperatures.
- Do not supply power to a faulty inverter even when its installation has been completed.
- Otherwise, it may result in an electric shock.
- Make sure that any foreign substances such as screws, metal, water and oil do not enter the inverter.
- Introducing foreign substances to the inverter may start a fire.

Usage Precautions

■ Transport and Installation

- Transport the inverter using a method appropriate for its weight.
- Do not stack inverters over the limit specified by the manual.
- Install the inverter according to the instructions provided by the manual.
- Do not open the cover of the inverter while transporting it.
- Do not place heavy objects on the inverter.
- Make sure to install the inverter in the direction specified by the manual.
- The inverter is a precision instrument. Do not drop it or expose it to heavy impact.
- The inverter requires Class 3 (200 V product) and Special Class 3 (400 V product) grounding.
- Immediately place any detached PCB on a conductor if you have detached it for installation or repair. The inverter can be damaged by static electricity.
- Do not expose the inverter to snow, rain, fog or dust.
- Do not cover or obstruct the cooling fan vents. This could result in the inverter overheating.
- For safety, make sure that the power of the inverter is turned off before installation.
- Ensure that the cables are in good condition to minimize the risk of fire or electric shock. Do not use an inferior quality cable or extend the length of the existing cable.

Use the inverter under the following conditions.

Item		Details
Environment	Temperature	<ul style="list-style-type: none"> ▪ Open Type - Maximum Surrounding Air Temperature : 50 °C (Heavy duty), 40 °C (Normal duty) ▪ Enclosure Type 1 – Maximum Ambient Temperature : 40 °C
	Ambient humidity	90% RH or less (no condensation)
	Storage temperature	- 20 - 65 °C
	Ambient environment	There should not be corrosive gas, inflammable gas, oil residue, dirt, etc.

Item		Details
	Altitude/vibration	Altitude of 1,000 m or less / vibrations of 5.9m/sec ² (= 1G) or less
	Ambient pressure	70 - 106 kPa

■ Wiring

- Do not install phase advanced capacitor, surge filter, or radio noise filter on the output of the inverter.
- Connect output side (terminals U, V and W) in the correct order.
- The inverter may be damaged if the terminals are connected incorrectly.
- Be careful. Connecting input side (terminals R, S, T) into output side (terminals U, V, W) incorrectly, and vice versa, may damage the inverter.

⚠ Caution

- **Wiring or inspection must be performed by a qualified technician.**

- Install the inverter before wiring.

■ Protection

- The accessible connections and parts listed below are of protective class 0. It means that the protection of these circuits relies only upon basic insulation and becomes hazardous in the event of a failure of the basic insulation. Therefore, devices connected to these circuits must provide electrical-shock protection as if the device was connected to supply mains voltage. In addition, during installation these parts must be considered, in relation with electrical-shock, as supply mains voltage circuits.
 - Class 0 circuits:
 - MULTI FUNCTION INPUT P1-P7
 - ANALOG FREQUENCY INPUT AI
 - SAFETY FUNCTION SA, SB, SC
 - ANALOG OUTPUT AO1, TO
 - CONTACT Q1, EG, 24,A1, C1, B1, S+, S-, SG
- Protective Class of the equipment: Protective Class I (See 4.3.5.1 IEC 61800-5-1).
- Type of electrical supply system: Supply earthing system: TT, TN, not suitable for corner-earthed systems.

■ Starting the inverter

- Check all parameters before operation. Parameter change may be necessary depending on the load.
- Do not supply a voltage to each terminal which exceeds the range outlined by the manual. Providing excess voltage may damage the inverter.

■ Usage

- If you selected the auto-restart function, please keep in mind that operation automatically restarts after a stop caused by a trip condition.
- Since the stop key on the keypad works when it is set to use, install [an](#) emergency stop switch separately.
- The inverter restarts when you reset [a](#) trip condition while the operating signal is inputted. Press the RESET switch after checking the operating signal.
- Do not modify the interior workings of the inverter.
- The electronic thermal function may not protect the motor under some conditions.
- Do not start or stop the inverter with [a](#) magnetic contactor that is installed on the input power supply.
- Minimize electromagnetic interference by using a noise filter, etc. Some electronic devices may not work correctly if they are used near the inverter. Be sure to take precautions.
- If the input current is unbalanced, install a reactor. Phase advanced capacitors or generators may overheat and get damaged by the power frequency from the inverter.
- If you initialize parameters, the parameter values are restored to factory defaults. Therefore please reconfigure the parameters as required if you operate after initialization.
- The inverter is capable of operating a motor at high speeds. Before increasing the inverter maximum output frequency make sure that the motor's maximum operating speeds are not exceeded.
- [Stopping](#) torque does not occur when the inverter's DC braking is used. If a stop torque is required, please install a braking resistor.
- The inverter is designed for 3-phase motor operation. Do not use the inverter to operate a single phase motor.

■ Prevention Measures for Abnormal Situations

- If the inverter is damaged and becomes uncontrollable, the machine may cause a dangerous situation. Install an additional safety device such as an emergency brake to prevent these situations.

- This product can cause a d.c. current in the protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in case of direct contact, only an RCD or RCM of Type B is allowed on the supply side of this product.

Repair, Inspection and Parts Replacement

- Do not conduct a Megger test (measuring insulation resistance) against the control circuit of the inverter.
- For details about regular inspection (part replacement intervals), see chapters 9.6 Daily Inspection and Regular Inspection List.

■ Disposal

- Dispose of the inverter according to your local regulations regarding the disposal of common industrial waste.
- Recycle all recyclable components contained in this inverter to preserve energy and resources. All packing materials and metal components of this product are recyclable in most areas. Plastic parts are recyclable or you may be able to burn them in a controlled environment, depending on local regulations.

■ General

- Figures in this manual are shown with covers or circuit breakers omitted for more detailed explanation. Install covers and circuit breakers according to the regulations before operation. Operate the product according to the instructions in this manual.
- Turn off the inverter when it is not in use.

■ Cleaning

- Be sure to turn off the inverter power supply and remove all plugs that are connected to the inverter socket before cleaning. Clean with a dry cloth. Never use water or a wet cloth on the inverter.

■ Long-term Storage

If you are not planning on using your inverter for a long period of time, store it under the following conditions:

- Comply with the recommended storage environment guidelines. (refer to Page v)
- If the storage period exceeds three months, store the inverter at an ambient temperature of -10 - +30°C to prevent the thermal degradation of the electrolytic capacitor.

- Package the inverter to prevent moisture from building up inside the inverter. Keep the relative humidity of the inverter under 70% by putting a desiccant (silica gel) packet inside the package.
- If the inverter is exposed to humidity or dust (e.g. if it is installed on construction equipment), detach it from any equipment before storing it under the conditions set forth on Page vi.

⚠ Caution

- **If the inverter is not supplied with electricity for a long period of time, the electrolytic condenser may suffer thermal degradation. To prevent this from happening, connect the power supply to the inverter for 30 - 60 minutes at least once a year. Do not perform any wiring or operation to the inverter on the output (secondary) side.**

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1. Basic Considerations

This section provides precautions and basic considerations you need to know before you use the inverter.

1.1 Features

- More powerful functions
 - V/F function
 - Slip compensation
 - Sensorless vector control
- User-oriented interface and eco-friendly design
 - iS7 Graphic LCD Keypad supported (Using specific cable for iS7)
 - Electric thermal system for motor protection
 - Input/output open-phase protection for inverter and sequence protection
 - EMC filter to reduce electromagnetic emission (400 V class built in)

1.2 Delivery Check

After unpacking the inverter, check the product rating plate on the housing to ensure that the type and rated output of the inverter are correct. Be sure to examine the product to ensure that it has not been damaged during transport.

Table 1-1 S100 Product

LS LV	0000		S100	-	2	E	O	F
	Motor Capacity		Type		Input Voltage	I/O Type	UL Type	EMC
LS Inverter	0004	0.4 [kW]	Standard inverter	-	1: Single phase 200-240[V] 2: Three- phase 200-240[V] 4: Three- phase 380-480[V]	S : Standard I/O E : Extention I/O	O : UL open & Enclosed Type1 ¹ X: IP66	Blank : Without Filter F : With Filter
	0008	0.75 [kW]						
	0015	1.5 [kW]						
	0022	2.2 [kW]						
	0037	3.7 [kW]						
	0040	4 [kW]						
	0055	5.5 [kW]						
	0075	7.5 [kW]						
	0110	11 [kW]						
	0150	15 [kW]						
	0185	18.5 [kW]						
0220	22 [kW]							

* iS7 inverter control is only applied for AC asynchronous(Induction Motor). Synchronous motor is excluded.

¹ The Enclosed Type 1 is a class that satisfies the requirements when adding a separate conduit option to S100 products.

■ Components

If any component is missing or the product is damaged, please contact one of our agencies or LSIS offices (refer to the back cover of the user manual).

■ Preparation of devices and components required for operation

Prepare components required for operation. Devices and components required for operation may be different depending on the application.

■ Installation

Consider the location, direction and surrounding space before installation to ensure longer product life and performance.

■ Wiring

Connect the power, motor and operation signal (control signal) to the terminal block. Be careful as the inverter and other devices may be damaged if not correctly connected.

1.3 Part Names

■ Full product (5.5-22.0 kW)

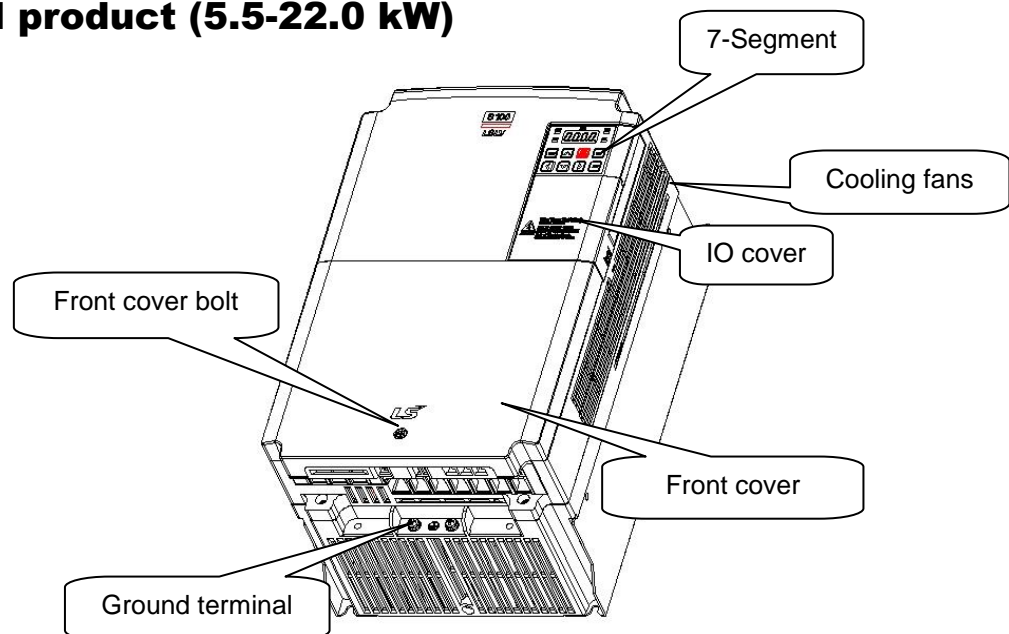


Figure 1-1 Full product

■ Front cover and IO cover removed (5.5-22.0 kW)

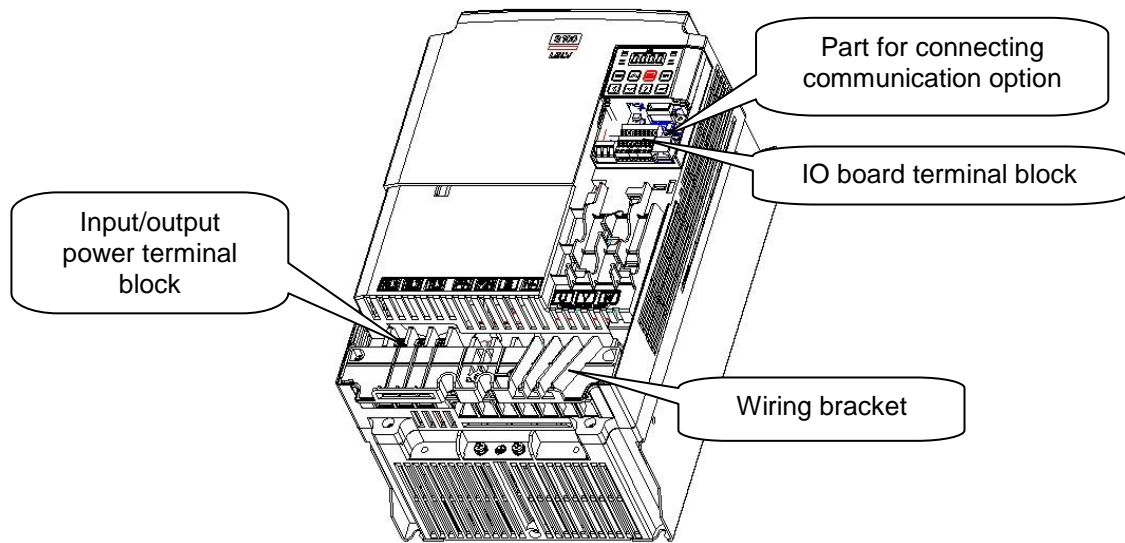


Figure 1-2 Front cover removed

2. Standard

2.1 Input and Output Rating

2.1.1 Input Voltage: Single Phase 200 V Product

(1) 0.4 - 2.2 kW

Type Name: LSLV xxxx S100 – 1xxx		0004	0008	0015	0022	
Applicable motors ²	HP	0.5	1	2	3	
	kW	0.4	0.75	1.5	2.2	
Output rating	Rated capacity ³ [kVA]		1.0	1.9	3.0	4.2
	Rated current ⁴ [A]	Heavy load	2.5	5.0	8.0	11.0
		Light load	3.1	6.0	9.6	12.0
	Output frequency		0 - 400 [Hz] (IM Sensorless: 0-120[Hz]) ⁵			
	Output voltage [V]		3 phase 200 - 240 V ⁶			
Input rating	Voltage [V]		1 phase 200 - 240 VAC (-15% - +10%)			
	Input frequency		50 - 60 [Hz] (±5%)			
	Rated current [A]	Heavy load	4.4	9.3	15.6	21.7
		Light load	5.8	11.7	19.7	24.0
Weight [Kg]		0.9	1.3	1.5	2.0	

² The applicable motor shows the max applicable capacity when 4-pole standard motor is used. (200 V product is based on 220 V, 400 V product on 440 V.)

³ For the rated capacity, 200 V product's input capacity is based on 220 V while 400 V product's input capacity is based on 440 V. The current rating is based on the heavy duty current.

⁴ There is a current limit on output rating according to the carrier frequency (Cn-04) settings.

⁵ If the control mode (dr.09 Control Mode) is set to No. 4 IM-Sensorless, [120Hz is the maximum frequency permitted](#).

⁶ The max output voltage cannot exceed the power voltage. The output voltage can be set to any value below the power voltage.

2.1.2 Input Voltage: 3-Phase 200V Product

(2) 0.4 - 4 kW

Type Name: LSLV xxxx S100 – 2xxx		0004	0008	0015	0022	0037	0040	
Applicable motors	HP	0.5	1	2	3	5	5.4	
	kW	0.4	0.75	1.5	2.2	3.7	4	
Output rating	Rated capacity[kVA]		1.0	1.9	3.0	4.2	6.1	6.5
	Rated current [A]	Heavy load	2.5	5.0	8.0	11.0	16.0	17.0
		Light load	3.1	6.0	10.0	12.0	18.0	18.0
	Output frequency		0 - 400 [Hz] (IM-Sensorless : 0 - 120 Hz)					
	Output voltage [V]		3 phase 200 - 240 V					
Input rating	Voltage [V]		3 phase 200 - 240 VAC (-15% - +10%)					
	Input frequency		50 - 60 [Hz] (±5%)					
	Rated current [A]	Heavy load	2.0	5.8	7.5	11.0	18.9	21.0
		Light load	3.9	7.3	10.8	13.9	24.0	24.0
Weight [Kg]		0.9	0.9	1.3	1.5	2.0	2.0	

(3) 5.5 - 22 kW

Type Name: LSLV xxxx S100 – 2xxx		0055	0075	0110	0150			
Applicable motors	HP	7.5	10	15	20			
	kW	5.5	7.5	11	15			
Output rating	Rated capacity[kVA]		9.1	12.2	17.5	22.9		
	Rated current [A]	Heavy load	24.0	32.0	46.0	60.0		
		Light load	30.0	40.0	56.0	69.0		
	Output frequency		0 - 400 [Hz] (IM-Sensorless : 0-120[Hz])					
	Output voltage [V]		3 phase 200 - 240 V					
Input rating	Voltage [V]		3 phase 200 - 240 VAC (-15% - +10%)					
	Input frequency		50 - 60 [Hz] (±5%)					
	Rated current [A]	Heavy load	25.8	34.9	50.8	66.7		
		Light load	32.7	44.2	62.3	77.2		
Weight [Kg]		3.3	3.3	4.6	7.1			

2.1.3 Input Voltage: 3-Phase 400 V Product

(4) 0.4 - 4 kW

Type Name: LSLV xxxx S100 – 4xxx		0004	0008	0015	0022	0037	0040	
Applicable motors	HP	0.5	1	2	3	5	5.4	
	kW	0.4	0.75	1.5	2.2	3.7	4	
Output rating	Rated capacity[kVA]		1.0	1.9	3.0	4.2	6.1	6.5
	Rated current [A]	Heavy load	1.3	2.5	4.0	5.5	8.0	9.0
		Light load	2.0	3.1	5.1	6.9	10.0	10.0
	Output frequency		0 - 400 [Hz] (IM-Sensorless : 0 - 120 Hz)					
	Output voltage [V]		3 phase 380 - 480V					
Input rating	Voltage [V]		3 phase 380 - 480 VAC (-15% - +10%)					
	Input frequency		50 - 60 [Hz] (±5%)					
	Rated current [A]	Heavy load	1.1	2.4	4.2	5.9	8.7	9.8
		Light load	2.0	3.3	5.5	7.5	10.8	10.8
Weight [Kg]		0.9	0.9	1.3	1.5	2.0	2.0	

(5) 5.5 - 22 kW

Type Name: LSLV xxxx S100 – 4xxx		0055	0075	0110	0150	0185	0220	
Applicable motors	HP	7.5	10	15	20	25	30	
	kW	5.5	7.5	11	15	18.5	22	
Output rating	Rated capacity[kVA]		9.1	12.2	17.5	22.9	28.2	33.5
	Rated current [A]	Heavy load	12.0	16.0	24.0	30.0	39.0	45.0
		Light load	16.0	23.0	30.0	38.0	44.0	58.0
	Output frequency		0 - 400 [Hz] (IM-Sensorless : 0 - 120 Hz)					
	Output voltage [V]		3 phase 380 - 480V					
Input rating	Voltage [V]		3 phase 380 - 480 VAC (-15% - +10%)					
	Input frequency		50 - 60 [Hz] (±5%)					
	Rated current [A]	Heavy load	12.9	17.5	26.5	33.4	43.6	50.7
		Light load	17.5	25.4	33.4	42.5	49.5	65.7
Weight [Kg]		3.3	3.4	4.6	4.8	7.5	7.5	

2.1.4 Common Features

(1) Control

Control method	V/F control, slip compensation, sensorless vector
Frequency setting resolution	Digital command: 0.01Hz Analog command: 0.06 Hz (Max. frequency: 60 Hz)
Frequency level	1% of max. output frequency
V/F pattern	Linear, square, user V/F
Overload tolerance	Heavy load current rating: 150% 1 minute, light load current rating: 120% 1 minute
Torque boost	Manual torque boost, automatic torque boost

(2) Operation

Operation type	Select one from keypad, terminal block and communication operation.
Frequency setting	Analog type: -10 - 10[V], 0 - 10[V], 0 - 20[mA] Digital type: Keypad, pulse train input
Operation function	PID control, up-down operation 3-wire operation, direct current braking, frequency limit, frequency jump, 2nd function, slip compensation, reverse rotation prevention, automatic restart, commercial electricity switching, auto-tuning, flying start, energy buffering operation, power braking, flux braking, leakage reduction operation
Input	Multi-functional terminal ⁷ (7 points) P1 - P7
	Selectable between NPN (Sink) and PNP (Source)
	Function: Forward direction operation, reverse direction operation, reset, outside trip, emergency stop, jog operation, multi-step speed frequency - high, medium and low, multi-step acceleration/deceleration - high, medium and low, DC braking on stop, 2nd motor section, frequency increase, frequency decrease, 3-wire operation, conversion to general operation during PID operation, conversion to body operation during option operation, frequency fixation of analog command, acceleration/deceleration stop.
Pulse train	0 Hz - 32 kHz, low level: 0 - 0.8 V, high level : 3.5 - 12 V

⁷ Functions related to multi-functional terminal can be [selected](#) based on IN group In.65-71 parameter settings.

Output	Multiple functions open collector terminal	Failure output and inverter operation status output	DC 24V 50mA or less
	Multi-functional relay terminal		(N.O., N.C.) AC 250 V 1 A or less, DC 30V 1A or less
	Analog output	0 - 12 Vdc (4 - 20 mA): Selectable from frequency, output current, output voltage and DC link voltage	
	Pulse train	Max. 32 kHz, 0 - 12[V]	

(3) Protection function

Trip	Overcurrent, overvoltage, low voltage, outside trip, ground fault current detection, inverter overheating, motor overheating, input/output open-phase, overload protection, lightload protection, communication error, frequency command loss, hardware failure, cooling fan failure, Pre-PID operation failure, no motor trip, outside brake trip, option failure, safety contact failure, inverter temp sensor failure, parameter writing error, IO board failure.
Warning	Stall prevention, overload, light load, cooling fan failure, frequency command loss, DB utilization, rotor time constant tuning failure
Instantaneous power interruption	Heavy load level 16 ms or less (light load level 8 ms or less): Continues to operate. (should be within rated input and output voltage) Heavy load level 16 ms or higher (light load level 8 ms or higher): Automatic restart operation allowed.

(4) Structure and usage environment

Cooling method	Forced air-cooling structure Forced cooling: 5.5 - 22 kW 200/400 V product
Protection structure	IP 20 (Default), UL Open & Enclosed Type 1 (Option) ⁸
Ambient temperature	Ambient temperature under the conditions without ice or frost Heavy load: - 10 - 50°C Light load: - 10 - 40°C [if used at 50°C for light load, 80% or less load is recommended.]

⁸ UL Enclosed type 1 with conduit box installed.

Storage temperature	-20°C - 65°C
Ambient humidity	90% relative humidity or less (no condensation)
Altitude, vibration	1,000 m or less, 5.9 m/sec ² (1G) or less
Ambient environment	There should be no corrosive gas, flammable gas, oil residue, dirt, etc., in the ambient environment. (Pollution Degree 2 Environment)

2.1.5 Dimensions (IP20 Type)

■ LSLV0004 S100 (single-phase 200 V), LSLV0004 S100 – 0008 S100(3-phase 200 V/3-phase 400 V)

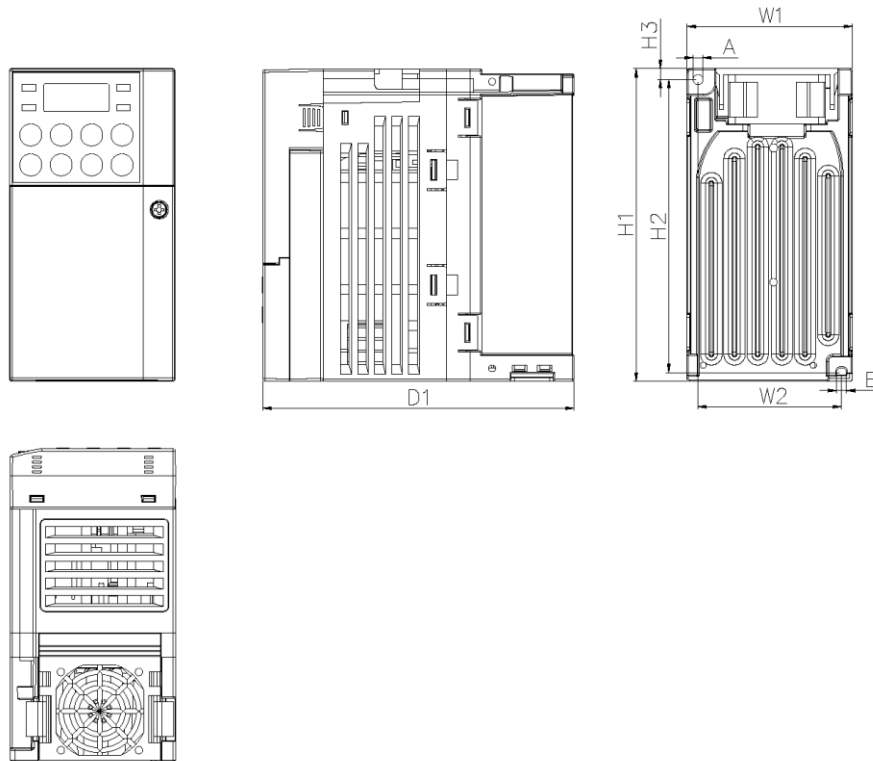


Figure 2-1 LSLV0004 S100(single-phase 200 V), LSLV0004 S100 – 0008 S100 (3-phase 200 V/3-phase 400 V)

■ **LSLV0008 – 0015 S100 (single-phase 200 V),
LSLV0015 S100 – 0022 S100 (3-phase 200 V/3-phase
400 V)**

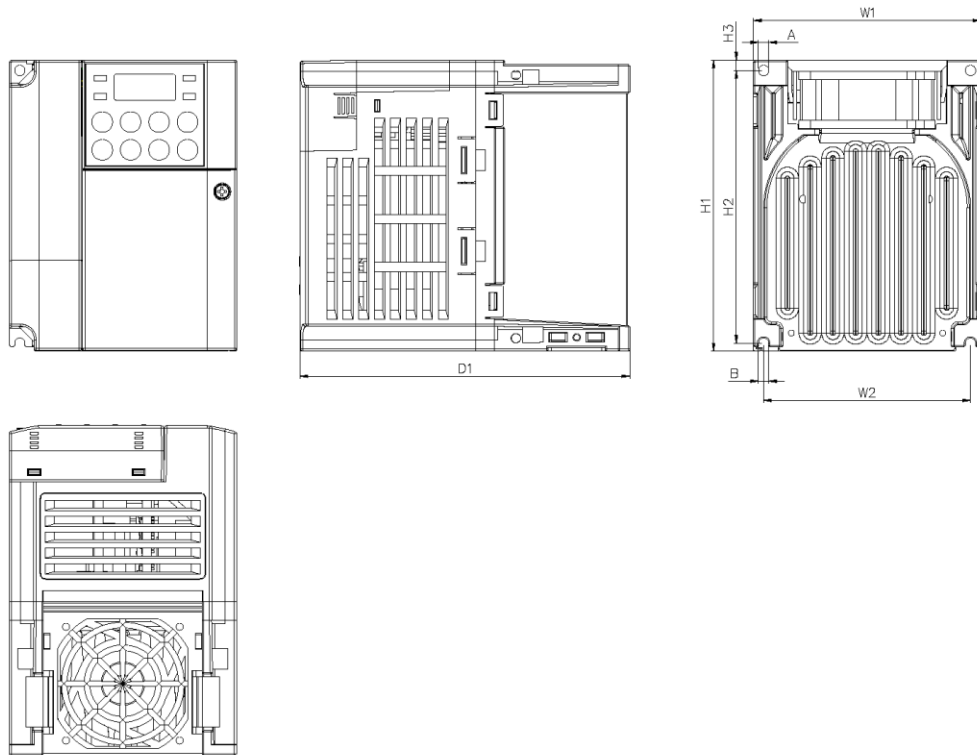


Figure 2-2 LSLV0008 – 0015 S100(single-phase 200 V), LSLV0015 S100 – 0022 S100 (3-phase 200 V/3-phase 400 V)

■ **LSLV0022 S100 (single-phase 200 V), LSLV0037 S100 – 0040 S100 (3-phase 200 V/3-phase 400 V)**

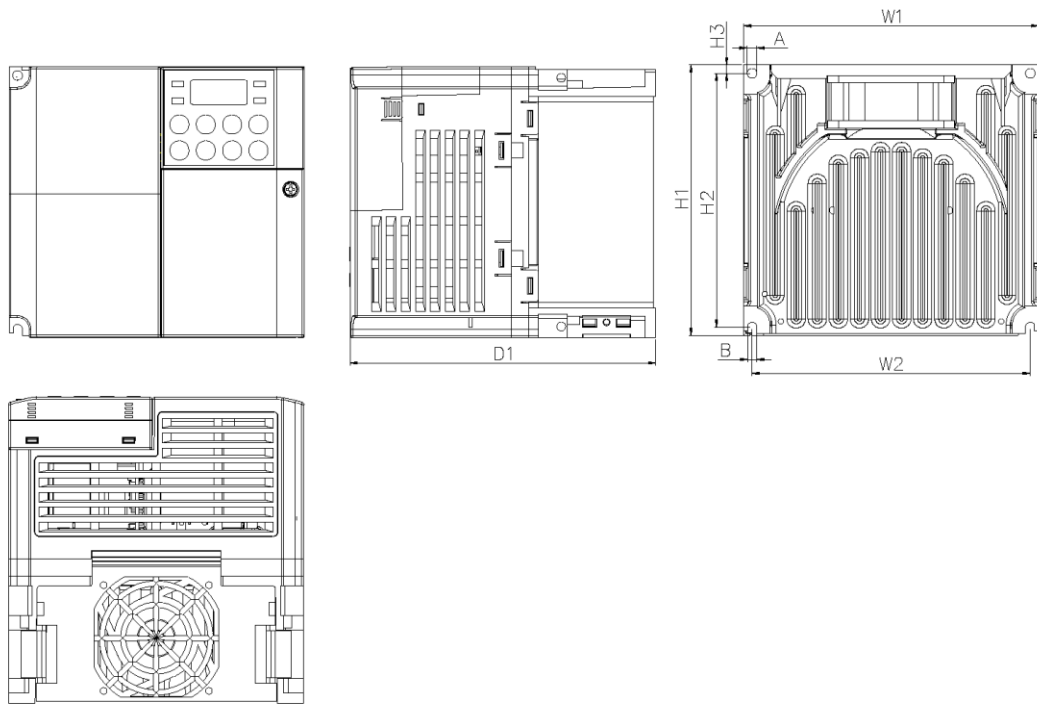


Figure 2-3 LSLV0022 S100 (single-phase 200 V), LSLV0037 S100 – 0040 S100 (3-phase 200 V/3-phase 400 V)

■ LSLV0055 - 0220 S100 (3-phase 200 V/3-phase 400 V)

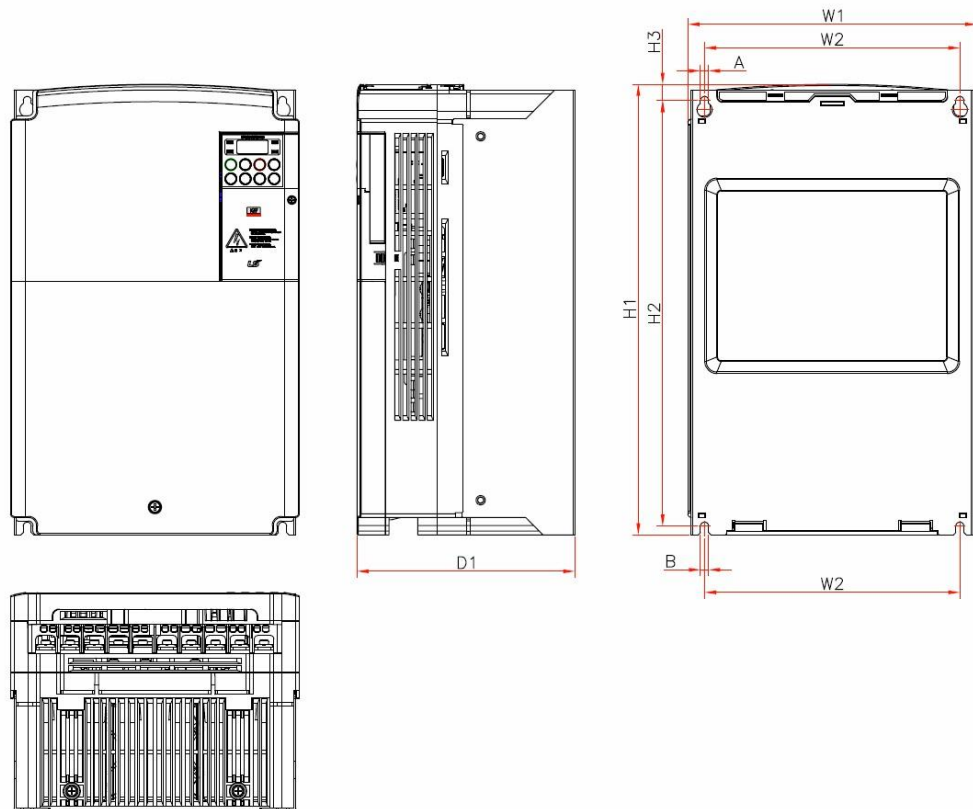


Figure 2-4 LSLV0055 – 0220 S100 (200 V/400 V)

Table 2-1 Dimensions per frame (single-phase 200 V)

Inverter	mm (inches)								
	W1	W2	H1	H2	H3	D1	A	B	Φ
LSLV0004S100-1	68 (2.68)	59 (2.32)	128 (5.04)	120 (4.72)	4.5 (0.18)	128 (5.04)	4 (0.16)	4 (0.16)	4 (0.16)
LSLV0008S100-1	100 (3.94)	91 (3.58)	128 (5.04)	120 (4.72)	4.5 (0.18)	130 (5.12)	4.5 (0.18)	4.5 (0.18)	4.5 (0.18)
LSLV0015S100-1	100 (3.94)	91 (3.58)	128 (5.04)	120 (4.72)	4.5 (0.18)	145 (5.71)	4.5 (0.18)	4.5 (0.18)	4.5 (0.18)
LSLV0022S100-1	140 (5.51)	132 (5.20)	128 (5.04)	120 (4.72)	4 (0.16)	145 (5.71)	4.5 (0.18)	4.25 (0.17)	4.5 (0.18)

Table 2-2 Dimensions per frame (3-phase 200 V)

Inverter	mm (inches)								
	W1	W2	H1	H2	H3	D1	A	B	Φ
LSLV0004S100-2	68 (2.68)	59 (2.32)	128 (5.04)	120 (4.72)	4.5 (0.18)	123 (4.84)	4 (0.16)	4 (0.16)	4 (0.16)
LSLV0008S100-2	68 (2.68)	59 (2.32)	128 (5.04)	120 (4.72)	4.5 (0.18)	128 (5.04)	4 (0.16)	4 (0.16)	4 (0.16)
LSLV0015S100-2	100 (3.94)	91 (3.58)	128 (5.04)	120 (4.72)	4.5 (0.18)	130 (5.12)	4.5 (0.18)	4.5 (0.18)	4.5 (0.18)
LSLV0022S100-2	100 (3.94)	91 (3.58)	128 (5.04)	120 (4.72)	4.5 (0.18)	145 (5.71)	4.5 (0.18)	4.5 (0.18)	4.5 (0.18)
LSLV0037S100-2	140 (5.51)	132 (5.20)	128 (5.04)	120 (4.72)	4 (0.16)	145 (5.71)	4.5 (0.18)	4.25 (0.17)	4.5 (0.18)
LSLV0055S100-2	160 (6.30)	137 (5.39)	232 (9.13)	216.5 (8.52)	10.5 (0.41)	140 (5.51)	5 (0.20)	5 (0.20)	
LSLV0075S100-2									
LSLV0110S100-2	180 (7.09)	157 (6.18)	290 (11.4)	273.7 (10.8)	11.3 (0.44)	163 (6.42)	5 (0.20)	5 (0.20)	
LSLV0150S100-2	220 (8.66)	193.8 (7.63)	350 (13.8)	331 (13.0)	13 (0.51)	187 (7.36)	6 (0.24)	6 (0.24)	

Table 2-3 Dimensions per frame (3-phase 400 V)

Inverter	mm (inches)								
	W1	W2	H1	H2	H3	D1	A	B	Φ
LSLV0004S100-4	68 (2.68)	59 (2.32)	128 (5.04)	120 (4.72)	4.5 (0.18)	123 (4.84)	4 (0.16)	4 (0.16)	4 (0.16)
LSLV0008S100-4	68 (2.68)	59 (2.32)	128 (5.04)	120 (4.72)	4.5 (0.18)	128 (5.04)	4 (0.16)	4 (0.16)	4 (0.16)
LSLV0015S100-4	100 (3.94)	91 (3.58)	128 (5.04)	120 (4.72)	4.5 (0.18)	130 (5.12)	4.5 (0.18)	4.5 (0.18)	4.5 (0.18)
LSLV0022S100-4	100 (3.94)	91 (3.58)	128 (5.04)	120 (4.72)	4.5 (0.18)	145 (5.71)	4.5 (0.18)	4.5 (0.18)	4.5 (0.18)
LSLV0037S100-4	140 (5.51)	132 (5.20)	128 (5.04)	120 (4.72)	4 (0.16)	145 (5.71)	4.5 (0.18)	4.25 (0.17)	4.5 (0.18)
LSLV0055S100-4	160 (6.30)	137 (5.39)	232 (9.13)	216.5 (8.52)	10.5 (0.41)	140 (5.51)	5 (0.20)	5 (0.20)	-
LSLV0075S100-4									
LSLV0110S100-4	180 (7.09)	157 (6.18)	290 (11.4)	273.7 (10.8)	11.3 (0.44)	163 (6.42)	5 (0.20)	5 (0.20)	-
LSLV0150S100-4									
LSLV0185S100-4	220 (8.66)	193.8 (7.63)	350 (13.8)	331 (13.0)	13 (0.51)	187 (7.36)	6 (0.24)	6 (0.24)	-
LSLV0220S100-4									

2.1.6 Power Terminal Block Wiring and External Fuse Specifications

Table 2-4 Specifications for terminal screws

Applicable inverter		Terminal screw size	1) screw torque (Kgf·cm)	2) cable			
				mm ²		AWG	
				R,S,T	U,V,W	R,S,T	U,V,W
200V Single phase	0.4 kW	M3.5	2.1 - 6.1	1.5	1.5	16	16
	0.75 kW	M3.5	2.1 - 6.1	1.5	1.5	16	16
	1.5 kW	M3.5	2.1 - 6.1	2.5	1.5	14	16
	2.2 kW	M4	2.1 - 6.1	2.5	1.5	14	16
200V Three-phase	0.4 kW	M3.5	2.1 - 6.1	1.5	1.5	16	16
	0.75 kW	M3.5	2.1 - 6.1	1.5	1.5	16	16
	1.5 kW	M3.5	2.1 - 6.1	1.5	1.5	16	16
	2.2 kW	M3.5	2.1 - 6.1	2.5	2.5	14	14
	3.7 kW	M4	2.1 - 6.1	4	4	12	12
	4 kW	M4	2.1 - 6.1	4	4	12	12
	5.5 kW	M4	2.1 - 6.1	6	6	10	10
	7.5 kW	M4	2.1 - 6.1	6	6	10	10
	11 kW	M5	4.0 - 10.2	10	10	6	8
	15 kW	M5	4.0 - 10.2	16	16	6	6
400V Three-phase	0.4 kW	M3.5	2.1 - 6.1	1.5	1.5	16	16
	0.75 kW	M3.5	2.1 - 6.1	1.5	1.5	16	16
	1.5 kW	M3.5	2.1 - 6.1	1.5	1.5	16	16
	2.2 kW	M3.5	2.1 - 6.1	1.5	1.5	16	16
	3.7 kW	M4	2.1 - 6.1	1.5	1.5	16	16
	4 kW	M4	2.1 - 6.1	1.5	1.5	16	16
	5.5 kW	M4	2.1 - 6.1	2.5	2.5	14	14
	7.5 kW	M4	2.1 - 6.1	4	4	12	12
	11 kW	M5	4.0 - 10.2	4	4	12	12
	15 kW	M5	4.0 - 10.2	6	6	10	10
	18.5 kW	M5	4.0 - 10.2	10	10	8	8
	22 kW	M5	4.0 - 10.2	10	10	6	8

- 1) Please tighten the terminal screws with specified torques. Any loose screw can cause short circuit and malfunction.
- 2) Copper cable of 600V and 75°C should be used.

The total wiring length should be within 200 m. Especially when connecting with a remote motor, the overcurrent protection may be activated or a device connected to the output side may malfunction due to increase in the ground leakage current within the wiring. Therefore when connecting with a motor, the total wiring length should be within 200 m. Even when multiple motors are connected, the total wiring length should be within 200 m. When connecting with a remote motor, **do not use 3 core cable.** (but if a 3.7 kW or less motor is used, the length should be 50 m or less)

$$\text{Line drop [V]} = (\sqrt{3} \times \text{cable resistance [m}\Omega\text{/m]} \times \text{wiring length [m]} \times \text{current[A]}) / 1000$$

If you want to reduce the line drop when the wiring length is long, please use thick cables. At this time, lower the carrier frequency or use an output circuit filter (micro surge filter).

Distance between inverter and motor	Up to 50 m (54.68 yd)	Up to 100 m (109.36 yd)	100 m (109.36 yd) or longer
Allowed carrier frequency	15 kHz or less	5 kHz or less	2.5 kHz or less

Note	Short Circuit Rating
	<ul style="list-style-type: none"> Maximum allowed prospective short-circuit current at the input power connection as defined in IEC 60439-1 is 100 kA. The drive is suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical amperes at the drive maximum rated voltage. RMS Symmetrical Amperes for S100 series are 5,000 A.

WARNING
<ul style="list-style-type: none"> Power supply must be connected to the R, S, and T Terminals. Connecting it to the U, V, W terminals causes internal damages to the inverter. Arranging the phase sequence is not necessary. Motor should be connected to the U, V, and W Terminals. If the forward command (FX) is on, the motor should rotate counter clockwise when viewed from the load side of the motor. If the motor rotates in the reverse, switch the U and V terminals.

2.2 Continuous Rated Current Derating for Inverters

2.2.1 Rated Current Derating for Carrier Frequency

When changing the carrier frequency, refer to Figure 2-5 for heavy load and Figure 2-6 for light load.

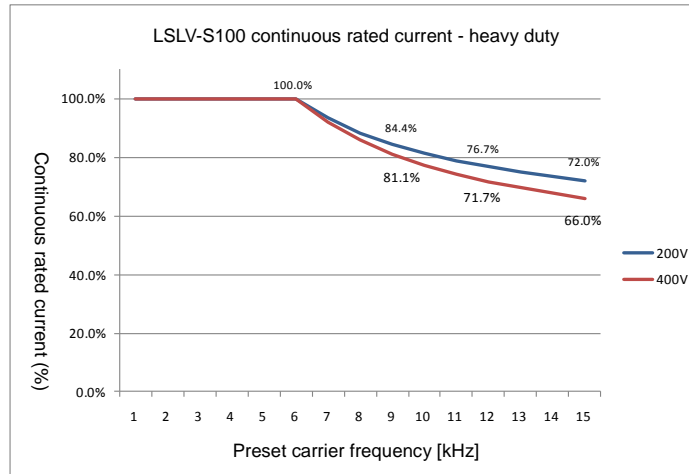


Figure 2-5 Continuous rated current for heavy load

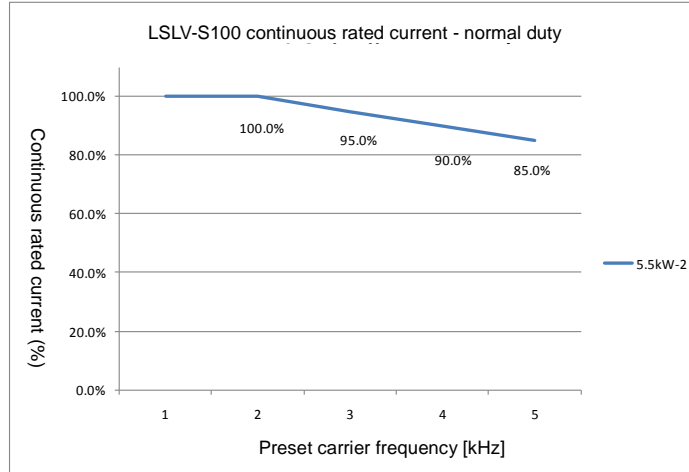


Figure 2-6 Continuous rated current for light load (5.5 kW 200 V)

2.2.2 Rated Current Derating for Input Voltage

The rated current capacity changes according to the inverter input voltage. Refer to Figure 2-7 and 2-8.

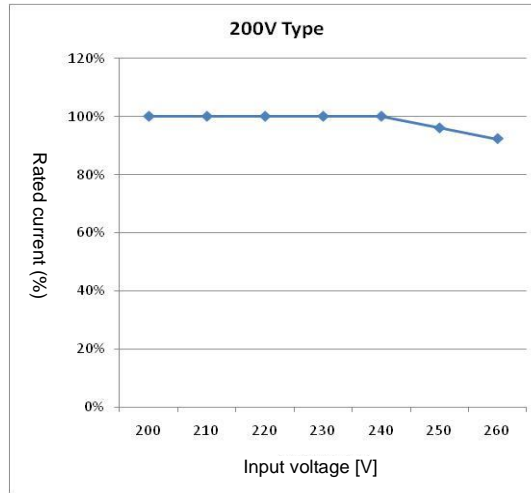


Figure 2-7 3-phase 200 V type continuous rated current

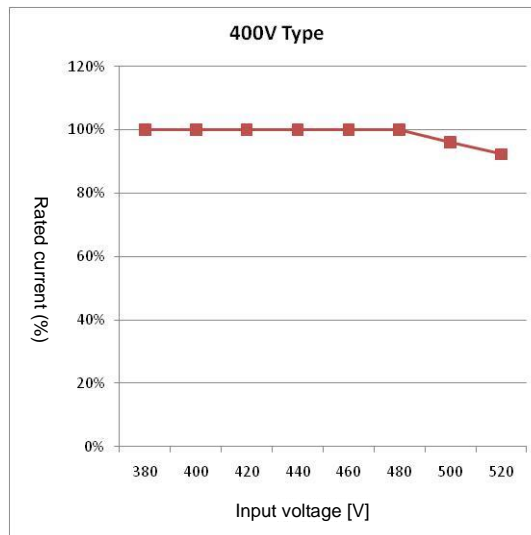


Figure 2-8 3-phase 400 V type continuous rated current

2.2.3 Rated Current Derating based on Ambient Temperature and Installation Method

Ambient temperature and installation method (e.g.: side-by-side installation) affects the inverter's rated current capacity. Refer to Figure 2-9.

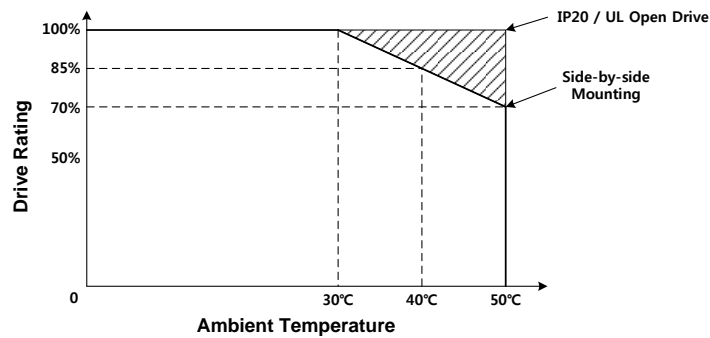




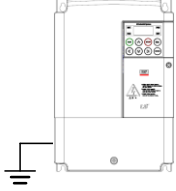



Figure 2-9 Continuous rated current based on ambient temperature and installation method

2.3 Types of Peripheral Devices

2.3.1 Precautions before Peripheral Device Installation

It is necessary to select and connect the peripheral devices correctly. Incorrect system configuration and connection hinder normal operation or reduce the inverter's life significantly. In the worst-case scenario, the inverter may be damaged. Therefore, adhere to the precautions in the manual.

	 ⚡	→	Power specifications	Use the power within the scope of power specifications allowed by the inverter. <ul style="list-style-type: none"> 200V product: 200 - 240V (-15% - +10%) 400 V product: 380 - 480 V (-15% - +10%)
	 ⚡	→	Molded case circuit breaker or earth leakage breaker	Inrush current can be significant at power on. Be sure to use the correct class breaker.
	 ⚡	→	Magnetic contactor	Installation is not required. If magnetic contactor is installed, do not use it to turn on/off the inverter frequently otherwise, the inverter's life may be reduced.
	 ⚡	→	AC and DC reactor (Optional)	A reactor may be used to improve the power factor or when input power capacity is large (1000 kVA or more, within 10m wiring length). Please select the reactor carefully.
Ground	 ⚡	→	Inverter location and wiring	Since the inverter's life is severely affected by the ambient temperature, do not allow the ambient temperature to exceed the allowed limit. Incorrect wiring may damage the product. Please follow the installation method. Ground terminal should be grounded.
Ground	 ⚡	→	Inverter output terminal	Do not install phase advanced capacitor, surge killer, or radio noise filter on the output side otherwise, the inverter may be damaged or operate abnormally. Ground terminal should be grounded.

2.3.2 Molded Case Circuit Breaker, Magnetic Contactor and Reactor Specifications

(1) Molded case circuit breaker and contactor specifications

Table 2-5 Molded case circuit breaker and contactor specifications

Inverter type	Molded case circuit breaker	Earth leakage breaker	Magnetic contactor	Inverter type	Molded case circuit breaker	Earth leakage breaker	Magnetic contactor
LSLV0004S100-1	TD125 NU	EBS 33c	MC-9	LSLV0004S100-4	TD125 NU	EBS 33c	MC-9
LSLV0008S100-1	TD125 NU	EBS 33c	MC-9	LSLV0008S100-4	TD125 NU	EBS 33c	MC-9
LSLV0015S100-1	TD125 NU	EBS 33c	MC-12	LSLV0015S100-4	TD125 NU	EBS 33c	MC-9
LSLV0022S100-1	TD125 NU	EBS 33c	MC-18	LSLV0022S100-4	TD125 NU	EBS 33c	MC-12
LSLV0004S100-2	TD125 NU	EBS 33c	MC-9	LSLV0037S100-4	TD125 NU	EBS 33c	MC-18
LSLV0008S100-2	TD125 NU	EBS 33c	MC-9	LSLV0040S100-4	TD125 NU	EBS 33c	MC-18
LSLV0015S100-2	TD125 NU	EBS 33c	MC-12	LSLV0055S100-4	TD125 NU	EBS 33c	MC-32
LSLV0022S100-2	TD125 NU	EBS 33c	MC-18	LSLV0075S100-4	TD125 NU	EBS 33c	MC-32
LSLV0037S100-2	TD125 NU	EBS 33c	MC-32	LSLV0110S100-4	TD125 NU	EBS 53c	MC-40
LSLV0040S100-2	TD125 NU	EBS 33c	MC-32	LSLV0150S100-4	TD125 NU	EBS 63c	MC-50
LSLV0055S100-2	TD125 NU	EBS 53c	MC-40	LSLV0185S100-4	TD125 NU	EBS 103c	MC-65
LSLV0075S100-2	TD125 NU	EBS 63c	MC-50	LSLV0220S100-4	TD125 NU	EBS 103c	MC-65
LSLV0110S100-2	TD125 NU	EBS 103c	MC-65				
LSLV0150S100-2	TD125 NU	EBS 203c	MC-100				

(2) Fuse and reactor specifications

Table 2-6 Fuse and reactor specifications

Inverter type	AC input fuse [external fuse]		AC reactor		DC reactor	
	Current [A]	Voltage [V]	Inductance [mH]	Current [A]	Inductance [mH]	Current [A]
LSLV0004S100-1	10	600	1.20	10	4	8.67
LSLV0008S100-1	10	600	1.20	10	4	8.67
LSLV0015S100-1	15	600	0.88	14	3	13.05
LSLV0022S100-1	20	600	0.56	20	1.3	18.45
LSLV0004S100-2	10	600	1.20	10	4	8.67
LSLV0008S100-2	10	600	1.20	10	4	8.67
LSLV0015S100-2	15	600	0.88	14	3	13.05
LSLV0022S100-2	20	600	0.56	20	1.3	18.45
LSLV0037S100-2	32	600	0.39	30	1.3	26.35
LSLV0040S100-2	50	600	0.39	30	1.3	26.35
LSLV0055S100-2	50	600	0.30	34.0	1.00	33.0
LSLV0075S100-2	63	600	0.22	45.3	0.70	46.5
LSLV0110S100-2	80	600	0.16	64.2	0.50	61.0
LSLV0150S100-2	100	600	0.13	79.1	0.41	75.6
LSLV0004S100-4	10	600	4.81	4.8	16	4.27
LSLV0008S100-4	10	600	4.81	4.8	16	4.27
LSLV0015S100-4	10	600	3.23	7.5	12	6.41
LSLV0022S100-4	15	600	2.34	10	8	8.9
LSLV0037S100-4	20	600	1.22	15	5.4	13.2
LSLV0040S100-4	32	600	1.22	15	5.4	13.2
LSLV0055S100-4	32	600	1.12	18.1	4.00	17.1
LSLV0075S100-4	35	600	0.78	26.1	2.80	24.8
LSLV0110S100-4	50	600	0.59	34.4	1.90	32.4
LSLV0150S100-4	63	600	0.46	43.6	1.50	41.0
LSLV0185S100-4	70	600	0.40	51.1	1.30	48.1
LSLV0220S100-4	100	600	0.30	67.3	0.95	63.4

Note

Short Circuit FUSE/BREAKER Marking

- Use Class H or RK5 UL Listed Input Fuse and UL Listed Breaker Only. See the table above For the Voltage and Current rating of the fuse and the breaker.

3. Installation

3.1 Precautions before Installation

The inverter uses plastic parts. Handle the inverter carefully so as not to damage it.

Warning

- Do not move the product by only holding the cover.

Install the inverter vertically with bolts on the firm surface that can support the weight of the inverter. Since the inverter's life can be severely affected by the ambient temperature, do not allow the ambient temperature of the installation place to exceed the allowed temperature (heavy load: -10 - 50°C, light load: -10 - 40°C).

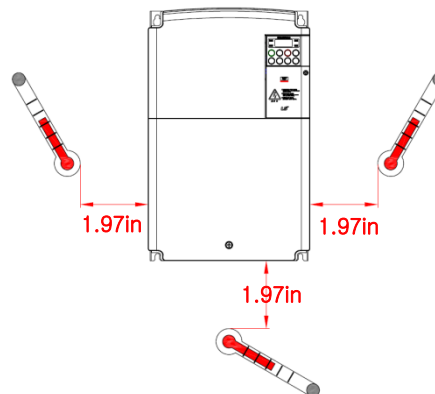


Figure 3-1 Positions for measuring ambient temperature

Since the inverter may be heated during operation, install it on fire retardant surface. Leave sufficient ambient space around the inverter to prevent heat saturation. The inverter produces a substantial amount of heat.

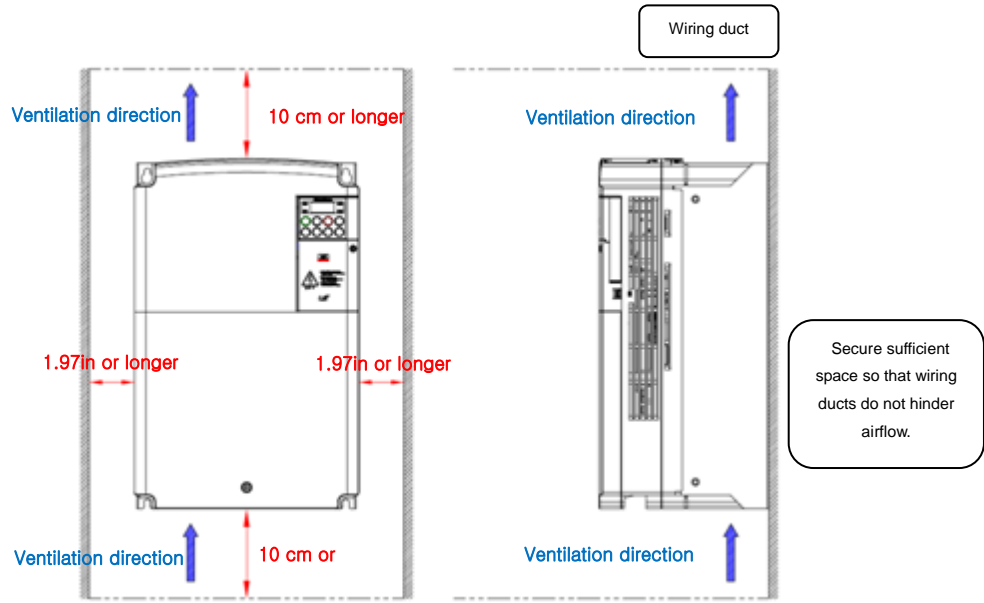


Figure 3-2 Ambient spacing

When installing multiple inverters inside a panel, select the locations for ventilation fan and inverters carefully. When installing an inverter, install it vertically and use screws and bolts to fasten it to the surface.

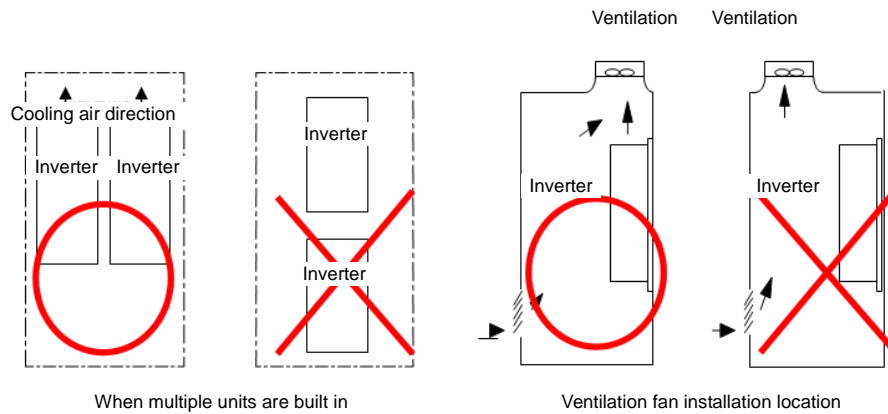


Figure 3-3 Ventilation fan and inverter installation locations

When installing multiple inverters closely side by side, remove the inverter top cover as shown in the [figure 3-5](#).

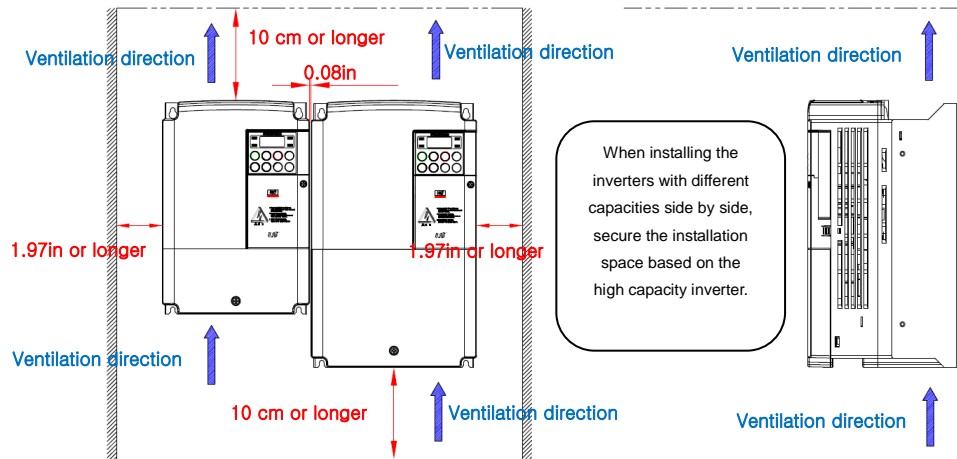


Figure 3-4 Side by side installation

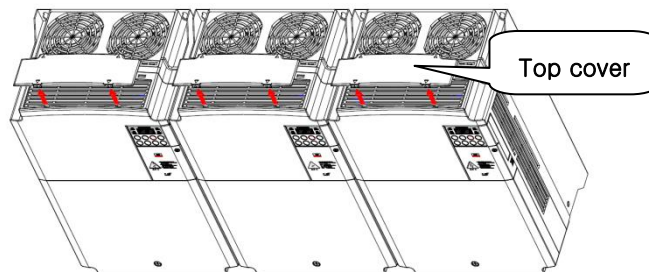


Figure 3-5 Remove the top covers for the side by side installation

Notes

- Install the panel so that the high-temperature air generated by the inverter can be exhausted with ease.

⚠ Caution

- For compliance with EMC requirements, product must be installed inside of metallic cabinet

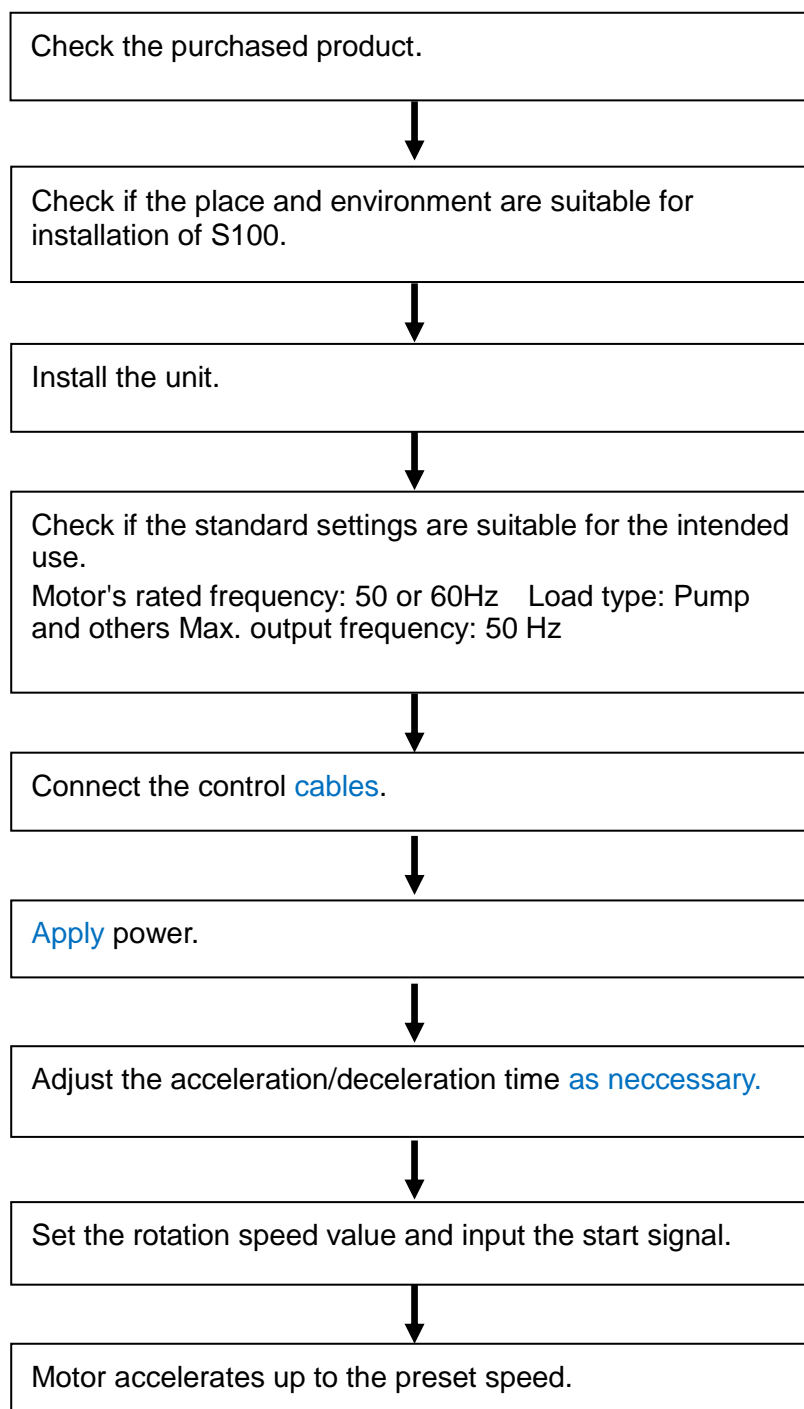
3.2 Installation Checklist

Check the mechanical and electrical installation environment before starting the inverter. Read the following checklist carefully. Be sure to read the safety precautions in this manual before using the inverter.

Checklist

- Mechanical installation checklist
 - Check if the ambient environment satisfies the operation conditions. (Check 'Precautions before Installation'.)
 - Leave sufficient ambient space around the inverter to prevent heat saturation. The inverter produces a substantial amount of heat.
 - Check if the air is circulating normally.
 - Check if the motor and drive device are ready to start.
- Electrical installation checklist
 - Check that the inverter is securely grounded.
 - Please replace any condenser that is 2 years old or more.
 - Match the input voltage with inverter's rated input voltage
 - Connect the input power to inverter input terminal (R,S,T) and use the correct torque for fastening.
 - Check that the correct input power fuse or protective device and breaker are installed.
 - Place the motor cable away from other cables.
 - Check the external input/output connection.
 - Make sure that input power is not connected to the inverter's output terminal.

3.3 Installation and Commissioning Procedures



4. Wiring

4.1 Wiring Precautions

- The inverter may be damaged if the input power is connected to the inverter's output terminal (U,V,W).
- For the power and motor terminals, use a crimp terminal with insulation cap.
- Ensure that there are no pieces of wire left inside the inverter after wiring. Any remaining wire residue may cause failure or malfunction.
- Use correctly rated cable for input/output wiring so that the voltage drop is below 2%. If the wiring between the inverter and motor is long, the motor torque goes down due to voltage drop in main circuit wiring during the low frequency operation.
- The wiring length between the inverter and motor should be below 200 m. If wiring between the inverter and motor is **too** long, the overcurrent protection may be activated or a device connected to the output side may malfunction due to increase in the floating capacity within the wiring. **For motor cables in excess of 50m a sinusoidal filter or other precautions may be required.**
- Since the main circuit input/output of the inverter include harmonic waves, communication device placed near the inverter can be affected by radio interference. It is recommended that an EMC filter be installed in the input side to reduce interference.
- Do not install phase advanced capacitor, surge killer, or radio noise filter on the output side of the inverter. Otherwise, inverter trip may occur or condenser or surge killer may be damaged.
- If a problem occurs during operation and the wiring needs to be changed, first ensure that the body LED or charge lamp near the power terminal block are off. The inverter's internal condenser is charged with high voltage for a while even after the power has been turned off.
- Do not connect magnetic contactor to the inverter output and turn it on/off during operation. (Inverter trip may occur or inverter may be damaged.)
- Apply the rated torque to terminal screws. Loosen screws can cause of short circuit and malfunction. Tighting the screw too much can damage the terminals and cause short circuit and malfunction.
- Use copper wires only with 600V, 75°C ratings for wiring.
- **To avoid interference with sensitive electronic equipment nearby the motor cable should be screened and the screen should be connected to ground at both the motor and inverter ends.**

4.2 Ground

- The motor and inverter **MUST** be grounded, as the inverter passes leakage current during high switching operation.
- 200 V product belongs to Class 3 grounding, with grounding resistance below 100 Ω (Ohm) while 400 V product belongs to Special Class 3 grounding, with grounding resistance below 10 Ω (Ohm).
- Connect grounding wire to the dedicated grounding terminal. Do not use the case or sash screw as the grounding terminal.
- Use thick wire for grounding if possible. Use the wire thickness specified below and keep wiring short if possible.

Table 4-1 Grounding wire specifications based on the motor capacity

Motor Capacity	Grounding wire specifications			
	mm ²		AWG	
	200V product	400 V product	200V product	400 V product
0.4 - 4 kW	4	2.5	12	14
5.5 - 7.5 kW	6	4	10	12
11 - 15 kW	16	10	6	8
18.5 - 22 kW	22	16	4	6

4.3 Wiring Method

(1) Removing the front cover and wiring bracket (5.5 kW 200/400 V - 15 kW 400 V)

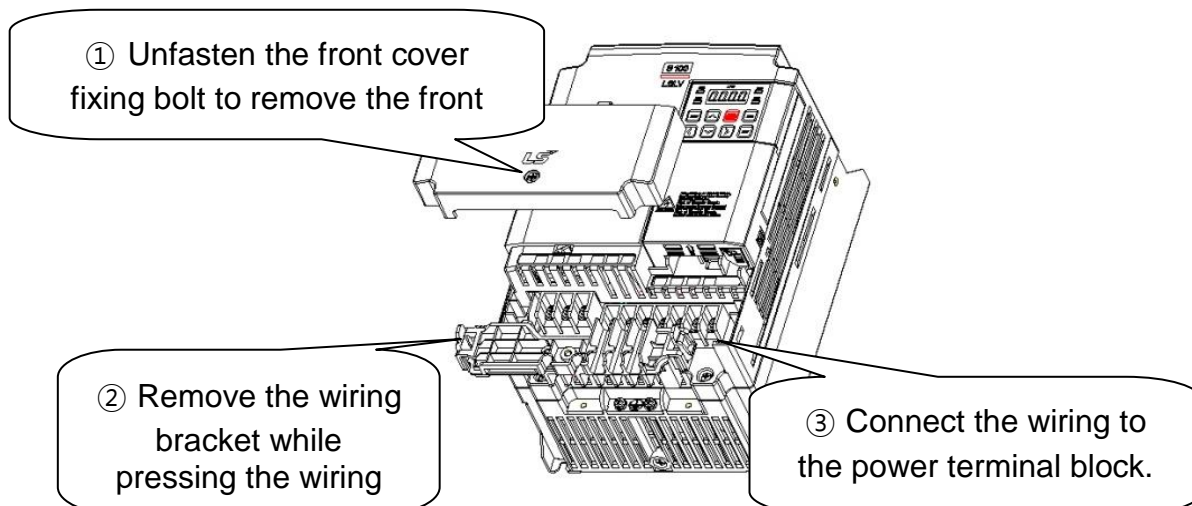


Figure 4-1 Removing the front cover and wiring bracket (5.5 kW 200/400 V - 15 kW 400 V)

1. Unfasten the front cover fixing bolt to remove the front cover.
2. Remove the wiring bracket while pressing the wiring bracket lock.
3. Connect the wiring to the power terminal block.

(2) Removing the front cover and wiring bracket (15 kW 200 V - 22 kW 200/400 V)

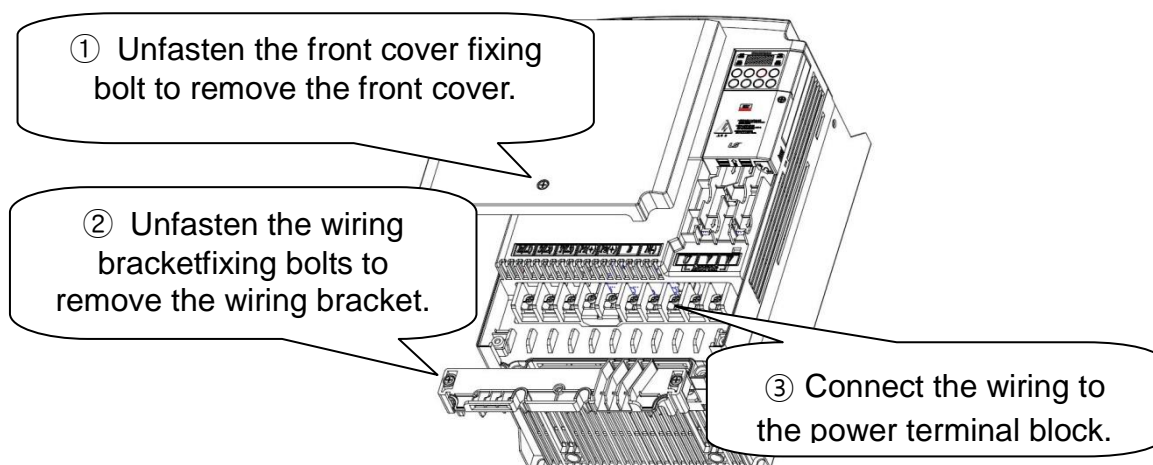


Figure 4-2 Removing the front cover and wiring bracket (15 kW 200 V - 22 kW 200/400 V)

1. Unfasten the front cover fixing bolt to remove the front cover.
2. Unfasten the wiring bracket fixing bolts to remove the wiring bracket.
3. Connect the wiring to the power terminal block.

(3) Removing IO bracket (5.5 ~ 22kW 200/400V)

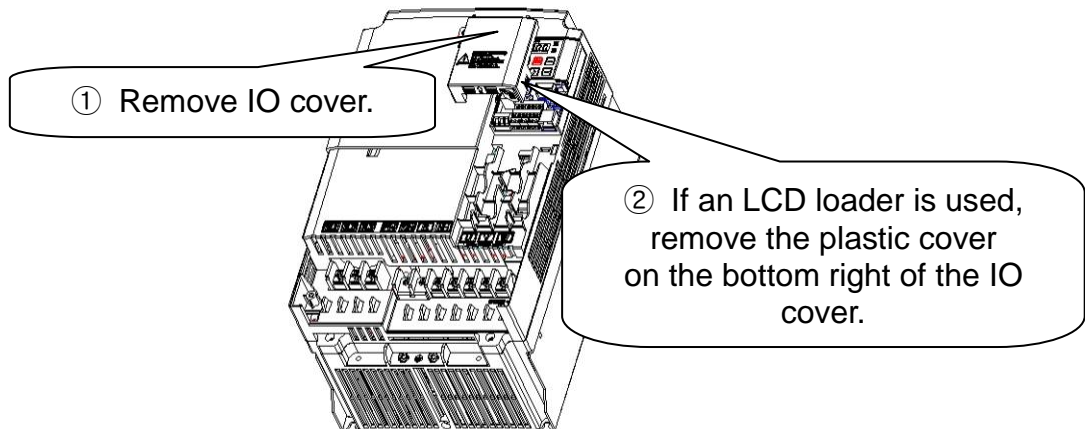
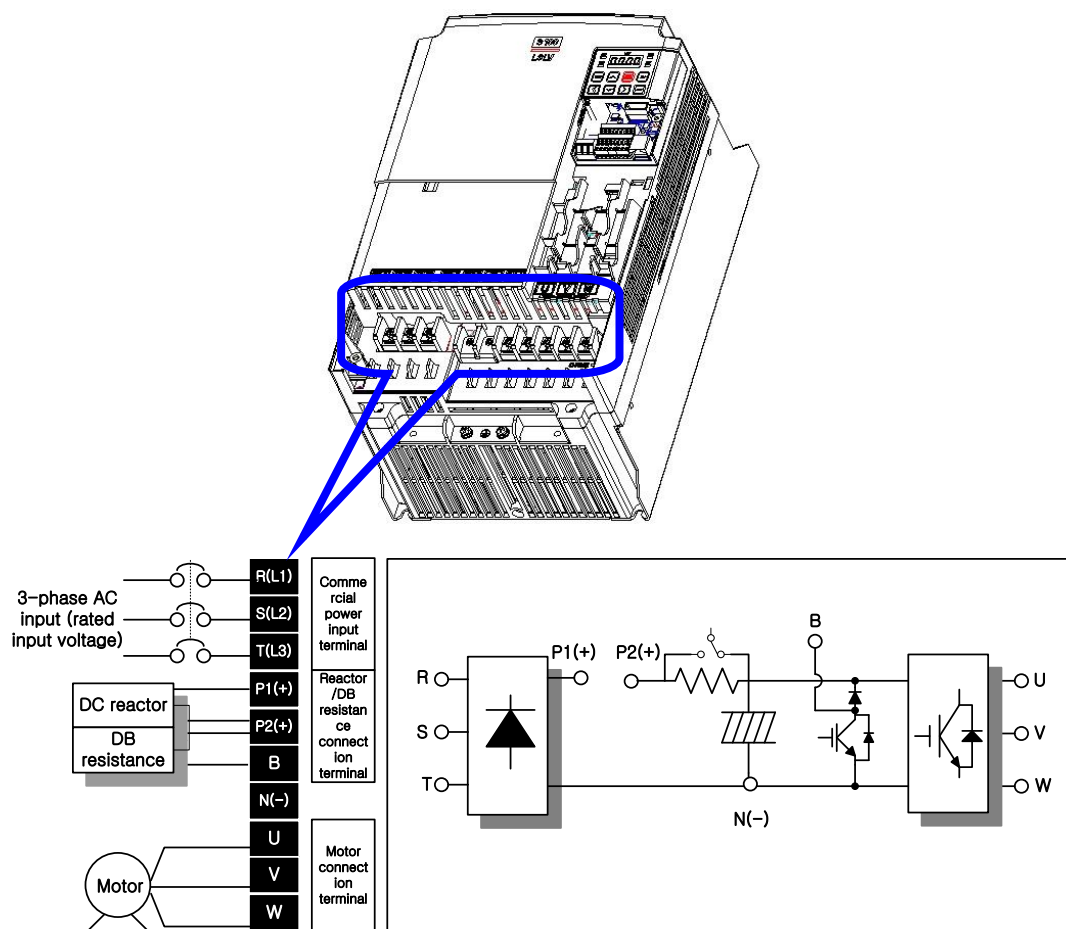


Figure 4-3 Removing IO bracket

1. Unfasten the front cover fixing bolt to remove the front cover.
2. Remove the IO cover.
3. If an LCD loader is used, remove the plastic cover on the lower side of the IO cover.
4. Connect the wiring to the IO terminal. (If an LCD loader is used, connect the loader cable to the RJ-45 connector.)

4.4 Power Terminal Wiring Diagram



Note: Necessary screen around motor wires not shown for clarity

Table 4-2 0.4 - 22 kW (200 V/400 V) main circuit terminal name and description

Terminal symbol	Terminal name	Description of the terminal
R(L1), S(L2), T(L3)	AC power input	Connects the commercial AC input.
P1(+)	(+) DC voltage terminal	(+) DC link voltage terminal.
N(-)	(-) DC voltage terminal	(-) DC link voltage terminal.
P2(+), B	Braking resistance connection terminal	Connects the braking resistance.
U, V, W	Inverter output	Connects the 3-phase induction motor.

4.5 Control Terminal Block Wiring Diagram

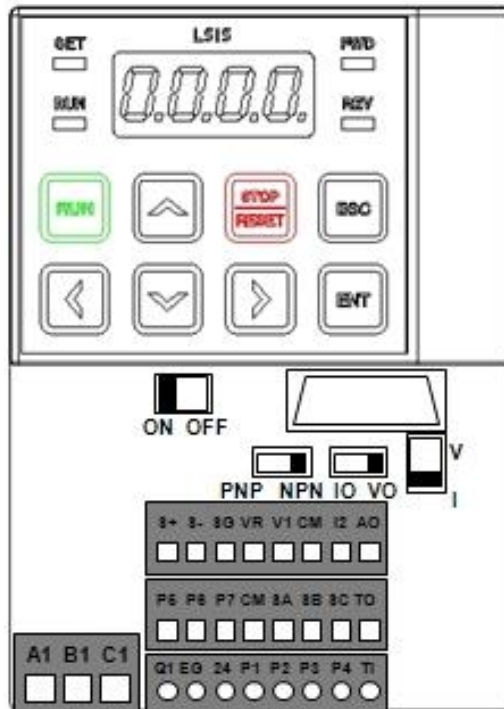


Figure 4-4 Standard I/O terminal

Please refer to the diagram for I/O terminal setting at back side of I/O cover.

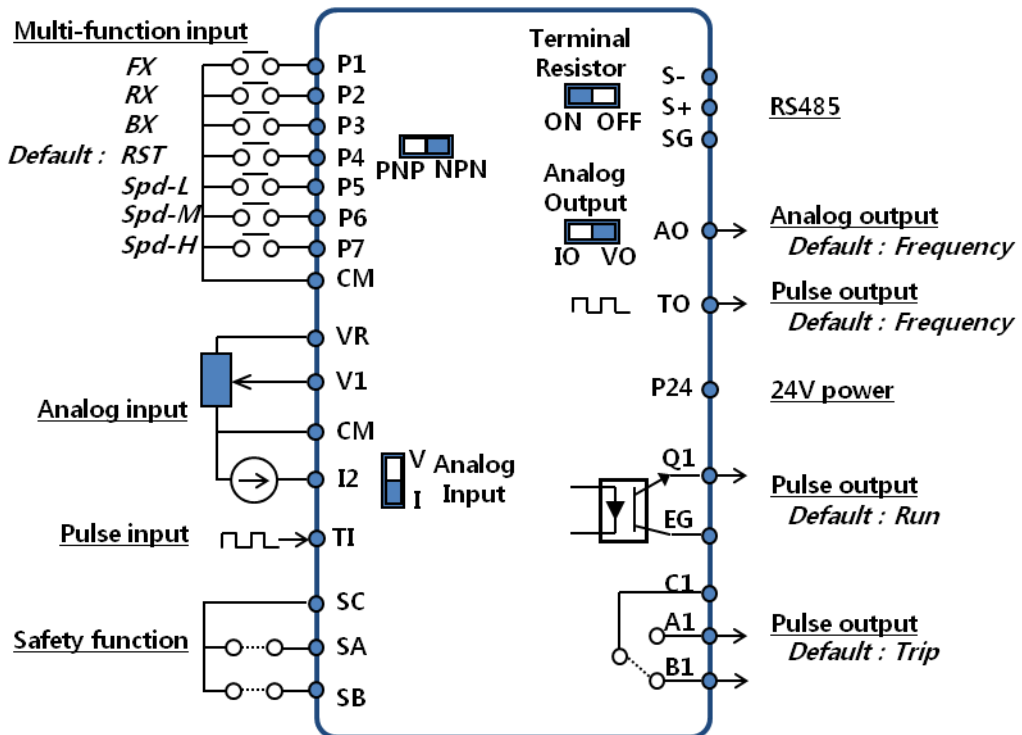


Figure 4-5 Power Terminal Wiring Diagram

Table 4-3 Control circuit terminal description

Category		Terminal symbol	Terminal name	Description of the terminal
Input Signal	Selecting the contact start function	P1 - P7	Multi-functional input 1-7	These terminals are digital multi-function and their use can be defined.
		CM	Sequence common terminal	Common terminal for contact input and analog input/output
	Analog frequency setting	VR	Power (+) terminal for frequency setting	+12VDC power supply for setting the analog frequency. Max power is +12 V at 100 mA.
		V1	Frequency setting (voltage)	Input DC 0~10V, -10~10V used to set motor frequency(speed) . Max input voltage : Unipolar (0 ~ 12V), Bipolar (-12V ~ 12V)
		I2	Frequency setting (current)	Input 4 - 20 mA used to set motor frequency(speed) . Max input current : 0~24mA The input resistance is 249 Ω. It can be used as unipolar voltage input V2 depending on the SW2 setting.
		TI	Frequency setting (pulse train)	Input 0 - 32 kHz can be set to the required motor frequency. <ul style="list-style-type: none"> ▪ Low level: 0 ~ 0.8V ▪ High level: 3.5 ~ 12 V
	Safety function setting	SA	Safety input A	If an emergency occurs, the motor power can be securely cut off externally . Operation is described below depending on the connection status of SA, SB and SC. <ul style="list-style-type: none"> ▪ Both SA and SB connected to SC: Normal operation ▪ Either of A or B connected to SC or Both disconnected: Motor power cut off
		SB	Safety input B	
		SC	Safety input power	DC 24V and 25mA or less
	Output signal	Analog	AO	analog voltage/current output terminal

Category	Terminal symbol	Terminal name	Description of the terminal
Contact			<ul style="list-style-type: none"> ▪ Voltage <ul style="list-style-type: none"> • Output voltage: 0 ~ 10 V • Max. output voltage: 12V • Max. output current: 10mA • Output current: 0 ~ 20mA • Max. output current: 24mA
	TO	pulse output terminal	Selectively outputs one among output frequency, output current, output voltage and DC voltage. <ul style="list-style-type: none"> ▪ Output frequency: 0 ~32kHz ▪ Output voltage: 0 ~ 12 V
	Q1	Multi-functional terminal (open collector)	DC 26V and 100mA or less
	EG	Common terminal for open collector	Common grounding terminal for external power for open collector.
	24	24 V power	Max. output current: 150 mA DC.
	A1,C1,B1	Fault signal output	Relay changes state when the inverter's protection function is activated to cut off the output. AC 250 V 1 A or less, DC 30 V 1 A or less <ul style="list-style-type: none"> ▪ Abnormal: A1-C1 CLOSED (B1-C1) ▪ Normal: B1-C1 OPEN (A1-C1)
	S+, S-, SG	RS-485 signal Input Terminal	RS-485 signal line. (Refer to Chapter 7 Communication Function (Page 7-1) in the user manual.)

⚠ Caution

- **Do not use more than 3m remote cable for the keypad. Failure of the signals on the keypad might occur.**
- To prevent radiated emissions in the analog and digital signals, a ferrite may be required around the wires of these signals.

■ Setting NPN (Sink) / PNP (Source)

The control circuit's sequence input terminal supports both NPN mode (Sink mode) and PNP mode (Source mode). You can use NPN(Sink)/PNP(Source) setting terminal (SW1) to switch the input terminal logic between NPN mode (Sink mode) and PNP mode (Source mode). The connection methods per mode are as follows.

■ NPN mode (Sink Mode)

Set NPN (Sink) / PNP (Source) switch to NPN. CM terminal (24 V GND) is the common terminal for contact input signals. The factory default is NPN mode (Sink mode).

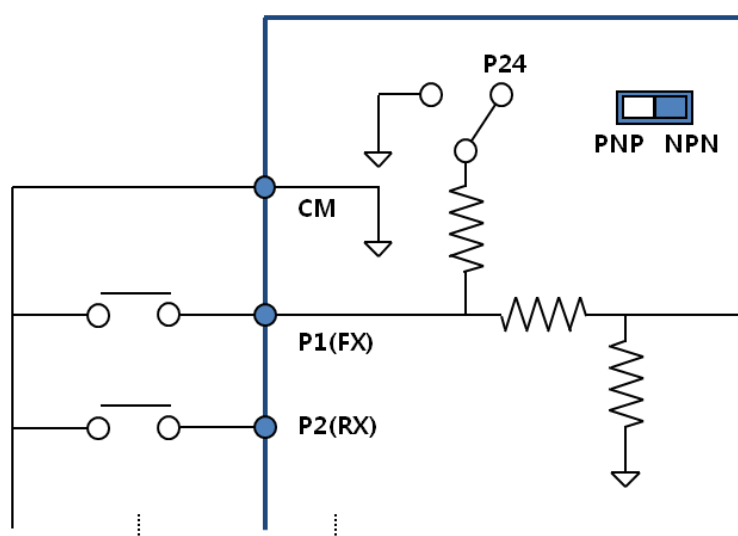


Figure 4-6 NPN (Sink) mode

■ PNP mode (Source mode)

Set NPN (Sink) / PNP (Source) switch to PNP. **24 terminal (24 V internal power) is the common terminal for contact input signals.** If you want to use **external** 24 V power, connect (-) terminal of the **external** power with CM (24 V GND) terminal.

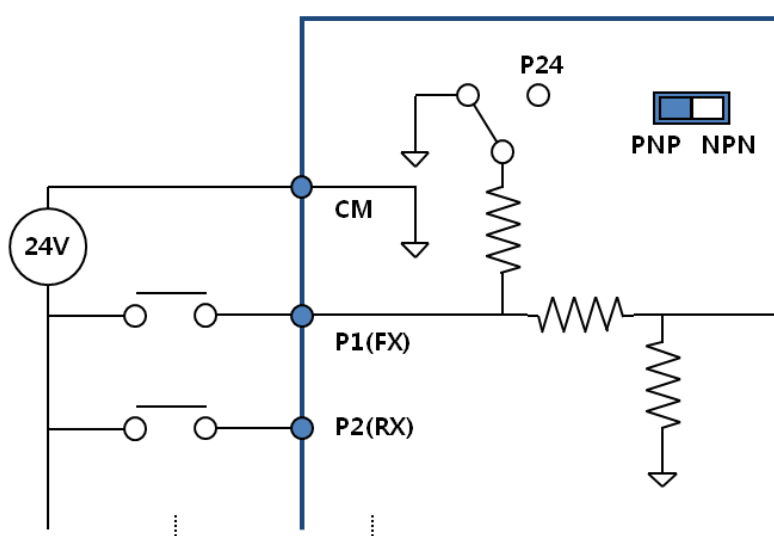


Figure 4-7 PNP (Source) mode

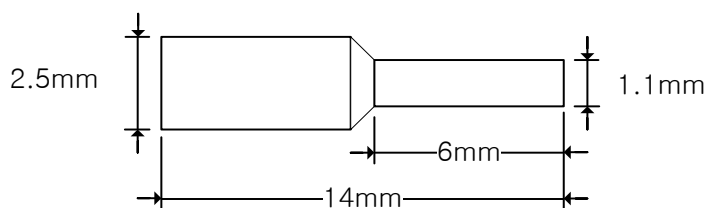
4.6 Signal Terminal Block Wiring Specifications

Table 4-4 Signal terminal block wiring specifications

Terminal type	Recommended wiring thickness [mm ²] (AWG)		Terminal screw	Torque [Nm]	Electrical specifications
	Crimp terminal not used	Crimp terminal used			
P1 - P7	0.75 (18)	0.5 (20)	M2	0.22-0.25	-
CM					-
VR					Output voltage: 12V Maximum output current: 100mA Potentiometer: 1 - 5 kΩ
V1					Maximum input voltage: -12 V - +12 V input
I2					0 - 20 mA input Internal resistance: 249 ohm
AO					Maximum output voltage: 12 [V] Maximum output current: 10mA
Q1					DC 26 V, 100 mA or less
EG					-
24					Maximum output current: 150 mA
SA, SB, SC ⁹					DC 24V and 25mA or less
S+, S-, SG					-
A1, B1, C1					1.0(17)

⁹ Please ensure that safety input 's wiring length is below 30m.

■ Recommended crimp terminal size for signal wiring

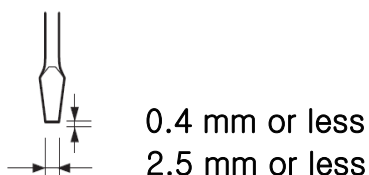


Note 1) when you use the cable tie, etc. to organize the control wiring, do it 15 cm or more away from the inverter. Otherwise, it may be impossible to assemble the front cover.

Note 2) Use copper wire satisfying 300 V and 75 °C limits.

Note 3) Apply required torque for terminal screw.

Note 4) When you engage the terminal block, use a screwdriver of 2.5 mm or less width and 0.4 mm or less thickness.



4.7 Built-in EMC Filter

The 400 V S100 inverter has a built-in EMC filter to reduce electromagnetic interference from the inverter. The default setting for EMC filter is on. To turn it off, replace the EMC filter grounding bolt with the plastic bolt in the wiring bracket.

■ Disabling EMC filter function

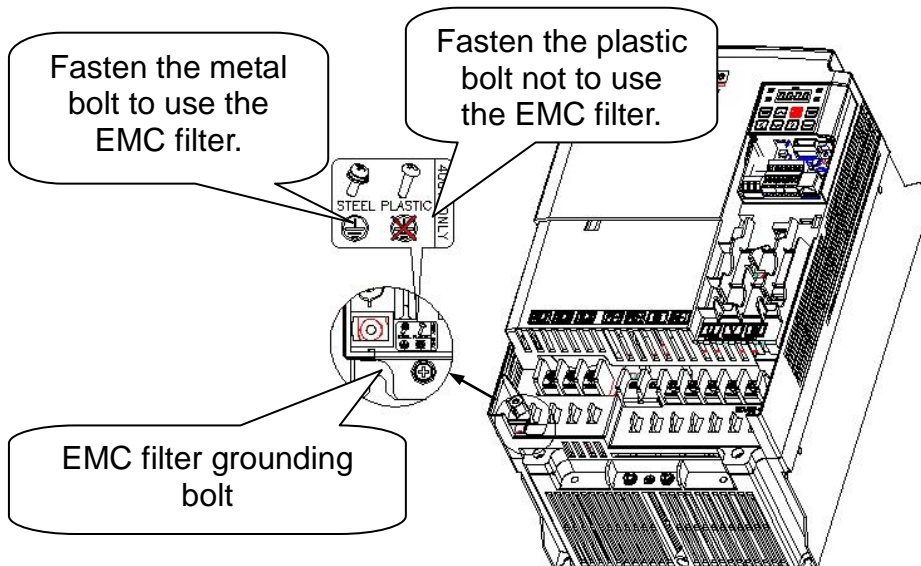


Figure 4-8 Disabling 5.5-22 kW or less EMC filter function

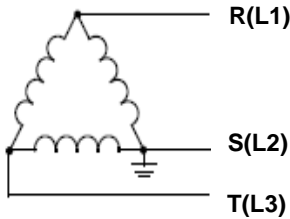
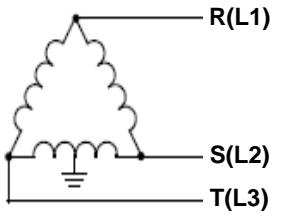
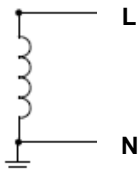
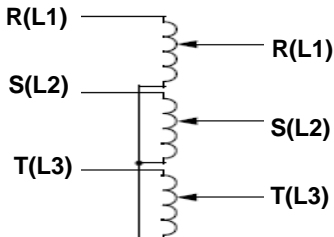
1. Replace the EMC filter grounding bolt with the plastic bolt in the wiring bracket to disable the EMC filter function.

Before starting to work, use a voltage tester to check the DC voltage across P1(+) and N(-) 10 minutes after cutting off the inverter power.

⚠ Caution

- If EMC filter is on, leakage current increases.
- If the input power is an asymmetrical grounding structure such as Delta connection, do not use the EMC filter. Otherwise, it may result in an electric shock.
- Disconnect the internal EMC filter when installing the drive on an IT system (an ungrounded power system or a high-resistance-grounded [over 30 ohms] power system), otherwise the system will be connected to ground potential through the EMC filter capacitors. This may cause danger or damage the drive. Disconnect the internal EMC filter when installing the drive on a corner-grounded TN system, otherwise the drive will be damaged.

Table 4-5 Asymmetrical grounding structure

Asymmetrical grounding structure			
A phase of delta connection is grounded (TN systems)		The intermediate tab of a phase of delta connection is grounded (TN systems)	
Grounded on the end of single phase (TN systems)		3-phase connection not grounded (IT systems)	

4.8 Dynamic Braking Resistor

■ Option type of dynamic braking resistor

Following table has reference to braking torque: 150%, %ED: 5%.
Rated power of DBU has to be doubled when %ED is 10%.

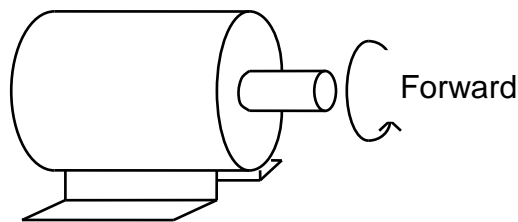
Inverter Capacity [kW]	150% Braking Torque, 5% ED					
	Single-phase		Three-phase 200V		Three-phase 400V	
	Resistor [ohm]	Watt [W]	Resistor [ohm]	Watt [W]	Resistor [ohm]	Watt [W]
0.4kW	300	100	300	100	1,200	100
0.75kW	150	150	150	150	600	150
1.5kW	60	300	60	300	300	300
2.2kW	50	400	50	400	200	400
3.7kW	-	-	33	600	130	600
4.0kW	-	-	33	600	130	600
5.5kW	-	-	20	800	85	1,000
7.5kW	-	-	15	1,200	60	1,200
11kW	-	-	10	2,400	40	2,000
15kW	-	-	8	2,400	30	2,400
18.5kW	-	-	5	3,600	20	3,600
22kW	-	-	5	3,600	20	3,600

4.9 Normal Operation Check

■ Check the motor for forward/reverse direction and use keypad operation to check for smooth operation

Use keypad to set the operation group's drv code to 0 number key and set the command frequency to a specific speed and then press the RUN button to send the command to the inverter to operate in the forward direction.

At this time, the induction motor axis rotates CCW on the load side. If not, you should change two of the inverter output terminals (U, V, W)



4.10 Wiring Checklist

Check the main circuit and control circuit wiring before starting the inverter. Read the following checklist carefully.

Checklist
<ul style="list-style-type: none">▪ Inverter, peripheral devices, option cards<ul style="list-style-type: none">• Is the inverter type as ordered?• Are the types and number of the peripheral devices (resistor, DC reactor, noise filter, etc.) as ordered?• Is the type of option card as ordered?▪ Installation location and method<ul style="list-style-type: none">• Are the installation location and method appropriate?▪ Power voltage and output voltage<ul style="list-style-type: none">• Is the power voltage within the inverter input voltage specifications?• Do all rated outputs satisfy the inverter output specifications?• Is the rating correct?

Checklist

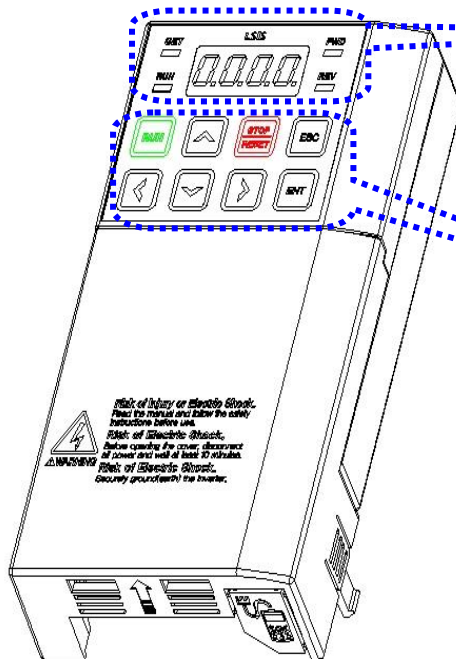
- **Main circuit wiring**
 - Is the power being entered through an MCB or MCCB?
 - Is the rating **and type** of the MCB or MCCB correct?
 - Is the wiring of the power supply connected correctly to the inverter input terminal? [The inverter may be damaged if the input power is connected to the inverter's output terminal (U,V,W).]
 - Is the wiring of motor connected to the inverter's output terminal in the order of phases? (if not, the motor rotates in the reverse direction.)
 - Do the power and motor use 600 V vinyl(PVC) insulated wire?
 - Is the wire size of main circuit appropriate?
 - Is the installation **and size** of the grounding cable correct?
 - Are the screws of inverter's main circuit terminal and grounding terminal fastened firmly?
 - If a single inverter is used to operate multiple motors, **is overload** protection circuit provided at each motor?
 - **If a** braking resistor or braking resistor unit is used, is the inverter separated from the power due to overload protection by magnetic contactor on the inverter power side?
 - Make sure that phase advanced capacitor, surge killer, or radio noise filter is not connected to the output side.
- **Control circuit wiring**
 - Is **twisted** pair shielded wire used for the inverter's control circuit wiring?
 - Is the **shield** connected to the ground terminal?
 - If operating in 3-wire sequence, **have you changed** the parameters of multi-function contact input terminal and **correctly connected** the wiring to the control circuit?
 - Is the wiring for options correct?
 - Is there any incorrect wiring?
 - Are the screws of inverter's control circuit terminal fastened firmly?
 - Is there any wire residues or screws left?
 - Check and remove any stray wiring strands are could short circuit to other terminals.
 - Is the wiring of control and main circuits separated within the duct and control board?
 - Is the wiring length below 50 m?
 - Is the wiring length of safety input below 30 m?

Notes

- It is highly recommended that the motor cable is of the screened type with screen being connected to ground at both ends.
- It is also recommended that twisted-pair cable with overall screen is used for control signals.
Twisted-pair wires coated with highly conductive materials help block the influence from outside electrical and magnetic fields.

5. Using the Keypad

5.1 Layout of the Keypad



- Display
 - SET/RUN indicator lamp
 - FWD/REV indicator lamp
 - 7-segment

- Key
 - RUN
 - STOP/RESET
 - Increase, decrease [▲, ▼]
 - Left and right movement [◀, ▶]
 - Enter [ENT]
 - ESC

Display		
FWD	Turns on when operating in the forward direction.	Blinks when a failure has occurred.
REV	Turns on when operating in the reverse direction.	
RUN	Turns on when operating. Blinks when accelerating or decelerating.	
SET	Turns on when setting the parameters. Blinks when ESC key operates as the multi-key.	
7-segment	Displays operation status and parameter information.	

Key		
RUN		Operation command
STOP/RESET		STOP: Command to stop, RESET: Command to reset when a failure has occurred
▲	Up	Use when moving codes or increasing the parameter value.
▼	Down	Use when moving codes or decreasing the parameter value.
◀	Left Shift	Use when moving between groups or moving to the left in the parameter setting.
▶	Right Shift	Use when moving between groups or moving to the right in the parameter setting.
ENT		Use when changing the parameter values or saving the changed parameters.
ESC		Jog or remote/local switch key. Use it to cancel during editing.

5.2 Display List for Numerals and Letters

0	0	A	A	K	K	U	U
1	1	b	B	L	L	v	V
2	2	c	C	m	M	w	W
3	3	d	D	n	N	x	X
4	4	E	E	O	O	y	Y
5	5	F	F	P	P	z	Z
6	6	G	G	Q	Q		
7	7	H	H	R	R		
8	8	I	I	S	S		
9	9	J	J	T	T		

5.3 Menu Structure

LSLV-S100 series inverter is composed of 11 groups as shown in the following table.

Table 5-1 Function description per parameter group

Group name	Sign	Function description
Operation group ¹⁰	-	Basic parameters needed for operation, such as target frequency and acceleration/deceleration time, etc.
Drive group	<i>dr</i>	Basic operation parameters such as jog operation, motor capacity selection and torque boost and keypad operation-related parameters
Basic function group	<i>br</i>	You can set the basic functions for motor parameters and multi-step frequency.
Advanced function group	<i>rd</i>	You can set acceleration/deceleration patterns and frequency limitation.
Control function group	<i>cn</i>	You can set the functions related to sensorless and vector controls.
Input terminal block function group	<i>in</i>	You can set functions related to inverter input terminal block such as multi-functional digital input and analog input.
Output terminal block function group	<i>ou</i>	You can set output terminal block functions including relay and analog output.
Communication function group	<i>ci</i>	If the inverter is equipped with built-in 485 communication and communication option card, you can set the related functions.
Application function group	<i>pp</i>	You can set functions for PID control sequence and other operations.
Protection function group	<i>pr</i>	You can set protection functions for motor and inverter.
2nd motor function group (Motor 2) ¹¹	<i>m2</i>	This is displayed if you selected the 2nd motor among multi-functional input terminal functions. You can set the functions related to the 2nd motor.

¹⁰ If the inverter is equipped with LCD keypad, only the target frequency is displayed.

¹¹ You should set the In.65 – 71 multi-functional input terminal function to no. 26 (2nd Motor) to display it.

5.4 Moving between groups

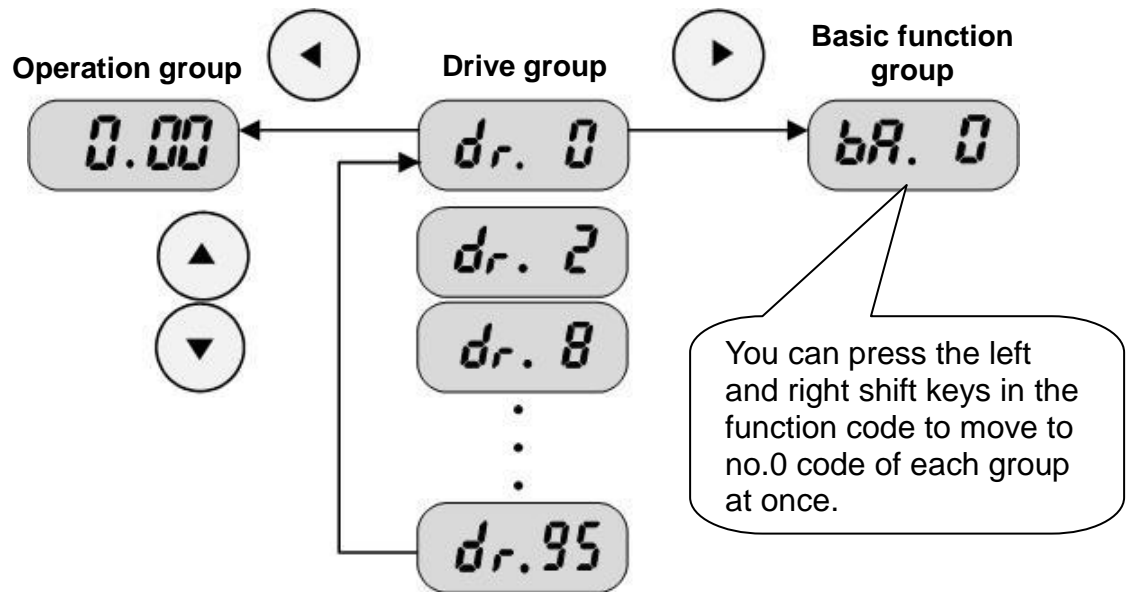
How to move between groups in the first code of each group

Group name	Sign	Moving between groups
Operation group ¹²	-	
Drive group	<i>dr</i>	
Basic function group	<i>br</i>	
Advanced function group	<i>Ad</i>	
Control function group	<i>cn</i>	
Input terminal block function group	<i>in</i>	
Output terminal block function group	<i>ou</i>	
Communication function group	<i>ct</i>	
Application function group	<i>ap</i>	
Protection function group	<i>pr</i>	
2nd motor function group (Motor 2) ¹³	<i>72</i>	

¹² If the inverter is equipped with LCD keypad, only the target frequency is displayed. The first code of the operation group is used to set the target frequency. Therefore, it is set to 0.00 at default, but if the user changes the operation frequency, the changed operation frequency is displayed.

¹³ You should set the In.65 – 71 multi-functional input terminal function to no. 26 (2nd Motor) to display it.

How to move between groups in the position which is not the first code of each group

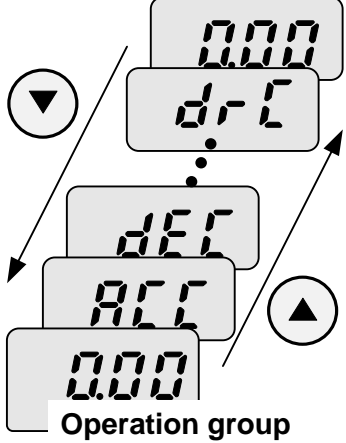



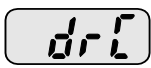



Do as follows to move from no.96 code of the drive group to the basic function group.

1		<ul style="list-style-type: none"> Indicates no.95 code of the drive group. Press the right shift key (▶) or left shift key (◀).
2		<ul style="list-style-type: none"> Indicates dr. 0, the first code of the drive group. Press the right shift key (▶).
3		<ul style="list-style-type: none"> Indicates bA. 0, the first code of the basic function group.

5.5 Moving between Codes within the Group

■ How to move between codes within the operation group

 <p>Operation group</p>	1		<ul style="list-style-type: none"> Indicates the first code of the operation group, 0.00. Press the up key (▲).
	2		<ul style="list-style-type: none"> Indicates the 2nd code of the operation group, ACC. Press the up key (▲).
	3		<ul style="list-style-type: none"> Indicates the 3rd code of the operation group, dEC. Press and hold the up key (▲).
	4		<ul style="list-style-type: none"> Indicates the last code of the operation group, drC. In the last code of the operation group, press the up key (▲) once more.
	5		<ul style="list-style-type: none"> Return to the first code of the operation group.
<p>You can use the down key (▼) to move in the opposite order.</p>			

■ How to use the jump code

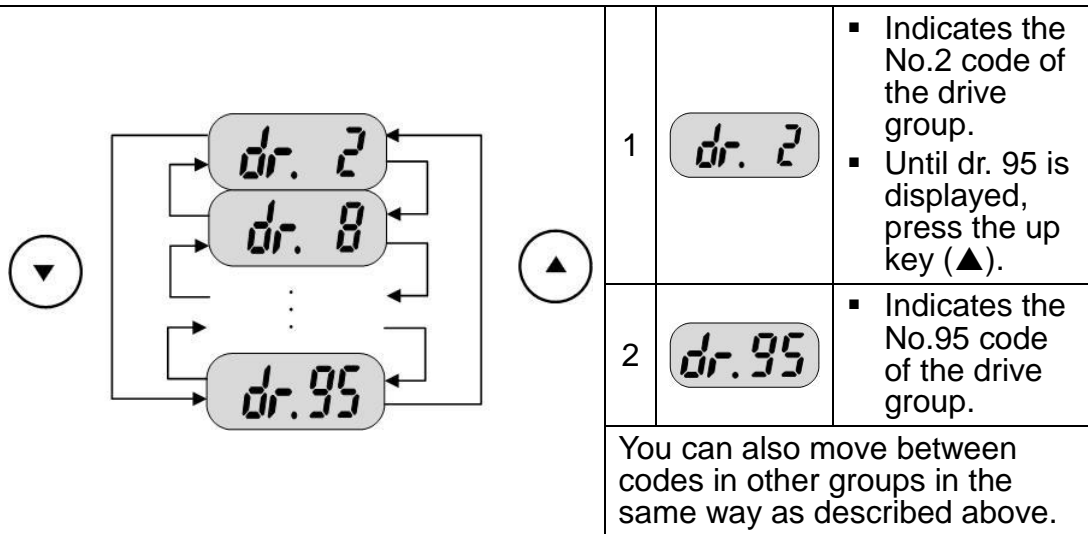
When moving from the first code of the drive group (dr. 0) to no.95 code.

	1		<ul style="list-style-type: none"> Indicates the first code of the drive group, dr. 0. Press the Enter key (ENT).
	2		<ul style="list-style-type: none"> It shows that you can move to no.9 code (toggles at one second interval). Use the down key (▼) to set to 5.
	3		<ul style="list-style-type: none"> Press the left shift key (◀) to move the cursor to the left to display 05. 0 is toggled at one second interval. Use the up key (▲) to set to 9.
	4		<ul style="list-style-type: none"> It shows that you can move to no.95 code. Press the Enter key (ENT).
	5		<ul style="list-style-type: none"> Indicates the No.95 code of the drive group.

You can also move between codes in other groups in the same way as described above.

■ How to move between codes in the same group

When moving from No.2 code to No.95 code in the drive group

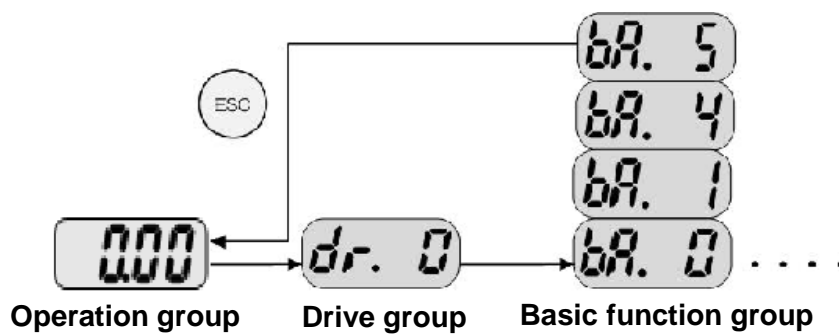


When using the up key (▲) or down key (▼) to move between codes in each group, sometimes the code number skips instead of increasing or decreasing by 1. This is because the inverter program keeps the number empty, reserving them for functions to be added later, or it has hidden the functions not used by the users. For detailed information, refer to Chapter 8 Function Display List.

E.g.) If the frequency upper/lower limit selection (Ad.24) is set to 0 (No), Ad.25 (frequency upper limit) and Ad.26 (frequency lower limit) are not displayed when you move between codes.

But if the frequency upper/lower limit selection (Ad.24) is set to 1 (Yes), Ad.25 and Ad.26 are visible.

5.6 Moving to the Initial Position

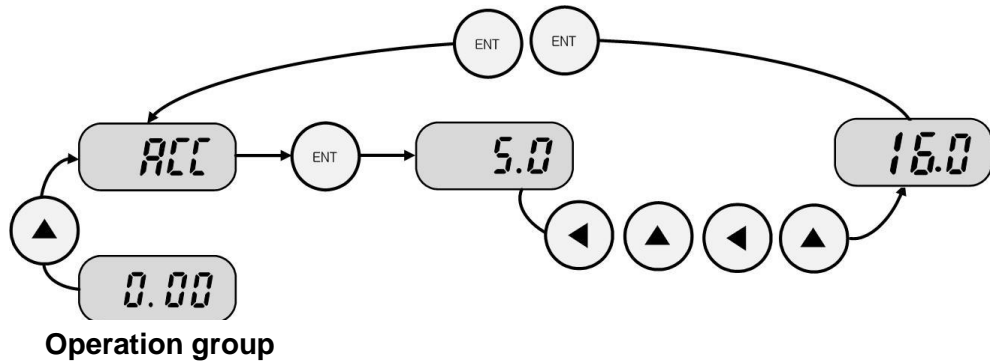


For the ESC key, the initial value (dr.90) is preset to 0 (move to the initial position). Therefore, if you press the ESC key in any code position in a group, you will be moved to the first position of the operation group. For other functions of the ESC key, refer to 5.11 Using the Multi-keys.

5.7 Setting the Parameters

■ Changing operation group parameters

When changing the acceleration time from 5.0 sec to 16.0 sec



1		<ul style="list-style-type: none"> Indicates the first code information of the operation group. Press the up key (▲).
2		<ul style="list-style-type: none"> Indicates the 2nd code of the operation group, which is the acceleration time ACC. Press the Enter key (ENT).
3		<ul style="list-style-type: none"> 0 of 5.0 blinks at one second interval. Press the left shift key (◀).
4		<ul style="list-style-type: none"> 5 of 5.0 blinks to show that value 5 can be changed. Press the up key (▲).
5		<ul style="list-style-type: none"> The value is changed to 6.0. Press the left shift key (◀).
6		<ul style="list-style-type: none"> 06.0 is displayed while 0 of 06.0 is blinking. Press the up key (▲).
7		<ul style="list-style-type: none"> Displays 16.0. Press the Enter key (ENT). 16.0 blinks¹⁴. Press the Enter key (ENT).
8		<ul style="list-style-type: none"> Displays ACC. The acceleration time is changed to 16.0 sec.

¹⁴ Blinking, when modifying the parameters, is to ask whether to input the modified values. At this time, press the Enter key (ENT) to confirm the input. If you do not want to confirm the modified values, you can cancel it by pressing left, right, up and down keys (◀)(▶)(▲)(▼) except the Enter key (ENT) while blinking.

■ Frequency setting

When setting the operation frequency to 30.05 [Hz] in the operation group



Operation group

1		<ul style="list-style-type: none"> Indicates the first code information of the operation group. Press the Enter key (ENT).
2		<ul style="list-style-type: none"> Press the left shift key (◀).
3		<ul style="list-style-type: none"> The position to be set moves to the left. Press the left shift key (◀) twice.
4		<ul style="list-style-type: none"> Use the up key (▲) to set to 3.
5		<ul style="list-style-type: none"> The value is changed to 30.00. Press the right shift key (▶) three times.
6		<ul style="list-style-type: none"> You can change the 2nd decimal place number. Press the up key (▲) until it reaches 5.
7		<ul style="list-style-type: none"> Press the Enter key (ENT). 30.05 blinks. Press the Enter key (ENT).
8		<ul style="list-style-type: none"> When 30.05 stops blinking, the operation frequency is set to 30.05.

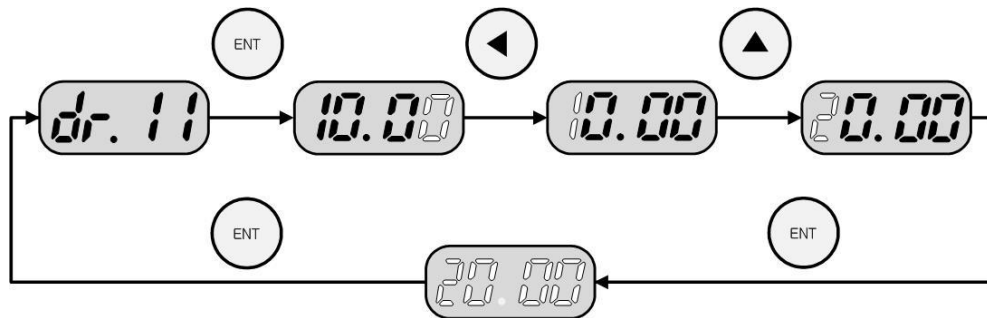
LSLV-S100 series has 4 places in the display, but you can use the left shift key (◀) and right shift key (▶) to extend up to 5 places to set and monitor the parameters.

If you press the direction keys except for the Enter key (ENT) while 30.05 is blinking in the above step 7, you can cancel the parameter settings.

You can cancel the current task and exit the editing mode by pressing the ESC key during editing.

■ Changing input/output group parameters

When changing the 11th code of the drive group (dr. 11) from 10.00 to 20.00



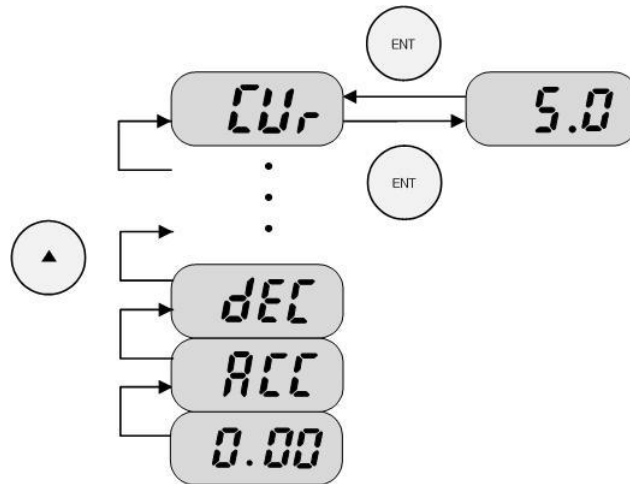
1		<ul style="list-style-type: none"> It indicates that the current position is No.11 code of the drive group. Press the Enter key (ENT).
2		<ul style="list-style-type: none"> It indicates that the preset value of No.11 code is 10.00. Use the left shift key (◀) to blink 1.
3		<ul style="list-style-type: none"> It indicates that the cursor is on 1.
4		<ul style="list-style-type: none"> Use the up key (▲) to increase up to 2. Press the Enter key (ENT).
5		<ul style="list-style-type: none"> Press the Enter key (ENT).
6		<ul style="list-style-type: none"> 20.00 blinks and then the code number is displayed. The parameter change is complete.

You can also move between codes in other groups in the same way as described above.

5.8 Monitoring Operation Status

■ Displaying output current

How to monitor the output current in the operation group

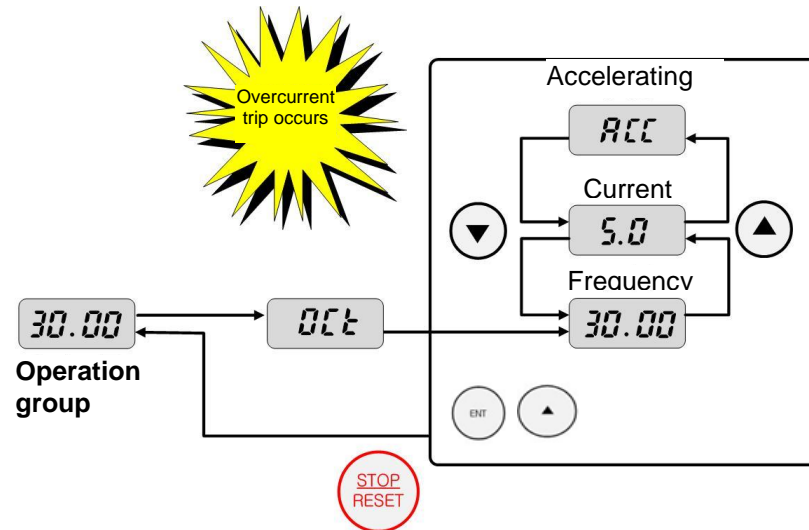


1		<ul style="list-style-type: none"> Indicates the first code of the function group 1. Press the up key (▲) or down key (▼) until CUr is displayed.
2		<ul style="list-style-type: none"> Indicates the code that can monitor the output current. Press the Enter key (ENT).
3		<ul style="list-style-type: none"> Indicates that the inverter output current is currently 5 [A]. Press the Enter key (ENT).
4		<ul style="list-style-type: none"> The output current monitor code is displayed.

The dCL (inverter DC link voltage) or VOL (inverter output voltage) in the operation group can be monitored in the same way as described above.

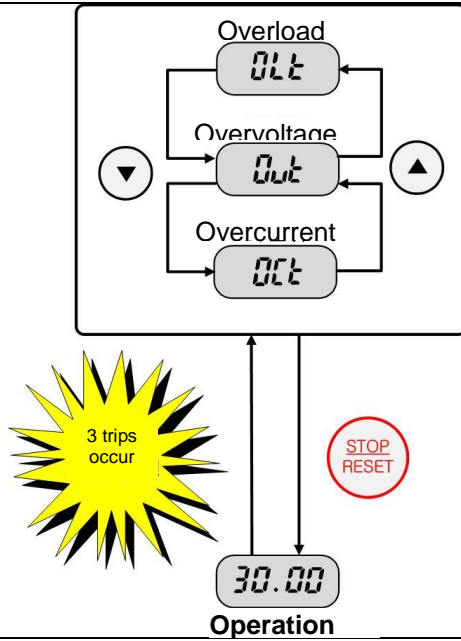
■ Displaying failure status

How to monitor the inverter failure status in the operation group



1		<ul style="list-style-type: none"> ▪ If the overcurrent trip occurs, it is marked as shown in the left. ▪ Press the Enter key (ENT). Press the up key (▲).
2		<ul style="list-style-type: none"> ▪ Indicates the operation frequency when a trip occurs. ▪ Press the up key (▲).
3		<ul style="list-style-type: none"> ▪ Indicates the output current when a trip occurs. ▪ Press the up key (▲).
4		<ul style="list-style-type: none"> ▪ Indicates the operation status. A trip has occurred during acceleration. ▪ Press the STOP/RST key.
5		<ul style="list-style-type: none"> ▪ The trip is released and the preset frequency is displayed.

If multiple trips occur at the same time

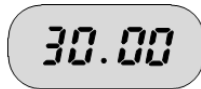


- If different types of trips occur at the same time, the information of up to 3 trips is displayed as shown in the left figure.

If a warning is issued at 30 Hz operation



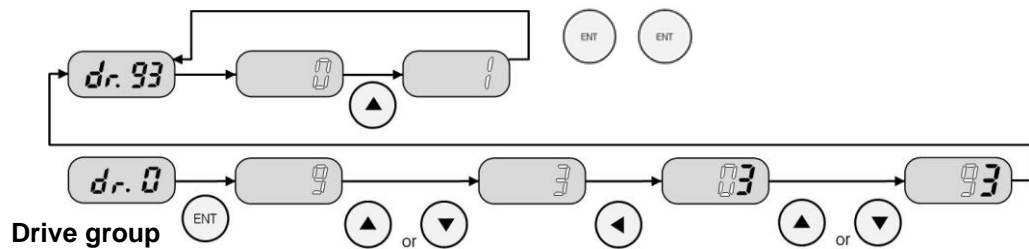
Alternates at one second interval



- When a warning is issued, the current screen and "Warn" turns on and off alternatively at one second interval.
- You can find the warning details in Pr.90.

5.9 Parameter initialization

If all drive groups are initialized in dr.93 code of the drive group




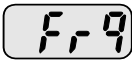


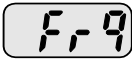

1		<ul style="list-style-type: none"> Indicates the first code of the drive group. Press the Enter key (ENT).
2		<ul style="list-style-type: none"> The code number to move displays the initial value 9. Use the up key (▲) or down key (▼) to change the value to 3.
3		<ul style="list-style-type: none"> The code number to move displays 3. Press the left shift key (◀).
4		<ul style="list-style-type: none"> 0 blinks to show that the value can be changed. Use the up key (▲) or down key (▼) to change the value to 9.
5		<ul style="list-style-type: none"> The code number to move displays 93. Press the Enter key (ENT).
6		<ul style="list-style-type: none"> It indicates that the current position is No. 93 code of the drive group. Press the Enter key (ENT).
7		<ul style="list-style-type: none"> Indicates the standby state for parameter initialization. Press the up key (▲).
8		<ul style="list-style-type: none"> Press the Enter key (ENT). The number blinks. Press the Enter key again.
9		<ul style="list-style-type: none"> The code number is displayed again. The parameter initialization is complete. Press the left shift key (◀) or right shift key (▶).
10		<ul style="list-style-type: none"> Moved to the first code of the drive group.


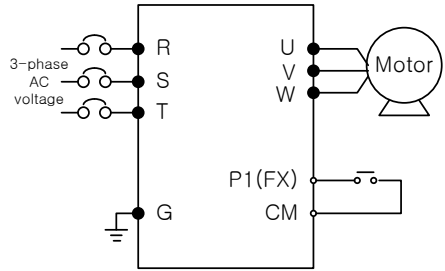
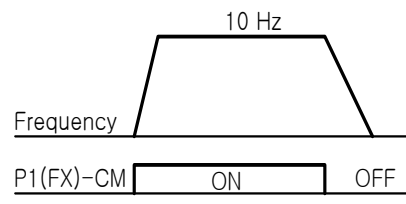
5.10 Frequency Setting and Basic Operation Method

⚠ Caution


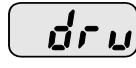

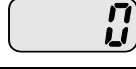

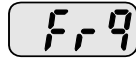


- The following descriptions assume that all parameters are set as the factory default. Therefore, if you changed the parameters after purchase, the parameters displayed may be different from the following. If this is the case, initialize the parameters to the factory defaults (refer to 5.9 Parameter initialization) and operate according to the following descriptions.




■ If using a potentiometer to set the frequency and issuing the operation command from the inverter terminal block

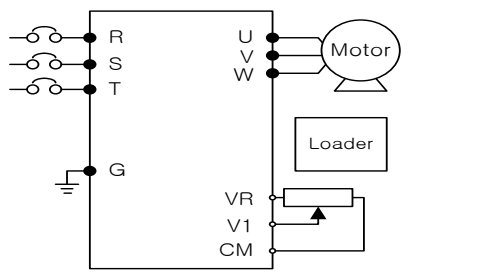
1		<ul style="list-style-type: none"> Power on the inverter.
2		<ul style="list-style-type: none"> Check if the mark as shown in the left appears on the inverter display. Press the up key (▲) 4 times.
3		<ul style="list-style-type: none"> Moved to the code that can change the frequency setting method. Press the Enter key (ENT).
4		<ul style="list-style-type: none"> The current frequency setting method is set to No.0 (frequency setting using the keypad). Press the up key (▲) 2 times.
5		<ul style="list-style-type: none"> Check if it indicates 2 (use the volume resistance to set the frequency). Press the Enter key (ENT).
6		<ul style="list-style-type: none"> If 2 blinks, press the Enter key (ENT) once more. When Frq is displayed, the frequency setting method is changed to the volume resistance. Press the down key (▼) 4 times to move to the frequency display status. Turn the volume resistance to 10 Hz.
7		<ul style="list-style-type: none"> Turn on the switch between P1 (FX) and CM terminals in the following wiring diagram. RUN (in operation) indicator lamp blinks on the inverter display, FWD (forward direction operation) indicator lamp is on, and the number display shows the accelerating frequency. When the operation frequency reaches 10 Hz, the display shows the left figure. Turn off the switch between P1 (FX) and CM terminals.

8		<ul style="list-style-type: none"> ▪ RUN (in operation) indicator lamps resumes blinking on the inverter display and the number display shows the decelerating frequency. ▪ when the operation frequency reaches 0 Hz, RUN (in operation) and FWD (forward direction operation) indicators turn off and the number display shows 10.00.
		
Wiring diagram		Operation pattern

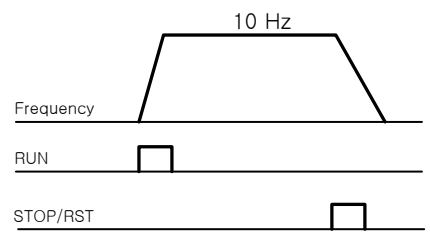
■ If using a potentiometer to set the frequency and using the RUN key of the keypad to issue operation command

1		<ul style="list-style-type: none"> ▪ Power on the inverter.
2		<ul style="list-style-type: none"> ▪ Check if 0.00 as shown on the left appears on the inverter display. ▪ Press the up key (▲) 3 times.
3		<ul style="list-style-type: none"> ▪ Moved to the code that can change the operation command method. ▪ Press the Enter key (ENT).
4		<ul style="list-style-type: none"> ▪ The operation command method is currently set to No.1 (inverter terminal block). ▪ Press the down key (▼).
5		<ul style="list-style-type: none"> ▪ Check if it indicates 0 and enter the Enter key (ENT). ▪ If 0 blinks, press the Enter key (ENT) once more.
6		<ul style="list-style-type: none"> ▪ If drv is displayed, the operation command method is changed to RUN key of the keypad. ▪ Press the up key (▲) 1 times.
7		<ul style="list-style-type: none"> ▪ Moved to the code that can change the frequency setting method. ▪ Press the Enter key (ENT).
8		<ul style="list-style-type: none"> ▪ The current frequency setting method is preset to No.0 (frequency setting using the keypad). ▪ Press the up key (▲) 2 times.
9		<ul style="list-style-type: none"> ▪ Check if it indicates 2 (using a potentiometer to set the frequency) and press the Enter key (ENT). ▪ If 2 blinks, press the Enter key (ENT) once more.

10		<ul style="list-style-type: none"> When Frq is displayed, the frequency setting method is changed to the keypad volume. Press the down key (▼) 4 times to move to the frequency display status. Turn the volume resistance to 10 Hz.
11		<ul style="list-style-type: none"> Press the RUN key of the inverter keypad. RUN (in operation) indicator lamp blinks on the inverter display, FWD (forward direction operation) indicator lamp is on, and the number display shows the accelerating frequency. When the operation frequency reaches 10 Hz, the display shows the left figure. Press STOP/RESET key of the inverter keypad.
12		<ul style="list-style-type: none"> RUN (in operation) indicator lamps resumes blinking on the inverter display and the number display shows the decelerating frequency. when the operation frequency reaches 0 Hz, RUN (in operation) and FWD (forward direction operation) indicators turn off and the number display shows 10.00.



Wiring diagram

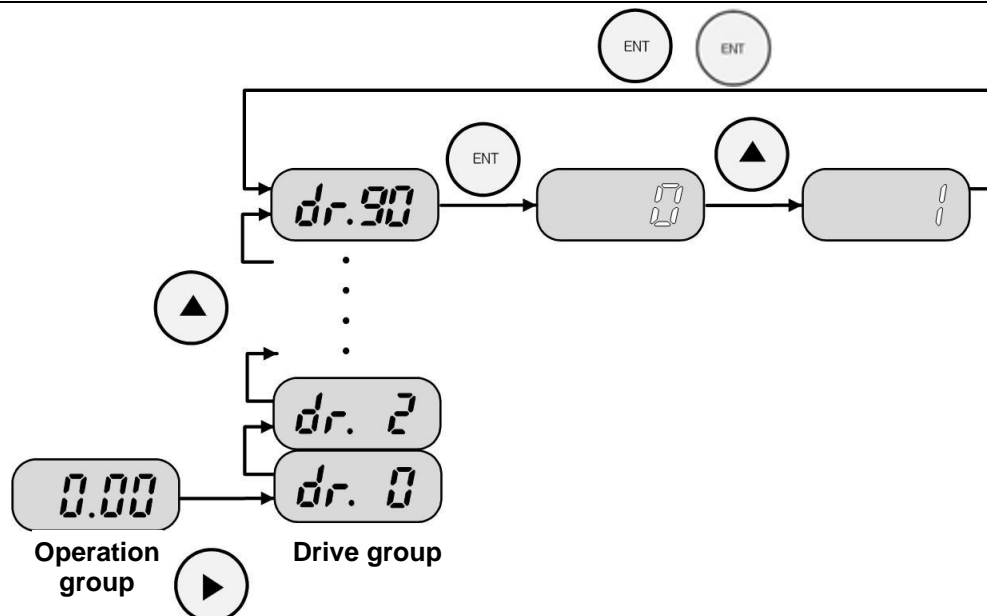


Operation pattern

5.11 Using ESC Key

- Move to initial location (refer to 5.6)
- Remote/local (refer to 6.7)

If using the jog operation to set the ESC key function



1		<ul style="list-style-type: none"> ▪ Indicates the first code of the operation group. ▪ Press the right shift key (▶).
2		<ul style="list-style-type: none"> ▪ Indicates the first code of the drive group. ▪ Press the up key (▲) or the down key (▼) until the ESC key setting code, 90, appears.
3		<ul style="list-style-type: none"> ▪ Indicates the ESC key code, dr.90. ▪ Press the Enter key (ENT).
4		<ul style="list-style-type: none"> ▪ Indicates the initial value, 0 (move to the initial location). ▪ Press the up key (▲) so that the jog operation mode, 1, is displayed.
5		<ul style="list-style-type: none"> ▪ Indicates the jog operation mode, 1. ▪ Press the Enter key (ENT). The number blinks. Press the Enter key again.

If you press the ESC key when ESC-key mode is set to Jog (1) or remote/local (2), then SET LED blinks.

6. Basic Functions

6.1 Introduction of S100 Basic Functions

Table 6-1 Introduction of S100 basic functions

Basic Functions	Usage Examples
Setting frequency with keypad	Setting operation frequency with keypad
Setting frequency by voltage input into the terminal block	Setting operation frequency by voltage input (V1, V2) of terminal block
Setting frequency by current input into the terminal block	Setting operation frequency by current input (I2) of terminal block
Setting frequency via RS-485 communications	Setting frequency by communicating with the upper level controller (PLC or PC) using terminal block (S+, S-)
Frequency fixation of analog command	Holding operation frequency by the input of the terminal selected as Analog Hold among multi-function terminals
Changing frequency to revolution	Changing the display method of motor revolutions (Hz or rpm)
Multi-step speed frequency setting	Multi-step speed operation using multi-function terminal
Operation command setting via keypad	Starting operation using the forward operation key (FWD) and the reverse operation key (REV), and stopping operation using the stop key (Stop)
Operation command setting via terminal block	Controlling operation command using terminal block FX/RX
Operation command setting via RS-485 communications	Setting operation command by communicating with the upper level controller (PLC or PC) using terminal block (S+, S-)
Local/remote switching operation using ESC keys	When operating with an operation command based on a method other than keypad such as terminal block or communication, checking inverter operation and facility without any parameter setting change or switching to manual operation using the keypad
Prohibition of forward or reverse rotation	Selecting prohibited direction of motor rotation
Starting with power on	When power is supplied to the inverter, the motor accelerates if the terminal block operating command is turned on

Basic Functions	Usage Examples
Starting on initialization after a trip takes place	When initialized after a trip takes place, the motor accelerates if the terminal block operating command is turned on
Acc/Dec time setting based on max. frequency	Setting acceleration and deceleration time based on maximum frequency
Acc/Dec time setting based on operation frequency	Setting acceleration and deceleration time based on the time elapsed from the current constant frequency to the target frequency of the next step
Multi-step Acc/Dec time setting using multi-function terminal	Setting multi-step acceleration and deceleration time using multi-function terminal
Changing Acc/Dec time by setting Acc/Dec time transition frequency	Changing acceleration and deceleration gradient without using multi-step terminal
Setting Acc/Dec pattern	Used when the pattern of acceleration and deceleration gradient is needed (Linear, S-curve)
Acc/Dec stop command	Stopping acceleration or deceleration or operating in constant speed using multi-function terminal
Linear V/F pattern operation	Used for load requiring constant torque irrespective of frequency
Square reduction V/F pattern operation	Operation pattern suitable for the load with the starting characteristics of square reduction, such as fan, pump, etc.
User V/F pattern operation	When the user changes the setting according to the V/F and load patterns of special motor instead of general induction motor
Manual torque boost	When a large amount of starting torque is needed such as in elevator load, etc.
Automatic torque boost	When selecting automatic adjustment function if a large amount of starting torque is required
Motor output voltage adjustment	Setting the motor voltage when the input power supply is different from the motor voltage specification
Accelerating start	A general acceleration method. When there is no function selection, it accelerates directly to the target frequency on operation command input.
Start after DC braking	When the motor is rotating before the voltage is supplied from the inverter, it stops the motor revolution by DC braking and then makes acceleration.

Basic Functions	Usage Examples
Deceleration stop	A general deceleration method. When there is no function selection, it decelerates down to 0 Hz and then stops.
Stopping by DC braking	Stopping the motor by supplying direct current at the preset frequency during deceleration
Free-run stop	When the operation command is turned off, the inverter output is blocked.
Power braking	Optimally decelerating without overvoltage trip
Frequency limit using maximum and start frequency	Limiting operation frequency by setting the maximum frequency and the start frequency
Frequency limit using the upper/lower limits	Limiting operation frequency using the upper and lower frequency limit function
Frequency jump	Avoiding mechanical resonance frequency
Multi-function input terminal control	Improving the response of input terminal

6.2 Frequency Setting Methods

Group	Code number	Name	Setting range and how to display the LCD keypad
Operation	Frq	Frequency setting method	0 KeyPad-1
			1 KeyPad-2
			2 V1
			4 V2 ¹⁵
			5 I2
			6 Int 485
			8 Field Bus
			12 Pulse

Select the frequency setting method from the Frq code of the operation group. The operation frequency can be set from an external controller through digital setting using keypad, analog setting using voltage (V1, V2) and current (I2) input of the control terminal block, and the use of the built-in RS-485 port or communication option.

¹⁵ V2 frequency setting is operated when switch of Analog Input (I2) of I/O board is selected as V.

■ Frequency Setting by Keypad 1: KeyPad-1

Group	Code	Name	LCD display	Setting		Setting range	Unit
Operation	0.00	Command frequency		0.00		0 - Max. frequenc	Hz
Operation	Frq	Frequency setting method	Freq Ref Src	0	KeyPad -1	-	-

After changing the frequency with keypad, press the program (ENT) key to apply the change. Set the operation group Frq code to 0 Keypad-1. When setting the desired frequency from the command frequency code (0.00) of the operation group, press the setting key (ENT) to apply the frequency change. It is not possible to set beyond the max. frequency (dr. 20).

■ Frequency Setting by Keypad 2: KeyPad-2

Group	Code	Name	LCD display	Setting		Setting range	Unit
Operation	0.00	Command frequency		0.00		0 - Max. frequen	Hz
Operation	Frq	Frequency Setting Methods	Freq Ref Src	1	KeyPad -2	-	-

Select 1 from the Frq code of the operation group.

To set the desired frequency from the command frequency code (0.00) of the operation group, press the Up key (▲) or Down key (▼) to change the frequency immediately. Select this function if you want to use the Up and Down keys for volume resistance.

It is not possible to set beyond the max. frequency (dr. 20).

■ Frequency Setting by Terminal Block V1 (Voltage Input): V1

Group	Code	Name	LCD display	Setting		Setting range	Unit
Operation	Frq	Frequency Setting Methods	Freq Ref Src	2	V1	-	-

Using the voltage (V1) input terminal of the terminal block, supply -10 to +10 V or 0 to +10 V.

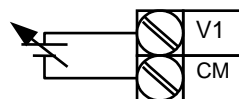
When supplying -10 to +10 V, you can change the rotating direction of the motor depending on the sign of voltage signal.

1. When supplying 0 to +10 V

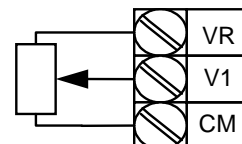
Group	Code	Name	LCD display	Setting	Setting range	Unit
Operation	Frq	Frequency Setting Methods	Freq Ref Src	2 V1	-	-
In	01	Frequency for maximum analog input	Freq at 100%	60.00	0.00 - Max. frequency	Hz
In	05	V1 input amount display	V1 Monitor [V]	0.00	0.00 - 12.00	V
In	06	V1 input polarity selection	V1 Polarity	0 Unipolar	0 - 1	-
In	07	Time constant of V1 input filter	V1 Filter	10	0 - 10000	msec
In	08	Minimum input voltage of V1	V1 volt x1	0.00	0.00 - 10.00	V
In	09	Output at V1 minimum voltage (%)	V1 Perc y1	0.00	0.00 - 100.00	%
In	10	Maximum input voltage for V1	V1 Volt x2	10.00	0.00 - 12.00	V
In	11	Output at V1 maximum voltage (%)	V1 Perc y2	100.00	0 - 100	%
In	16	Changing rotation direction	V1 Inverting	0 No	0 - 1	-
In	17	V1 quantization level	V1 Quantizing	0.04	0.04 - 10.00	%

Set In.06 related with the input terminal block to Unipolar no. 0.

Make an input to V1 terminal with a potentiometer using the voltage output of the external controller or the VR output terminal of the inverter control terminal block, as shown in the figure below.



External power



Internal power source

Figure 6-1 Frequency setting by voltage input into the terminal block

2. When using 0 to +10 V of external circuit

In.01 (Freq at 100%) for connecting **potentiometer** to terminal block: Set the operation frequency on max. voltage input. Set the operation frequency when the value set at In.11 or 15 of the input terminal block function group is 100%.

- **Example 1)** When setting In.01 to 40.00 and other codes up to In.16 to the default value and then supplying 10 V to the V1 terminal, the system operates at 40.00 Hz.
- **Example 2)** When setting In.11 to 50% and other codes from In.01 to In.16 to the default value and then supplying 10 V to the V1 terminal, the system operates at 30.00 Hz which is equal to 50% of 60 Hz, the maximum frequency.

In.05 Monitor [V]: Shows the magnitude of the voltage input to the V1 terminal. Used to monitor the magnitude of the present voltage input.

In.07 V1 Filter: Use this filter when the frequency setting value varies largely due to noisy environment, etc. Setting the filter time constant sufficiently large may reduce the width of frequency variation, but the responsiveness may be slowed. The larger the time constant is, the longer the time t . The set time means the time required to increase the frequency up to approximately 63% of the frequency set within the inverter when the voltage input is supplied in steps, as shown in the figure below.

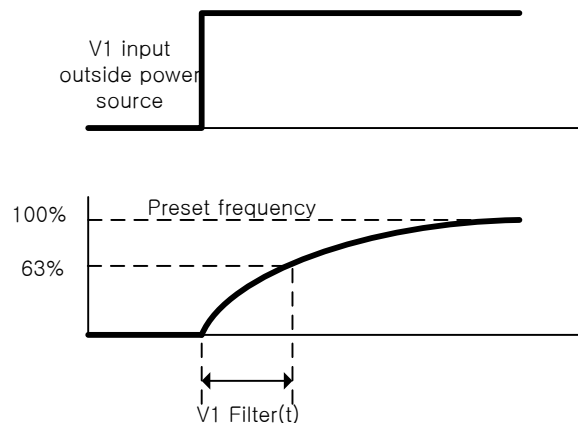


Figure 6-2 In.07 V1 Filter

In.08 V1 Volt x1 - In.11 V1 Perc y2: Able to set the gradient of output frequency, offset value, etc. for the magnitude of the input voltage.

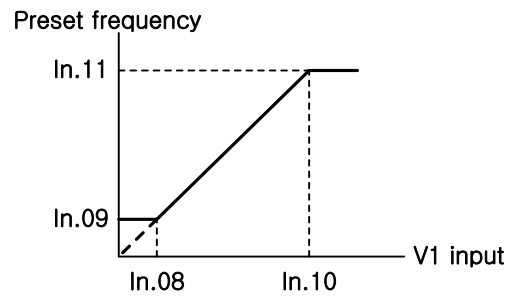


Figure 6-3 In.08 V1 Volt x1 - In.11 V1 Perc y2

In.16 V1 Inverting: Able to rotate in the opposite of the current rotation direction by setting to 1 Yes.

In.17 V1 Quantizing: Used when the analog signal input to the V1 terminal has high noise. Using the value of low-pass filter of In.07 may reduce the noise to a certain level; however, increasing the value will impair the responsiveness and create pulsation with a long period (ripple) in the output frequency. The resolution of the output frequency to the analog input will be reduced, but the noise effect will be reduced by the quantizing function in a system sensitive to noise.

The quantization setting value is the percentage compared to the max. analog input value. Thus, if the max. input value is 10 V and the quantization value is set to 1%, the frequency will vary by 0.6 Hz (at the max. frequency of 60 Hz) with the interval of 0.1 V. The output frequencies corresponding to when the input value is increased and decreased are different from each other, in order to eliminate the impact caused by the variation of analog input value. As shown in the figure below, if, after dividing the quantizing value into four equal parts, the analog input value is increased, inputting a value corresponding to 3/4 of the quantizing value will change the output frequency, and then, from the next step, it will be increased according to the quantizing value. In the case that the analog input value is decreased, reducing the input as much as a value corresponding to 1/4 of the quantizing value will change the output frequency.

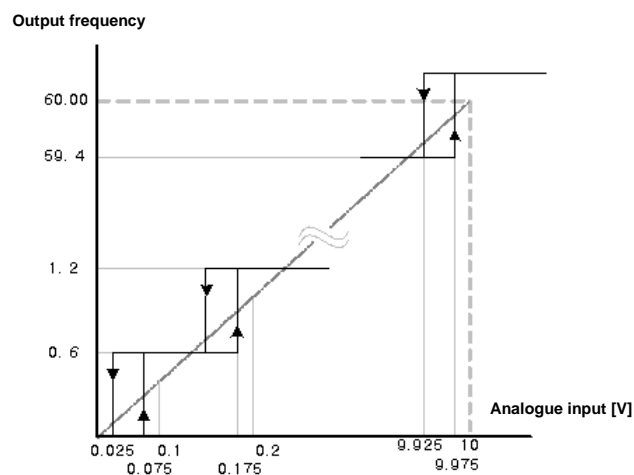


Figure 6-4 In.17 V1 Quantizing

3. When supplying -10 to +10 V

Group	Code	Name	LCD display	Setting	Setting range	Unit
Operation	Frq	Frequency Setting Methods	Freq Ref Src	2	V1	-
In	01	Frequency for maximum analog input	Freq at 100%	60.00	0 - Max. frequency	Hz
In	05	V1 input amount display	V1 Monitor	0.00	0.00 - 12.00 V	V
In	06	V1 input polarity selection	V1 Polarity	1	Bipolar	-
In	12	V1-Minimum input voltage	V1-volt x1'	0.00	10.00 - 0.00 V	V
In	13	Output (%) at the V1-min. voltage	V1-Perc y1'	0.00	-100.00 - 0.00%	%
In	14	V1-Maximum input voltage	V1-Volt x2'	-10.00	-12.00 - 0.00 V	V
In	15	Output (%) at the V1-max. voltage	V1-Perc y2'	-100.00	-100.00 - 0.00%	%

Set In.06 to 1 Bipolar.

Codes from In.12 to 15 are displayed only for Bipolar, and you can make settings for the voltage with the range of 0 to -10 V supplied to the V1 terminal. Make an input to V1 terminal with a potentiometer using the voltage output of the external controller as shown in the figure below.

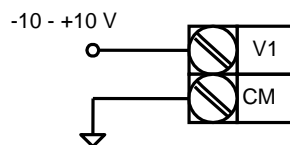


Figure 6-5 Settings for the voltage with the range of -10 to 10 V supplied to the V1 terminal

The output frequency for the bidirectional voltage input (-10 to +10 V) will show the following behavior:

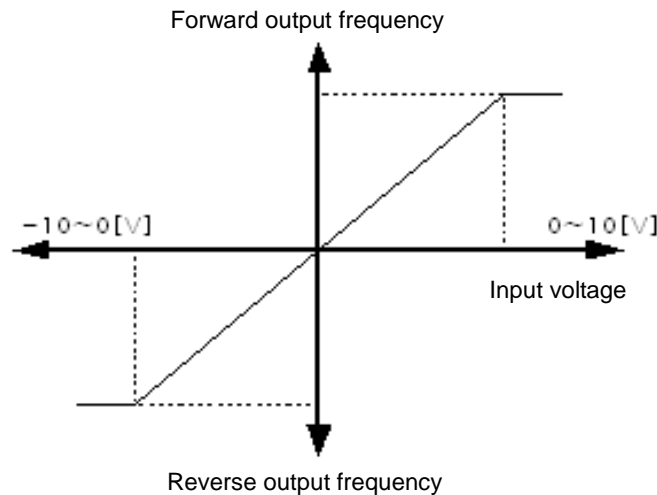


Figure 6-6 Output frequency for the bidirectional voltage input (-10 to +10 V)

In.12 V1 –volt x1' - In.15 V1 –Perc y2': Able to set the gradient of output frequency, offset value, etc. for the magnitude of the negative input voltage as follows:

Example) If the minimum and maximum negative input voltages of V1 are -2 V and -8 V respectively and the output ratios to them are set to 10% and 80% accordingly, the output frequency will vary between 6 Hz and 48 Hz.

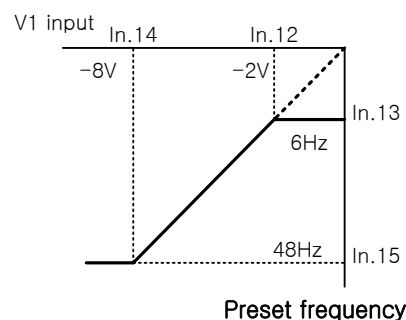


Figure 6-7 Example of In.12 V1-volt X1 - In.15 V1 Perc y2

For more information on settings for 0 - +10 V, please refer to In.08 V1 Volt x1 - In.11 V1 Perc y2 (page 6-6).

The table below shows how to select the keypad or the direction of terminal block and the motor rotation by bidirectional voltage input.

Table 6-2 How to select the keypad or the direction of terminal block and the motor rotation by bidirectional voltage input

Operation command	Voltage input	
	0 - 10 V	-10 - 0 V
FWD	Forward	Reverse
REV	Reverse	Forward

■ Frequency Setting by Terminal Block I2 (Current Input)

Group	Code	Name	LCD display	Setting		Setting range	Unit
				5	I2		
Operation	Frq	Frequency Setting Methods	Freq Ref Src	5	I2	-	-
In	01	Frequency for maximum analog input	Freq at 100%	60.00		0 - Max. frequency	Hz
In	50	I2 input amount display	I2 Monitor	0.00		0.00 - 20.00	mA
In	52	I2 input filter time constant	I2 Filter	10		0 - 10000	ms
In	53	I2 minimum input current	I2 Curr x1	4.00		0.00 - 20.00	mA
In	54	Output (%) at the I2 min. current	I2 Perc y1	0.00		0 - 100	%
In	55	I2 maximum input current	I2 Curr x2	24.00		0.00 - 24.00	mA
In	56	Output (%) at the I2 max. current	I2 Perc y2	100.00		0.00 - 100.00	%
In	61	Changing rotation direction of I2	I2 Inverting	0	NO	0 - 1	-
In	62	I2 quantization level	I2 Quantizing	0.04		0.04 - 10.00	%

Select 5 I2 from the Frq code of the operation group. Set the frequency by supplying current ranging from 0 to 20 mA to the I2 terminal of the terminal block.

In.01 Freq at 100%: Set the operation frequency on max. current input. Set the operation frequency when the value set from In.56 is 100%.

Example 1) When setting In.01 to 40.00 and other codes from In.53 to 56 to the default value and then supplying 20 mA to the I2 terminal, the system operates at 40.00 Hz.

Example 2) When setting In.56 to 50% and the setting values of In.01 and from In.53 to 55 are identical to the default value and then supplying 20 mA to the I2 terminal, the system operates at 30.00 Hz.

In.50 I2 Monitor: Shows the magnitude of the current input to the I2 terminal. Used to monitor the magnitude of the present current input.

In.52 I2 Filter: The set time means the time required to increase the frequency up to approximately 63% of the I2 value made by step input within the inverter when the current input is supplied in steps.

In.53 I2 Curr x1 - In.56 I2 Perc y2: Able to set the gradient of output frequency, offset value, etc. for the magnitude of the current as follows:

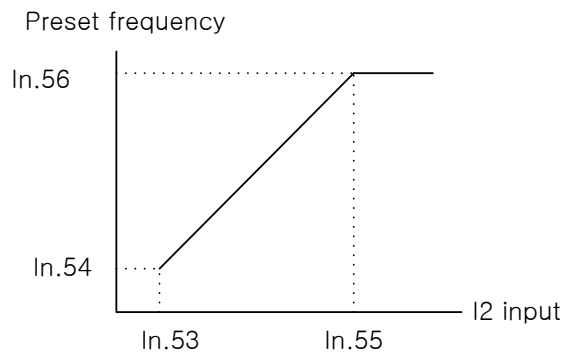


Figure 6-8 Setting the gradient of output frequency and offset value for the magnitude of current

■ Frequency Command by Terminal Block I2 (Voltage Input)

Depending on the SW2 setting, the terminal block I2 is able to input voltage (0 to 12 V).

(Refer to 4.5 Wiring Diagram of Control Terminal Block.)

▪ 0 to +12 V input

Group	Code	Name	LCD display	Setting		Setting range	Unit
dr	07	Frequency Setting Methods	Freq Ref Src	4	V2	-	-
In	35	V2 input amount display	V2 Monitor	0.00		0.00 - 12.00	V
In	37	V2 input filter time constant	V2 Filter	10		0 - 10000	msec
In	38	Minimum input voltage of V2	V2 Volt x1	0.00		0.00 - 12.00	V
In	39	Output (%) at the V2-min. voltage	V2 Perc y1	0.00		0.00 - 100.00	%
In	40	Maximum input voltage of V2	V2 Volt x2	10.00		0 - 12.00	V
In	41	Output (%) at the V2 max. voltage	V2 Perc y2	100.00		0.00 - 100.00	%
In	46	V2 rotation direction change	V2 Inverting	0	No	0 - 1	-

Group	Code	Name	LCD display	Setting	Setting range	Unit
In	47	V2 quantization level	V2 Quantizing	0.04	0 ¹⁶ , 0.04 - 10.00	%

If the SW2 is set to current input (I), In.35 to 47 codes are invisible.

■ Frequency Setting by Terminal Block TI (Pulse Input)

Group	Code	Name	LCD display	Setting		Setting range	Unit
Operation	Frq	Frequency Setting Methods	Freq Ref Src	12	Pulse	-	-
In	01	Frequency for maximum analog input	Freq at 100%	60.00		0.00 - Max. frequency	Hz
In	91	Pulse input amount display	Pulse Monitor	0.00		0.00 - 50.00	kHz
In	92	TI input filter time constant	TI Filter	10		0 - 9999	msec
In	93	Minimum input pulse of TI	TI Pls x1	0.00		0.00 - 32.00	kHz
In	94	Output (%) at the TI min. pulse	TI Perc y1	0.00		0.00 - 100.00	%
In	95	Maximum input pulse of TI	TI Pls x2	32.00		0.00 - 32.00	kHz
In	96	Output (%) at the TI max. pulse	TI Perc y2	100.00		0.00 - 100.00	%
In	97	Changing rotation direction	TI Inverting	0	No	0 - 1	-
In	98	TI quantization level	TI Quantizing	0.04		0.00 ¹⁷ , 0.04 - 10.00	%

¹⁶ With 0 set, quantizing is not used.

¹⁷ With 0 set, quantizing is not used.

Select 12 Pulse from the Frq code of the operation group. Set the frequency by supplying pulse ranging from 0 to 32.00 kHz to the TI terminal of the terminal block.

In.01 Freq at 100%: Set the operation frequency on max. pulse input. Set the operation frequency when the value set from In.96 is 100%.

Example 1) When setting In.01 to 40.00 and other codes from In.93 to In.96 to the default value and then supplying 32 kHz to the TI terminal, the system operates at 40.00 Hz.

Example 2) When setting In.96 to 50% and the setting values of In.01 and from In.93 to 95 are identical to the default value and then supplying 32.00 kHz to the TI terminal, the system operates at 30.00 Hz.

In.91 Pulse Monitor: Shows the magnitude of the pulse frequency to the TI terminal. Used to monitor the magnitude of the present pulse frequency.

In.92 TI Filter: The set time means the time required to increase the frequency up to approximately 63% of the TI value made by step input within the inverter when the pulse input is supplied in steps.

In.93 TI Pls x1 - In.96 TI Perc y2: Able to set the gradient of output frequency, offset value, etc. for the magnitude of the pulse frequency as follows:

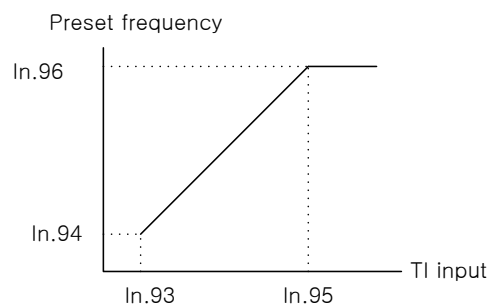


Figure 6-9 Setting the gradient of output frequency and offset value for the magnitude of pulse

In.97 TI Inverting: Able to change the rotation direction of the present operation.

In.98 TI Quantizing: Identical to the V1 Quantizing function of In.17. Please refer to page 6-7, 'In.17 V1 Quantizing.'

■ Frequency setting via RS-485 communications: Int 485

Group	Code	Name	LCD display	Setting	Setting range	Unit	
Operation	Frq	Frequency Setting Methods	Freq Ref Src	6	Int 485	-	-
CM	01	Built-in communication inverter ID	Int485 St ID	-	1	1 - 250	-
CM	02	Built-in communication protocol	Int485 Proto	0	ModBus RTU	0 - 2	-
				1	Reserved		-
				2	LS Inv 485		-
CM	03	Built-in communication speed	Int485 BaudR	3	9600 bps	0 - 7	-
CM	04	Built-in communication frame setting	Int485 Mode	0	D8 / PN / S1	0 - 3	-
				1	D8 / PN / S2		-
				2	D8 / PE / S1		-
				3	D8 / PO / S1		-

When setting the operation group Frq code to 6 Int 485, you can control the inverter by communicating with the upper level controller (PLC or PC) using the RS-485 terminals (S+, S-, SG) of the terminal block. For more information, refer to Chapter 7-1 Communication Function.

Notes

- For details on other communication options such as CANopen, please refer to the relevant manual.

6.3 Frequency HOLD of Analog Command

Group	Code	Name	LCD display	Setting	Setting range	Unit	
Operation	Frq	Frequency Setting Methods	Freq Ref Src	0	Keypad-1	0 - 12	-
				1	Keypad-2		
				2	V1		
				4	V2		
				5	I2		
				6	Int 485		
				8	Field Bus		
				12	Pulse		
In	65 - 71	Setting Px terminal function	Px Define (Px: P1 - P7)	21	Analog hold	0 - 49	-

In the case of setting frequency using the analog input of the control terminal block, this function holds the operation frequency when the terminal selected as Analog Hold among multi-function terminals is input.

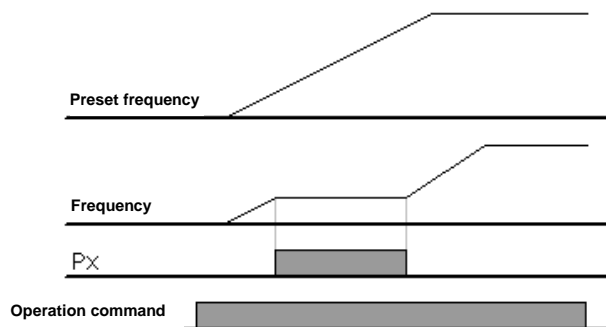


Figure 6-10 Frequency HOLD of analog command

6.4 Changing the display from Frequency to Revolutions(RPM)¹⁸

When setting the value of dr.21 Hz/Rpm Sel to 1 Rpm Display, the frequency is changed to revolution for display.

Group	Code	Name	LCD display	Setting	Setting range	Unit
dr	21	Speed unit selection	Hz/Rpm Sel	1	Rpm Display	-

6.5 Multi-Step Speed Frequency Setting

Group	Code	Name	LCD display	Setting	Setting range	Unit	
Operation	St1 - St3 ¹⁹	Multi-step speed frequencies 1 - 3	Step Freq 1-3	-	0 - Maximum frequency	Hz	
bA	53 - 56	Multi-step speed frequencies 4 - 7	Step Freq 4-7	-	0 - Maximum frequency	Hz	
In	65 - 71	Setting Px terminal function	Px Define (Px: P1-P7)	7	Speed-L	0 - 49	-
In				8	Speed-M		-
In				9	Speed-H		-
In	89	Multi-step command delay time	InCheck Time	1	1 - 5000	ms	

It is possible to perform multi-step speed operation using multi-function terminal. The 0 speed frequency uses the frequency command selected in the Freq code of the operation group. Input the desired step frequency into St1 to St3 codes of the operation group and 53 to 56 codes of the bA group. After selecting a terminal to be used as the multi-step input among multi-function terminals P1 to P7, set one of multi-step functions (7: Speed-L, 8: Speed-M, 9: Speed-H) respectively. Speed-L, Speed-M, and Speed-H are recognized as binary code, so the system operates by selecting the frequency set from St1 to St3 and bA.53 to bA.56. If the multi-function terminals P5, P6, and P7 are set to Speed-L, Speed-M, and Speed-H respectively, the system operates as follows:

¹⁸ It is visible only on the LCD keypad.

¹⁹ When using LCD, it corresponds to IN.50 – In.52 Step Freq-1 – 3.

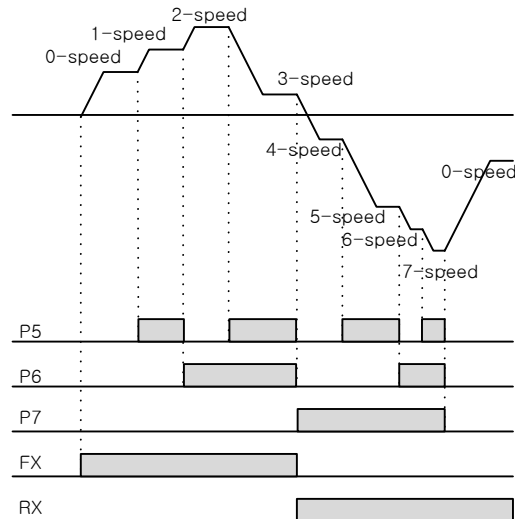


Figure 6-11 Example of 8 speed setting

Table 6-3 Example of 8 speed setting

Speed	FX or RX	P7	P6	P5
0	✓	-	-	-
1	✓	-	-	✓
2	✓	-	✓	-
3	✓	-	✓	✓
4	✓	✓	-	-
5	✓	✓	-	✓
6	✓	✓	✓	-
7	✓	✓	✓	✓

In.89 In Check Time: Using the multi-function input terminal with the multi-step speed frequency setting, you can set the time to check the terminal block input within the inverter. For example, with the In Check Time of the terminal block set to 100 ms and the multi-function terminal P6 input, the system will check if there is any input from another terminal block for 100 ms. When 100 ms has elapsed, it accelerates or decelerates to the frequency relevant to the P6 terminal.

6.6 Setting Method of Operation Command

Group	Code	Name	LCD display	Setting		Setting range	Unit
Operation	drv	Operation command method	Cmd Source ²⁰	0	Keypad	0 - 4	
				1	Fx/Rx-1		
				2	Fx/Rx-2		
				3	Int 485		
				4	Field Bus		
Operation	drC	Select rotation direction	_2 ¹	F	Forward	F, r	
				r	Reverse		

Select the operation command setting method from the drv code of the operation group. In addition to basic operation using keypad and multi-function terminal, the operation command is able to use built-in RS-485 communication, fieldbus option card, and so on.

(1) Keypad Operating Command: KeYPad

Group	Code	Name	LCD display	Setting		Setting range	Unit
Operation	drv	Operation command method	Cmd Source	0	KeyPad	0 - 4	-

If setting the drv code²² of the operation group to 0 Keypad, start the operation using the operation command key (RUN) on the inverter keypad and stop it using the stop key (STOP).

(2) Terminal Block Operating Command 1: Fx/Rx-1

Group	Code	Name	LCD display	Setting		Setting range	Unit
Operation	drv	Operation command method	Cmd Source	1	Fx/Rx-1	0 - 4	-
In	65 - 71	Setting Px terminal function	Px Define (Px: P1-P7)	1	FX	0 - 49	-
In	65 - 71	Setting Px terminal function	Px Define (Px: P1-P7)	2	RX		-

²⁰ When using LCD, it will be displayed in DRV-06.

²¹ When using LCD, it will be invisible.

²² When using [LCD Loader](#), [corresponds](#) corresponds to DRV-06 Cmd Source.

Set the drv code²³ of the operation group to 1 Fx/Rx-1. After selecting terminals to be used as the forward (FX) and the reverse (RX) operation command out of multi-function terminals P1 to P7, set the functions of the corresponding terminals, among In. 65 to 71 of the terminal block input group, to FX and RX. In the case that the FX terminal and the RX terminal are simultaneously turned on or off, the inverter will stop.

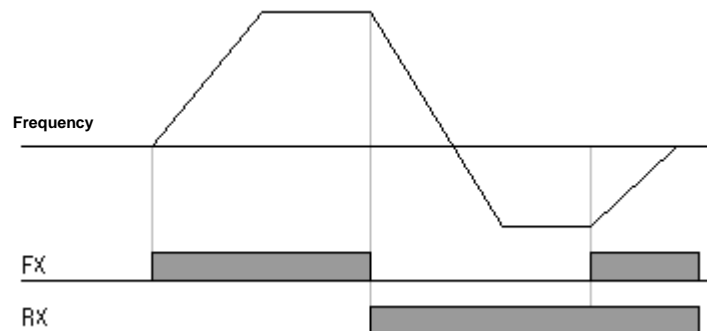


Figure 6-12 Terminal Block Operating Command 1

(3) Terminal Block Operating Command 2: Fx/Rx-2

Group	Code	Name	LCD display	Setting	Setting range	Unit	
Operation	drv	Operation command method	Cmd Source	2	Fx/Rx-2	0 - 4	-
In	65 - 71	Setting Px terminal function	Px Define (Px: P1 - P7)	1	FX	0 - 49	-
In	65 - 71	Setting Px terminal function	Px Define (Px: P1 - P7)	2	RX		-

The FX terminal is used as operation command, and the rotation direction is selected by the RX terminal. Set the drv code²⁴ of the operation group to 2 Fx/Rx-2. After selecting terminals to be used as the forward (FX) and the reverse (RX) operation command out of multi-function terminals P1 to P7, set the functions of the corresponding terminals, among In. 65 to 71 of the terminal block input group, to FX and RX.

²³ When using [LCD Loader](#), corresponds to DRV-06 Cmd Source.

²⁴ When using [LCD Loader](#), corresponds to DRV-06 Cmd Source.

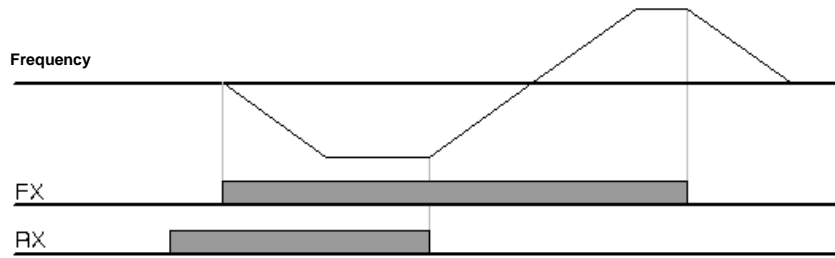


Figure 6-13 Terminal Block Operating Command 2

(4) Operation Command by RS-485 Communications: Int 485

Group	Code	Name	LCD display	Setting		Setting range	Unit
Operation	drv	Operation command method	Cmd Source	3	Int 485	0 - 4	-
CM	01	Built-in communication inverter ID	Int485 St ID	1		1 - 250	-
CM	02	Built-in communication protocol	Int485 Proto	0	ModBus RTU	0 - 2	-
CM	03	Built-in communication speed	Int485 BaudR	3	9600 bps	0 - 7	-
CM	04	Built-in communication frame setting	Int485 Mode	0	D8 / PN / S1	0 - 3	-

When setting the drv code²⁵ of the operation group to 3 Int 485, you can control the inverter by communicating with the upper level controller (PLC or PC) using the RS-485 terminals (S+, S-) of the terminal block. For more information, please refer to Chapter 9 Communication Function (page 7-1).

²⁵ When using LCD Loader, corresponds to DRV-06 Cmd Source.

6.7 Local/Remote Switching Operation Using ESC Key

(In the case of checking the inverter operation and facilities without changing the existing parameter settings)

Group	Code	Name	LCD display		Setting	Setting range	Unit
dr	90	ESC –key function selection	-	2	Local/Remote	0 - 2	-
Operation	drv	Operation command method	Cmd Source	1	Fx/Rx-1	0 - 4	-

⚠ Caution

- Be careful when you use the local/remote switching operation, because improper usage of the switching operation may cause serious problems to facility such as abnormal stop while operating the inverter.

When operating with a command based on a method other than keypad such as terminal block or communication, it may be used when checking inverter operation and facility without changing any parameter setting or switching to manual operation using the keypad.

■ Definition of Local

Local means all operation commands and frequency commands or torque commands can be operated by the keypad. In this case, JOG command is ignored. (Operation will be possible only when, out of In.65 - 71 multi-function terminals P1 to P7, 13 RUN Enable is set and this terminal is on.)

■ Definition of Remote

In Remote mode the inverter will only respond to external command, frequency and communication signals, i.e. will not operate from the keypad (Local mode).

■ dr.90 ESC Key Setting

When setting to 2 Local/Remote, the ESC Key will act as the local/remote function. In this case, there is no change for the inverter operation because it operates depending on the already set parameters by the Remote mode. If you want to switch to the Local mode, just press the ESC Key to make the SET LED blink and operate the inverter with the RUN key on the keypad setting. Pressing the ESC Key again causes the SET LED to be turned off, and the inverter operates according to the operation command method selected in the operation group drv.

■ When Switching from Remote to Local

If you switch from Remote to Local, the system stops if it has been operating.

■ When Switching from Local to Remote

If you switch from Local to Remote, the display is changed according to the already set command source and frequency source.

It is still possible to switch to Remote while the system is operating in the Local mode. However, the operation depends on which source is set.

1. When the terminal block is the command source

If you switch to the Remote mode while operating in the Local mode, it operates according to the command from the terminal block. In other words, if the reverse operation terminal (RX) is input to the terminal block and the motor rotates in the forward direction in the Local mode, it will rotate in the reverse direction when you switch to Remote.

2. When it is the digital command source

Digital command source refers to all of the command sources except for the terminal block source. That is, the digital command source includes communication and keypad sources. For these digital command sources, the inverter stops first and then begins to operate with the next command. At this moment, the target frequency is set to the currently set frequency source.

■ State in Which a Terminal is Turned On When Power is On

If the terminals of FX, RX, FWD_JOG, REV_JOG, and PRE EXCITE are turned on already when Ad.10 Power-on Run is set to 0 No, it is possible to operate the inverter with the keypad by switching to the Local mode. However, it will not operate if you switch to the Remote mode again. In other words, if at least one of the five terminals mentioned above is set and turned on when the power is on, the motor will operate in neither FX nor RX. Thus, when the Power-on Run is set to No, make sure to turn on the inverter and then turn off all of the [above terminals, in order to](#) run the motor with the relevant terminal.

■ State in Which the Motor Stopped Due to Trip While Operating

When the motor stops due to trip and the initialization is performed again, keypad operation is still possible in Local mode. But when switching to Remote mode again, the inverter will not operate the motor even if the operation command is input to the terminal block. That is, the motor can run only if the operation command terminal is turned on again after all of the operation terminals are turned off.

6.8 Prohibition of Forward or Reverse Rotation: Run Prevent

Group	Code	Name	LCD display	Setting		Setting range	Unit
Ad	09	Selection of prohibited rotation direction	Run Prevent	0	None	0 - 2	-
				1	Forward Prev		
				2	Reverse Prev		

Prohibited direction of motor rotation may be selected.

0 : None: Both forward and reverse rotations are possible.

1 : Forward Prev: Forward operation is prevented.

2 : Reverse Prev: Reverse operation is prevented.

*. When Inverter is operated by LCD Loader, **REV** is limited. when Inverter is decreased to 0hz by REV button while FWD driving, Inverter maintains present state during driving.

6.9 Starting with Power on: Power-on Run

Group	Code	Name	LCD display	Setting		Setting range	Unit
Operation	drv	Operation command method	Cmd Source	1 2	Fx/Rx-1 or Fx/Rx-2	0 - 4	-
Ad	10	Starting with power on	Power-on Run	1	Yes	0 - 1	-

When power is supplied to the inverter, the motor accelerates if the terminal block operating command is turned on. It is valid only if the selection of the drv operation command (Cmd Source) of the operation group is set to 1 (Fx/Rx-1) or 2 (Fx/Rx-2). At this moment, a trip may occur if the inverter begins to operate when the fan load is in free-run state. Thus, if you set the bit 4 to 1 in the Cn.71 speed search, the inverter will start to operate by performing speed search on startup. If the speed search is not selected, it will accelerate to the normal V/F pattern without speed search on acceleration. If this function is not selected, the operation command of the terminal block should be turned off and then on, in order to begin operation.

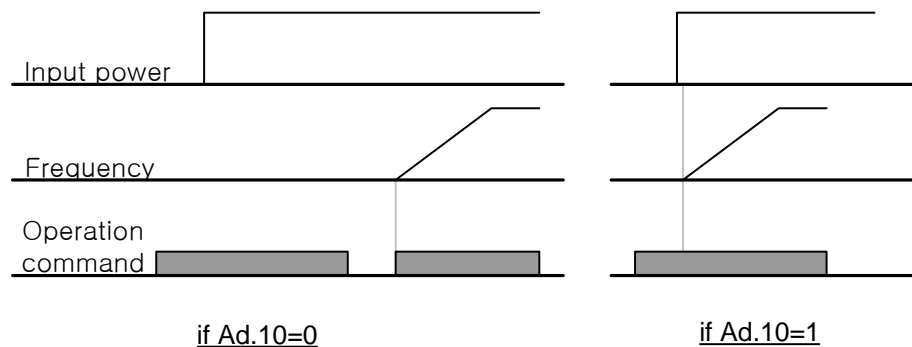


Figure 6-14 Comparison of the Power-on Run function when it is set to Ad.10=0 or Ad.10= 1

⚠ Caution

- When using this function, be aware of the risk of accident because the motor will rotate as soon as the power is supplied.

6.10 Starting on Reset After a Trip Takes Place: Reset Restart

Group	Code	Name	LCD display	Setting	Setting range	Unit
operation	drv	Operation command method	Cmd Source	1 2	Fx/Rx-1 or Fx/Rx-2	-
Pr	08	Selection of startup on trip reset	RST Restart	1	Yes	-
Pr	09	Number of automatic restarts	Retry Number	0	0 - 10	-
Pr	10	Delay time of automatic restart	Retry Delay	1.0	0 - 60	sec

When reset after a trip takes place, the motor accelerates if the terminal block operating command is turned on. When an inverter trip occurs, the inverter will cut off the power so that the motor will be in free-run state. At this moment, a trip may occur again if the inverter begins to operate; thus, if you set the bit 2 to 1 in the Cn.71 speed search, the inverter will start to operate by performing speed search on fault reset. If the speed search is not selected, it will accelerate to the normal V/F pattern without speed search on acceleration. If this function is not required, the operation command should be turned off and then on after reset, in order to begin operation.

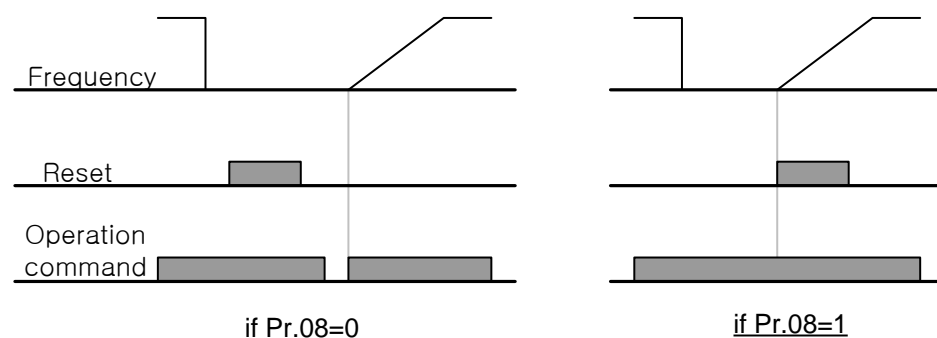


Figure 6-15 Comparison of the RST Restart function when it is set to Pr.08 = 0 or Pr.08 = 1

⚠ Caution

- When using this function, be aware of the risk of accident because the motor will rotate if a RUN command is present on the terminal block or the keypad after a trip has been reset.

6.11 Setting Acc/Dec Time

(1) Acc/Dec time setting based on max. frequency

Group	Code	Name	LCD display	Setting	Setting range	Unit	
Operation	ACC	Acceleration time	Acc Time	20.0	0.0 - 600.0	sec	
Operation	dEC	Deceleration time	Dec Time	30.0	0.0 - 600.0	sec	
dr	20	Maximum frequency	Max Freq	60.00	40.00 - 400.00	Hz	
bA	08	Acc/Dec reference frequency	Ramp T Mode	0	Max Freq	0 - 1	-
bA	09	Time unit setting	Time scale	1	0.1 sec	0 - 2	-

If you set 08 in the basic function group (bA) to Max Freq, you can accelerate and decelerate with the same gradient based on the maximum frequency irrespective of the operation frequency. The acceleration time set from 03 of the drive group (dr) is the time elapsed from 0 Hz to the maximum frequency, while the deceleration time from 04 is that from the maximum frequency to 0 Hz.

Example) If you set the maximum frequency to 60.00 Hz, Acc/Dec time to 5 sec, and the operation frequency to 30 Hz, the time required to reach 30 Hz will be 2.5 sec.

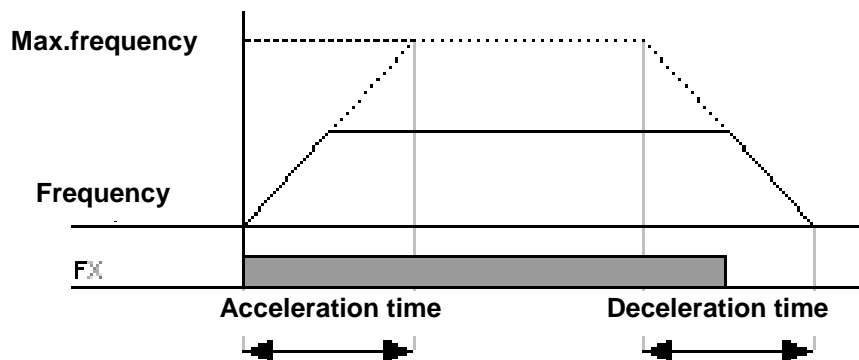


Figure 6-16 Setting Acc/Dec time

bA.09 Time scale: Used when precise acceleration/deceleration time is necessary depending on the load characteristic or it is required to increase the maximum set time. Change the units of all functions related to time.

Setting type		Range of setting Acc/Dec time	Setting details
0	0.01 sec	0.00 - 60.00	Able to set down to the unit of 0.01 sec.
1	0.1 sec	0.0 - 600.0	Able to set down to the unit of 0.1 sec.
2	1 sec	0 - 6000	Able to set down to the unit of 1 sec.

⚠ Caution

- Be careful when you change the unit because the maximum allowable time will be changed as well. With the acceleration time set to 1000 sec, it will be changed to 60.00 sec if you change the bA.09 Time scale to the type 0 (0.01 sec).

(2) Setting Acc/Dec Time Based on Operation Frequency

Group	Code	Name	LCD display	Setting	Setting range	Unit
Operation	ACC	Acceleration time	Acc Time	20.0	0.0 - 600.0	sec
Operation	dEC	Deceleration time	Dec Time	30.0	0.0 - 600.0	sec
bA	08	Acc/Dec reference frequency	Ramp T Mode	1	Delta Freq	-

If you set 08 in the basic function group (bA) to Delta Freq, you can set the acceleration and deceleration time to the time elapsed from the current operation frequency at constant speed to the target frequency in the next step. With the acceleration time set to 5 sec and 10 Hz/30 Hz step operation at stationary state, the behavior of the acceleration time will be as follows:

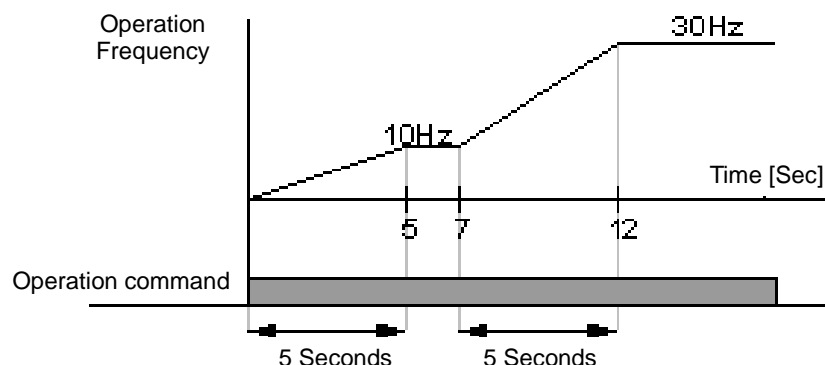


Figure 6-17 Acceleration time set to 5 sec and 10 Hz/30 Hz step operation at stationary state

(3) Setting Multi-step Acc/Dec Time Using Multi-function Terminals

Group	Code	Name	LCD display	Setting	Setting range	Unit	
Operation	ACC	Acceleration time	Acc Time	20.0	0.0 - 600.0	sec	
Operation	dEC	Deceleration time	Dec Time	30.0	0.0 - 600.0	sec	
bA	70 - 82	Multi-step acceleration time 1 - 7	Acc Time - 1 - 7	x.xx	0.0 - 600.0	sec	
bA	71 - 83	Multi-step deceleration time 1 - 7	Dec Time - 1 - 7	x.xx	0.0 - 600.0	sec	
In	65 - 71	Setting Px terminal function	Px Define (Px: P1-P7)	11	XCEL-L	0 - 49	-
In	65 - 71	Setting Px terminal function	Px Define (Px: P1-P7)	12	XCEL-M		-
In	89	Multi-step command delay time	In Check Time	1	1 - 5000	ms	

It is possible to change acceleration and deceleration time using multi-function terminals. Set the time for acceleration/deceleration in ACC, dEC of the operation group and the time for Acc Time 1 - 7 and Dec Time 1 - 7 in the codes from 70 to 83. After selecting a terminal to be used as the multi-step acceleration/deceleration time command out of the multi-function terminals P1 to P7, set each one of the multi-step acceleration/deceleration commands (XCEL-L, XCEL-M, XCEL-H). XCEL-L and XCEL-M are recognized as binary codes, so the system operates by selecting the acceleration/deceleration time set from bA.70 to bA.83. If the multi-function terminals P6 and P7 are set to XCEL-L, XCEL-M and XCEL-H individually, the system operates as follows:

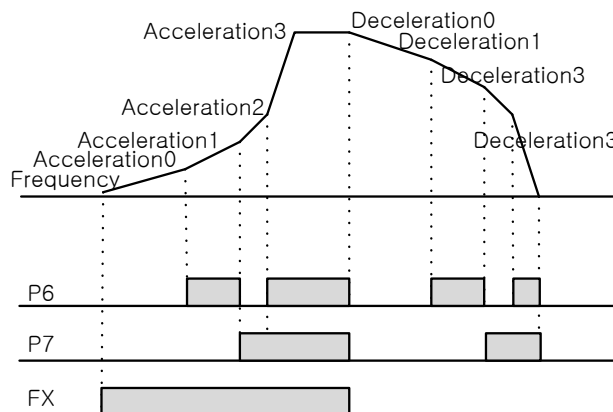


Figure 6-18 Setting multi-step Acc/Dec time using multi-function terminals

Table 5-4 Setting multi-function terminals P6 and P7

Acc/Dec time	P7	P6
0	-	-
1	-	✓
2	✓	-
3	✓	✓

In.89 In Check Time: Using the multi-function input terminal with the multi-step acceleration/deceleration setting, you can set the time to check the terminal block input within the inverter. For example, with the In Check Time of the terminal block set to 100 ms and the multi-function terminal P6 input, the system will check if there is any input from another terminal block for 100 ms. When 100 ms has elapsed, it will be set to acceleration/deceleration time relevant to the P6 terminal.

(4) Changing Multi-step Acc/Dec Time by Setting Acc/Dec Time Transition Frequency

Group	Code	Name	LCD display	Setting	Setting range	Unit
Operation	ACC	Acceleration time	Acc Time	10.0	0.0 - 600.0	sec
Operation	dEC	Deceleration time	Dec Time	10.0	0.0 - 600.0	sec
bA	70	Multi-step acceleration time 1	Acc Time-1	20.0	0.0 - 600.0	sec
bA	71	Multi-step deceleration time 1	Dec Time-1	20.0	0.0 - 600.0	sec
Ad	60	Acc/Dec time transition frequency	Xcel Change Fr	30.00	0 - Max. frequency	Hz

It is possible to change acceleration and deceleration gradient without using multi-function terminal. The system will operate with the gradient set in bA.70 and 71 at below the Acc/Dec transition frequency set in Ad.60 by the operation frequency. However, when the operation frequency increases to higher than the Acc/Dec transition frequency, it will operate with the Acc/Dec gradient set in ACC and dEC of the operation group. If the multi-function input terminal function is set and input to the multi-step Acc/Dec (XCEL-L, XCEL-M and XCEL-H), it will operate with multi-step Acc/Dec input irrespective of the Acc/Dec transition frequency.

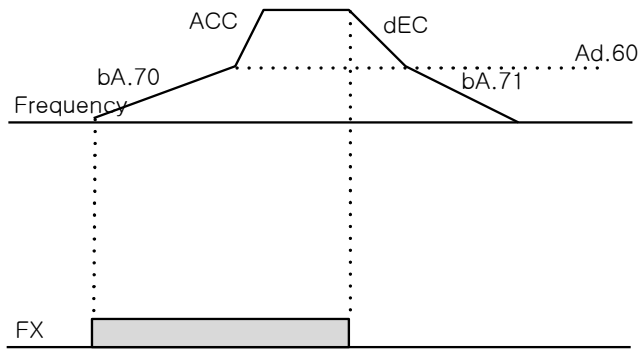


Figure 6-19 Changing multi-step Acc/Dec time by setting Acc/Dec time transition frequency

6.12 Setting Acc/Dec Pattern

Group	Code	Name	LCD display	Setting		Setting range	Unit
bA	08	Acc/Dec reference frequency	Ramp T mode	0	Max Freq	0 - 1	-
Ad	01	Accelerating pattern	Acc Pattern	0	Linear	0 - 1	-
Ad	02	Decelerating pattern	Dec Pattern	1	S-Curve		-
Ad	03	S-curve acceleration start point gradient	Acc S Start	40		1 - 100	%
Ad	04	S-curve acceleration end point gradient	Acc S End	40		1 - 100	%
Ad	05	S-curve deceleration start point gradient	Dec S Start	40		1 - 100	%
Ad	06	S-curve deceleration end point gradient	Dec S End	40		1 - 100	%

Set the patterns of acceleration and deceleration gradient. There are two types of patterns with the following functions:

Setting type		Function
0	Linear	The output frequency has a constant magnitude and linearly increases or decreases.
1	S-curve	Used for applications where smooth acceleration/deceleration is required such as elevator load or door. S-curve ratio is adjustable by using the functions from 03 to 06.
		<p style="text-align: center;">⚠ Caution</p> <ul style="list-style-type: none"> Pay attention when setting the Acc/Dec pattern to S-curve because it will cause the relevant time to be longer than the set Acc/Dec time. For actual Acc/Dec time, refer to page 6.11 Setting Acc/Dec Time.

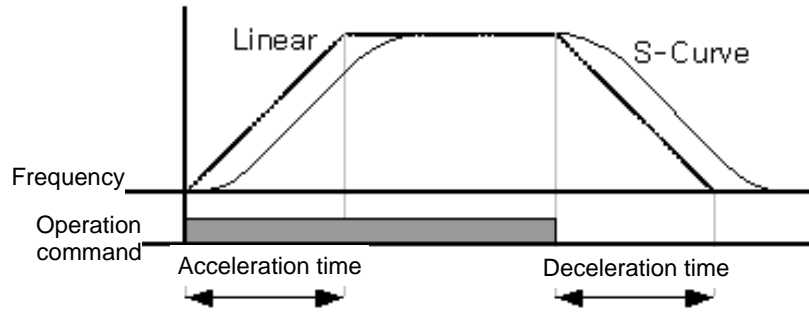


Figure 6-20 Setting Acc/Dec pattern

Ad.03 Acc S Start: When setting the Acc/Dec pattern to S-curve, the curve gradient may be adjustable. Used to adjust the S-curve ratio when beginning to accelerate. The curve ratio is based on 1/2 of the target frequency; thus, be sure to set the ratio that the curve acceleration occupies out of the 1/2 frequency. For example, if the target frequency is identical to the maximum frequency (max Freq [Hz]), the value will be 60 Hz. Thus, with Ad.03 Acc S Start set to 50%, the frequency range which the curve acceleration will occupy when the S-curve accelerates to 30 Hz will be 0 to 15 Hz, and the 15 Hz - 30 Hz section will be linear acceleration.

Ad.04 Acc S End: The curve gradient can be adjusted at the moment when the operation frequency reaches the target frequency. In the same manner for Acc S Start, set the ratio that the curve acceleration occupies out of the remaining section based on 1/2 frequency of the target frequency. In the case of setting like the example of Acc S Start, the system will accelerate with a linear gradient from 30 to 45 Hz while accelerating with a curve gradient from 45 to 60 Hz, and then operate at constant speed.

Ad.05 Dec S Start - Ad.06 Dec S End: Set the curve deceleration gradient ratio for deceleration. It is the same as the acceleration ratio described above the setting method.

Acc/Dec time at the S-curve:

Actual acceleration time = set acceleration time + set acceleration time * starting point slope/2 + set acceleration time * ending point slope/2

Actual deceleration time = set deceleration time + set deceleration time * starting point slope/2 + set deceleration time * ending point slope/2

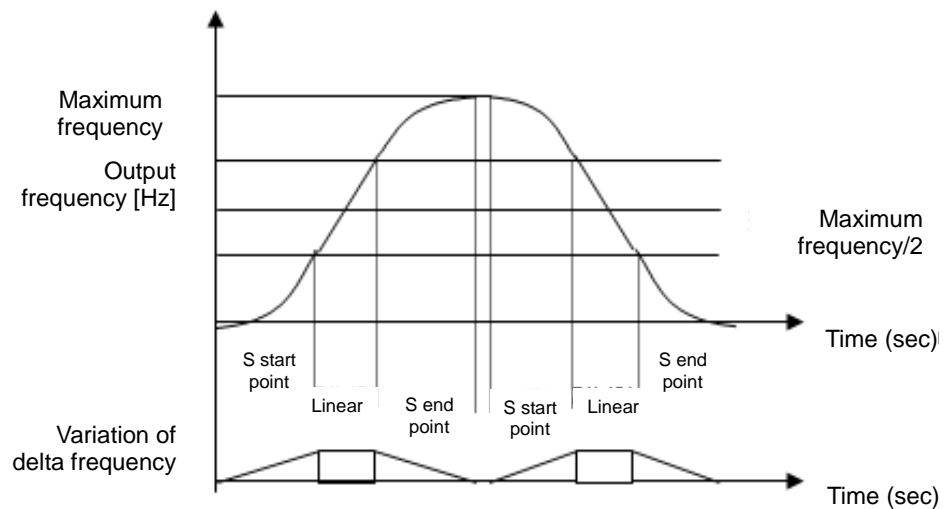


Figure 6-21 S-Curve Acc/Dec pattern

6.13 Acc/Dec Stop Command

Group	Code	Name	LCD display	Setting	Setting range	Unit
In	65 - 71	Setting Px terminal function	Px Define (Px: P1 - P7)	25 XCEL Stop	-	-

It is possible to stop acceleration or deceleration and operate at constant speed using the multi-function terminal. The figure below shows the use of the multi-function terminal P7.

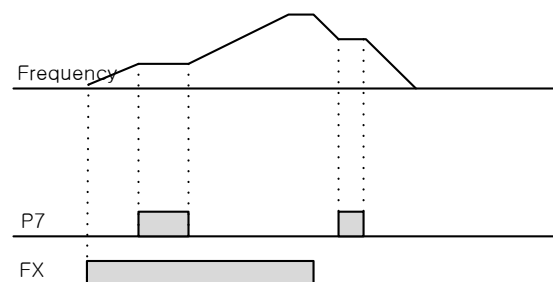


Figure 6-22 Acc/Dec stop command using the terminal P7

6.14 V/F Voltage Control

Set the magnitude and gradient of voltage, output pattern, etc. according to the output frequency. In addition, adjust the amount of torque boost at low speed.

■ Linear V/F Pattern Operation

Group	Code	Name	LCD display	Setting	Setting range	Unit
dr	09	Control mode	Control Mode	0	V/F	-
dr	18	Base frequency	Base Freq	60.00	30.00 - 400.00	Hz
dr	19	Start frequency	Start Freq	0.50	0.01 - 10.00	Hz
bA	07	V/F pattern	V/F Pattern	0	Linear	-

The output voltage is increased and decreased at a certain rate according to the ratio of voltage/frequency (V/F), depending on the fluctuation of frequency. It is used for constant torque load requiring a constant torque irrespective of frequency.

- **dr.18 Base Freq:** Sets the base frequency. This is the frequency in which the inverter's rated voltage is output. Enter the frequency stated on the motor nameplate.
- **dr.19 Start Freq:** Sets the start frequency. This is the frequency in which the inverter voltage begins to be output. If the target frequency is lower than the start frequency, no voltage is output from the inverter. If it began to operate above the start frequency and then decelerates to stop, however, it will stop as shown in the figure below.

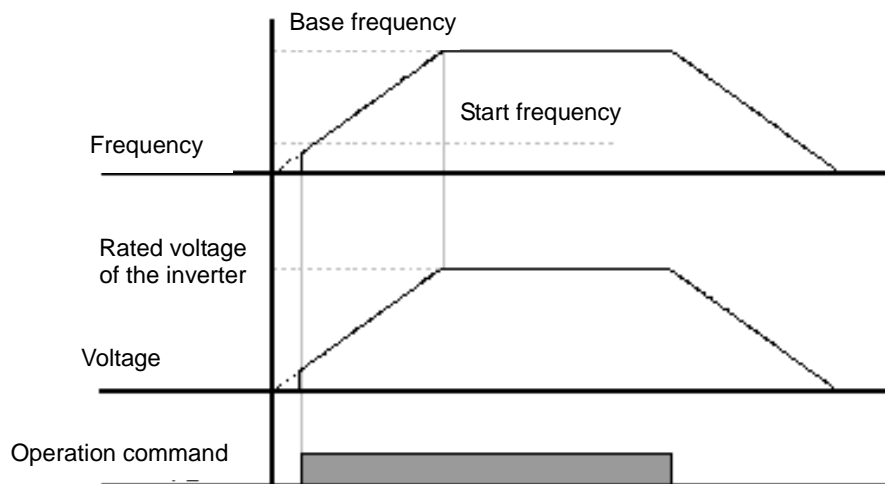


Figure 6-23 In the case of operating above the start frequency and then decelerating to stop

■ Square Reduction V/F Pattern Operation (Operation When Using Fan and Pump Load)

Group	Code	Name	LCD display	Setting		Setting range	Unit
bA	07	V/F pattern	V/F Pattern	1	Square	0 - 3	-
				3	Square 2		

This is an operation pattern suitable for a load with the starting characteristics of square reduction, such as fan, pump, etc. Select the Square or Square 2 for use depending on the start characteristic of load.

- **Square:** The voltage is output proportionally to the value of the frequency raised to the 1.5th power (command frequency * 1.5).
- **Square 2:** The voltage is output proportionally to the value of the frequency raised to the 2nd power (command frequency * 2). It is used for variable torque (VT) load such as fan or pump.

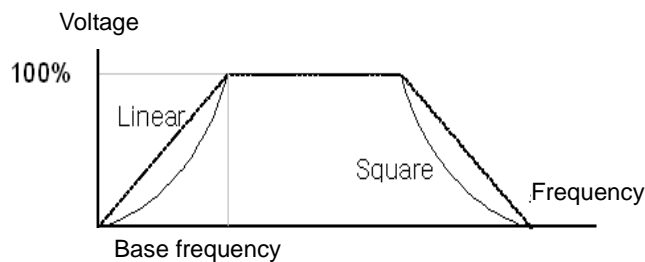


Figure 6-24 Square reduction V/F pattern operation

■ User defined V/F Pattern Operation

Group	Code	Name	LCD display	Setting		Setting range	Unit
bA	07	V/F pattern	V/F Pattern	2	User V/F	0 - 3	-
bA	41	User frequency 1	User Freq 1	15.00		0 - Max. frequency	Hz
bA	42	User voltage 1	User Volt 1	25		0 - 100%	%
bA	43	User frequency 2	User Freq 2	30.00		0 - Max. frequency	Hz
bA	44	User voltage 2	User Volt 2	50		0 - 100%	%
bA	45	User frequency 3	User Freq 3	45.00		0 - Max. frequency	Hz
bA	46	User voltage 3	User Volt 3	75		0 - 100%	%

Group	Code	Name	LCD display	Setting	Setting range	Unit
bA	47	User frequency 4	User Freq 4	60.00	0 - Max. frequency	Hz
bA	48	User voltage 4	User Volt 4	100	0 - 100%	%

The user can make the setting according to the V/F and load patterns of a special motor instead of a general induction motor.

- **bA.41 User Freq 1 - bA.48 User Volt 4:** Select an arbitrary frequency between the start frequency and the maximum frequency to set the user frequency (User Freq x), and set the voltages corresponding to each frequency to the user voltage (User Volt x).

Notes

- The output voltage 100% is based on the bA.15 Rated Volt setting.
- However, it is based on the input voltage if the bA.15 Rated Volt is set to '0.'

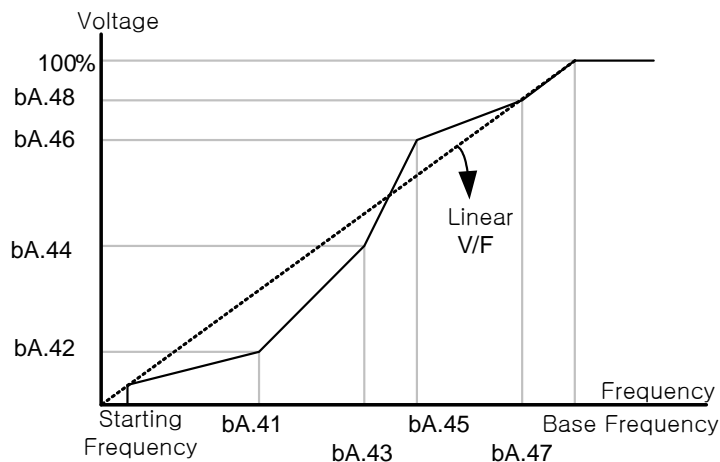


Figure 6-25 bA.41 User Freq 1 - bA.48 User Volt 4 user V/F pattern operation

⚠ Caution

- If you set the pattern so that it deviates greatly from the linear V/F pattern when using a general induction motor, the torque may become insufficient or the motor may overheat due to excessive excitation.
- When you use the user V/F pattern, the forward torque boost (dr.16 Fwd Boost) and the reverse torque boost (dr.17 Rev Boost) do not work.

6.15 Torque Boost

- Manual Torque Boost (When a high start torque is required for **certain load types.**)

Group	Code	Name	LCD display	Setting		Setting range	Unit
dr	15	Torque boost method	Torque Boost	0	Manual	0 - 1	-
dr	16	Forward torque boost	Fwd Boost	2.0		0.0 - 15.0	%
dr	17	Reverse torque boost	Rev Boost	2.0		0.0 - 15.0	%

Adjusts the output voltage during low speed operation or when starting. You can increase the output voltage in the low speed area to improve the start characteristic or raise the low speed torque.

- dr.16 Fwd Boost:** Adjusts the amount of torque boost during forward rotation.
- dr.17 Rev Boost:** Adjusts the amount of torque boost during reverse rotation.

⚠ Caution

- If you set the amount of torque boost too large, the motor may overheat at low speed due to excessive excitation.

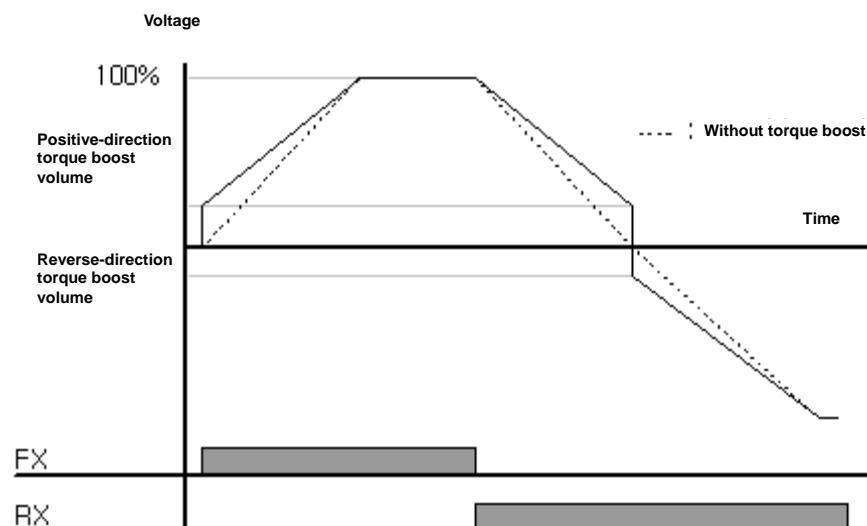


Figure 6-26 Manual torque boost

■ Auto Torque Boost (When a large amount of starting torque is required or automatic adjustment function is used)

Group	Code number	Function display	Setting display		Setting Range
dr	15	Torque Boost	1	Auto	0 - 1
bA	20	Auto Tuning	3	Rs+Lsigma	-

Using the motor parameters, the inverter will automatically calculate the amount of torque boost and output the voltage. Since the stator resistance, the inductance value and no-load current value of the motor are required to have the automatic torque boost function to operate properly, be sure to perform auto-tuning (bA.20 Auto Tuning) prior to use.

6.16 Adjustment of Motor Output Voltage

(Setting the motor voltage when the input power supply is different from the motor voltage specification)

Group	Code	Name	LCD display	Setting	Setting range	Unit
bA	15	Rated motor voltage	Rated Volt	0	0, 170 - 480	V

Enter the voltage stated on the motor nameplate. The set voltage value becomes the output voltage value at the base frequency. At a level higher than the base frequency, the output voltage will be dependent on the set value if the input voltage is higher than the set voltage. But if it is lower, the input voltage will be output.

If setting it to '0,' the output voltage will be compensated based on the input voltage while the inverter is stationary. At a level higher than the base frequency, the input voltage will be output if the input voltage is lower than the set voltage.

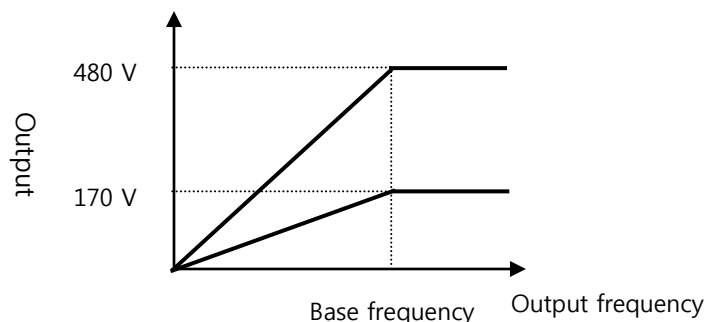


Figure 6-27 Setting the motor voltage when the input power supply is different from the motor voltage specification

6.17 Start Mode Selection

Select the start mode when the operation command is input at stationary state.

Group	Code	Name	LCD display	Setting	Setting range	Unit
Ad	07	Start mode	Start mode	0 Acc	0 - 1	-
Ad	12	DC braking time at startup	Dc-Start Time	0.00	0.00 - 60.00	sec
Ad	13	Amount of applied DC	Dc Inj Level	50	0 - 200	%

■ Accelerating Start

Group	Code	Name	LCD display	Setting	Setting range	Unit
Ad	07	Start mode	Start mode	0 Acc	0 - 1	-

It is a general acceleration method. When there is no function selection, it accelerates directly to the target frequency on operation command input.

■ Start after DC Braking

Group	Code	Name	LCD display	Setting	Setting range	Unit
Ad	07	Start mode	Start Mode	1 Dc-Start	0 - 1	-
Ad	12	DC braking time at startup	Dc-Start Time	0.00	0.00 - 60.00	sec
Ad	13	Amount of applied DC	Dc Inj Level	50	0 - 200	%

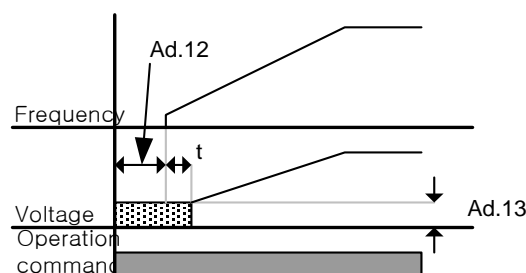


Figure 6-28 Start after DC braking

Accelerates after supplying DC voltage to the motor for a set time. When the motor is rotating before the voltage is supplied from the inverter, it can stop the motor revolution by DC braking and then make acceleration. Also, when applying mechanical brake to the motor shaft, it may be used if a constant torque is required even after opening the mechanical brake.

⚠ Caution

- The DC braking quantity is the basis of the set motor rated current, so do not set the current value higher than the inverter rated current. Or the motor may be overheated or damaged.
- If the DC braking quantity is too large or the braking time is too long, the motor may be overheated or damaged.

6.18 Stop Mode Selection

Select a method to stop the motor when a stop command is input to the inverter during its operation.

■ Deceleration Stop

Group	Code	Name	LCD display	Setting		Setting range	Unit
Ad	08	Stop mode	Stop Mode	0	Dec	-	-

This is a general deceleration method. When there is no function selection, the motor decelerates(ramps) down to 0 Hz and then stops, as shown in the figure below.

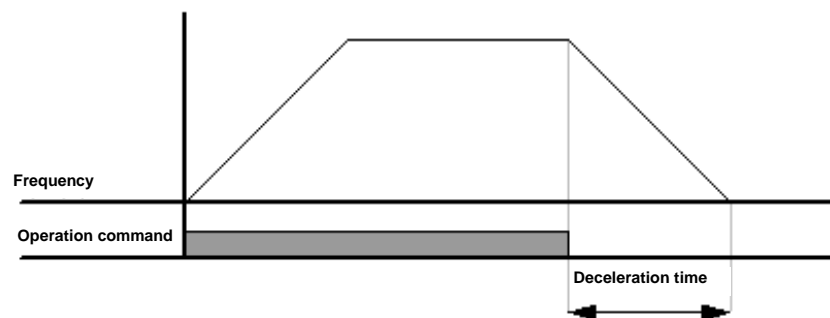


Figure 6-29 Deceleration stop

■ Stopping using DC Braking

(Stopping the motor by supplying direct current at a preset frequency during deceleration)

When the frequency reaches the set value during deceleration, the motor will be stopped by DC braking.

Group	Code	Name	LCD display	Setting display		Range	Unit
Ad	08	Stop mode	Stop Mode	1	DC-Brake	-	-
Ad	14	Output prior to DC braking	Dc-Block Time	0.10		0.00 - 60.00	sec
Ad	15	DC braking time	Dc-Brake Time	1.00		0 - 60	sec
Ad	16	DC braking quantity	Dc-Brake Level	50		0 - 200	%
Ad	17	DC braking frequency	Dc-Brake Freq	5.00		0.00 - 60.00	Hz

When the deceleration begins with the stop command input and the frequency reaches the DC braking frequency (Ad.17 Dc-Brake Freq), the motor receives DC voltage and stops.

- **Ad.14 Dc-Block Time:** Set the time to block the inverter output before starting DC braking. If the load inertia is large or the DC braking frequency (Ad.17 Dc-Brake Freq) is high, a trip may occur due to overcurrent when supplying DC voltage to the motor. Therefore, adjust this time to prevent an overcurrent trip.
- **Ad.15 Dc-Brake Time:** Set the time to supply DC voltage to the motor.
- **Ad.16 Dc-Brake Level:** You can adjust the DC braking quantity. The reference is the rated current of the motor.
- **Ad.17 Dc-Brake Freq:** Set the start frequency for DC braking. When the inverter begins to decelerate and reaches this frequency, it begins DC braking.

Notes

- If you use the dwell frequency and set it to a level lower than the DC braking frequency, the dwell operation will not work, but the DC braking will be performed instead.

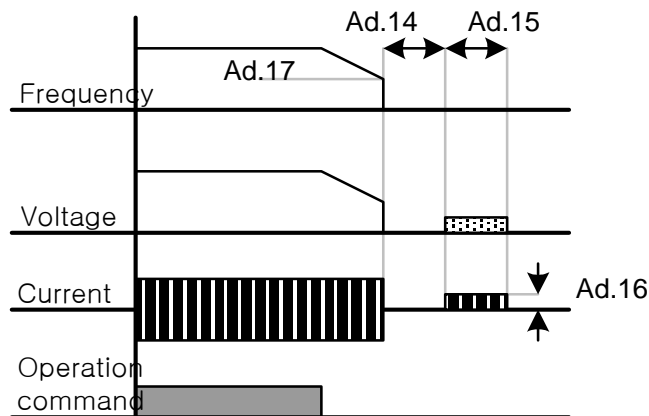


Figure 6-30 Stop after DC braking

⚠ Caution

- If the DC braking quantity is too large or the braking time is too long, the motor may be overheated or damaged, so be careful about this matter.
- The DC braking quantity is the basis of the set motor rated current, so do not set the current value higher than the inverter rated current. Or the motor may be overheated or damaged.

■ Free-run stop (Coasting)

Group	Code	Name	LCD display	Setting display	Setting range	Unit
Ad	08	Stop mode	Stop mode	2 Free-Run	-	-

When the operation command is turned off, the inverter output is blocked and the motor free-wheels without power to stop.

⚠ Caution

- When the inertia on the motor load side is large and the motor is operating at high speed, the motor may still rotate due to the load inertia even when the inverter output is blocked, so caution is required.

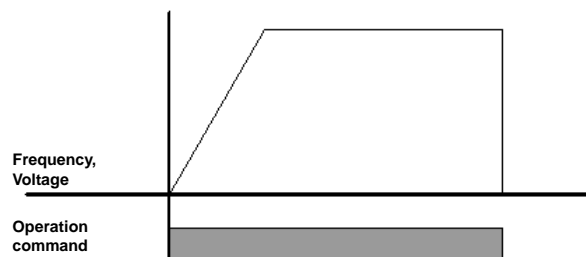


Figure 6-31 Free-run stop

■ Power Braking

(Optimally decelerating without overvoltage trip)

Group	Code	Name	LCD display	Setting	Setting range	Unit
Ad	08	Stop mode	Stop Mode	4 Power Braking	-	-

In the case that the inverter DC voltage rises above a certain level due to the motor regenerative energy, adjust the deceleration gradient or perform the acceleration again to reduce the regenerative energy. Power braking can be used when a short deceleration time is needed without any other braking resistance and braking unit. However, the deceleration time may be longer than the set deceleration time, be careful not to cause any damage due to motor overheating when using power braking for a load with frequent deceleration.

⚠ Caution

- Do not use this function where frequent deceleration takes place or the motor may be overheated or damaged.
- The stall prevention and power braking functions work only during deceleration, the latter takes higher priority. For example, when both BIT3 of Pr.50 and the power braking of Ad.08 are set, the power braking will function. Overvoltage trip may occur when the deceleration time is too short or the inertia is large.

6.19 Frequency Limit

You can limit the operation frequency setting using the maximum frequency, start frequency, upper/lower limit of frequency, etc.

■ Limiting Frequency Using the Maximum Frequency and the Start Frequency

Group	Code	Name	LCD display	Setting	Setting range	Unit
dr	19	Start frequency	Start Freq	0.50	0.01 - 10.00	Hz
dr	20	Maximum frequency	Max Freq	60.00	40.00 - 400.00	Hz

- **dr.19 Start Freq:** Has lower limit function for the parameter with the unit related to speed (Hz, rpm). It is set to 0.00 if you set the frequency lower than the start frequency.
- **dr.20 Max Freq:** Has upper limit function for the parameter with all speed units (Hz, rpm) except for the base frequency (dr.18 Base Freq). *It is not possible to set the base frequency higher than the maximum frequency.*

■ Limiting Frequency Using the Upper and Lower Limit of Frequency

Group	Code	Name	LCD display	Setting	Setting range	Unit
Ad	24	Frequency limit	Freq Limit	0 No	0 - 1	-
Ad	25	Lower limit frequency	Freq Limit Lo	0.50	0.0 - upper limit	Hz
Ad	26	Upper limit frequency	Freq Limit Hi	60.00	0.50 - Max. frequency	Hz

- **Ad.24 Freq Limit:** *When setting to Yes(1) with the initial setting of No(0), the frequency can be set only between the lower limit (Ad.25) and the upper limit (Ad.26). With the setting of No, the Ad.25 and Ad.26 codes are not visible.*
- **Ad.25 Freq Limit Lo, Ad.26 Freq Limit Hi:** Set the upper limit and lower limit, respectively. The maximum and minimum settings of the upper and lower limits are limited to the lower limit and the upper limit, respectively. In addition, when setting the frequency with the keypad, the frequency can be set between the upper limit and the lower limit.

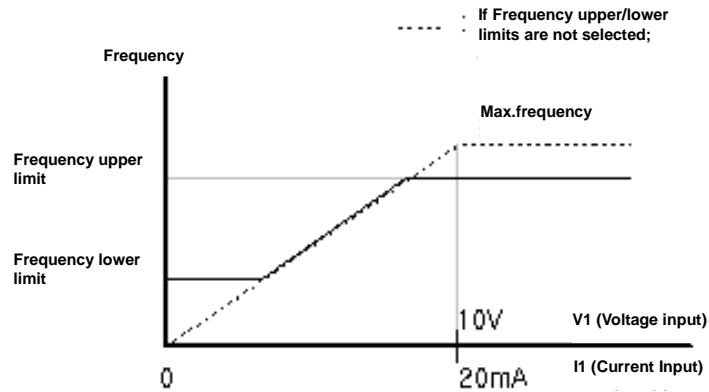


Figure 6-32 Limiting frequency using the upper and lower limit of frequency

■ Frequency Jump

(Avoiding mechanical resonance frequency)

The frequency jump function is to prevent the frequency setting so as not to operate within the resonance frequency band where any resonance may occur in the user's mechanical system. The frequency jump band will be passed while the motor accelerates or decelerates; thus, you cannot set the frequency within the set frequency jump band.

Group	Code	Name	LCD display	Setting		Setting range	Unit
Ad	27	Frequency jump	Jump Freq	0	No	0 - 1	-
Ad	28	Lower limit 1 of jump frequency	Jump Lo 1	10.00		0.00 - Upper limit 1 of jump frequency	Hz
Ad	29	Upper limit 1 of jump frequency	Jump Hi 1	15.00		Lower limit 1 of jump frequency 1 - Max. frequency	Hz
Ad	30	Lower limit 2 of jump frequency	Jump Lo 2	20.00		0.00 - Upper limit 2 of jump frequency	Hz
Ad	31	Upper limit 2 of jump frequency	Jump Hi 2	25.00		Lower limit 2 of jump frequency 1 - Max. frequency	Hz
Ad	32	Lower limit 3 of jump frequency	Jump Lo 3	30.00		0.00 - Upper limit 3 of jump frequency	Hz
Ad	33	Upper limit 3 of jump frequency	Jump Hi 3	35.00		Lower limit 3 of jump frequency 1 - Max. frequency	Hz

In the case of increasing the frequency setting, when the frequency setting value (voltage, current, RS-485 communication, keypad setting, etc.) is within the jump frequency band, it will be maintained at the lower limit value of the frequency jump and then the frequency will be increased when the value gets out of the frequency jump band.

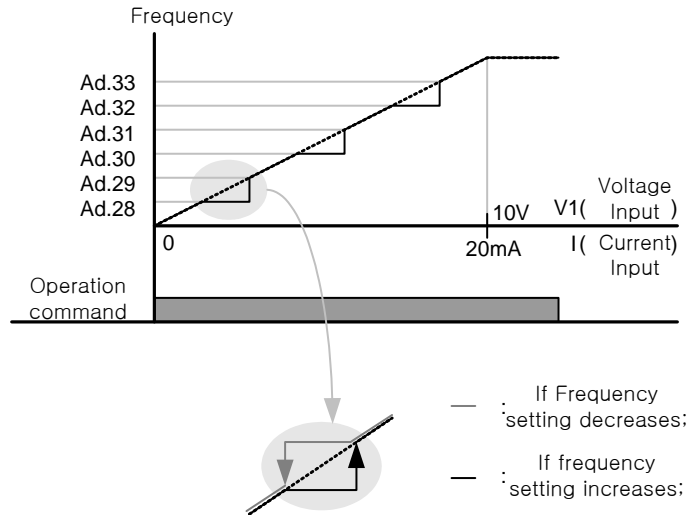


Figure 6-33 Frequency jump

6.20 Selection of Second Operation Method

(Switching to another operation method)

Using a multi-function input terminal, you can input the frequency setting, operation command, etc. as the second setting value. You can use this function to stop remote control and operate on the inverter body, when you are performing remote operation using any communication option.

Group	Code	Name	LCD display	Setting	Setting range	Unit	
Operation	drv	Operation command method	Cmd Source	1	Fx/Rx-1	0 - 4	-
Operation	Frq	Frequency setting Action	Freq Ref Src	2	V1	0 - 12	-
bA	04	The second operation command method	Cmd 2nd Src	0	Keypad	0 - 4	-
bA	05	The second frequency setting method	Freq 2nd Src	0	KeyPad-1	0 - 12	-
In	65 - 71	Setting Px terminal function	Px Define (Px: P1-P7)	15	2nd Source	0 - 49	-

Select it as 15 2nd Source by selecting one of the multi-function terminals between In.65 and In.71 of the terminal block input group.

- **bA.04 Cmd 2nd Src, bA.05 Freq 2nd Src:** If the multi-function input terminal set as the 2nd Source is turned on, the operation can be performed with the set values from the bA.04 and 05 instead of the set values from the drv code and the Frq code of the operation group.
- **Cmd 2nd Src is the main source, which cannot be changed during operation.**

⚠ Caution

- If you set a multi-function input terminal to the 2nd Source and turn it on, the operation state will be changed because all of the relevant commands including the frequency command and the operation command will be changed to the 2nd commands. Therefore, ensure that the 2nd commands are correctly set before inputting the selected multi-function terminal. Overvoltage trip may occur when the deceleration time is too short or the inertia is large.





6.21 Multi-function Input Terminal Control

(Improving the response of input terminals)

Filter time constant, contact type, and so on for the multi-function input terminal of the inverter terminal block can be set.





Group	Code	Name	LCD display	Setting	Setting range	Unit
In	85	Multi-function input terminal on filter	DI On Delay	10	0 - 10000	ms
In	86	Multi-function input terminal off filter	DI Off Delay	3	0 - 10000	ms
In	87	Selection of multi-function input contact	DI NC/NO Sel	000 0000 ²⁶	-	-
In	90	State of multi-function input terminal	DI Status	000 0000	-	-

- **In.85 DI On Delay, In.86 DI Off Delay:** When the input terminal state does not change during the set time after the terminal is input, it is recognized as on or off.
- **In.87 DI NC/NO Sel:** You can select the contact type of the input terminal. Used as A contact state (normal open) when setting the dot position of the switch corresponding to each bit to the below position, while used as B contact state (normal close) when setting it to the above position. The order is P1, P2 ..., and P7 from the right..

Display	B contact state	A contact state
Segment		
LCD		

- **In.90 DI Status:** Displays the state of the input terminal block. If you set the corresponding bit to A contact in dr.87, the On state will be indicated when the dot mark of the switch is above while the Off state is indicated when it is below. It acts in the opposite way when it is set to B contact. The states are displayed in the order of P1, P2 ..., and P7 from the right.

²⁶ The initial value 000 0000 is displayed as  in the SEG.

Display	Bit setting state when setting A contact (On)	When setting A contact Bit setting off state (Off)
Segment		
LCD		

7. RS-485 Communication Function

7.1 Introduction of Communication Function

This user manual explains the standards, installation and programs of the serial communication of the LSLV-S100 inverter for communicating with PC or FA computer. Communication method for LSLV-S100 inverter is designed to operate or monitor LSLV-S100 series inverter from long distance using CPU or FA computer (below).

■ Advantages Using Communication Method

Since the inverter can be operated or monitored by a user-programmed PC or PLC, it is easily applicable to factory automation.

- Changing or monitoring parameter by computer is possible.
(Ex: Acc/Dec Time, Frequency Command, etc.)
- Interface type of RS-485 standards:
 - a. Communication between inverter and computers of various companies is possible.
 - b. Since it is multi-drop link system, single computer can control up to 16 inverters simultaneously.
 - c. Highly immune to electro-magnetic interference.

The inverter is capable of communicating with the RS-232 card integrated computer via commonly sold RS-232/485 converter. Specifications and performance of converter vary depending on the manufacturer, but basic functions are identical. Please refer to user manual of the manufacturer for details about specifications and usage method.

Caution

- Read this manual carefully before you install or run the inverter.
- Failure to comply with this manual may result in injury or damage to other instruments.
- Make sure to connect PLC and inverter SG. Communication error by noise might occur.

7.1.1 Communication Standard

Table 7-1 Communication standard

Item	Standard
Communication method	RS-485
Transmission type	Bus type, Multi drop Link System
Inverter type name	LSLV-S100 series
Number of connected inverters	Maximum 16
Transmission distance	Maximum 1,200 m (Recommended distance: within 700 m)
Recommended wires	0.75 mm ² (18AWG), Shield Type Twisted-Pair Wire
Installation type	Connect to the dedicated terminal (S+, S-, SG) of control terminal block
Power supply	Use the insulated power from the interior of the inverter as the power supply (supplied by the inverter).
Communication speed	Can be selected among 1,200/2,400/9,600/19,200/38,400/57,600/115,200 bps
Control procedure	Asynchronous communications system
Communication system	Half duplex system
Letter system	Modbus-RTU: Binary, LS Bus: ASCII
Stop bit length	1-bit / 2-bit
Frame error check	2 bytes
Parity check	None/Even/Odd

7.1.2 Communication System Configuration

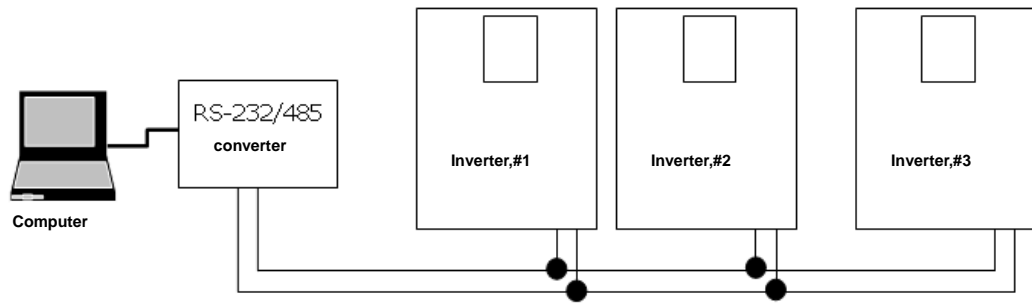


Figure 7-1 Communication system configuration

RS-485 terminal connection: Connect to S+, S-, and SG (Shield line) of terminal block. (Refer to chapter 4 Wiring (page 4-3))

Number of inverters that can be connected: **Maximum 16**

Number of settable stations (CM.01 Int485 St ID): 1 - 250

Allowed communication line length: Total extension length is 1,200 m, but keep within 700 m for stable communication.

Please use repeater in order to enhance the existing communication speed when using communication line longer than 1,200 m or increasing the number of devices. Repeater is effective when smooth communication is not available due to noise.

7.1.3 Default Setting

Group	Code	Name	LCD display	Setting	Setting range	Unit	
CM	01	Built-in communication inverter ID	Int485 St ID	1	1 - 250	-	
CM	02	Built-in communication protocol	Int485 Proto	0	ModBus RTU	0, 2	-
CM	03	Built-in communication speed	Int485 BaudR	3	9600 bps	0 - 7	-
CM	04	Built-in communication frame setting	Int485 Mode	0	D8 / PN / S1	0 - 3	-
CM	05	Transmission delay after reception	Resp Delay	5	0 - 1000	msec	

CM.01 Int485 St ID: Set inverter station ID.

CM.02 Int485 Proto: Built-in protocol is Modbus-RTU(0) / LS INV 485(2).

Table 7-2 Built-in protocol

Number	Display	Contents
0	Modbus-RTU	Modbus-RTU compatible protocol
2	LS INV 485	Dedicated protocol for LS inverter

CM.03 Int485 BaudR: Set communication speed. Can be set up to 115,200 bps.

Number	Display
0	1200 bps
1	2400 bps
2	4800 bps
3	9600 bps
4	19200 bps
5	38400 bps
6	56 Kbps
7	115 Kbps ²⁷

CM.04 Int485 Mode: Select communication frame configuration. Set data length, parity check method, and the number of stop bits.

Number	Display	Contents
0	D8 / PN / S1	8-bit data / parity check not done / one stop bit
1	D8 / PN / S2	8-bit data / parity check not done / two stop bits
2	D8 / PE / S1	8-bit data / even number parity check / one stop bit
3	D8 / PO / S1	8-bit data / odd number parity check / one stop bit

CM.05 Resp Delay: 485 communication (Modbus-RTU or LS INV 485) integrated in S100 works as slave. S100, as a slave, responds to the master only after the time set in this function code. It is used in a system in which master cannot deal with fast response of slave. Set this function code to appropriate value for smooth master-slave communication.

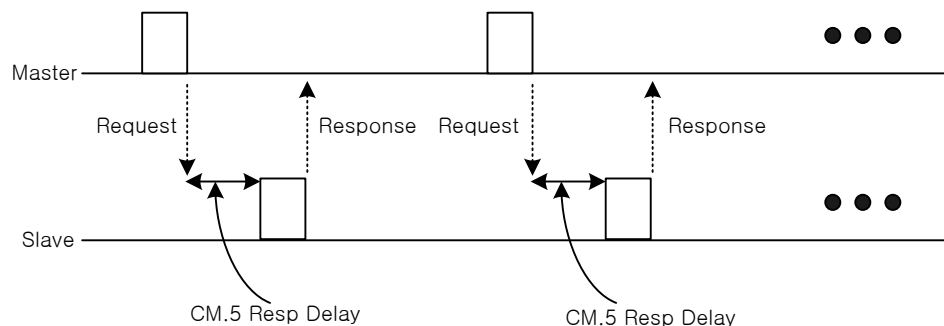


Figure 7-2 CM.05 Resp Delay

²⁷ Means 115,200 bps.

7.1.4 Setting Operation Command and Frequency

Group	Code	Name	LCD display	Setting		Setting range	Unit
Operation	drv	Operation command method	Cmd Source	3	Int 485	0 - 4	-
Operation	Frq	Frequency setting method	Freq Ref Src	6	Int 485	0 - 12	-

Select **drv**, **Frq** of the operation group to No. 3 and 6 Int 485 like above. Then operation command and frequency for parameter in common area can be set via communication function.

7.1.5 Command Loss Protective Operation

Set judging standard and protective operation in case of communication problem during certain time.

Group	Code	Name	LCD display	Setting		Setting range	Unit
Pr	12	Motion at speed command loss	Lost Cmd Mode	1	Free-Run	0 - 5	-
Pr	13	Time to judge speed command loss	Lost Cmd Time	1.0		0.1 - 120 [s]	sec
Pr	14	Operation frequency at speed command loss	Lost Preset F	0.00		Start frequency - Maximum frequency [Hz]	Hz
OU	31	Multi-function relay 1 item	Relay 1	13	Lost Command	0 - 35	-
OU	33	Multi-function output 1 item	Q1 Define				

Pr.12 Lost Cmd Mode, Pr.13 Lost Cmd Time: Select the motion of the inverter when communication error occurred during the time set at Pr.13.

Table 7-3 Selection of inverter motion in case of communication error

Item		Function
0	None	Speed command immediately becomes operation frequency without protective operation.
1	Free-Run	Inverter blocks output. Motor performs free-run.
2	Dec	It decelerates and stops.
3	Hold Input	Operation continues at input speed command until it reaches speed loss.
4	Hold Output	Operation continues at operation frequency before speed loss.
5	Lost Preset	It is operated at the frequency set at Pr. 14 Lost Preset F.

7.1.6 Setting Virtual Multi-Function Input

Group	Code	Name	LCD display	Setting		Setting range	Unit
CM	70 - 77	Communication multi-function input x	Virtual DI x (x: 1-8)	0	None	0 - 49	-
CM	86	Communication multi-function input monitoring	Virt DI Status	-	-	-	-

CM.70 - 77: Can control multi-function input by communication (common area 0h0385: refer to page 7-33).

Function set for each bit operates when desired function at CM.70 to 77 are set and BIT value of the desired function set to 1 at 0h0322. Set operation group drv according to the operation command source. For example, if you want to send Fx command by controlling virtual multi-function input common area via Int485, set CM.70 Virtual DI 1 to FX and give 0h0001 to 0h0322 area. Then, FX function operates.

Operates independent of In.65 - 71 Px Define and cannot be set redundantly. Can easily check virtual multi-function input at CM.86 Virt DI Status.

7.1.7 Cautions When Setting Parameters via Communication²⁸

Group	Code	Name	LCD display	Setting		Setting range	Unit
CNF	48	48	Parameter Save	0	No	0 - 1	-
				1	Yes		-

Set common area parameters, keypad parameters or drive control via communication. Then, restart the inverter. The settings return to previous value.

Set No. 1 Yes at CNF.48 Parameter Save and all set values are saved in the inverter. [This set value is maintained even if you remove power from the inverter.](#)

Set 0 to 0h03E0 address via communication and to 1, [then all parameter values set currently are saved in the inverter.](#) This set value is maintained even if you restart the inverter. However, it does not work if you reset to 0 from 1.

²⁸ Can only be set when the LCD loader is installed.

7.1.8 Setting Special Communications Area

■ Total Memory Map for S100 Communication

Table 7-4 Total memory map for S100 communication

Communication area	Memory map	Details
5 series compatible communication common area	0h0000 - 0h00FF	iS5, iP5A, iV5, iG5A compatible area
Parameter registration type area	0h0100 - 0h01FF	Areas registered at CM.31 - 38 and CM.51 - 58
	0h0200 - 0h023F	Area registered for User Group
	0h0240 - 0h027F	Area registered for Macro Group
	0h0280 - 0h02FF	Reserved
S100 communication common area	0h0300 - 0h037F	Inverter monitoring area
	0h0380 - 0h03DF	Inverter control area
	0h03E0 - 0h03FF	Inverter memory control area
	0h0400 - 0h0FFF	Reserved
	0h1100	dr Grp
	0h1200	bA Grp
	0h1300	Ad Grp
	0h1400	Cn Grp
	0h1500	In Grp
	0h1600	OU Grp
	0h1700	CM Grp
	0h1800	AP Grp
	0h1B00	Pr Grp
	0h1C00	M2 Grp

7.1.9 Parameter Group for Periodic Data Transmission

Can communicate using communication address registered at communication function group (CM). It is convenient since it communicates using various parameters as a communication frame at the same time.

Group	Code	Name	LCD display	Setting		Setting range	Unit
CM	31 - 38	Output communication address x	Para Status-x	-	-	0000 - FFFF	Hex
CM	51 - 58	Input communication address x	Para Control-x	-	-	0000 - FFFF	Hex

■ x : 1 - 8

- **Communication address 0h0100 - 0h0107:** Can read data value of the parameter corresponding to communication code registered at CM.31 -38 Status Para x. (Read-only)
- **Communication address 0h0110 - 0h0117:** Can write and read data value of the parameter corresponding to communication code registered at CM.51 - 58 Control Para x. (Can read / write)

Table 7-5 0h0100 - 0h0117: Currently registered CM Grp parameter

Address	Parameter	Assigned content by bit
0h0100	Status Parameter-1	Parameter communication code value registered at CM.31
0h0101	Status Parameter-2	Parameter communication code value registered at CM.32
0h0102	Status Parameter-3	Parameter communication code value registered at CM.33
0h0103	Status Parameter-4	Parameter communication code value registered at CM.34
0h0104	Status Parameter-5	Parameter communication code value registered at CM.35
0h0105	Status Parameter-6	Parameter communication code value registered at CM.36
0h0106	Status Parameter-7	Parameter communication code value registered at CM.37
0h0107	Status Parameter-8	Parameter communication code value registered at CM.38
0h0110	Control Parameter-1	Parameter communication code value registered at CM.51
0h0111	Control Parameter-2	Parameter communication code value registered at CM.52

Address	Parameter	Assigned content by bit
0h0112	Control Parameter-3	Parameter communication code value registered at CM.53
0h0113	Control Parameter-4	Parameter communication code value registered at CM.54
0h0114	Control Parameter-5	Parameter communication code value registered at CM.55
0h0115	Control Parameter-6	Parameter communication code value registered at CM.56
0h0116	Control Parameter-7	Parameter communication code value registered at CM.57
0h0117	Control Parameter-8	Parameter communication code value registered at CM.58

⚠ Caution

- When registering parameter to Control Parameter, set operation speed (0h0005,0h0380,0h0381) and operation command (0h0006, 0h0382) parameter to the backmost of the Para Control Frame. That is, set operation speed and command to the highest number of Para Control-h. (e.g., when Para Ctrl Num is 5, set operation speed to Para Control-4 and operation command to Para Control-5.)

7.1.10 Parameter Group for U&M Mode User and Macro Grp Transmission²⁹

Can communicate using USG Grp. and MAC Grp. communication address registered at U&M mode.

- **U&M>USR → 1 - 64 User Grp. Para h:** USR parameter registered at keypad can be read/write via communication address 0h0200 to 0h023F.
- **U&M>MAC → 1 - 64 Macro Grp. Para h:** Macro parameter set at keypad can be read/write via 0h0240 to 0h02A3.

Table 7-6 0h0200 - 0h023F: Currently registered User Grp parameter

Address	Parameter	Assigned content by bit
0h0200	User Grp. Code 1	Parameter value registered at U&M > USR → 1
0h0201	User Grp. Code 2	Parameter value registered at U&M > USR → 2
.	.	.
.	.	.
.	.	.
0h023E	User Grp. Code 63	Parameter value registered at U&M > USR → 1
0h023F	User Grp. Code 64	Parameter value registered at U&M > USR → 2

Table 7-7 0h0240 - 0h02A3: Currently registered Macro Grp parameter

Address	Parameter	Assigned content by bit
0h0240	Macro Grp. Code 1	Parameter value registered at U&M > MC → 1
0h0241	Macro Grp. Code 2	Parameter value registered at U&M > MC → 1
.	.	.
.	.	.
.	.	.
0h02A2	Macro Grp. Code 98	Parameter value registered at U&M > MC → 98
0h02A3	Macro Grp. Code 99	Parameter value registered at U&M > MC → 99

²⁹ Can only be set when the LCD loader is installed.

7.2 Communication Protocol

7.2.1 LS INV 485 Protocol

The computer or other host is the master, while the inverter is the slave. The inverter, which is the slave, responds to the Read/Write commands issued by the master.

■ Basic Configuration

- 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 * 4 bytes	2 bytes	1 byte

- Error response:

NAK	Station ID	CMD	Error code	SUM	EOT
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

- Details:

- 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 inverter number and is displayed as 2 byte ASCII-HEX.
- (ASCII-HEX: hexadecimal display using '0' to '9' and 'A' to 'F'.)
- CMD: Use capital letter (IF Error in case of small letter)

Table 7-8 CMD: Using capital letter

Character	ASCII-HEX	Command
'R'	52h	Read
'W'	57h	Write
'X'	58h	Request monitor registration
'Y'	59h	Perform monitor registration

- Data: ASCII-HEX

Ex) When data value is 3000: 3000 → '0'B'B'8'h → 30h 42h 42h 38h

- Error code: 2 displayable ASCII (20h - 7Fh)
- Transmission/reception buffer size: Transmission = 39 bytes, Reception = 44 bytes
- Monitor registration buffer: 8 Words
- SUM: Check communication error via sum.
 - ♦ SUM = Lower 8 bits of (Station ID + CMD + Data) in ASCII-HEX
 - Ex) In case of a command to read 1 content from 3000 address like below

ENQ	Station ID	CMD	Addresses	Number of addresses	SUM	EOT
05h	'01'	'R'	'3000'	'1'	'A7'	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	2 bytes	1 byte

- ♦ $SUM = '0' + '1' + 'R' + '3' + '0' + '0' + '0' + '1'$
 $= 30h + 31h + 52h + 33h + 30h + 30h + 30h + 31h$
 $= 1A7h$ (Control value is not included: ENQ, ACK, NAK, etc.)

SUM becomes A7h since lower 1 byte is taken from SUM.

- BroadCast function

Used when giving a simultaneous command to all inverters connected in network.

- ♦ Method: Give a command via station ID 255.
- ♦ Operation: Each inverter deals with it regardless of set station ID (No response is issued, however)

7.2.2 Detailed Read Protocol

- Read request: In case of read command of successive n words from XXXX address

ENQ	Station ID	CMD	Address	Number of addresses	SUM	EOT
05h	'01' - 'FA'	'R'	'XXXX'	'1' - '8' = n	'XX'	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	2 bytes	1 byte

Total bytes = 12, Quotation marks (' ') indicate character.

- Read normal response:

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01' - 'FA'	'R'	'XXXX'	'XX'	04h
1 byte	2 bytes	1 byte	N * 4 bytes	2 bytes	1 byte

Total bytes = 7 * n * 4 = Maximum 39

- Read error response:

NAK	Station ID	CMD	Error code	SUM	EOT
15h	'01' - 'FA'	'R'	'**'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes = 9

7.2.3 Detailed Write Protocol

- Write request:

ENQ	Station ID	CMD	Address	Number of addresses	Data	SUM	EOT
05h	'01'-'FA'	'W'	'XXXX'	'1' - '8' = n	'XXXX...'	'XX'	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	n * 4 bytes	2 bytes	1 byte

Total bytes = 12 + n * 4 = Maximum 44

- Write normal response:

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01' - 'FA'	'W'	'XXXX...'	'XX'	04h
1 byte	2 bytes	1 byte	n * 4 bytes	2 bytes	1 byte

Total bytes = 7 + n * 4 = Maximum 39

- Write error response:

NAK	Station ID	CMD	Error code	SUM	EOT
15h	'01' - 'FA'	'W'	'**'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes = 9

7.2.4 Monitor Registration Detailed Protocol

■ Monitor Registration

- Monitor registration request:

Monitor registration is a function that designates data which needs continuous monitoring and updates data periodically.

In case of registration request for n addresses (do not need to be continuous)

ENQ	Station ID	CMD	Number of addresses	Address	SUM	EOT
05h	'01' - 'FA'	'X'	'1' - '8' = n	'XXXX...'	'XX'	04h
1 byte	2 bytes	1 byte	1 byte	n * 4 bytes	2 bytes	1 byte

Total bytes = 8 + n * 4 = Maximum 40

- Monitor registration normal response:

ACK	Station ID	CMD	SUM	EOT
06h	'01' - 'FA'	'X'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	1 byte

Total bytes = 7

- Monitor registration error response:

NAK	Station ID	CMD	Error code	SUM	EOT
15h	'01' - 'FA'	'X'	'**'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes = 9

■ Perform monitor registration

- Monitor registration perform request:

Data read request of address registered via monitor registration request

ENQ	Station ID	CMD	SUM	EOT
05h	'01' - 'FA'	'Y'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	1 byte

Total bytes = 7

- Monitor registration perform normal response:

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01' - 'FA'	'Y'	'XXXX...'	'XX'	04h
1 byte	2 bytes	1 byte	n * 4 bytes	2 bytes	1 byte

Total bytes = 7 + n * 4 = Maximum 39

- Monitor registration perform error response:

NAK	Station ID	CMD	Error code	SUM	EOT
15h	'01' - 'FA'	'Y'	'**'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes = 9

■ Error Code

Table 7-9 Error code

Code	Abbreviation	Description
01: ILLEGAL FUNCTION	IF	Received function cannot be performed at slave. That is, the corresponding function does not exist.
02: ILLEGAL DATA ADDRESS	IA	Received parameter address is invalid at slave.
03: ILLEGAL DATA VALUE	ID	Received data is invalid at slave.
21: WRITE MODE ERROR	WM	Read only or change prohibition during operation
22: FRAME ERROR	FE	Different frame size or Num

■ ASCII Code

Table 7-10 ASCII code

Character	Hex	Character	Hex	Character	Hex
A	41	q	71	@	40
B	42	r	72	[5B
C	43	s	73	\	5C
D	44	t	74]	5D
E	45	u	75		5E
F	46	v	76		5F
G	47	w	77		60
H	48	x	78	{	7B
I	49	y	79		7C
J	4A	z	7A	}	7D
K	4B	0	30	~	7E
L	4C	1	31	BEL	07
M	4D	2	32	BS	08
N	4E	3	33	CAN	18
O	4F	4	34	CR	0D
P	50	5	35	DC1	11
Q	51	6	36	DC2	12
R	52	7	37	DC3	13
S	53	8	38	DC4	14
T	54	9	39	DEL	7F
U	55	space	20	DLE	10
V	56	!	21	EM	19
W	57	"	22	ACK	06
X	58	#	23	ENQ	05
Y	59	\$	24	EOT	04
Z	5A	%	25	ESC	1B
a	61	&	26	ETB	17
b	62	'	27	ETX	03
c	63	(28	FF	0C
d	64)	29	FS	1C
e	65	*	2A	GS	1D
f	66	+	2B	HT	09
g	67	,	2C	LF	0A
h	68	-	2D	NAK	15
i	69	.	2E	NUL	00
j	6A	/	2F	RS	1E
k	6B	:	3A	S1	0F
l	6C	;	3B	SO	0E
m	6D	<	3C	SOH	01
n	6E	=	3D	STX	02
o	6F	>	3E	SUB	1A
p	70	?	3F	SYN	16
				US	1F
				VT	0B

7.2.5 Modbus-RTU Protocol

■ Function code and protocol (unit: byte)

- Function Code #03 (Read Holding Register)

<Query>	<Response>
Field Name	Field Name
Slave Address	Slave Address
Function(0x03)	Function(0x03)
Starting Address Hi	Byte Count
Starting Address Lo	Data Hi
# of Points Hi	Data Lo
# of Points Lo	...
CRC Lo	...
CRC Hi	Data Hi
	Data Lo
	CRC Lo
	CRC Hi

} # number of Points

- Function Code #04 (Read Input Register)

<Query>	<Response>
Field Name	Field Name
Slave Address	Slave Address
Function(0x04)	Function(0x04)
Starting Address Hi	Byte Count
Starting Address Lo	Data Hi
# of Points Hi	Data Lo
# of Points Lo	...
CRC Lo	...
CRC Hi	Data Hi
	Data Lo
	CRC Lo
	CRC Hi

} # number of Points

- Function Code #06 (Preset Single Register)

<Query>	<Response>
Field Name	Field Name
Slave Address	Slave Address
Function(0x06)	Function
Starting Address Hi	Starting Address Hi
Starting Address Lo	Starting Address Lo
Preset Data Hi	Preset Data Hi
Preset Data Lo	Preset Data Lo
CRC Lo	CRC Lo
CRC Hi	CRC Hi

- Function Code #16 (hex 0h10) (Preset Multiple Register)

<Query>		<Response>
Field Name		Field Name
Slave Address		Slave Address
Function(0x10)		Function(0x10)
Starting Address Hi		Starting Address Hi
Starting Address Lo		Starting Address Lo
# of Register Hi		# of Register Hi
# of Register Lo		# of Register Lo
Byte Count		CRC Lo
Data Hi	} # number of Points	CRC Hi
Data Lo		
...		
...		
Data Hi		
Data Lo		
CRC Lo		
CRC Hi		

- Exception Code

Code
01: ILLEGAL FUNCTION
02: ILLEGAL DATA ADDRESS
03: ILLEGAL DATA VALUE
06: SLAVE DEVICE BUSY

- Response

Field Name
Slave Address
1)Function
Exception Code
CRC Lo
CRC Hi

- 1) The function value is the one set to the top level bit of the query function value.

Example of Modbus-RTU Communication use

When Acc time is changed to 5.0 sec and Dec time is changed to 10.0 sec.

The frame Inverter transmit to master

	Slave Address	Function	Starting Address	# of Register	Byte Count	Data 1	Data 2	CRC
Hex	0x01	0x10-	0x1102	0x0002	0x04	0x0032	0x0064	0x1202
Description	CM.01 Int485 St ID	Preset Multiple Register	Adress for starting communication – 1 (0x1103-1)			50 (ACC time 5.0 is related)	100 (DEC time 10.0 is related)	

The frame mater tramsmit to Inverter

	Slave Address	Function	Starting Address	# of Register	CRC
Hex	0x01	0x10-	0x1102	0x0002	0xE534
Description	CM.01 Int485 St ID	Preset Multiple Register	Adress for starting communication – 1 (0x1103-1)		

7.2.6 Existing iS5 / iP5 / iV5 / iG5 Compatible Common Area Parameter

Communication Address	Parameter	Scale	Unit	R/W	Assigned content by bit	
0h0000	Inverter model	-	-	R	6: S100	
0h0001	Inverter capacity	-	-	R	0: 0.75 kW 1: 1.5 kW 2: 2.2 kW	
					3: 3.7 kW 4: 5.5 kW 5: 7.5 kW	
					6: 11 kW 7: 15 kW 8: 18.5 kW	
					9: 22 kW	
					256 : 0.4 kW, 257 : 1.1 kW, 258 : 3.0 kW 259 : 4.0 kW	
0h0002	Inverter input voltage	-	-	R	0: 220 V product 1: 440 V product	
0h0003	Version	-	-	R	(Ex) 0h0100: Version 1.00 0h0101: Version 1.01	
0h0004	Reserved	-	-	R/W		
0h0005	Command frequency	0.01	Hz	R/W		
0h0006	Operation command (option) * Refer to additional description	-	-	R	B15	Reserved
					B14	0: Keypad Freq
					B13	1: Keypad Torq
					B12	2 ~ 16: Terminal block multi-step speed
					B11	17: Up
					B10	18: Down 19: STEADY
					B9	22: V1 24: V2 25: I2 26: Reserved 27: Built-in 485 28: Communication option 30: JOG 31: PID

Communication Address	Parameter	Scale	Unit	R/W	Assigned content by bit		
				R/W	B8	0: Keypad	
					B7	1: FX/RX-1	
					B6	2: FX/RX-2	
						3: Built-in 485	
					R/W	4: Communication option	
						B5	Reserved
						B4	Emergency stop
B3	W: Trip initialization (0→1) R: Trip status						
R/W	B2	Reverse operation (R)					
	B1	Forward operation (F)					
R/W	B0	Stop (S)					
0h0007	Acceleration time	0.1	sec	R/W	-		
0h0008	Deceleration time	0.1	sec	R/W	-		
0h0009	Output current	0.1	A	R	-		
0h000A	Output frequency	0.01	Hz	R	-		
0h000B	Output voltage	1	V	R	-		
0h000C	DC Link Voltage	1	V	R	-		
0h000D	Output power	0.1	kW	R	-		
0h000E	Operation status (status of Inverter)	-	-	R/W	B15	0: Remote, 1: Keypad Local	
					B14	1: Frequency command source performs communication (Built-in, Option)	
						1: Operation command source performs communication (Built-in, Option)	
					B13	Reverse operation command	
					B12	Forward operation command	
					B11	Brake release signal	
					B10	Jog mode	
					B9		

Communication Address	Parameter	Scale	Unit	R/W	Assigned content by bit	
					Bit	Description
					B8	Drive stopped.
					B7	DC Braking
					B6	Speed reached.
					B5	Decelerating
					B4	Accelerating
					B3	Operates according to the set value of Fault (Trip) *Pr.30 Trip Out Mode.
					B2	Operates in reverse direction.
					B1	Operates in forward direction.
					B0	Stop
0h000F	Trip information	-	-	R	B15	Reserved
					B14	Reserved
					B13	Reserved
					B12	Reserved
					B11	Reserved
					B10	H/W-Diag
					B9	Reserved
					B8	Reserved
					B7	Reserved
					B6	Reserved
					B5	Reserved
					B4	Reserved
					B3	Level Type trip
					B2	Reserved
					B1	Reserved
B0	Latch Type trip					
0h0010	Input terminal information	-	-	R	B15	Reserved
					B14	Reserved
					B13	Reserved
					B12	Reserved
					B11	Reserved
					B10	Reserved
B9	Reserved					

Communication Address	Parameter	Scale	Unit	R/W	Assigned content by bit	
					Bit	Parameter
					B8	Reserved
					B7	Reserved
					B6	P7
					B5	P6
					B4	P5
					B3	P4
					B2	P3
					B1	P2
					B0	P1
0h0011	Output terminal information	-	-	R	B15	Reserved
					B14	Reserved
					B13	Reserved
					B12	Reserved
					B11	Reserved
					B10	Reserved
					B9	Reserved
					B8	Reserved
					B7	Reserved
					B6	Reserved
					B5	Reserved
					B4	Reserved
					B3	Reserved
					B2	Reserved
B1	MO					
B0	Relay 1					
0h0012	V1	0.01	%	R	V1 voltage input	
0h0013	V2	0.01	%	R	V2 voltage input	
0h0014	I2	0.01	%	R	I2 current input	
0h0015	Motor rotation speed	1	rpm	R	Current motor rotation speed display	
0h0016 - 0h0019	Reserved	-	-	-	-	
0h001A	Select Hz/rpm	-	-	R	0: Hz unit 1: rpm unit	
0h001B	Display the number of poles for the selected motor	-	-	R	Display the number of poles for the selected motor	

7.3 S100 Expansion Common Area Parameter

■ Inverter monitoring area parameter (all read only)

Communication Address	Parameter	Scale	Unit	Assigned content by bit
0h0300	Inverter model	-	-	S100: 0006h
0h0301	Inverter capacity	-	-	0.4 kW: 1900h 0.75 kW: 3200h
				1.1 kW: 4011h 1.5 kW: 4015h
				2.2 kW: 4022h 3.0 kW: 4030h
				3.7 kW: 4037h 4.0 kW: 4040h
				5.5 kW: 4055h 7.5 kW: 4075h
				11 kW: 40B0h 15 kW: 40F0h
				18.5 kW: 4125h 22 kW: 4160h
				0h0302
100 V single phase forced cooling: 0121h				
200 V single phase self cooling: 0220h				
200 V 3-phase self cooling: 0230h				
200 V single phase forced cooling: 0221h				
200 V 3-phase forced cooling: 0231h				
400 V single phase self cooling: 0420h				
400 V 3-phase self cooling: 0430h				
400 V single phase forced cooling: 0421h				
400 V 3-phase forced cooling: 0431h				
0h0303	Inverter S/W version	-	-	(Ex) 0h0100: Version 1.00
				0h0101: Version 1.01

Communication Address	Parameter	Scale	Unit	Assigned content by bit		
0h0304	Reserved	-	-	-		
0h0305	Inverter operation state	-	-	B15	0: Normal state	
				B14	4: Warning occurred	
				B13	8: Fault occurred (operates according to the set value of Pr.30 Trip Out Mode.)	
				B12		
				B11		
				-	-	
				B8		
				B7	1: Speed searching	
				B6	2: Accelerating	
				B5	3: At constant speed	
				B4	4: Decelerating	
					5: Decelerating to stop 6: H/W OCS 7: S/W OCS 8: Dwell operating	
				B3	0: Stop	
				B2	1: Operates in forward direction.	
				B1	2: Operates in reverse direction.	
				B0	3: DC operating (0 speed control)	
0h0306	Inverter operation, frequency command source	-	-	B15	Operation command source	
				B14		
				B13		0: Keypad
				B12		1: Communication option
				B11		3: Built-in 485
				B10		4: Terminal block
				B9		5: reserved
				B8		
				B7	Frequency command source	
				B6	0: Keypad speed	
				B5	1: Keypad torque	
				B4	2 - 4: Up/down operation speed	
				B3		
				B2	5: V1	
				B1	7: V2	

Communication Address	Parameter	Scale	Unit	Assigned content by bit	
				B0	8: I2 9: Pulse 10: Built-in 485 11: Communication option 13: Jog 14: PID 25 - 39: Multi-step speed frequency
0h0307	Keypad S/W version	-	-	(Ex.) 0h0100: Version 1.00	
0h0308	Keypad title version	-	-	(Ex.) 0h0101: Version 1.01	
0h0309 - 0h30F	Reserved	-	-	-	
0h0310	Output current	0.1	A	-	
0h0311	Output frequency	0.01	Hz	-	
0h0312	Output RPM	0	RPM	-	
0h0313	Motor feedback speed	0	RPM	-32768rpm - 32767rpm (with directionality)	
0h0314	Output voltage	1	V	-	
0h0315	DC Link Voltage	1	V	-	
0h0316	Output power	0.1	kW	-	
0h0317	Output torque	0.1	%	-	
0h0318	PID reference	0.1	%	-	
0h0319	PID feedback	0.1	%	-	
0h031A	Display the number of poles for the 1st motor	-	-	Display the number of poles for the 1st motor	
0h031B	Display the number of poles for the 2nd motor	-	-	Display the number of poles for the 2nd motor	
0h031C	Display the number of poles for the selected motor	-	-	Display the number of poles for the selected motor	
0h031D	Select Hz/rpm	-	-	0: Hz 1: rpm	
0h031E - 0h031F	Reserved	-	-	-	
0h0320	Digital input information			B15	Reserved
				B14	Reserved
				B13	Reserved
				B12	Reserved
				B11	Reserved

Communication Address	Parameter	Scale	Unit	Assigned content by bit	
				B10	Reserved
				B9	Reserved
				B8	Reserved
				B7	Reserved
				B6	P7 (Basic I/O)
				B5	P6 (Basic I/O)
				B4	P5 (Basic I/O)
				B3	P4 (Basic I/O)
				B2	P3 (Basic I/O)
				B1	P2 (Basic I/O)
				B0	P1 (Basic I/O)
0h0321	Digital output information	-	-	B15	Reserved
				~	Reserved
				B8	Reserved
				B7	Reserved
				B6	Reserved
				B5	Reserved
				B4	Reserved
				B3	Reserved
				B2	Reserved
				B1	Q1
				B0	Relay 1
0h0322	Virtual digital input information	-	-	B15	Reserved
				~	Reserved
				B8	Reserved
				B7	Virtual DI 8 (CM.77)
				B6	Virtual DI 7 (CM.76)
				B5	Virtual DI 6 (CM.75)
				B4	Virtual DI 5 (CM.74)
				B3	Virtual DI 4 (CM.73)
				B2	Virtual DI 3 (CM.72)
				B1	Virtual DI 2 (CM.71)
				B0	Virtual DI 1 (CM.70)
0h0323	Display the selected motor	-	-	0: The 1st motor / 1: The 2nd motor	
0h0324	AI1	0.01	%	Analog input V1 (basic I/O)	
0h0325	Reserved	0.01	%		

Communication Address	Parameter	Scale	Unit	Assigned content by bit	
0h0326	AI3	0.01	%	Analog input V2 (basic I/O)	
0h0327	AI4	0.01	%	Analog input I2 (basic I/O)	
0h0328	AO1	0.01	%	Analog output 1 (basic I/O)	
0h0329	AO2	0.01	%	Analog output 2 (basic I/O)	
0h032A	AO3	0.01	%	Reserved	
0h032B	AO4	0.01	%	Reserved	
0h032C	Reserved	-	-	-	
0h032D	Reserved	-	-	-	
0h032E	Reserved	-	-	-	
0h032F	Reserved	-	-	-	
0h0330	Latch type trip information-1	-	-	B15	Fuse Open Trip
				B14	Overheat Trip
				B13	Arm Short
				B12	External Trip
				B11	Overvoltage Trip
				B10	Overcurrent Trip
				B9	NTC Trip
				B8	Reserved
				B7	Reserved
				B6	Input open-phase trip
				B5	Output open-phase trip
				B4	Ground Fault Trip
				B3	E-Thermal Trip
				B2	Inverter Overload Trip
B1	Underload Trip				
B0	Overload Trip				
0h0331	Latch type trip information-2	-	-	B15	Reserved
				B14	Reserved
				B13	Blocking the inverter output by the terminal block input on the safety option (Only for the product higher than 90 kW)
				B12	Reserved
				B11	Reserved

Communication Address	Parameter	Scale	Unit	Assigned content by bit	
				Bit	Content
				B11	Reserved
				B10	Bad option card
				B9	No Motor trip
				B8	External brake trip
				B7	Bad contact of basic IO board
				B6	Pre PID Fail
				B5	Error while writing parameters
				B4	Reserved
				B3	FAN Trip
				B2	PTC (thermal sensor) trip
				B1	Reserved
				B0	MC Fail Trip
0h0332	Level type trip information	-	-	B15	Reserved
				B14	Reserved
				B13	Reserved
				B12	Reserved
				B11	Reserved
				B10	Reserved
				B9	Reserved
				B8	Reserved
				B7	Reserved
				B6	Reserved
				B5	SafetyB
				B4	SafetyA
				B3	Keypad lost command
				B2	Lost Command
0h0333	H/W diagnosis trip information	-	-	B15	Reserved
				~	Reserved
				B6	Reserved
				B5	QueueFull
				B3	Watchdog-2 error

Communication Address	Parameter	Scale	Unit	Assigned content by bit	
				B2	Watchdog-1 error
				B1	EEPROM error
				B0	ADC error
0h0334	Warning information	-	-	B15	Reserved
				~	Reserved
				B10	Reserved
				B9	Auto Tuning failed
				B8	Keypad lost
				B7	Encoder misconnection
				B6	Wrong installation of encoder
				B5	DB
				B4	FAN running
				B3	Lost command
				B2	Inverter Overload
				B1	Underload
				B0	Overload
0h0335 - 0h033F	Reserved	-	-	-	
0h0340	On Time date	0	Day	Total number of days when the inverter is powered on	
0h0341	On Time minute	0	Min	Total number of minutes excluding the total number of On Time days	
0h0342	Run Time date	0	Day	Total number of days when the inverter drives the motor	
0h0343	Run Time minute	0	Min	Total number of minutes excluding the total number of Run Time days	
0h0344	Fan Time date	0	Day	Total number of days when the heat sink fan has run	
0h0345	Fan Time minute	0	Min	Total number of minutes excluding the total number of Fan Time days	
0h0346- 0h0348	Reserved	-	-	-	
0h0349	Reserved	-	-	-	
0h034A	Option 1	-	-	0: None 9: CANopen	
0h034B	Reserved	-	-		
0h034C	Reserved				

■ Inverter control area parameter (both read and write)

Communication Address	Parameter	Scale	Unit	Assigned content by bit	
0h0380	Frequency command	0.01	Hz	Command frequency setting	
0h0381	RPM command	1	rpm	Command RPM setting	
0h0382	Operation command	-	-	B7	Reserved
				B6	Reserved
				B5	Reserved
				B4	Reserved
				B3	0→1: Free-run stop
				B2	0→1: Trip initialization
				B1	0: Reverse command 1: Forward command
				B0	0: Stop command 1: Run command
				Ex) Forward operation command: 0003h Reverse operation command: 0001h	
0h0383	Acceleration time	0.1	sec	Acceleration time setting	
0h0384	Deceleration time	0.1	sec	Deceleration time setting	
0h0385	Virtual digital input control (0:Off, 1:On)	-	-	B15	Reserved
				B14	Reserved
				B13	Reserved
				B12	Reserved
				B11	Reserved
				B10	Reserved
				B9	Reserved
				B8	Reserved
				B7	Virtual DI 8 (CM.77)
				B6	Virtual DI 7 (CM.76)
				B5	Virtual DI 6 (CM.75)
				B4	Virtual DI 5 (CM.74)
				B3	Virtual DI 4 (CM.73)
B2	Virtual DI 3 (CM.72)				
B1	Virtual DI 2 (CM.71)				

Communication Address	Parameter	Scale	Unit	Assigned content by bit	
				B0	Virtual DI 1 (CM.70)
0h0386	Digital output control (0:Off, 1:On)	-	-	BI5	Reserved
				BI4	Reserved
				BI3	Reserved
				BI2	Reserved
				BI1	Reserved
				BI0	Reserved
				B9	Reserved
				B8	Reserved
				B7	Reserved
				B6	Reserved
				B5	Reserved
				B4	Reserved
				B3	Reserved
				B2	Reserved
B1	Q1 (Basic I/O, OU.33: None)				
B0	Relay 1 (Basic I/O, OU.31: None)				
0h0387	Reserved	-	-	Reserved	
0h0388	PID reference	0.1	%	Give the PID reference command	
0h0389	PID feedback value	0.1	%	PID feedback value	
0h038A	Motor rated current	0.1	A	-	
0h038B	Motor rated voltage	1	V	-	
0h038C - 0h038F	Reserved			-	
0h0390	Torque Ref	0.1	%	Torque command	
0h0391	Fwd Pos Torque Limit	0.1	%	Forward motoring torque limit	
0h0392	Fwd Neg Torque Limit	0.1	%	Forward regenerative torque limit	
0h0393	Rev Pos Torque Limit	0.1	%	Reverse motoring torque limit	
0h0394	Rev Neg Torque Limit	0.1	%	Reverse regenerative torque limit	
0h0395	Torque Bias	0.1	%	Torque bias	
0h0396 - 0h399	Reserved	-	-	-	

Communication Address	Parameter	Scale	Unit	Assigned content by bit
0h039A	Anytime Para	-	-	Set the CNF.20 ³⁰ value (see page 8-46)
0h039B	Monitor Line-1	-	-	Set the CNF.21 value (see page 8-46)
0h039C	Monitor Line-2	-	-	Set the CNF.22 value (see page 8-46)
0h039D	Monitor Line-3	-	-	Set the CNF.23 value (see page 8-45)

Notes

The frequency set by way of communication into the S100 common area frequency address (0h0380, 0h0005) will not be saved even with the Parameter Save. Perform setting as follows to continuously use the frequency set through communication even after the power cycle:

1. Frequency setting method (dr.07): Set dr.07 (Freq Ref Source) to Keypad-1.
2. Frequency setting (0h1101): Set the frequency through communication into the S100 parameter area frequency address (0h1101).
3. Storing parameters (0h03E0): Perform Parameter Save (0h03E0: '1') before turning off the power.
4. After the power cycle, the frequency set and saved through communication will be displayed.

■ Inverter memory control area parameter (both read and write)

The characteristic of this area is that, when the parameter is set, not only the value is reflected to the inverter but also it is saved. However, the parameters set in other areas through communication will be reflected to the inverter, but not saved. It means that all of the setting values will be cleared after the power cycle of the inverter and will revert back to the previous values prior to the setting. Therefore, after setting through communication, be sure to perform the Parameter Save prior to power off. But this area will be saved to the inverter without the need of the Parameter Save.

³⁰ Displayed when the LCD is installed.

Communication Address	Parameter	Scale	Unit	Changeable during Operation	Function
¹⁾ 0h03E0	Save parameters	-	-	X	0: No 1:Yes
¹⁾ 0h03E1	Monitor mode initialization	-	-	O	0: No 1:Yes
¹⁾ 0h03E2	Parameter initialization	-	-	X	0: No 1: All Grp 2: Drv Grp 3:bA Grp 4: Ad Grp 5:Cn Grp 6:In Grp 7:OU Grp 8: CM Grp 9:AP Grp 12:Pr Grp 13:M2 Grp * Setting prohibited during trip
0h03E3	Display changed parameters	-	-	O	0: No 1:Yes
0h03E4	Reserved	-	-	-	-
¹⁾ 0h03E5	Delete all fault history	-	-	O	0: No 1:Yes
¹⁾ 0h03E6	Delete user registration code	-	-	O	0: No 1:Yes
²⁾ 0h03E7	Hide parameter mode	0	Hex	O	Write: 0 - 9999 Read: 0: Unlock 1:Lock
²⁾ 0h03E8	Lock parameter editing	0	Hex	O	Write: 0 - 9999 Read: 0: Unlock 1:Lock
0h03E9	Easy setting of initial parameters	-	-	O	0: No 1:Yes
¹⁾ 0h03EA	Initializing power consumption	-	-	O	0: No 1:Yes
¹⁾ 0h03EB	Initializing the accumulative time of inverter operation	-	-	O	0: No 1:Yes
¹⁾ 0h03EC	Initialize cooling fan accumulated operation time	-	-	O	0: No 1:Yes

- 1) Be sure to set the parameters very carefully. After setting a parameter to 0 through communication, set it to another value. If a parameter has been set to a value other than 0 and a non-zero value is entered again, an error message is returned. You can find out the previously set value by reading the parameter through communication.

⚠ Caution

- Since the data is saved to the inverter, the communication may be lost due to the extended performance time. Therefore, be careful when performing setting.

- 2) They are parameters for entering the password. When the password is entered first, the state will be changed from Lock to Unlock, and vice versa. When the same parameter value is continuously entered, the parameter is executed just once and then the values will not be reflected afterwards. Therefore, if you want to enter the same value once again, change it to another value and enter the previous value again.
Example) If you want to enter 244 twice, do it in the following order: 244 → 0 → 244

8. Table of Functions

Note) Deal with setting value not allowed

1. Setting value not allocated : “rd ”
2. Overlap setting value (Multi-function input, PID Reference, PID Feedback) : “OL ”
3. Setting value not allowed (Option, V2, I2) : “no ”

Displayed like above. In this case, pushing “ENT” is no operation.

8.1 Operation Group³¹

No.	Communi- cation address	Name	SEG display	Setting range	Initial value	Pro- perty ³²	Refer- ence page	Control mode ³³	
								V/F	SL
-	0h1F00	Target frequency	0.00	0 - Max. frequency [Hz]	0.00	O/7		O	O
-	0h1F01	Acceleration time	ACC	0.0 - 600.0 [s]	20.0	O/7		O	O
-	0h1F02	Deceleration time	dEC	0.0 - 600.0 [s]	30.0	O/7		O	O
-	0h1F03	Operation command method	drv	0	Keypad	1: Fx/Rx-1	X/7	O	O
				1	Fx/Rx-1				
				2	Fx/Rx-2				
				3	Int 485				
				4	Field Bus				
-	0h1F04	Frequency setting Action	Frq	0	Keypad-1	0: Keypad -1	X/7	O	O
				1	Keypad-2				
				2	V1				
				4	V2				
				5	I2				
				6	Int 485				
				8	Field Bus				
				12	Pulse				
-	0h1F05	Multi-step speed frequency 1	St1	0.00 - Max. frequency [Hz]	10.00	O/7		O	O

³¹ Not visible when the LCD loader is installed.

³² Property: O or X: Write during operation, A: 7SEG/LCD Common, 7: 7SEG Only, L: LCD Only

³³ Indicates the effectivity by code dependent on control mode setting: V/F, SL: IM sensorless mode.

No.	Communication	Name	SEG display	Setting range	Initial value	Property	Reference	Control mode ³³	
-	0h1F06	Multi-step speed frequency 2	St2	0.00 - Max. frequency [Hz]	20.00	O/7		O	O
-	0h1F07	Multi-step speed frequency 3	St3	0.00 - Max. frequency [Hz]	30.00	O/7		O	O
-	0h1F08	Output current	CUr			-/7		O	O
-	0h1F09	Motor revolution	rPM			-/7		O	O
-	0h1F0A	Inverter DC voltage	dCL	-	-	-/7		O	O
-	0h1F0B	User selection display	vOL			-/7		O	O
-	0h1F0C	Present fault display	nOn			-/7		O	O
-	0h1F0D	Select rotation direction	drC	F	Forward operation	F	O/7	O	O
				r	Reverse operation				

8.2 Drive group (PAR → dr)

No.	Communi- -cation address	Name	LCD display	Setting range		Initial value	Pro- -perty	Refer- -ence page	Control mode	
									V/F	SL
00	-	Jump code	Jump Code	1 - 99		9	O/A		0	0
01 ³⁴	0h1101	Target frequency	Cmd Frequency	0.00 - Max. frequency [Hz]		0.00	O/L		0	0
03 ³⁵	0h1103	Acceleration time	Acc Time	0.0 - 600.0 [s]		20.0	O/L		0	0
04 ³⁶	0h1104	Deceleration time	Dec Time	0.0 - 600.0 [s]		30.0	O/L		0	0
06 ³⁷	0h1106	Operation command method	Cmd Source	0	Keypad	1: Fx/Rx-1	X/L		0	0
				1	Fx/Rx-1					
				2	Fx/Rx-2					
				3	Int 485					
				4	Field Bus					
07 ³⁸	0h1107	Frequency setting Action	Freq Ref Src	0	Keypad-1	0: Keypad -1	X/L		0	0
				1	Keypad-2					
				2	V1					
				4	V2					
				5	I2					
				6	Int 485					
				8	FieldBus					
				12	Pulse					
09	0h1109	Control mode	Control Mode	0	V/F	0: V/F	X/A		0	0
				2	Slip Compen					
				4	IM Sensorless					
11	0h110B	Jog frequency	Jog Frequency	0.00, 0.50 - Max. frequency [Hz]		10.00	O/A		0	0
12	0h110C	Jog operation acceleration time	Jog Acc Time	0.0 - 600.0 [s]		20.0	O/A		0	0

³⁴ Displayed only when the LCD keypad is installed

³⁵ Displayed only when the LCD keypad is installed

³⁶ Displayed only when the LCD keypad is installed

³⁷ Displayed only when the LCD keypad is installed

³⁸ Displayed only when the LCD keypad is installed

No.	Communi- -cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
13	0h110D	Jog operation deceleration time	Jog Dec Time	0.0 - 600.0 [s]	30.0	O/A		O	O
14	0h110E	Motor capacity	Motor Capacity	0: 0.2 kW, 1: 0.4 kW 2: 0.75 kW, 3: 1.1 kW 4: 1.5 kW, 5: 2.2 kW 6: 3.0 kW, 7: 3.7 kW 8: 4.0 kW, 9: 5.5 kW 10: 7.5 kW, 11: 11.0 kW 12: 15.0 kW, 13: 18.5 kW 14: 22.0 kW, 15: 30.0 kW	Depend ent on inverter capacity	X/A		O	O
15	0h110F	Torque boost method	Torque Boost	0	Manual	0: Manual	X/A	O	X
				1	Auto				
¹⁾ 16	0h1110	Forward torque boost	Fwd Boost	0.0 - 15.0[%]	2.0	X/A		O	X
²⁾ 17	0h1111	Reverse torque boost	Rev Boost	0.0 - 15.0[%]	2.0	X/A		O	X
18	0h1112	Base frequency	Base Freq	30.00 - 400.00 [Hz]	60.00	X/A		O	O
19	0h1113	Start frequency	Start Freq	0.01 - 10.00 [Hz]	0.50	X/A		O	O
20	0h1114	Maximum frequency	Max Freq	40.00 - 400.00	60.00	X/A		O	O
21	0h1115	Speed unit selection	Hz/Rpm Sel	0	Hz Display	0: Hz Display	O/A	O	O
				1	Rpm Display				
80	0h1150	Display selection	-	Select the first item displayed on the	0: Operati	O/7		O	O

No.	Communi- -cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
		upon power supply ³⁹		inverter indicator upon power supply.	on frequent cy				
				0 Operation frequency					
				1 Acceleration time					
				2 Deceleration time					
				3 Operation Command Methods					
				4 Frequency command method					
				5 Multi-step speed frequency 1					
				6 Multi-step speed frequency 2					
				7 Multi-step speed frequency 3					
				8 Output current					
				9 Motor revolution					
				10 Inverter DC voltage					
				11 User selection display (dr.81)					
				12 Present fault status					
				13 Operation direction selection					
				14 Output current 2					
				15 Motor revolution 2					
				16 Inverter DC voltage 2					

³⁹ It is not visible on the LCD keypad.

No.	Communi- -cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
				17	User selection display 2 (dr.81)					
81	0h1151	Monitor item selection	-	Monitor one of the following items in the user selection display code.		0: Output Voltage	O/7		O	O
				0	Output voltage [V]					
				1	Output power [kW]					
				2	Torque [kgf · m]					
89	0h03E3	Display changed parameters	-	0	View All	0: View All	O/7		O	O
				1	View Changed					
90	0h115A	ESC –key function selection	-	0	Movement to initial position	0: None	X/7		O	O
				1	JOG Key					
				2	Local / Remote					
93	0h115D	Parameter initialization	-	0	No	0: No	X/7		O	O
				1	All Grp					
				2	dr Grp					
				3	bA Grp					
				4	Ad Grp					
				5	Cn Grp					
				6	In Grp					
				7	OU Grp					
				8	CM Grp					
				9	AP Grp					
				12	Pr Grp					
				13	M2 Grp					
16	Operation Grp									
94	0h115E	Password registration		0 – 9999			O/7		O	O
95	0h115F	Parameter lock setting		0 - 9999			O/7		O	O

No.	Communi- -cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
97	0h1161	Inverter software version	-			-/7		0	0
98	0h1162	IO board version display	IO S/W Ver			-/A		0	0

* Codes in shaded rows are hidden codes that are displayed only after setting other corresponding codes.

1) Can be displayed only when code value of dr.15 (Torque Boost) is "Manual"

2) Can be displayed only when code value of dr.15 (Torque Boost) is "Manual"

8.3 Basic function group (PAR → bA)

No.	Communi- -cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
00	-	Jump code	Jump Code	1 - 99	20	O/A		0	0
01	0h1201	Auxiliary command setting method	Aux Ref Src	0	None	0: None	X/A	0	0
				1	V1				
				3	V2				
				4	I2				
				6	Pulse				
³ 02	0h1202	Auxiliary command motion selection	Aux Calc Type	0	$M+(G \cdot A)$	0: $M+(G \cdot A)$	X/A	0	0
				1	$M^*(G \cdot A)$				
				2	$M/(G \cdot A)$				
				3	$M+(M^*(G \cdot A))$				
				4	$M+G \cdot 2(A-50\%)$				
				5	$M^*(G \cdot 2(A-50\%))$				
				6	$M/(G \cdot 2(A-50\%))$				
				7	$M+M^*G \cdot 2(A-50\%)$				
03	0h1203	Auxiliary command gain	Aux Ref Gain	-200.0 - 200.0[%]	100.0	O/A		0	0
04	0h1204	Second operation	Cmd 2nd Src	0	Keypad	1: Fx/Rx-1	X/A	0	0
				1	Fx/Rx-1				

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
		command method		2	Fx/Rx-2					
				3	Int 485					
				4	FieldBus					
05	0h1205	Second frequency setting method	Freq 2nd Src	0	Keypad-1	0: Keypad-1	O/A		O	O
				1	Keypad-2					
				2	V1					
				4	V2					
				5	I2					
				6	Int 485					
				8	FieldBus					
				12	Pulse					
07	0h1207	V/F pattern	V/F Pattern	0	Linear	0: Linear	X/A		O	X
				1	Square					
				2	User V/F					
				3	Square 2					
08	0h1208	Acc/Dec reference frequency	Ramp T Mode	0	Max Freq	0: Max Freq	X/A		O	O
				1	Delta Freq					
09	0h1209	Time unit setting	Time Scale	0	0.01 sec	1: 0.1 sec	X/A		O	O
				1	0.1 sec					
				2	1 sec					
10	0h120A	Input power frequency	60/50 Hz Sel	0	60 Hz	0 : 60Hz	X/A		O	O
				1	50 Hz					
11	0h120B	Number of motor poles	Pole Number	2 - 48			X/A		O	O
12	0h120C	Rated slip speed	Rated Slip	0 - 3000 [rpm]		Depende nt on inverter capacity	X/A		O	O
13	0h120D	Rated motor current	Rated Curr	1.0 - 1000.0 [A]			X/A		O	O
14	0h120E	Motor no- load current	Noload Curr	0.0 - 1000.0 [A]			X/A		O	O
15	0h120F	Rated motor voltage	Rated Volt	170 - 480 [V]			0	X/A		O
16	0h1210	Motor efficiency	Efficiency	70 - 100[%]		Depende nt on inverter	X/A		O	O
17	0h1211	Load inertia	Inertia	0 - 8			X/A		O	O

No.	Communication address	Name	LCD display	Setting range	Initial value	Property	Reference page	Control mode	
								V/F	SL
		rate	Rate		capacity				O
18	0h1212	Power display trim	Trim Power %	70 - 130[%]		O/A		O	O
19	0h1213	Input power voltage	AC Input Volt	0 / 170 - 480 V	0	O/A		O	O
20	-	Auto-tuning	Auto Tuning	0	None	0: None	X/A	X	O
				1	All				
				2	ALL (Stdstl)				
				3	Rs+Lsigma				
				6	Tr (Stdstl)				
21	-	Stator resistor	Rs	Dependent on motor setting	-	X/A		X	O
22	-	Leakage inductance	Lsigma	Dependent on motor setting	-	X/A		X	O
23	-	Stator inductance	Ls	Dependent on motor setting	-	X/A		X	O
⁴⁾ 24	-	Rotor time constant	Tr	25 - 5000 [ms]	-	X/A		X	O
⁵⁾ 41	0h1229	User frequency 1	User Freq 1	0.00 - Max. frequency [Hz]	15.00	X/A		O	X
42	0h122A	User voltage 1	User Volt 1	0 - 100[%]	25	X/A		O	X
43	0h122B	User frequency 2	User Freq 2	0.00 - Max. frequency [Hz]	30.00	X/A		O	X
44	0h122C	User voltage 2	User Volt 2	0 - 100[%]	50	X/A		O	X
45	0h122D	User frequency 3	User Freq 3	0.00 - Max. frequency [Hz]	45.00	X/A		O	X
46	0h122E	User voltage 3	User Volt 3	0 - 100[%]	75	X/A		O	X
47	0h122F	User frequency 4	User Freq 4	0.00 - Max. frequency [Hz]	60.00	X/A		O	X
48	0h1230	User voltage 4	User Volt 4	0 - 100[%]	100	X/A		O	X
⁶⁾ 50	0h1232	Multi-step speed frequency 1	Step Freq-1	0.00 - Max. frequency [Hz]	10.00	O/L		O	O
51	0h1233	Multi-step speed	Step Freq-2	0.00 - Max. frequency [Hz]	20.00	O/L		O	O

No.	Communication address	Name	LCD display	Setting range	Initial value	Property	Reference page	Control mode	
								V/F	SL
		frequency 2							
52	0h1234	Multi-step speed frequency 3	Step Freq-3	0.00 - Max. frequency [Hz]	30.00	O/L		O	O
53	0h1235	Multi-step speed frequency 4	Step Freq-4	0.00 - Max. frequency [Hz]	40.00	O/A		O	O
54	0h1236	Multi-step speed frequency 5	Step Freq-5	0.00 - Max. frequency [Hz]	50.00	O/A		O	O
55	0h1237	Multi-step speed frequency 6	Step Freq-6	0.00 - Max. frequency [Hz]	60.00	O/A		O	O
56	0h1238	Multi-step speed frequency 7	Step Freq-7	0.00 - Max. frequency [Hz]	60.00	O/A		O	O
70	0h1246	Multi-step acceleration time 1	Acc Time-1	0.0 - 600.0 [s]	20.0	O/A		O	O
71	0h1247	Multi-step deceleration time 1	Dec Time-1	0.0 - 600.0 [s]	20.0	O/A		O	O
⁷⁾ 72	0h1248	Multi-step acceleration time 2	Acc Time-2	0.0 - 600.0 [s]	30.0	O/A		O	O
73	0h1249	Multi-step deceleration time 2	Dec Time-2	0.0 - 600.0 [s]	30.0	O/A		O	O
74	0h124A	Multi-step acceleration time 3	Acc Time-3	0.0 - 600.0 [s]	40.0	O/A		O	O
75	0h124B	Multi-step deceleration time 3	Dec Time-3	0.0 - 600.0 [s]	40.0	O/A		O	O
76	0h124C	Multi-step acceleration time 4	Acc Time-4	0.0 - 600.0 [s]	50.0	O/A		O	O
77	0h124D	Multi-step deceleration time 4	Dec Time-4	0.0 - 600.0 [s]	50.0	O/A		O	O
78	0h124E	Multi-step acceleration	Acc Time-5	0.0 - 600.0 [s]	40.0	O/A		O	O

No.	Communi- cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
		time 5							
79	0h124F	Multi-step deceleration time 5	Dec Time- 5	0.0 - 600.0 [s]	40.0	O/A		O	O
80	0h1250	Multi-step acceleration time 6	Acc Time- 6	0.0 - 600.0 [s]	30.0	O/A		O	O
81	0h1251	Multi-step deceleration time 6	Dec Time- 6	0.0 - 600.0 [s]	30.0	O/A		O	O
82	0h1252	Multi-step acceleration time 7	Acc Time- 7	0.0 - 600.0 [s]	20.0	O/A		O	O
83	0h1253	Multi-step deceleration time 7	Dec Time- 7	0.0 - 600.0 [s]	20.0	O/A		O	O

* Codes in shaded rows are hidden codes that are displayed only after setting other corresponding codes.

3) Can be displayed only when bA.01 is not 0

4) bA.24 will be displayed only when dr.09 control mode is "IM Sensorless"

5) bA.41 – 48 will be displayed only when any of bA.07 and M2.25 (M2.V/F Patt) is set to "User V/F"

6) bA.50 – 64 will be displayed only when any of In.65 - 71 multi-function inputs is set to "Multi-step speed (Speed-L.M.H)" In.50 – In.52 will be displayed when LCD display is applied.

7) Displayed only when any of In.72 - 75 multi-function inputs is set to "Multi-step Acc/Dec (Xcel-L, M, H)"

8.4 Expanded function group (PAR → Ad)

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
00	-	Jump code	Jump Code	1 - 99		24	O/A		○	○
01	0h1301	Accelerating pattern	Acc Pattern	0	Linear	0: Linear	X/A		○	○
02	0h1302	Decelerating pattern	Dec Pattern	1	S-curve		X/A		○	○
⁸⁾ 03	0h1303	S-curve acceleration start point gradient	Acc S Start	1 - 100[%]		40	X/A		○	○
04	0h1304	S-curve acceleration end point gradient	Acc S End	1 - 100[%]		40	X/A		○	○
⁹⁾ 05	0h1305	S-curve deceleration start point gradient	Dec S Start	1 - 100[%]		40	X/A		○	○
06	0h1306	S-curve deceleration end point gradient	Dec S End	1 - 100[%]		40	X/A		○	○
07	0h1307	Start mode	Start Mode	0	Acc	0: Acc	X/A		○	○
				1	Dc-Start					
08	0h1308	Stop mode	Stop Mode	0	Dec	0: Dec	X/A		○	○
				1	Dc-Brake					
				2	Free-Run					
				3	Reserved					
				4	Power Braking					
09	0h1309	Selection of prohibited rotation direction	Run Prevent	0	None	0: None	X/A		○	○
				1	Forward Prev					
				2	Reverse Prev					
10	0h130A	Starting with power on	Power-on Run	0	No	0: No	O/A		○	○
				1	Yes					
¹⁰⁾ 12	0h130C	DC braking time at startup	Dc-Start Time	0.00 - 60.00 [s]		0.00	X/A		○	○
13	0h130D	Amount of applied DC	Dc Inj Level	0 - 200[%]		50	X/A		○	○

No.	Communi- cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
¹¹⁾ 14	0h130E	Output blocking time before DC braking	Dc-Block Time	0.00 - 60.00 [s]	0.10	X/A		○	○
15	0h130F	DC braking time	Dc-Brake Time	0.00 - 60.00 [s]	1.00	X/A		○	○
16	0h1310	DC braking quantity	Dc-Brake Level	0 - 200[%]	50	X/A		○	○
17	0h1311	DC braking frequency	Dc-Brake Freq	Start frequency - 60.00 [Hz]	5.00	X/A		○	○
20	0h1314	Dwell frequency on acceleration	Acc Dwell Freq	Start frequency - Max. frequency [Hz]	5.00	X/A		○	○
21	0h1315	Dwell operation time on acceleration	Acc Dwell Time	0.0 - 60.0 [s]	0.0	X/A		○	○
22	0h1316	Dwell frequency on deceleration	Dec Dwell Freq	Start frequency - Max. frequency [Hz]	5.00	X/A		○	○
23	0h1317	Dwell operation time on deceleration	Dec Dwell Time	0.0 - 60.0 [s]	0.0	X/A		○	○
24	0h1318	Frequency limit	Freq Limit	0	No	0: No	X/A	○	○
				1	Yes				
¹²⁾ 25	0h1319	Lower limit frequency Limit	Freq Limit Lo	0.00 - upper limit [Hz]	0.50	O/A		○	○
26	0h131A	Upper limit frequency Limit	Freq Limit Hi	0.50 - Max. frequency [Hz]	60.00	X/A		○	○
27	0h131B	Frequency jump	Jump Freq	0	No	0: No	X/A	○	○
				1	Yes				
¹³⁾ 28	0h131C	Jump frequency Lower limit 1	Jump Lo 1	0.00 - jump frequency upper limit 1 [Hz]	10.00	O/A		○	○
29	0h131D	Jump frequency Upper limit 1	Jump Hi 1	Jump frequency lower limit 1 - Max. frequency [Hz]	15.00	O/A		○	○
30	0h131E	Jump frequency Lower limit 2	Jump Lo 2	0.00 - jump frequency upper limit 2 [Hz]	20.00	O/A		○	○

No.	Communication address	Name	LCD display	Setting range	Initial value	Property	Reference page	Control mode	
								V/F	SL
31	0h131F	Jump frequency Upper limit 2	Jump Hi 2	Jump frequency lower limit 2 - Max. frequency [Hz]	25.00	O/A		○	○
32	0h1320	Jump frequency Lower limit 3	Jump Lo 3	0.00 - jump frequency upper limit 3 [Hz]	30.00	O/A		○	○
33	0h1321	Jump frequency Upper limit 3	Jump Hi 3	Jump frequency lower limit 3 - Max. frequency [Hz]	35.00	O/A		○	○
¹⁴⁾ 41	0h1329	Brake release current	BR Rls Curr	0.0 - 180.0[%]	50.0	O/A		○	○
42	0h132A	Brake release delay time	BR Rls Dly	0.00 - 10.00 [s]	1.00	X/A		○	○
44	0h132C	Brake release forward frequency	BR Rls Fwd Fr	0.00 - 400.00 [Hz] (V/F, Slip Compen) 0.00 - 120.00 [Hz] (IM Sensorless)	1.00	X/A		○	○
45	0h132D	Brake release reverse frequency	BR Rls Rev Fr	0.00 - 400.00 [Hz] (V/F, Slip Compen) 0.00 - 120.00 [Hz] (IM Sensorless)	1.00	X/A		○	○
46	0h132E	Brake engage delay time	BR Eng Dly	0.00 - 10.00 [s]	1.00	X/A		○	○
47	0h132F	Brake engage frequency	BR Eng Fr	0.00 - 400.00 [Hz] (V/F, Slip Compen) 0.00 - 120.00 [Hz] (IM Sensorless)	2.00	X/A		○	○
50	0h1332	Energy saving operation	E-Save Mode	0	None	0: None	X/A	○	○
				1	Manual				
				2	Auto				
¹⁵⁾ 51	0h1333	Energy saving level	Energy Save	0 - 30[%]	0	O/A		○	○
60	0h133C	Acc/Dec time transition frequency	Xcel Change Fr	0.00 - Max. frequency [Hz]	0.00	X/A		○	○
64	0h1340	Cooling fan control	FAN Control	0	During Run	0: During Run	O/A	○	○
				1	Always ON				
				2	Temp Control				
65	0h1341	Up/down operation frequency save	U/D Save Mode	0	No	0: No	O/A	○	○
				1	Yes				

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
66	0h1342	Output contact On/Off control method	On/Off Ctrl Src	0	None	0: None	X/A		O	O
				1	V1					
				3	V2					
				4	I2					
				6	Pulse					
67	0h1343	Output contact On level	On-C Level	10.00 - 100.00[%]		90.00	X/A		O	O
68	0h1344	Output contact Off level	Off-C Level	-100.00 - Output contact On level [%]		10.00	X/A		O	O
70	0h1346	Safe operation selection	Run En Mode	0	Always Enable	0: Always Enable	X/A		O	O
				1	DI Dependent					
¹⁶⁾ 71	0h1347	Safe operation stop method	Run Dis Stop	0	Free-Run	0: Free- Run	X/A		O	O
				1	Q-Stop					
				2	Q-Stop Resume					
72	0h1348	Safe operation deceleration time	Q-Stop Time	0.0 - 600.0 [s]		5.0	O/A		O	O
74	0h134A	Selection of regeneration evasion function for press	RegenAvd Sel	0	No	0: No	X/A		O	O
				1	Yes					
75	0h134B	Voltage level of regeneration evasion motion for press	RegenAvd Level	200 V: 300 - 400		350 V	X/A		O	O
				400 V: 600 - 800		700 V				
¹⁷⁾ 76	0h134C	Compensation frequency limit of regeneration evasion for press	CompFreq Limit	0.00 - 10.00 Hz		1.00 [Hz]	X/A		O	O
77	0h134D	Regeneration evasion for press P gain	RegenAvd Pgain	0.0 - 100.0%		50.0[%]	O/A		O	O
78	0h134E	Regeneration evasion for press I gain	RegenAvd Igain	20 - 30000 [ms]		500 [ms]	O/A		O	O

* Codes in shaded rows are hidden codes that are displayed only after setting other corresponding codes.

8) Ad.03 and 04 can be displayed only when Ad. 01 is 1.

9) Ad.05 and 06 can be displayed only when Ad. 02 is 1.

10) Ad.12 will be displayed only when Ad.07 "Start Mode" is set to "Dc-Start".

11) Ad.14 - 17 will be displayed only when Ad.08 "Stop Mode" is set to "DC-Brake".

12) Ad.25 - 26 will be displayed only when Ad.24 (Freq Limit) is set to "Freq Limit".

13) Ad.28 - 33 will be displayed only when Ad.27 (Jump Freq) is set to "Yes".

14) Ad.41 - 47 will be displayed only when any code value of OU.31 or 33 is set to "BR Control".

15) Ad.51 will be displayed only when Ad.50 (E-Save Mode) is set to any value other than "None".

16) Ad.71 - 72 will be displayed only when Ad.70 (Run En Mode) is set to "DI Dependent".

17) Ad.76 - 78 will be displayed only when Ad.74 (RegenAvd Sel) is set to "Yes".

8.5 Control Function Group (PAR → Cn)

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
00	-	Jump code	Jump Code	1 - 99		4	O/A		O	O
04	0h1404	Carrier frequency	Carrier Freq	HD	V/F: 1.0 - 15.0 [kHz] SL: 2.0 - 15.0 [kHz]	3.0	X/A		O	O
				ND	V/F: 1.0 - 5.0 [kHz] SL: 2.0 - 5.0 [kHz]	2.0				
05	0h1405	Switching mode	PWM Mode	0	Normal PWM	0: Normal PWM	X/A		O	O
				1	Lowleakage PWM					
09	0h1409	Initial excitation time	PreExTi me	0.00 - 60.00 [s]		1.00	X/A		X	O
10	0h140A	Initial excitation amount	Flux Force	100.0 - 300.0%		100.0	X/A		X	O
11	0h140B	Continued operation duration	Hold Time	0.00 - 60.00 [s]		0.00	X/A		X	O
20	0h1414	Sensorless 2 nd gain display setting	SL2 G View Sel	0	No	0: No	O/A		X	O
				1	Yes					
21	0h1415	Sensorless speed controller proportional gain1	ASR-SL P Gain1	0 - 5000[%]		Dependent on motor capacity	O/A		X	O
22	0h1416	Sensorless speed controller integral gain1	ASR-SL I Gain1	10 - 9999 [ms]		Dependent on motor capacity	O/A		X	O
¹⁸⁾ 23	0h1417	Sensorless speed controller proportional gain2	ASR-SL P Gain2	1.0 - 1000.0[%]		Dependent on motor capacity	O/A		X	O
24	0h1418	Sensorless speed controller integral gain2	ASR-SL I Gain2	1.0 - 1000.0[%]		Dependent on motor capacity	O/A		X	O

No.	Communication address	Name	LCD display	Setting range		Initial value	Property	Reference page	Control mode	
									V/F	SL
26	0h141A	Flux estimator proportional gain	Flux P Gain	10 - 200[%]		Dependent on motor capacity	O/A		X	O
27	0h141B	Flux estimator integral gain	Flux I Gain	10 - 200[%]		Dependent on motor capacity	O/A		X	O
28	0h141C	Speed estimator proportional gain	S-Est P Gain1	0 - 32767		Dependent on motor capacity	O/A		X	O
29	0h141D	Speed estimator integral gain1	S-Est I Gain1	100 - 1000		Dependent on motor capacity	O/A		X	O
30	0h141E	Speed estimator integral gain2	S-Est I Gain2	100 - 10000		Dependent on motor capacity	O/A		X	O
31	0h141F	Sensorless current controller proportional gain	ACR SL P Gain	10 - 1000		Dependent on motor capacity	O/A		X	O
32	0h1420	Sensorless current controller integral gain	ACR SL I Gain	10 - 1000		Dependent on motor capacity	O/A		X	O
48	-	Current controller P gain	ACR P Gain	0 - 10000		1200	O/A		X	O
49	-	Current controller I gain	ACR I Gain	0 - 10000		120	O/A		X	O
52	0h1434	Torque controller output filter	Torque Out LPF	0 - 2000 [ms]		0	X/A		X	O
53	0h1435	Torque limit setting method	Torque Lmt Src	0	Keypad-1	0: Keypad-1	X/A		X	O
				1	Keypad-2					
				2	V1					
				4	V2					
				5	I2					
				6	Int 485					

No.	Communication address	Name	LCD display	Setting range		Initial value	Property	Reference page	Control mode	
									V/F	SL
				8	FieldBus					
¹⁹⁾ 54	0h1436	Positive-direction reverse torque limit	FWD +Trq Lmt	0.0 - 200.0[%]		180	O/A		X	O
55	0h1437	Positive-direction regeneration torque limit	FWD – Trq Lmt	0.0 - 200.0[%]		180	O/A		X	O
56	0h1438	Negative-direction reverse torque limit	REV +Trq Lmt	0.0 - 200.0[%]		180	O/A		X	O
57	0h1439	Negative-direction regeneration torque limit	REV – Trq Lmt	0.0 - 200.0[%]		180	O/A		X	O
70	0h1446	Speed search mode selection	SS Mode	0	Flying Start-1	0: Flying Start-1	X/A		O	O
				1	Flying Start-2					
71	0h1447	Speed search operation selection	Speed Search	Bit	0000-1111	0000 ⁴⁰	X/A		O	O
				0001	Selection of speed search on acceleration					
				0010	When starting on initialization after trip					
				0100	When restarting after instantaneous power interruption					

⁴⁰ The initial value 0000 will be displayed in SEG as .

No.	Communication address	Name	LCD display	Setting range		Initial value	Property	Reference page	Control mode	
									V/F	SL
				1000	When starting with power on					
²⁰⁾ 72	0h1448	Speed search reference current	SS Sup-Current	80 - 200[%]		150	O/A		O	O
73	0h1449	Speed search proportional gain	SS P-Gain	0 - 9999		Flying Start -1 : 100	O/A		O	O
						Flying Start -2 : 600				
74	0h144A	Speed search integral gain	SS I-Gain	0 - 9999		Flying Start -1 : 200	O/A		O	O
						Flying Start -2 : 1000				
75	0h144B	Output blocking time before speed search	SS Block Time	0.0 - 60.0 [s]		1.0	X/A		O	O
76	0h144C	Speed search Estimator gain	Spd Est Gain	50 ~ 150 [%]		100	O/A		O	O
77	0h144D	Energy buffering selection	KEB Select	0	No	0: No	X/A		O	O
				1	Yes					
²¹⁾ 78	0h144E	Energy buffering start level	KEB Start Lev	110.0 - 140.0[%]		125.0	X/A		O	O
79	0h144F	Energy buffering stop level	KEB Stop Lev	125.0 - 145.0[%]		130.0	X/A		O	O
80	0h1450	Energy buffering gain	KEB Gain	1 - 20000		1000	O/A		O	O
²²⁾ 85	0h1455	Flux estimator proportional gain1	Flux P Gain1	100 - 700		370	O/A		X	O
86	0h1456	Flux estimator proportional gain2	Flux P Gain2	0 - 100		0	O/A		X	O
87	0h1457	Flux estimator proportional gain3	Flux P Gain3	0 - 500		100	O/A		X	O

No.	Communi- cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
88	0h1458	Flux estimator integral gain1	Flux I Gain1	0 - 200	50	O/A		X	O
89	0h1459	Flux estimator integral gain2	Flux I Gain2	0 - 200	50	O/A		X	O
90	0h145A	Flux estimator integral gain3	Flux I Gain3	0 - 200	50	O/A		X	O
91	0h145B	Sensorless voltage compensation1	SL Volt Comp1	0 - 60	30	O/A		X	O
92	0h145C	Sensorless voltage compensation 2	SL Volt Comp2	0 - 60	20	O/A		X	O
93	0h145D	Sensorless voltage compensation 3	SL Volt Comp3	0 - 60	20	O/A		X	O
94	0h145E	Sensorless field weakening start frequency	SL FW Freq	80.0 - 110.0[%]	100.0	X/A		X	O
95	0h145F	Sensorless gain switching frequency	SL Fc Freq	0.00 - 8.00 [Hz]	2.00	X/A		X	O

* Codes in shaded rows are hidden codes that are displayed only after setting other corresponding codes.

18) Cn.23 - 32 will be displayed only when dr.09 (Control Mode) is set to "IM Sensorless" and CON-20 (SL2 G View Sel) is set to "YES".

19) Cn.54 - 57 will be displayed only when dr.09 (Control Mode) is set to "IM Sensorless". In addition, the initial value of torque limit will be changed to 150% when setting the Ad.74 regeneration evasion function.

20) Cn.73 - 76 will be displayed only when any bit of Cn.71 is set to "1". Also, any bit of Cn.72 is set to "1" and Ssmode of Cn.70 is set to '0' (Flying Start-1).

21) Cn.78 - 80 will be displayed only when Cn.77 (KEB Select) is set to "Yes".

22) Cn.23 - 32 will be displayed only when dr.09 (Control Mode) is set to "IM Sensorless" and CON-20 (SL2 G View Sel) is set to "YES".

8.6 Input Terminal Block Function Group (PAR → In)

No.	Communi- cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
00	-	Jump code	Jump Code	1 - 99	65	O/A		O	O
01	0h1501	Frequency for maximum analog input	Freq at 100%	0.00 - Max. frequency [Hz]	60.00	O/A		O	O
02	0h1502	Torque at maximum analog input	Torque at 100%	0.0 - 200.0[%]	100.0	O/A		X	X
05	0h1505	V1 input amount display	V1 Monitor [V]	-12.00 - 12.00 [V]	0.00	O/A		O	O
06	0h1506	V1 input polarity selection	V1 Polarity	0	Unipolar	0: Unipolar	X/A	O	O
				1	Bipolar				
07	0h1507	Time constant of V1 input filter	V1 Filter	0 - 10000 [ms]	10	O/A		O	O
08	0h1508	Minimum input voltage of V1	V1 Volt x1	0.00 - 10.00 [V]	0.00	O/A		O	O
09	0h1509	Output at V1 minimum voltage (%)	V1 Perc y1	0.00 - 100.00[%]	0.00	O/A		O	O
10	0h150A	Maximum input voltage for V1	V1 Volt x2	0.00 - 12.00 [V]	10.00	O/A		O	O
11	0h150B	Output at V1 maximum voltage (%)	V1 Perc y2	0.00 - 100.00[%]	100.00	O/A		O	O
²³⁾ 12	0h150C	V1–minimum input voltage	V1 –Volt x1'	-10.00 - 0.00 [V]	0.00	O/A		O	O
13	0h150D	Output at V1 minimum voltage (%)	V1 –Perc y1'	-100.00 - 0.00[%]	0.00	O/A		O	O
14	0h150E	V1–maximum input voltage	V1 –Volt x2'	-12.00 - 0.00[V]	-10.00	O/A		O	O
15	0h150F	Output at V1 maximum voltage (%)	V1 –Perc y2'	-100.00 - 0.00[%]	-100.00	O/A		O	O
16	0h1510	V1 rotation direction change	V1 Inverting	0	No	0: No	O/A	O	O
				1	Yes				

No.	Communi- cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
17	0h1511	V1 quantization level	V1 Quantizing	0.00 / 0.04 - 10.00[%]	0.04	X/A		O	O
24)35	0h1523	V2 input amount display	V2 Monitor[V]	0.00 - 12.00 [V]	0.00	O/A		O	O
37	0h1525	V2 input filter time constant	V2 Filter	0 - 10000 [ms]	10	O/A		O	O
38	0h1526	Minimum input voltage of V2	V2 Volt x1	0.00 - 10.00 [V]	0.00	O/A		X	X
39	0h1527	Output (%) at the V2-min. voltage	V2 Perc y1	0.00 - 100.00[%]	0.00	O/A		O	O
40	0h1528	Maximum input voltage of V2	V2 Volt x2	0.00 - 10.00 [V]	10	O/A		X	X
41	0h1529	Output (%) at the V2 max. voltage	V2 Perc y2	0.00 - 100.00[%]	100.00	O/A		O	O
46	0h152E	V2 rotation direction change	V2 Inverting	0	No	0: No	O/A	O	O
				1	Yes				
47	0h152F	V2 quantization level	V2 Quantizing	0.00 ⁴¹ , 0.04 - 10.00[%]	0.04	O/A		O	O
50	0h1532	I2 input amount display	I2 Monitor[mA]	0 - 24 [mA]	0.00	O/A		O	O
52	0h1534	I2 input filter time constant	I2 Filter	0 - 10000 [ms]	10	O/A		O	O
53	0h1535	I2 minimum input current	I2 Curr x1	0.00 - 20.00 [mA]	4.00	O/A		O	O
54	0h1536	Output (%) at the I2 min. current	I2 Perc y1	0.00 - 100.00[%]	0.00	O/A		O	O
55	0h1537	I2 maximum input current	I2 Curr x2	0.00 - 24.00 [mA]	20.00	O/A		O	O
56	0h1538	Output (%) at the I2 max. current	I2 Perc y2	0.00 - 100.00[%]	100.00	O/A		O	O
61	0h153D	Changing rotation direction of I2	I2 Inverting	0	No	0: No	O/A	O	O
				1	Yes				

⁴¹ Quantizing is not used when setting to 0.

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
62	0h153E	I2 quantization level	I2 Quantizing	0.00 ⁴² , 0.04 - 10.00[%]		0.04	O/A		O	O
65	0h1541	P1 terminal function setting	P1 Define	0	None	1: FX	X/A		O	O
				1	FX					
66	0h1542	P2 terminal function setting	P2 Define	2	RX	2: RX	X/A		X	X
67	0h1543	P3 terminal function setting	P3 Define	3	RST	5: BX	X/A		O	O
68	0h1544	P4 terminal function setting	P4 Define	4	External Trip	3: RST	X/A		O	O
69	0h1545	P5 terminal function setting	P5 Define	5	BX	7: Sp-L	X/A		O	O
70	0h1546	P6 terminal function setting	P6 Define	6	JOG	8: Sp-M	X/A		O	O
71	0h1547	P7 terminal function setting	P7 Define	7	Speed-L	9: Sp-H	X/A		O	O
				8	Speed-M					
				9	Speed-H					
				11	XCEL-L					
				12	XCEL-M					
				13	RUN Enable					
				14	3-Wire					
				15	2nd Source					
				16	Exchange					
				17	Up					
				18	Down					
				20	U/D Clear					
				21	Analog Hold					
				22	I-Term Clear					
				23	PID Openloop					

⁴² Quantizing is not used when setting to 0.

No.	Communication address	Name	LCD display	Setting range	Initial value	Property	Reference page	Control mode	
								V/F	SL
				24 P Gain2					
				25 XCEL Stop					
				26 2nd Motor					
				34 Pre Excite					
				38 Timer In					
				40 dis Aux Ref					
				46 FWD JOG					
				47 REV JOG					
				49 XCEL-H					
85	0h1555	Multi-function input terminal on filter	DI On Delay	0 - 10000 [ms]	10	O/A		O	O
86	0h1556	Multi-function input terminal off filter	DI Off Delay	0 - 10000 [ms]	3	O/A		O	O
87	0h1557	Multi-function input Contact selection	DI NC/NO Sel	P7 – P1		000 0000 ⁴³	X/A	O	O
				0	A contact (NO)				
				1	B contact (NC)				
89	0h1559	Multi-step command delay time	InCheck Time	1 - 5000 [ms]	1	X/A		O	O
90	0h155A	State of multi-function input terminal	DI Status	P7 – P1		000 0000	O/A	O	O
				0	Open (Off)				
				1	Connection (On)				
91	0h155B	Pulse input amount display	Pulse Monitor [kHz]	0.00 - 50.00 [kHz]	0.00	O/A		O	O
92	0h155C	TI input filter time constant	TI Filter	0 - 9999 [ms]	10	O/A		O	O
93	0h155D	Minimum input pulse of TI	TI Pls x1	0.00 - 32.00 [kHz]	0	O/A		O	O
94	0h153E	Output (%) at the TI min. pulse	TI Perc y1	0.00 - 100.00[%]	0.00	O/A		O	O
95	0h155F	Maximum input pulse of TI	TI Pls x2	0.00 - 32.00 [kHz]	32.00	O/A		O	O

⁴³ The initial value 000 0000 is displayed as  in the SEG.

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
96	0h1560	Output (%) at the TI max. pulse	TI Perc y2	0 - 100[%]		100.00	O/A		○	○
97	0h1561	TI rotation direction change	TI Inverting	0	No	0: No	O/A		○	○
				1	Yes					
98	0h1562	TI quantization level	TI Quantizing	0.00 ⁴⁴ , 0.04 - 10.00[%]		0.04	O/A		○	○

* Codes in shaded rows are hidden codes that are displayed only after setting other corresponding codes.

23) In.12 - 15 will be displayed only when In.06 (V1 Polarity) is set to "Bipolar".

24) In.35 - 47 will be displayed only when SW2 on the IO board is selected to V.


25) In.50 - 62 will be displayed only when SW2 on the IO board is selected to I.

⁴⁴ Quantizing is not used when setting to 0.

8.7 Output Terminal Block Function Group (PAR → OU)


No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL SLT
00	-	Jump code	JumpCode	1 - 99		30	O/A		0	0
01	0h1601	Analog output 1 item	AO1 Mode	0	Frequency	0: Frequency	O/A		0	0
				1	Output Current					
				2	Output Voltage					
				3	DCLink Voltage					
				4	Torque					
				5	Output Power					
				6	Idse					
				7	Iqse					
				8	Target Freq					
				9	Ramp Freq					
				10	Speed Fdb					
				12	PID Ref Value					
				13	PID Fdb Value					
				14	PID Output					
				15	Constant					
02	0h1602	Analog output 1 gain	AO1 Gain	-1000.0 - 1000.0[%]		100.0	O/A		0	0
03	0h1603	Analog output 1 bias	AO1 Bias	-100.0 - 100.0[%]		0.0	O/A		0	0
04	0h1604	Analog output 1 filter	AO1 Filter	0 - 10000 [ms]		5	O/A		0	0
05	0h1606	Analog constant output 1	AO1 Const %	0.0 - 100.0[%]		0.0	O/A		0	0
06	0h1606	Analog output 1 monitor	AO1 Monitor	0.0 - 1000.0[%]		0.0	-/A		0	0

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL SLT
30	0h161E	Fault output item	Trip Out Mode	Bit	000 - 111	010 ⁴⁵	O/A		O	O
				1	Low voltage					
				2	Any faults other than low voltage					
				3	Automatic restart final failure					
31	0h161F	Multi- function relay 1 item	Relay 1	0	None	29: Trip	O/A		O	O
				1	FDT-1					
				2	FDT-2					
				3	FDT-3					
				4	FDT-4					
				5	Over Load					
				6	IOL					
				7	Under Load					
				8	Fan Warning					
				9	Stall					
				10	Over Voltage					
				11	Low Voltage					
				12	Over Heat					
				13	Lost Command					
				14	Run					
				15	Stop					
				16	Steady					
				17	Inverter Line					
				18	Comm Line					
				19	Speed Search					
22	Ready									
28	Timer Out									
29	Trip									
31	DB Warn%ED									
34	On/Off Control									
35	BR Control									

⁴⁵ The initial value 010 will be displayed in SEG as .

No.	Communi- cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode		
								V/F	SL SLT	
33	0h1621	Multi- function output 1 item	Q1 Define	0	None	14: Run		O/A	O	O
				1	FDT-1					
				2	FDT-2					
				3	FDT-3					
				4	FDT-4					
				5	Over Load					
				6	IOL					
				7	Under Load					
				8	Fan Warning					
				9	Stall					
				10	Over Voltage					
				11	Low Voltage					
				12	Over Heat					
				13	Lost Command					
				14	Run					
				15	Stop					
				16	Steady					
				17	Inverter Line					
				18	Comm Line					
				19	Speed Search					
22	Ready									
28	Timer Out									
29	Trip									
31	DB Warn%ED									
34	On/Off Control									
35	BR Control									
41	0h1629	Multi- function output monitoring	DO Status	-	00	X/A		-	-	
50	0h1632	Multi- function output On delay	DO On Delay	0.00 - 100.00 [s]	0.00	O/A		O	O	
51	0h1633	Multi- function output Off delay	DO Off Delay	0.00 - 100.00 [s]	0.00	O/A		O	O	

No.	Communi- cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode		
								V/F	SL SLT	
52	0h1634	Multi- function output contact selection	DO NC/NO Sel	Q1, Relay1		00 ⁴⁶	X/A		O	O
				0	A contact (NO)					
				1	B contact (NC)					
53	0h1635	Fault output On delay	TripOut OnDly	0.00 - 100.00 [s]	0.00	O/A		O	O	
54	0h1636	Fault output Off delay	TripOut OffDly	0.00 - 100.00 [s]	0.00	O/A		O	O	
55	0h1637	Timer On delay	TimerOn Delay	0.00 - 100.00 [s]	0.00	O/A		O	O	
56	0h1638	Timer Off delay	TimerOff Delay	0.00 - 100.00 [s]	0.00	O/A		O	O	
57	0h1639	Detected frequency	FDT Frequency	0.00 - Max. frequency [Hz]	30.00	O/A		O	O	
58	0h163A	Detected frequency band	FDT Band	0.00 - Max. frequency [Hz]	10.00	O/A		O	O	
61	0h163D	Pulse output gain	TO Mode	0	Frequency	0	O/A		O	O
				1	Output Current					
				2	Output Voltage					
				3	DCLink Voltage					
				4	Torque					
				5	Output Power					
				6	Idse					
				7	Iqse					
				8	Target Freq					
				9	Ramp Freq					
				10	Speed Fdb					
				12	PID Ref Value					
				13	PID Fdb Value					
				14	PID Output					
				15	Constant					
62	0h163E	Pulse output gain	TO Gain	-1000.0 - 1000.0[%]	100.0	O/A		O	O	
63	0h163F	Pulse output bias	TO Bias	-100.0 - 100.0[%]	0.0	O/A		O	O	

⁴⁶ The initial value 00 will be displayed in SEG as .

No.	Communi- cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL SLT
64	0h1640	Pulse output filter	TO Filter	0 - 10000 [ms]	5	O/A		0	0
65	0h1641	Pulse output constant output 2	TO Const %	0.0 - 100.0[%]	0.0	O/A		0	0
66	0h1642	Pulse output monitor	TO Monitor	0.0 - 1000.0[%]	0.0	O/A		0	0

8.8 Communication Function Group (PAR → CM)

No.	Communi- cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
00	-	Jump code	Jump Code	1 - 99	20	O/A		0	0
01	0h1701	Built-in communication inverter ID	Int485 St ID	1 - 250	1	O/A		0	0
02	0h1702	Built-in communication protocol	Int485 Proto	0	ModBus RTU	0: ModBus RTU	O/A	0	0
				2	LS Inv 485				
03	0h1703	Built-in communication speed	Int485 BaudR	0	1200 bps	3: 9600 bps	O/A	0	0
				1	2400 bps				
				2	4800 bps				
				3	9600 bps				
				4	19200 bps				
				5	38400 bps				
				6	56 Kbps				
				7	115 Kbps ⁴⁷				
04	0h1704	Built-in communication frame setting	Int485 Mode	0	D8/PN/S1	0: D8/PN/S1	O/A	0	0
				1	D8/PN/S2				
				2	D8/PE/S1				
				3	D8/PO/S1				
05	0h1705	Transmission delay after reception	Resp Delay	0 - 1000 [ms]	5 ms	O/A		0	0
06 ⁴⁸	0h1706	Communication option S/W version	FBus S/W Ver	-	0.00	O/A		0	0
07	0h1707	Communication option inverter ID	FBus ID	0 - 255	1	O/A		0	0
08	0h1708	FIELD BUS communication speed	FBUS BaudRate	-	12Mbps	-/A		0	0
09	0h1709	Communication option LED status	FieldBus LED	-	-	O/A		0	0

⁴⁷ 115,200 bps.

⁴⁸ CM 06 – 9 codes will be displayed only after installing the communication option card. Refer to separate option user manual for the option.

No.	Communi- cation address	Name	LCD display	Setting range	Initial value	Pro- perty	Refer- ence page	Control mode	
								V/F	SL
30	0h171E	Number of output parameters	ParaStatus Num	0 - 8	3	O/A		0	0
31	0h171F	Output communication address 1	Para Stauts- 1	0000 - FFFF Hex	000A	O/A		0	0
32	0h1720	Output communication address 2	Para Stauts- 2	0000 - FFFF Hex	000E	O/A		0	0
33	0h1721	Output communication address 3	Para Stauts- 3	0000 - FFFF Hex	000F	O/A		0	0
34	0h1722	Output communication address 4	Para Stauts- 4	0000 - FFFF Hex	0000	O/A		0	0
35	0h1723	Output communication address 5	Para Stauts- 5	0000 - FFFF Hex	0000	O/A		0	0
36	0h1724	Output communication address 6	Para Stauts- 6	0000 - FFFF Hex	0000	O/A		0	0
37	0h1725	Output communication address 7	Para Stauts- 7	0000 - FFFF Hex	0000	O/A		0	0
38	0h1726	Output communication address 8	Para Stauts- 8	0000 - FFFF Hex	0000	O/A		0	0
50	0h1732	Number of input parameters	Para Ctrl Num	0 - 8	2	O/A		0	0
51	0h1733	Input communication address 1	Para Control-1	0000 - FFFF Hex	0005	X/A		0	0
52	0h1734	Input communication address 2	Para Control-2	0000 - FFFF Hex	0006	X/A		0	0
53	0h1735	Input communication address 3	Para Control-3	0000 - FFFF Hex	0000	X/A		0	0
54	0h1736	Input communication address 4	Para Control-4	0000 - FFFF Hex	0000	X/A		0	0
55	0h1737	Input communication address 5	Para Control-5	0000 - FFFF Hex	0000	X/A		0	0
56	0h1738	Input communication address 6	Para Control-6	0000 - FFFF Hex	0000	X/A		0	0

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
57	0h1739	Input communication address 7	Para Control-7	0000 - FFFF Hex		0000	X/A		0	0
58	0h173A	Input communication address 8	Para Control-8	0000 - FFFF Hex		0000	X/A		0	0
70	0h1746	Communication multi-function input 1	Virtual DI 1	0	None	0: None	O/A		0	0
71	0h1747	Communication multi-function input 2	Virtual DI 2	1	FX	0: None	O/A		0	0
72	0h1748	Communication multi-function input 3	Virtual DI 3	2	RX	0: None	O/A		0	0
73	0h1749	Communication multi-function input 4	Virtual DI 4	3	RST	0: None	O/A		0	0
74	0h174A	Communication multi-function input 5	Virtual DI 5	4	External Trip	0: None	O/A		0	0
75	0h174B	Communication multi-function input 6	Virtual DI 6	5	BX	0: None	O/A		0	0
76	0h174C	Communication multi-function input 7	Virtual DI 7	6	JOG	0: None	O/A		0	0
77	0h174D	Communication multi-function input 8	Virtual DI 8	7	Speed-L	0: None	O/A		0	0
				8	Speed-M					
				9	Speed-H					
				11	XCEL-L					
				12	XCEL-M					
				13	RUN Enable					
				14	3-Wire					
				15	2nd Source					
				16	Exchange					
				17	Up					
				18	Down					
				20	U/D Clear					
				21	Analog Hold					
22	I-Term Clear									
23	PID Openloop									
24	P Gain2									

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
				25	XCEL Stop					
				26	2nd Motor					
				34	Pre Excite					
				38	Timer In					
				40	dis Aux Ref					
				46	FWD JOG					
				47	REV JOG					
				49	XCEL-H					
86	0h1756	Communication multi-function input monitoring	Virt DI Status	-		0	X/A		0	0
94 ⁴⁹	-	Communication data upload	Comm Update	0	No	0: No	-/A		0	0
				1	Yes					

⁴⁹ CM 94 code will be displayed only after installing the communication option card.

8.9 Application Function Group (PAR → AP)

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
00	-	Jump code	Jump Code	1 - 99		20	O/A		0	0
01	0h1801	Application function selection	App Mode	0	None	0: None	X/A		0	0
				1	-					
				2	Proc PID					
²⁶⁾ 16	0h1810	PID output monitor	PID Output	[%]		0.00	-/A		0	0
17	0h1811	PID reference monitor	PID Ref Value	[%]		50.00	-/A		0	0
18	0h1812	PID feedback monitor	PID Fdb Value	[%]		0.00	-/A		0	0
19	0h1813	PID reference setting	PID Ref Set	-100.00 - 100.00[%]		50.00	O/A		0	0
20	0h1814	PID reference selection	PID Ref Source	0	Keypad	0: Key pad	X/A		0	0
				1	V1					
				3	V2					
				4	I2					
				5	Int 485					
				7	FieldBus					
				11	Pulse					
21	0h1815	PID feedback selection	PID F/B Source	0	V1	0: V1	X/A		0	0
				2	V2					
				3	I2					
				4	Int 485					
				6	FieldBus					
				10	Pulse					
22	0h1816	PID controller proportional gain	PID P-Gain	0.0 - 1000.0[%]		50.0	O/A		0	0
23	0h1817	PID controller integral time	PID I-Time	0.0 - 200.0 [s]		10.0	O/A		0	0
24	0h1818	PID controller differentiation time	PID D-Time	0 - 1000 [ms]		0	O/A		0	0
25	0h1819	PID controller feed-forward compensation gain	PID F-Gain	0.0 - 1000.0[%]		0.0	O/A		0	0

No.	Communication address	Name	LCD display	Setting range	Initial value	Property	Reference page	Control mode	
								V/F	SL
26	0h181A	Proportional gain scale	P Gain Scale	0.0 - 100.0 [%]	100.0	X/A		○	○
27	0h181B	PID output filter	PID Out LPF	0 - 10000 [ms]	0	O/A		○	○
29	0h181D	PID upper limit frequency	PID Limit Hi	PID lower limit frequency [Hz] - 300.00 [Hz]	60.00	O/A		○	○
30	0h181E	PID lower limit frequency	PID Limit Lo	-300.00 [Hz] - PID upper limit frequency [Hz]	-60.00	O/A		○	○
31	0h181F	PID output inverse	PID Out Inv	0	No	0: No	X/A	○	○
				1	Yes				
32	0h1820	PID output scale	PID Out Scale	0.1 - 1000.0[%]	100.0	X/A		○	○
34	0h1822	PID controller motion frequency	Pre-PID Freq	0.00 - Max. frequency [Hz]	0.00	X/A		○	○
35	0h1823	PID controller motion level	Pre-PID Exit	0.0 - 100.0[%]	0.0	X/A		○	○
36	0h1824	PID controller motion delay time	Pre-PID Delay	0 - 9999 [s]	600	O/A		○	○
37	0h1825	PID sleep mode delay time	PID Sleep DT	0.0 - 999.9 [s]	60.0	O/A		○	○
38	0h1826	PID sleep mode frequency	PID Sleep Freq	0.00 - Max. frequency [Hz]	0.00	O/A		○	○
39	0h1827	PID wake-up level	PIDWakeUp Lev	0 - 100[%]	35	O/A		○	○
40	0h1828	PID wake-up mode setting	PID WakeUp Mod	0	Below Level	0: Below Level	O/A	○	○
				1	Above Level				
				2	Beyond Level				
42	0h182A	PID controller unit selection	PID Unit Sel	0	%	0:%	O/A	○	○
				1	Bar				
				2	mBar				
				3	Pa				
				4	kPa				
				5	Hz				
				6	rpm				
7	V								


No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
				8	l					
				9	kW					
				10	HP					
				11	°C					
				12	°F					
43	0h182B	PID unit gain	PID Unit Gain	0.00 - 300.00[%]		100.00	O/A		O	O
44	0h182C	PID unit scale	PID Unit Scale	0	x100	2: x 1	O/A		O	O
				1	x10					
				2	x 1					
				3	x 0.1					
				4	x 0.01					
45	0h182D	PID 2nd proportional gain	PID P2-Gain	0.0 - 1000.0[%]		100.0	X/A		O	O

* Codes in shaded rows are hidden codes that are displayed only **after** setting **other** corresponding codes.

26) AP 16 - 45 will be displayed only when AP.01 (App Mode) is set to "Proc PID".

8.10 Protection Function Group (PAR → Pr)

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
00	-	Jump code	Jump Code	1 - 99		40	O/A		0	0
04	0h1B04	Load level setting	Load Duty	0	Normal Duty	1: Heavy Duty	X/A		0	0
				1	Heavy Duty					
05	0h1B05	Input/output open-phase protection	Phase Loss Chk	Bit	00 - 11	00 ⁵⁰	X/A		0	0
				01	Open-phase of output					
				10	Open-phase of input					
06	0h1B06	Open-phase of input voltage band	IPO V Band	1 - 100[V]		15	X/A		0	0
07	0h1B07	deceleration time at fault	Trip Dec Time	0.0 - 600.0 [s]		3.0	O/A		0	0
08	0h1B08	Selection of startup on trip reset	RST Restart	0	No	0: No	O/A		0	0
				1	Yes					
09	0h1B09	Number of automatic restarts	Retry Number	0 - 10		0	O/A		0	0
²⁷⁾ 10	0h1B0A	Automatic restart delay time	Retry Delay	0.0 - 60.0 [s]		1.0	O/A		0	0
12	0h1B0C	Motion at speed command loss	Lost Cmd Mode	0	None	0: None	O/A		0	0
				1	Free-Run					
				2	Dec					
				3	Hold Input					
				4	Hold Output					
				5	Lost Preset					
²⁸⁾ 13	0h1B0D	Time to judge speed command loss	Lost Cmd Time	0.1 - 120 [s]		1.0	O/A		0	0
14	0h1B0E	Operation frequency at speed command loss	Lost Preset F	Start frequency - Max. frequency [Hz]		0.00	O/A		0	0

⁵⁰ The initial value 00 will be displayed in SEG as .

No.	Communication address	Name	LCD display	Setting range		Initial value	Property	Reference page	Control mode	
									V/F	SL
15	0h1B0F	Analog input loss judgement level	AI Lost Level	0	Half of x1	0: Half of x1	O/A		O	O
				1	Below x1					
17	0h1B11	Overload warning selection	OL Warn Select	0	No	0: No	O/A		O	O
				1	Yes					
18	0h1B12	Overload alarm level	OL Warn Level	30 - 200[%]		150	O/A		O	O
19	0h1B13	Overload warning time	OL Warn Time	0.0 - 30.0 [s]		10.0	O/A		O	O
20	0h1B14	Motion at overload fault	OL Trip Select	0	None	1: Free-Run	O/A		O	O
				1	Free-Run					
				2	Dec					
21	0h1B15	Overload fault level	OL Trip Level	30 - 200[%]		180	O/A		O	O
22	0h1B16	Overload fault time	OL Trip Time	0.0 - 60.0 [s]		60.0	O/A		O	O
25	0h1B19	Underload warning selection	UL Warn Sel	0	No	0: No	O/A		O	O
				1	Yes					
26	0h1B1A	Underload warning time	UL Warn Time	0.0 - 600.0 [s]		10.0	O/A		O	O
27	0h1B1B	Underload fault selection	UL Trip Sel	0	None	0: None	O/A		O	O
				1	Free-Run					
				2	Dec					
28	0h1B1C	Underload fault time	UL Trip Time	0.0 - 600.0 [s]		30.0	O/A		O	O
29	0h1B1D	Underload lower limit level	UL LF Level	10 - 30[%]		30	O/A		O	O
30	0h1B1E	Underload upper limit level	UL BF Level	30 - 100[%]		30	O/A		O	O
31	0h1B1F	No motor Motion at detection	No Motor Trip	0	None	0: None	O/A		O	O
				1	Free-Run					
32	0h1B20	No motor detection current level	No Motor Level	1 - 100[%]		5	O/A		O	O
33	0h1B21	No motor detection delay	No Motor Time	0.1 - 10.0 [s]		3.0	O/A		O	O

No.	Communication address	Name	LCD display	Setting range		Initial value	Property	Reference page	Control mode	
									V/F	SL
40	0h1B28	Electronic thermal fault selection	ETH Trip Sel	0	None	0: None	O/A		O	O
				1	Free-Run					
				2	Dec					
41	0h1B29	Motor cooling fan type	Motor Cooling	0	Self-cool	0: Self-cool	O/A		O	O
				1	Forced-cool					
42	0h1B2A	Electronic thermal 1 minute rating	ETH 1min	120 - 200[%]		150	O/A		O	O
43	0h1B2B	Electronic thermal continuous rating	ETH Cont	50 - 150[%]		120	O/A		O	O
50	0h1B32	Stall prevention motion and flux braking	Stall Prevent	Bit	0000 - 1111	1000 ⁵¹	X/A		O	O
				0001	Accelerating					
				0010	At constant speed					
				0100	At deceleration					
				1000	FluxBraking					
51	0h1B33	Stall frequency 1	Stall Freq 1	Start frequency - stall frequency 1 [Hz]		60.00	O/A		O	O
52	0h1B34	Stall level 1	Stall Level 1	30 - 250[%]		180	X/A		O	O
53	0h1B35	Stall frequency 2	Stall Freq 2	Stall frequency 1 - stall frequency 2 [Hz]		60.00	O/A		O	O
54	0h1B36	Stall level 2	Stall Level 2	30 - 250[%]		180	X/A		O	O
55	0h1B37	Stall frequency 3	Stall Freq 3	Stall frequency 2 - stall frequency 4 [Hz]		60.00	O/A		O	O
56	0h1B38	Stall level 3	Stall Level 3	30 - 250[%]		180	X/A		O	O
57	0h1B39	Stall frequency 4	Stall Freq 4	Stall frequency 3 - Max. frequency [Hz]		60.00	O/A		O	O
58	0h1B3A	Stall level 4	Stall Level 4	30 - 250[%]		180	X/A		O	O

⁵¹ The initial value 0000 will be displayed in SEG as .

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
66	0h1B42	DB resistor warning level	DB Warn % ED	0 - 30[%]		0	O/A		0	0
79	0h1B4F	Cooling fan fault selection	FAN Trip Mode	0	Trip	0: Trip	O/A		0	0
				1	Warning					
80	0h1B50	Motion selection at option trip	Opt Trip Mode	0	None	1: Free- Run	O/A		0	0
				1	Free-Run					
				2	Dec					
81	0h1B51	Low voltage fault judgement delay time	LVT Delay	0.0 - 60.0 [s]		0.0	X/A		0	0
90	0h1B5A	Warning information	-			-	-/7		0	0
91	0h1B5B	Fault history 1	-			-	-/7		0	0
92	0h1B5C	Fault history 2	-			-	-/7		0	0
93	0h1B5D	Fault history 3	-			-	-/7		0	0
94	0h1B5E	Fault history 4	-			-	-/7		0	0
95	0h1B5F	Fault history 5	-			-	-/7		0	0
96	0h1B60	Fault history deletion	-	0	No	0: No	-/7		0	0
				1	Yes					

* Codes in shaded rows are hidden codes that are displayed only **after** setting **other** corresponding codes.

27) Pr.10 will be displayed only when Pr.09 (Retry Number) is set to "0" or more.

28) Pr.13 - 15 will be displayed only when Pr.12 (Lost Cmd Mode) is not "NONE".

8.11 2nd Motor Function Group (PAR → M2)⁵²

No.	Communi- cation address	Name	LCD display	Setting range		Initial value	Pro- perty	Refer- ence page	Control mode	
									V/F	SL
00	-	Jump code	Jump Code	1 - 99		14	O/A		O	O
04	0h1C04	Acceleration time	M2-Acc Time	0.0 - 600.0 [s]		20.0	O/A		O	O
05	0h1C05	Deceleration time	M2-Dec Time	0.0 - 600.0 [s]		30.0	O/A		O	O
06	0h1C06	Motor Capacity	M2- Capacity	0	0.2 kW	-	X/A		O	O
				1	0.4 kW					
				2	0.75 kW					
				3	1.1 kW					
				4	1.5 kW					
				5	2.2 kW					
				6	3.0 kW					
				7	3.7 kW					
				8	4.0 kW					
				9	5.5 kW					
				10	7.5 kW					
				11	11.0 kW					
				12	15.0 kW					
				13	18.5 kW					
				14	22.0 kW					
15	30.0 kW									
07	0h1C07	Base frequency	M2-Base Freq	30.00 - 400.00 [Hz]		60.00	X/A		O	O
08	0h1C08	Control mode	M2-Ctrl Mode	0	V/F	0: V/F	X/A		O	O
				2	Slip Compen					
				4	IM Sensorless					
10	0h1C0A	Number of motor poles	M2-Pole Num	2 - 48		Depen- dent on motor setting	X/A		O	O
11	0h1C0B	Rated slip speed	M2-Rated Slip	0 - 3000 [rpm]			X/A		O	O
12	0h1C0C	Motor rated current	M2-Rated Curr	1.0 - 1000.0 [A]			X/A		O	O

⁵² Displayed when any of In. 65 – 71 is set to "2nd MOTOR"

No.	Communication address	Name	LCD display	Setting range	Initial value	Property	Reference page	Control mode	
								V/F	SL
13	0h1C0D	Motor no-load current	M2-No-load Curr	0.5 - 1000.0 [A]		X/A		0	0
14	0h1C0E	Motor rated voltage	M2-Rated Volt	170 - 480[V]		X/A		0	0
15	0h1C0F	Motor efficiency	M2-Efficiency	70 - 100[%]		X/A		0	0
16	0h1C10	Load inertia rate	M2-Inertia Rt	0 - 8		X/A		0	0
17	-	Stator resistor	M2-Rs	0.0 - 9.999[Ω]		X/A		0	0
18	-	Leakage inductance	M2-Lsigma	0.000 - 9.999 [mH]		X/A		0	0
19	-	Stator inductance	M2-Ls	0.00 - 99.99 [mH]		X/A		0	0
20	-	Rotor time constant	M2-Tr	25 - 5000 [ms]		X/A		0	0
25	0h1C19	V/F pattern	M2-V/F Patt	0	Linear	0: Linear	X/A	0	0
				1	Square				
				2	User V/F				
26	0h1C1A	Forward torque boost	M2-Fwd Boost	0.0 - 15.0[%]	2.0	X/A		0	0
27	0h1C1B	Reverse torque boost	M2-Rev Boost	0.0 - 15.0[%]		X/A		0	0
28	0h1C1C	Stall prevention level	M2-Stall Lev	30 - 150[%]	150	X/A		0	0
29	0h1C1D	Electronic thermal 1 minute rating	M2-ETH 1min	100 - 200[%]	150	X/A		0	0
30	0h1C1E	Electronic thermal continuous rating	M2-ETH Cont	50 - 150[%]	100	X/A		0	0

8.12 Group Dedicated for LCD Loader

8.12.1 Trip Mode(TRP Last-x)

No.	Function display	Name	Setting range	Initial value	Reference page
00	Trip Name(x)	Fault type display	-	-	
01	Output Freq	Operation frequency at fault	-	-	
02	Output Current	Output Current at fault	-	-	
03	Inverter State	Acceleration/Deceleration state at fault	-	-	
04	DCLink Voltage	DC section state	-	-	
05	Temperature	NTC temperature	-	-	
06	DI State	Input terminal state	-	0000 0000	
07	DO state	Output terminal state	-	000	
08	Trip On Time	Fault time after Power on	-	0/00/00 00:00	
09	Trip Run Time	Fault time after operation start	-	0/00/00 00:00	
10	Trip Delete?	Delete fault history	0	No	0: No
			1	Yes	

8.12.2 Config Mode (CNF)

No.	Function display	Name	Setting range		Initial value	Reference page
00	Jump Code	Jump code	1 - 99		1	
01	Language Sel	keypad language selection	0: English		English	
			1: Korean			
02	LCD Contrast	LCD contrast adjustment	-		-	
10	Inv S/W Ver	Main body S/W version	-		-	
11	KeypadS/W Ver	Keypad S/W version	-		-	
12	KPD Title Ver	Keypad title version	-		-	
20	Anytime Para	Status window display item	0	Frequency	0: Frequency	
21	Monitor Line-1	Monitor mode display item 1	1	Speed	0: Frequency	
22	Monitor Line-2	Monitor mode display item 2	2	Output Current	2: Output Current	
23	Monitor Line-3	Monitor mode display item 3	3	Output Voltage	3: Output Voltage	
			4	Output Power		
			5	WHour Counter		
			6	DCLink Voltage		
			7	DI State		
			8	DO State		
			9	V1 Monitor[V]		
			10	V1 Monitor[%]		
			13	V2 Monitor[V]		
			14	V2 Monitor[%]		
			15	I2 Monitor[mA]		
			16	I2 Monitor[%]		
17	PID Output					
18	PID Ref Value					

No.	Function display	Name	Setting range		Initial value	Reference page
			19	PID Fdb Value		
			20	Torque		
			21	Torque Limit		
			23	Speed Limit		
24	Mon Mode Init	Monitor mode initialization	0	No	0: No	
			1	Yes		
30	Option-1 Type	Option slot 1 type display	0	None	0: None	
31	Option-2 Type	Option slot 2 type display	6	Ethernet	0: None	
32	Option-3 Type	Option slot 3 type display	9	CANopen	0: None	
40	Parameter Init	Parameter initialization	0	No		
			1	All Grp		
			2	DRV Grp		
			3	BAS Grp		
			4	ADV Grp		
			5	CON Grp		
			6	IN Grp		
			7	OUT Grp		
			8	COM Grp		
			9	APP Grp		
			12	PRT Grp		
			13	M2 Grp		
			16	SPS Grp		
41	Changed Para	Changed parameter Sign	0	View All	0: View All	
			1	View Changed		
42	Multi Key Sel	ESC Key item	0	None	0: None	
			1	JOG Key		
			2	Local / Remote		
			3	UserGrp SelKey		
43	Macro Select	Macro function item	0	None	0: No	
			1	Draw App		
44	Erase All Trip	Fault history deletion	0	No	0: No	
			1	Yes		

No.	Function display	Name	Setting range		Initial value	Reference page
45	UserGrp AllDel	User registration code deletion	0	No	0: No	
			1	Yes		
46	Parameter Read	Read parameters	0	No	0: No	
47	Parameter Write	Write parameters	0	No	0: No	
			1	Yes		
48	Parameter Save	Save parameters	0	No	0: No	
			1	Yes		
50	View Lock Set	Hide parameter mode	0 - 9999		Un-locked	
51	View Lock Pw	Password for hiding parameter mode	0 - 9999		Password	
52	Key Lock Set	Lock parameter edit	0 - 9999		Un-locked	
53	Key Lock Pw	Password for locking parameter edit	0 - 9999		Password	
60	Add Title Up	Additional title update	0	No	0: No	
			1	Yes		
61	Easy Start On	Simple parameter setting	0	No	1: Yes	
			1	Yes		
62	WHCount Reset	Initialize power consumption	0	No	0: No	
			1	Yes		
70	On-time	Inverter accumulated motion time	Year/month/day hour: minute		-	
71	Run-time	Inverter accumulated operation time	Year/month/day hour: minute		-	
72	Time Reset	Initialize inverter accumulated operation time	0	No	0: No	
			1	Yes		
74	Fan Time	Cooling fan accumulated operation time	Year/month/day hour: minute		-	
75	Fan Time Rst	Initialize cooling fan accumulated operation time	0	No	-	

9. Troubleshooting and Inspection






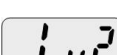

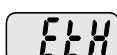


⚠ Caution

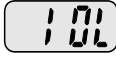

Be sure to read the safety precautions in the beginning of this manual before checking the inverter.

9.1 Protection Function Item

■ Protection from output current and input voltage

Table 9-1 Protection function item from output current and input voltage

SEG display	LCD display	Type	Contents	Notes
	Over Load	Latch	Occurs if the motor overload fault is selected and the load level exceeds the set level. Works only when Pr.20 is set to any value other than No. 0.	-
	Under Load	Latch	Occurs if the underload protection function is selected and the motor load level is not more than the set underload level. Works only when Pr.27 is set to any value other than No. 0.	-
	Over Current1	Latch	Occurs if the inverter output current is greater than 200 % of the rated current.	-
	Over Voltage	Latch	Occurs if the internal DC circuit voltage increases more than the specified value.	-
	Low Voltage	Level	Occurs if the internal DC circuit voltage decreases less than the specified value.	-
	Low Voltage2	Latch	Occurs if the internal DC circuit voltage decreases less than the specified value during the inverter operation.	-
	Ground Trip	Latch	Occurs if a ground fault occurs in the inverter output side causing a current greater than the specified value to flow. There is a difference in the ground fault detection currents depending on the inverter capacity.	-
	E-Thermal	Latch	Occurs according to the inverse time-limit thermal characteristic to prevent overheating in the motor. Works only when Pr.40 is set to any value other than No. 0.	-
	Out Phase Open	Latch	Occurs if one or more phases to the motor is open circuit. Works only when bit 1 of Pr.05 is set to 1.	-
	In Phase Open	Latch	Occurs if one of the input power phases is missing. Works only when bit 2 of Pr.05 is set to 1.	-


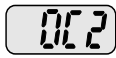
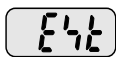
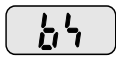
SEG display	LCD display	Type	Contents	Notes
	Inverter OLT	Latch	A protection function for the inverse time-limit thermal characteristic to protect the inverter from overheating. It is based on 150 %, 1 minute and 200 %, 4 seconds according to the inverter rated current. For 200 %, 4 seconds, there is a difference depending on the inverter capacity.	-
	No Motor Trip	Latch	Occurs if the motor is not connected when operating the inverter. Works only when Pr.31 is set to No. 1.	-


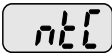

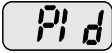



Notes

- Level: Resets automatically if the fault is corrected. It is not saved in the fault history.
- Latch: Resets if the reset signal is input after the fault is corrected.
- Fatal: Once the fault is corrected, the fault is reset if you turn off the inverter power and then turn it on again after the internal charge lamp power is turned off. Contact our customer service center if the fault still remains after turning on the power again.
- When using the LCD loader, the trip details are displayed in the LCD loader and "TRIP" message is displayed in the SEG regardless of the trip details.
- When more than one trip occurs, the first trip is displayed in the LCD and the subsequent trips are displayed by priority in the SEG.

■ Protection via abnormal internal circuit and external signals

Table 9-2 Protection function item via abnormal internal circuit and external signals

SEG display	LCD display	Type	Contents	Notes
	Over Heat	Latch	This fault occurs if the temperature of the inverter heat sink increases more than the specified value.	-
	Over Current2	Latch	This fault occurs if the DC section in the inverter detects shorted circuit current.	-
	External Trip	Latch	External fault signal by the function selection of the multi-function terminal. Select No.4 External Trip in the functions of No. In.65 - 71.	-
	BX	Level	Blocks the inverter output by the function selection of a multi-function terminal. Select No.5 BX in the functions of No. In.65 - 71.	-

SEG display	LCD display	Type	Contents	Notes
	H/W-Diag	Fatal	When the problems occurs in the memory (EEPROM), analog-digital converter output (ADC Off Set), CPU malfunction (Watch Dog-1, Watch Dog-2), and others of the inverter. - EEP Err: When the problem occurs at the parameter read/write due to KPD EEP Rom burn-out, etc. - ADC Off Set: When the problems occurs in the current sensing section (U/V/W CT, etc.)	-
	NTC Open	Latch	This fault occurs if the problem is detected with the temperature detection sensor of the IGBT (Insulated Gate Bipolar Transistor).	-
	Fan Trip	Latch	This fault occurs if a problem is detected in the cooling fan. Works only when Pr.79 is set to No. 0.	Applicable to product below 22 kW
	Pre-PID Fail	Latch	If the controlled variable (PID feedback) is input below set value by the function settings of AP.34 - 36 during the Pre-PID operation, it is judged as an error in the load system and this fault occurs.	-
	Ext-Brake	Latch	Works when operating with external brake signal by the function selection of a multi-function terminal. This fault occurs if the inverter output current at the inverter start remains below Ad-41. Set any of OU-31 and 32 to No. 35 BR Control.	-
 	Safety A(B) Err	Level	This fault occurs if either or both of the safety relay input signals (SA, SB) are lost.	-

■ Protection via option




Table 9-3 Protection function item via keypad and option

SEG display	LCD display	Type	Contents	Notes
	Lost Command	Level	This fault occurs if the frequency command or operation command via the terminal block, communication or other without using the keypad is lost. Works only when Pr.12 is set to any value other than No. 0.	-
	IO Board Trip	Latch	Occurs if basic I/O or external communication card is not connected to inverter or there is poor connection.	-
				-
				Occurs if fault persists for longer than 5 seconds.
	ParaWrite Trip	Latch	Occurs if communication is not established during parameter writing due to a Loader cable problem, bad connection, etc.	Applicable when the LCD keypad is used
	Option Trip-1	Latch	Occurs if there is a problem between the inverter main body and an option card (communication).	Applicable when an option is used

9.2 Alarm Function Item

Table 9-4 Alarm function item

SEG display	LCD display	Description
	Over Load	This alarm signal occurs if the motor is over-loaded. Works only when Pr.17 is set to 1. If the signal is required to be sent to the output contact, select No. 5 Over Load among the functions of No. OU.31 and 33.
	Under Load	If the underload alarm is required, select "1" in the No. Pr.25. For the output signal, select No. 7 Under Load in the functions of No. OU.31 and 33.
	Inv Over Load	This alarm occurs if accumulated time is 60 % of the level of the inverter overheat protection function (Inverter IOLT). For the output signal, select No. 6 IOL in the functions of No. OU.31 and 33.
	Lost Command	This alarm signal can be output even if Pr.12 Lost Cmd Mode is selected to No. 0. The alarm occurs under the set condition in the Pr.13 - 15. For the output signal, select No. 13 Lost Command in the functions of OU.31 - 33.

SEG display	LCD display	Description
	Fan Warning	This alarm occurs if a problem is detected in the cooling fan with Pr.79 FAN Trip Mode set to No. 1. For the output signal, select No. 8 Fan Warning in the functions of OU.31 and 33.
	DB Warn %ED	This alarm occurs if DB resistor usage is above the set value. Set the detection level in Pr.66.
	Retry Tr Tune	Works only when DR.9 is set to No. 4. Occurs if the time constant (Tr) of the motor's rotor is too low or too high during auto-tuning.

9.3 Troubleshooting

Type	Cause	Remedy
Over Load	<ul style="list-style-type: none"> The load is above the motor rated capacity. The setting of the overload fault level (Pr.21) is too small. 	<ul style="list-style-type: none"> Increase the capacity of the motor and the inverter. Increase the setting in the overload fault level.
Under Load	<ul style="list-style-type: none"> There is a problem with the mechanical connection between the motor and the load. The underload level (Pr.29, 30) is set above the minimum system load. 	<ul style="list-style-type: none"> Check the mechanical/physical connection between the motor and the load for damage. Decrease the setting of the underload level.
Over Current ¹	<ul style="list-style-type: none"> The Acc/Dec time is too short compared to the load inertia (GD^2). The inverter load is above the rated capacity. The inverter output is sent during the motor idling or coasting. The mechanical brake motion for motor is too fast. 	<ul style="list-style-type: none"> Increase the Acc/Dec time setting. Replace the inverter with an inverter of higher capacity. Operate after the motor stops or use the speed search function (Cn.60). Check the mechanical brake.
Over Voltage	<ul style="list-style-type: none"> The deceleration time is too short compared to the load inertia (GD^2). A regenerative load is connected to the inverter. The input power voltage is too high. 	<ul style="list-style-type: none"> Increase the deceleration time setting. Use braking resistor(s). Check that the input power voltage is below the specified value.

Type	Cause	Remedy
Low Voltage	<ul style="list-style-type: none"> ▪ The input power voltage is too low. ▪ A load that is larger than the power capacity is connected to the power system. (welder, direct motor connection, etc.) ▪ A magnetic contactor or other device on the power input side has opened momentarily or malfunctioned. 	<ul style="list-style-type: none"> ▪ Check that the input power voltage is above the specified value. ▪ Increase the power capacity. ▪ Replace the magnetic contactor.
Low Voltage2	<ul style="list-style-type: none"> ▪ The input power voltage has decreased during the operation. ▪ An input phase-loss has occurred. ▪ A magnetic contactor or other device on the power input has malfunctioned. 	<ul style="list-style-type: none"> ▪ Check that the input power voltage is above the specified value. ▪ Check the input wiring. ▪ Replace the magnetic contactor if broken.
Ground Trip	<ul style="list-style-type: none"> ▪ A ground fault has occurred in the inverter output line. ▪ The motor insulation is damaged. 	<ul style="list-style-type: none"> ▪ Check the output terminal wiring of the inverter. ▪ Replace the motor.
E-Thermal	<ul style="list-style-type: none"> ▪ The motor could be overheating. ▪ The inverter load is above the rated capacity. ▪ The electronic thermal level is set too low. ▪ The inverter has operated the motor at low speed for a long time. 	<ul style="list-style-type: none"> ▪ Decrease the load or the operation frequency. ▪ Increase the inverter capacity. ▪ Set the electronic thermal level properly. ▪ Use forced cooling method on motor.
Out Phase Open	<ul style="list-style-type: none"> ▪ A magnetic contactor, Isolator or other device is faulty on the inverter output side. ▪ The output wiring is faulty. 	<ul style="list-style-type: none"> ▪ Check the device(s) on the output side for faults. ▪ Test the output wiring.
In Phase Open	<ul style="list-style-type: none"> ▪ A magnetic contactor or other device is faulty on the input side. ▪ The input wiring is faulty. ▪ The inverter DC capacitor(s) needs to be replaced. 	<ul style="list-style-type: none"> ▪ Check the magnetic contactor on the inverter input side. ▪ Check the input wiring. ▪ The inverter DC capacitor(s) should be replaced. Contact a local service center.
Inverter OLT	<ul style="list-style-type: none"> ▪ The load is above the inverter rated capacity. ▪ The torque boost level is too high. 	<ul style="list-style-type: none"> ▪ Increase the capacity of the motor and the inverter. ▪ Decrease the torque boost level.

Type	Cause	Remedy
Over Heat	<ul style="list-style-type: none"> ▪ The cooling system has a problem. ▪ The inverter is used for longer than the replacement interval of the cooling fan. ▪ Ambient temperature is too high. 	<ul style="list-style-type: none"> ▪ Check for any foreign substances in the vent such as the air intake, the exhaust, and others. ▪ The inverter cooling fan should be replaced. ▪ Keep the ambient temperature of the inverter below 50°C.
Over Current ²	<ul style="list-style-type: none"> ▪ A short circuit has occurred in the inverter output line. ▪ An inverter IGBT (output switching device) is faulty. 	<ul style="list-style-type: none"> ▪ Check the output terminal wiring of the inverter. ▪ Inverter operation is not possible. Contact a local service center.
NTC Open	<ul style="list-style-type: none"> ▪ The ambient temperature is too high. ▪ The internal temperature sensor for the inverter is faulty. 	<ul style="list-style-type: none"> ▪ Operate the inverter in area at which the ambient temperature is above - 10°C. ▪ Contact a local service center.
FAN Lock	<ul style="list-style-type: none"> ▪ Foreign matter or substance has stuck in the inverter vent in which the fan is located. ▪ The inverter cooling fan needs to be replaced. 	<ul style="list-style-type: none"> ▪ Check the air intake and exhaust. ▪ The inverter cooling fan should be replaced.
IP54 FAN Trip	<ul style="list-style-type: none"> ▪ The fan connector is not connected. ▪ The inverter cooling fan needs to be replaced. 	<ul style="list-style-type: none"> ▪ Connect the fan connector. ▪ The inverter cooling fan should be replaced.

9.4 Troubleshooting in Case of No Alarm Display

■ You cannot set the parameters.

Cause	Measure
The inverter is in operation. (The inverter is in drive mode.)	Stop the inverter to change to the program mode and then set the parameters.
The parameter access level is incorrect.	Check the correct parameter access level and then set the parameters.
The password is incorrect.	Check the password, reset the parameter UNLOCK and then set the parameters.
Low voltage has been detected.	Check the power input to reset the low voltage status and then set the parameters.

■ The motor does not rotate according to the command even if the Forward key on the keypad is pressed or an external operation signal is input.

- The motor does not rotate.

Cause	Measure
The setting for the frequency command method is incorrect.	Check the setting for the frequency command method.
The setting for the operation command method is incorrect.	Check the setting for the operation command method.
The power is not supplied to the terminal R, S, T.	Check the connection of the terminal R, S, T and U, V, W.
Is the power lamp turned off?	Power on the inverter.
The operation command RUN is off.	Turn on the operation command RUN.
The motor is locked.	Unlock the motor or decrease the load.
The load is too heavy.	Operate the motor independently.
An emergency stop signal is input.	Reset the emergency stop signal and try again.
The wiring for the control circuit terminal is incorrect.	Check the wiring for the control circuit terminal, perform correct wiring and try again.
The selection for the input method of frequency command is incorrect.	Check the input method of frequency command, perform correct setting and try again.
The selection for the voltage/current input of the main frequency command is incorrect.	Check the voltage/current input, perform correct setting and try again.

Cause	Measure
The selection for the sink mode/source mode is incorrect.	Check the sink mode/source mode setting, change the setting correctly and try again.
The frequency command value is too low.	Check the frequency command to input a value above the minimum frequency and try again.
The STOP key is pressed.	This is normal stop.
The motor torque is too low.	Use a different inverter control type such as V/F, Sensorless, etc. If the same problem persists, increase the inverter and motor capacity.

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

Cause	Measure
The wiring for the motor output cable is incorrect.	Change over any 2 from 3 motor wires (U, V, W).
The connection between the control circuit terminal (forward/reverse rotation) for the inverter and the forward/reverse rotation signal on the control panel side is incorrect.	Check the forward/reverse rotation wiring and make any corrections necessary.

- The motor rotates in only one direction.

Cause	Measure
The reverse rotation prohibition is selected.	Remove the reverse rotation prohibition (Ad.09 = 1 or 2) and try again.
The reverse rotation signal is not input even if the 3-wire sequence is selected.	Check the input signal associated with the 3-wire operation to make the correct adjustment.

■ **The motor is overheated.**

Cause	Measure
The load is too high.	<ul style="list-style-type: none"> ▪ Decrease the load. ▪ Increase the Acc/Dec time. ▪ Check the parameters associated with the motor and set the correct values. ▪ Replace the motor and the inverter with those of the capacity suitable for the load level.
The ambient temperature of the motor is too high.	<ul style="list-style-type: none"> ▪ Improve the environment to decrease the ambient temperature of the motor.
The phase-to-phase withstanding voltage of the motor is insufficient.	<ul style="list-style-type: none"> ▪ Use a motor whose phase-to-phase surge withstanding voltage is larger than maximum surge voltage. ▪ Use the motor only for 400 V inverter. ▪ Connect an AC reactor to the inverter output side. ▪ (When connecting the AC reactor, set the carrier frequency to 2 kHz.)
The motor fan has stopped or the fan is obstructed with dust and dirt.	Clean the motor fan to remove the foreign substance.

■ **The motor stops during acceleration or when the load is connected.**

Cause	Measure
<ul style="list-style-type: none"> ▪ The load is too high. 	<ul style="list-style-type: none"> ▪ Decrease the load. ▪ Replace the motor and the inverter with those of a higher capacity.

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

Cause	Measure
The frequency command value is low.	<ul style="list-style-type: none"> ▪ Check the frequency command, input a correct value and try again.
The load is too high.	<ul style="list-style-type: none"> ▪ Decrease the load. ▪ Increase the acceleration time. ▪ Check the mechanical brake status.
The acceleration time setting is too long.	<ul style="list-style-type: none"> ▪ Check and change the acceleration time.
The combined value of the motor properties and the inverter parameter settings.	<ul style="list-style-type: none"> ▪ Check and change the parameters associated with the motor.
The level for stall prevention during acceleration is low.	<ul style="list-style-type: none"> ▪ Check and change the stall prevention level.

Cause	Measure
The level for stall prevention during operation is low.	<ul style="list-style-type: none"> Check and change the stall prevention level.
The starting torque is insufficient.	<ul style="list-style-type: none"> Change to vector control operation and try again. Auto-tuning required. If the same problem persists increase the motor and the inverter capacity.

■ Vibration occurs in rotation during operation.

Cause	Measure
The load variance is too high.	<ul style="list-style-type: none"> Increase the capacity of the motor and the inverter.
The power voltage changes.	<ul style="list-style-type: none"> Decrease the power voltage variance.
Vibration occurs at specific frequencies.	<ul style="list-style-type: none"> Adjust the output frequency to avoid the resonance area.

■ The motor overheats and rotation is unstable.

Cause	Measure
The V/F pattern setting is incorrect.	<ul style="list-style-type: none"> Set the V/F pattern suitable for the motor specification.

■ The motor deceleration time is too long even if a Dynamic Braking (DB) resistor option is connected.

Cause	Measure
The deceleration time setting is too long.	<ul style="list-style-type: none"> Check the deceleration time and change the setting.
The motor torque is insufficient.	<ul style="list-style-type: none"> If the parameters associated with the motor are normal, the motor capacity is insufficient. Therefore, increase the motor capacity.
The load is above the internal torque limit that is determined from the inverter rated current.	<ul style="list-style-type: none"> Increase the inverter capacity.

■ Motor speed holding is poor at low speed lightly loaded conditions.

Cause	Measure
The carrier frequency is high.	<ul style="list-style-type: none"> Decrease the setting of the inverter carrier frequency.
Over-excitation has occurred due to inaccurate V/F setting at low speed.	<ul style="list-style-type: none"> Decrease the torque boost value to avoid over-excitation.

■ When operating the inverter, other equipment close by operates incorrectly.

Cause	Measure
Radio frequency interference from the motor cable.	<ul style="list-style-type: none"> ▪ Reduce the carrier frequency to minimum. ▪ Install a screened cable between the inverter and the motor. Connect the screen at BOTH ends to ground. .

■ When operating the inverter, the earth leakage breaker is actuated.

Cause	Measure
An earth leakage breaker (RCD) is actuated by the leakage current from the inverter.	<ul style="list-style-type: none"> ▪ Ground the inverter by connecting it to a dedicated ground terminal. ▪ Check that the ground resistance is below 100 ohms for the 200 V series and 10 ohms for the 400 V series. ▪ Check the sensitivity of the earth leakage breaker. Can the trip current be increased safely? ▪ Decrease the setting of the inverter carrier frequency. ▪ Reduce the cable length between the inverter and the motor or fit a sinusoidal filter in the motor cable.

■ When the motor rotates, vibration occurs in the machine.

- The motor vibrates severely and does not rotate normally.

Cause	Measure
<ul style="list-style-type: none"> ▪ The phase voltage balance is poor. 	<ul style="list-style-type: none"> ▪ Check the input power voltage to stabilize the power. ▪ Check the motor insulation status.

- Humming noise or other noise occurs in the motor.

Cause	Measure
<ul style="list-style-type: none"> ▪ Resonance occurs between the machine's natural frequency and the carrier frequency. 	<ul style="list-style-type: none"> ▪ Increase or decrease the carrier frequency slightly.
<ul style="list-style-type: none"> ▪ Resonance occurs between the machine's natural frequency and the inverter output frequency. 	<ul style="list-style-type: none"> ▪ Increase or decrease the inverter command frequency slightly. ▪ Use the frequency jump function to avoid the frequency band in which the resonance occurs.

- Vibration/hunting occurs in the motor.

Cause	Measure
<ul style="list-style-type: none"> ▪ The frequency command contains electronic noise. 	<ul style="list-style-type: none"> ▪ If noise gets into the analog input terminal causing disturbance in the frequency command, change the value of the input filter time constant (IN07).
<ul style="list-style-type: none"> ▪ The wiring of the inverter and the motor is long. 	<ul style="list-style-type: none"> ▪ Keep the total wiring length of the inverter and the motor within 100 m. (Below 3.7 kW: within 50 m)

- **The motor does not stop completely even if the inverter output stops.**

Cause	Measure
DC braking does not work normally at stop therefore it is impossible to decelerate sufficiently.	<ul style="list-style-type: none"> ▪ Adjust the parameters associated with the DC braking. ▪ Increase the DC braking current setting. ▪ Increase the DC braking time setting at stopping.

- **The output frequency is not increased to the command frequency.**

Cause	Measure
The command frequency is within the jump frequency range.	<ul style="list-style-type: none"> ▪ Set the command frequency again to outside the jump frequency range.
The upper limit for the frequency command is exceeded.	<ul style="list-style-type: none"> ▪ Set the upper limit for the frequency command to above the command frequency you wish to set.
The stall prevention function is working during acceleration due to high load.	<ul style="list-style-type: none"> ▪ Replace the inverter with the one of next higher capacity.

- **The cooling fan does not rotate.**

Cause	Measure
The parameters for the cooling fan control are not set correctly.	<ul style="list-style-type: none"> ▪ Check the parameter setting for the cooling fan control. ▪ During Run (fan working at inverter operation), Always On (fan always working), Temp Control (fan working above certain temperature)

9.5 Cooling Fan Replacement

■ Fan replacement procedure (for 5.5 - 22.0 kW product)

To replace the fan, press the fan bracket on the top of the product in the direction of the arrow and pull it forward, and then disconnect the fan connector.

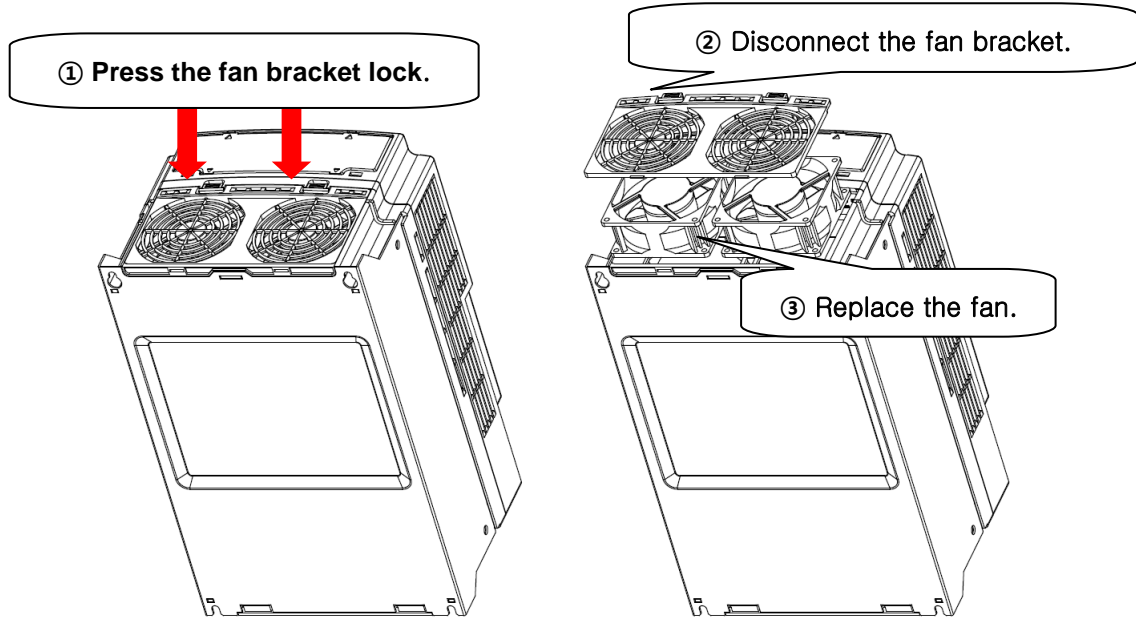


Figure 9-1 5.5 - 22.0 kW

9.6 Daily Inspection and Regular Inspection List

■ Daily inspection

Ins-pection area	Inspection item	Things to inspect	Inspection method	Judgement criteria	Inspection equipment
All	Ambient environment	Check for ambient temperature, humidity, dust, and others.	Refer to Safety Precautions in page iii.	No icing (ambient temperature: -10 - +40) and no condensation (ambient humidity below 50%)	Thermometer, hygrometer, recorder
	Complete device	Is there any abnormal vibration or noise?	Determine it visually or acoustically	OK or not OK	
	Power voltage	Is main circuit voltage OK?	Measure voltage between inverter terminal board R, S, T-phase.	-	Digital multimeter /tester
Main circuit	Main DC capacitor(s)	1) Is there any leakage? 2) Is capacitor split or swollen?	1) , 2) Check it visually.	1), 2) OK or not OK	-
Cooling system	Cooling fan	1) Is there any abnormal vibration or noise?	1) With power off, turn it by hand.	1) Must be turned smoothly	-
Display	Meter	Is display value OK?	Check display value on the panel.	Check specified value and standard value.	Voltmeter/ ammeter, etc.
Motor	All	1) Is there any abnormal vibration or noise? 2) Is there any abnormal smell?	1) Check it by hand, visually, and acoustically. 2) Check for problem such as overheat or damage.	OK or not OK	-

■ Regular inspection (annually)

Inspection area	Inspection item	What to inspect	Inspection method	Judgement criteria	Inspection equipment
Main circuit	All	1) Inspect megger (between main circuit terminal and ground terminal) 2) Is there anything loose in fastening area? 3) Is there any overheat evidence in each part?	1) Disconnect inverter and short R, S, T, U, V, W terminal, and then measure from this section to ground terminal using megger. 2) Tighten screws. 3) Check it visually.	1) Must be above 5 MΩ 2), 3) OK or not OK	DC 500 V megger
	Connecting conductor /wire	1) Is there any corrosion in conductor? 2) Is there any damage to wire sheath?	1) , 2) Check it visually.	1), 2) OK or not OK	-
	Terminal block	Is there any damage?	Check it visually.	Must be OK	-
	Smoothing condenser	Measure electrostatic capacity.	Measure it using capacity meter.	Must be above 85% of rated output capacity	Capacity meter
	Relay	1) Is there any chattering noise during operation? 2) Is there any damage in contact?	1) Check it acoustically. 2) Check it visually.	Relay must operate correctly	-
	Braking resistor	1) Is there any damage in resistor? 2) Check for evidence.	1) Check it visually. 2) Disconnect one side and measure it using tester.	1) OK or not OK 2) Must be within $\pm 10\%$ of resistor rated value	Digital multimeter/ analog tester

Inspection area	Inspection item	What to Inspect	Inspection method	Judgement criteria	Inspection equipment
Control circuit Protection circuit	Motion check	1) Check each output voltage for unbalance during inverter operation. 2) After testing sequence protection motion, display circuit must be OK.	1) Measure voltage between inverter output terminal U, V, W. 2) Short or open inverter protection circuit output forcibly.	1) Phase-to-phase voltage balance For 200 V (400 V) application, it must be within 4 V (8 V) 2) Circuit must work without any problem according to sequence.	Digital multimeter/ DC voltmeter
Cooling system	Cooling fan	Check the connector and wiring is OK.	Correct any problems in this area.	Cooling fan must operate correctly.	-
Display	Meter	Is display value OK?	Check display value on the panel.	Check specified value and standard value.	Voltmeter/ ammeter, etc.

■ Regular inspection (bi-annually)

Inspection area	Inspection item	Things to inspect	Inspection method	Judgement criteria	Inspection equipment
Main circuit	All	Megger check (between main circuit terminal and ground terminal)	Disconnect inverter and short R, S, T, U, V, W terminal, and then measure from this section to ground terminal using megger.	5 MΩ or over	DC 500 V megger
Motor	Insulation Resistance	Megger check (between output terminal and ground terminal)	Disconnect U, V, W and tie up motor wiring.	5 MΩ or over	DC 500 V megger

EMI / RFI POWER LINE FILTERS

LSis inverters, S100 series



RFI FILTERS

THE LS RANGE OF POWER LINE FILTERS **FEB (Standard)** and **FF (Footprint)** SERIES, HAVE BEEN SPECIFICALLY DESIGNED WITH HIGH FREQUENCY **LSis 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

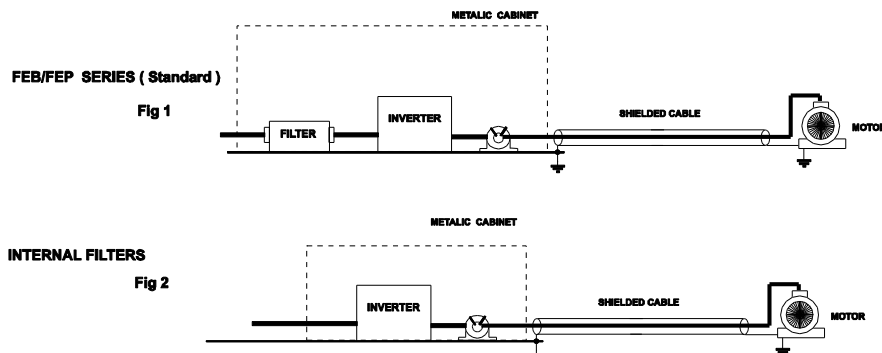
IN CASE OF A LEAKAGE CURRENT PROTECTIVE DEVICES IS USED ON POWER SUPPLY, IT MAY BE FAULT AT POWER-ON OR OFF. IN AVOID THIS CASE, THE SENSE CURRENT OF PROTECTIVE DEVICE SHOULD BE LARGER

RECOMMENDED INSTALLATION INSTRUCTIONS

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

- 1-) Check the filter rating label to ensure that the current, voltage rating and part number are correct.
- 2-) For best results the filter should be fitted as closely as possible to the incoming mains supply of the wiring enclosure, usually directly after the enclosures circuit breaker or supply switch.
- 3-) The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Care should be taken to remove any paint etc... from the mounting holes and face area of the panel to ensure the best possible earthing of the filter.
- 4-) Mount the filter securely.
- 5-) Connect the mains supply to the filter terminals marked **LINE**, connect any earth cables to the earth stud provided. Connect the filter terminals marked **LOAD** to the mains input of the inverter using short lengths of appropriate gauge cable.
- 6-) Connect the motor and fit the **ferrite core** (output chokes) as close to the inverter as possible. Armoured or screened cable should be used with the 3 phase conductors only threaded twice through the center of the ferrite core. The earth conductor should be securely earthed at both inverter and motor ends. The screen should be connected to the enclosure body via and earthed cable gland.
- 7-) Connect any control cables as instructed in the inverter instructions manual.

IT IS IMPORTANT THAT ALL LEAD LENGTHS ARE KEPT AS SHORT AS POSSIBLE AND THAT INCOMING MAINS AND OUTGOING MOTOR CABLES ARE KEPT WELL SEPARATED.



PR0064

LSLV series / Footprint Filters											
INVERTER	POWER	CODE	CURRENT	VOLTAGE	LEAKAGE CURRENT	DIMENSIONS L W H	MOUNTING Y X	WEIGHT	MOUNT	FIG.	OUTPUT CHOKE
SINGLE PHASE											
MAX.											
LSLV004S100-1	0.4kW	FFS100-M010-2	10A	250VAC	3.5 mA	176 x 71.5 x 45	162 x 50	0.6Kg	M4	B	FS - 1
LSLV006S100-1	0.75kW	FFS100-M011-2	10A	250VAC	3.5 mA	176 x 103.5 x 45	162 x 82	0.8Kg	M4	B	FS - 1
LSLV0015S100-1	1.5kW	FFS100-M020-2	20A	250VAC	3.5 mA	176 x 103.5 x 45	162 x 82	0.8Kg	M4	B	FS - 2
LSLV0022S100-1	2.2kW	FFS100-M021-2	20A	250VAC	3.5 mA	176 x 143.5 x 45	162 x 122	0.9Kg	M4	B	FS - 2
THREE PHASE											
NOM. MAX.											
LSLV004S100-2	0.4kW	FFS100-T006-2	6A	250VAC	0.3 mA 18 mA	176 x 71.5 x 45	162 x 50	1.6Kg	M4	B	FS - 2
LSLV006S100-2	0.75kW										
LSLV0015S100-2	1.5kW	FFS100-T012-2	12A	250VAC	0.3 mA 18 mA	176 x 103.5 x 45	162 x 82	1.6Kg	M4	B	FS - 2
LSLV0022S100-2	2.2kW										
LSLV0037S100-2	3.7kW	FFS100-T020-2	20A	250VAC	0.3 mA 27 mA	176 x 143.5 x 45	162 x 122	1.8 Kg	M4	B	FS - 2
LSLV0040S100-2	4kW										
LSLV0055S100-2	5.5kW	FFS100-T030-2	30A	250VAC	0.3 mA 27 mA	280 x 163.5 x 60	266 x 142	2 Kg	M4	B	FS - 2
LSLV0075S100-2	7.5kW	FFS100-T050-2	50A	250VAC	0.3 mA 27 mA	280 x 163.5 x 60	266 x 142	2.5 Kg	M4	B	FS - 2
THREE PHASE											
NOM. MAX.											
LSLV004S100-4	0.4kW	FFS100-T006-2	6A	400VAC	0.3 mA 18 mA	176 x 71.5 x 45	162 x 50	1.6Kg	M4	B	FS - 2
LSLV006S100-4	0.75kW										
LSLV0015S100-4	1.5kW										
LSLV0022S100-4	2.2kW	FFS100-T012-2	12A	400VAC	0.3 mA 18 mA	176 x 103.5 x 45	162 x 82	1.6Kg	M4	B	FS - 2
LSLV0037S100-4	3.7kW	FFS100-T020-2	20A	400VAC	0.3 mA 27 mA	176 x 143.5 x 45	162 x 122	1.8 Kg	M4	B	FS - 2
LSLV0040S100-4	4kW										
LSLV0055S100-4	5.5kW	FFS100-T030-2	30A	400VAC	0.3 mA 27 mA	280 x 163.5 x 60	266 x 142	1.8 Kg	M4	B	FS - 2
LSLV0075S100-4	7.5kW										

EN 55011 CLASS B IEC/EN 61800-3 C2

LSLV series / Standard Filters											
INVERTER	POWER	CODE	CURRENT	VOLTAGE	LEAKAGE CURRENT	DIMENSIONS L W H	MOUNTING Y X	WEIGHT	MOUNT	FIG.	OUTPUT CHOKE
THREE PHASE											
NOM. MAX.											
LSLV0055S100-2	5.5kW	FEB 3042	42A	220-480VAC	0.9mA 27mA	310 x 50 x 85	30 x 295	2.8Kg	---	A	FS - 2
LSLV0075S100-2	7.5kW	FEB 3055	55A	220-480VAC	0.9mA 27mA	250 x 85 x 90	60 x 235	3.1Kg	---	A	FS - 2
LSLV0110S100-2	11kW	FEB 3075	75A	220-480VAC	0.9mA 27mA	270 x 80 x 135	60 x 255	4Kg	---	A	FS - 2
LSLV0150S100-2	15kW	FEB 3100	100A	220-480VAC	0.9mA 27mA	270 x 90 x 150	65 x 255	5.5Kg	---	A	FS - 3
LSLV0185S100-2	18.5kW	FEB 3130	130A	220-480VAC	0.9mA 27mA	270 x 90 x 150	65 x 255	7.5Kg	---	A	FS - 3
LSLV0220S100-2	22kW										

LSLV0055-0220 S100-2 EN 55011 CLASS A IEC/EN 61800-3 C3

LSLV series / Internal Filters			
INVERTER	POWER	FIG.	OUTPUT CHOKE
THREE PHASE			
LSLV0055S100-4	5.5kW	2	FS - 2
LSLV0075S100-4	7.5kW	2	FS - 2
LSLV0110S100-4	11kW	2	FS - 2
LSLV0150S100-4	15kW	2	FS - 3
LSLV0185S100-4	18.5kW	2	FS - 3
LSLV0220S100-4	22kW	2	FS - 3

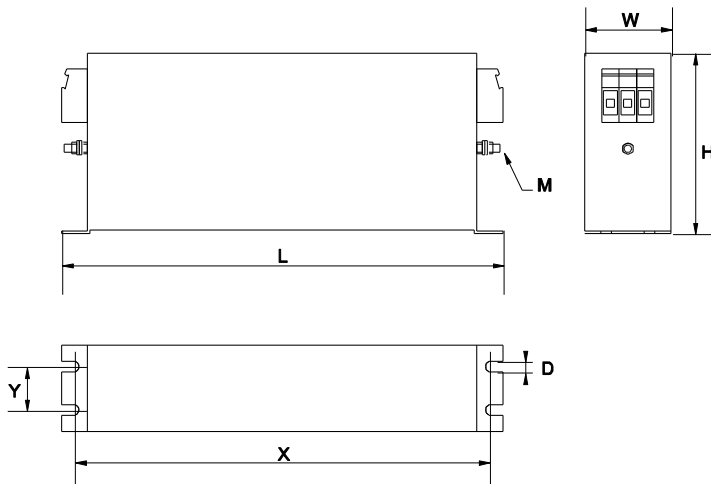
EN 55011 CLASS A IEC/EN 61800-3 C3

1) 0055-0220-4 : To Conform to EMC directive, Input choke, FS-2 with 2 turns, should be installed on power supply cable.

2) The EMC test is taken at 3kHz carrier frequency.

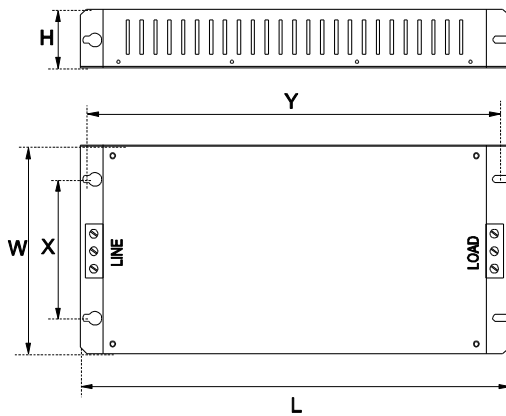
FEB SERIES (Standard)

FIG.A

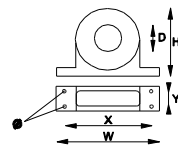


FF SERIES (Footprint)

FIG. B



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



FS SERIES (output chokes)

CODE	D	W	H	X	Ø
FS- 1	21	85	50	22	4
FS- 2	28,5	105	62	80	5
FS- 3	48	150	110	125 x 30	5

PR0064

Quality Assurance

Product Name	LSIS Standard Inverter		Date of Installation	
Model Name	LSLV-S100		Warranty Period	
Customer	Name			
	Address			
	Phone			
Retailer	Name			
	Address			
	Phone			

This product was produced under strict quality control and test procedures of LS industrial Systems technicians.
 It's term of warranty is 12 months after the date of installation. If no date of installation is written, the warranty is valid for 18 months after the date of manufacture.
 However, this term of warranty may change depending on contract terms.

Free Technical Support

If malfunction occurs when the product has been used in a proper manner and the product warranty has not expired, contact one of our agencies or designated service centers. We will repair the product free of charge.

Paid Technical Support

A certain fee will be charged for service in the following cases:

- Malfunction was caused by the intentional or unintentional negligence of the consumer.
- Malfunction was caused by inappropriate voltage or defects of machines connected to the product.
- Malfunction was caused by Act of God (fire, flood, gas, earthquake, etc.).
- The product was modified or repaired in a place that is not our agency or service center.
- The product does not have a LSIS plate attached to it
- The warranty has expired.

Please visit LSIS homepage (<http://www.lsis.biz>) for more useful information and services:

Manual Revision History

Number	Issued Year and Month	Revised Content	Version No.	Notes
1	2012. 01.	First edition	1.00	-
2				

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