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AC Variable Speed Drive

LSLV-S300 Series

User's Manual

0.4~75 kW[200V] 0.4~220 kW[400V]



Safety Instructions

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

LS ELECTRIC

This operation manual is intended for users with basic knowledge of electricity and electric devices.

* S300 is the series name of the LSLV-S300.
* The software of this product may be revised for better functionality or performance. If you find any deviation from this user manual, check out the latest version on our website below.
  (https://www.ls-electric.com)

Safety Information

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

Safety symbols in this manual

⚠ Hazard

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

⚠ Warning

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

⚠ Caution

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

Safety Information

⚠ Hazard

- Never remove the product cover or touch the internal printed circuit board (PCB) or any contact points when the power is on. Also, do not start the product when the cover is open. This may cause an electrical shock due to the exposure of high-voltage terminals or the charging area.
- Even if the power is off, do not open the cover unless it is absolutely necessary, like for the wiring operation or for a regular inspection. Opening the cover may still cause an electrical shock, even after the power is blocked, because the product has been charged for a long period of time.
- Before opening the cover to start working, wait at least 10 minutes after the power is disconnected and check that the DC voltage of the product has been discharged using a tester. Otherwise, it may cause an electrical shock and result in personal injury or even death.
- Supply earthing system: TT, TN, not suitable for corner-earthed systems

⚠ Warning

- Make sure to install a ground connection between the equipment and the motor for safe use. Otherwise, it may cause an electrical shock and result in personal injury or even death.
- Do not turn on the power if the product is damaged or faulty. If you find that the product is faulty, disconnect the power supply and have the product professionally repaired.
- The inverter becomes hot during operation. Avoid touching the inverter until it has cooled to avoid burns. Avoid touching the inverter until it has cooled to avoid burns.
- Do not allow foreign objects such as screws, metals, water, or oil to get inside the product. It can cause damage or a fire.
- Do not operate the switch with wet hands. Otherwise, it may cause an electrical shock and result in personal injury or even death.

ⓘ Caution

- Do not disassemble or change the inside of the product at your own discretion. This may result in failure or malfunction, causing worker injury or product damage. Also, products disassembled or changed at your own discretion will not be entitled to the product warranty.
- Do not use the inverter for single-phase motor operation, as it has been designed for three-phase motor operation. Using a single-phase motor may damage the motor.
- Do not place heavy objects on top of electric cables. Heavy objects may damage the cable and result in an electric shock.

Note

Maximum allowed prospective short-circuit current at the input power connection is defined in IEC 60439-1 as 100 kA. LSLV-S300 is suitable for use in a circuit capable of delivering not more than 100kA RMS at the drive's maximum rated voltage, depending on the selected MCCB. RMS symmetrical amperes for recommended MCCB are the following table.

Remarque

Le courant maximum de court-circuit présumé autorisé au connecteur d'alimentation électrique est défini dans la norme IEC 60439-1 comme égal à 100 kA. Selon le MCCB sélectionné, la série LSLV-S300 peut être utilisée sur des circuits pouvant fournir un courant RMS symétrique de 100 kA maximum en ampères à la tension nominale maximale du variateur. Le tableau suivant indique le MCCB recommandé selon le courant RMS symétrique en ampères.

Working Voltage	UTE100 (E/N)	UTS150 (N/H/L)	UTS250 (N/H/L)	UTS400 (N/H/L)
240V(50/60Hz)	50/65kA	65/100/150kA	65/100/150kA	65/100/150kA
480V(50/60Hz)	25/35kA	35/65/100kA	35/65/100kA	35/65/100kA

Working Voltage	UTS600 (N/H/L)	UTS800 (N/H/L)	UTS1200 (N/H/P/L)
240V(50/60Hz)	65/100/150kA	65/100/150kA	50/100/65/150kA
480V(50/60Hz)	35/65/100kA	35/65/100kA	35/65/50/100kA

Working Voltage	ABS33c	ABS53c	ABS63c	ABS103c	ABS203c	ABS403c
240V(50/60Hz)	30kA	35kA	35kA	85kA	85kA	75kA
480V(50/60Hz)	7.5kA	10kA	10kA	26kA	26kA	35kA

Quick Reference Table

The table below is a summary of situations that users encounter frequently while using the product. Refer to the following to search for information more easily and quickly:

Situation	Ref.
What are the recommended wiring lengths?	p.36
What are the factory default settings for multi-function terminals DI1 to DI8?	p.40
I want to install a frequency meter on the analog terminal.	p.43
I want to change the inverter's operation frequency using a potentiometer.	p.94
I want to operate the inverter using a multi-step speed configuration.	p.105
I want to configure the inverter to start operating as soon as the power source is applied.	p.117
I want to apply PID control to my system.	p.182
The motor is too noisy.	p.230
The motor is too hot.	p.402
The inverter is too hot.	p.419
I want to check the changed parameters only.	p.535
Can I check the current of the motor in Smart Operator?	p.536
I found something unusual in the product or motor.	p.737
The cooling fan does not work.	p.746
I want to know how to store the inverter when it is not in use.	p.752

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1 Preparing the Installation

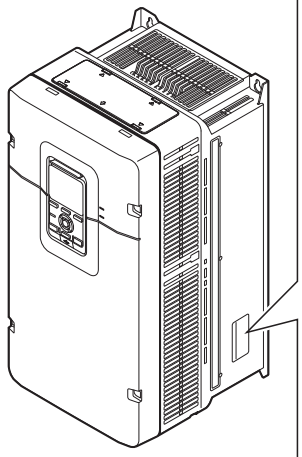
This chapter provides details on product identification, part names, correct installation, and cable specifications. To install the inverter correctly and safely, carefully read and follow the instructions.

1.1 Product Identification

The S300 inverter is manufactured in a range of product groups based on motor capacity and power source specifications. Product name and specifications are detailed on the rating plate. Check the product specification before installing the product and make sure that it is suitable for the intended use. For more detailed product specifications, refer to **16.2 Product Specification Details**.

Note

Open the packaging and check the product name and check the product for defects. If the product is found to be faulty, contact your supplier.



Model

LSLV0220S300-2COFD

INPUT 200-240 3Phase 50/60Hz
HD:146.5A ND:163A
OUTPUT 0-Input V 3Phase 0.01 - 590Hz
HD:152/124A ND:169/156A
116 kVA(D) IP20

Input Power Specifications

Output Power Specifications

QR Code

Ser. No 550D130005F
Inspected by J.D. PARK

LS ELECTRIC MADE IN KOREA

LSLV□□□□ S300 - □□□□□

Maximum Applicable Motor Capacity (based on HD)

0004 - 0.4 kW
0008 - 0.75 kW
0015 - 1.5 kW
0022 - 2.2 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
0300 - 30 kW
0370 - 37 kW
0450 - 45 kW
0550 - 55 kW
0750 - 75 kW
0900 - 90 kW
1100 - 110 kW
1320 - 132 kW
1600 - 160 kW
1850 - 185 kW
2200 - 220 kW

Series Name

S300 Series

Input Voltage

2 - 3 Phase 200 V - 240 V
4 - 3 Phase 380 V - 480 V

Operator

C - LCD Operator
N - No LCD Operator

UL Type

0 - UL Open Type
E - UL Type 1

EMC filter

F - Built-in EMC
N - No Built-in EMC

Reactor

D - Built-in DC Reactor
N - Non-DCR

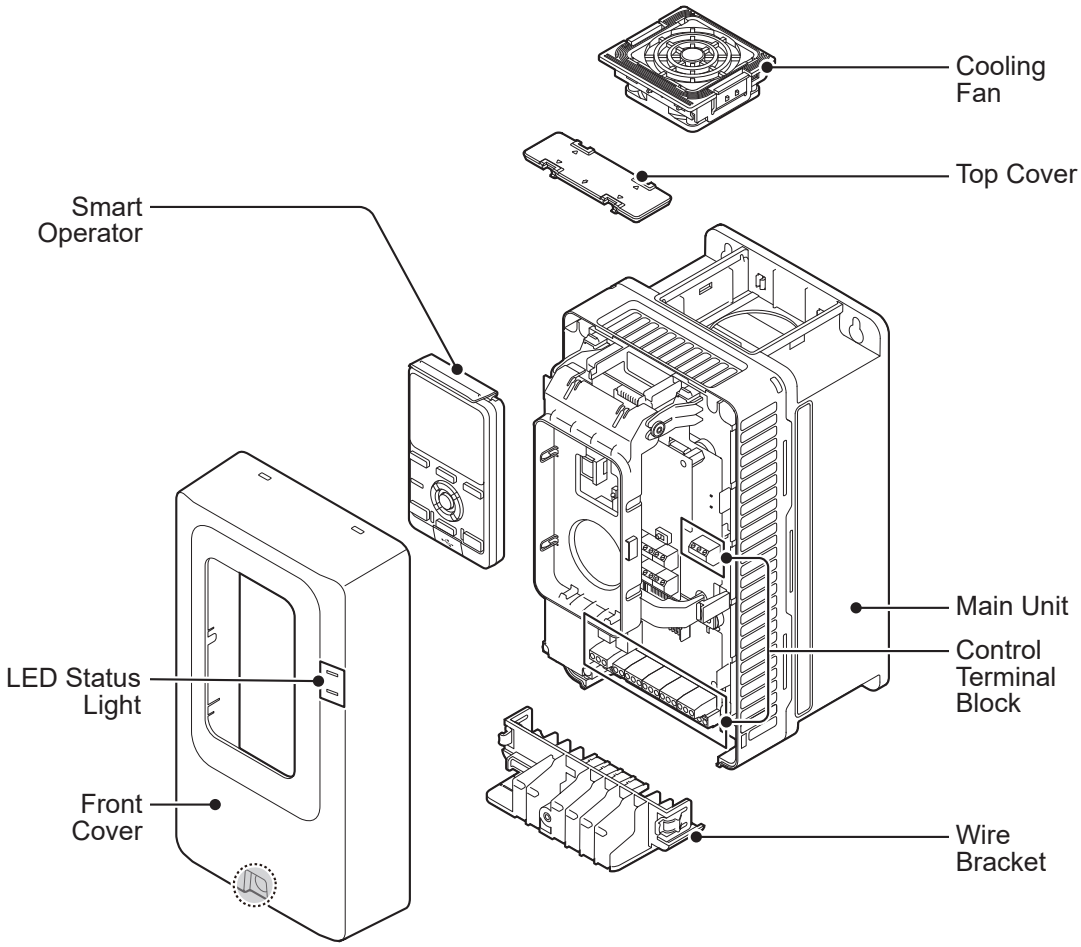
[Image 1. Product Rating Plate]

1.2 Check the Part Names

See the assembly diagram below for the part names. Refer to the following images, as detailed images may vary according to product groups. Refer to **4.1 Description of the Inverter Status Indicator LED** for instructions on the LED status light in the front of the inverter.

200 V Class 0.4-4 kW / 400 V Class 0.4-4 kW

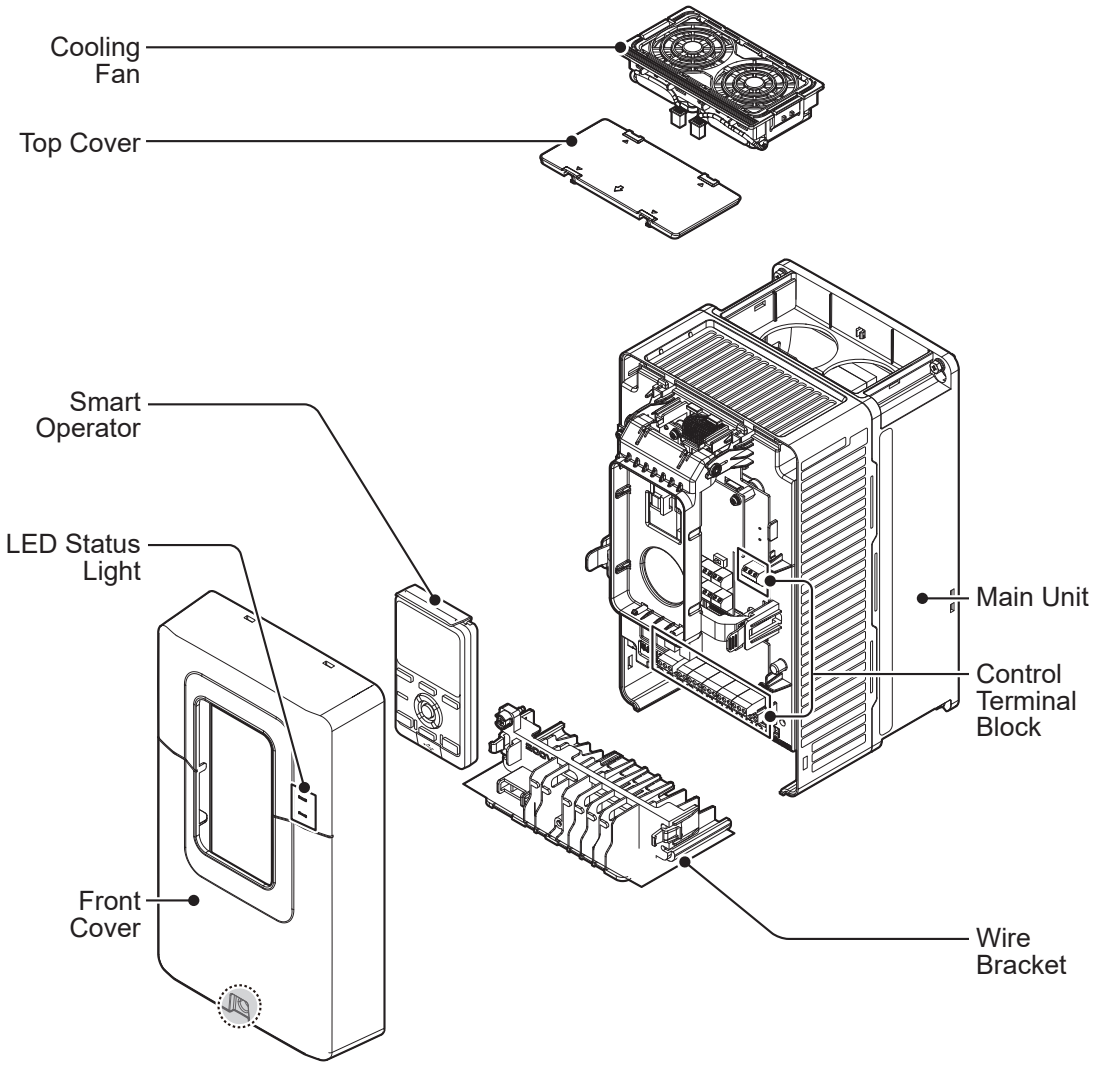
LSLV0004S300-4 / LSLV0008S300-4 / LSLV0015S300-4 / LSLV0022S300-4 / LSLV0040S300-4
LSLV0004S300-2 / LSLV0008S300-2 / LSLV0015S300-2 / LSLV0022S300-2 / LSLV0040S300-2



[Image 2. 200 V class 0.4-4 kW / 400 V class 0.4-4 kW Assembly Diagram]

200 V Class 5.5-7.5 kW / 400 V Class 5.5-7.5 kW

LSLV0055S300-2 / LSLV0075S300-2
LSLV0055S300-4 / LSLV0075S300-4

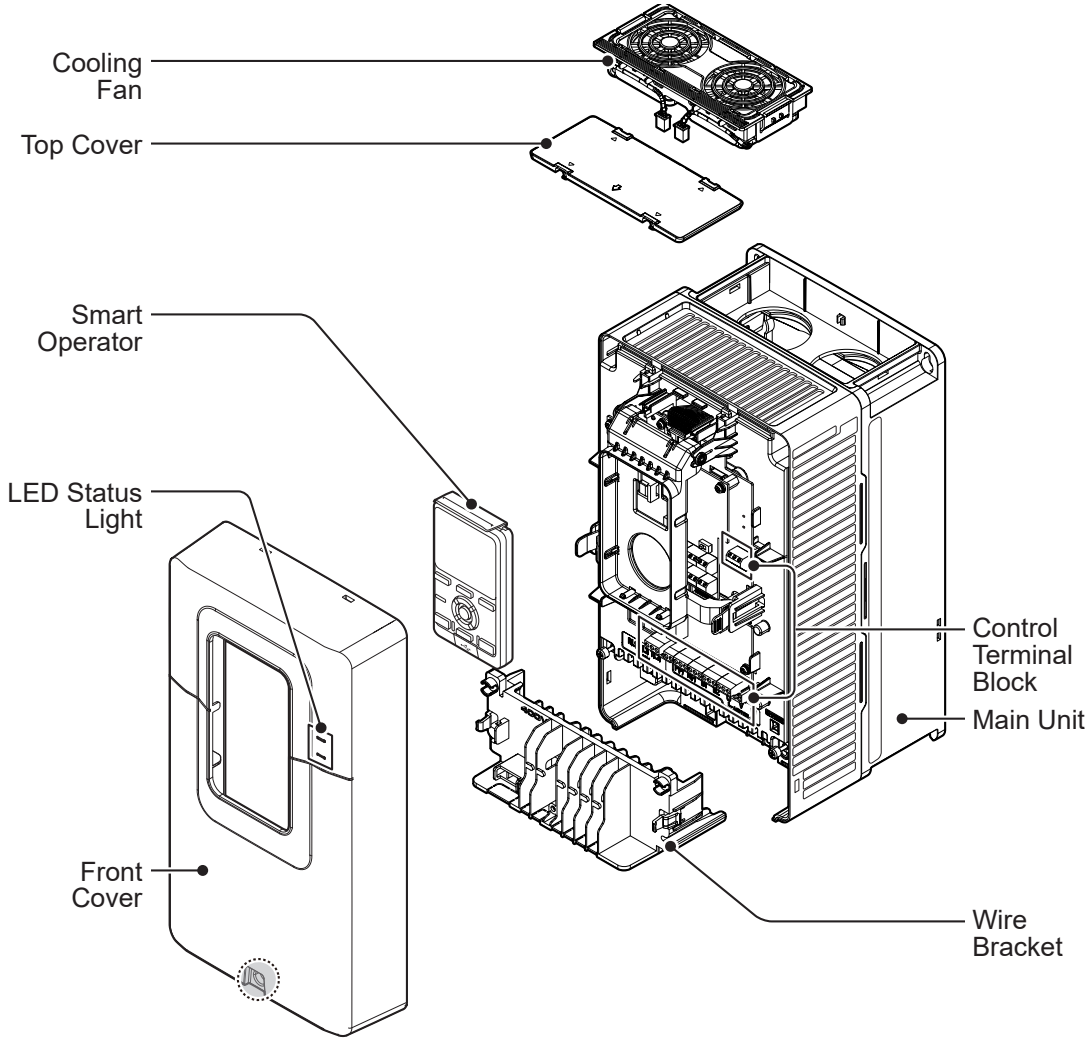


: Front Cover Bolted Joint

[Image 3. 200 V class 5.5-7.5 kW / 400 V class 5.5-7.5 kW Assembly Diagram]

200 V Class 11 kW / 400 V Class 11-15 kW

LSLV0110S300-2
LSLV0110S300-4 / LSLV0150S300-4

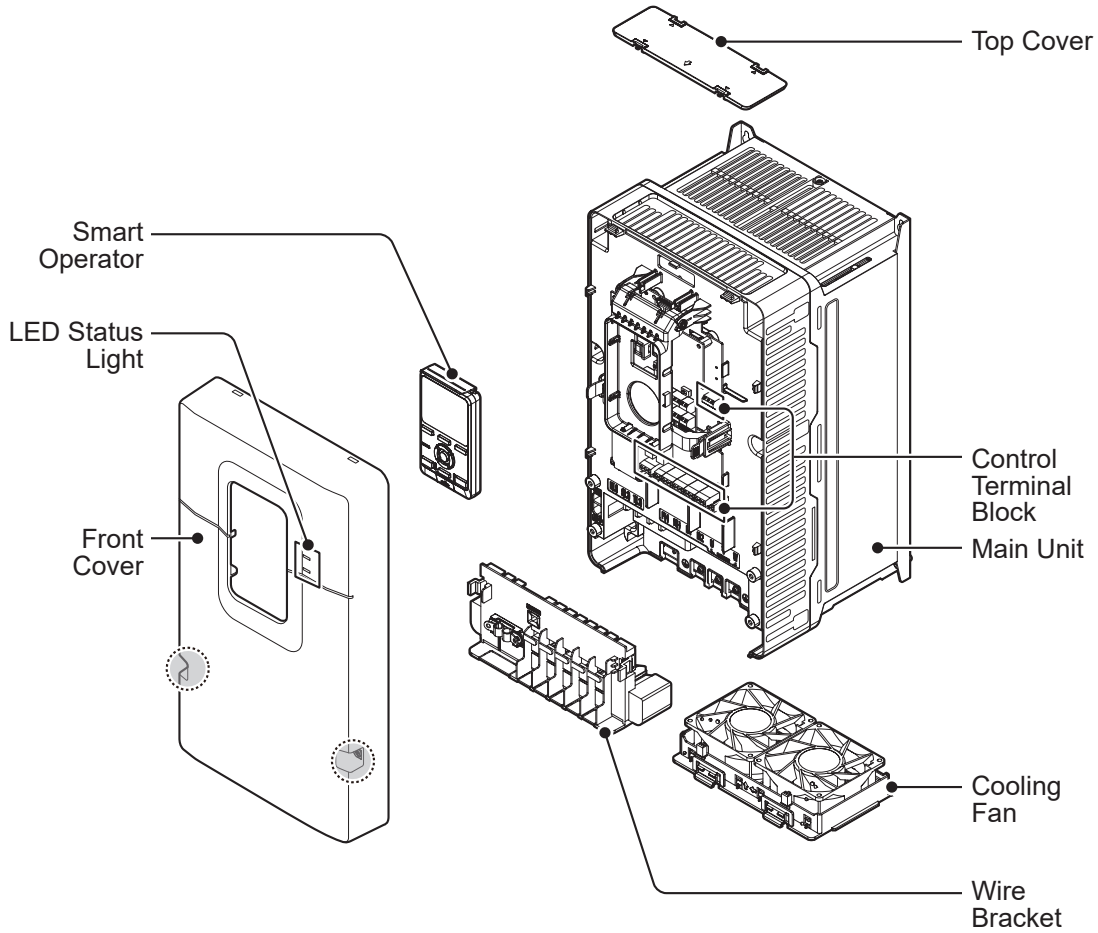


: Front Cover Bolted Joint

[Image 4. 200 V Class 11 kW / 400 V Class 11-15 kW Assembly Diagram]

200 V Class 15-18.5 kW / 400 V Class 18.5-22 kW

LSLV0150S300-2 / LSLV0185S300-2
LSLV0185S300-4 / LSLV0220S300-4

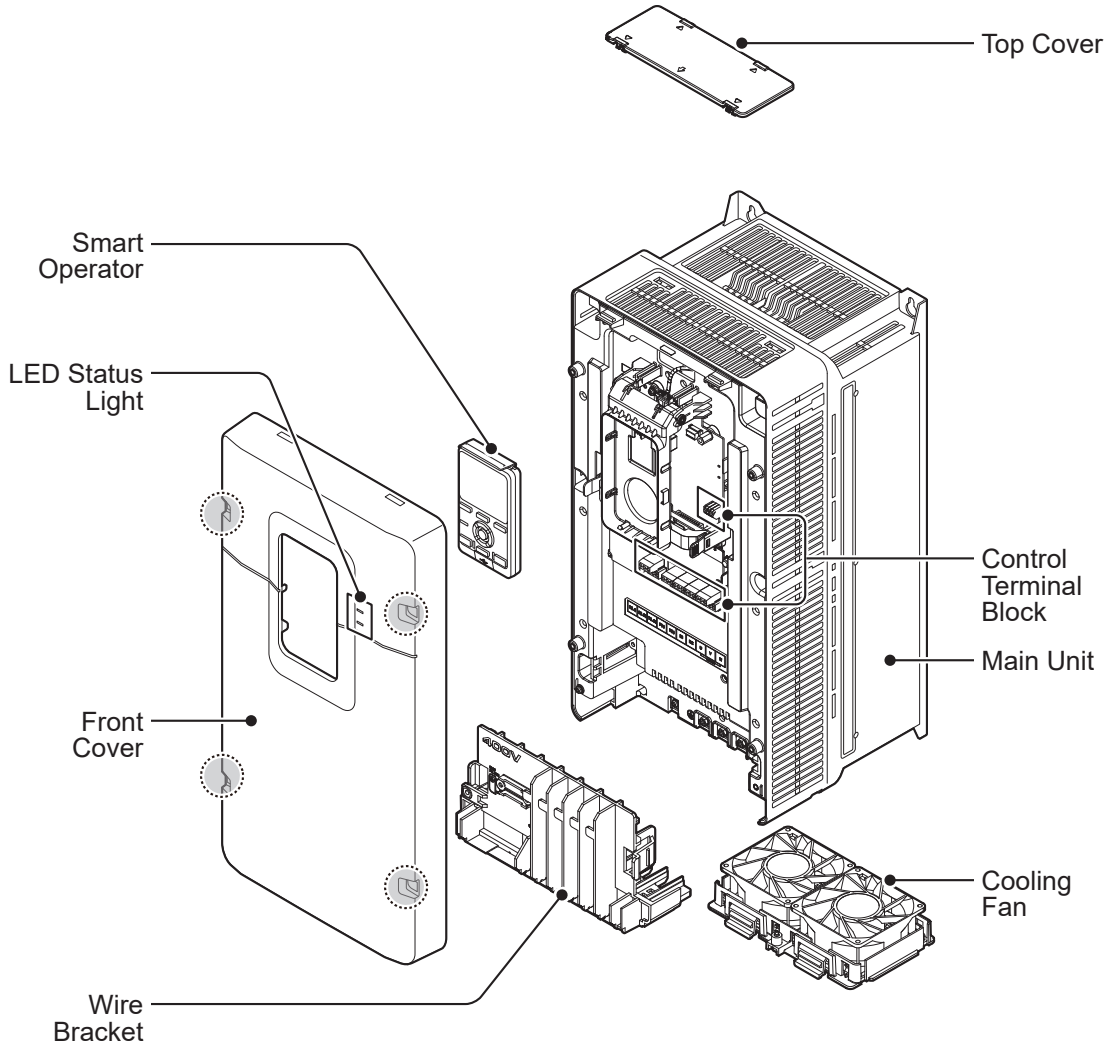


: Front Cover Bolted Joint

[Image 5. 200 V Class 15-18.5 kW / 400 V Class 18.5-22 kW Assembly Diagram]

200 V Class 22 kW / 400 V Class 30~37 kW

LSLV0220S300-2
LSLV0300S300-4 / LSLV0370S300-4

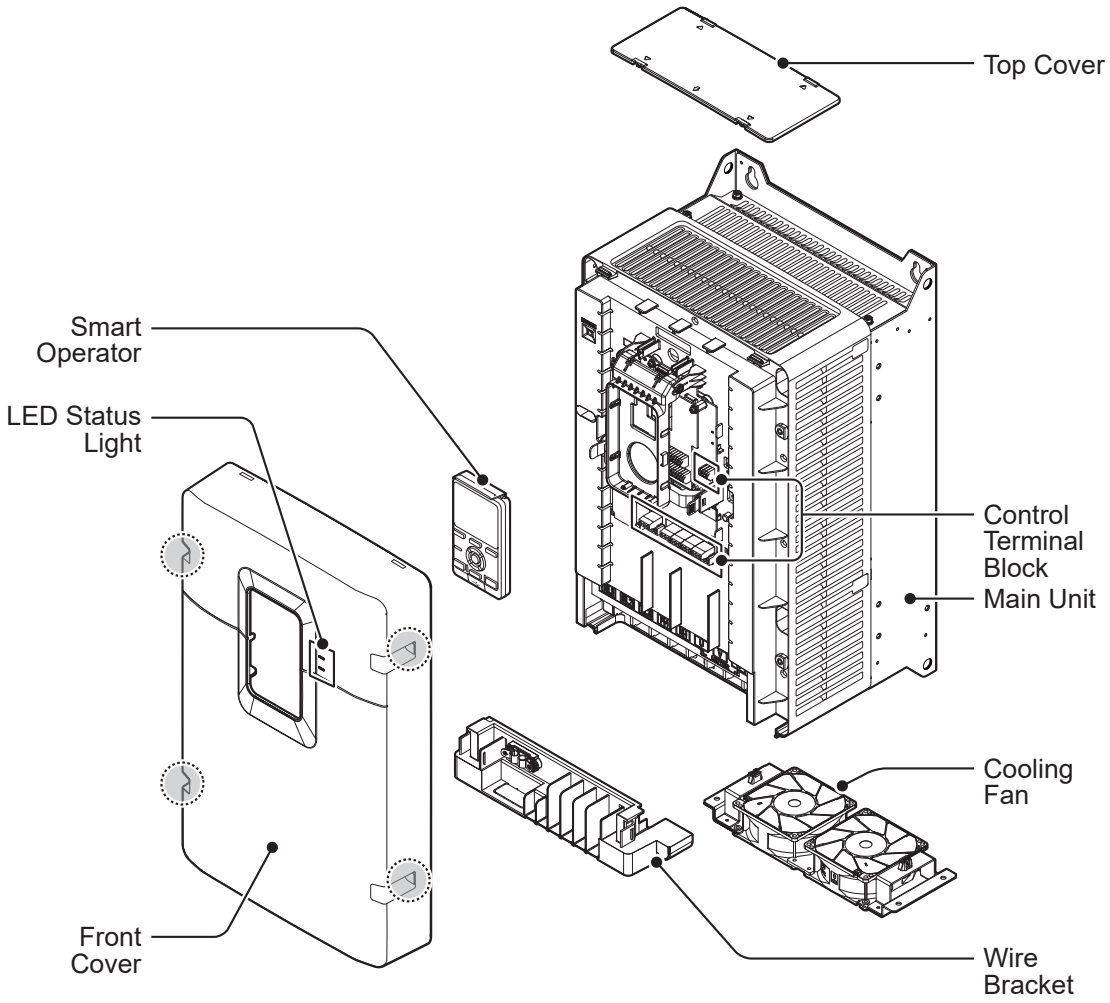


: Front Cover Bolted Joint

[Image 6. 200 V Class 22 kW / 400 V Class 30-37 kW Assembly Diagram]

200 V Class 30 kW / 400 V Class 45 kW

LSLV0300S300-2
LSLV0450S300-4

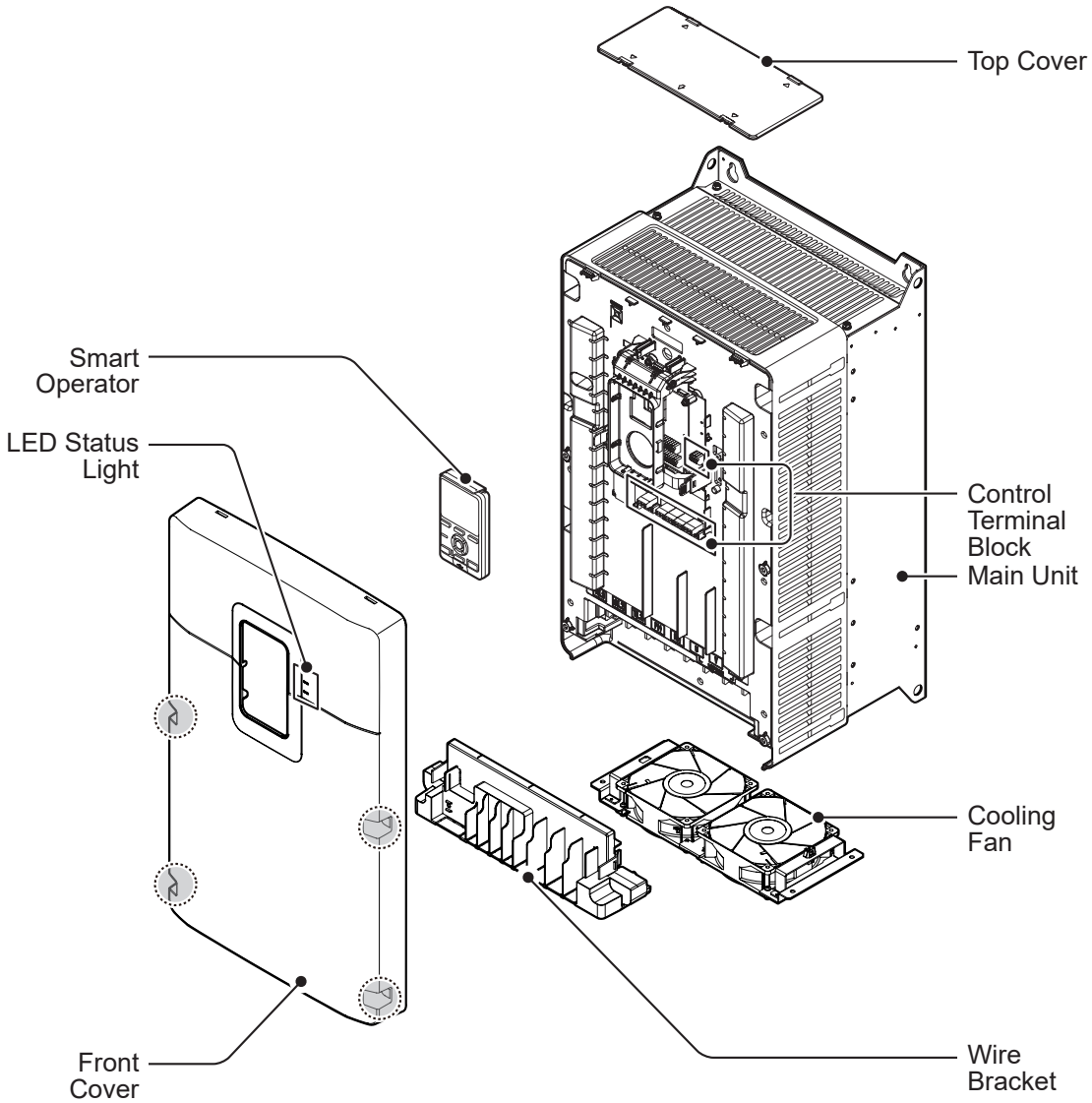


: Front Cover Bolted Joint

[Image 7. 200 V Class 30 kW / 400 V Class 45 kW Assembly Diagram]

200 V Class 37-45 kW / 400 V Class 55-75 kW

LSLV0370S300-2 / LSLV0450S300-2
LSLV0550S300-4 / LSLV0750S300-4

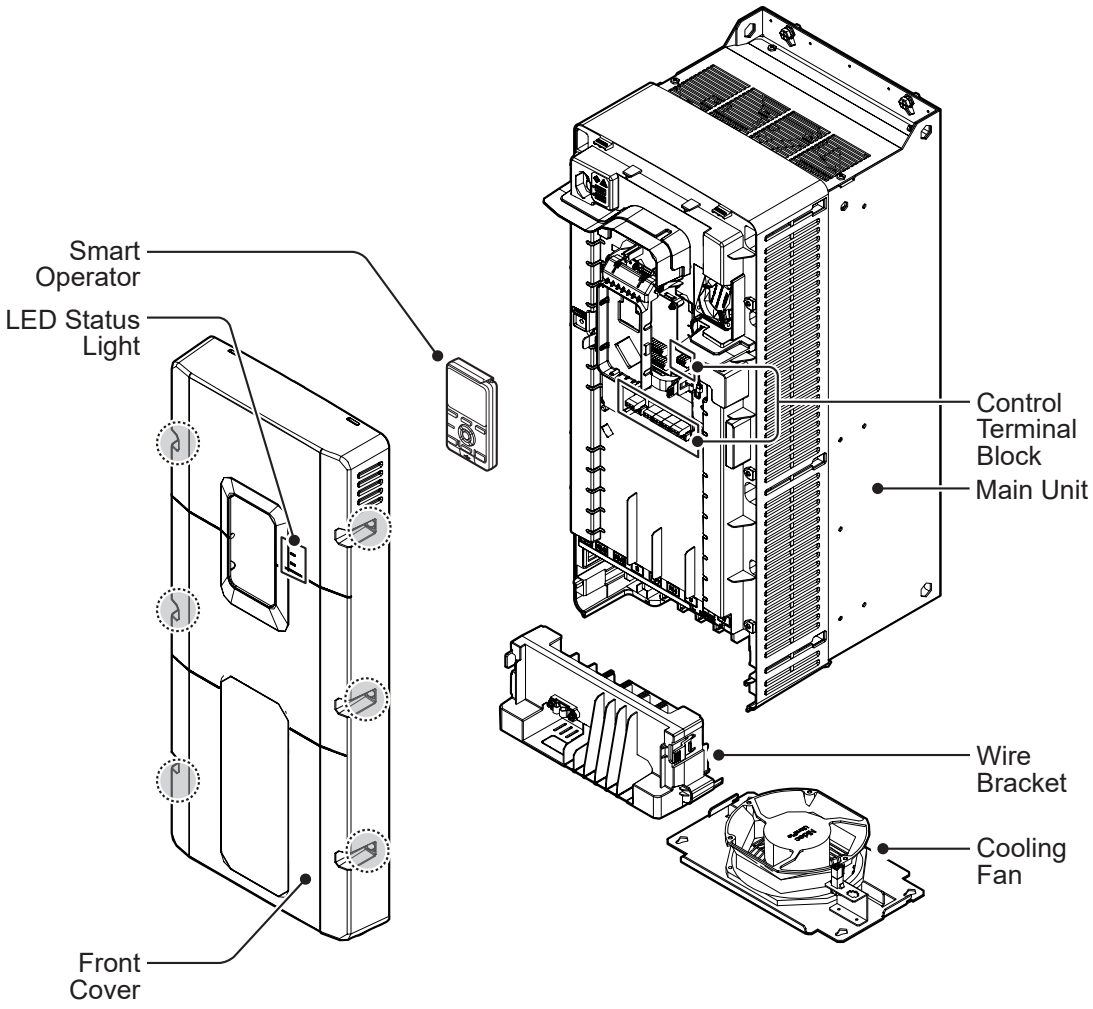


: Front Cover Bolted Joint

[Image 8. 200 V Class 37-45 kW / 400 V Class 55-75 kW Assembly Diagram]

400 V Class 90-110 kW

LSLV0900S300-4 / LSLV1100S300-4

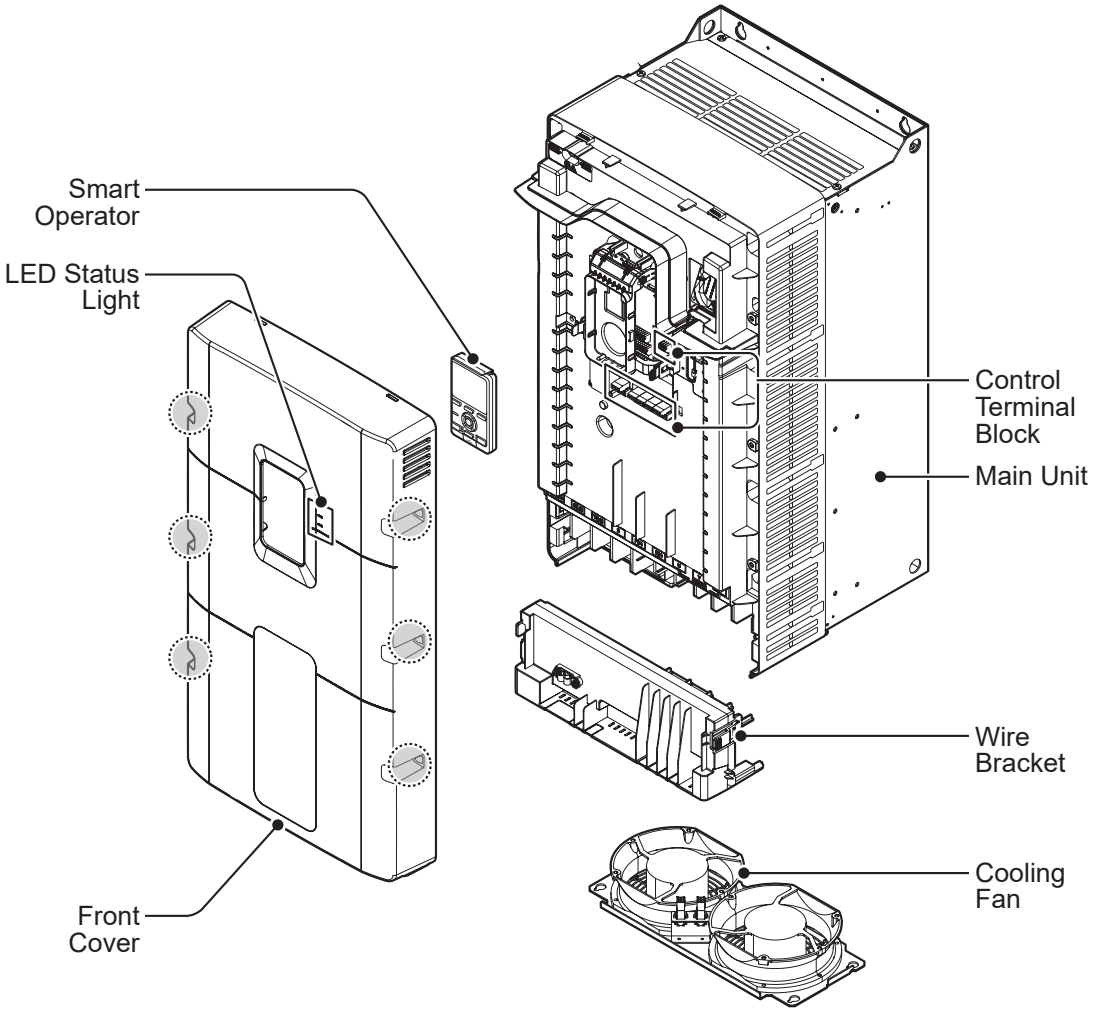


: Front Cover Bolted Joint

[Image 9. 400 V Class 90-110 kW Assembly diagram]

200 V Class 55-75 kW / 400 V Class 132-160 kW

LSLV0550S300-2 / LSLV0750S300-2
LSLV1320S300-4 / LSLV1600S300-4

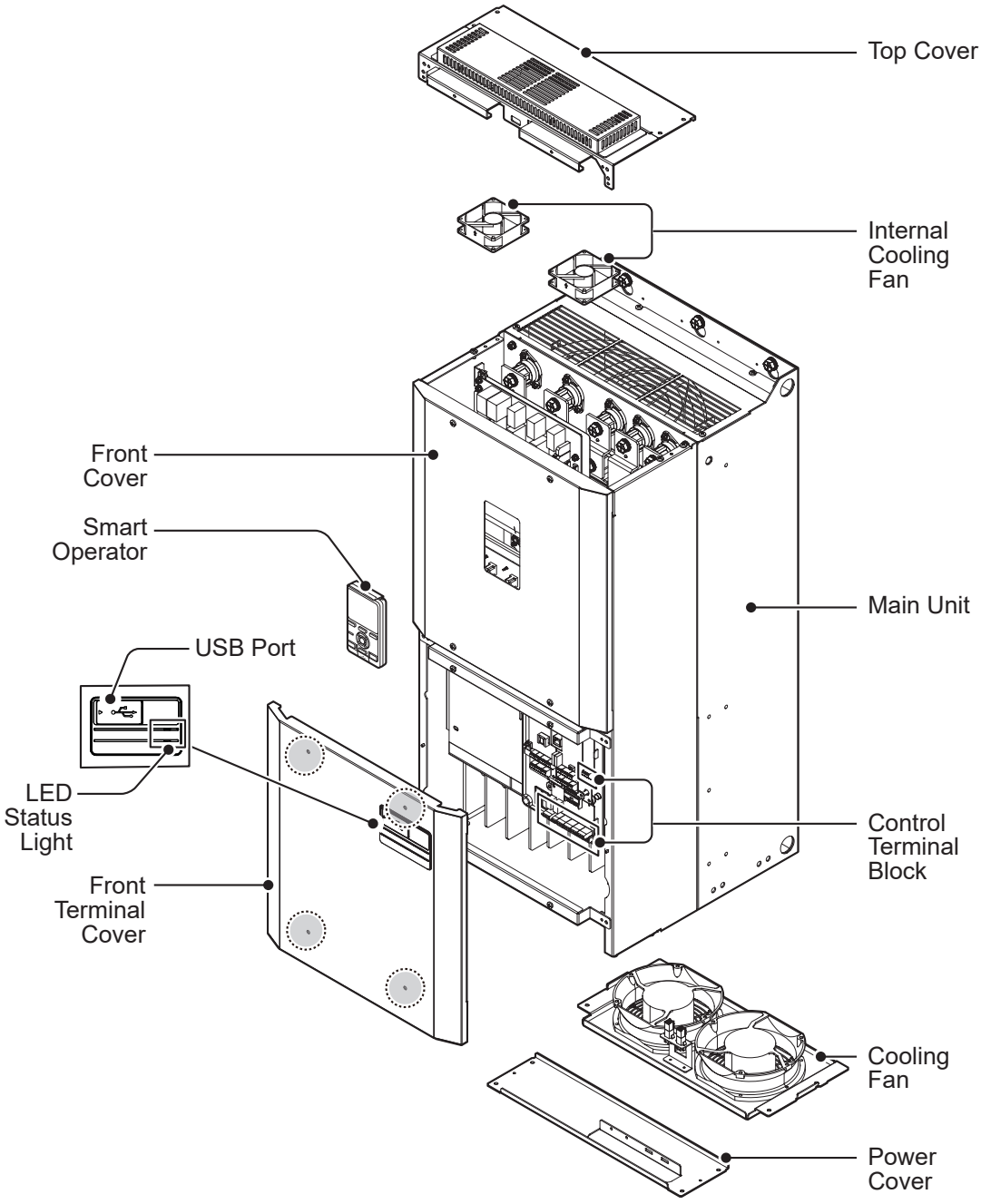


: Front Cover Bolted Joint

[Image 10. 200 V Class 55-75 kW / 400 V Class 132-160 kW Assembly Diagram]

400 V Class 185-220 kW

LSLV1850S300-4 / LSLV2200S300-4



[Image 11. 400 V Class 185-220 kW Assembly diagram]

1.3 Installation Considerations

Inverters are composed of various precise electronic parts, and therefore the installation environment can significantly impact the lifespan and reliability of the product. The table below details the ideal operation and installation conditions for the inverter.

Table 1. Inverter Installation Environment

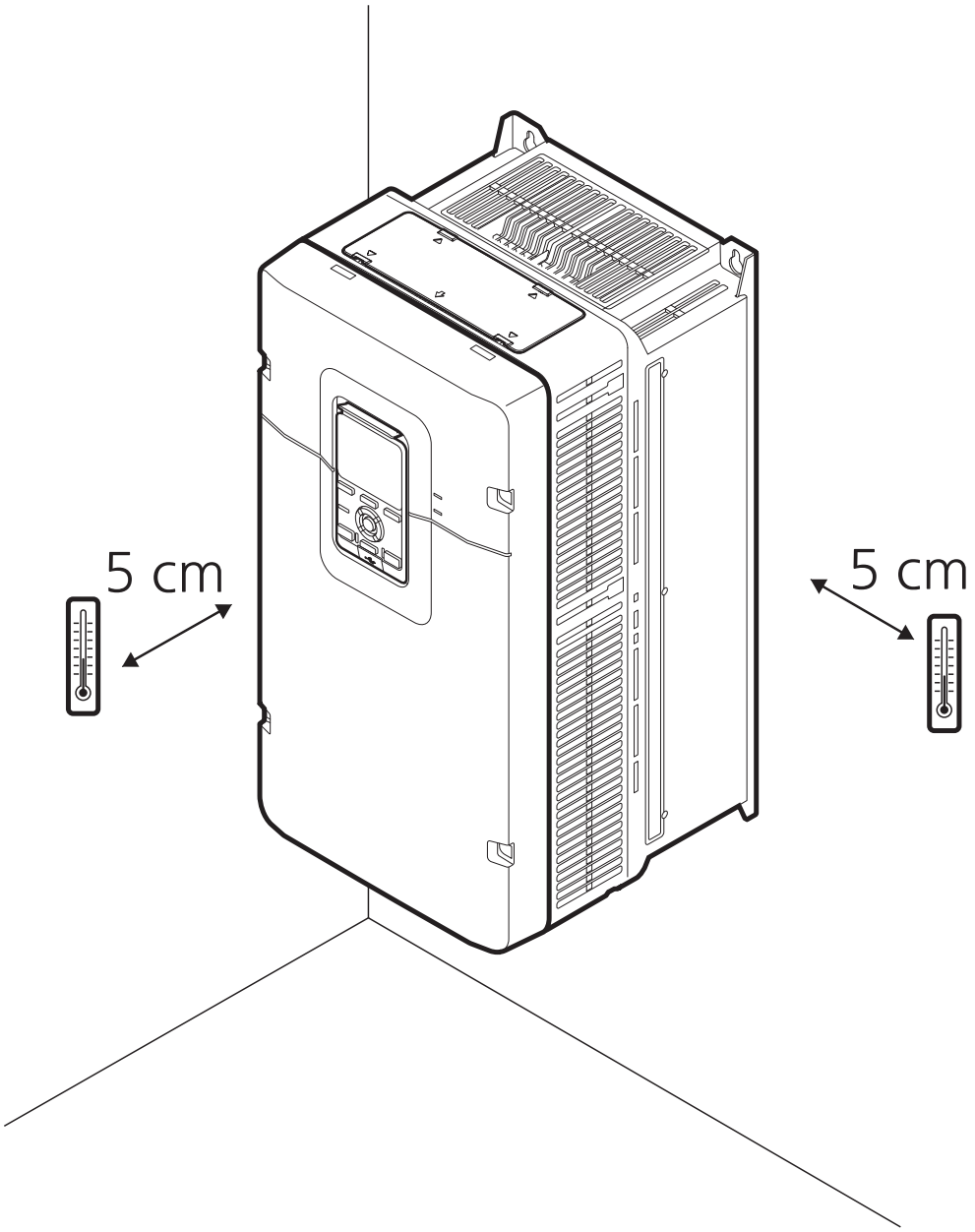
Items	Description
Ambient temperature*	Where there is no ice or frost, • -10~50℃ on heavy duty • -10~40℃ on normal duty The conduit option requires 1.5%/℃ current derating when it is over 30℃ on normal duty and when it is over 40℃ on heavy duty.
Ambient humidity	Less than 95% relative humidity (no condensation)
Storage temperature	-20~65℃
Environmental factors	Prevent contact with corrosive gases, inflammable gases, oil stains, dust, and other pollutants (Pollution Degree 2 Environment).
Altitude	Maximum of 1,000 m above sea level (1000-2000 m, 1%/100 m derating)
Vibration	Less than 9.8 m/sec² (1.0 G)
Air Pressure	70~106kPa
Installation Method	Wall-mount type or flange options
Turning on the Inverter	Overvoltage category III
Length of Output Wiring**	Within 100 m

* The ambient temperature is the temperature measured at a point 5 cm from the surface of the inverter.

** The maximum allowed carrier frequency per wiring length is as follows (contact the customer center if the wiring exceeds 100 m):

Table 2. Maximum Allowed Carrier Frequency per Wiring Length

Wiring Length Between Inverter and Motor	50 m or shorter	100 m or shorter	Longer than 100m
Allowed Carrier Frequency	15 kHz or lower	5 kHz or lower	3 kHz or lower



[Image 12. Measurement Criteria for Ambient Temperature for Installation]

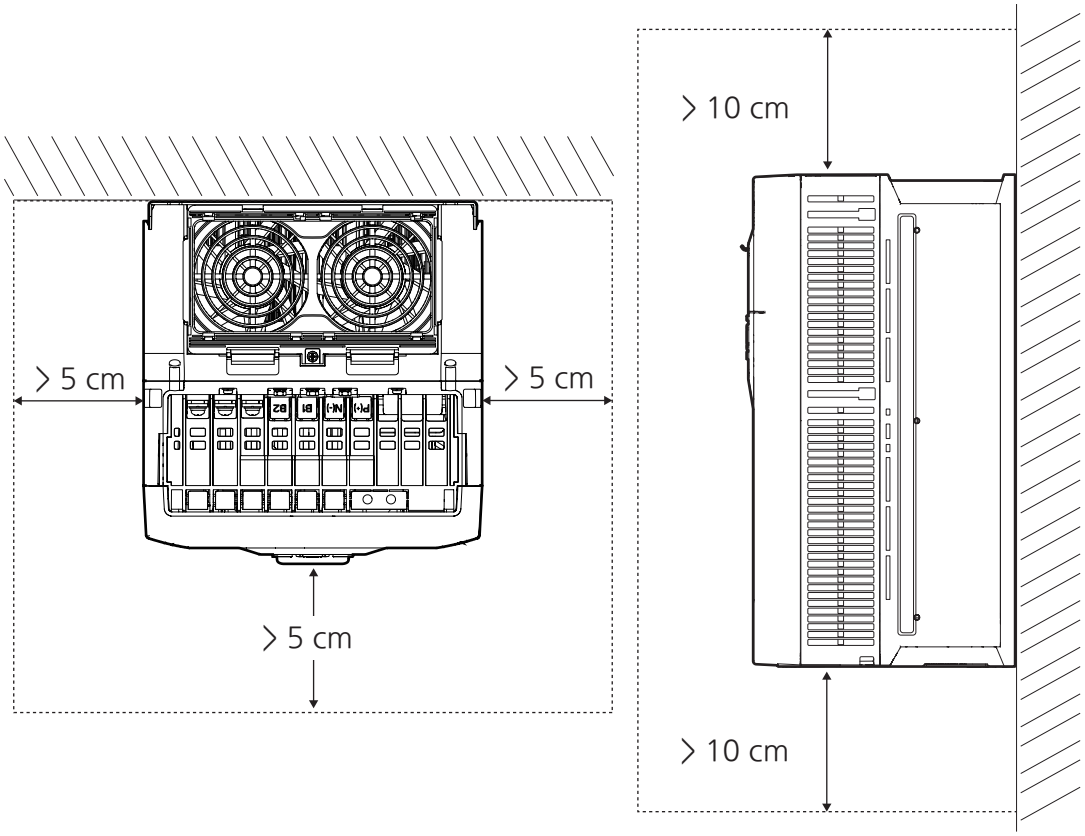
⚠ Caution

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

1.4 Selecting the Installation Location

When selecting an installation location, consider the following points:

- The location must be free from vibration, and the inverter must be installed on a wall that can support the inverter's weight.
- The inverter can become very hot during operation. Install the inverter on a surface that is fire-resistant or flame-retardant and with sufficient clearance around the inverter to allow air to circulate.



[Image 13. Selection Criteria for Installation Location]

- Make sure that sufficient air circulation is provided around the product. When installing the product inside the panel, carefully consider the position of the product's cooling fan and the ventilation louver. The product must be placed so that the cooling fan can discharge heat satisfactorily during the operation.

1.5 Wire Selection

Make sure to use wires that are appropriate for the use and specifications of each I/O and control circuit for safe and reliable operation of the product. Refer to the following information to assist you with cable selection:

⚠ Caution

- Select the thickest possible cable for I/O wiring to ensure that the percentage of voltage drop does not exceed 2%.
- Use copper cables rated for 600 V and 75 ℃ or above for I/O wiring.
- Use copper cables rated for 300 V and 75 ℃ for control terminal wiring.

1.5.1 Ground Wire Specifications

Table 3. Ground Wire Specifications per Model

Model LSLV□□□□	Ground			Model LSLV□□□□	Ground		
	mm²	AWG	Bolt		mm²	AWG	Bolt
0004S300-2	1.5	18	M4	0004S300-4	1.5	20	M4
0008S300-2	1.5	14	M4	0008S300-4	1.5	18	M4
0015S300-2	1.5	12	M4	0015S300-4	1.5	14	M4
0022S300-2	1.5	10	M4	0022S300-4	1.5	14	M4
0040S300-2	2.5	10	M4	0040S300-4	1.5	12	M4
0055S300-2	4	8	M4	0055S300-4	1.5	10	M4
0075S300-2	10	6	M4	0075S300-4	4	8	M4
0110S300-2	16	4	M4	0110S300-4	4	8	M4
0150S300-2	16	4	M4	0150S300-4	6	6	M4
0185S300-2	16	4	M4	0185S300-4	10	6	M4
0220S300-2	25	3	M5	0220S300-4	16	4	M4
0300S300-2	35	1	M8	0300S300-4	16	4	M5
0370S300-2	50	1/0	M8	0370S300-4	16	4	M5
0450S300-2	70	3/0	M8	0450S300-4	25	3	M8
0550S300-2	95	3/0	M12	0550S300-4	35	1	M8
0750S300-2	120	250	M12	0750S300-4	50	1/0	M8
				0900S300-4	70	2/0	M8
				1100S300-4	95	3/0	M8

Model LSLV□□□□	Ground			Model LSLV□□□□	Ground		
	mm²	AWG	Bolt		mm²	AWG	Bolt
				1320S300-4	120	4/0	M12
				1600S300-4	150	300	M12
				1850S300-4	185	350	M12
				2200S300-4	240	500	M12

1.5.2 Power I/O Cable Specifications

Table 4. I/O Wiring Specifications per Model

Model LSLV□□□□	Power Terminal Wiring									
	mm² (AWG)			AWG			Lug Specifications [1]		Bolt	
	R/S/T	P/N	U/V/W	R/S/T	P/N	U/V/W	R/S/T/U/V/W	P/N	R/S/T	P/N/U/V/W
0004S300-2	1.5	1.5	1.5	20.0	18.0	18.0	0102-xx04	0102-xx04	M3.5	M3.5
0008S300-2	1.5	1.5	1.5	16.0	14.0	14.0	0102-xx04	0102-xx04	M3.5	M3.5
0015S300-2	1.5	1.5	1.5	14.0	12.0	12.0	0102-xx04	0102-xx04	M3.5	M3.5
0022S300-2	1.5	2.5	2.5	12.0	10.0	10.0	0102-xx04	0102-xx04	M3.5	M3.5
0040S300-2	2.5	4.0	4.0	10.0	10.0	10.0	0102-xx04	0102-xx04	M3.5	M3.5
0055S300-2	4.0	6.0	6.0	8.0	8.0	8.0	0102-xx04	0102-xx04	M4	M4
0075S300-2	10.0	10.0	10.0	8.0	6.0	6.0	0103-xx04	0103-xx04	M4	M4
0110S300-2	16.0	16.0	16.0	6.0	4.0	4.0	0104-xx05	0104-xx05	M5	M5
0150S300-2	25.0	25.0	25.0	4.0	3.0	3.0	0105-xx05	0105-xx05	M5	M5
0185S300-2	25.0	35.0	35.0	3.0	2.0	2.0	0105-xx05	0105-xx05	M5	M5
0220S300-2	50.0	70.0	50.0	1.0	2/0	1/0	0108-xx06	0108-xx06	M6	M6
0300S300-2	70.0	95.0	70.0	2/0	3/0	2/0	0109-xx08	0109-xx08	M8	M8
0370S300-2	95.0	120.0	95.0	3/0	250.0	4/0	0112-xx08	0112-xx08	M8	M8
0450S300-2	120.0	185.0	150.0	250.0	350.0	300.0	0114-xx08	0114-xx08	M8	M8
0550S300-2	95x2	120x2	95x2	3/0x2	250x2	4/0x2	0112-xx08	0112-xx08	M12	M12

[1] American Wire Gauge (AWG) applicable lug (based on Dong-a Bestech)
PPNO□□□□-□□□□

Model LSLV□□□□	Power Terminal Wiring									
	mm² (AWG)			AWG			Lug Specifications [1]		Bolt	
	R/S/T	P/N	U/V/W	R/S/T	P/N	U/V/W	R/S/T/U/V/W	P/N	R/S/T	P/N/U/V/W
0750S300-2	120x2	180x2	120x2	250x2	350x2	250x2	0114-xx08	0114-xx08	M12	M12
0004S300-4	1.5	1.5	1.5	22.0	22.0	20.0	0102-xx04	0102-xx04	M3.5	M3.5
0008S300-4	1.5	1.5	1.5	20.0	18.0	18.0	0102-xx04	0102-xx04	M3.5	M3.5
0015S300-4	1.5	1.5	1.5	18.0	14.0	14.0	0102-xx04	0102-xx04	M3.5	M3.5
0022S300-4	1.5	1.5	1.5	16.0	14.0	14.0	0102-xx04	0102-xx04	M3.5	M3.5
0040S300-4	1.5	1.5	1.5	14.0	12.0	12.0	0102-xx04	0102-xx04	M3.5	M3.5
0055S300-4	2.5	2.5	2.5	12.0	10.0	10.0	0102-xx04	0102-xx04	M4	M4
0075S300-4	4.0	4.0	4.0	10.0	8.0	8.0	0102-xx04	0102-xx04	M4	M4
0110S300-4	6.0	6.0	6.0	8.0	8.0	8.0	0102-xx04	0102-xx04	M4	M4
0150S300-4	10.0	10.0	10.0	8.0	6.0	8.0	0103-xx04	0103-xx04	M4	M4
0185S300-4	10.0	16.0	10.0	6.0	6.0	6.0	0104-xx05	0104-xx05	M5	M5
0220S300-4	16.0	25.0	16.0	4.0	4.0	4.0	0104-xx05	0104-xx05	M5	M5
0300S300-4	25.0	35.0	25.0	3.0	2.0	3.0	0105-xx05	0107-xx05	M5	M6
0370S300-4	35.0	50.0	35.0	2.0	1.0	2.0	0105-xx05	0107-xx05	M5	M6
0450S300-4	50.0	70.0	50.0	1.0	2/0	1/0	0108-xx08	0108-xx08	M8	M8
0550S300-4	70.0	95.0	70.0	2/0	4/0	3/0	0111-xx08	0111-xx08	M8	M8
0750S300-4	95.0	120.0	95.0	4/0	250.0	4/0	0112-xx08	0112-xx08	M8	M8
0900S300-4	70x2	70x2	70x2	2/0x2	3/0x2	2/0x2	0109-xx08	0109-xx08	M8	M8
1100S300-4	95x2	95x2	95x2	3/0x2	4/0x2	3/0x2	0110-xx08	0110-xx08	M8	M8
1320S300-4	120x2	150x2	120x2	4/0x2	300x2	250x2	0113-xx12	0113-xx12	M12	M12
1600S300-4	150x2	185x2	150x2	300x2	500x2	300x2	0114-xx12	0114-xx12	M12	M12
1850S300-4	185x2	240x2	185x2	350x2	500x2	400x2	0117-xx12	0117-xx12	M12	M12
2200S300-4	185x2	240x2	185x2	350x2	500x2	400x2	0117-xx12	0117-xx12	M12	M12

1.5.3 Signal (Control) Cable Specifications

Table 5. Control Wiring Specifications by Terminal

Terminals	Wire gauge [2]	
	mm²	AWG
VR+, VR-, AI1, AI2, AI3, TI, TO, AO1, AO2, EPI, 5G	0.33~1.25	16~22
DI1~DI8, CM, DP, DG	0.33~2.0	14~22
DA1, DB1, DC1, DA2, DC2, DQ3, EG	0.33~2.0	14~22
SP, SA, SB	0.33~2.0	14~22
S+, S-, 5G	0.75	18

[2] Use shielded twisted pair cables (recommended).

2 Installing the Product

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

Installation Flowchart

The flowchart lists the sequence to be followed during installation. Install the product following the flowchart and check the operation status. For more information on each step, refer to the pages below.

Product Identification (refer to **page 62**)

↓

Check the Installation Location (refer to **page 13**)

↓

Mounting the Inverter (refer to **page 22**)

↓

Wiring the Ground Connection (refer to **page 28**)

↓

Power and Signal Wiring (refer to **page 29**)

↓

Post-Installation Checks (refer to **page 50**)

↓

Turning on the Inverter

↓

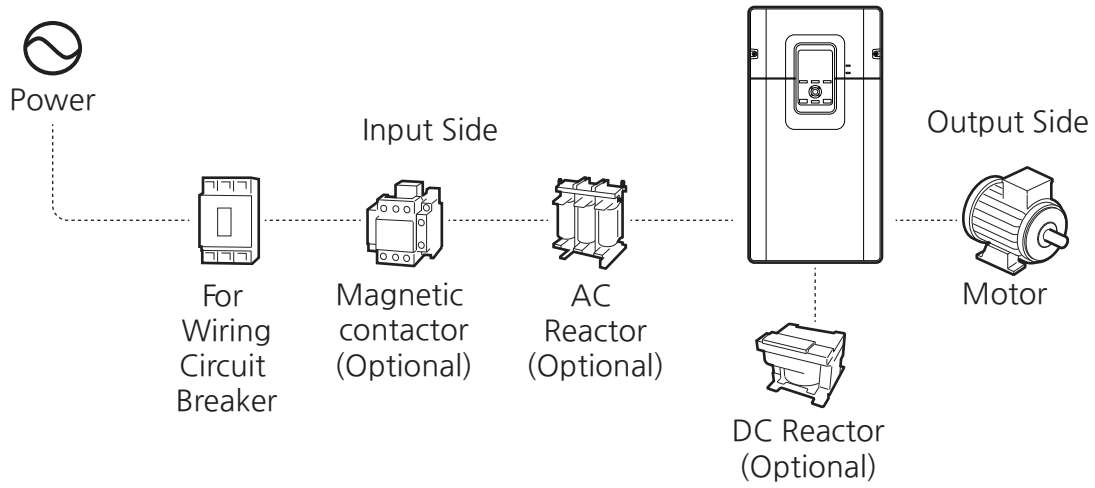
Parameter Configuration (refer to **page 53**)

↓

Testing (refer to **page 60**)

Basic configuration diagram

The following illustration shows the basic system configuration. Use the diagram as a reference when configuring the system by connecting the product with peripheral devices. Ensure that the product has a suitable rating for the configuration and that all the required peripherals and optional devices (brake units, reactors, noise filters, etc.) are available. For more details on the product's rated input and output specifications, refer to **16.1 Input and Output Specifications**. For more details on available peripheral devices, refer to **16.4 Peripheral Devices**.



[Image 1. System configuration]

ⓘ Caution

- Note that the illustration in this user manual may represent the product with the cover open or the circuit breaker removed for explanation. When operating the inverter, make sure to follow the instructions in the user manual after fully installing the necessary parts, such as the cover and circuit breaker.
- Do not start or stop the inverter with a magnetic contactor. This may cause damage to the inverter.
- Install additional safety devices, such as emergency brakes. In the event that control is difficult as a result of product failure, dangerous situations may occur.
- High levels of current draw while powering on can affect the system. Ensure that correctly rated circuit breakers are installed to operate safely when powering on.
- It is necessary to use a reactor if improvement to the power factor is required, if the wiring length is less than 10 meters, or if the input voltage capacity is large (600 kVA or more, and the power supply capacity is 10 times or more than the inverter capacity). Ensure that the reactor's capacity and rating are taken into consideration when selecting it (refer to **16.4.2 AC Input Fuse and Reactor Specifications**).

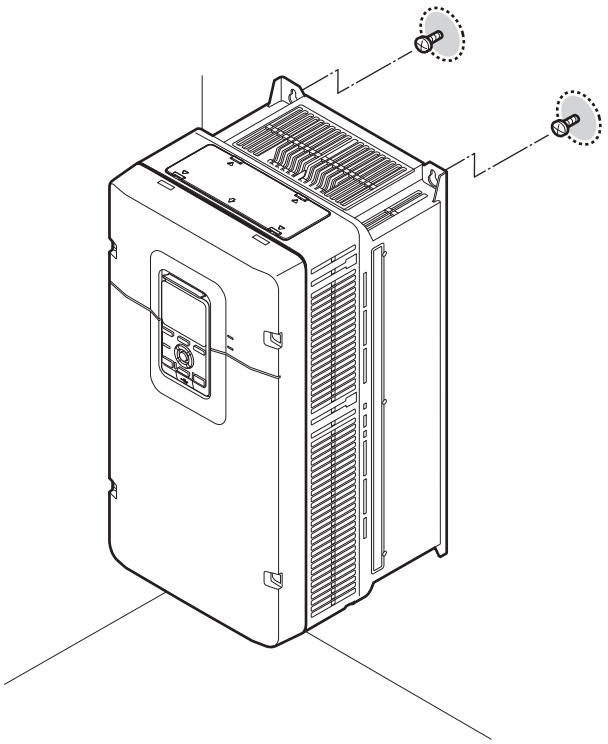
2.1 Mounting on the Wall or within the Panel

Mount the inverter on a wall or inside a panel following the procedures provided below. Before installation, ensure that there is sufficient space to meet the clearance specifications and that there are no obstacles impeding the cooling fan's air flow.

Select a wall or panel capable of supporting the installation, and check the inverter's mounting bracket dimensions (refer to **16.3.1 External Dimensions**).

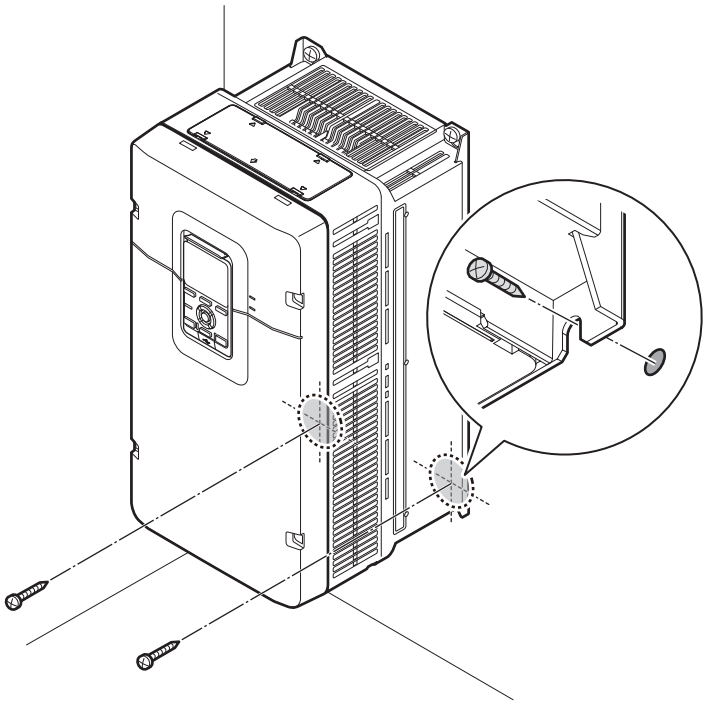
1 Draw a horizontal line using a level on the wall or inside the panel where you want to install the inverter, and accurately mark the locations of the mounting bolts on the horizontal line.

2 Use a drill to pierce two mounting holes at the installation location, and install the mounting bolts. Do not fully tighten the bolts at this time. Fully tighten the mounting bolts after the inverter has been mounted.



[Image 2. Fixing mounting bolts (top)]

3 Mount the inverter on a wall or inside a panel using two mounting bolts. Tighten the upper mounting bolts, then install two lower mounting bolts and tighten them to mount the inverter. Ensure that the inverter is placed flat on the mounting surface and that the installation surface can securely support the weight of the inverter.



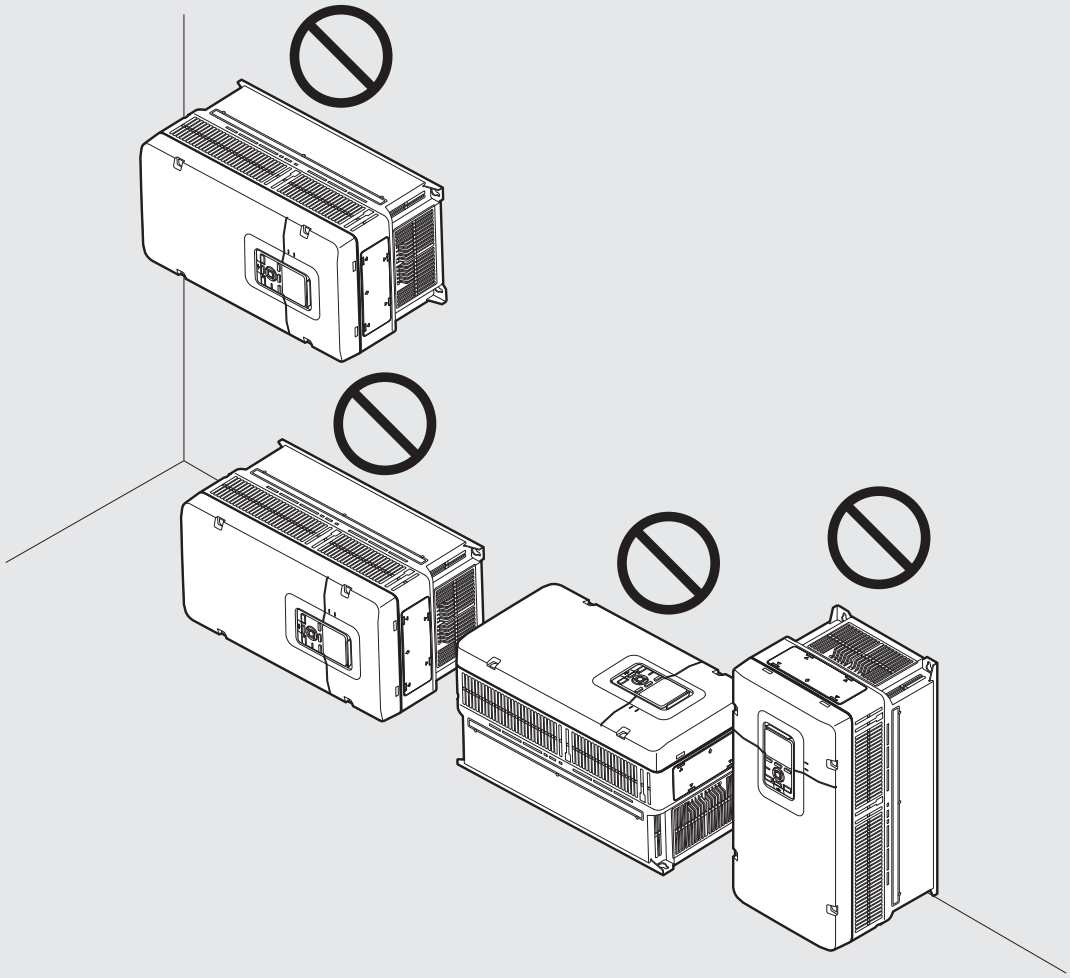
[Image 3. Fixing mounting bolts (bottom)]

Note

The quantity and dimensions of the mounting brackets vary based on the frame size. Refer to **16.3.1 External Dimensions** for detailed information about your model.

ⓘ Caution

- Always support the inverter by using the metal frames when moving it. Do not transport the inverter by lifting it with the inverter's covers or plastic surfaces. The inverter may tip over if the covers break, resulting in injury or damage to the product.
- Use a transport method that is suitable for the weight of the product. Some high-capacity inverters may be too heavy for one person to carry. Use an adequate number of people and transport tools to safely move the product.
- Do not install the inverter on the floor or mount it sideways against a wall. The inverter must be installed vertically, on a wall or inside a panel, with its rear flat on the mounting surface and at least 10 cm from the floor.



[Image 4. Example of incorrect mounting]

2.2 Wiring

Open the front cover, remove the wiring brackets and control terminal cover, and then install the ground connection as specified. Complete the cable connections by connecting an appropriately rated cable to the terminals on the power and control terminal blocks. Read the following information carefully before making wiring connections to the inverter: All warning instructions must be followed.

ⓘ Caution

- Install the inverter before carrying out wiring connections. Refer to **1.3 Installation Considerations** and **1.4 Selecting the Installation Location** for details.
- Ensure that no small metal debris, such as wire cut-offs or screws, remain inside the inverter. Metal debris and screws in the inverter may cause inverter failure.
- Tighten terminal screws to their specified torque. Loose terminal block screws may allow the cables to disconnect and cause a short circuit or inverter failure. Refer to **16.5 Terminal Screw Specifications** for torque specifications.
- Do not place heavy objects on top of electric cables. Heavy objects may damage the cable and result in an electric shock.
- Use cables with the largest cross-sectional area, appropriate for power terminal wiring, to ensure that any voltage drop does not exceed 2%.
- Use copper cables rated at 600 V, 75℃ for power terminal wiring.
- Use copper cables rated at 300 V, 75℃ for control terminal wiring.
- Be sure that the display screen of the Smart Operator as well as the charging indicator are turned off before changing the wiring due to a problem while operating. As soon as the power is turned off, be careful to avoid electric shock, as the capacitor in the inverter is charged with a high voltage.

2.2.1 Step 1 Front Cover Disassembly

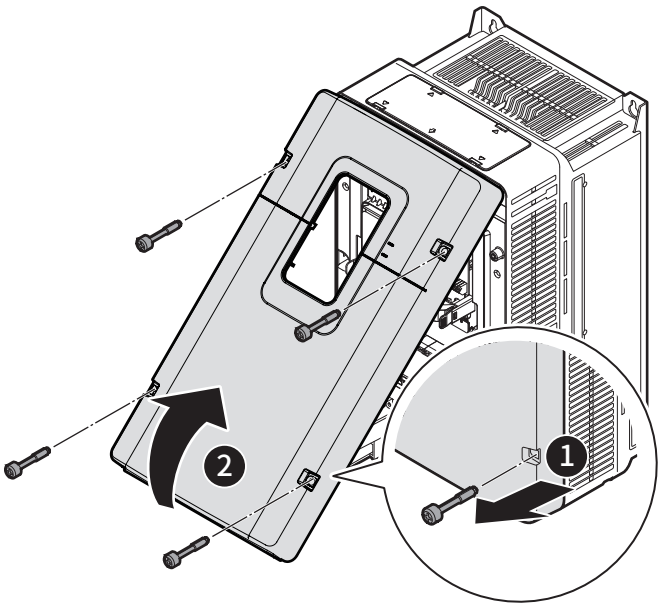
For power terminal and control terminal wiring, the front cover and the wiring bracket must be disassembled in order. Disassemble each front cover and wiring bracket in the following order.

Note

Depending on the product family, the number of bolts on the front cover and the location and shape of the wiring bracket may vary. Refer to **1.2 Check the Part Names** for details.

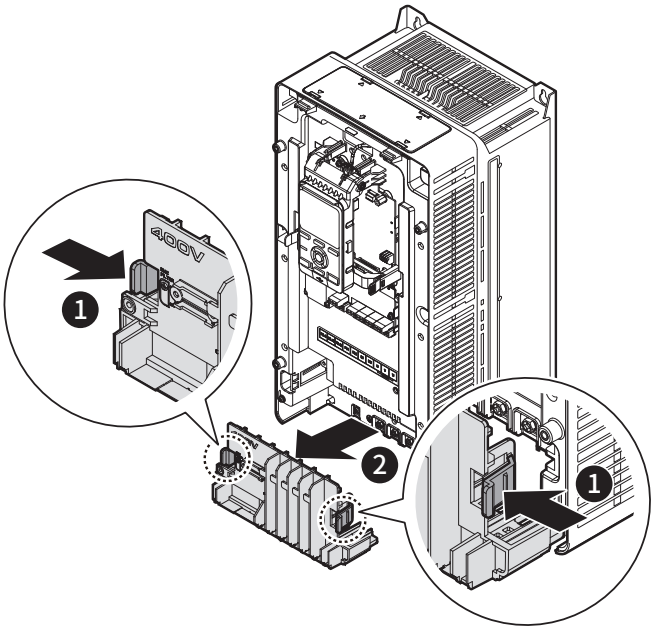
1 Unscrew the fixing bolts on the front cover and disassemble it.

- Disassemble the fixing bolts of the front terminal cover on 400 V products with a capacity of 185 - 220 kW.



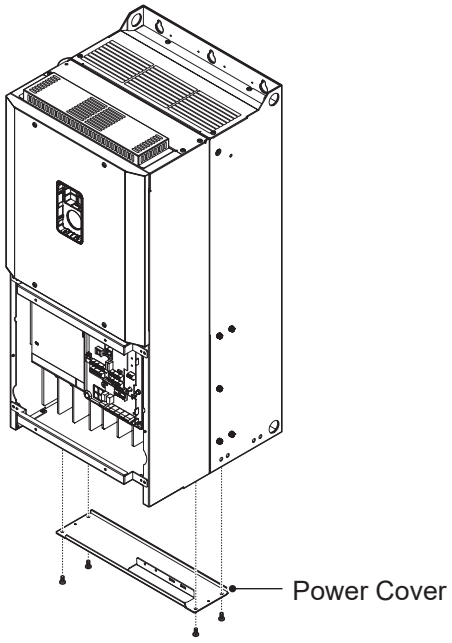
[Image 5. Front cover disassembly]

2 While holding both ends of the wiring bracket pressed inward, disassemble the wiring bracket.



[Image 6. Wiring bracket disassembly]

- Disassemble the bolts of the Power Cover on 400 V products with a capacity of 185 - 220 kW. The front terminal cover serves as a bracket on products in this capacity that do not have wiring brackets.



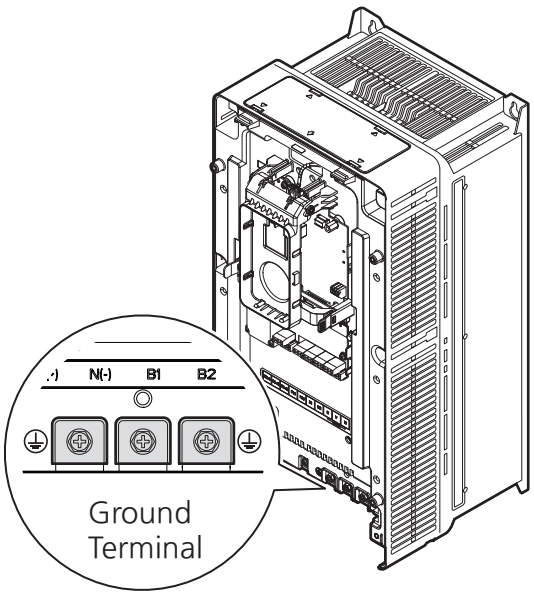
[Image 7. Power cover disassembly]

2.2.2 Step 2 Ground Connection

Disassemble the front cover(s) and the wiring bracket. Then, follow the instructions below to install the ground connection for the inverter.

1 Connect the prepared ground wire to the ground (⏚) terminal on the bottom of the inverter.

- Refer to **1.5 Wire Selection** to find the appropriate cable specification for your installation.



[Image 8. Ground terminal connection]

2 Connect the other ends of the ground cables to the supply earth (ground) terminal.

Note

- 200 V products require Class 3 grounding. Resistance to the ground must be less than 100 Ω.
- 400 V products require Special Class 3 grounding. Resistance to the ground must be less than 10 Ω.

⚠ Warning

Make sure to install a ground connection between the equipment and the motor for safe use. Otherwise, it may cause an electrical shock and result in personal injury or even death.

2.2.3 Step 3 Power Terminal Wiring

The following illustration shows the terminal layout and connection configuration on the power terminal block. Refer to the detailed descriptions to understand the function and location of each terminal before making wiring connections. Ensure that the selected cables meet or exceed the specifications in **1.5 Wire Selection** before installing them.

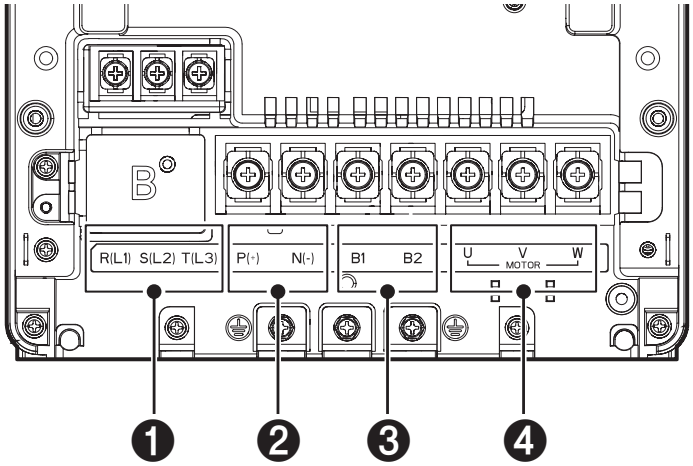
⚠ Caution

- Apply rated torques to the terminal screws. Loose screws may cause short circuits and malfunctions. Tightening the screw too much may damage the terminals and cause short circuits and malfunctions.
- Use copper wires only with 600V, 75℃ rating for the power terminal wiring, and 300V, 75℃rating for the control terminal wiring.
- Power supply wirings must be connected to the R, S, and T terminals. Connecting them to the U, V, W terminals causes internal damages to the inverter. Motor should be connected to the U, V, and W Terminals. Arrangement of the phase sequence is not necessary.

⚠ Attention

- Appliquer des couples de marche aux vis des bornes. Des vis desserrées peuvent provoquer des courts-circuits et des dysfonctionnements. Ne pas trop serrer la vis, car cela risque d'endommager les bornes et de provoquer des courts-circuits et des dysfonctionnements.
- Utiliser uniquement des fils de cuivre avec une valeur nominale de 600 V, 75 ℃ pour le câblage de la borne d'alimentation, et une valeur nominale de 300 V, 75 ℃ pour le câblage de la borne de commande.
- Les câblages de l'alimentation électrique doivent être connectés aux bornes R, S et T. Leur connexion aux bornes U, V et W provoque des dommages internes à l'onduleur. Le moteur doit être raccordé aux bornes U, V et W. L'arrangement de l'ordre de phase n'est pas nécessaire.

Power Terminal Labels and Descriptions



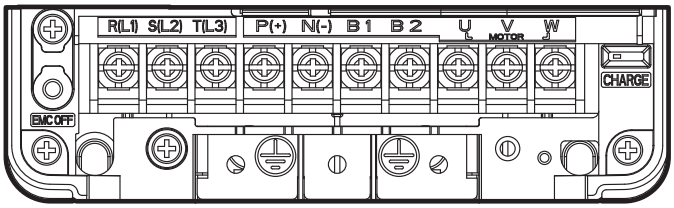
[Image 9. Power terminal]

Table 1. Power terminal configuration

No.	Terminal Labels	Name	Description
1	R(L1), S(L2), T(L3)	AC power input terminal	Mains supply AC power connections.
2	P(+)	+ DC link terminal	DC voltage (+) terminal. Connects DC (+) when using DC as inverter power.
	N(-)	- DC link terminal	DC voltage (-) terminal. Connects DC (-) when using DC as inverter power.
3	B1, B2	Brake resistor terminal	Connects the brake resistor.
4	U, V, W	Motor output terminal	Connects the 3-phase AC motor.

200 V Class 0.4-4kW / 400V Class 0.4-4kW

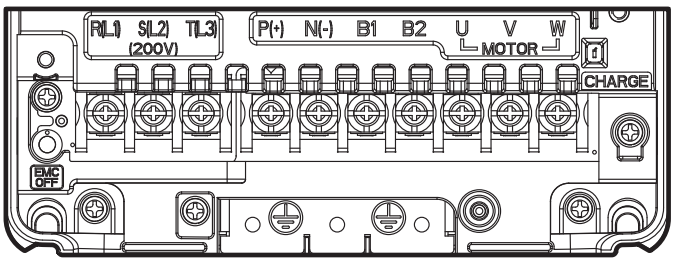
LSLV0004S300-4 / LSLV0008S300-4 / LSLV0015S300-4 / LSLV0022S300-4 / LSLV0040S300-4
LSLV0004S300-2 / LSLV0008S300-2 / LSLV0015S300-2 / LSLV0022S300-2 / LSLV0040S300-2



[Image 10. 200V Class 0.4-4kW / 400V Class 0.4-4kW Power Terminals]

200V Class 5.5-7.5kW

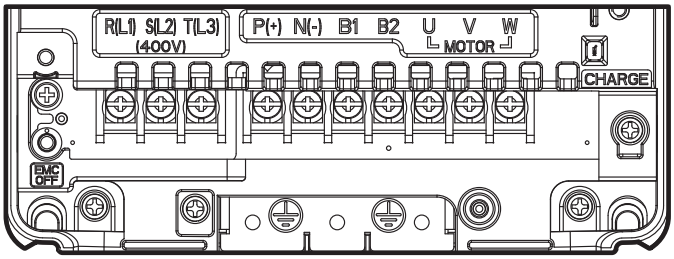
LSLV0055S300-2 / LSLV0075S300-2



[Image 11. 200V Class 5.5-7.5kW Power Terminals]

400V Class 5.5-7.5kW

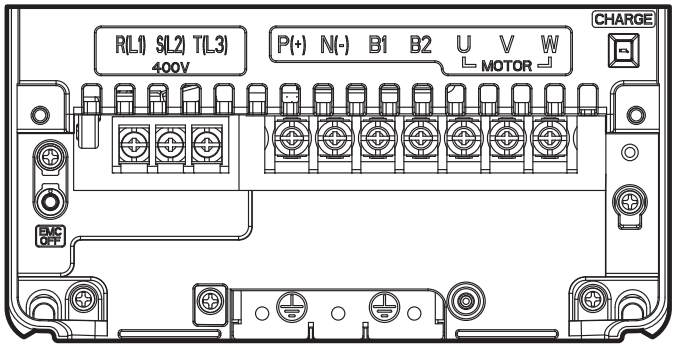
LSLV0055S300-4 / LSLV0075S300-4



[Image 12. 400V Class 5.5-7.5kW Power Terminals]

200V Class 11kW

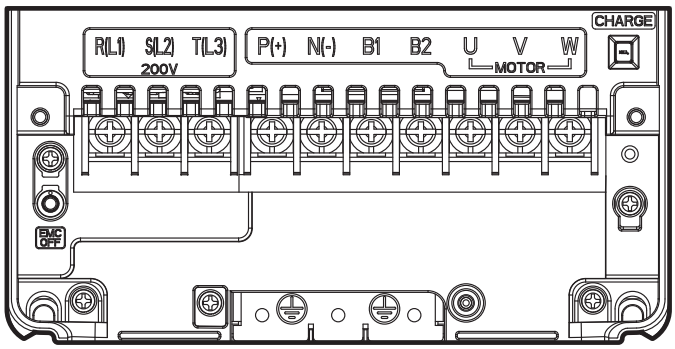
LSLV0110S300-2



[Image 13. 200V Class 11kW Power Terminals]

400V Class 11-15kW

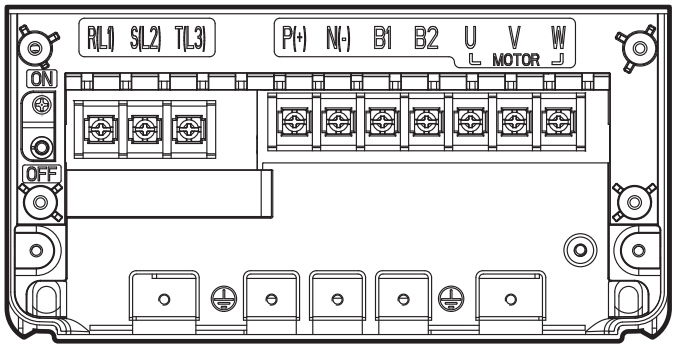
LSLV0110S300-4 / LSLV0150S300-4



[Image 14. 400V Class 11-15kW Power Terminals]

200V Class 15-18.5kW

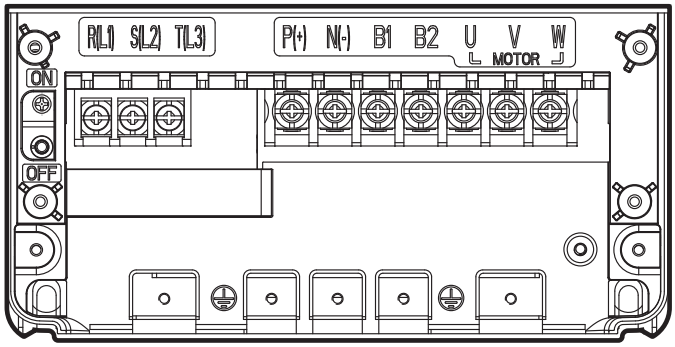
LSLV0150S300-2 / LSLV0185S300-2



[Image 15. 200V Class 15-18.5kW Power Terminals]

400V Class 18.5-22kW

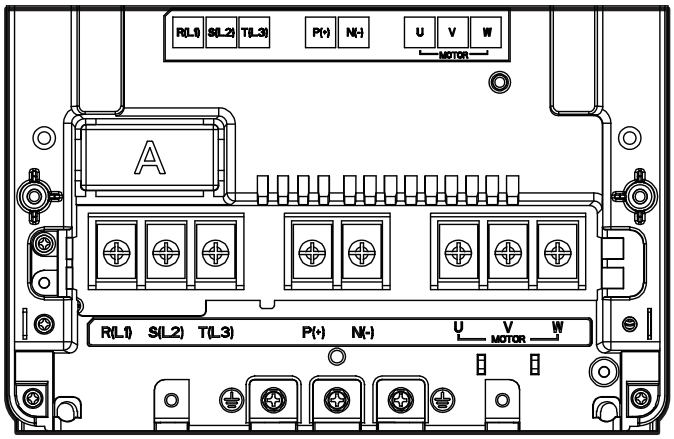
LSLV0185S300-4 / LSLV0220S300-4



[Image 16. 400V Class 18.5-22kW Power Terminals]

200V Class 22kW

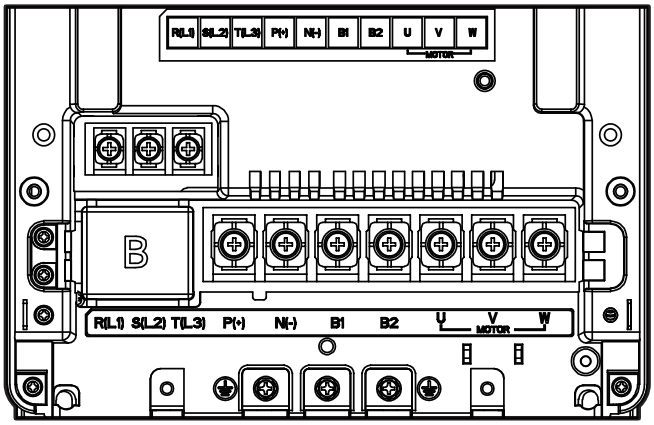
LSLV0220S300-2



[Image 17. 200V Class 22kW Power Terminals]

400V Class 30-37kW

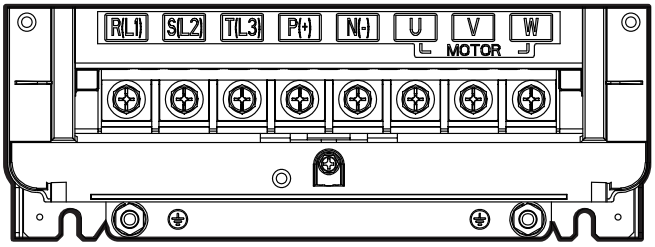
LSLV0300S300-4 / LSLV0370S300-4



[Image 18. 400V Class 30-37kW Power Terminals]

200V Class 30kW / 400V Class 45kW

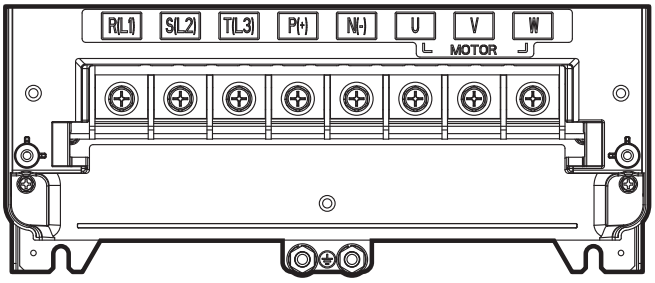
LSLV0300S300-2 / LSLV0450S300-4



[Image 19. 200V Class 30kW / 400V Class 45kW Power Terminals]

200V Class 37-45kW / 400V Class 55-75kW

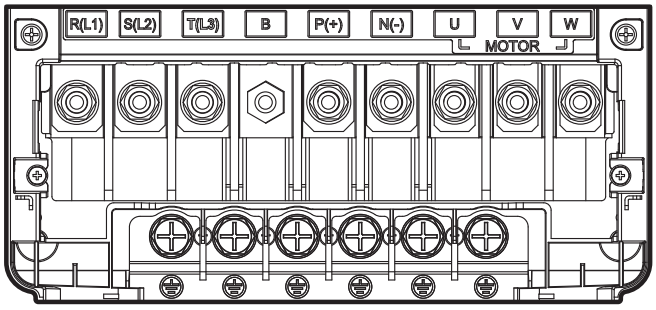
LSLV0370S300-2/LSLV0450S300-2
LSLV0550S300-4 / LSLV0750S300-4



[Image 20. 200V Class 37-45kW / 400V Class 55-75kW Power Terminals]

400V Class 90-110kW

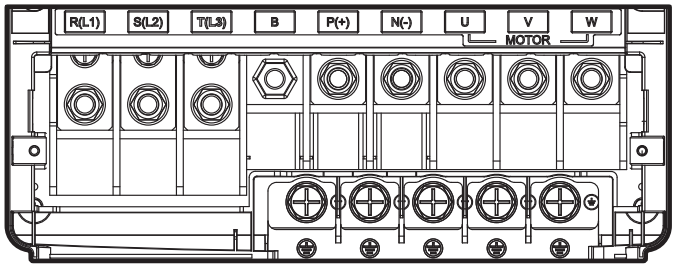
LSLV0900S300-4 / LSLV1100S300-4



[Image 21. 400V Class 90-110kW Power Terminals]

200V Class 55-75kW / 400V Class 132-160kW

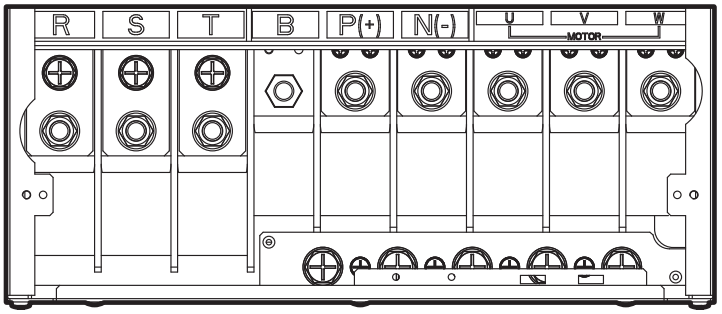
LSLV0550S300-2 / LSLV0750S300-2
LSLV1320S300-4 / LSLV1600S300-4



[Image 22. 200V Class 55-75kW / 400V Class 132-160kW Power Terminals]

400V Class 185-220kW

LSLV1850S300-4 / LSLV2200S300-4



[Image 23. 400V Class 185-220kW Power Terminals]

Note

The location of the power terminal labels may vary according to the product family.

⚠ Warning

Do not connect power to the inverter until the installation has been fully completed and the inverter is ready to be operated. Otherwise, it may cause an electrical shock and result in personal injury or even death.

ⓘ Caution

- Connect the input power wiring of the inverter to the R/S/T terminals and the output wiring to the motor to the U/V/W terminals. The product may be damaged if it is connected in reverse.
- To use DC input to operate the inverter, connect the DC input terminals to P (+) and N (-).
- Use insulated ring lugs when connecting cables to R/S/T and U/V/W terminals.
- The inverter's power terminal connections can cause harmonics that may interfere with other communication devices located near the inverter. To reduce interference the installation of noise filters or line filters may be required.
- Do not connect advanced-phase capacitors, surge killers, or radio noise filters to the output side of the product. There is a possibility that a trip may occur or the connected device may be damaged.
- Do not connect a magnetic contactor to the wiring on the output side of the product (motor side). There is a possibility that a trip may occur or the product may be damaged.

Note

- Do not use 3 core cables when connecting a remotely located motor with the inverter.
- Make sure that the total cable length does not exceed 100 m. For wire lengths greater than 100 m, please contact customer service.
- Long cable runs can cause reduced motor torque in low-frequency applications due to voltage drop. Long cable runs also increase a circuit's susceptibility to stray capacitance and may trigger over-current protection devices or result in a malfunction of equipment connected to the inverter. Voltage drop is calculated by using the following formula:

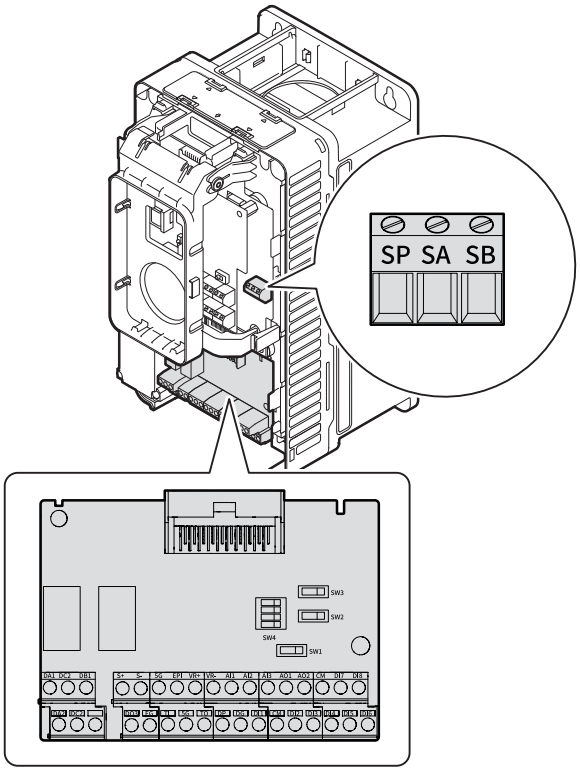
  Voltage Drop (V) = [$\sqrt{3}$ X cable resistance (MΩ/m) X cable length (m) X current (A)] / 1000

- Use cables with the largest possible cross-sectional area to ensure that voltage drop is minimized over long cable runs. Lowering the carrier frequency and installing a micro surge filter may also help to reduce voltage drop.

Wiring Length Between Inverter and Motor	50 m or shorter	100 m or shorter	Longer than 100m
Allowed Carrier Frequency	15 kHz or lower	5 kHz or lower	3 kHz or lower

2.2.4 Step 4 Control Terminal Wiring

Below is a diagram showing the layout and connection configuration of the control circuit. Refer to the detailed information and install the control circuit wiring. Ensure that the cables selected meet or exceed the specifications in **1.5 Wire Selection** before installing them.



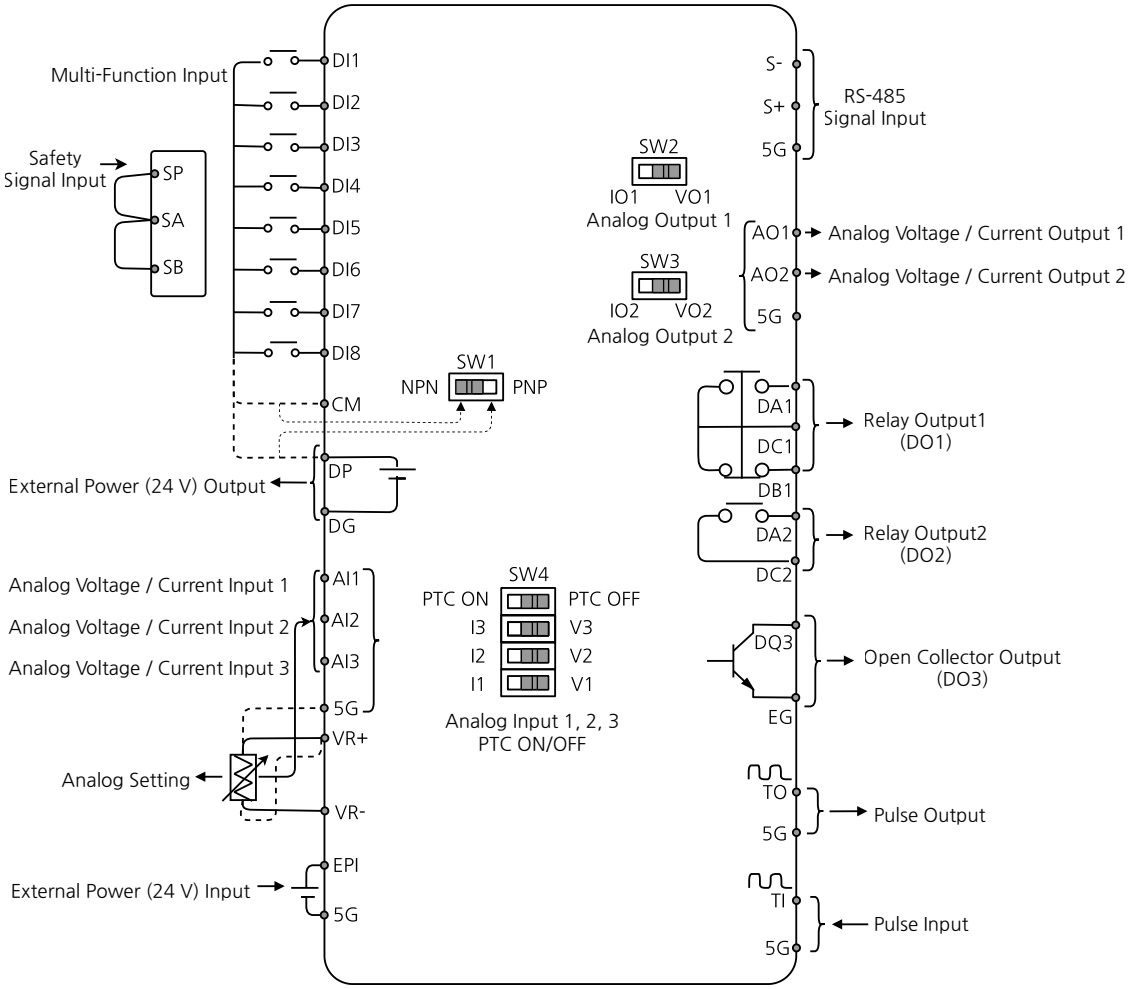
[Image 24. Control terminal]

Table 2. Safety terminal configuration

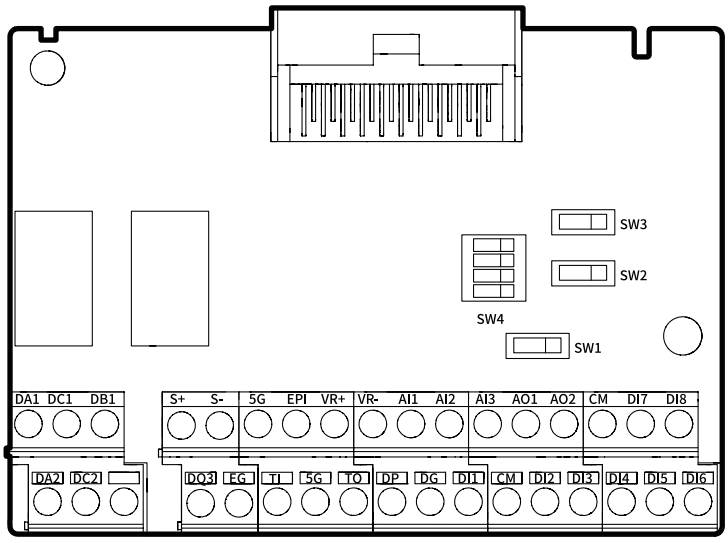
Category	Terminal Labels	Name	Description
Safety signal [1]	SP	Safety power output terminal	DC 24 V, 25 mA or less
	SA	Safety input A terminal	Based on the input signal from outside, it blocks the output.
	SB	Safety input B terminal	• If both SA and SB are connected to SP: Normal operation • If either SA or SB is disconnected from the SP: Block product output

[1] Three safety terminals are connected by short bars when shipped from the factory.

Input/Output control terminal wiring diagram



[Image 25. Input/Output control terminal wiring]



[Image 26. IO board switch]

Table 3. Dip switch configuration

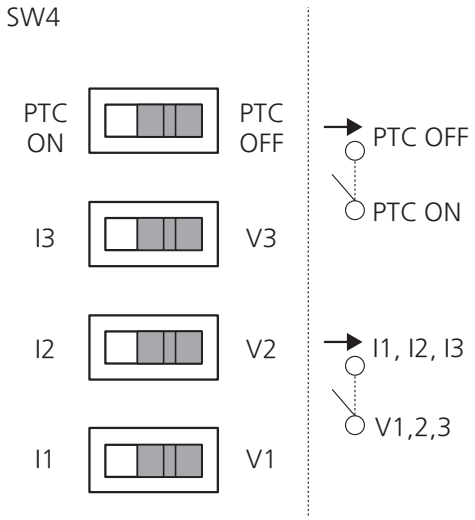
Switch labels	Description	Factory value (Default)
SW1	NPN/PNP setting switch (Left: NPN, Right: PNP)	Left: NPN
SW2	IO1/VO1 terminal setting switch (Left: IO1, Right: VO1)	Right: VO1
SW3	IO2/VO2 terminal setting switch (Left: IO2, Right: VO2)	Right: VO2
SW4	I1, I2, I3, PTC ON/V1, V2, V3 PTC OFF terminal selection switch (Left: I1, I2, I3, PTC ON, Right: V1, V2, V3, PTC OFF)	Right: V1, V2, V3, PTC OFF

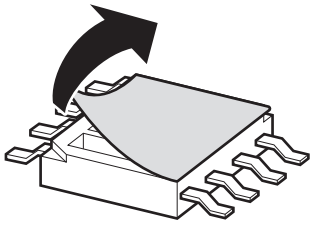
- DI1~DI8: Digital Input 1-8
- DP: Digital Power 24 V Output, Max 150 mA
- DG: Digital Ground
- CM: Digital Input Common
- DA1, DC1, DB1: Digital Relay1 Output
- DA2, DC2: Digital Relay2 Output
- DQ3, EG: Digital Open Collector Output
- EPI: Power Supply Input (for external power supply)
- 5G: Analog Ground
- AO1, AO2: Analog Output 1, 2
- AI1, AI2, AI3: Analog Input 1, 2, 3
- PTC: Positive Temperature Coefficient thermistor

- VR+, VR-: Analog ± Voltage Reference, output voltage ±10 V, Maximum current output 20 mA
- TO: Pulse Train Output
- TI: Pulse Train Input

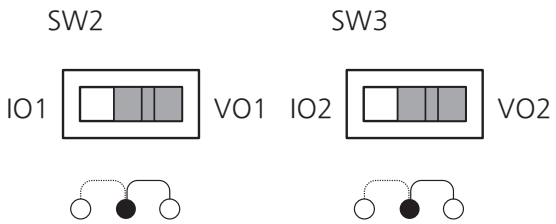
Table 4. Input/communication terminal configuration

Category	Terminal Labels	Name	Description
Terminal input selection	DI1~DI8	Digital input Terminals 1-8	Configurable for digital input terminals. The factory default is as follows: • DI1: FX • DI2: RX • DI3: BX • DI4: External Trip-1 • DI5: Speed-L • DI6: Speed-M • DI7: Speed-H • DI8: JOG
	CM	Common terminal	Common terminal for digital input terminals.
Analog input	VR+	Analog positive (+) voltage reference terminal	Power supply for analog reference. • Output Voltage: 10V • Maximum Current Output: 20mA • Potentiometer: 1~10kΩ
	VR-	Analog negative (-) voltage reference terminal	Power supply for analog reference. • Output Voltage: -10V • Maximum Current Output: 20mA • Potentiometer: 1~10kΩ

Category	Terminal Labels	Name	Description
Analog input	AI1~AI3	Analog voltage/ current input terminal (switch selection)	Depending on the setting of the switch (SW4), it can be used as either a voltage or current input. AI3 can be used as PTC sensor input. Factory default is V1, 2, and 3.  **[Image 27. Factory default setting for analog input terminal (SW4 switch)]** **[When voltage is selected]** Select the appropriate terminal block by setting the switch (SW4) to V1, 2, 3. Depending on the setting of the analog input mode, the following voltage ranges can be used. • Unipolar: 0.00 - 10 V • Bipolar: -10.00 - 10 V **[When current is selected]** Select the appropriate terminal block by setting the switch (SW4) to I1, 2, 3. If the analog input mode is set to "Current," the following current ranges can be used. • Input current: 4.00~20.00mA **[When inputting PTC]** Connect the PTC sensor to the AI3 input terminal and select the PTC ON switch (SW4).

Category	Terminal Labels	Name	Description
Analog input	AI1~AI3	Analog voltage/ current input terminal (switch selection)	**[Note]** **Remove SW4 dip switch seal tape** It is shipped with seal tape attached for SW4 dip switch protection (factory default: Analog voltage input). Remove the seal tape to change the switch settings, as shown in the following illustration. Using the cut-out corner of the switch mold, the seal tape can be easily removed.  **[Image 28. Remove SW4 switch seal tape]**
	TI	Pulse train input terminal	Set it to 0.00-32.00 kHz and enter it. • Low Level: 0~1.2V • High Level: 2.0~12V(Duty 30~70%)
	5G	Analog common terminal	Analog ground common terminal. (It differs from the CM common terminal.)
External power input	EPI	External power input terminal	By connecting external power to the EPI terminal and 5G ground, it can be utilized as backup power for the control unit. It is possible to use the Smart Operator, communication options, and some of the controller's features. • Precautions: Do not connect external power to DP/DG terminals. The DP/DG terminal is for internal power or service power. • Input power: 24V(21.6~26.4V), 0.5A
RS-485 communication	S+/S-	RS-485 signal input terminal	Used to send or receive RS-485 signals. Refer to **10 Using Built-in Communication Features** for more details. It is used with 5G ground.

Output Terminal Labels and Descriptions

Category	Terminal Labels	Name	Description
Analog output	AO1, AO2	Analog voltage/current Output terminal (switch selection)	Depending on the selection of the switch (SW2, SW3), it can be used as either a voltage or current output. Factory default is VO1, VO2.  **[Image 29. Factory default setting for analog output terminal (SW2, 3 switch)]** **[When voltage is selected]** Select the appropriate terminal block by selecting the switch (SW2, SW3) to VO1, VO2. Depending on the setting of the analog output mode, the following voltage ranges can be used. • Unipolar: 0.00 - 10 V • Bipolar: -10.00 - 10 V **[When current is selected]** Select the appropriate terminal block by selecting the switch (SW2, SW3) to IO1, IO2. If the analog output mode is set to "Current," the following current ranges can be used. • Output current: 4.00~20.00mA • External resistor connection: 249Ω
Analog output	TO	Pulse train output terminal	It outputs 0.00-32.00 kHz. (Duty around 50%) • Low Level: 1 V or less • High Level: 12V
	5G	Analog common terminal	Analog ground common terminal.

Category	Terminal Labels	Name	Description
Digital power	DP	Digital power output terminal	Digital service power. DC 24 V (21.6 - 26.4 V), 150 mA or less • Precautions: Do not connect with the CM (digital common terminal).
	DG	Digital ground terminal	External 24 V common terminal.
Terminal output	DA1, DC1, DB1	Digital multifunction output relay 1 terminal (A, B terminal) (parameter DO1)	It outputs a signal or multifunction signal in other situations, including when the product's protection function is activated. • N.O.: AC 250 V 3 A or less, DC 30 V 3 A or less • N.C.: AC 250 V 3 A or less, DC 30 V 3 A or less • Fault condition: A1 and C1 contacts are connected (B1 and C1 open connection) • Normal operation: B1 and C1 contacts are connected (A1 and C1 open connection)
	DA2, DC2	Digital multifunction output relay 2 terminal (A terminal) (parameter DO2)	• N.O.: AC 250 V 5 A or less, DC 30 V 5 A or less • Fault condition: A2 and C2 contacts are connected
	DQ3, EG	Digital multifunction open collector output terminal (parameter DO3)	It selects and outputs one of the multifunction output signals.

Note

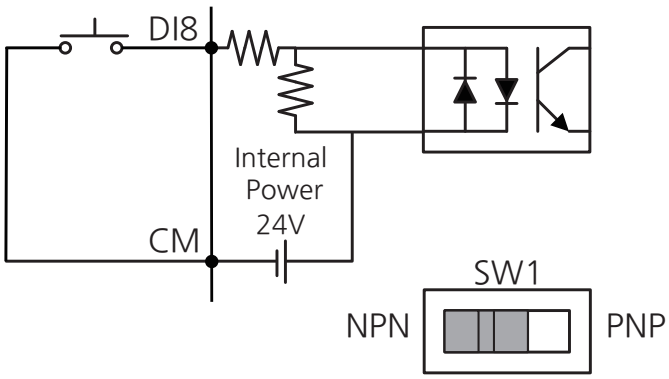
- Ensure that the total cable length does not exceed 50 m.
- Ensure that the length of any safety-related wiring does not exceed 30 m.
- Ensure that the wiring length when using Smart Operator does not exceed 3 m. There may be a signal error if the wiring length exceeds 3 m.
- Use ferrite material to block electromagnetic waves emitted from analog and digital signals.
- Be sure to apply the cable ties no closer than 15 cm from the inverter when using cables with cable ties. This provides sufficient access to fully close the front cover.

2.2.5 Step 5 PNP/ NPN Mode Selection

The product supports both NPN (Sink) and PNP (Source) modes for sequence inputs at the terminal. Select an appropriate mode to suit requirements using the NPN/PNP selection switch (SW1) on the control board. The NPN/PNP selection switch (SW1) is set to NPN mode when shipped from the factory. Refer to the following information for detailed applications.

NPN mode (Sink)

Select NPN using the PNP/NPN selection switch (SW1). The CM terminal is an input signal common terminal, and DP/DG is an internal power supply terminal.

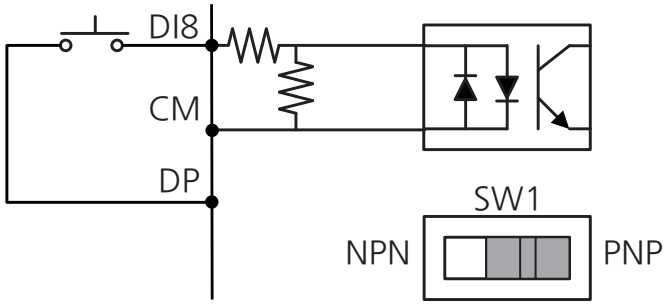


[Image 30. NPN mode]

PNP mode (Source)

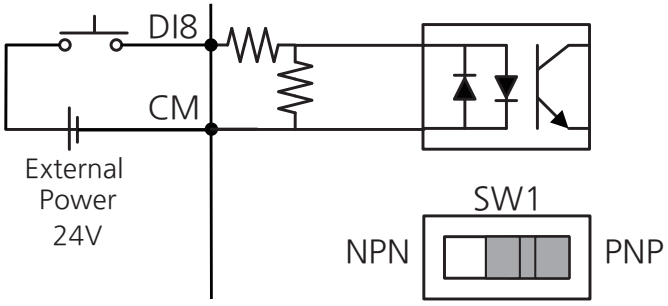
Select PNP using the PNP/NPN selection switch (SW1). The CM terminal is an input signal common terminal, and DP/DG is an internal power supply terminal.

If you are using the internal power supply in PNP mode, connect the external circuit to DI and DP.



[Image 31. PNP mode (internal power)]

If you are using the PNP mode with an external power supply, connect the external circuit to DI and CM, and connect the (-) terminal of the external power supply to CM.



[Image 32. PNP mode (external power)]

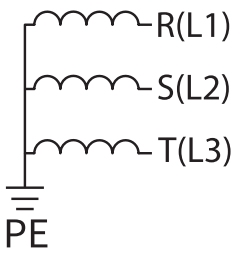
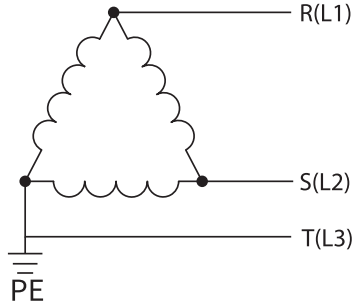
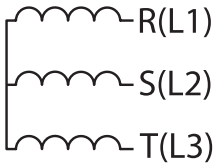
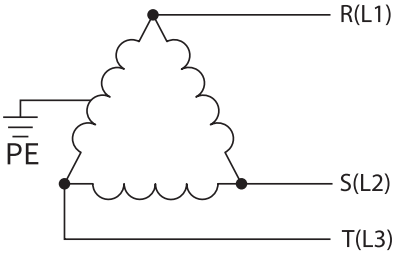
2.2.6 Step 6 Enabling and Disabling EMC filter and Varistor (VAR) Ground

The EMC filter and varistor (VAR) ground of the product can be enabled or disabled. EMC filter and VAR ground feature are set to On by factory default. The use of an EMC filter may increase leakage current at the expense of reducing airborne noise generated by the product. Use an EMC filter and VAR ground if a symmetrical ground scheme is used. Refer to the EMC filter and VAR ground conditions table below if you are using any other asymmetrical ground power, such as corner ground, midpoint ground, or non-ground power.

Table 5. EMC filters and VAR ground conditions

Model name LSLV□□□□	Symmetrical ground power	Corner ground power, midpoint ground power	Non-ground power
0004S300-2 ~0220S300-2	Enable EMC filter Enable VAR ground	Disable EMC filter Disable VAR ground	Disable EMC filter Disable VAR ground
0300S300-2 ~0750S300-2	Enable EMC filter Enable VAR ground	Disable EMC filter Enable VAR ground	Disable EMC filter Disable VAR ground
0004S300-4 ~0370S300-4	Enable EMC filter Enable VAR ground	Disable EMC filter Disable VAR ground	Disable EMC filter Disable VAR ground
0450S300-4 ~2200S300-4	Enable EMC filter Enable VAR ground	Disable EMC filter Enable VAR ground	Disable EMC filter Disable VAR ground

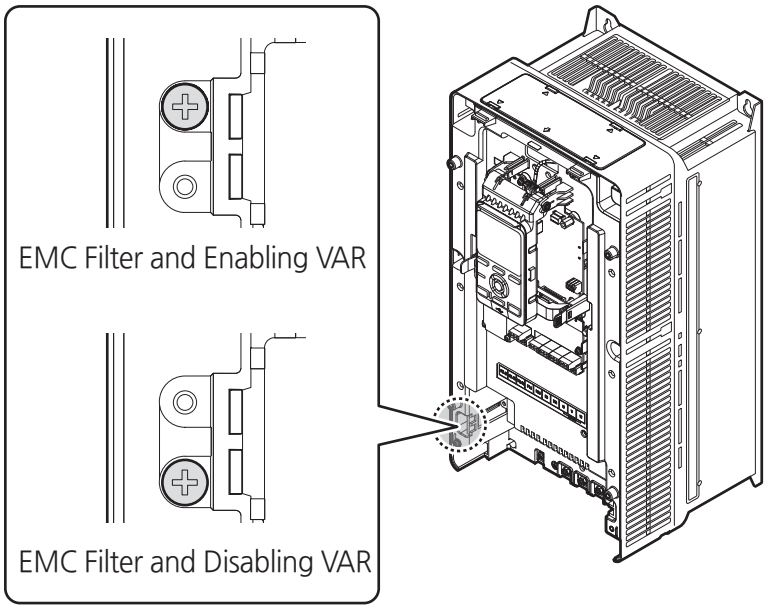
Table 6. Ground Power Structure

Ground power			
Symmetrical ground power		Corner ground power	
Non-ground power		Midpoint ground power	

Enabling and disabling the EMC filter and VAR ground varies depending on the inverter capacity. Refer to the following description of inverter capacity.

200 V level 0.4 - 22 kW / 400 V level 0.4 - 37 kW

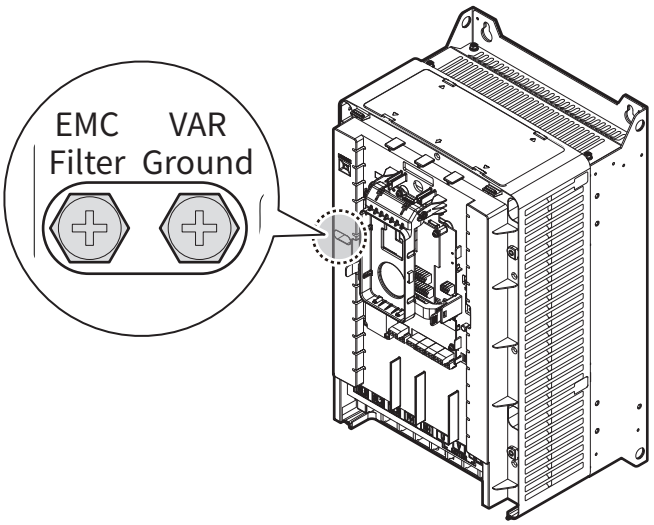
The EMC filter and VAR ground terminal are located on the terminal block in models with corresponding capacities. One screw is used to enable and disable the EMC filter and VAR ground. Therefore, the EMC filter and the VAR ground cannot be disabled separately. If you are enabling the EMC filter and VAR ground, install the screw in the upper hole, and if you are disabling the EMC filter and VAR ground, install the screw in the lower hole, as shown in the below illustration.



[Image 33. 200 V level 0.4 - 22 kW / 400 V level 0.4 - 37 kW model EMC filter, VAR ground]

200 V level 30 - 75 kW / 400 V level 45 - 220 kW

The EMC filter and VAR ground terminal are located on the upper-left side of the inverter, not on the terminal block in models with corresponding capacities. Each screw is used to enable and disable the EMC filter and VAR ground. Accordingly, the EMC filter and VAR ground may be fixed with screws or removed, as shown in the following illustration. When the EMC filter or VAR grounding screw is tightened, the EMC filter or VAR grounding is enabled, and when the screw is removed, the EMC filter or VAR ground will be disabled.



[Image 34. 200 V level 30 - 75 kW / 400 V level 45 - 220 kW model EMC filter, VAR ground]

2.2.7 Step 7 Reassembling the Wiring Bracket and the Front Cover

After completing the wiring and basic configurations, reassemble the wiring bracket and the front cover. Note that the assembly procedure may vary according to the product group or frame size of the product.

2.3 Post-Installation Checklist

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

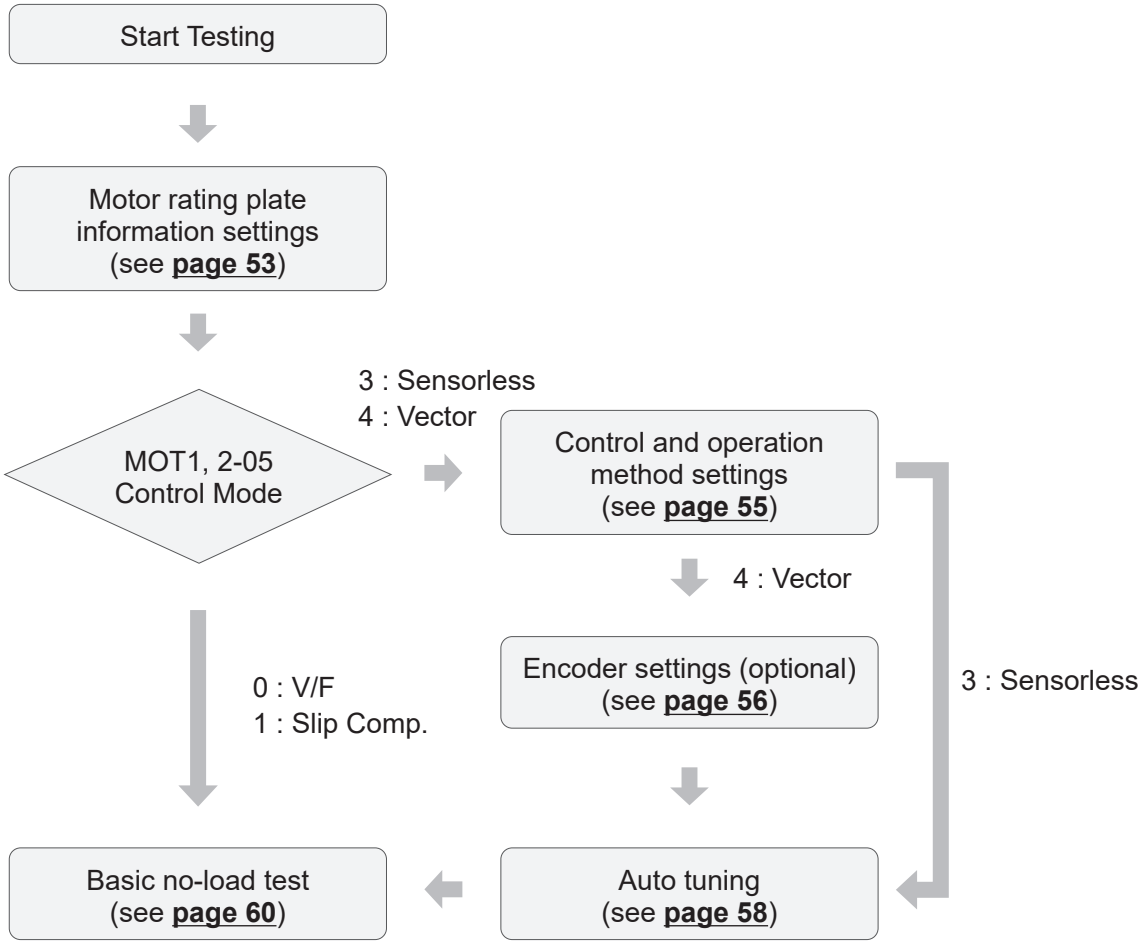
Table 7. Installation check

Situation	Details	Ref.	Check
Installation location/I/O voltage	Is the installation location appropriate?	p.13	
	Is the inverter's rated output sufficient to supply the equipment? (Derating is applied in specific conditions.)	p.753	
Power Terminal Wiring	Is a circuit breaker installed on the input side of the inverter?	p.21	
	Is the circuit breaker correctly rated?	p.774	
	Are the power source cables correctly connected to the input terminals of the inverter? (Caution: connecting the power source to the U/V/W terminals may damage the inverter.)	p.29	
	Are the motor output cables connected in the correct phase order? (Caution: Motors will rotate in the reverse direction if the phase cables are not wired in the correct order.)	p.29	
	Are the cables used in the power terminal connections correctly rated?	p.16	
	Is the inverter grounded correctly?	p.28	
	Are the power terminal screws and the ground terminal screws tightened to their specified torques?	p.29	
	Are the overload protection circuits installed correctly on the motors (if multiple motors are being run using one inverter)?	-	
	Is the inverter separated from the power source by a magnetic contactor (if a braking resistor is in use)?	p.21	
	Are advanced-phase capacitors, surge protection, and electromagnetic interference filters installed correctly? (These devices MUST not be installed on the output side of the inverter.)	p.36	

Situation	Details	Ref.	Check
Control Terminal Wiring	Are shielded twisted pair (STP) cables used for control terminal wiring?	-	
	Is the shielding of the STP wiring properly grounded?	-	
	If 3-wire operation is required, are the multifunction input terminals defined prior to the installation of the control wiring connections?	**p.37**	
	Is the shielding of the STP wiring properly grounded?	-	
	Are the control cables properly wired?	**p.37**	
	Are the control terminal screws tightened to their specified torques?	-	
	Is the total cable length of all control wiring less than 50 m?	**p.44**	
	Is the total length of safety wiring less than 30 m?	**p.44**	
	Are there any debris or screws left inside the inverter?	**p.25**	
	Are any cables contacting adjacent terminals, creating a potential short circuit risk?	-	
	Are the control terminal connections separated from the power terminal connections?	-	
	Have the capacitors been replaced if they have been in use for more than 2 years?	**p.441**	
	Has a fuse been installed for the power source?	**p.774**	
	Are the connections to the motor separated from other connections?	-	

3 Operation Sequence and Testing

In order to maximize motor performance and operate the normal protection function, various motor information must be set. Set in the following sequence based on the motor control mode you want to use:



3.1 Setting Up Motor Rating Plate Information

Enter the information displayed on the motor rating plate. Motor rating plate information is used for motor control, protective operation, and others. Enter the motor type in MOT1 and MOT2-04 (Motor Type) and the motor capacity in MOT1 and MOT2-21 (Motor Capacity). If there is no capacity setting option for the motor, select the closest higher capacity to the motor's actual capacity. After that, enter the remaining rating plate information. For items that are not entered, apply default values based on motor capacity.

Example of motor rating plate information settings

Group	Code	LCD Display	Set Value		Setting Range	Initial value	Unit
MOT1, MOT2	04	Motor Type	0	Induction Motor	0~1	0	-
	21	Motor Capacity	2	0.75kW	0~27	3	-
	23	Base Frequency	60.00		5.00~590.00	60.00	Hz
	24	Rated Speed	1710		150~17700	1750	rpm
	25	Number of Poles	4		2~100	4	-
	26	Rated Current	3.4		1.0~1000	6.4	A
	27	Rated Voltage	0		0 or 180-480	0	V
	28	Efficiency	74		70~100	80	%
	35	No-load Current	1.7		0.5~1000.0	2.6	A

Details of motor rating plate information settings

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>MOT1, MOT2-04
Motor Type</td><td>Set the type of the motor connected to the inverter. The following motors can be selected:
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Induction Motor</td><td>Induction motor</td></tr>
<tr><td>1</td><td>Perm Magnet Motor</td><td>Permanent magnet motor</td></tr>
</table></td></tr>
<tr><td>MOT1, MOT2-21
Motor Capacity</td><td>Set the capacity of the motor connected to the inverter. According to the motor capacity, the default value of the related parameter changes if the value is changed.</td></tr>
<tr><td>MOT1, MOT2-23
Base Frequency</td><td>Enter the base frequency of the motor rating plate. A base frequency is the inverter’s output frequency when running at its rated voltage. Refer to the motor’s rating plate to set this parameter value.</td></tr>
<tr><td>MOT1, MOT2-24
Rated Speed</td><td>Enter the rated speed of the motor rating plate.</td></tr>
<tr><td>MOT1, MOT2-25
Number of Poles</td><td>Enter the number of poles on the motor rating plate.</td></tr>
<tr><td>MOT1, MOT2-26
Rated Current</td><td>Enter the rated current of the motor rating plate.</td></tr>
<tr><td>MOT1, MOT2-27
Rated Voltage</td><td>Enter the rated voltage of the motor rating plate. Set the motor voltage if the input power and the motor voltage specifications differ.
• The output voltage can be maintained at the set value if the set voltage is lower than the input power supply voltage above the base frequency.
• A voltage smaller than the input power supply voltage is output if the set voltage is higher than the input power supply voltage above the base frequency.
• The output voltage size is determined by the input power voltage during V/F operation if the set voltage is set to 0 above the base frequency.</td></tr>
<tr><td>MOT1, MOT2-28
Efficiency</td><td>Enter the efficiency of the motor rating plate.</td></tr>
<tr><td>MOT1, MOT2-35
No-load Current</td><td>Enter the no-load current of the motor rating plate. Only induction motors are affected by this, and if it is not specified on the rating plate, use the default value that changes when the motor capacity is set or enter the value displayed on the Smart Operator’s initial screen when operating at the base frequency with no load.</td></tr>
</table>

3.2 Setting Control and Operation Method

Select the appropriate operating mode for your system.

Example of setting control and operation method

Group	Code	LCD Display	Set Value		Setting Range	Initial value	Unit
MOT1, MOT2	05	Control Mode	0	V/F	0~4	0	-
	08	Torque Control En	0	No	0~1	0	-

Details of setting the control and operation method

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td rowspan="5">MOT1, MOT2-05 Control Mode</td><td colspan="3">Set the motor control method.</td></tr>
<tr><td>Item</td><td colspan="2">Functionality</td></tr>
<tr><td>0</td><td>V/F</td><td>Operates in a V/F control mode (open loop control where voltage size is determined by operating frequency). Refer to <u>6.1 Induction Motor V/F Control</u> for details.</td></tr>
<tr><td>1</td><td>Slip Comp.</td><td>It is a control mode that compensates for slip during induction motor V/F control operation without position/speed sensors. It can only be set when the induction motor type is selected. Refer to <u>3.4 Auto Tuning</u> and perform tuning in advance.
Refer to <u>6.1.4 Slip Compensation Operation</u> for details.</td></tr>
<tr><td>2</td><td>V/F PG</td><td>This is a control mode that compensates for slip during induction motor V/F control operation with position/speed sensors. It can only be set when the induction motor type is selected.</td></tr>
<tr><td>3</td><td>Sensorless</td><td>Operates in vector control mode without position/speed sensors. Refer to <u>3.4 Auto Tuning</u> and perform tuning in advance.
As there is no position/speed sensor, the control may be unstable at low speeds (less than 1/120 of the base frequency for induction motors and 1/20 of the base frequency for synchronous motors).</td></tr>
<tr><td>4</td><td>Vector [1]</td><td>Operates in vector control mode with position/speed sensors. Refer to <u>3.4 Auto Tuning</u> and perform tuning in advance.</td></tr>
</table>

[1] Configurable only when MOT1-05 is selected.

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>MOT1, MOT2-08 Torque Control En</td><td colspan="3">Set the operation method when operating in vector control mode (Sensorless, Vector). It is disabled when V/F control mode (V/F, Slip Comp., V/F PG) is selected.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>No</td><td>Set to speed control mode. The speed control function controls the motor to maintain the set speed.</td></tr>
<tr><td>1</td><td>Yes</td><td>Perform torque control. The torque control function controls the motor to maintain the torque value set. When the load torque is balanced with the output torque, the rotational speed of the motor remains constant. Therefore, during torque control, the rotational speed of the motor is determined by the magnitude and direction of the output torque, as well as the load torque.
The torque control can only be selected in the sensorless or vector control modes for induction motors.</td></tr>
</table></td></tr>
</table>

3.3 Setting the Encoder

It is a method used to control the rotor by measuring the position/speed of the rotor with a position/speed sensor. Once the encoder has been wired according to the manual for the encoder option card, set the encoder parameters.

How to set encoders

Group	Code	LCD Display	Set Value		Setting Range	Initial value	Unit
ENC	02	Enc Monitor[Hz]	-		-	-	Hz
	10	Auto Flying Start	0	No	0~1	1	-
			1	Yes			
	11	Enc Output Phase	0	(A+B)	0~1	0	-
	12	Pulse/Revolution	1024		10~4096	1024	-
	13	Enc LPF Gain	3		0~10000	3	msec
	16	Wire Check Trip En	1	Yes	0~1	0	-
	17	Wire Check Time	10		1~100	10	sec
	18	Enc Pulse Chk Time	1000		500~5000	1000	msec

Details of encoder settings

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>ENC-2 Enc Monitor[Hz], ENC-3 Enc Monitor[rpm]</td><td>The encoder output is converted into motor rotation speed and displayed in Hz or rpm.</td></tr>
<tr><td>ENC-10 Auto Flying Start</td><td>If set to 1 (Yes), the motor will start from the current motor speed without going through the starting sequence (dwell, brake, Start Mode, etc.) if the motor is rotating when the operation starts, and it will accelerate or decelerate to the target frequency.
If set to 0 (No), the motor will start from zero speed and follow the starting sequence.</td></tr>
<tr><td>ENC-11 Enc Output Phase</td><td>Set the direction of the encoder output pulse.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>(A + B)</td><td>Forward Operation</td></tr>
<tr><td>1</td><td>-(A + B)</td><td>Reverse Operation</td></tr>
</table></td></tr>
<tr><td>ENC-12 Pulse/ Revolution</td><td>Enter the number of output pulses per revolution of the encoder.</td></tr>
<tr><td>ENC-13 Enc LPF Gain</td><td>Set the time constant of the encoder pulse low-pass filter. Refer to AIN-04, 19, 34 (AI1-3 LPF Gain) in <u>8.2.4 Filter</u>.</td></tr>
<tr><td>ENC-16 Wire Check Trip En
ENC-17 Wire Check Time</td><td>Check the wiring of the line-drive type encoder.
If you are using a line-drive encoder, set ENC-16 to 1 (yes).</td></tr>
<tr><td>ENC-18 Enc Pulse Chk Time</td><td>It is the minimum pulse period that determines the encoder speed as 0 Hz. When there is no pulse signal for more than this time period, it is regarded as 0 Hz.</td></tr>
</table>

3.4 Auto Tuning

You can measure motor parameters automatically. Additionally, you can test the operation of the encoder if the encoder option card is connected to the inverter's main body. Measured motor parameters are used for auto torque boost, sensorless vector control, and vector control, among others. The parameters required for control mode are tuned if 1 (Auto Tuning) is selected in BAS-20 (Auto Tuning). After applying power to the inverter, the first auto tuning performs inverter tuning, which is a longer process (up to about 20 minutes). Refer to **3.1 Setting Up Motor Rating Plate Information** and check the item before performing this function.

Example of auto tuning settings

Group	Code	LCD Display	Set Value		Setting Range	Initial value	Unit
BAS	20	Auto Tuning	0	None	0~1	0	-
			1	Auto Tuning			

Caution

- Ensure that auto tuning is performed after the motor has stopped.
- Before you run auto tuning, check the motor rating pole number, rated slip, rated current, rated voltage, and efficiency on the motor's rating plate and enter the data. Default values will be used for items not entered.

Auto tuning results – Induction motor

Group	Code	LCD Display	Result value
MOT1, MOT2	35	No-load Current	The auto tuning result value is displayed.
	36	Stator Resistance	
	37	Leakage Inductance	
	38	Stator Inductance	
	39	Rotor TimeConstant	

Auto tuning results – Synchronous motor

Group	Code	LCD Display	Result value
MOT1, MOT2	36	Stator Resistance	The auto tuning result value is displayed.
	40	q-axis Inductance	
	41	d-axis Inductance	
	42	PM Rotor Flux	

Auto tuning results – Synchronous reluctance motor

Group	Code	LCD Display	Result value
MOT1, MOT2	36	Stator Resistance	The auto tuning result value is displayed.
	43	SynRM q-axis Inductance	
	44	SynRM d-axis Inductance	

Auto Tuning Parameter Setting Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>BAS-20
Auto Tuning</td><td>If you press the ENTER key after selecting the necessary item from the BAS-20 menu, auto tuning will be executed immediately.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>Auto tuning is not enabled. If auto tuning is enabled, this will indicate that auto tuning is complete.</td></tr>
<tr><td>1</td><td>Auto Tuning</td><td>Start auto tuning to measure all required parameters.
As the motor is not rotating while the parameters are measured, the parameters are not affected when the load is connected to the motor spindle. However, when measuring parameters, do not rotate the motor spindle on the load side.</td></tr>
</table>
</td></tr>
</table>

3.5 Basic No-Load Test

After installing the product and checking the checklist, follow the instructions below to test the inverter.

Refer to **4.3 How to Use the Smart Operator** and **5 Learning Basic Functions** for basic information regarding parameter changes, such as setting the operation command source, setting the target frequency, and setting the acceleration/ deceleration time.

1 Activate the power supply for the inverter. Check if the LED status indicator is illuminated.

2 Select the command source. For command source settings, see **5.2 Operation Command Settings**.

- The command source can be easily set with the Easy Start On function when using the Smart Operator. For the Easy Start On function, see **12.1.2 Parameter Easy Start (Easy Start On)**.

3 Set a frequency reference, and then check the following:

- Whether the frequency value changes if the voltage input value is changed when the frequency is set to one of AI1/2/3 and when the analog voltage/current input terminal setting switch is selected as voltage
- Whether the frequency value changes if the current input value is changed when the frequency is set to one of AI1/2/3 and when the analog voltage/current input terminal setting switch is selected as current

4 Set the acceleration (DRV-05 Acc Time) and deceleration (DRV-06 Dec Time) times.

5 Start the motor and check the following:

- Ensure that the motor rotates in the correct direction. If the motor is rotating in the reverse direction, refer to the following details:
- Ensure that the motor accelerates and decelerates according to the set times and that the motor speed reaches the frequency reference.

Note

If the forward command (FX) is on, the motor should rotate counterclockwise when viewed from the load side of the motor. If the motor rotates in the reverse direction, switch the cables at the U and V terminals.

Remarque

Si la commande avant (FX) est activée, le moteur doit tourner dans le sens anti-horaire si on le regarde côté charge du moteur. Si le moteur tourne dans le sens inverse, inverser les câbles aux bornes U et V.

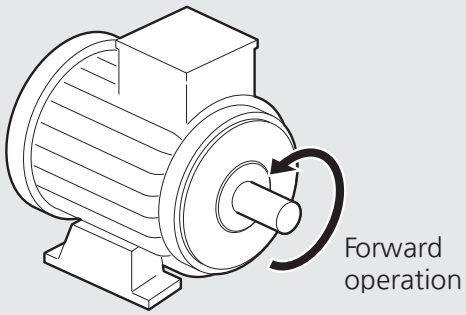
Check the motor's rotational direction

1 Set DRV-10 (1st Command Source) of the drive group (DRV) to 0 (Keypad) with the Smart Operator.

2 Set DRV-01 (Command Frequency) of the drive group (DRV) to an arbitrary target frequency with the Smart Operator.

3 Press the FWD key of the Smart Operator. The forward operation will start.

4 Observe that the motor's axis rotates counterclockwise (forward direction), as shown in the following illustration.



[Image 1. Check motor's rotational direction]

ⓘ Caution

- Check the parameter settings before running the inverter. Parameter settings may have to be adjusted depending on the load.
- Do not supply the inverter with an input voltage that exceeds the rated voltage of the equipment. This may cause damage to the inverter.
- Make sure that the motor does not exceed its rated operating range. Inverters can easily increase the rotation speed of motors, so you should check the motor's rated operating range before maximizing the rotation speed.

4 Learning to Perform Basic Operations

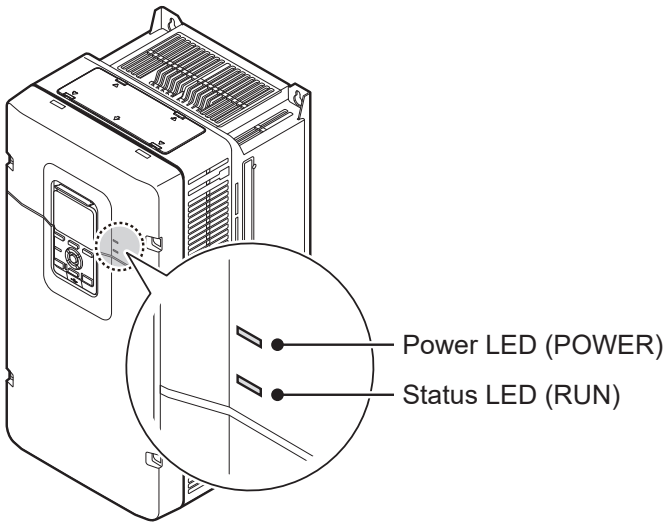
This chapter describes the Smart Operator's composition and operation method, as well as the function groups used for inverter operation and the basic operation method using the Smart Operator. Before proceeding with actual use, familiarize yourself with the various functions of the inverter, such as setting, changing frequency or input voltage, and issuing operating instructions, in order to learn the correct basic operating method.

4.1 Description of the Inverter Status Indicator LED

Refer to the following table for a detailed description of the functions of the inverter's status indicator LED. For a description of the Smart Operator's status LEDs, refer to **4.2.2 Description of the Status Indicator LED**.

Note

The location of the inverter status LEDs may vary according to the product family. Refer to **1.2 Check the Part Names** for details.



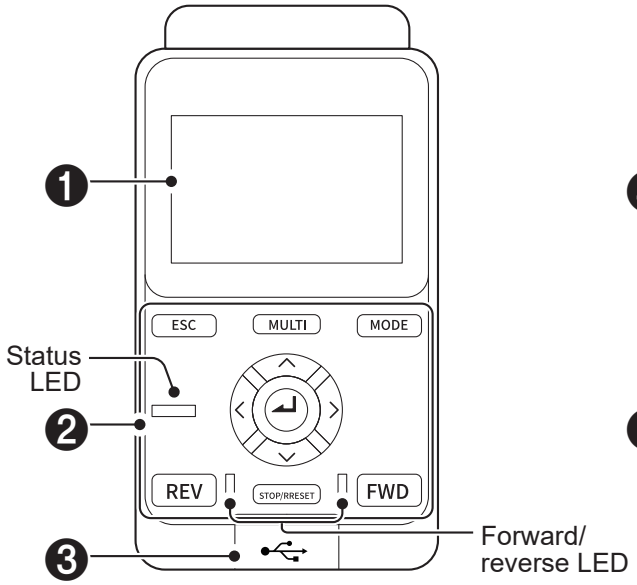
[Image 1. Inverter status LED]

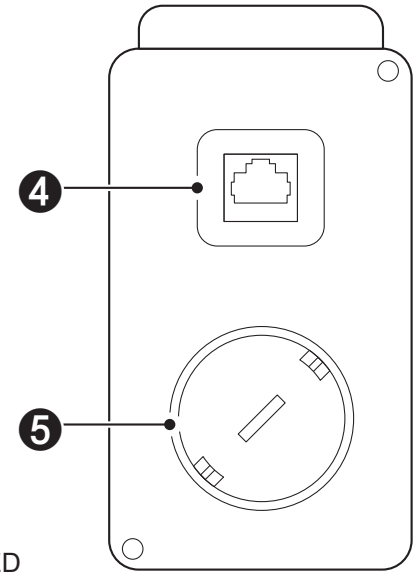
Table 1. Inverter body LED

Classification	Name	Inverter status	Color	Display method
Power display	POWER	Turning on the Inverter	Green	Always on
Operation status display	RUN	Normal	Green	1.4-second interval flashing
		Trip	Red	0.2-second interval flashing

4.2 Description of the Smart Operator's Composition and Functions

Refer to the following illustration and table to identify the part names and functions of the Smart Operator.





[Image 2. Front part of the Smart Operator] [Image 3. Rear part of the Smart Operator]

Table 2. Composition of the Smart Operator's parts

No.	Name	Description
❶	LCD screen	You can check the function settings and operation status. Refer to **4.2.3 LCD Screen Composition** for details.
❷	Control panel (input key) and status display lamp	You can set various inverter functions, give operation commands by changing the frequency or input voltage, and determine the current situation through the status display lamp. Refer to **4.2.1 Description of Operation Key Functions** and **4.2.3 LCD Screen Composition** for details.
❸	USB Port	You can connect the Smart Operator to a PC and use it for various purposes. For details, refer to **12.4 USB mode** for details.
❹	RJ45 communication port	The Smart Operator is connected to the main body of the inverter through this port.
❺	Battery cover	This is the Smart Operator's battery cover. • Battery type: CR2032 • One battery is provided with your purchase. For details on installing (replacing) the battery, refer to **Installing (replacing) the Smart Operator battery**.

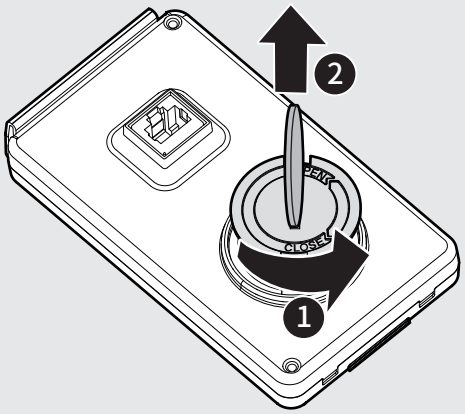
Note

Installing (replacing) the Smart Operator battery

When the Smart Operator is shipped, the battery (CR2032) is already installed.
Please follow the steps below when installing (replacing) the battery for the first time or when the battery is low and needs to be replaced.

1 Use the snap hook to separate the Smart Operator from the product. Be careful not to pull too hard since there is a communication line connecting the Smart Operator to the product.

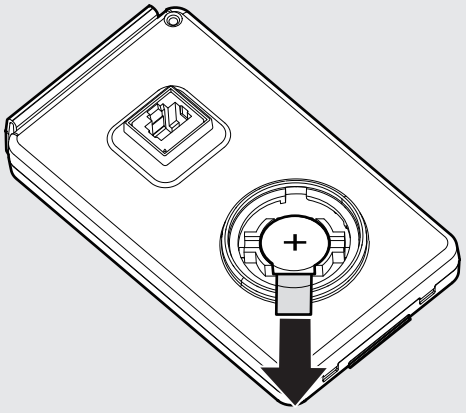
2 Using a flathead (-) screwdriver or coin, remove the battery cover by turning it in the opening direction.



[Image 4. Battery cover removal]

3 When using the battery for the first time or using the RTC option, remove the insulation strip attached to the battery.

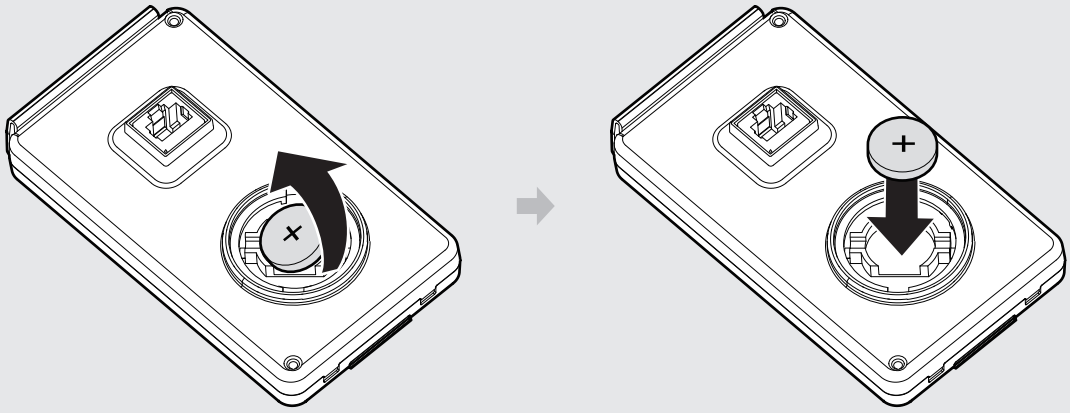
- If the battery insulation strip is not removed and power is supplied to the inverter, the **Date Time Reset** message will be displayed.



[Image 5. Battery insulation strip removal]

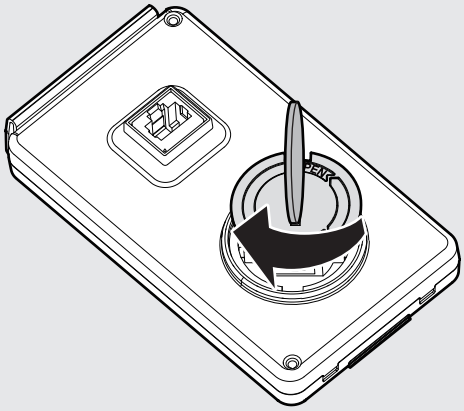
Note

4 Remove the old battery and install the new one in the correct orientation when replacing an old battery.



[Image 6. Battery replacement]

5 Using a flathead (-) screwdriver or coin, close the battery cover by turning it in the closing direction.



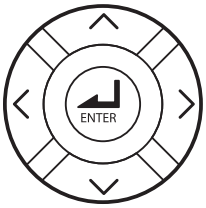
[Image 7. Battery cover combination]

6 In order to install the Smart Operator, raise it to the installation position and press the snap hook until it clicks into place.

4.2.1 Description of Operation Key Functions

Refer to the following table for descriptions of the functions for each key.

Table 3. Smart Operator operation key

Classification	Display	Function name	Functionality
Key	ESC	Cancel (ESC) key	In editing mode, if you press the Cancel ESC key before pressing the Program ENTER key, the previously saved data will be retained. Press to navigate to the first code of a group when moving codes within a group.
	MULTI	Multifunction (MULTI) key	Local/Remote, Keypad Jog, and Favorite codes can be registered depending on the settings. Refer to **12.1.1 Setting Mode Parameters** for detailed setting method.
	MODE	MODE key	Displays the Menu screen.
		Program (ENTER) key	By pressing once in the parameter code that can be set, the parameter code enters an editing state, and by pressing again after editing, the modified data will be saved.
		Up arrow key/ Down arrow key	Used when moving codes or editing data values.
		Left arrow key/ Right arrow key	Navigates between groups. Moves the cursor in editing mode.
	REV	Reverse operation (REV) key	Operates in the reverse direction.
	STOP/RESET	STOP key	Stops the inverter or resets the trip.
	FWD	Forward operation (FWD) key	Operates in the forward direction.

4.2.2 Description of the Status Indicator LED

Refer to the following table for a detailed description of the Smart Operator's status indicator LED. For a description of the status indicator LED located on the front of the inverter body, refer to **4.1 Description of the Inverter Status Indicator LED**.

Table 4. Smart Operator LED

Classification	Name	Inverter status	Color	Display method
Inverter status display	Status LED	Trip	Red	0.5-second interval flashing
		Warning	Yellow	0.5-second interval flashing
		In operation	Green	Always on
		Tuning	White	0.5-second interval flashing
Operation direction status display	Forward/ reverse LED	Accelerating	Green	0.5-second interval flashing
		Decelerating	Green	0.5-second interval flashing
		At constant speed	Green	Always on
		Operation stopped.	-	Off

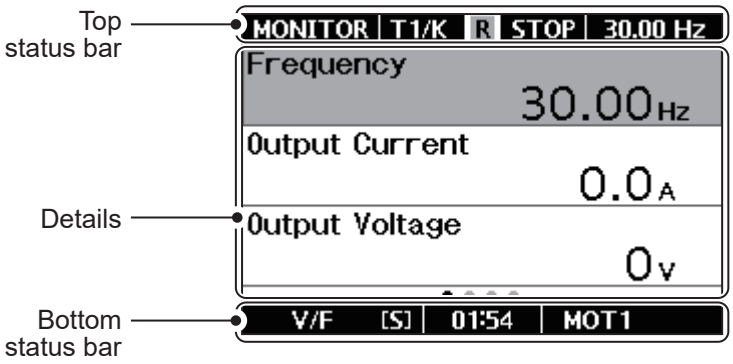
4.2.3 LCD Screen Composition

The following illustration shows the composition of the Smart Operator screen. The Smart Operator displays Monitor mode as the initial screen when it is turned on.

The screen consists of upper/lower status bars and detailed items between them. Depending on the mode (menu), the composition of the screen may differ. Refer to **4.2.4 Menu (mode) and Screen** for details.

Note

The Smart Operator displays Monitor mode as the initial screen when it is turned on. Depending on the mode (menu), the composition of the screen may differ. Refer to **4.2.4 Menu (mode) and Screen** for details about the screen in Monitor mode.



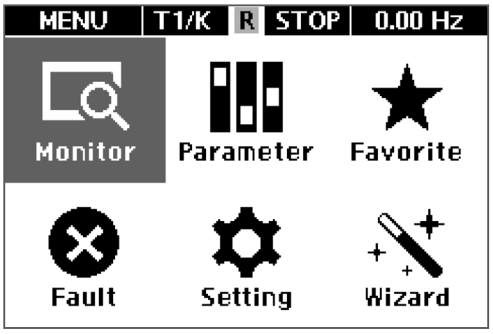
[Image 8. LCD Screen Composition]

4.2.4 Menu (mode) and Screen

The S300 series inverter consists of six modes, as follows: Each mode has function items appropriate for its characteristics, and in the case of parameter mode, functions necessary for the operation of the inverter are displayed as group units.

- Monitor: Monitor mode
- Parameter: Parameter configuration mode
- Favorite: Favorite mode
- Fault: Trip mode
- Setting: Configuration mode
- Wizard: Wizard mode (Easy Start)

Enter the main menu screen by pressing the MODE key, select the desired mode using the direction keys (▲/▼/◀/▶), and press the ENTER key to navigate to the corresponding screen.



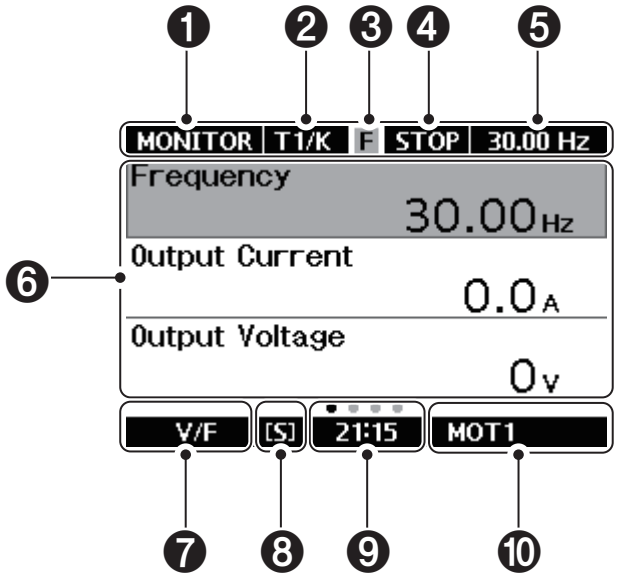
[Image 9. Menu screen]

4.2.4.1 Monitor mode

In Monitor mode, information about the inverter's operation is displayed. You can set the frequency, display the operating frequency, monitor the output current and voltage, etc.

Enter the main menu screen by pressing the MODE key, select the **Monitor** mode using the direction keys (▲/▼/◀/▶), and press the ENTER key to navigate to the Monitor mode screen.

The Monitor mode is composed of the following:



[Image 10. Monitor mode screen]

Table 5. Monitor mode screen composition

No.	Screen name	Display	Description
❶	Mode display	**MONITOR**	Monitor mode
		PARAM	Parameter mode
		PARAM E	Parameter editing mode
		FAVORITE	Favorite mode
		FAVOR.E	Favorite editing mode
		ALERT	Alert mode
		HISTORY	Alert history mode
		SETTING	Configuration mode
		WIZARD	Wizard mode

No.	Screen name	Display	Description
❷	Operation command source	**K**	Smart Operator
		T1	Fx/Rx-1
		T2	Fx/Rx-2
		3W	3-Wire
		R	RS-485 built-in communication
		O	Option
		U	USB
		KJ	Smart Operator jog
		TJ	Terminal jog
		US	User Sequence
	Frequency command source	**K**	Smart Operator
		A1, A2 , A3	Analog A1, A2, A3
		P	Pulse
		UD	Up/Down
		R	485 built-in communication
		U	USB
		O	Option
		US	User Sequence
		X1, X2, X3	Extension option analog
		PS	Position Control
		J	Jog
		PI	PID
		1~15	Multistep speed 1-15
❸	Multifunction key setting	**R**	Remote Mode
		L	Local Mode
		J	Smart Operator jog
		F	Favorite Register/Delete

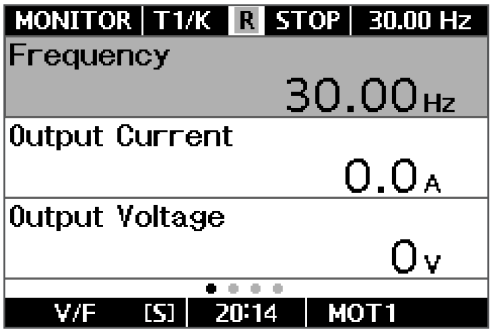
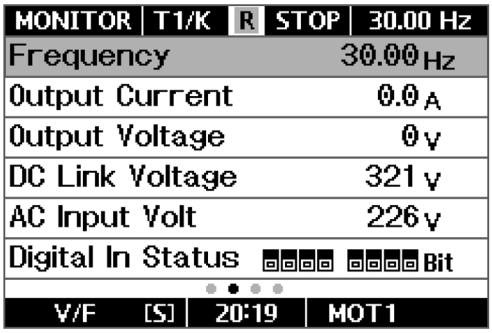
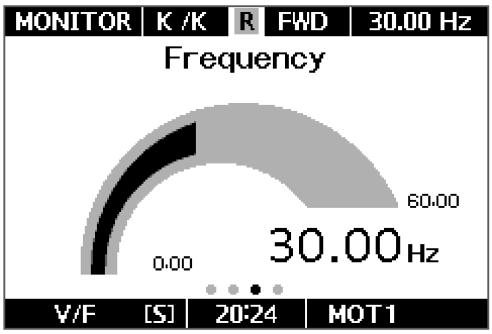
No.	Screen name	Display	Description
❹	Inverter operation state	**STOP**	Stopped
		FWD	Forward operation
		REV	Reverse operation
		TRIP	Trip
		WARN	Warning
		STL	Stall
		SPS	Speed search
		OSS	S/W overcurrent suppression
		OSH	H/W overcurrent suppression
		TUNE	Tuning
		FIRE	Fire Mode
		SLP	PID Operation Sleep Mode
		DC	DC Braking
		KEB	KEB operation
❺	Continuous monitoring display items	**Frequency** (default)	Refer to **12.2.2 Monitoring Item Settings for Top Status Bar**.
❻	Display items	**MONITOR1** (default)	Monitor 1, monitor 2, monitor gauge, monitor graph display (press ⟨/⟩ key in Monitor mode to change monitor screen type)
❼	Control mode display	**V/F**	V/F control mode
		Slip Comp.	Slip Compensation control mode
		V/F PG	V/F PG control mode
		Sensorless	Sensorless Vector control mode
		Vector	Sensored Vector control mode
❽	Operation mode display	**[S]**	Speed control mode
		[T]	Torque control mode
		[P]	Position control mode
❾	Current time display	**Hour:minute**	Current time
❿	Control motor display	**MOT1**	First motor selection
		MOT2	Second motor selection

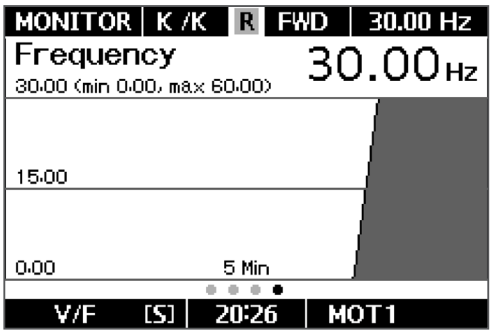
4.2.4.2 Monitor mode type

You can change the monitor screen type by pressing the ⟨/⟩ key in Monitor mode.

In Setting mode, you can select the items to be displayed on each monitor. In Monitor mode, you can navigate directly to Setting mode by pressing the ENT key. Refer to **12.2.1 Item Change in Monitor Display Mode** for details.

Table 6. Monitor mode type

Monitor screen type	Description
Monitor 1	This monitor mode displays three items. 
Monitor 2	This monitor mode displays six items. 
Monitor gauge	This monitor mode is displayed as a gauge. 

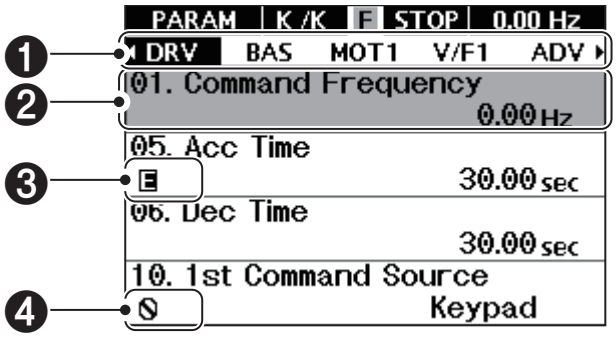
Monitor screen type	Description
Monitor graph	This monitor mode is displayed as a graph. You can set the graph display time in Setting mode as well as using the ▲/▼ key on the Smart Operator. The maximum value can be changed in 10% increments using the ▲ key, and the X-axis time can be changed using the ▼ key. 

4.2.4.3 Parameter mode

You can set the functions necessary for operation.

Enter the main menu screen by pressing the MODE key, select the **Parameter** mode using the direction key (▲/▼/◀/▶), and press the ENTER key to navigate to the Parameter mode screen.

Parameter mode is composed of the following:



[Image 11. Parameter mode screen]

Table 7. Parameter mode screen composition

No.	Classification	Description
❶	Parameter group information	Displays the parameter group name (refer to **Description of the Parameter configuration mode**)
❷	Parameter group details	Displays selected parameter sub-details (code number + code name + parameter value)
❸	Parameter property (changed value)	Displayed when default settings are changed to other values (refer to **4.4 Parameter Setting**)
❹	Parameter property (read only)	Displayed when the item is a read-only property

Description of the Parameter configuration mode

The Parameter configuration mode is composed of the following function groups:

Table 8. Parameter function group

Group name	Display	Description
Drive Group	DRV	Configures basic parameters for inverter operation, such as target frequency and acceleration/ deceleration time. You can check information regarding jog operation settings, inverter temperature, and cooling fan information.
Basic function group	BAS	Configures the parameters related to DC braking, acceleration/deceleration pattern, multistep speed frequency, etc.
First motor group	MOT1	Configures the basic functions related to the first motor.
First motor V/F control group	VF1	Configures functions related to the first motor V/F control.
First motor vector control group	VEC1	Configures functions related to the first motor vector control.
Second motor group	MOT2	Configures the basic functions related to the second motor. Refer to **7.16 Second Motor Operation**.
Second motor V/F control group	VF2	Configures the second motor V/F control function. Refer to **7.16 Second Motor Operation**.
Second motor vector control group	VEC2	Configures the second motor vector control function. Refer to **7.16 Second Motor Operation**.
Advanced function group	ADV	Configures functions related to dwell operation, frequency jump, and up/down operation.

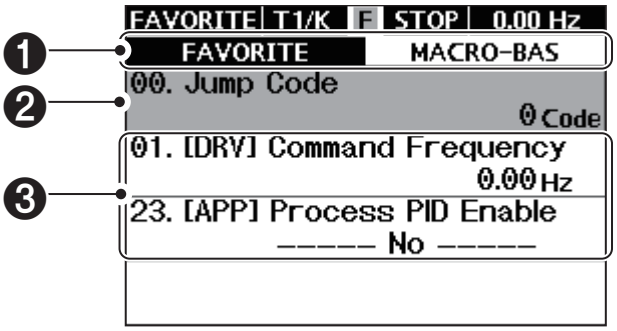
Group name	Display	Description
Application function group	APP	Configures functions related to application function activations, speed search, and kinetic energy buffering motion (KEB).
Input terminal function group	DIN	Configures the function of the multifunction digital input terminal.
Analog input terminal group	AIN	Configures the functions of the analog input terminal.
Output terminal group	OUT	Configures output terminal-related functions, including digital multifunctional outputs and analog outputs.
Process PID group	PPID	Configures functions related to PID control.
Protection function group	PRT	Configures motor and inverter protection functions.
Diagnostic function group	DIAG	Configures functions related to inverter diagnosis.
Built-in communication group	INTC	Configures functions related to built-in slave communication.
Built-in master communication group	INTM	Configures functions related to built-in master communication. (Required when using the user sequence function.)
USB communication group	USBC	Configures functions related to USB communication.
Virtual multifunction input group	VIRT	Configures functions related to the virtual multifunction input group.
Encoder group	ENC	Configures functions related to the encoder. (Visible when the encoder option is installed.)
External PID group	EPI1 EPI2	Configures functions related to external PID control.
Position control group	POS1 POS2	Configures functions related to position control.
User Sequence group	US USL USV USP USM	Configures functions related to user sequence.

4.2.4.4 Favorite mode

A user may group frequently used parameters and edit the parameter values of selected macro functions. Refer to **4.5 Favorites Settings** for details.

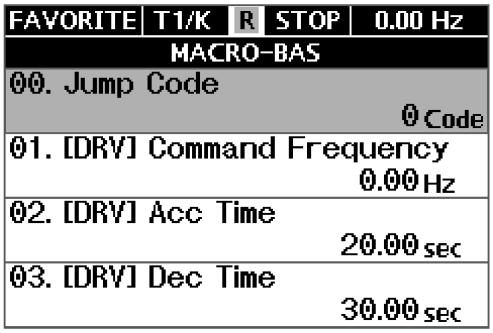
Enter the main menu screen by pressing the MODE key, select the **Favorite** mode using the direction key (▲/▼/◀/▶), and press the ENTER key to navigate to the Favorite mode screen.

The Favorite mode is composed of the following:



[Image 12. Favorite mode screen]

Table 9. Favorite mode screen composition

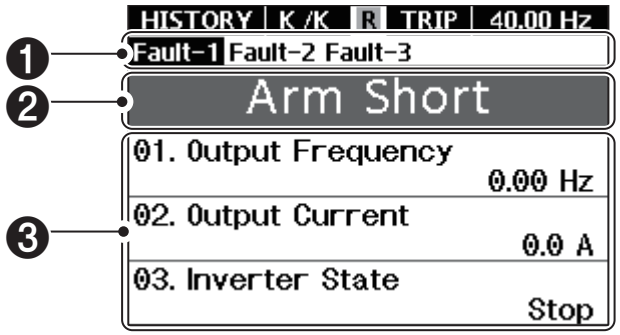
No.	Classification	Description
❶	Tab information	Favorite tab information When there are no parameters registered in **Favorite**, only the MACRO-BAS tab appears on the initial screen. 
❷	Jump Code	Enter the code number to go directly to the desired item (refer to **4.3.3 Navigating Directly to Different Codes (Jump Codes)**)
❸	Registration information	Parameter items registered in favorites • Code number + [group name] code name + parameter value • In Favorites mode, a parameter value may be modified without having to navigate to the corresponding parameter location (refer to **4.5 Favorites Settings**)

4.2.4.5 Trip mode

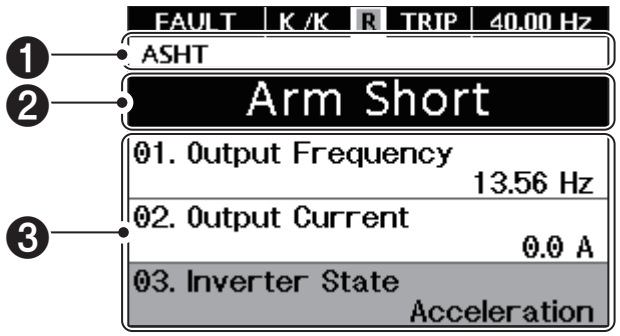
When a trip occurs during operation, the type of trip, frequency of operation, current, and voltage at the time of the trip will be displayed. It is also possible to monitor the types of trips that have occurred in the past. The trip data will not be displayed if no trip has been made and there is no past trip history. Refer to **12.3 Trip Status Monitoring** and **14.1 Trip and Warning** for details.

Enter the main menu screen by pressing the MODE key, select the **Trip** mode using the direction key (▲/▼/◀/▶), and press the ENTER key to navigate to the Trip mode screen.

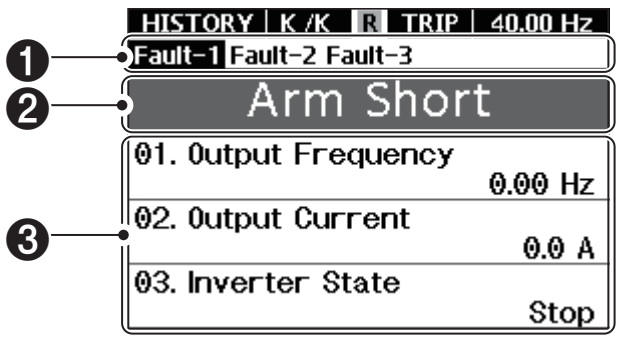
Trip mode is composed of the following:



[Image 13. Screen when there is a previously occurred trip]



[Image 14. Screen when one trip occurred]



[Image 15. Screen when two or more trips occurred]

Table 10. Trip mode screen composition

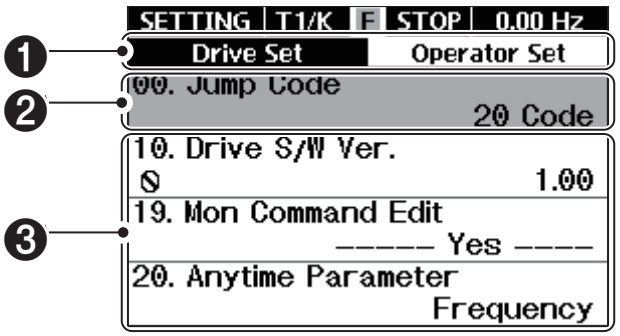
No.	Classification	Description
❶	Trip type/history information tab	The information is displayed according to the type of trip or by the history tab, depending on the situation (Fault-1: last occurred trip)
❷	Fault trip information	Displays the currently occurring trip type
❸	Trip details	Displays information on output frequency, current, operation status, etc. at the time the trip occurred

4.2.4.6 Configuration mode

You can configure the usage environment for the inverter itself, which is not related to operation functions, including setting the Smart Operator language, selecting the monitor mode environment, displaying the type of option card installed on the inverter, initializing parameters, and copying functions. Refer to **12 Inverter Setting Mode** for details.

Enter the main menu screen by pressing the MODE key, select the **Setting** mode using the direction key (▲/▼/◀/▶), and press the ENTER key to navigate to the Setting mode screen.

The Setting mode is composed of the following:



[Image 16. Setting mode screen]

Table 11. Setting mode screen composition

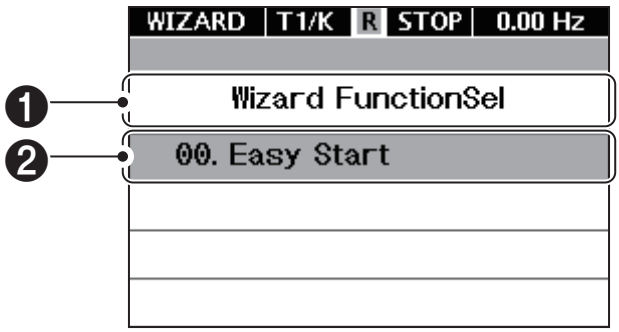
No.	Classification	Description
❶	Tab information	Separates setting items into settings related to operation or Smart Operator operation and displays them in tabs
❷	Jump Code	Enter the code number to go directly to the desired item (refer to **4.3.3 Navigating Directly to Different Codes (Jump Codes)**)
❸	Sub-details	Displays setting tab sub-details

4.2.4.7 Wizard mode

This mode simplifies the complex, multistep setup process for users who are not familiar with it. It is the same mode as the Easy Start On function. Refer to **12.1.2 Parameter Easy Start (Easy Start On)** for details.

Enter the main menu screen by pressing the MODE key, select the **Wizard** mode using the direction keys (▲/▼/◀/▶), and press the ENTER key to navigate to the Wizard mode screen.

The Wizard mode is composed as follows:



[Image 17. Wizard mode screen]

Table 12. Wizard mode screen composition

No.	Classification	Description
❶	Title	Displays the Wizard mode title
❷	Run item	Runs Wizard (refer to **12.1.2 Parameter Easy Start (Easy Start On)**)

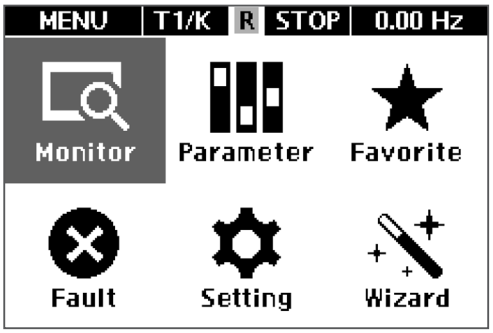
4.3 How to Use the Smart Operator

To use the product's functions, it is necessary to select the group and code to which the function belongs with the Smart Operator and set the parameter value for each function. Refer to **13 Table of Functions** to find the functions you need. Check the group and code to which the function belongs and the set value (parameter) range for the function. Select the group and code using the Smart Operator, and set the parameter value according to the description below.

4.3.1 Navigating to the Main Menu (Mode) Screen

Pressing the MODE key will navigate to the main menu screen, regardless of where the screen is currently located.

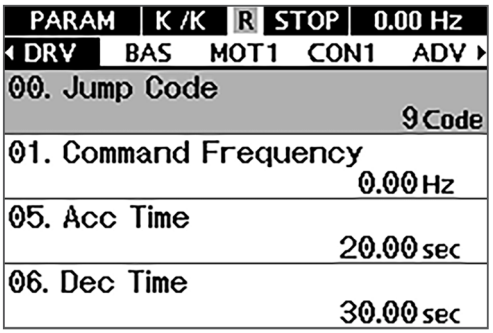
Press the direction key (/ / /) of the Smart Operator to navigate to and select the desired mode. Enter the corresponding mode by pressing the ENTER key.



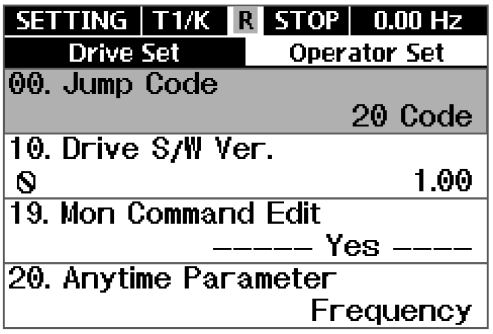
[Image 18. Menu screen]

4.3.2 Navigating to Code (Function Item)

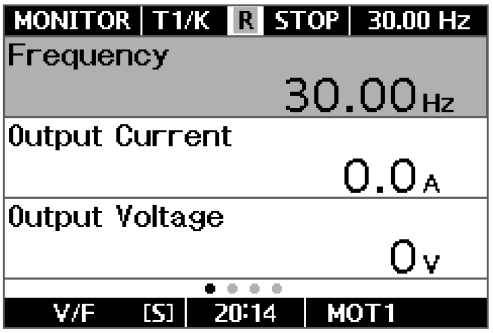
On the menu screen, press the direction key () to navigate to the desired mode, and press the  key to enter it.



[Image 19. Parameter configuration group screen]



[Image 20. Drive Set tab screen in Setting mode]

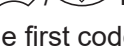


[Image 21. Monitor mode screen]

[Select a parameter group or information tab]

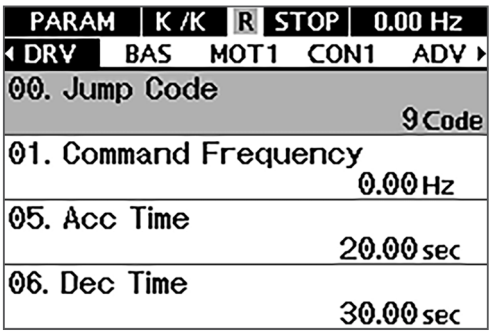
You can select the desired parameter group or information tab by pressing the  key.

Navigating to function items]

- You can navigate to the desired function item by pressing the  key.
- You can navigate to the first code (jump code) by pressing the ESC key.

4.3.3 Navigating Directly to Different Codes (Jump Codes)

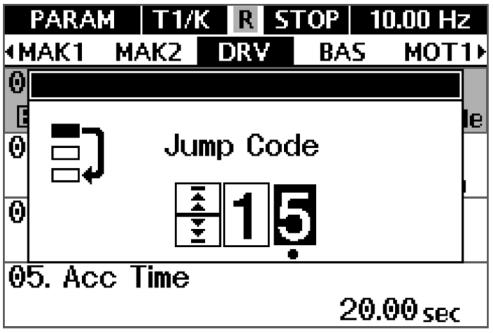
There is a jump code input item that can be used to navigate to the code of each group in the Parameter mode and Setting mode groups. You can navigate (jump) directly to the desired code by using the Jump Code, which is the first code of a specific group in parameter mode. It allows you to move faster than pressing the ▲/▼ key when the code number is large. An example of navigating to code number 15 of the drive group (DRV) is shown in the following illustration.



[Image 22. Jump Code selection screen]

[Group Selection]

- When in parameter configuration mode, press the ◀/▶ key to navigate to the drive group (DRV) and select code number 00 (pressing the ESC key on a specific item navigates to code number 00).
- Press the ENTER key.



[Image 23. Jump Code No. input screen]

[Example of entering code number 15]

- Enter the first digit (5): Press the ▲/▼ key to enter 5.
- Enter the second digit (1): Press the ◀/▶ key from the first digit to navigate to the second digit input position, then press the ▲/▼ key to enter 1.
- Press the ENTER key.

[Note]

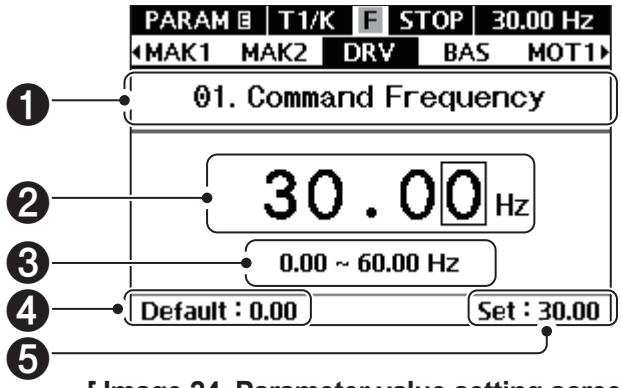
- Current input position: A round dot symbol appears below the number.
- ▲▼ : By pressing the ◀/▶ key, you can navigate to this button position. Then, press the ▲ key to input the code number 99 and press the ▼ key to input the code number 00.

4.4 Parameter Setting

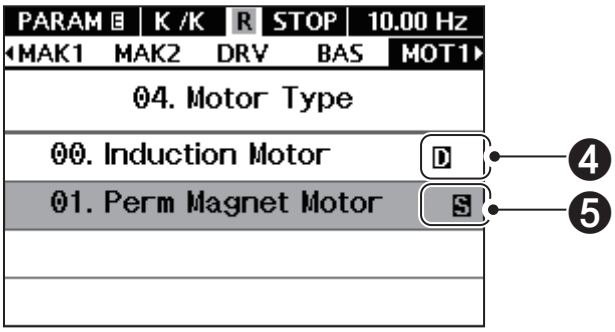
You can directly change the parameters required for operation.

On the Parameter configuration mode screen, select the parameter group and items to be set, then press the ENTER key to change the items. However, items marked as ⃠ in the list are read-only and cannot be edited.

The Parameter configuration change screen is composed of the following.



[Image 24. Parameter value setting screen]

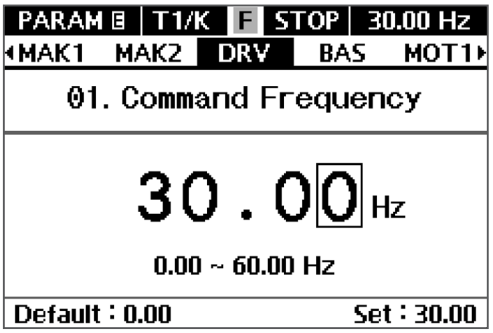


[Image 25. Parameter item selection screen]

Table 13. Parameter mode screen composition

No.	Description
❶	Code number and code name
❷	Displays the new parameter values. Press the ⟨/⟩ key to move to the position
❸	Settable range
❹	Initial value at product shipment
❺	Current setting values

An example of changing the command frequency setting value of code number 01 in the drive group (DRV) is shown in the following illustration.



[Image 26. Parameter value input screen]

- By pressing the ◁/▷ key, navigate to the desired position to enter a value. Then, press the △/▽ key to enter the desired setting value.
- Press the ENTER key.
- Once set, you can navigate to the list of the corresponding group, and if a value other than the default value is entered, **E** will be displayed on the corresponding item in the list.

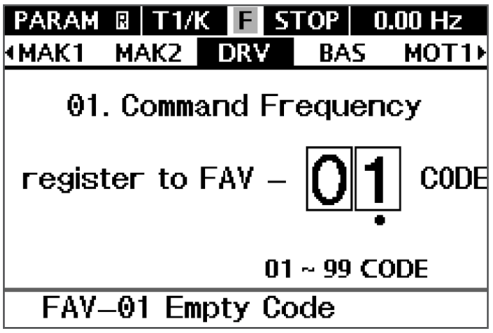
4.5 Favorites Settings

4.5.1 Register/delete favorite parameters

Among the function items in each parameter mode group, this function allows you to register or delete frequently used parameters in the Favorite group. The MULTI key must be set to a function that allows you to register or delete favorites in order to use this function. You can enable the favorites register/delete function of MULTI by following the example in the below table.

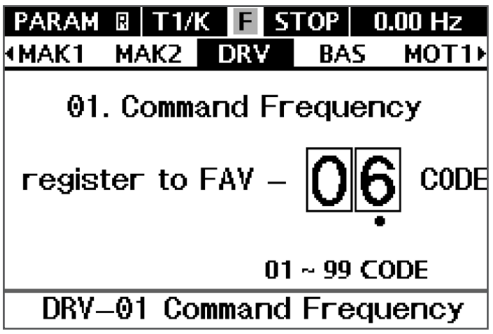
Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial value	Unit
Setting	Operator Set	15	Multi Key Select	2	Favorite Add/ Del	-	0	

Favorite Registration



[Image 27. Favorite registration screen]
(if there is no parameter registered in the selected code)

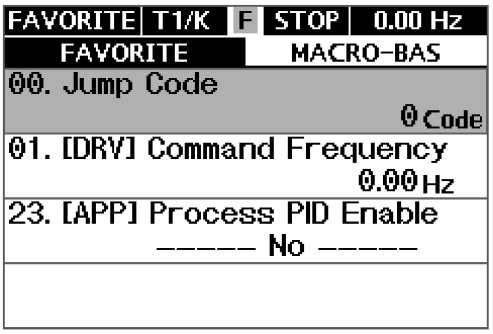
- Navigate to the parameter you want to register as a favorite in the Parameter mode and press the MULTI key. Navigate to the Favorite registration screen.
- By pressing the ◁/▷ key, navigate to the position to enter a value. Then, by pressing the △/▽ key, enter the code number of the favorites group to register the parameter.
- Press the ENTER key. The parameter is registered as a favorite in the selected code.



[Image 28. Favorite registration screen]
(If there is a parameter registered in the selected code)

[Note]
The parameters will be overwritten if there are already registered parameters for the selected code number.

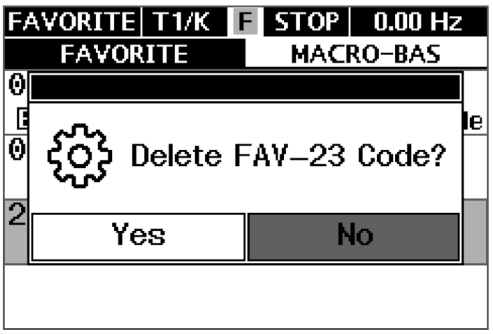
Favorite deletion



[Image 29. Favorite list screen]

- In Favorite mode, navigate to the parameter you want to delete and press the ENTER key. (It is not possible to unregister the 00-Jump Code.)

[Note]
The favorite items on the MACRO-BAS tab, which are registered by default, can only be edited and cannot be deleted.

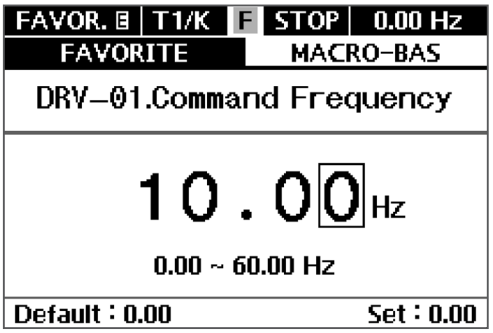


[Image 30. Confirmation screen for deleting favorites]

- In the pop-up window asking for deletion, select YES and press the ENTER key. The parameter will be deleted from the favorites list.

4.5.2 Editing the Favorite Parameters

The parameter values registered in the favorite group can be directly edited in Favorite mode.



[Image 31. Editing screen of the favorites registration parameter value]

- Navigate to the parameter you want to delete in Favorite mode and press the ENTER key. Navigate to the parameter change screen.
- By pressing the ◁/▷ key, navigate to the desired position to enter a value. Then, press the △/▽ key to enter the desired setting value.
- Press the ENTER key.
- Once set, you can navigate to the list of the corresponding group, and if a value other than the default value is entered, **E** will be displayed on the corresponding item in the list.

4.6 Macro settings

4.6.1 Selecting macro

Similar to Favorites settings, this function allows you to easily use basic functions in each Parameter mode group by pre-registering them into a group.

Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
Setting	Drive Set	47	Macro Select	0	Basic	0-2	0	-
				1	3-Wire			
				2	Up Down Drive			

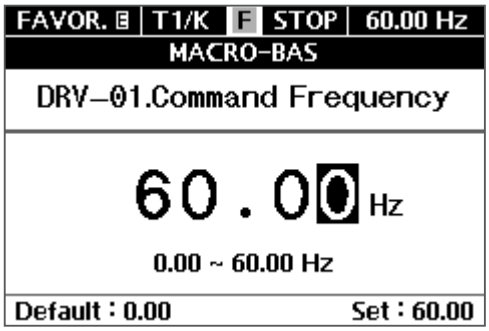
The parameters and initial values for each macro are as follows:

Macro settings value	Group	Code	LCD Display	Initial Value
BASIC	DRV	02	Command Frequency	60.00Hz
		05	Acc Time	20.00sec
		06	Dec Time	30.00sec
		10	1st Command Src	Fx/Rx-1
		11	1st Freq Ref Src	Keypad
	DIN	01	DI1 Define	FX
		03	DI2 Define	RX
		09	DI5 Define	Speed-L
		11	DI6 Define	Speed-M
		13	DI7 Define	Speed-H
		15	DI8 Define	JOG

Macro settings value	Group	Code	LCD Display	Initial Value
3WIRE	DRV	02	Command Frequency	60.00Hz
		05	Acc Time	20.00sec
		06	Dec Time	30.00sec
		10	1st Command Src	3-Wire
		11	1st Freq Ref Src	Keypad
	DIN	01	DI1 Define	FX
		03	DI2 Define	RX
		05	DI3 Define	3-Wire
UPDOWN	DRV	05	Acc Time	20.00sec
		06	Dec Time	30.00sec
		10	1st Command Src	Fx/Rx-1
		11	1st Freq Ref Src	Up Down Drive
	ADV	75	Up/Down Mode	U/D Normal
	DIN	01	DI1 Define	FX
		03	DI2 Define	RX
		07	DI4 Define	Up
		09	DI5 Define	Down
		11	DI6 Define	Up/Down Clear
		13	DI7 Define	Up/Down Save

4.6.2 Edit macro Parameters

The parameter values registered in the favorite group can be directly edited in Macro mode.



[Image 32. Editing screen of the macro parameter value]

- Navigate to the parameter you want to delete in Macro mode and press the ENTER key. Navigate to the parameter change screen.
- By pressing the ◁/▷ key, you can navigate to the position to enter a value. Then, press the △/▽ key to enter the desired setting value.
- Press the ENTER key.
- Once set, you can navigate to the list of the corresponding group, and if a value other than the default value is entered, E will be displayed on the corresponding item in the list.

5 Learning Basic Functions

This chapter describes the basic functions of the S300 inverter. Check the reference page in the table to see the detailed description for each of the basic features.

Table 1. Search Basic Functions

Basic Functions	Use Example	Ref.
Setting the frequency in the Smart Operator	Configures the operating frequency with the Smart Operator.	p.94
Setting frequency via analog input in the terminal block	Configures operating frequency via voltage input (AI1, AI2, and AI3) at the terminal block.	p.94
Setting the frequency via pulse input in the terminal block	Configures the operating frequency via pulse frequency input at the terminal block.	p.97
Frequency reference source configuration for RS-485 communication	Configures frequency to the upper-level controllers, such as PLCs or PCs, via communications terminals (S+/S-/5G) of the terminal block.	p.97
Frequency Hold by Analog Input	Enables the user to hold a frequency using analog inputs at terminals.	p.103
Changing the unit of speed (Hz↔rpm)	Changes the unit of speed (Hz and rpm).	p.103
Multistep Frequency Configuration	Configures multistep frequency operations by receiving an input at the terminals defined for each step frequency.	p.105
Limiting the frequency with maximum/start frequency	Configures the frequency reference limits by defining a start frequency and a maximum frequency.	p.107
Limiting the frequency with upper and lower limits	Limits the operating frequency by configuring an upper limit and a lower limit.	p.108
Frequency jump	Configures the inverter to avoid running a motor in mechanically resonating frequencies and to reduce noise.	p.109
Command source configuration for terminal block inputs	Configures the inverter to accept inputs at the Fx/Rx terminals.	p.111
RS-485 Communication as a Command Input Device	Configures operation commands to the upper-level controllers, such as PLCs or PCs via communications terminals (S+/S-/5G) of the terminal block.	p.114

Basic Functions	Use Example	Ref.
Forward/Reverse Rotation Prevention	Configures the inverter to limit a motor's rotation direction.	p.116
Start at power-on	Configures to accelerate instantly if the operation command is on when inverter power is supplied.	p.117
Reset and restart after a trip	Configures the inverter to start operating if the operation command is on after the inverter is reset following a fault trip.	p.118
Acceleration start	Acceleration start is a general acceleration mode. If there are no extra settings applied, the motor accelerates directly to the frequency reference when the command is input.	p.119
Start after DC braking	Performs DC injection braking before accelerating the motor again when the motor keeps rotating from the inertia of the load itself after the power supply to the inverter is interrupted.	p.119
Deceleration stop	Deceleration stop is a typical method used to stop a motor. The motor decelerates to 0 Hz and stops unless otherwise selected.	p.121
Stop after DC braking	Stops the motor by supplying DC power when the operating frequency is reduced to the set value while decelerating.	p.122
Free-run stop	When the Operation command is off, the inverter output turns off, and the load stops due to residual inertia.	p.124
Acc/dec time setting based on the maximum frequency	Configures the acceleration and deceleration times for a motor based on the maximum frequency.	p.126
Acc/dec time setting based on the operating frequency	Configures acceleration and deceleration times for a motor based on the time needed to reach the target frequency of the next step from the current operating frequency at a fixed speed.	p.127
Multi-stage acc/ dec time setting with multifunction terminals	Configures multistage acceleration and deceleration times for a motor with multifunction terminals.	p.128
Switching acc/dec time Frequency Settings	Enables modification of acceleration and deceleration gradients without using multistep terminals.	p.129
Acc/dec pattern settings	Configures acceleration and deceleration gradient patterns. Basic patterns to choose from include linear and S-curve patterns.	p.130
Acc/dec stop command settings	Stops the current acceleration or deceleration and controls motor operation at a constant speed. Multifunction terminals must be configured for this command.	p.133

5.1 Frequency Settings

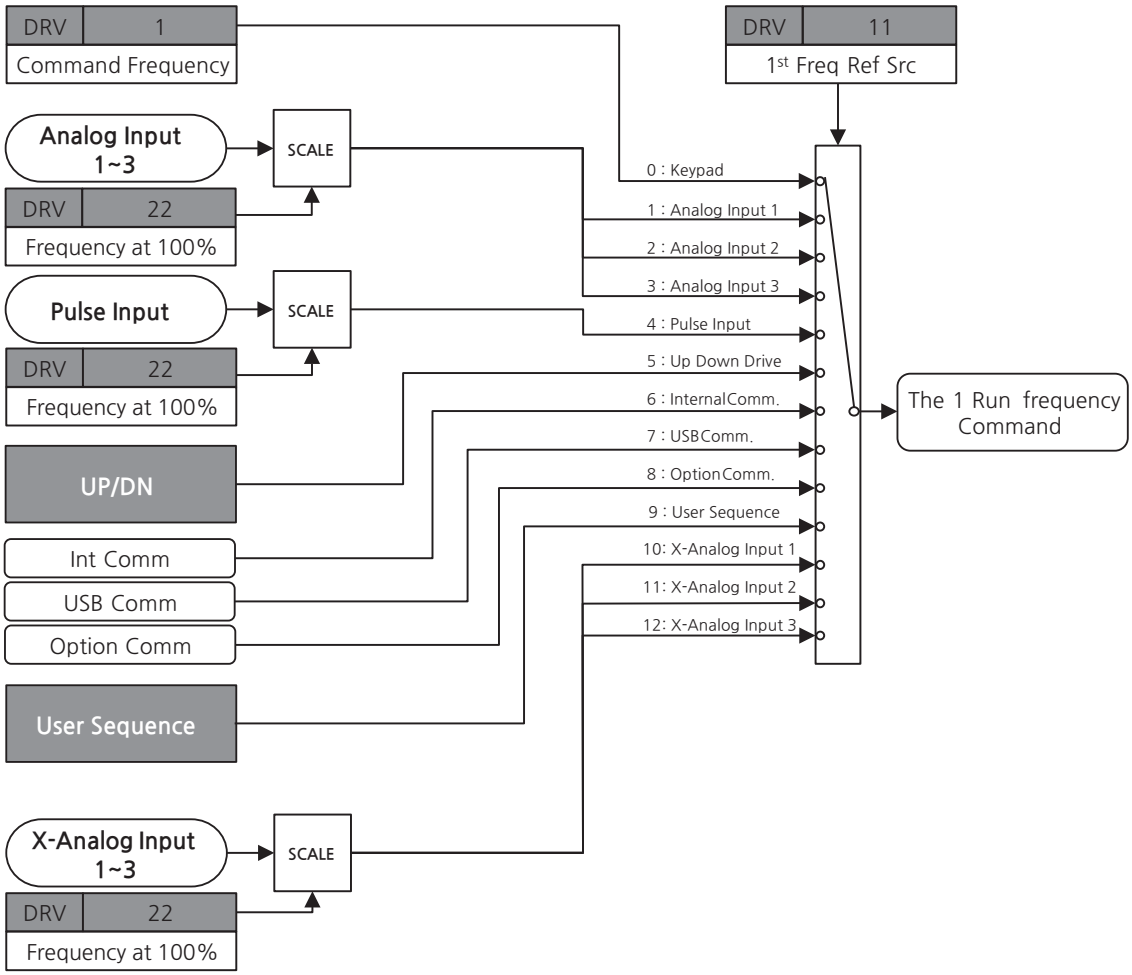
5.1.1 Operating Frequency Settings

5.1.1.1 Operating Frequency Source Settings

Frequency commands for S300 are determined by the frequency command sources as follows:

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	11	1st Freq Ref Src	0	Keypad	0~12	0	-
			1	Analog Input 1			
			2	Analog Input 2			
			3	Analog Input 3			
			4	Pulse Input			
			5	Up Down Drive			
			6	Internal Comm.			
			7	USB Comm.			
			8	Option Comm. [1]			
			9	UserSequence			
			10	X-Analog Input [2]			
			11	X-Analog Input [2]			
			12	X-Analog Input [2]			

[1] Configurable only when equipped with communication options
[2] Configurable only when equipped with extension I/O options



[Image 1. Operating Frequency Determination Block]

5.1.1.2 Setting Operating Frequency in the Smart Operator-Direct Input

Set the frequency in the Smart Operator and press the ENT key to change the frequency. Set the desired frequency in DRV-01 (Command Frequency, target frequency) code after choosing 0 (Keypad) in DRV-11 (1st Freq Ref Src, frequency setting method) code.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	01	Command Frequency	0.00		0.00~60.00	0.00	Hz
	02	Command Speed	0		0~1800	0	rpm
	11	1st Freq Ref Src	0	Keypad	-	0	-

* The gray shaded area is displayed when the speed unit is rpm (when 1 [rpm Display] is selected in DRV-32 [Hz/rpm Select]). The rpm value is based on a 4-pole motor (MOT1, 2-25) and varies depending on the actual number of poles.

5.1.1.3 Setting Frequency via Terminal Analog Voltage Input (AI1-AI3)

You can set the frequency by inputting the voltage from AI1-AI3 terminals (frequency setting (voltage) terminals) from the control terminal block. Voltage inputs of 0-+10 V or -10-+10 V are available. SW4 must be selected as V1-V3.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	11	1st Freq Ref Src	1	Analog Input 1	1~3	0	-
			2	Analog Input 2			
			3	Analog Input 3			
	22	Frequency at 100%	60.00		0.00~60.00	60.00	Hz
	23	Speed at 100%	1800		0~1800	1800	rpm

Group	Code	LCD Display	Set value	Setting Range	Initial Value	Unit
AIN	02	AI1 Value [3]	-	-10.00~10.00	-	V
			-	0.00~20.00	-	mA
	17	AI2 Value [3]	-	-10.00~10.00	-	V
			-	0.00~20.00	-	mA
	32	AI3 Value [3]	-	-10.00~10.00	-	V
			-	0.00~20.00	-	mA

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Setting a Frequency Reference for 0–10 V Input

Select one among 1-3 (AI1-AI3) in DRV-11 (1st Freq Ref Src, frequency setting method) code, then select 0 (Unipolar Voltage) in AI1-AI3 Type Select code from analog terminal block input group (AIN). Use the power of the external controller or VR+ terminal (analog power terminal) of the control terminal block to input voltage in AI1-AI3 terminals as the volume resistance. Refer to **8.2 Analog Input** for details.

Setting a Frequency Reference for -10–10 V Input

Select one among 1-3 (AI1-AI3) in DRV-11 (1st Freq Ref Src, frequency setting method) code, then select 1 (Bipolar Voltage) in AI1-AI3 Type Select code from analog terminal block input group (AIN).

Use the power of the external controller or VR+ and VR- terminals (analog power terminals) of the control terminal block to input voltage in AI1-AI3 terminals as the volume resistance.

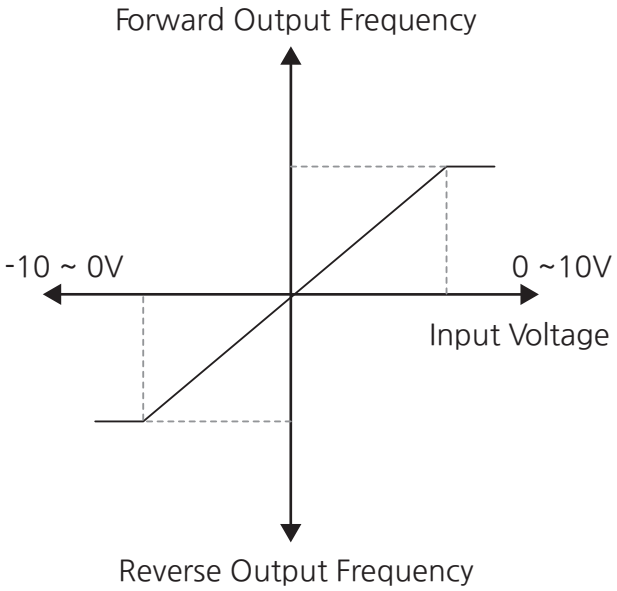
Rotational direction of the motor changes according to the voltage signal code when the input voltage is between -10-+10 V.

Refer to **8.2 Analog Input** for details.

Table 2. Rotational Directions for Different Operation Commands and Voltage Inputs

Operation command	Input voltage	
	0~10V	-10~0V
FWD	Fwd	Rev
REV	Rev	Fwd

[3] The units are changed according to the setting values in AIN-01, 16, and 31 (AI1-AI3 Type Select).



5.1.1.4 Setting Frequency via Analog Current Input in Terminal Block

You can set the frequency by inputting current from AI1-AI3 terminals (frequency setting [current] terminals) of the control terminal block.

Current in between 0 and 20 mA is available for input. SW4 must be selected as I1-I3 current (in the direction of ON).

Inputting Current of 4-20 mA in Terminal Block

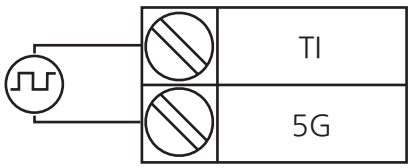
Select one among 1-3 (AI1-AI3) in DRV-11 (1st Freq Ref Src, frequency setting method) code, then select 2 (Current) in AI1-AI3 Type Select code from analog terminal block input group (AIN). Refer to **8.2 Analog Input** for details.

5.1.1.5 Setting the Frequency via Pulse Input in the Terminal Block

Set frequency by inputting pulse frequency of 0-32 kHz in the TI Terminal (pulse input terminal) of the control terminal block.

Inputting Pulse of 0-32 kHz in Terminal Block

Select 4 (Pulse Input) in DRV-11 (1st Freq Ref Src, frequency setting method) code. Refer to **8.4 Pulse Input** for details.



[Image 2. Inputting Pulse in Terminal Block

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	11	1st Freq Ref Src	4	Pulse Input	-	0	-

5.1.1.6 Setting Frequency with Internal Communications

Select 6 (Internal Comm.) in DRV-11 (1st Freq Ref Src), frequency setting code for the drive group (DRV). Control the inverter via communications with upper-level controllers, such as PLCs or PCs, by using S+/S-/SG terminals (RS-485 signal input terminals) of the control terminal block. Refer to **10 Using Built-in Communication Features** for details.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	11	1st Freq Ref Src	6	Internal Comm.	-	0	-

Communication parameter addresses used to set frequency are as follows:

Communication Address	parameter	Scale	Unit	Details
0380h	Frequency command	0.01	Hz	Set command frequencies

5.1.1.7 Up-Down Operation

The acceleration and deceleration can be controlled through input at the multifunction terminal block. Similar to a flowmeter, the up-down operation can be applied easily to a system that uses the upper and lower limits of the switch output signals to command acceleration or deceleration for a motor.

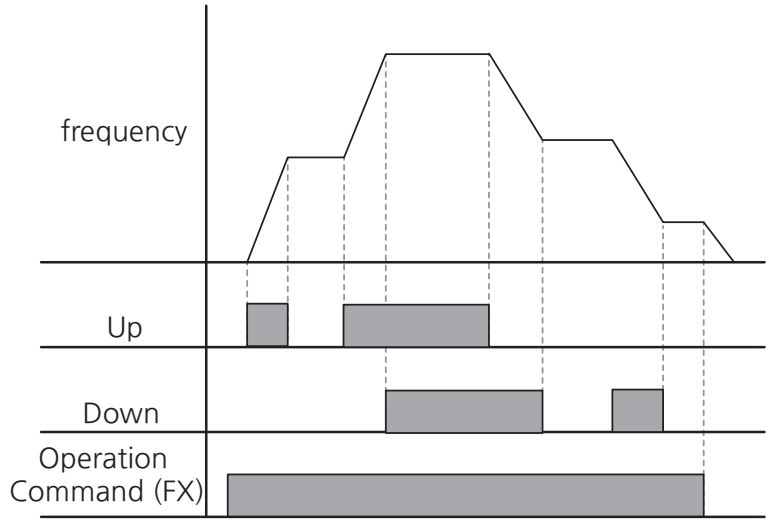
Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	11	1st Freq Ref Src	5	Up Down Drive	-	0	-
ADV	75	Up/Down Mode	0	Up/Down Normal	0~2	0	-
			1	Up/Down Step			
			2	Up/Down Step+Norm			
	76	Up/Down Save Mode	0	No	0~1	0	-
			1	Yes			
	77	Up/Down Step Freq	0.00		0.00~60.00	0.00	Hz
	78	Up/Down Step Speed	0		0~1800	0	rpm
	79	Up/Down Save Freq	0.00		0.00~60.00	0.00	Hz
	80	Up/Down Save Speed	0		0~1800	0	rpm
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	22	Up	-	1, 2, 4, 5, 10, 11, 12, 9	-
			23	Down			
			24	Up/Down Clear			
			25	Up/Down Save			

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Up/Down Operation (Up/Down Mode) Details

- **Up/Down Normal**

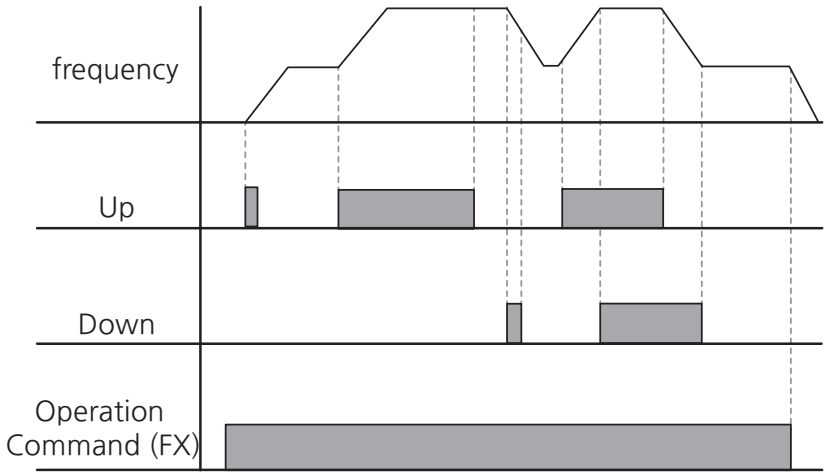
Target frequency is accelerated or decelerated according to the input at the Up/Down terminals based on the maximum/minimum frequencies.



[Image 3. Up-Down Operation (Normal)]

- **Up/Down Step**

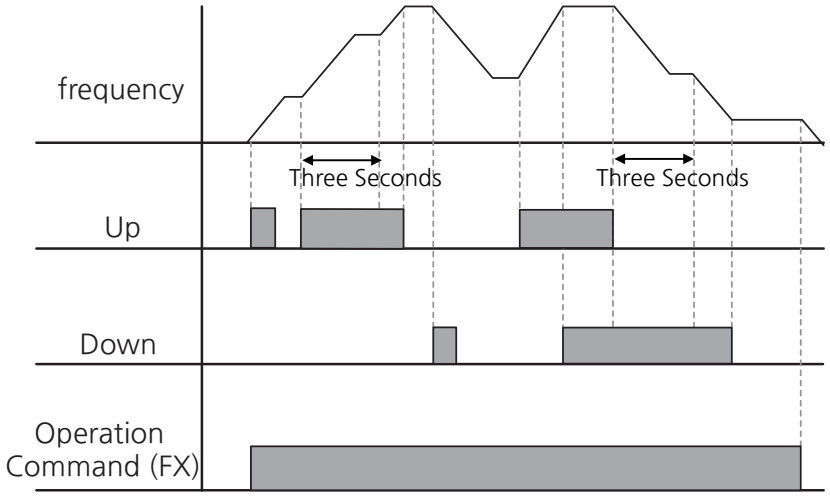
It is accelerated or decelerated as much as the step frequency set in ADV-77 (Up/Down Step Freq) or ADV-78 (Up/Down Step Speed) every positive edge according to what is input at the Up/Down terminals.



[Image 4. Up-Down Operation (Step)]

• **Up/Down Step+Normal**

It is accelerated or decelerated as much as the step frequency set in ADV-77 (Up/Down Step Freq) or ADV-78 (Up/Down Step Speed) every positive edge according to what is input at the Up/Down terminals. When the input is maintained for three seconds from a positive edge, it works the same as selecting Up/Down Normal.

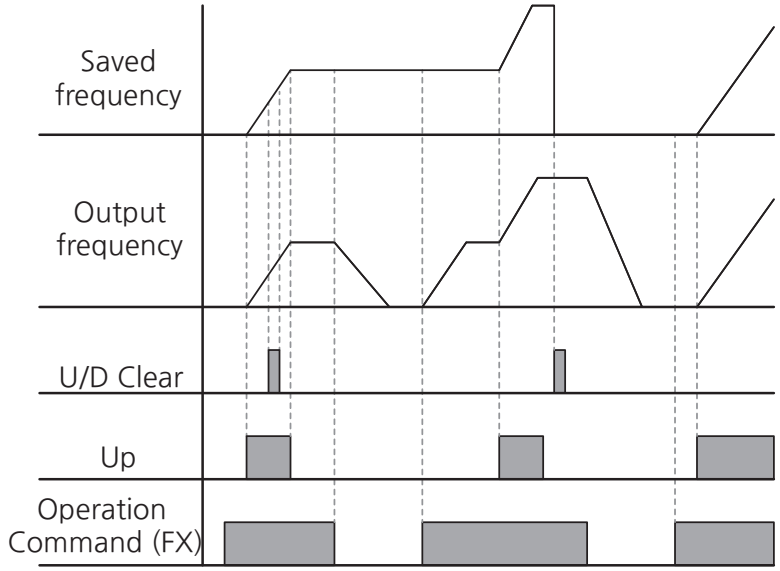


[Image 5. Up-Down Operation (Step+ Normal)]

• **Up/Down Save Mode**

During a constant speed operation, the operating frequency is saved automatically in the following conditions: the operation command (FX or RX) is off, a fault trip occurs, or the power is off.

When the operation command is turned on again, or when the inverter regains the power source or resumes a normal operation from a fault trip, it resumes operation at the saved frequency. To delete the saved frequency, use the multifunction terminal block. Set one of the multifunction terminals to 22 (U/D Clear) and apply signals to it when stopped or at a fixed speed to delete saved frequencies in an up-down operation.

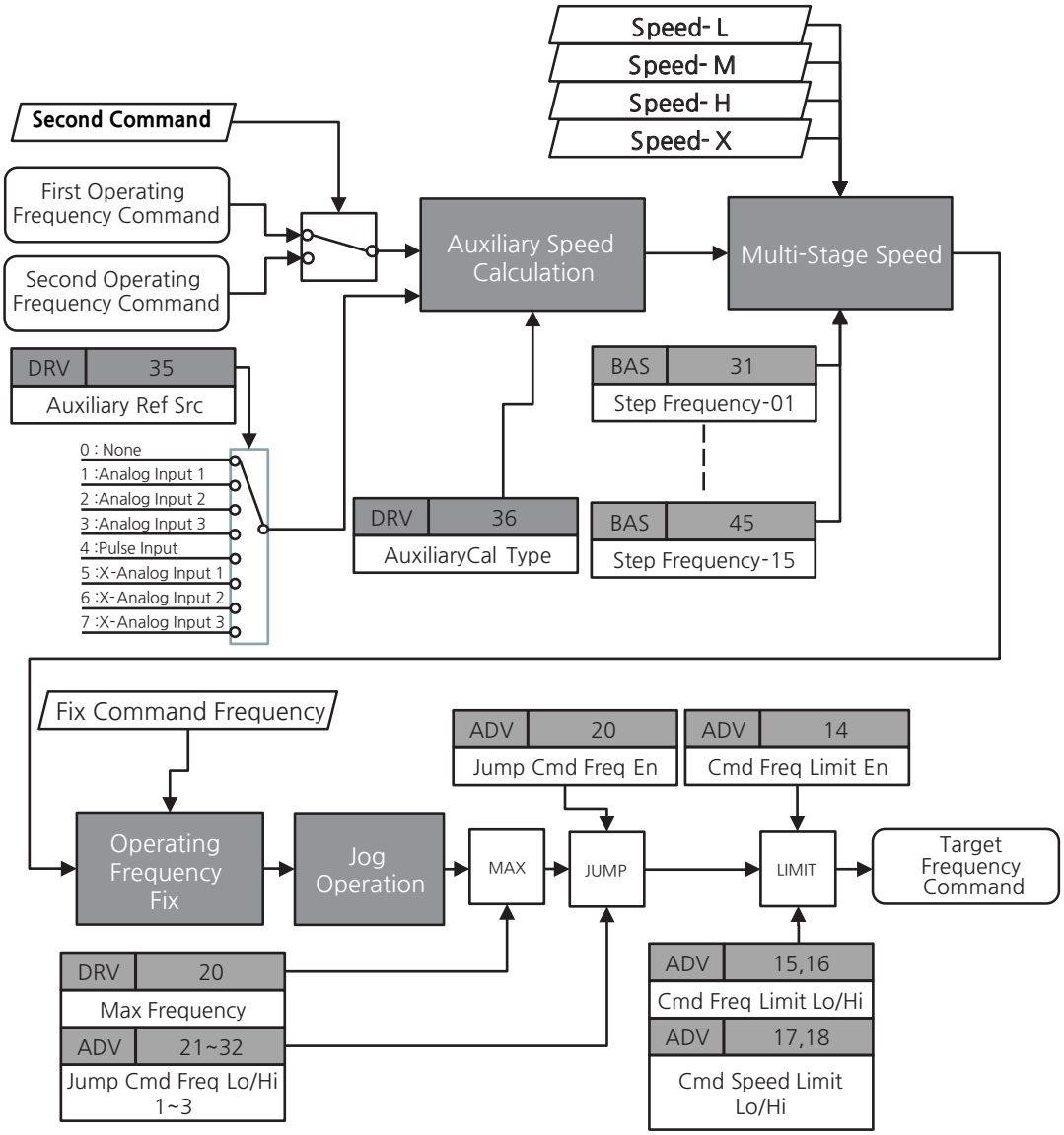


[Image 6. Up-Down Operation (Save Mode)]

5.1.2 Operating Frequency-related Functions

5.1.2.1 Selecting Operating Frequency

Operating frequency is selected and reflected as the following structure:



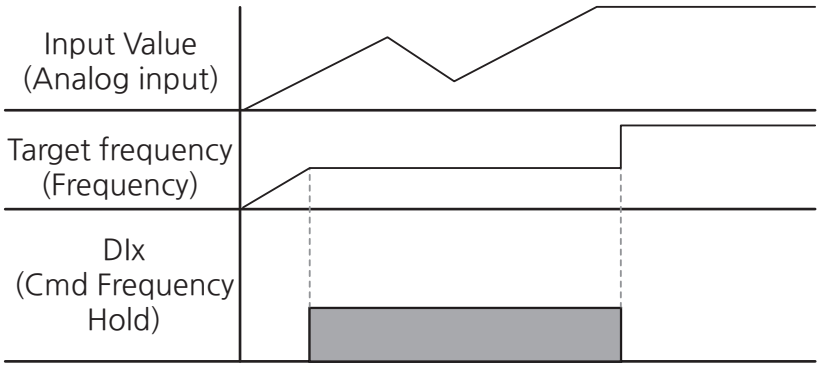
[Image 7. Structure of Target Frequency Determination]

5.1.2.2 Holding Operating Frequency

When a signal is input at the terminal, among multifunction input terminals, for which Command Frequency Hold is selected, the operating frequency is held at the output value at that moment regardless of inverter operation status.

Jog operation runs on jog frequency instead of following the frequency on hold.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx:DI1~DI8)	26	Cmd Frequency Hold	-	1, 2, 4, 5, 10, 11, 12, 9	-



[Image 8. An Example of Frequency Change Due to Operating Frequency Hold]

5.1.2.3 Changing Unit of Speed

You can change the unit of speed by selecting 0 (Hz Display) or 1 (rpm Display) for DRV-32 (Hz/rpm Select), the unit of speed selection code for a drive group (DRV).

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	32	Hz/rpm Select	0	Hz Display	0~1	0	-
			1	rpm Display			

Table 3. Parameters for Each Unit of Speed

Hz		RPM	
Code	Parameter Name	Code	Parameter Name
DRV-01	Command Frequency	DRV-02	Command Speed
DRV-15	Jog Frequency	DRV-16	Jog Speed
DRV-20	Max Frequency	DRV-21	Maximum Speed
DRV-22	Frequency at 100%	DRV-23	Speed at 100%
BAS-08	DC Brake Frequency	BAS-09	DC Brake Speed
BAS-31~45	Step Frequency-1~15	BAS-46~60	Step Speed-1~15
MOT1-15	Start Frequency	MOT1-16	Start Speed
VF1-02, 05, 08, 11	User Frequency-1~4	VF1-03, 06, 09, 12	User Speed-1~4
VF1-79, 82, 85, 88	Stall Frequency-1~4	VF1-80, 83, 86, 89	Stall Speed-1~4
VF1-27	SlipGain SwOv Freq	VF1-28	SlipGain SwOv Spd
MOT2-01	Command Frequency	MOT2-02	Command Speed
MOT2-15	Start Frequency	MOT2-16	Start Speed
VF1-02, 05, 08, 11	User Frequency-1~4	VF1-03, 06, 09, 12	User Speed-1~4
VF1-79, 82, 85, 88	Stall Frequency-1~4	VF1-80, 83, 86, 89	Stall Speed-1~4
VF2-27	SlipGain SwOv Freq	VF2-28	SlipGain SwOv Spd
ADV-05	AccDwell Frequency	ADV-06	AccDwell Speed
ADV-08	DecDwell Frequency	ADV-09	DecDwell Speed
ADV-15	Cmd Freq Limit Lo	ADV-17	Cmd Speed Limit Lo
ADV-16	Cmd Freq Limit Hi	ADV-18	Cmd Speed Limit Hi
ADV-21	Jump Cmd Freq Lo1	ADV-27	Jump Cmd Speed Lo1
ADV-22	Jump Cmd Freq Hi1	ADV-28	Jump Cmd Speed Hi1
ADV-23	Jump Cmd Freq Lo2	ADV-29	Jump Cmd Speed Lo2
ADV-24	Jump Cmd Freq Hi2	ADV-30	Jump Cmd Speed Hi2
ADV-25	Jump Cmd Freq Lo3	ADV-31	Jump Cmd Speed Lo3
ADV-26	Jump Cmd Freq Hi3	ADV-27	Jump Cmd Speed Hi3
ADV-55	Acc Change Freq	ADV-56	Acc Change Speed
ADV-58	Dec Change Freq	ADV-59	Dec Change Speed
ADV-77	Up/Down Step Freq	ADV-78	Up/Down Step Speed
ADV-79	Up/Down Save Freq	ADV-80	Up/Down Save Speed
APP-30	RegenAvd FreqLimit	APP-31	RegenAvd Spd Limit
OUT-75	FDT Frequency	OUT-77	FDT Speed
OUT-76	FDT Frequency Band	OUT-78	FDT Speed Band

Hz		RPM	
Code	Parameter Name	Code	Parameter Name
PPID-55	Pre-PID Set Freq	PPID-56	Pre-PID Set Spd
PPID-62	Sleep Boost Freq	PPID-63	Sleep Boost Spd
PPID-64	Sleep Check Freq 1	PPID-65	Sleep Check Spd1
PPID-70	Sleep Check Freq 2	PPID-71	Sleep Check Spd2
PRT-14	Lost Preset Freq	PRT-15	Lost Preset Speed

* Rpm calculation shall be reflected as per the number of poles for each motor when using motors number 1 and 2

5.1.2.4 Multistep Frequency Configuration

Multifunction terminals enable multistep operation. Zero frequency uses frequency commands selected in DRV-01 (Command Frequency) or DRV-02 (Command Speed).

Input a step frequency you want to operate in no.30-45 (Step Frequency) or no.46-60 (Step Speed) of the basic functional group (BAS).

Select terminals among multifunction terminals DI1-DI8 for multistep input, then set one of the multistep functions (Speed-L, Speed-M, Speed-H, and Speed-X), respectively.

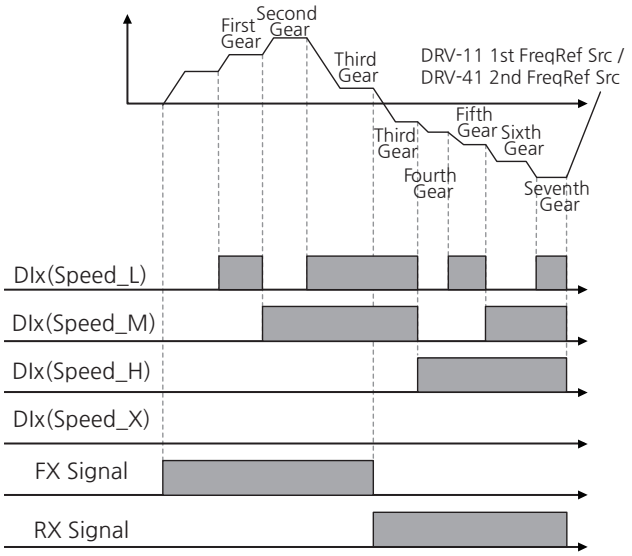
Speed-L, Speed-M, Speed-H, and Speed-X are recognized as binary codes; therefore, select frequencies set in BAS-31-45 (Step Frequency-01 to Step Frequency-15) or BAS-46-60 (Step Speed-01 to Step Speed-15) for operation.

Multifunction terminals DI5, DI6, DI7, and DI8 set as Speed-L, Speed-M, Speed-H, and Speed-X, respectively, work as follows:

DIN-20 Step DI Check Time

You can set the time to check input at the terminal block inside the inverter when you use multifunction input terminals to set multistep frequencies. For example, when you set the time to check input at the terminal block (In Check Time) as 100 msec with input at multifunction terminal DI6, it checks whether input is received at other terminal blocks. It accelerates or decelerates to the frequency of the DI6 terminal after 100 msec.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
BAS	31~45	Step Frequency-xx (Frequency-xx: Frequency-01~Frequency-15	-		0.00~Max Frequency [4]	-	Hz
	46~60	Step Speed-xx (Speed-xx: Speed-01~Speed-15)	-		0~Maximum Speed [5]	-	rpm
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	10	Speed-L	-	1, 2, 4, 5, 10, 11, 12, 9	-
			11	Speed-M			
			12	Speed-H			
			13	Speed-X			
	20	Step DI Check Time	1		1~60000	1	msec



[Image 9. An Example of Frequency Change Due to Multistep Frequency Settings]

4 DRV-20(Max Frequency)
5 DRV-21(Maximum Speed)

5.1.2.5 Frequency Limit

Operating frequency settings can be limited with the maximum frequency/start frequency, upper limit, and lower limit of the frequency.

Limiting the Frequency Using the Maximum Frequency and Start Frequency

Group	Code	LCD Display	Set value	Setting Range	Initial Value	Unit
MOT1, MOT2	15	Start Frequency	0.50	0.00~10.00	0.50	Hz
MOT1, MOT2	16	Start Speed	15	0~300	15	rpm
DRV	20	Max Frequency	60.00	10.00~590.00	60.00	Hz
DRV	21	Maximum Speed	1800	300~17700	1800	rpm

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Limiting the Frequency Using the Maximum Frequency and Start Frequency-Setting Details

Code and Functions	Description
MOT1, MOT2-15 Start Frequency	Configures lower limits for parameters with speed-related units (Hz or rpm). If an input frequency is lower than the start frequency, the setting value becomes 0.00.
MOT1, MOT2-16 Start Speed	
DRV-20 Max Frequency, DRV-21 Maximum Speed	Configures the upper limit and lower limit, respectively. The minimum setting value of the upper limit is the lower limit, whereas the maximum setting value of the lower limit is the upper limit. Frequencies are configurable between the upper limit and lower limit even when configured in the Smart Operator.

Limiting the frequency with upper and lower limits

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
ADV	14	Cmd Freq Limit En	1	Yes	-	0	-
	15	Cmd Freq Limit Lo	0.50		0~Cmd Freq Limit Hi	0.50	Hz
	16	Cmd Freq Limit Hi	60.00		Cmd Freq Limit Lo ~ Max Frequency [6]	60.00	Hz
	17	Cmd Speed Limit Lo	15		0~Cmd Speed Limit Hi	15	rpm
	18	Cmd Speed Limit Hi	1800		Cmd Speed Limit Lo ~ Maximum Speed [7]	1800	rpm

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Limiting the Frequency Using the Upper and Lower Limits-Setting Details

Code and Functions	Description
ADV-14 Cmd Freq Limit En	The initial setting value is 0 (No). When the setting is changed to 1 (Yes), the frequency can be set only between the lower limit (ADV-15) and the upper limit (ADV-16).
ADV-15 Cmd Freq Limit Lo, ADV-16 Cmd Freq Limit Hi, ADV-15 Cmd Speed Limit Lo, ADV-16 Cmd Speed Limit Hi	Configures the upper limit to all parameters for the unit of speed (Hz and rpm) excluding the base frequencies (MOT1, MOT2-23 Base Frequency). Frequency cannot be set higher than the upper limit frequency.

⚠ Caution

- The lower limit frequency of the inverter is the setting frequency for ADV-15 (Cmd Freq Limit Lo) when ADV-14 (Cmd Freq Limit En) is 1 (Yes), and MOT1, MOT-215 (Start Freq) when ADV-14 (Cmd Freq Limit En) is 0 (No).
- The upper limit frequency of the inverter is the setting frequency for ADV-16 (Cmd Freq Limt Hi) when ADV-14 (Cmd Freq Limt En) is 1 (Yes), and DRV-20 (Max Frequency) when ADV-14 (Cmd Freq Limt En) is 0 (No).

[6] DRV-20(Max Frequency)
[7] DRV-21(Maximum Speed)

Frequency Jump

Frequency jump is used to avoid mechanical resonant frequencies. When the motor accelerates or decelerates, it passes through the frequency jump band, in which the operating frequency is not configurable.

When a frequency setting is increased, the frequency is maintained at the lower limit of the frequency jump while the frequency parameter settings (voltage, current, RS-485 communication, Smart Operator settings, etc.) are within the jump frequency band. The frequency is increased when the frequency setting value goes out of the frequency jump band.

Group	Code	LCD Display	Set value	Setting Range	Initial Value	Unit
ADV	20	Jump Cmd Freq En	0 No	-	0	-
	21	Jump Cmd Freq Lo 1	10.00	0.00~Jump Cmd Freq Hi 1	10.00	Hz
	22	Jump Cmd Freq Hi 1	15.00	Jump Cmd Freq Lo 1~ Max Frequency [8]	15.00	Hz
	23	Jump Cmd Freq Lo 2	20.00	0.00~Jump Cmd Freq Hi 2 [8]	20.00	Hz
	24	Jump Cmd Freq Hi 2	25.00	Jump Cmd Freq Lo 2~ Max Frequency	25.00	Hz
	25	Jump Cmd Freq Lo 3	30.00	0.00~Jump Cmd Freq Hi 3	30.00	Hz
	26	Jump Cmd Freq Hi 3	35.00	Jump Cmd Freq Lo 3~ Max Frequency [8]	35.00	Hz
	27	Jump Cmd Speed Lo1	300	0~Jump Cmd Speed Hi1	300	rpm
	28	Jump Cmd Speed Hi1	450	Jump Cmd Speed Lo1~ Maximum Speed [9]	450	rpm
	29	Jump Cmd Speed Lo2	600	0~ Jump Cmd Speed Hi2	600	rpm
	30	Jump Cmd Speed Hi2	750	Jump Cmd Speed Lo2~ Maximum Speed [9]	750	rpm
ADV	31	Jump Cmd Speed Lo3	900	0~ Jump Cmd Speed Hi3	900	rpm
	32	Jump Cmd Speed Hi3	1050	Jump Cmd Speed Lo3~ Maximum Speed [9]	1050	rpm

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

[8] DRV-20(Max Frequency)
[9] DRV-21(Maximum Speed)

5.2 Operation Command Settings

5.2.1 Setting Methods of Operation Commands

Select how to configure operation commands. Built-in RS485 communication, Fieldbus, and option cards per application are available for operation commands other than basic operation using the Smart Operator or multifunction terminals.

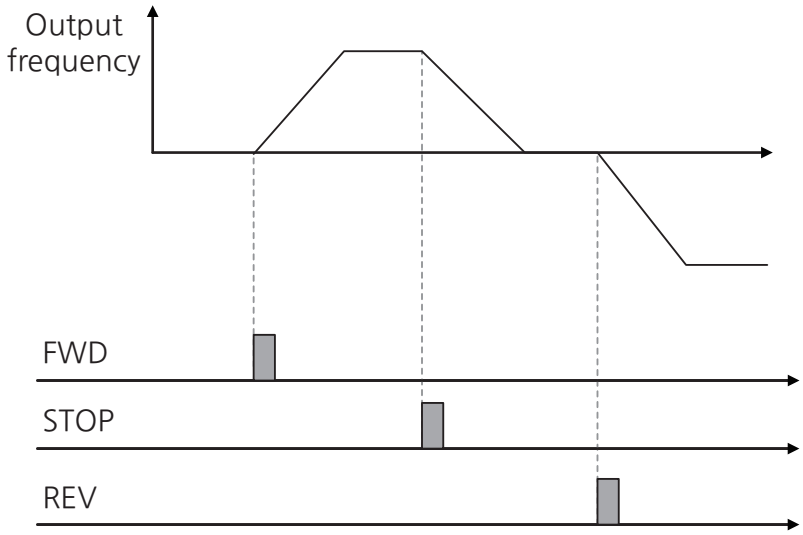
Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	10	1st Command Source	0	Keypad	0~7	0	-
			1	Fx/Rx-1			
			2	Fx/Rx-2			
			3	3-Wire			
			4	Internal Comm.			
			5	USB Comm.			
			6	Option Comm. [10]			
			7	UserSequence			

5.2.1.1 Setting Operation Commands in the Smart Operator

Select how to configure operation commands. Built-in RS485 communication, Fieldbus, and option cards per application are available for operation commands other than basic operation using the Smart Operator or multifunction terminals.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	10	1st Command Source	0	Keypad	-	0	-

[10] Configurable only when equipped with communication options



[Image 10. An Example of Frequency Change When Inputting Operation Commands in the Smart Operator]

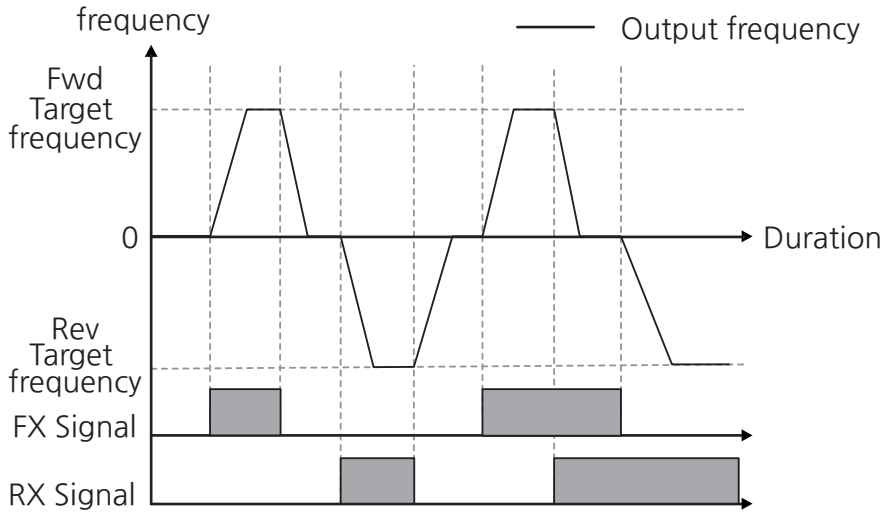
5.2.1.2 Terminal Block as a Command Input Device (Assigning Fx/Rx Terminals)

Select 1 (Fx/Rx-1) for no.10 of the drive group (DRV) to input operation commands with a multifunction terminal block. Select terminals among multifunction terminals DI1-DI8 for forward (FX) and reverse (RX) operation commands, then set the codes for the relative terminals in the terminal input group (DIN) as 1(FX) and (RX). Operation stops when the terminal set as 1 (FX) and one set as 2 (RX) turn on or off simultaneously.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	10	1st Command Source	1	Fx/Rx-1	-	1	-
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	1	FX	-	1, 2, 4, 5, 10, 11, 12, 9	-
			2	RX			

Assigning Fx/Rx Terminals–Setting Details

Code and Functions	Description
DRV-10 1st Command Source	Select 1 (Fx/Rx-1).
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	Select terminals for forward (FX) and reverse (RX) operation commands.



[Image 11. An Example of a Frequency Change When Inputting Operation Commands via a Terminal Block (Assigning Fx/Rx Terminals)]

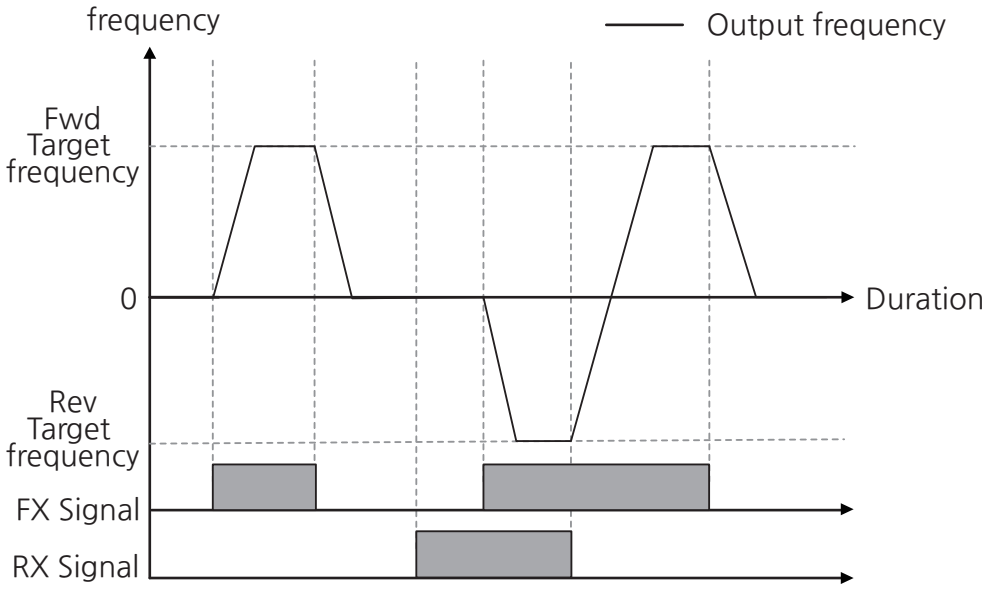
5.2.1.3 Terminal Block as a Command Input Device (Run and Rotation Direction Commands)

Set no.10 of the drive group (DRV) as Fx/Rx-2 and use the FX terminal for operation commands and the RX terminal for rotational selections. Select terminals among multifunction terminals DI1-DI8 for forward (FX) and reverse (RX) operation commands, then set the code for the relative terminals in the terminal input group (DIN) as 1 (FX) and 2 (RX).

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	10	1st Command Source	2	Fx/Rx-2	-	1	-
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	1	FX	-	1, 2, 4, 5, 10, 11, 12, 9	-
			2	RX			

Run Command and Fwd/Rev Change Command Using Multifunction Terminal – Setting Details

Code and Functions	Description
DRV-10 1st Command Source	Select 2 (Fx/Rx-2).
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	Select terminals for operation commands (FX) and rotation commands (RX).



[Image 12. An Example of a Frequency Change When Inputting Operation Commands via a Terminal Block (Assigning Command/Rotational Direction Terminals)]

5.2.1.4 Communication as a Command Input Device

To input operation commands via communication, select as per the communication type in DRV-10 (1st Command Source), the code for the operation command method of the drive group (DRV).

Use S+/S- (RS-485 signal input terminal) terminals of the control terminal block for internal communication, and use the USB port on the control board for USB communication to control the inverter. Refer to **10 Using Built-in Communication Features** for details.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	10	1st Command Source	4	Internal Comm.	-	1	-
			5	USB Comm.			

5.2.2 Local/Remote Switching Operations with Multifunction Keys in the Smart Operator

(When checking inverter operation and inspecting equipment without changing the existing parameters)

Mode	Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
Setting	Operator Set	15	Multi Key Select	0	Local/ Remote Sel	-	0	-
Parameter	DRV	15	Jog Frequency	10.00		0.00~ 60.00	10.00	-

⚠ Caution

Use the local/remote switching operation only when necessary, as it may cause equipment issues such as the inverter stopping during operation.

The local/remote switching operation function using multifunction keys(MULTI) of the Smart Operator can be used to manually switch the operation mode in cases where the operating instructions are set using methods other than the Smart Operator, such as terminal blocks or communications. This function allows for verification of the inverter operation, equipment inspection, or manual operation switching in emergency situations without the need for separate parameter settings.

- **The definition of Local**: Local is a function that switches all operation commands, frequency commands, or torque commands to allow control by the Smart Operator. Therefore, it makes all operations available in the Smart Operator. Jog commands are ignored in this case. (However, it is only operable at On if the functions of the multifunction terminal are set as 18 [RUN Enable].) Operating locally is also referred to as onsite operation mode.
- **The definition of Remote**: Remote is used to operate the inverter according to the preset method of operation commands and frequency commands. It works via communication if set as communication and multistep if set as multistep. Operating remotely is also referred to as remote operation mode.
- **Operator Set-15 (Multi-Key Select)**: R will be displayed on the status bar at the top of the Smart Operator when the no. 2 Local/Remote is set. The multifunction key works as the Local/Remote function. When R is displayed on the status bar at the top of the Smart Operator, the inverter is in remote operation (Remote) mode, in which operations are based on preset parameters with no changes to the operation. When you press the multifunction key (MULTI) when R is displayed on the pop-up window for the Smart Operator status, the R on the status bar at the top changes to an L, switching into onsite operation (Local) mode, enabling operation with FX operation (FWD) key and RX operation (REV) key in the Smart Operator. Press the multifunction key (MULTI) again and R will be displayed again on the status bar at the top. The inverter will operate as the operation command method set in DRV-10 (1st Command Source).
- **When switching from Remote to Local**: The sign for commands and frequency sources on the status bar at the top changes from T1/K to K/K when switching from remote operation (Remote) mode to on-site operation (Local) mode.
- **When switching from Local to Remote**: The sign for commands and frequency sources on the status bar at the top changes from K/K to preset T1/K when switching from onsite operation (Local) mode to remote operation (Remote) mode. It can be switched when the inverter is operating as well. However, it works differently according to which source is set.
  - **For terminal block command sources**: It operates according to commands from the terminal block when switched to Remote during Local operation. That is, when reverse operation terminal (RX) is in the terminal block while the motor is running in the forward direction in Local, it runs in the reverse direction again when switched into Remote.
  - **For digital command sources**: Digital command sources refer to all command sources excluding terminal block sources. Those include communications, PLC, and the Smart Operator. For these digital command sources, the inverter operates in the status from the previous remote operation (Remote) mode. The target frequency is set as the current frequency source.
  - **When terminal signal is input when the power turns on**: When ADV-02 (Power-on Run) is set as 0 (None) with terminal signals set as FX, RX,

FWD_JOG, REV_JOG, or PRE EXCITE are input, it is operable with the Smart Operator when changed to Local, but it does not operate when changed back to Remote. This means that the motor is not operable in remote operation (Remote) mode when any one of the terminals where the above five functions are set is On when the power is on. Turn off all the above terminals after turning on the inverter when ADV-02 (Power-on Run) is set as 0 (None) to operate the motor in remote operation (Remote) mode.

- **When the motor is stopped due to a trip during operation**: When the motor is stopped and reset in Local due to a trip during operation, the inverter does not operate the motor when changed back to Remote while operating with the Smart Operator. It is the same when operation commands are in the terminal block. Therefore, turn off all terminals before turning on the operation command terminal again to operate the motor.

5.2.3 Functions on Operation Command

5.2.3.1 Forward/Reverse Rotation Prevention

The rotation direction of motors can be configured to have them run in only one direction. When reverse rotation is prevented, if you turn off the FX terminal and turn on the RX terminal block to avoid a reverse operation during forward operation with the terminal block, the operating frequency will decelerate down to 0 Hz and the inverter maintains operation at zero speed.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
ADV	01	Run Prevent Select	0	None	0~2	0	-
			1	Forward Prevent			
			2	Reverse Prevent			

Forward/Reverse Run Prevention Setting Details

Code and Functions	Description		
ADV-01 Run Prevent Select	Choose a direction to prevent.		
	Configuration		Functionality
	0	None	Do not set rotation prevention direction.
	1	Forward Prevent	Prevents forward rotation.
	2	Reverse Prevent	Prevents reverse rotation.

5.2.3.2 Immediate Run upon Power Up (Power On Run)

When the power is supplied to the inverter, it will accelerate when the operation command in the terminal block is On.

It is only valid when ADV-02 (Power-on Run) is set as Start Mode or Speed Search while no. 10 of the drive group (DRV) is set as Fx/Rx-1 or Fx/Rx-2.

If the load (fan load) is at free-run, operating the inverter at this time may cause a trip. So, set ADV-02 (Power-on Run) as Speed Search to perform speed search while running and start operation. If Start Mode is selected, it will accelerate in a normal V/F pattern without a speed search.

If this function is not selected, turn off the operation command in the terminal block, then turn it back on to start the operation.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	10	1st Command Source	1	Fx/Rx-1	-	1	-
			2	Fx/Rx-2			
ADV	02	Power-on Run	1	Start Mode	-	0	-
			2	Speed Search			

⚠ Caution

Be cautious of safety incidents, as this function makes the motor rotate at the time of power supply.

5.2.3.3 Reset and Restart after A Trip (Reset Restart)

The inverter restarts if the operation command at the terminal block is On when the inverter is reset after a trip. When a fault trip occurs, the inverter will cut off the output and the motor will free-run. Another fault trip may be triggered if the inverter begins its operation while the motor is in a free-run state.

It works when you set PRT-05 (Reset Restart) as Start Mode or Speed Search. Auto-restart delay time is configurable in PRT-07 (Retry Delay), and the inverter is reset after the time set in PRT-07 (Retry Delay) after a trip. The number of auto-restart times is configurable in PRT-06 (Retry Number), and it will restart as many times as set in PRT-06 (Retry Number) after a trip and a reset. (If another trip occurs during the restart after a reset, the number in PRT-06 (Retry Number) will count down one by one and conduct a reset and restart as many times as set. If it successfully resets and restarts after the initial trip, it does not restart again before another trip occurs. The reduced count of PRT-06 (Retry Number) from the restart after a trip is recoverable.)

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	10	1st Command Source	1	Fx/Rx-1	-	1	-
PRT	05	Reset Restart	0	None	0~2	0	-
			1	Start Mode			
			2	Speed Search			
	06	Retry Number	1		1~10	1	-
	07	Retry Delay	1.0		0.0~60.0	1.0	sec

5.2.4 Start Settings

Select how to start the inverter when the operation command is input.

5.2.4.1 Acceleration Start

Acceleration start is a general acceleration method. If there are no extra settings applied, the motor will accelerate directly to the target frequency when an operation command is input

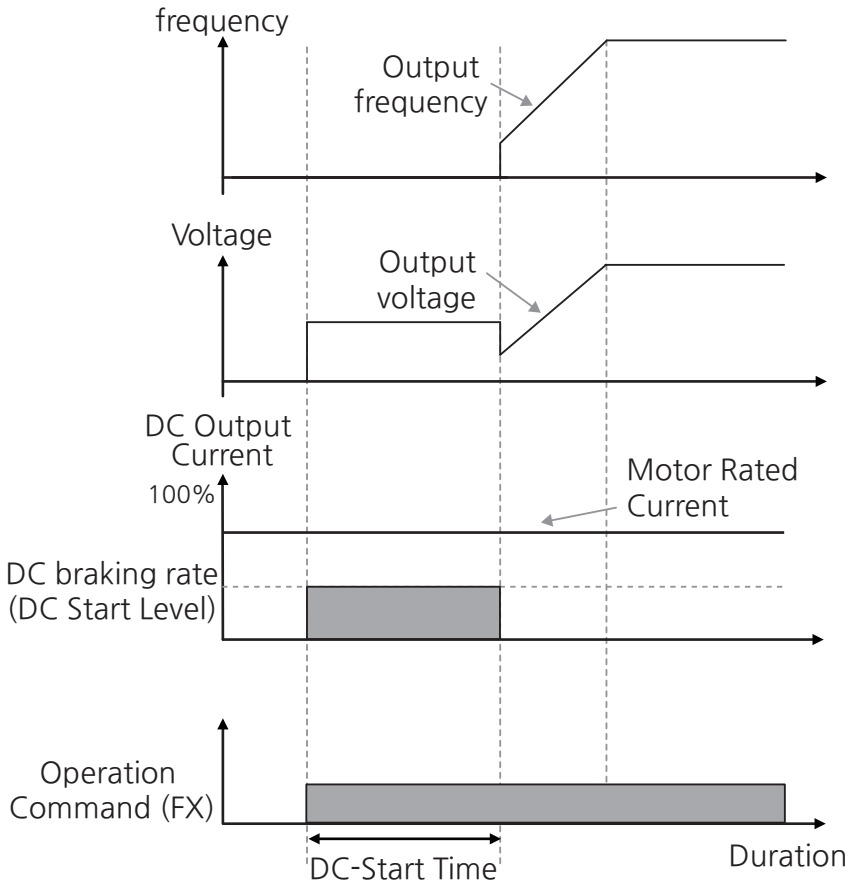
Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
BAS	01	Start Mode	0	Acceleration	-	0	-

5.2.4.2 Start after DC Braking

This start mode supplies DC voltage for a set amount of time to the motor before acceleration. If the motor continues to rotate due to its inertia load before the inverter supplies voltage, DC braking will stop the motor for acceleration.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
BAS	01	Start Mode	1	DC Start	-	0	-
	03	DC-Start Time	1.00		0.01 ~60.00	1.00	sec
	04	DC Start Level [11]	50		1~200	50	%

[11] The percentage to the peak of rated current of the motor
e.g.) where the setting value is 60% and rated current of the motor is 30 Arms, DC output is $30 \times \sqrt{2} \times 0.6 = 25.45$ A.



[Image 13. An Example of Starting after DC braking]

⚠ Caution

The amount of DC braking required is based on the rated current of the motor. However, if the amount of DC braking is larger than the rated current of the inverter, it is restricted to that value. A large amount of DC braking or long braking time may overheat or damage the motor or cause an overload trip for the inverter. **Reduce the amount or time of DC braking in such cases**.

5.2.4.3 Speed search operation

This function restores operation command values (target frequency) without any trips, such as overvoltage or overcurrent, when operating the inverter with operation commands while the motor is free-running [12]. Refer to **7.13 Speed Search Operation** for details.

[12] You may not be able to tell if it is free-running or stopping.

5.2.5 Stop Settings

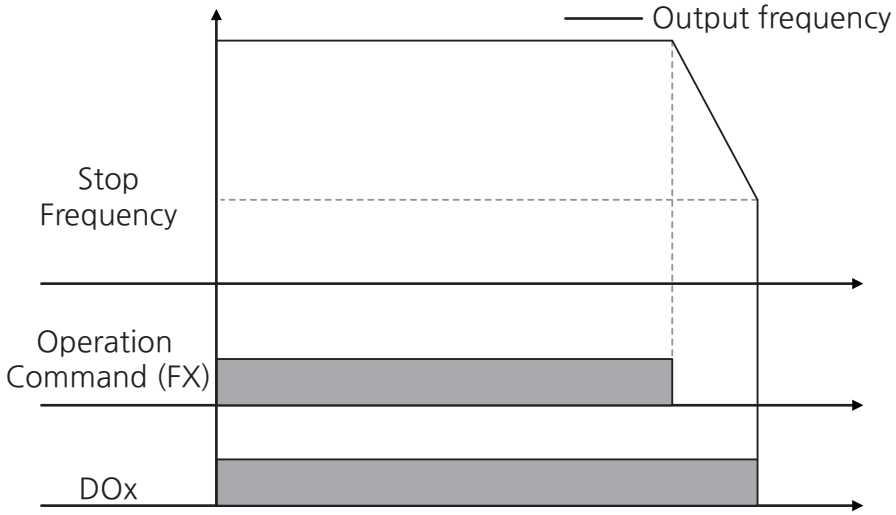
Select how to stop the motor when a stop command is input to the inverter during operation.

5.2.5.1 Deceleration Stop

It is a general way to stop a motor in which it is decelerated down to MOT1, MOT2-17 (Stop Frequency) before stopping.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
BAS	02	Stop Mode	0	Deceleration	-	0	-
MOT1, MOT2	17	Stop Frequency	0.00		0.00~ 10.00	0.00	Hz
	18	Stop Speed	0		0~300	24, 14, 0	rpm
OUT	50,52,54	DO1~DO3 Define	14	Run	-	14	

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.



[Image 14. An Example of Deceleration Stop]

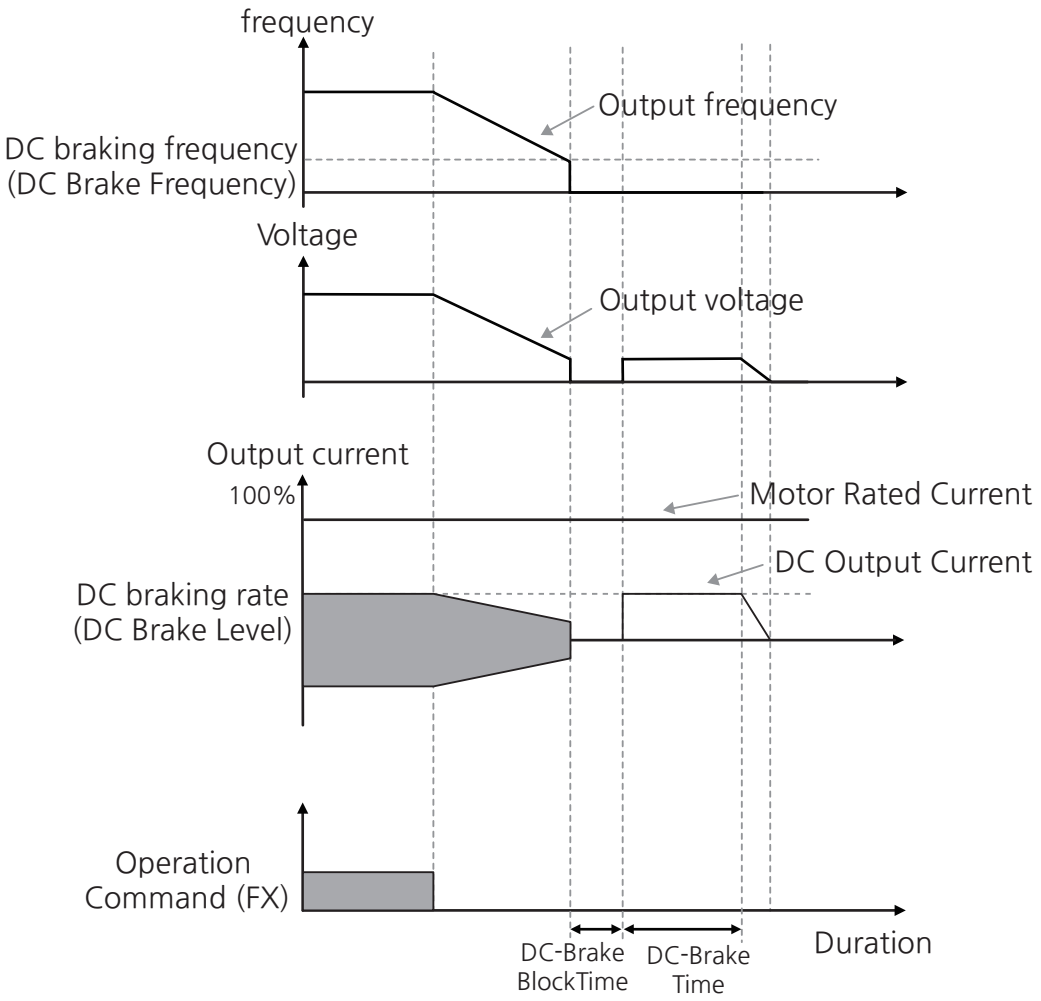
5.2.5.2 Stop after DC Braking

When the operating frequency reaches the set value (DC braking frequency) during deceleration, the inverter stops the motor by supplying DC power. With a stop command input, the inverter begins decelerating the motor. When the frequency reaches the DC braking frequency (BAS-08 DC Brake Frequency), the inverter supplies DC voltage to the motor and stops it by DC braking.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
BAS	02	Stop Mode	1	DC Brake	-	0	-
	05	DC Brake BlockTime	0.10		0.00~60.00	0.10	sec
	06	DC Brake Time	1.00		0.01~60.00	1.00	sec
	07	DC Brake Level	50		1~200	50	%
	08	DC Brake Frequency	5.00		0.00~60.00	5.00	Hz

DC Braking After Stop Setting Details

Code and Functions	Description
BAS-05 DC Brake BlockTime	Sets the time to block the inverter output before DC braking.
BAS-06 DC Brake Time	Sets the time for DC voltage supply to the motor.
BAS-07 DC Brake Level	Adjusts the amount of DC braking. The setting value is a percentage(%) to the peak of rated current of the motor based on the rated current of the motor. **e.g.)** where the setting value is 60% and rated current of the motor is 30 Arms, DC output is $30\times\sqrt{2}\times0.6=25.45$ A.
BAS-08 DC Brake Frequency	Set the frequency to start DC braking. When the frequency is reached after the inverter starts to decelerate, DC braking starts. If the dwell frequency is set lower than the DC braking frequency, dwell operation will not work and DC braking will start instead.



[Image 15. An Example of Stopping after DC braking]

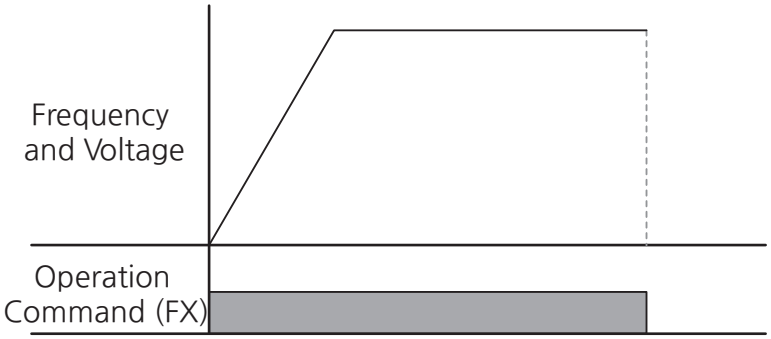
ⓘ Caution

- The amount of DC braking required is based on the rated current of the motor. However, if the amount of DC braking is bigger than the rated current of the inverter, it is restricted to that value. A large amount of DC braking or long braking time may overheat or damage the motor or cause an overload trip for the inverter. **Reduce the amount or time of DC braking in such cases.**
- If the inertia of the load is great, or if DC braking frequency (BAS-08 DC Brake Frequency) is set too high, a fault trip may occur due to an overcurrent when the inverter supplies DC voltage to the motor. Increase time of output interruption before braking in such cases.

5.2.5.3 Free Run Stop

When the Operation command is off, the inverter output turns off, and the load stops due to residual inertia.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
BAS	02	Stop mode	2	CoastStop (FreeRun)	-	0	-



[Image 16. An Example of Free Run Stop]

Caution

Note that when there is high inertia on the motor load and the motor is operating at high speed, the load's inertia may cause the motor to continue rotating if the inverter output is blocked.

Note

Turning off operation commands during S/W overcurrent suppression, stall prevention, kinetic energy buffering operation, or regeneration avoidance will stop the motor by free run regardless of setting values for the stop.

5.2.5.4 Power Braking

When the inverter's DC voltage rises above a specified level due to the regenerative energy of the motor, a control will be made to either adjust the deceleration gradient level or re-accelerate the motor in order to reduce the regenerative energy. Power braking can be used when short deceleration times are needed without brake resistors, or when optimum deceleration is needed without causing an over voltage fault trip.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
BAS	02	Stop mode	4	Power Braking	-	0	-
	11	PwrBrk BandWidth	100		0~500	100	%
	12	PwrBrk FluxBrkGain	100		0~200	100	%

Power Braking–Setting Details

Code and Functions	Description
BAS-11 PwrBrk BandWidth	Sets bandwidth for the power braking controller. The bigger the inertia, the lower the value should be set in order to prevent trips.
BAS-12 PwrBrk FluxBrkGain	Sets the size of applied voltage for power braking. The bigger the value, the bigger the supplied voltage is, stopping the motor quickly, but it may overheat or damage the motor.

⚠ Caution

- Do not use power braking for loads with frequent decelerations. It may overheat or damage the motor.
- Note that if deceleration time is too short or inertia of the load is too great, an overvoltage fault trip may occur.
- Note that if a free run stop is used, the actual deceleration time can be longer than the pre-set deceleration time.

5.3 Acc/Dec Settings

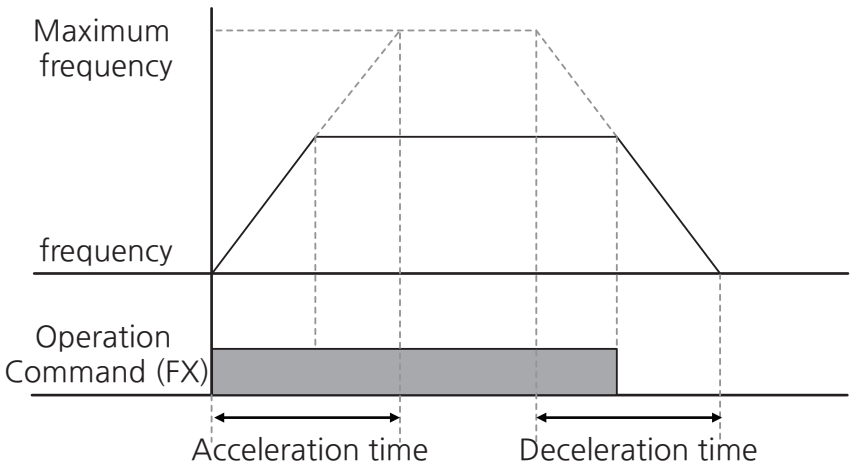
5.3.1 Acc/Dec Time Settings

5.3.1.1 Acc/Dec Time Setting Based on the Maximum Frequency

Set acceleration and deceleration time with the same gradient based on the maximum frequency regardless of the operating frequency. Select 0 (Max Frequency) in the acceleration or deceleration reference frequency code, BAS-76 (Ramp Time Mode), in basic functional group (BAS) to set acceleration and deceleration times based on the maximum frequency.

Acceleration time set in no.5 of the drive group (DRV) refers to the time required for the inverter to reach the maximum frequency from 0 Hz. Likewise, deceleration time set in no.6 refers to the time required for deceleration stop to reach 0 Hz from the maximum frequency.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	05	Acc Time	20.00		0.00~ 6000.00	20.00	sec
	06	Dec Time	30.00		0.00~ 6000.00	30.00	sec
	20	Max Frequency	60.00		40.00~ 400.00	60.00	Hz
BAS	76	Ramp Time Mode	0	Max Frequency	-	0	-



[Image 17. Frequency Change Based on Acc/Dec Time Settings (Based on the Maximum Frequency)]

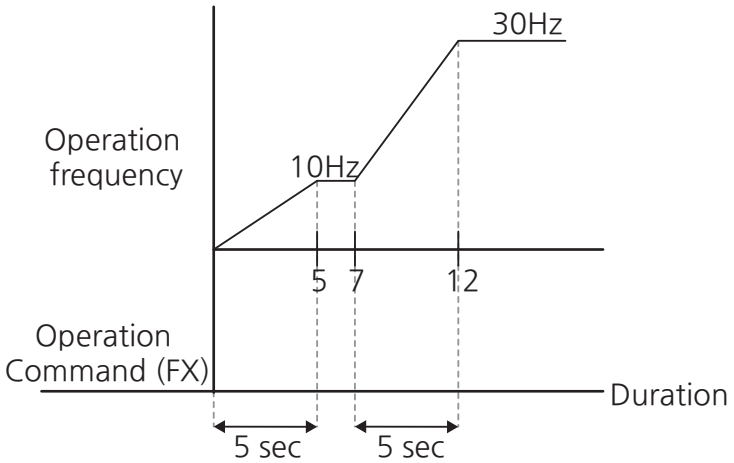
5.3.1.2 Acc/Dec Time Setting Based on the Operating Frequency

Set acceleration and deceleration times for a motor based on time needed to reach the target frequency of the next step from the current frequency operating at a fixed speed. Select 1 (Delta Frequency) in the acceleration or deceleration reference frequency code, BAS-76 (Ramp Time Mode), to set acceleration and deceleration times based on operating frequency.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	05	Acc Time	20.00		0.00~ 6000.00	20.00	sec
	06	Dec Time	30.00		0.00~ 6000.00	30.00	sec
BAS	76	Ramp Time Mode	1	Delta Frequency	-	0	-
	77	Pattern UpdateBand	0.3		0.0~1.0	0.3	Hz

Acc/Dec Times Based on the Operating Frequency-Setting Details

If acceleration time is set to 5 seconds and step-operated in 10 Hz and 30 Hz at a stop, the acceleration time is as follows:



[Image 18. Frequency Change Based on Acc/Dec Time Settings (Based on the Operating Frequency)]

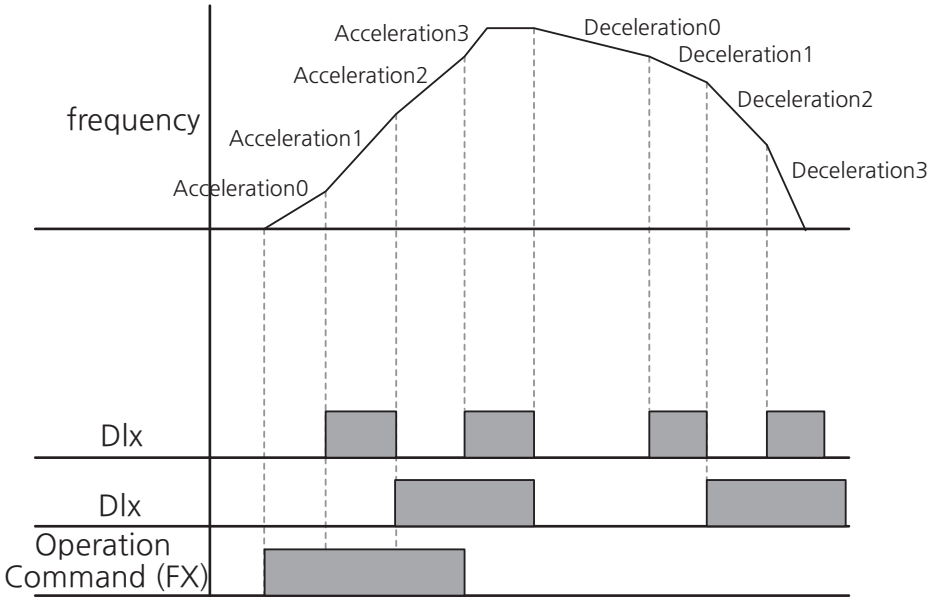
If a command frequency is an analog source with subtle changes every time, acceleration and deceleration may fail. Adjust BAS-77 (Pattern UpdateBand) values in such cases for acceleration and deceleration.

5.3.1.3 Multi-stage Acc/Dec Time Setting with Multifunction Terminals

You can set a switch frequency for acceleration and deceleration times to change the acceleration and deceleration gradients without configuring multifunction terminals.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	05	Acc Time	20.00		0.00~6000.00	20.00	sec
	06	Dec Time	30.00		0.00~6000.00	30.00	sec
BAS	78	Acc Time-1	20.00		0.00~6000.00	20.00	sec
	79	Dec Time-1	20.00		0.00~6000.00	20.00	sec
	80	Acc Time-2	30.00		0.00~6000.00	30.00	sec
	81	Dec Time-2	30.00		0.00~6000.00	30.00	sec
	82	Acc Time-3	40.00		0.00~6000.00	40.00	sec
	83	Dec Time-3	40.00		0.00~6000.00	40.00	sec
	84	Acc Time-4	50.00		0.00~6000.00	50.00	sec
	85	Dec Time-4	50.00		0.00~6000.00	50.00	sec
	86	Acc Time-5	60.00		0.00~6000.00	60.00	sec
	87	Dec Time-5	60.00		0.00~6000.00	60.00	sec
	88	Acc Time-6	70.00		0.00~6000.00	70.00	sec
	89	Dec Time-6	70.00		0.00~6000.00	70.00	sec
	90	Acc Time-7	80.00		0.00~6000.00	80.00	sec
	91	Dec Time-7	80.00		0.00~6000.00	80.00	sec
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	14	XCEL-L	-	1, 2, 4, 5, 10, 11, 12, 9	
			15	XCEL-M			
			16	XCEL-H			
	20	Step DI Check Time	1		1~60000	1	msec

All changes to the terminal block shall be completed within the Step DI Check Time if two or more multi-stage acceleration and deceleration terminals are used.



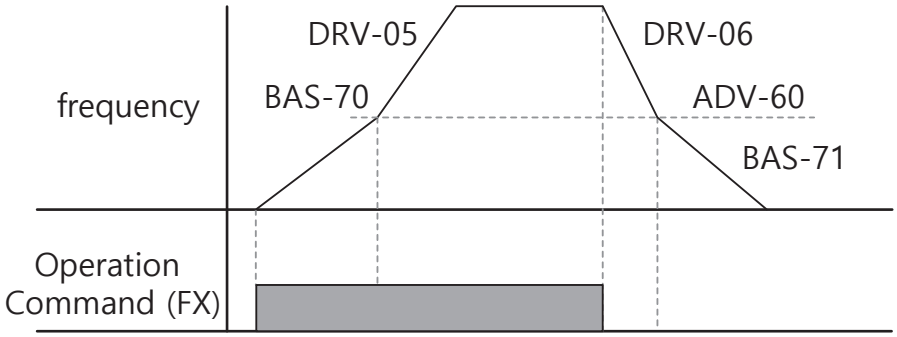
[Image 19. Frequency Change Based on Multi-Stage Acc/Dec Time Settings]

5.3.1.4 Setting Acc/Dec Time Switch Frequency

You can set a switch frequency for acceleration and deceleration times to change the acceleration and deceleration gradients without configuring multifunction terminals.

Group	Code	LCD Display	Set value	Setting Range	Initial Value	Unit
DRV	05	Acc Time	20.00	0.00~6000.00	20.00	sec
	06	Dec Time	30.00	0.00~6000.00	30.00	sec
ADV	55	Acc Change Freq	00.00	0.00~60.00	0.00	Hz
	56	Acc Change Speed	0	0~1800	0	rpm
	57	Acc Change AccTime	20.00	0.00~6000.00	20.00	sec
	58	Dec Change Freq	0.00	0.00~60.00	0.00	Hz
	59	Dec Change Speed	0	0~1800	0	rpm
	60	Dec Change DecTime	20.00	0.00~6000.00	20.00	sec

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.



[Image 20. Frequency Change Based on Acc/Dec Time Switch Frequency Settings]

5.3.2 Functions on Acc/Dec

5.3.2.1 Setting Acc/Dec S-Curve Patterns

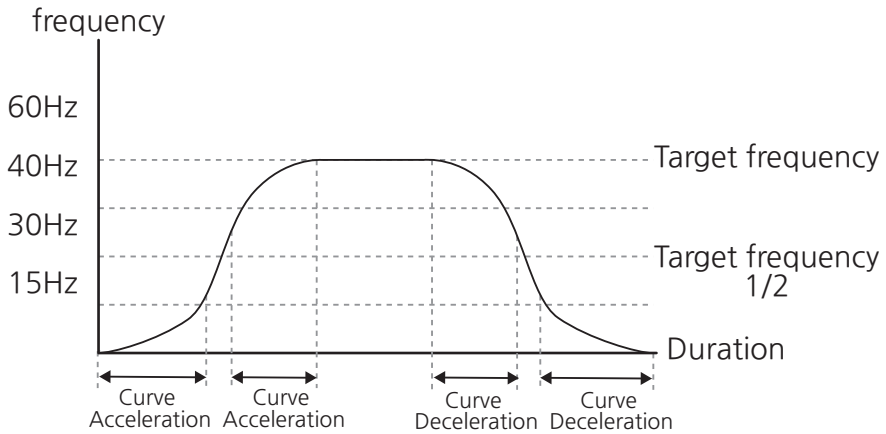
Acceleration and deceleration gradient patterns can be configured for softer acceleration and deceleration. Linear pattern features a linear increase or decrease to the output frequency at a fixed rate. An S-curve pattern, on the other hand, is used for smoother and more gradual increase or decrease such as lifting loads or elevator doors. The S-curve ratio can be adjusted in 66-71 codes of the basic functional group (BAS).

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
BAS	66	Acc Pattern	1	S-curve	-	0	-
	67	Acc S-Curve Start	40		1~100	40	%
	68	Acc S-Curve End	40		1~100	40	%
	69	Dec Pattern	1	S-curve	-	0	-
	70	Dec S-Curve Start	40		1~100	40	%
	71	Dec S-Curve End	40		1~100	40	%
	76	Ramp Time Mode	0	Max Frequency	0~1	0	-
			1	Delta Frequency			
	77	Pattern UpdateBand	0.3		0.0~1.0	0.3	Hz

Acc/Dec Pattern-Setting Details

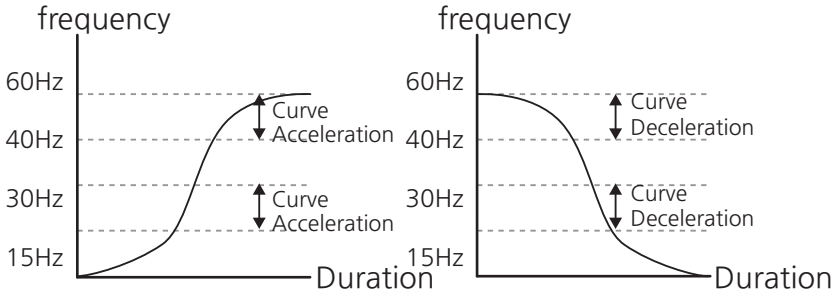
Code and Functions	Description
BAS-67 Acc S-Curve Start	Sets the curve ratio (gradient) when starting acceleration if acceleration and deceleration pattern is set as an S-Curve. Gradient level is the ratio which gradient acceleration takes up in the section under 1/2 frequency based on the 1/2 frequency of target frequency. If the target frequency and maximum frequency are set at 60 Hz and Acc S-Curve Start is set to 50%, curved acceleration is conducted in between 0-15 Hz whereas linear acceleration is conducted in between 15-30 Hz when the S-curve accelerates up to 30 Hz.
BAS-68 Acc S-Curve End	Set the gradient level for when the operation frequency reaches the target frequency. The curve ratio is the ratio that the curve acceleration takes place within the section above the 1/2 frequency, based on the 1/2 frequency of the frequency reference. If the setting is identical to the example of BAS-67, linear acceleration is conducted in between 30-45 Hz, whereas curved acceleration is conducted before it is operated at a fixed speed in between 45-60 Hz.
BAS-70 Dec S-Curve Start, BAS-71 Dec S-Curve End	Sets the rate of S-curve deceleration. The setup method is the same as the ratio during acceleration.
BAS-77 Pattern UpdateBand	Acceleration and deceleration patterns are updated again if the command frequency changes bigger than this value.

Acc/dec pattern settings



[Image 21. Frequency Change Based on Acc/Dec Pattern Settings]

S-Curve



[Image 22. Frequency Change When Acc/Dec Pattern Is Set as an S-Curve]

Note

The Calculation of the Actual Acc/Dec Times for S-Curve Application

- Actual acceleration time = user-configured acceleration time + user-configured acceleration time x starting gradient level/2 + user-configured acceleration time x ending gradient level/2.
- Actual deceleration time = user-configured deceleration time + user-configured deceleration time x starting gradient level/2 + user-configured deceleration time x ending gradient level/2.

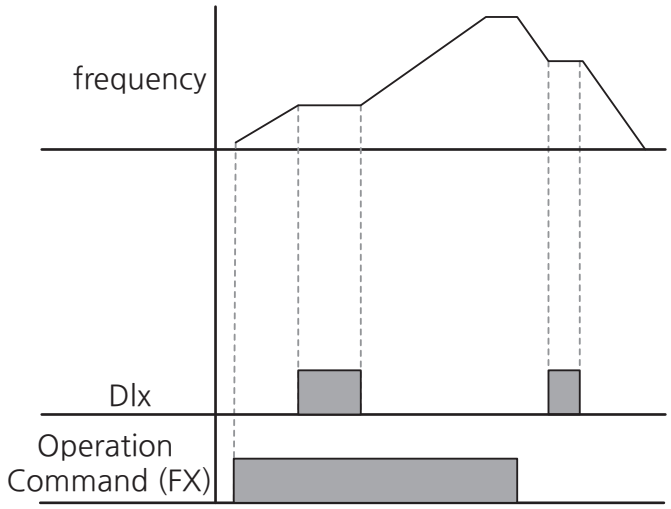
ⓘ Caution

Note that actual acceleration and deceleration times become greater than user-defined acceleration and deceleration times when an S-curve is selected for their patterns.

5.3.2.2 Acc/Dec Stop Command Settings

Multifunction input terminals can be configured to stop acceleration or deceleration and operate the inverter at a fixed speed.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DIN	01 ,03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	17	XCEL Stop	-	1, 2, 4, 5, 10, 11, 12, 9	-



[Image 23. Frequency Change Based on Acc/Dec Stop Command Settings]

6 Using the Advanced Functions of the Motor

6.1 Induction Motor V/F Control

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

V/F Control Common Parameters

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	05	Control Mode	0	V/F	0~5	0	-
	15	Start Frequency	0.50		0.00~10.00	0.50	Hz
	16	Start Speed	15		0~300	15	rpm
	23	Base Frequency	60.00		5.00~590.00	60.00	Hz

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

V/F Operation-Setting Details

Code and Functions	Description
MOT1, MOT2-15 Start Frequency	Sets the start frequency. A start frequency is a frequency at which the inverter starts voltage output. Set the target frequency higher than the start frequency to start operation.
MOT1, MOT2-16 Start Speed	Sets the start speed. The start speed is speed at which the inverter starts voltage output.
MOT1, MOT2-23 Base Frequency	Sets a base frequency. A base frequency is the inverter's output frequency when running at its rated voltage. Refer to the motor's rating plate to set this parameter value.

6.1.1 Linear V/F pattern operation

A linear V/F pattern configures the inverter to increase or decrease the output voltage at a fixed rate for different operation frequencies based on V/F characteristics. It is used for loads that require constant torque regardless of the frequency.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
VF1, VF2	01	V/F Pattern	0	Linear	0~3	0	-

Linear V/F Pattern Setting Details

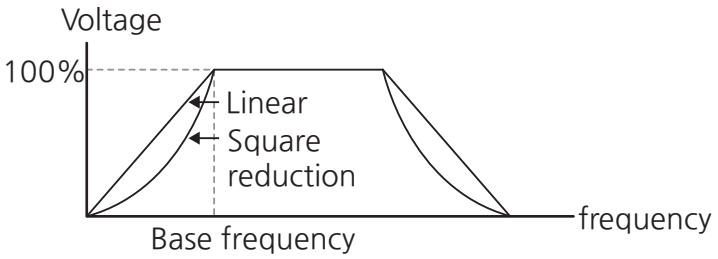
Code and Functions	Description
VF1, VF2-01 VF Pattern	It is a basic pattern that applies voltage proportionate to the operating frequency of the motor. You can secure the starting torque with a torque boost if the starting torque is not big enough.

6.1.2 Square Reduction V/F Pattern Operation

It is an operation pattern that is ideal for loads whose starting characteristics is square reduction, such as fans and pumps.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
VF1, VF2	01	V/F Pattern	1	Square	0~3	0	-
			3	Square 2			

Square Reduction V/F pattern Operation - Setting Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>VF1, VF2-1 V/F Pattern</td><td>Select 1 (Square) or 3 (Square 2) according to the load’s starting characteristics.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>1</td><td>Square</td><td>The inverter produces output voltage proportional to 1.5 square of the operation frequency.</td></tr>
<tr><td>3</td><td>Square 2</td><td>The inverter produces output voltage proportional to 2 square of the operation frequency. This setup is ideal for variable torque loads, such as fans or pumps.</td></tr>
</table>


[Image 1. Comparison of V/F pattern operations]</td></tr>
</table>

6.1.3 User V/F Pattern Operation

The inverter allows users to configure to suit the V/F pattern and load characteristics of special motors.

Group	Code	LCD Display	Set value	Setting Range	Initial Value	Unit
VF1, VF2	01	V/F Pattern	2 User V/F	-	0	-
	02	User Frequency-1	15.00	0.00~ User Frequency-2	15.00	Hz
	03	User Speed-1	450	0~User Speed-2	450	rpm
	04	User Voltage-1	25	0~100	25	%
	05	User Frequency-2	30.00	User Frequency-1~ User Frequency-3	30.00	Hz
	06	User Speed-2	900	User Speed-1~User Speed-3	900	rpm
	07	User Voltage-2	50	0~100	50	%
	08	User Frequency-3	45.00	User Frequency-2~ User Frequency-4	45.00	Hz
	09	User Speed-3	1350	User Speed-2~User Speed-4	1350	rpm
	10	User Voltage-3	75	0~100	75	%
	11	User Frequency-4	60.00	User Frequency-3~ Max Frequency [1]	60.00	Hz
	12	User Speed-4	1800	User Speed-3~ Maximum Speed [2]	1800	rpm
	13	User Voltage-4	100	0~100	100	%

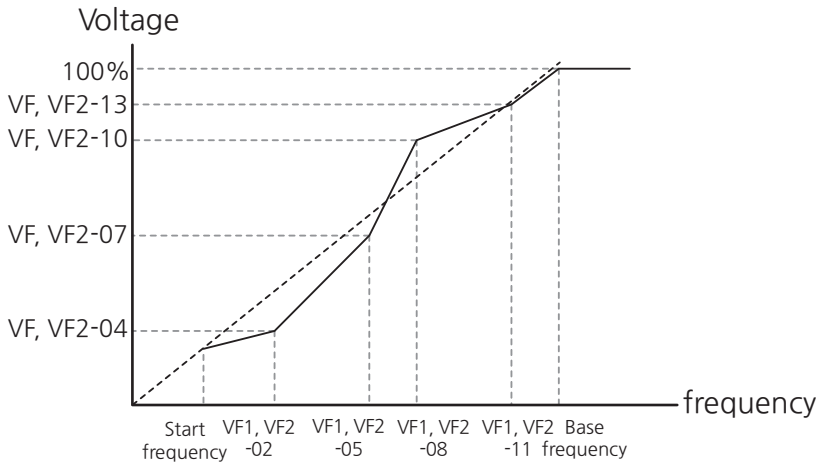
* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

1 DRV-20(Max Frequency)
2 DRV-21(Maximum Speed)

User V/F pattern Setting Details

Code and Functions	Description
VF1, VF2-02, 05, 08, 11 User Frequency-x (Frequency-x: Frequency-1~Frequency-4)	Sets user frequencies (VF1, VF2-02, 05, 08, and 11) by selecting arbitrary frequencies in between the start frequency and maximum frequency.
VF1, VF2-03, 06, 09, 12 User Speed-x (Speed-x: Speed-1~Speed-4)	Sets user speed (VF1, VF2-03, 06, 09, and 12) by selecting arbitrary speed in between the start speed and maximum speed.
VF1, VF2-04, 07, 10, 13	Sets corresponding voltages for user frequencies (VF1, VF2-02, 05, 08, and 11) or user speed (VF1, VF2-03, 06, 09, and 12) in user voltages (VF1, VF2-04, 07, 10, and 13), respectively.

100% output voltage in the following image is based on the setting values of MOT1 and MOT2-27 (rated voltage). However, when MOT1 and MOT2-27 (rated voltage) are set as 0, it is based on the input voltage (DRV-30 Ref AC Input Volt).



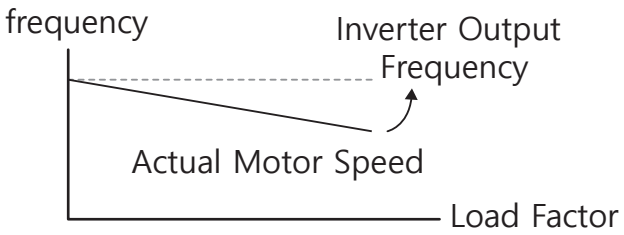
[Image 2. Frequency Change Based on User V/F Pattern Operation Settings]

ⓘ Caution

- When a normal induction motor is in use, care must be taken not to configure the output pattern away from a linear V/F pattern. Non-linear V/F patterns may cause insufficient motor torque or motor overheating due to over-excitation.
- User V/F pattern does not work when VF1 and VF2-31 (Torque Boost Mode) are set as manual torque boost and auto torque boost.

6.1.4 Slip Compensation Operation

The operational characteristics of the induction motor make the difference between the output frequency of the inverter and the actual rotational frequency of the motor. The difference of the frequencies is called the slip frequency, whose size changes as per the load. You can maintain the rotational frequency of the motor by compensating the speed deviation with this feature.



[Image 3. Slip Compensation Operation]

6.1.4.1 Basic Slip Compensation

It simply compensates for the slip with information on the rating plate of the motor.

Refer to **3.1 Setting Up Motor Rating Plate Information** before use.

Basic Slip Compensation Operation Settings

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	04	Motor Type	0	Induction Motor	-	0	-
	05	Control Mode	1	Slip Comp.	-	0	-
VF1, VF2	21	Slip Comp Mode	0	Basic Comp.	0~1	0	-

6.1.4.2 Advanced Slip Compensation

You can calculate the slip with motor parameters and compensate for it more accurately than basic slip compensation.

Refer to **3.1 Setting Up Motor Rating Plate Information** and check before use and refer to **3.4 Auto Tuning** for tuning.

Slip Compensation Operation Settings

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	04	Motor Type	0	Induction Motor	-	0	-
	05	Control Mode	1	Slip Comp.	-	1	-
VF1, VF2	21	Slip Comp Mode	1	Advanced Comp.	0~1	0	-
	22	SlipGain Mot-Low	100		0~300	100	%
	23	SlipGain Mot-High	100		0~300	100	%
	24	SlipGain Gen-Low	100		0~300	100	%
	25	SlipGain Gen-High	100		0~300	100	%
	26	SlipComp LPF Gain	300		1~10000	300	msec
	27	SlipGain SwOv Freq	9.00		0.00~ 20.00	9.00	Hz
	28	SlipGain SwOv Spd	270		0~600	270	rpm

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Slip Compensation Operation Setting Details

Code and Functions	Description
VF1, VF2-22 SlipGain Mot-Low, VF1, VF2-23 SlipGain Mot-High, VF1, VF2-24 SlipGain Gen-Low, VF1, VF2-25 SlipGain Gen-High	Sets gains for calculated slip compensation frequency. VF1, VF2-22 and VF1, VF2-23 set low speed and high speed gains for a reverse load. VF1, VF2-24 and VF1, VF2-25 set low speed and high speed gains for a regenerative load. Adjust gains according to load/speed as slip frequency calculated by the amount of manual or auto torque boost (select how to boost torque in VF1, VF2-31 Torque Boost Mode) may change.
VF1, VF2-26 SlipComp LPF Gain	Sets time constant for low-pass filter of calculated slip compensation frequency. Refer to AIN-04, 19, 34 (AI1-3 LPF Gain) in **8.2.4 Filter**.
VF1, VF2-27 SlipGain SwOv Freq	Sets frequency where slip compensation gains for low speed and high speed are switched based on setting values for reverse and regenerative operations.

6.2 Vector Control for Induction Motors

It controls torque instantaneously for precise location/speed or torque control and rapid acceleration and deceleration. It demonstrates a great torque at a low current compared to V/F control.

Vector Control Settings

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	04	Motor Type	0	Induction Motor	-	0	-
	05	Control Mode	4	Vector	-	0	
	08	Torque Control En	0	No	0~1	0	-
	51	ACR Bandwidth	100		50~400	100	%
	54	ASR Adjust Gain	4		1~10	4	-
VEC1, VEC2	14	Pre-Excite Time	Dependent on motor		0.00~ 60.00	Dependent on motor	sec
	15	FluxCtrl Bandwidth	100		50~400	100	%
	16	Flux Forcing	150.0		100.0~ 200.0	150.0	%
	18	FluxWeak Ctrl Mode	2	Adjust by Volt	0~2	2	-
	19	FW Volt Ref Ratio	95.0		85.0~ 100.0	95.0	%
	20	FW Control Gain	100		10~1000	100	%

Control Gain Setting Details

Code and Functions	Description
MOT1, MOT2-08 Torque Control En	Sets the use of torque control mode.
MOT1, MOT2-51 ACR Bandwidth	Sets the bandwidth of an auto current regulator. The bandwidth is set in percentage (%), and the default, 100%, is calculated automatically. The auto current regulator is used for DC output, vector control, auto tuning, etc.
MOT1, MOT2-54 ASR Adjust Gain	Sets speed control gains. Overshoot decreases as the value increases, but noise may occur at high speeds, so use an appropriate value. It is not used for torque control mode.
VEC1, VEC2-14 Pre-Excite Time	Sets a pre-excitation time. Pre-excitation is used to start the operation after performing excitation up to the motor's rated flux. The induction motor requires exciting current to generate a rotating field. The time needed to create a field should be secured before operation as the field is created slowly compared to the current increase. Set the VEC1 and VEC2 values big to reduce the required time. It is not used when a synchronous motor is selected.
VEC1, VEC2-15 FluxCtrl Bandwidth	Sets the bandwidth for a flux controller. The bandwidth is set in percentage (%), and the default, 100%, is calculated automatically.
VEC1, VEC2-16 Flux Forcing	Sets the upper limit of flux current during flux control. It is used for vector control of the induction motor and is set as percentage (%) of No Load Current. You can reduce the initial excitation time by increasing the value, but it may cause current pulsation.
VEC1, VEC2-18 - FluxWeak Ctrl Mode	Provides field weakening operation methods.
VEC1, VEC2-19 FW Volt Ref Ratio	Sets the voltage for a field weakening operation.
VEC1, VEC2-20 FW Control Gain	Sets the gain for a field weakening controller.

Caution

- Controller gains can be adjusted according to load characteristics. However, use with caution because conditions, such as motor overheating or unstable system may occur depending on the controller gain settings.
- For high-performance operation, the parameters of the motor connected to the inverter output must be measured. Use auto tuning (BAS-20 Auto Tuning) to measure the parameters before you run sensorless vector operation. To run high-performance sensorless vector control, the inverter and the motor must have the same capacity. If the motor capacity is smaller than the inverter capacity by more than two levels, control may be inaccurate. In that case, change the control mode to V/F control. In addition, when operating with sensorless vector control, do not connect multiple motors to the inverter output for operation.

6.2.1 Sensorless Vector Control for Induction Motors

Sensorless vector control is an operation to carry out vector control without using location/speed sensors but with an estimation of the motor rotational speed calculated by the inverter.

Setting Sensorless Vector Control

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	4	Motor Type	0	Induction Motor	0~1	0	-
	5	Control Mode	3	Sensorless	-	0	-
VEC1, VEC2	37	IMSL SpdCompNoLoad	100		95~110	100	%
	38	IMSL Torque Comp	100		10~500	100	%
	39	IMSL Speed Comp	100		10~500	100	%
	40	IMSL LSpd Trq Comp	100		10~500	105	%

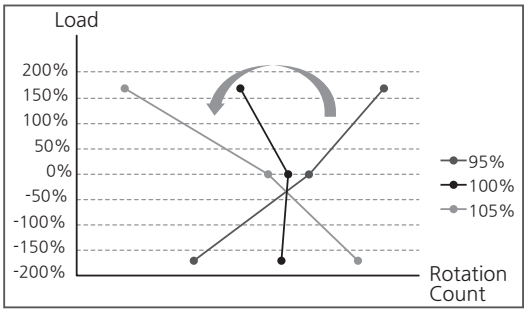
Sensorless Vector Control Operation-Setting Details

Code and Functions	Description
VEC1, VEC2-37 IMSL SpdCompNoLoad	Adjust the speed with these parameters if the estimated and actual speeds are different at no load.
VEC1, VEC2-38 IMSL Torque Comp	Adjust the torque with these parameters if the estimated and actual torque are different.
VEC1, VEC2-39 IMSL Speed Comp	Adjust the speed with these parameters if the estimated and actual speeds are different.
VEC1, VEC2-40 IMSL LSpd Trq Comp	Adjust with these parameters if it does not start at a low speed (lower than 5% of the rated speed).

6.2.1.1 Sensorless Vector Control Operation Guide for Induction Motors

Table 1. Sensorless Vector Control Operation Guide for Induction Motors

Problem	Relevant function code	Troubleshooting
If the number of motor rotations drops due to lack of torque	VEC1, VEC2-38 IMSL Torque Comp	If the rotational frequency drops extremely, causing its error rate to drop to more than 2% of the rated speed, increase the value in 10% increments.
If there is current hunting when the load is larged at around the rated speed	VEC1, VEC2-38 IMSL Torque Comp	Tune to reduce values.

Problem	Relevant function code	Troubleshooting
If the error rate of the rotational frequency is more than 1% of the rated speed when there is enough torque	VEC1, VEC2-39 IMSL Speed Comp	Change the value in 5% increments. It tilts counterclockwise as the value increases. Refer to the following for load-rotational frequency curve according to the values:  **[Image 4. Rotational Frequency as per Load]**
If there is not enough torque due to a load increase at a low speed (less than 5% of the rated speed)	VEC1, VEC2-40 IMSL LSpd Trq Comp	If there is not enough torque at a low speed, increase the value in 5% increments.
If it rotates in the reverse direction due to a load increase at a low speed (less than 5% of the rated speed)	VEC1, VEC2-40 IMSL LSpd Trq Comp	If it rotates in reverse direction due to a load increase at a low speed, decrease the value by 5% at a time.
If there is not enough torque at a low speed (less than 5% of the rated speed) when the load inertia is large.	MOT1, MOT2-54 ASR Adjust Gain	High load inertia makes it difficult to control from time to time. In such cases, increase the value by 1 at a time.

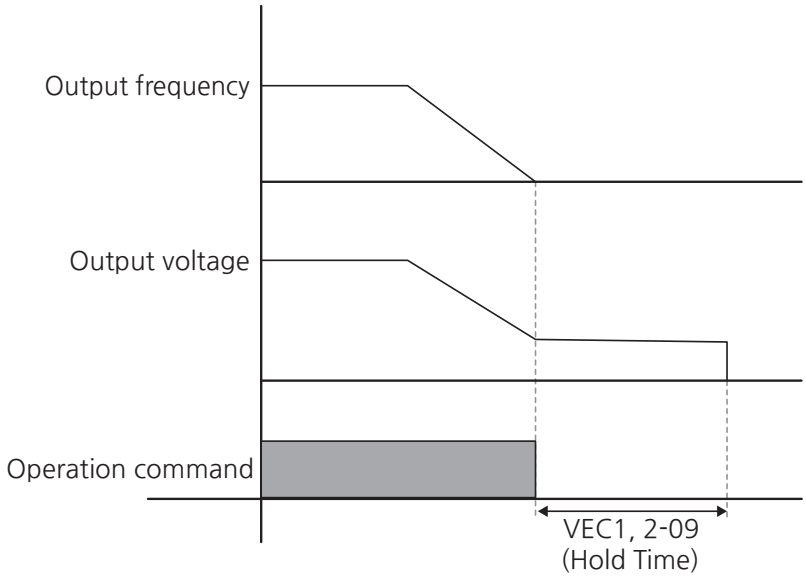
6.2.2 Vector Control for Induction Motors Using Location/ Speed Sensors

It is a method used to control the rotor by measuring the position/speed of the rotor with a position/speed sensor. Check the connection of the encoder (location/speed sensors) before starting an operation. Refer to **3.3 Setting the Encoder** for encoder settings.

Vector Control for Induction Motors Using Location/Speed Sensors

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	04	Motor Type	0	Induction Motor	-	0	-
	05	Control Mode	2	V/F PG	-	0	-
VEC1, VEC2	09	Hold Time	1.00		0.00~ 60.00	1.00	sec
	34	IMSD Trq Comp	100		10~500	0	%

Vector Control Operation for Induction Motors Using Location/Speed Sensors-Setting Details

Code and Functions	Description
VEC1, VEC2-9 Hold Time	When the motor is in the deceleration stop via the stop command, conduct a continuous operation for a set time before blocking the output.  **[Image 5. How does VEC1, VEC2-9 (Hold Time) work]**
VEC1, VEC2-34 IMSD Trq Comp	When the output torque of the inverter is different from the desired amount in torque mode, adjust these compensation values. Adjust these values when output current is bigger than what is required for control in speed mode as well. Excessive settings may cause a trip to the inverter. It only works for vector control that uses location and speed sensors.

6.3 Torque Control for Induction Motors

Torque control controls the motor to achieve the corresponding torque, based on preset command values. It can be used in both sensorless vector control and vector control using location/speed sensors. For vector control using location/speed sensors, check the connection of the encoder (location/speed sensors) before starting operation. For encoder-related settings, refer to **3.3 Setting the Encoder**.

6.3.1 Setting Torque Control for Induction Motors

Set the parameters as follows for torque control: Refer to **6.6.3 Speed/Torque Switch** for speed limits or speed/torque switch regarding torque control.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	04	Motor Type	0	Induction Motor	-	0	-
	05	Control Mode	4	Vector	-	0	-
	08	Torque Control En	1	Yes	-	0	-
DRV	03	Command Torque	0		-320.0~320.0	0.0	%
VEC1, VEC2	34	IMSD Trq Comp	100		10~500	100	%

Torque Control for Induction Motors-Setting Details

Code and Functions	Description
VEC1, VEC2-34 IMSD Trq Comp	When the output torque of the inverter is different from the desired amount in torque mode, adjust these compensation values. Excessive settings may cause a trip to the inverter. It only works for vector control that uses location and speed sensors.

Note

If the MOT1, MOT2-08 (Torque Control En) setting value is 1 (Yes), the default value of BAS-02 (Stop Mode) becomes 2 (Coast Stop [Free Run]).

6.3.2 Setting Torque Command Sources

Torque commands for S300 are determined by the torque command sources as follows: Torque settings are only available in torque control mode.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	12	1st Torque Ref Src	0	Keypad	0~11	0	-
			1	Analog Input 1			
			2	Analog Input 2			
			3	Analog Input 3			
			4	Pulse Input			
			5	Internal Comm.			
			6	USB Drive			
			7	Option Comm. [3]			
			8	User Sequence			
			9	X-Analog Input 1 [4]			
			10	X-Analog Input 2 [4]			
			11	X-Analog Input 3 [4]			

6.3.2.1 Setting Torque Reference in Smart Operator-Direct Input

Set torque commands in Smart Operator and press ENTER key to change torque commands. Set desired torque in DRV-03 (Command Torque) code after choosing 0 (Keypad) in DRV-12 (1st Torque Ref Src, torque command setting method) code.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	03	Command Torque	0.0		-320.0~320.0	0.0	%
	12	1st Torque Ref Src	0	Keypad	-	0	-

[3] Configurable only when equipped with communication options
[4] Configurable only when equipped with extension I/O options

6.3.2.2 Setting Torque via Terminal Analog Voltage Input (AI1-AI3)

Set torque by inputting voltage in AI1-AI3 terminals in the control terminal block.

Voltage inputs of 0-+10 V or -10-+10 V are available. SW4 must be selected as V1-V3.

Group	Code	LCD Display	Set value		Setting Range (Scope of Expression)	Initial Value	Unit
DRV	12	1st Torque Ref Src	1	Analog Input 1	1~3	0	-
			2	Analog Input 2			
			3	Analog Input 3			
	24	Torque at 100%	100.0		0.0~200.0	100.0	%
AIN	02	AI1 Value [5]	-		-10.00~10.00	-	V
			-		0.00~20.00	-	mA
	17	AI2 Value [5]	-		-10.00~10.00	-	V
			-		0.00~20.00	-	mA
	32	AI3 Value [5]	-		-10.00~10.00	-	V
			-		0.00~20.00	-	mA

Setting a Frequency Reference for 0–10 V Input

Select one among 1-3 (AI1-AI3) in DRV-12 (1st Torque Ref Src, torque setting method) code, then select 0 (Unipolar Voltage) in AI1-AI3 Type Select code from the analog terminal block input group (AIN). Use the power of the external controller or VR+ terminal (analog power terminal) of the control terminal block to input voltage in AI1-AI3 terminals as the volume resistance. Refer to **8.2 Analog Input** for details.

Setting a Frequency Reference for -10–10 V Input

Select one among 1-3 (AI1-AI3) in DRV-12 (1st Torque Ref Src, torque setting method) code, then select 1 (Bipolar Voltage) in AI1-AI3 Type Select code from the analog terminal block input group (AIN).

Use the power of the external controller or VR+ and VR- terminals (analog power terminals) of the control terminal block to input voltage in AI1-AI3 terminals as the volume resistance.

Torque direction of the motor can be changed according to the voltage signal code when input voltage in between -10-+10 V.

Refer to **8.2 Analog Input** for details.

[5] The units are changed according to AIN-01, 16, and 31 (AI1-AI3 Type Select).

Table 2. Torque Directions for Different Operation Commands and Voltage Inputs

Operation command	Input voltage	
	0~10V	-10~0V
FWD	Fwd	Rev
REV	Rev	Fwd

6.3.2.3 Setting frequency via analog current input in terminal block

You can set torque by inputting current from AI1-AI3 terminals (frequency setting (current) terminals) in the control terminal block.

Current in between 4 and 20 mA can be input. SW4 must be selected as I1-I3 current (in the direction of ON).

Inputting current of 4-20 mA in terminal block

Select one among 1-3 (AI1-AI3) in DRV-12 (1st Torque Ref Src, torque setting method) code,

then select 2 (Current) in AI1-AI3 Type Select code from the analog terminal block input group (AIN). Refer to **7.3 3-Wire Operation** for details.

6.3.2.4 Setting Torque via Pulse Input in Terminal Block

Set torque by inputting pulse frequency of 0.00-32.00 kHz in TI terminal (pulse input terminal) of the control terminal block.

Inputting Pulse of 0-32 kHz in Terminal Block

Select 4 (Pulse Input) in DRV-12 (1st Torque Ref Src, torque setting method) code. Refer to **8.4 Pulse Input** for details.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	12	1st Torque Ref Src	4	Pulse Input	-	0	-

6.3.2.5 Setting Torque with Internal Communication

Select 5 (Internal Comm.) in DRV-12 (1st Torque Ref Src), the frequency setting code for the drive group (DRV). Control the inverter via communications with upper-level controllers, such as PLCs or PCs, by using S+/S-/SG terminals (RS-485 signal input terminals) of the control terminal block. Refer to **10 Using Built-in Communication Features** for details.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DRV	12	1st Torque Ref Src	5	Internal Comm.	-	0	-

Parameters used to set torque with communications are as follows:

Communication Address	parameter	Scale	Unit	Details
0390h	Torque Ref	0.1	%	Command torque

6.4 V/F Control for Synchronous Motors

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

V/F Control Parameters

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	04	Motor Type	1	Perm Magnet Motor	1	0	-
	05	Control Mode	0	V/F	-	0	-
	23	Base Frequency	60.00		5.00~590.00	60.00	Hz
VF1, VF2	54	PM V/F HPF Gain	0.7		0.0~1.0	0.7	-
	55	PM V/F HPF Wcut	1		0~3	1	Hz
	56	PM V/F CurrLmtGain	150		0~200	150	%
	57	PM V/F DC Inj Perc	100		0~150	100	%
	58	PM V/F Idse Limit	70		0~150	70	%

V/F Operation-Setting Details

Code and Functions	Description
MOT1, MOT2-23 Base Frequency	Sets a base frequency. A base frequency is the inverter's output frequency when running at its rated voltage. Refer to the motor's rating plate to set this parameter value.
V/F1, V/F2-54 PM V/F HPF Gain	Sets the gain for the PM V/F stabilization controller. Adjust these values if the motor vibrates during operation.
V/F1, V/F2-55 PM V/F HPF Wcut	Sets cut-off frequency of high-pass filter of PM V/F stabilization controller. Adjust these values if the motor vibrates during operation.
V/F1, V/F2-56 PM V/F CurrLmtGain	Sets the maximum allowed current as % of rated current of the motor.
V/F1, V/F2-57 PM V/F DC Inj Perc	Sets the size of DC current applied to the motor before starting it as % of rated current of the motor.
V/F1, V/F2-58 PM V/F Idse Limit	Sets the maximum allowed current for D-axis as % of rated current of the motor. Reduce these values when the current is too big during a no-load operation.

6.5 Vector Control for Synchronous Motors

It controls torque for precise location/speed or torque control and rapid acceleration and deceleration. It demonstrates a large amount of torque at low current compared to V/F control.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	04	Motor Type	1	Perm Magnet Motor	-	0	-
	05	Control Mode	3	Sensorless	-	0	-
	51	ACR Bandwidth	100		50~400	100	%
	54	ASR Adjust Gain	4		1~10	4	-
	61	IPPE Enable	1	Yes	0~1	1	-
	62	IPPE Volt Ref Perc	50		10~100	50	%
	63	IPPE Curr Peak Per	120		10~150	120	%
VEC1, VEC2	61	PLL Z Gain	3		1~6000	3	-
	62	PLL F Gain	100		1~500	100	%

Synchronous Motors Vector Control Setting Details

Code and Functions	Description
MOT1, MOT2-51 ACR Bandwidth	Sets the bandwidth of an auto current regulator. The bandwidth is set in percentage (%), and the default, 100%, is calculated automatically. The auto current regulator is used for DC output, vector control, auto tuning, etc.
MOT1, MOT2-54 ASR Adjust Gain	Sets speed control gains. Use appropriate values as overshoot decreases as the values get bigger, but with possible noise in the speed. It is not used for torque control mode.
VEC1, VEC2-62 PLL F Gain	Sets the gain for flux controllers. Adjust if the motor does not start or if it vibrates.

Caution

- Controller gains can be adjusted according to load characteristics. Use with caution because conditions, such as motor overheating or unstable system may occur depending on the controller gain settings.
- For high-performance operation, the parameters of the motor connected to the inverter output must be measured. Use auto tuning (BAS-20 Auto Tuning) to measure the parameters before you run sensorless vector operation. To run high-performance sensorless vector control, the inverter and the motor must have the same capacity. If the motor capacity is smaller than the inverter capacity by more than two levels, control may be inaccurate. In that case, change the control mode to V/F control. In addition, when operating with sensorless vector control, do not connect multiple motors to the inverter output for operation.

6.5.1 Initial Angle Detection

Initial angle detection is a process of matching the location of rotor and location inside the inverter when starting the motor. For synchronous motors, the absolute position of flux from the permanent magnet, that is, the absolute position of rotor must be accurate to instantaneously and precisely control torque from the motor since rotor flux occurs from the permanent magnet attached to the rotor. As it is highly important to have the absolute position, or, location information of the initial stimulus when starting the motor, it detects initial angle before starting.

Initial Angle Detection Settings

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	61	IPPE Enable	1	Yes	-	1	-
	62	IPPE Volt Ref Perc	50		10~100	50	%
	63	IPPE Curr Peak Per	120		10~150	120	%

Initial Angle Detection-Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>MOT1, MOT2 61
IPPE Enable</td><td colspan="3">You need to figure out the initial position of the stimulus when starting the motor for vector control (including sensorless operation) over synchronous motors.
<table><tr><th colspan="2">Configuration</th><th>Functionality</th></tr><tr><td>0</td><td>No</td><td>Starts by detecting position without initial stimulus detection.</td></tr><tr><td>1</td><td>Yes</td><td>Applies pulse-type voltage according to stimulus position and detects the position of stimulus from the current that changes per location. There is a bit of noise during the initial start from voltage pulse injection.</td></tr></table></td></tr>
<tr><td>MOT1, MOT2-62
IPPE Volt Ref Perc</td><td colspan="3">Sets applied pulse voltage as a % of motor rating.</td></tr>
<tr><td>MOT1, MOT2-63
IPPE Curr Peak Per</td><td colspan="3">Sets the maximum current that flows when applying pulse voltage as a % of motor rating. Larger values improve accuracy of detection but increase noise, while smaller values reduce noise but decrease accuracy. Extreme values may cause overcurrent trips.</td></tr>
</table>

6.5.2 Sensorless Vector Control Operation Settings for Synchronous Motors

Select desired motor capacity in MOT1 and MOT2-21 (Motor Capacity), then select the following codes respectively and input rating plate information of the motor. If there is no motor capacity setting, select a higher capacity that is close to the relative motor capacity.

Code and Functions	Description
MOT1, MOT2-21 Motor Capacity	Set the capacity of the motor connected to the inverter. According to the motor capacity, the default value of the related parameter changes if the value is changed.
MOT1, MOT2-23 Base Frequency	Enter the base frequency of the motor rating plate. A base frequency is the inverter's output frequency when running at its rated voltage. Refer to the motor's rating plate to set this parameter value.

Code and Functions	Description
MOT1, MOT2-24 Rated Speed	Enter the rated speed of the motor rating plate.
MOT1, MOT2-25 Number of Poles	Enter the number of poles on the motor rating plate.
MOT1, MOT2-26 Rated Current	Enter the rated current of the motor rating plate.
MOT1, MOT2-27 Rated Voltage	Enter the rated voltage of the motor rating plate. Set the motor voltage if the input power and the motor voltage specifications differ. • The output voltage can be maintained at the set value if the set voltage is lower than the input power supply voltage above the base frequency. • A voltage smaller than the input power supply voltage is output if the set voltage is higher than the input power supply voltage above the base frequency. The output voltage size is determined by the input power voltage during V/F operation if the set voltage is set to 0 above the base frequency.

Refer to **3.4 Auto Tuning** and run auto-tune after setting motor parameters.

6.5.3 Sensorless Vector Control Operation Guide for Synchronous Motors

Table 3. Sensorless Vector Control Operation Guide for Synchronous Motors

Problem	Relevant function code	Troubleshooting
If there is not enough starting torque	VEC1, VEC2-62 PLL F Gain	Reduce values by 10% at a time.
If there is motor hunting at the start		
If there are speed fluctuations during low-speed operation		
If you hear a “thud” right after acceleration or when stopping after deceleration		
If there are fluctuations during accelerated operation		
If an operation fails with static auto-tuning parameters and a trip occurs	MOT1, MOT2-36 Stator Resistance, MOT1, MOT2-40 q-axis Inductance, MOT1, MOT2-41 d-axis Inductance, MOT1, MOT2-42 PM Rotor Flux	Improper static PM auto-tuning can cause starting failure from parameter errors, so use parameters from the rating plate of the motor for operation.
1. If starting after the current flows as much as torque limit settings or if it fails to start and inverter overload occurs when starting under overload 2. If it cannot detect motor speed properly or if the current (over 150% of rating) overflows under overload (exceeding rated load) for each area of set speed	MOT1, MOT2-40 q-axis Inductance	If the Lq parameter is no longer constant under overload and decreases due to magnetic saturation, etc., reduce the values by 5% at a time.
If there is motor hunting or an OCT trip under a low-speed (less than 10 Hz) regenerative load	MOT1, MOT2-51 ACR Bandwidth	Reduce values by 10% at a time.
If an OCT trip or hunting occurs during high-speed operation		

Problem	Relevant function code	Troubleshooting
If speed severely hunts and rated current flows during no-load operation	MOT1, MOT2-54 ASR Adjust Gain	Reduce values by 1 at a time.
If OCT trip occurs after applying and releasing rapid low-speed regenerative load (more than 100%)		
If OVT occurs due to rapid acceleration/deceleration at medium-speed (more than 30 Hz) or drastic load changes		
If speed fluctuates during high-speed, overload, or normal operation		
If OCT trip occurs after applying and releasing rapid low-speed regenerative load (more than 100%)		
If it fails to start due to large load inertia		Increase values by 1 at a time.
If there is a trip when starting or accelerating during free-run at over constant speed	BAS-01 Start Mode	For PM motor control, it starts after initial angle detection while stopping. Set the value as 2 (Speed Search) if you want to accelerate during a free-run.

6.5.4 Vector Control for Synchronous Motors Using Location/Speed Sensors

It is a method used to control the rotor by measuring the position/speed of the rotor with a position/speed sensor. Check the connection of the encoder (location/speed sensors) before starting an operation. Refer to **3.3 Setting the Encoder** for encoder settings.

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	04	Motor Type	1	Perm Magnet Motor	-	0	-
	05	Control Mode	4	Vector	-	0	-

6.6 Common Functions of Vector Control

6.6.1 Torque Limits in Speed Control

Speed control mode limits torque output. You can set both reverse and regenerative torque limits for forward and reverse operations.

Torque Limit Settings

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
BAS	16	Torque Limit Src	0	Keypad	0~8	0	
MOT1, MOT2	05	Control Mode	3	Sensorless	-	0	
			4	Vector			
	08	Torque Control En	0	No	0~1	0	
VEC1, VEC2	21	Fwd +Torque Limit	180.0		0.0~320.0	180	%
	22	Fwd -Torque Limit	180.0		0.0~320.0	180	%
	23	Rev +Torque Limit	180.0		0.0~320.0	180	%
	24	Rev -Torque Limit	180.0		0.0~320.0	180	%

Common Parameters for Torque Limits

Communication Address	parameter	Scale	Unit	Details
0391h	Fwd +Torque Limit	0.1	%	Forward motoring torque limits
0392h	Fwd -Torque Limit	0.1	%	Forward regenerative torque limits
0393h	Rev +Torque Limit	0.1	%	Reverse motoring torque limits
0394h	Rev -Torque Limit	0.1	%	Reverse regenerative torque limits

Torque Limits-Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>MOT1, MOT2-05 Control Mode, MOT1, MOT2-08 Torque Control En</td><td colspan="3">Torque limit is active in sensorless or vector speed control modes.</td></tr>
<tr><td>BAS-16 Torque Limit Src</td><td colspan="3">Select a type to which you want to set the amount of torque limits. You can set via Smart Operator, analog input at the terminal block, or various communications.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Keypad</td><td>Limits set in VEC1, VEC2-26, and 27 (TrqMode FwdFreqLmt, TrqMode RevFreqLmt) or VEC1, VEC2-28, and 29 (TrqMode Fwd SpdLmt, TrqMode Rev SpdLmt) are applied.</td></tr>
<tr><td>1</td><td>Analog Input 1</td><td rowspan="3">Limits apply according to the set analog input at the terminal block.</td></tr>
<tr><td>2</td><td>Analog Input 2</td></tr>
<tr><td>3</td><td>Analog Input 3</td></tr>
<tr><td>4</td><td>Pulse Input</td><td>Limits apply according to the pulse input at the terminal block.</td></tr>
<tr><td>5</td><td>Internal Comm.</td><td rowspan="4">Limits apply according to the set values in common parameter communication addresses 0391h-0394h.</td></tr>
<tr><td>6</td><td>USB Comm.</td></tr>
<tr><td>7</td><td>Option Comm. [6]</td></tr>
<tr><td>8</td><td>UserSequence</td></tr>
<tr><td>9</td><td>System</td><td>When using the winder/unwinder function, the calculated torque limit is applied. Refer to <u>7.28.10 Torque Limit Calculation Part</u> for more details.</td></tr>
</table></td></tr>
</table>

[6] Configurable only when equipped with communication options

6.6.2 Speed Limits in Torque Control

If output torque of the motor is bigger than load torque in torque control mode, motor speed gradually increases. Operating frequency (speed) should be limited to prevent this. You cannot control torque when this function is active as speed limit is its main objective.

Torque Limit Settings

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
BAS	17	TrqMode SpdLmt Src	0	Keypad	0~8	0	
MOT1, MOT2	05	Control Mode	3	Sensorless	0~4	0	
			4	Vector			
	08	Torque Control En	1	Yes	0~1	0	
VEC1, VEC2	26	TrqMode FwdFreqLmt	60.00		0.00~ 60.00	60.00	Hz
	27	TrqMode RevFreqLmt	60.00		0.00~ 60.00	60.00	Hz
	28	TrqMode Fwd SpdLmt	1800		0~1800	1800	rpm
	29	TrqMode Rev SpdLmt	1800		0~1800	1800	rpm
	30	TrqMode SpdLmtGain	20.0		1.0~100.0	20.0	%

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Common Communication Parameter Addresses for Speed Limits

Communication Address	parameter	Scale	Unit	Details
038Ch	Fwd Freq Limit	0.01	Hz	Forward frequency limit
038Dh	Rev Freq Limit	0.01	Hz	Reverse frequency limit
0393h	Fwd Speed Limit	0.1	rpm	Forward speed limit
0394h	Rev Speed Limit	0.1	rpm	Reverse speed limit

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Speed Limits-Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>MOT1, MOT2-05 Control Mode, MOT1, MOT2-08 Torque Control En</td><td colspan="3">Torque limit is active in sensorless or vector torque control modes.</td></tr>
<tr><td>BAS-17 TrqMode SpdLmt Src</td><td colspan="3">Select a type to which you want to set the amount of speed limits. You can set via Smart Operator, analog input at the terminal block, or various communications.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Keypad</td><td>Limits set in VEC1, VEC2-26, and 27 (TrqMode FwdFreqLmt, TrqMode RevFreqLmt) or VEC1, VEC2-28, and 29 (TrqMode Fwd SpdLmt, TrqMode Rev SpdLmt) are applied.</td></tr>
<tr><td>1</td><td>Analog Input 1</td><td rowspan="3">Limits apply according to the set analog input at the terminal block.</td></tr>
<tr><td>2</td><td>Analog Input 2</td></tr>
<tr><td>3</td><td>Analog Input 3</td></tr>
<tr><td>4</td><td>Pulse Input</td><td>Limits apply according to the pulse input at the terminal block.</td></tr>
<tr><td>5</td><td>Internal Comm.</td><td rowspan="4">Limits apply according to set values in common parameters 038Ch, 038Dh, or 0393h and 0394h.</td></tr>
<tr><td>6</td><td>USB Comm.</td></tr>
<tr><td>7</td><td>Option Comm. [7]</td></tr>
<tr><td>8</td><td>UserSequence</td></tr>
</table></td></tr>
<tr><td>VEC1, VEC2-30 TrqMode SpdLmtGain</td><td colspan="3">If current speed exceeds the speed limit, torque is reduced at a fixed rate. You can set torque reduction rate.</td></tr>
</table>

[7] Configurable only when equipped with communication options

6.6.3 Speed/Torque Switch

You can switch from speed mode to torque mode or from torque mode to speed mode with multi-functional input during operation.

Torque Limit Settings

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	29	Spd/Trq Change	-	1, 2, 4, 5, 10, 11, 12, 9	-

When the signal on multifunctional input terminal where 29 (Spd/Trq Change) is set turns On during vector torque operation after you set MOT1-05 (Motor Type) as 4 (Vector) and MOT1 and MOT2-08 (Torque Control En) as 1 (Yes), it will switch to speed mode.

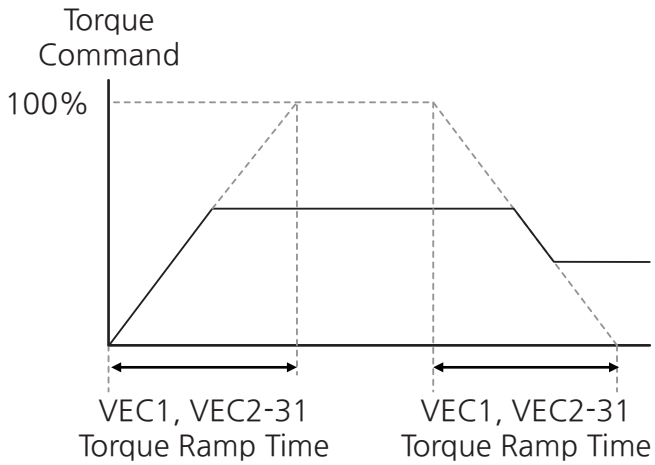
During vector speed operation, when the signal on multi-functional input terminal where 29 (Spd/Trq Change) is set turns On, it switches into vector torque mode.

6.6.4 Torque Command Increase Time Setting

Sets the time required for the torque command to increase. It can be configured using code VEC1, VEC2-31 (Torque Ramp Time), and represents the time taken for the torque command to reach 100%. This function operates only in torque control mode.

Torque Command Increase Time Setting Details

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	05	Control Mode	3	Sensorless	-	0	-
			4	Vector			
	08	Torque Control En	1	Yes	0~1	0	-
DRV	03	Command Torque	0.0		-320.0~ 320.0	0.0	%
VEC1, VEC2	31	Torque Ramp Time	0		0~10000	0	msec



[Image 6. Torque Command Change Based on Acc/Dec Time Settings]

6.7 Vector Control for Synchronous Reluctance Motors

Voltage is applied in proportion to the output frequency. The applied voltage during start operation can be adjusted using the offset voltage.

Vector Control Parameters

Group	Code	LCD Display	Set value		Setting Range	Initial Value	Unit
MOT1, MOT2	04	Motor Type	2	Sync Reluc Motor	2	0	-
	05	Control Mode	0	V/F	-	0	-
	23	Base Frequency	60.00		5.00~ 590.00	60.00	Hz

Group	Code	LCD Display	Set value	Setting Range	Initial Value	Unit
VF1, VF2	60	SynRM V/f HPF Gain	0.7	0.1~10	0.7	-
	61	SynRM V/f HPF Wcut	1	0~3	1	Hz
	62	SynRM V/F CurrLmtG	150	0~200	150	%
	63	SynRM V/f Voffset	100	0~300	100	%
	64	SynRM Reac Pwr Ref	130	50~300	50	%

V/F Control Parameters Details

Code and Functions	Description
MOT1, MOT2-23 Base Frequency	Sets the base frequency. The base frequency is the output frequency at the inverter's rated voltage. Check the motor rating plate and enter the appropriate value.
V/F1, V/F2-60 SynRM V/f HPF Gain	Sets the gain for SynRM V/F stability control. Adjust this value if vibration occurs during motor operation.
V/F1, V/F2-61 SynRM V/f HPF Wcut	Sets the cutoff frequency of the high-pass filter for SynRM V/f stability control. Adjust this value if vibration occurs during motor operation.
V/F1, V/F2-62 SynRM V/f CurrLmtGain	Sets the maximum allowable voltage as a percentage (%) of the rated voltage during motor operation.
V/F1, V/F2-63 SynRM V/f Voffset	Sets the initial voltage offset as a percentage (%). Increase this value if torque is insufficient during initial operation.
V/F1, V/F2-64 SynRM Reac Pwr Ref	Sets the reference value for reactive power control as a percentage (%) of the rated reactive power. Lower this value under light load conditions. Increase this value if operation fails under heavy load conditions.

7 Learning Advanced Features

7.1 Auxiliary Frequency Operation

You can use the main frequency and auxiliary frequency simultaneously for an operating frequency with various computational conditions. The main frequency is used for setting the operating frequency, whereas the auxiliary frequency is used to fine-tune during operation at the main frequency.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	35	Auxiliary Ref Src	1	Analog Input 1	0~4	0	-
	36	Auxiliary Cal Type	0	M+(G*A)	0~12	0	-
	37	Auxiliary Ref Gain	100.0	100.0	-200.0~ 200.0	100.0	%
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	34	Disable Aux Ref	-	1, 2, 4, 5, 10, 11, 12, 9	-

Auxiliary Reference Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td rowspan="6">DRV-35 Auxiliary Ref Src</td><td colspan="3">Select an input type for auxiliary frequency commands.</td></tr>
<tr><td colspan="2">Item</td><td>Functionality</td></tr>
<tr><td>0</td><td>None</td><td>Auxiliary frequency reference is disabled.</td></tr>
<tr><td>1</td><td>Analog Input 1</td><td>Select the AI1 terminal (analog input terminal) of the control terminal block as the source of auxiliary commands.</td></tr>
<tr><td>2</td><td>Analog Input 2</td><td>Select the AI2 terminal (analog input terminal) of the control terminal block as the source of auxiliary commands.</td></tr>
<tr><td>3</td><td>Analog Input 3</td><td>Select the AI3 terminal (analog input terminal) of the control terminal block as the source of auxiliary commands.</td></tr>
<tr><td>4</td><td>Pulse Input</td><td>Select pulse input at the TI Terminal as the source of auxiliary commands.</td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>DRV-36 Auxiliary Cal Type</td><td>After setting the size of the auxiliary reference gain with DRV-37 (Aux Ref Gain), you can set the reflection ratio for the main reference. Note that items 4–7 from the setting items below may result in either plus (+) or minus (-) values with just unipolar analog inputs.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>M+(G*A)</td><td>main command value + (auxiliary gain * auxiliary value * DRV-22)</td></tr>
<tr><td>1</td><td>M*(G*A)</td><td>main command value * (auxiliary gain * auxiliary value)</td></tr>
<tr><td>2</td><td>M/(G*A)</td><td>main command value * (auxiliary gain * auxiliary value)</td></tr>
<tr><td>3</td><td>M+{M*(G*A)}</td><td>main command value + (main command value * [auxiliary gain * auxiliary value])</td></tr>
<tr><td>4</td><td>M+G*2*(A-50)</td><td>main command value + auxiliary gain * 2 * (auxiliary value - 50) * DRV-22</td></tr>
<tr><td>5</td><td>M*{G*2*(A-50)}</td><td>main command value * auxiliary gain * 2 * (auxiliary value - 50)</td></tr>
<tr><td>6</td><td>M/{G*2*(A-50)}</td><td>main command value / auxiliary gain * 2 * (auxiliary value - 50)</td></tr>
<tr><td>7</td><td>M+M*G*2*(A-50)</td><td>main command value + main command value * auxiliary gain * 2 * (auxiliary gain - 50)</td></tr>
<tr><td>8</td><td>(M-A)^2</td><td>(main command value - auxiliary value) ^ 2</td></tr>
<tr><td>9</td><td>M^2 + A^2</td><td>main command value ^ 2 + auxiliary value ^ 2</td></tr>
<tr><td>10</td><td>MAX(M,A)</td><td>MAXIMUM (main command value, auxiliary value)</td></tr>
<tr><td>11</td><td>MIN(M,A)</td><td>MINIMUM (main command value, auxiliary value)</td></tr>
<tr><td>12</td><td>(M+A)/2</td><td>(main command value + auxiliary value) / 2</td></tr>
</table>
M: main frequency value (Hz or rpm)
G: Auxiliary reference gain (%)
A: Auxiliary frequency command value (Hz or rpm) or gain (%)</td></tr>
<tr><td>DRV-37 Auxiliary Ref Gain</td><td>Adjust the size of the input (DRV-35 Auxiliary Ref Src) configured as the auxiliary frequency.</td></tr>
<tr><td>DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)</td><td>Set one of the multifunction input terminals to 34 (Disable Aux Ref), and turn it on to disable auxiliary frequency commands and operate the inverter using the main frequency commands only.</td></tr>
</table>

Table 1. An Example of Auxiliary Frequency Operation

An Example of Auxiliary Frequency Operation
When the frequency setting in Smart Operator is the main frequency and AI1 analog voltage is the auxiliary frequency, • Main frequency: Keypad (operation frequency 30 Hz) • Maximum frequency (DRV-20 Max Frequency): 400 Hz • Frequency with maximum analog input (DRV-22 Frequency at 100%): 60 Hz • Auxiliary settings (DRV-35 Auxiliary Ref Src): Analog Input 1: 6V • Auxiliary gain settings (DRV-37 Auxiliary Ref Gain): 50% • DIN-01~15: Factory default output

For example, the auxiliary A in the following table is 60% (= 100% * [6 V / 10 V]).

Item [1]		Functionality
0	M[Hz]+(G*A)[Hz/100%]	30Hz(M)+(50%(G)x60%(A)*60Hz/%)=48Hz
1	M[Hz]*(G*A)	30Hz(M)x(50%(G)x60%(A))=9Hz
2	M[Hz]/(G*A)	30Hz(M)/(50%(G)x60%(A))=100Hz
3	M[Hz]+{M[Hz]*(G*A)}	30Hz(M)+{30[Hz]x(50%(G)x60%(A))}=39Hz
4	M[Hz]+ G*2*(A-50)[Hz/100%]	30Hz(M)+50%(G)x2x(60%(A)–50%)x60Hz=36Hz
5	M[HZ]*{G*2*(A-50)}	30Hz(M)x{50%(G)x2x(60%(A)–50%)}=3Hz
6	M[HZ]/{G*2*(A-50)}	30Hz(M)/{50%(G)x2x(60%–50%)}=300Hz
7	M[HZ]+M[HZ]*G*2*(A-50)	30Hz(M)+30Hz(M)x50%(G)x2x(60%(A)–50%)=33Hz
8	(M[Hz]-A[Hz/100%])^2	(30Hz(M) - 60%(A)*60Hz/%)^2=36(Hz^2)
9	M[Hz]^2+(A[Hz/100%])^2	(30Hz(M) + 60%(A)*60Hz/%)^2=2196(Hz^2) -> 400Hz
10	Max(M[Hz], A[Hz/100%])	Max(30Hz(M) , 60%(A)*60Hz/%)=36Hz
11	Min(M[Hz], A[Hz/100%])	Min(30Hz(M) , 60%(A)*60Hz/%)=30Hz
12	(M[Hz]+A[Hz/100%])/2	(30Hz(M) + 60%(A)*60Hz/%)/2=33Hz

Note

When the maximum frequency value is high, there may be an output frequency deviation due to errors in analog input or calculations.

[1] M: Main frequency command (Hz or rpm), G: Auxiliary gain (%), A: Auxiliary (%), Hz / 100% is converted to rpm instead of Hz when you change the set frequency for DRV-22 (Frequency at 100%) to rpm.

7.2 Jog operation

The jog operation allows for temporary control of the inverter. You can enter a jog operation command using the multifunction terminals.

The jog operation is the second-highest priority, after the dwell operation. If a jog operation is requested while operating the multistep, up-down, or 3-wire operation modes, the jog operation overrides all other operation modes.

7.2.1 Jog Operation by Terminal Block 1-Forward Jog

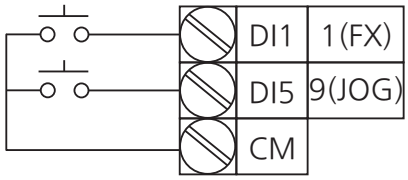
Set a jog operation with input at the multifunction terminal block. Refer to the following parameters for forward jog operation.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	15	Jog Frequency	10.00		0.00~Max Frequency [2]	10.00	Hz
	16	Jog Speed	300		0~Maximum Speed [3]	300	rpm
	17	Jog Acc Time	20.00		0.00~6000.00	20.00	sec
	18	Jog Dec Time	30.00		0.00~6000.00	30.00	sec
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	9	JOG	-	1, 2, 4, 5, 10, 11, 12, 9	-

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

[2] DRV-20(Max Frequency)
[3] DRV-21(Maximum Speed)

Forward Jog Description Details

Code and Functions	Description
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	Select one of the multifunction terminals, DI1-DI8, for the jog frequency settings, then set the codes for the relative terminal of the terminal input group (DIN) to 9 (JOG).  **[Image 1. [An Example of Terminal Settings for Jog Operation]**
DRV-15 Jog Frequency, DRV-16 Jog Speed	Set the unit of speed (Hz or rpm) for a jog operation.
DRV-17 Jog Acc Time	Set the acceleration time for a jog operation.
DRV-18 Jog Dec Time	Set the deceleration time for a jog operation.

If a signal is entered at the jog terminal while an FX operation command is on, the operation frequency changes to the jog frequency and the jog operation begins.

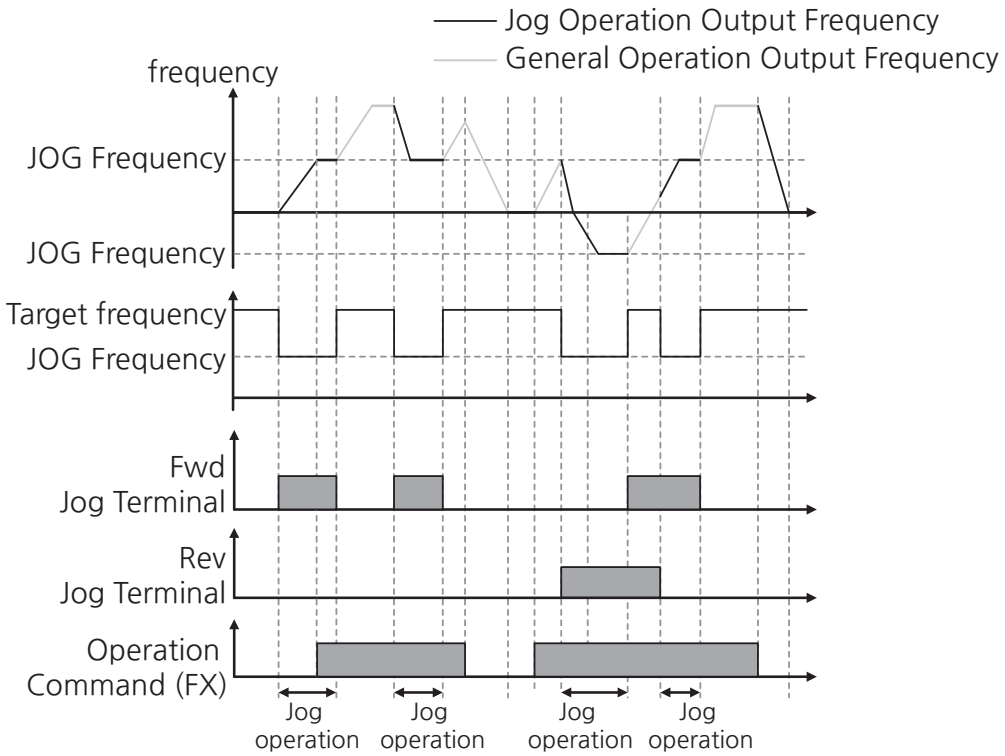
7.2.2 Jog Operation by Terminal Block 2-Forward / Reverse Jog

For jog operation 1, an operation command must be entered to start the operation, but for jog operation 2, you only need a terminal with either a forward jog or reverse jog setting to start the jog operation. The priorities for frequency, acceleration and deceleration times, and terminal block inputs (Dwell, 3-wire, up-down, etc.) during jog operation are identical to jog operation 1. If a different operation command is entered during a jog operation, it is ignored and the operation keeps running with the jog frequency.

An Example of Forward / Reverse Jog Settings

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	15	Jog Frequency	10.00		0.00~Max Frequency [4]	10.00	Hz
	16	Jog Speed	300		0~Maximum Speed [5]	300	rpm
	17	Jog Acc Time	20.00		0.00~6000.00	20.00	sec
	18	Jog Dec Time	30.00		0.00~6000.00	30.00	sec
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	35	Forward JOG	-	1, 2, 4, 5, 10, 11, 12, 9	-
			36	Reverse JOG			

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.



[Image 2. An Example of Forward / Reverse Jog Operation]

[4] DRV-20(Max Frequency)
[5] DRV-21(Maximum Speed)

7.2.3 Jog Frequency Limits

You can limit jog frequencies with upper limit and lower limit settings at ADV-19 (Jog Freq Limit En) (refer to **Limiting the Frequency Using the Maximum Frequency and Start Frequency**). Refer to the following parameters to limit the jog frequency:

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	15	Jog Frequency	10.00		0.00~Max Frequency [6]	10.00	Hz
ADV	14	Cmd Freq Limit En	0	No	0~1	0	-
	15	Cmd Freq Limit Lo	0.50		0.00~Cmd Freq Limit Hi	0.50	Hz
	16	Cmd Freq Limit Hi	Max Frequency		Cmd Freq Limit Lo ~Max Frequency	Max Frequency	Hz
	17	Cmd Speed Limit Lo	15		0~ Cmd Speed Limit Hi	15	rpm
	18	Cmd Speed Limit Hi	1800		Cmd Speed Limit Lo~Maximum Speed [7]	1800	rpm
	19	Jog Freq Limit En	1	Yes	0~1	1	-

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Limiting Jog Frequency Using Upper and Lower Limits' Setting Details

Code and Functions	Description
ADV-14 Cmd Freq Limit En	The initial setting value is 0 (No). When the setting is changed to 1 (Yes), the frequency can be set only between the lower limit (ADV-15) and the upper limit (ADV-16).
ADV-15/17 Cmd Freq/Speed Limit Lo, ADV-16/18 Cmd Freq/Speed Limit Hi	Configures the upper limit to all parameters for the unit of speed (Hz and rpm) excluding the base frequencies (MOT1, MOT2-23 Base Frequency). Frequency cannot be set higher than the upper limit frequency.
ADV-19 Jog Freq Limit En	Limits jog the frequency with upper and lower limits when set to 1 (Yes).

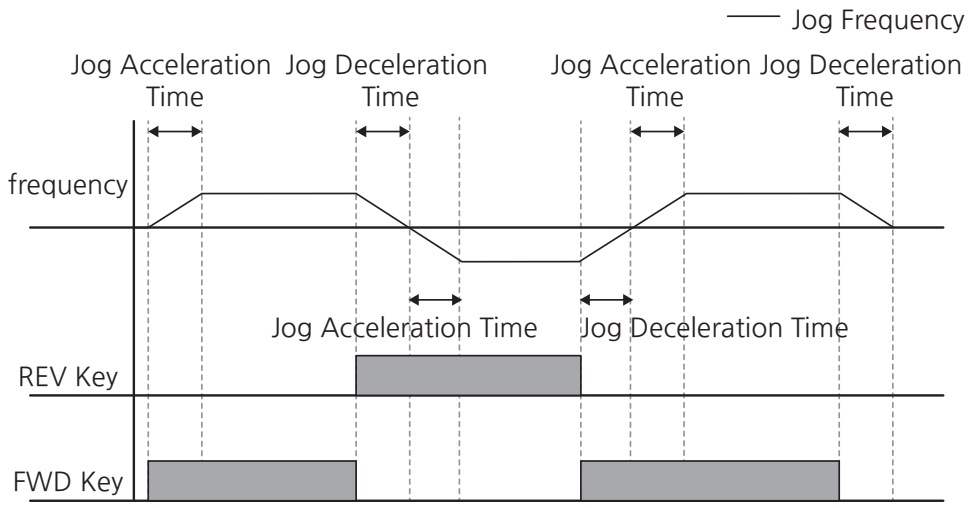
6 DRV-20(Max Frequency)
7 DRV-21(Maximum Speed)

7.2.4 Jog Operation with Smart Operator

Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
Setting	Operator Set	15	Multi Key Select	1	JOG Key	-	0	-
Parameter	DRV	15	Jog Frequency	10.00		0.00~Max Frequency [8]	10.00	Hz
		16	Jog Speed	300		0~Maximum Speed [9]	300	rpm
		17	Jog Acc Time	20.00		0.00~6000.00	20.00	sec
		18	Jog Dec Time	30.00		0.00~6000.00	30.00	sec

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Set code 15 in the Operator Set group from the Setting mode to 1, JOG Key. Press the MULTI key and J on the status bar at the top will change to a reversed image (J) with the operation command source and reference command source on the status bar at the top of Smart Operator displaying KJ/J. Then, the jog operation with the Smart Operator will be available. Long-press the forward operation (FWD) key or reverse operation (REV) key of the Smart Operator to operate with the preset jog frequency (DRV-15 Jog Frequency). It stops if you do not press the forward operation (FWD) key or reverse operation (REV) key. Acceleration and deceleration times to jog operating frequency are configurable at DRV-17 (Jog Acc Time) and DRV-18 (Jog Dec Time).



[Image 3. An Example of a Jog Operation with the Smart Operator]

[8] DRV-20(Max Frequency)
[9] DRV-21(Maximum Speed)

Note

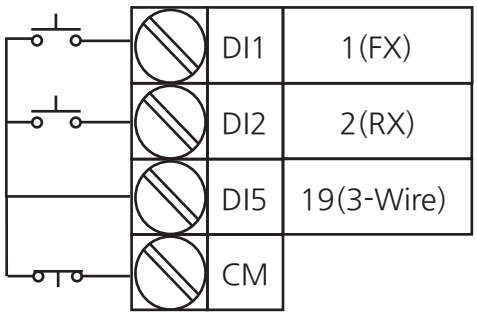
- During the inverter operation, you cannot change Multi Key Select parameters or activate/deactivate the (MULTI) key in the Setting mode.
- A jog operation is the second-highest priority after a dwell operation, and a jog operation with the Smart Operator is the highest priority among jog operations.

7.3 3-Wire Operation

The 3-wire operation latches the signal input (the signal stays on after the button is released) and is used when operating the inverter with a push button.

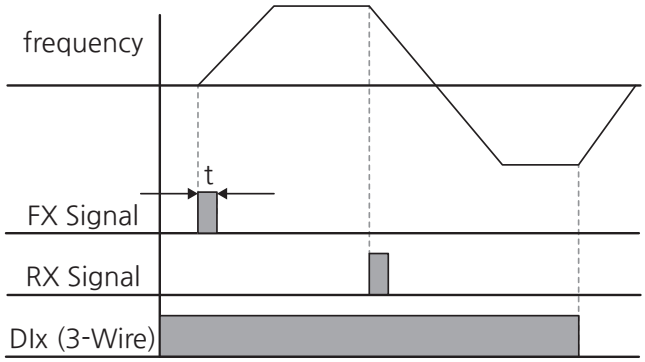
Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	10	1st Command Source	3	3-Wire	0~6	1	-
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	19	3-Wire	-	1, 2, 4, 5, 10, 11, 12, 9	-

To enable the 3-wire operation, the following circuit sequence is necessary. The minimum input time (t) for the 3-wire operation is 1 ms, and the operation stops when both forward and reverse operation commands are entered at the same time.



[Image 4. An Example of 3-Wire Operation Settings]

Timing Diagram



[Image 5. An Example of 3-Wire Operation]

7.4 Safe Operation Mode

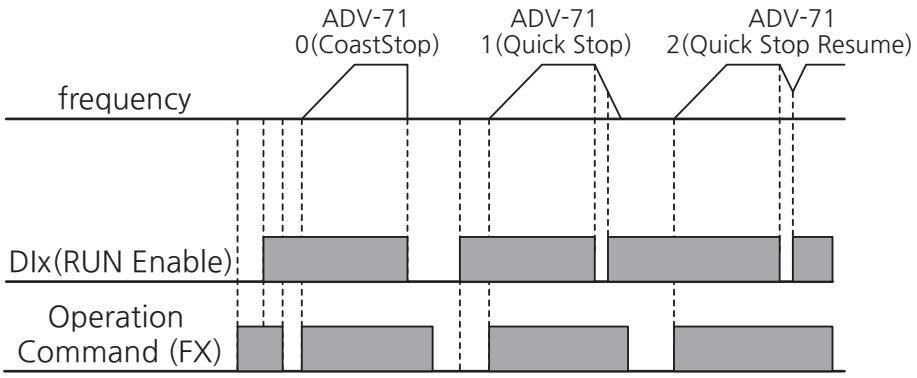
Operation commands are run only when the signal in the multifunction input terminal set as a safe operation mode is turned on. Safe operation mode is used to safely and carefully control the inverter through the multifunction terminals.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
ADV	71	Run Disable Stop	0	CoastStop (FreeRun)	0~2	0	-
	72	Quick Stop Time	5.00		0.00~ 6000.00	5.00	sec
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	18	RUN Enable	-	1, 2, 4, 5, 10, 11, 12, 9	-

Safe Operation Mode Setting Details

Code and Functions	Description
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	Selects one of the multifunction input terminals for operation in safe operation mode and sets it to 18 (RUN Enable).

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>ADV-71
Run Disable Stop</td><td>Sets operation of the inverter when the multifunction input terminal in safe operation mode is off.
When the safe operation mode input terminal is off, it decelerates to the safe operation mode deceleration time (Quick Stop Time), and when the operation command the lifted or the off state is selected, it stops according to the deceleration time (DRV-06 Dec Time).
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>CoastStop (FreeRun)</td><td>Blocks the inverter output when the multifunction terminal is off.</td></tr>
<tr><td>1</td><td>Quick Stop</td><td>Decelerates to the Quick Stop Time and then stops. Once stopped, the operation command must be entered again to restart the operation, even if the multifunction terminal is turned On.</td></tr>
<tr><td>2</td><td>Quick Stop Resume</td><td>Decelerates to the Quick Stop Time and then stops. Once stopped, a normal operation will continue if the multifunction terminal is back on with the operation command turned on.</td></tr>
</table></td></tr>
<tr><td>ADV-72
Quick Stop Time</td><td>Sets the deceleration time when ADV-71 is set to 1 (Quick Stop) or 2 (Quick Stop Resume).</td></tr>
</table>



[Image 6. An Example of Operating in Safe Operation Mode]

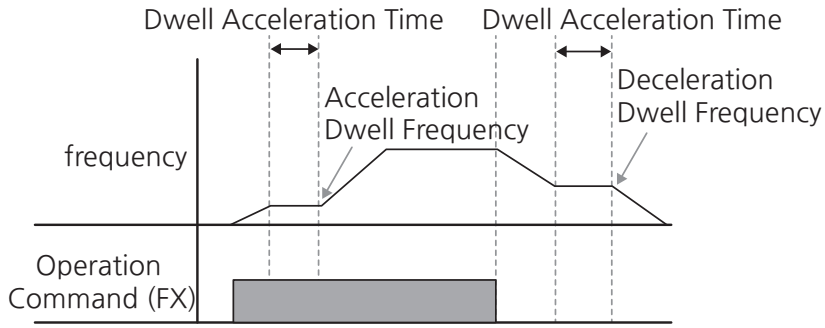
7.5 Dwell Operation

The dwell operation is used to maintain torque during the application and release of the brakes on lift-type loads. An inverter dwell operation runs as follows based on the acceleration and deceleration dwell frequencies and dwell time set by the user:

- **Acceleration dwell operation**: When an operation command is input, acceleration will continue until it reaches the acceleration dwell frequency (ADV-05 AccDwell Frequency) based on the preset acceleration time, then it will operate at a constant speed during the acceleration dwell operation time (ADV-07 AccDwell Time). After the Acc Dwell Time has passed, acceleration is carried out based on the acceleration time and the operation speed that was originally set.
- **Deceleration dwell operation**: When a stop command is input, deceleration will continue until it reaches deceleration dwell frequency (ADV-08 DecDwell Frequency), then it will operate at a constant speed during the deceleration dwell operation time (DRV-07 DecDwell Time). After the set time, deceleration will be carried out based on the deceleration time that was originally set, then the operation will stop.

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
ADV	05	AccDwell Frequency	5.00	start frequency-max frequency [10]	5.00	Hz
	06	AccDwell Speed	150	0~1800	150	rpm
	07	AccDwell Time	0.0	0~60.0	0.0	sec
	08	DecDwell Frequency	5.00	start frequency-max frequency	5.00	Hz
	09	DecDwell Speed	150	0~1800	150	rpm
	10	DecDwell Time	0.0	0~60.0	0.0	sec

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.



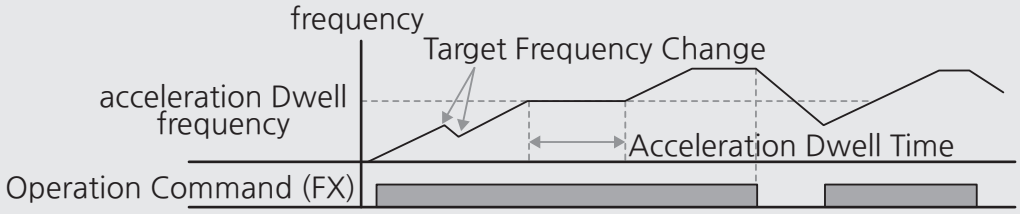
[Image 7. An Example of a Dwell Operation]

[10] DRV-20(Max Frequency)

Note

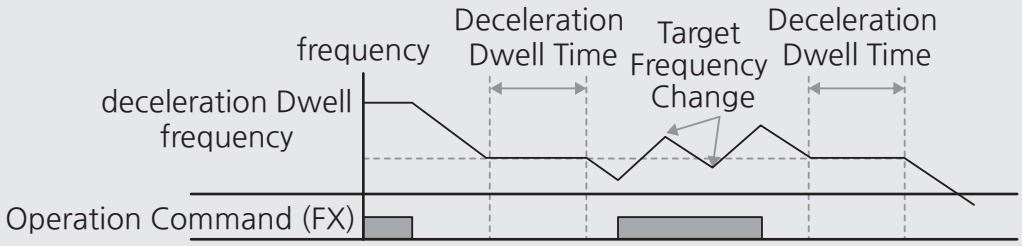
Dwell operations do not work when:

- Dwell operations will not work if the time is set to 0.00 sec or the dwell frequency is set to 0.00 Hz.
- The acceleration dwell operating instructions are only valid once upon initial instruction, so they will not function if the acceleration dwell frequency is passed again during a stop or deceleration and then accelerated again.



[Image 8. An Example of Acceleration Dwell Operation]

- Although a deceleration dwell operation will be carried out whenever stop or deceleration commands are entered and the deceleration dwell frequency is passed through, it will not work during a deceleration by a simple frequency change (which is not a deceleration due to an operation stop).



[Image 9. An Example of Deceleration Dwell Operation]

7.6 Torque Boost

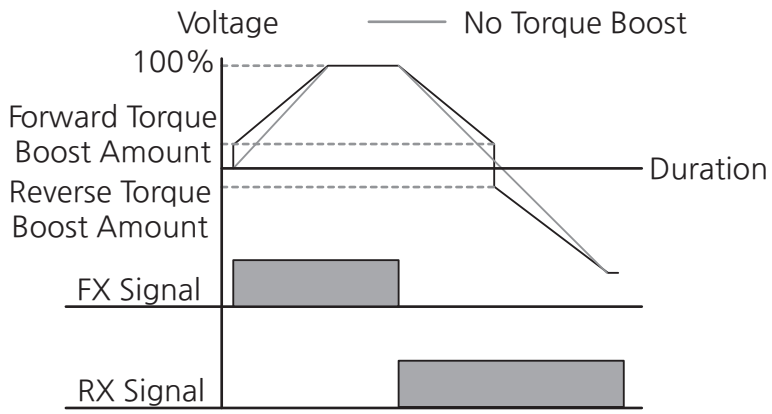
7.6.1 Manual Torque Boost

Manual torque boost allows users to adjust output voltage during a low speed operation or motor start. Increase low speed torque or improve motor starting properties by manually increasing output voltage. Configure manual torque boost while running loads that require high starting torque, such as lift-type loads.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
VF1, VF2	31	Torque Boost Mode	0	Manual	-	0	-
	32	Forward Boost	2.0		0.0~15.0	2.0	%
	33	Reverse Boost	2.0		0.0~15.0	2.0	%

Manual Torque Boost Setting Details

Code and Functions	Description
VF1, VF2-32 Forward Boost	Set torque boost for forward operation.
VF1, VF2-33 Reverse Boost	Set torque boost for reverse operation.



[Image 10. An Example of Manual Torque Boost]

⚠ Caution

Excessive torque boost setting may result in over-excitation, causing motor overheating or overcurrent trips.

7.6.2 Auto Torque Boost

The auto torque boost adjusts the amount of boost automatically based on load volume and outputs inverter voltage, whereas the manual torque boost outputs inverter voltage based on the amount of torque boost set by the user regardless of the load characteristics.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
VF1, VF2	31	Torque Boost Mode	1	Auto	-	0	-
	34	ATB Mot-Gain	100.0		0.0~300.0	100.0	%
	35	ATB Gen-Gain	100.0		0.0~300.0	100.0	%
	36	ATB LPF Gain	3		1~10000	3	msec

Auto Torque Boost Setting Details

Code and Functions	Description
VF1, VF2-34 ATB Mot-Gain	Adjusts the amount of torque boost compensation calculated by a reverse load.
VF1, VF2-35 ATB Gen-Gain	Adjusts the amount of torque boost compensation calculated by a regenerative load.
VF1, VF2-36 ATB LPF Gain	Sets time constant for low-pass filter of output voltage calculated by the auto torque boost. Refer to AIN-04, 19, 34 (AI1-3 LPF Gain) in **8.2.4 Filter**.

⚠ Caution

Excessive torque boost setting may result in over-excitation, causing motor overheating or overcurrent trips.

7.7 PID Control

PID control is one of the most common autocontrol methods. It uses a combination of proportional, integral, and differential controls. PID control enables more flexible control over automation systems.

The functions of PID control that can be applied to the inverter operation are as follows:

Table 2. Usage and Functions of PID Control

Usage	Functionality
Speed control	Controls speed by giving feedback on the current speed of the device or equipment to be controlled. It helps maintain a consistent speed or operate at a target speed.
Pressure Control	Controls pressure by giving feedback on the current pressure of the device or equipment to be controlled. It helps maintain consistent pressure or operate at the target pressure.
Flow Control	Controls flow by giving feedback on the amount of current flow in the device or equipment to be controlled. It helps maintain a consistent flow or operate at a target flow.
Temperature Control	Controls temperature by giving feedback on the current temperature of the device or equipment to be controlled. It helps maintain a consistent temperature or operate at a target temperature.

7.7.1 Basic PID Operation

PID operates by controlling the output frequency of the inverter, through automated system process control to maintain speed, pressure, flow, temperature and tension.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	01	Process PID Enable	1	Yes	-	0	-
PPID	01	Control State	0	Idle	0~4	0	-
			1	Pre-PID			
			2	RUN			
			3	Sleep Boost			
			4	Sleep			
	02	Output Value	-		Unit Min [11]~ Unit Max [12]	-	%
	03	Reference Value	-		Unit Min [11]~ Unit Max [12]	-	%
	04	Feedback Value	-		Unit Min [11]~ Unit Max [12]	-	%
	05	Error Value	-		Unit Min [11]~ Unit Max [12]	-	%
	10	Reference1 Source	0	Keypad	0~9	0	-
	11	Ref1 Keypad Set	0.00		Unit Min [11]~ Unit Max [12]	50.00	PID Unit [13]
	12	Ref1 Auxiliary Src	0	None	0~4	0	-
	13	Ref1 Auxiliary Mode	0	M+(G*A)	0~12	0	-
	14	Ref1 Auxiliary Gain	0.00		-200.00~200.00	0.00	%
	15	Reference2 Source	0	Keypad	0~9	0	-
	16	Ref2 Keypad Set	0.00		Unit Min [11]~ Unit Max [12]	50.00	PID Unit [13]

[11] 2 x PPID-92(Unit at 0%) - PPID-93(Unit at 100%)
[12] PPID-93(Unit at 100%)
[13] PPID-90(Unit Select)

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PPID	17	Ref2 Auxiliary Src	0	None	0~4	0	-
	18	Ref2 Auxiliary Mode	0	M+(G*A)	0~12	0	-
	19	Ref2 Auxiliary Gain	0.00		-200.00~200.00	0.00	%
	20	Reference Acc Time	20.00		0.00~6000.00	20.00	sec
	21	Reference Dec Time	30.00		0.00~6000.00	30.00	sec
	25	Feedback Source	0	Analog Input 1	0~8	0	-
	26	Fdb Auxiliary Src	0	None	0~4	0	-
	27	Fdb Auxiliary Mode	0	M+(G*A)	0~12	0	-
	28	Fdb Auxiliary Gain	0.00		-200.00~200.00	0.00	%
	29	Deadband Width	0		0~Unit Default [14]	0	PID Unit [13]
	30	Deadband Delay	0.00		0.00~600.00	0.00	sec
	35	Proportional Gain1	50.0		0.0~1000.0	50.0	%
	36	Integral Time1	10.00		0.0~200.00	10.00	sec
	37	Derivative Time1	0		0~1000	0	msec
	38	Feedforward Gain	0.0		0.0~1000.0	0.0	%
	40	Proportional Gain2	50.0		0.0~1000.0	50.0	%
	41	Integral Time2	10.00		0.00~200.00	10.00	sec
	42	Derivative Time2	0		0~1000	0	msec
	45	Output Mode	2	PID+Main Freq	-	2	-
	46	Output Limit Low	0.00		-100.00~ Output Limit High	0.00	%
	47	Output Limit High	100.00		Output Limit Low~ 100.00	100.00	%
	48	Output Scale	100.0		0.1~1000.0	100.0	%

[14] (PPID-93(Unit at 100%) - PPID-92(Unit at 0%))/2

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PPID	49	Output LPF Gain	0		0~10000	0	msec
	50	Output Inverse	0	No	0~1	0	-
	80	Step Reference 1	0.00		Unit Min [11]~ Unit Max [12]	50.00	%
	81	Step Reference 2	0.00		Unit Min [11]~ Unit Max [12]	50.00	%
	82	Step Reference 3	0.00		Unit Min [11]~ Unit Max [12]	50.00	%
	83	Step Reference 4	0.00		Unit Min [11]~ Unit Max [12]	50.00	%
	84	Step Reference 5	0.00		Unit Min [11]~ Unit Max [12]	50.00	%
	85	Step Reference 6	0.00		Unit Min [11]~ Unit Max [12]	50.00	%
	86	Step Reference 7	0.00		Unit Min [11]~ Unit Max [12]	50.00	%
	90	Unit Select	1	%	0~40	1	-
	91	Unit Scale	2	X1	0~4	2	-
	92	Unit at 0%	0.00		0.00~Unit at 100%	0.00	%
	93	Unit at 100%	100.00		Unit at 0%~300.00	100.00	%

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	37	PPID Run Enable	-	1, 2, 4, 5, 10, 11, 12, 9	-
			39	PPID Ref Change			
			40	PPID Gain Change			
			41	PPID I-Term Clear			
			42	PPID Output Hold			
			45	PPID Step Ref-L			
			46	PPID Step Ref-M			
			47	PPID Step Ref-H			

Note

- PID output (PID OUT) is bipolar and restricted by PPID-46 (Output Limit Low) and PPID-47 (Output Limit High) settings. 100.0% of PID output is based on setting values of DRV-20 (Max Frequency).
- PID output is reflected as the target frequency of the inverter. It becomes the inverter output frequency by the acceleration and deceleration times.

Basic PID Operation Setting Details

Code and Functions	Description
APP-01 Process PID Enable	Set the code to 1 (Yes) to set functions for process PID.
DIx Define (DIx: DI1~DI8)	Set the code to 37 (PPID Run Enable) and input configured terminal block to run process PID operation.
PPID-01 Control State	Displays the current status of the process PID control (Idle, RUN, Pre-PID, Sleep, or Sleep Boost).
PPID-02 Output Value	Displays the current output value of the PID controller by applying the preset unit, gain, and scale.
PPID-03 Reference Value	Displays the current reference value of the PID controller by applying the preset unit, gain, and scale. Reference 1 is applied by default. Set the Define code of DI1-DI8 of terminal input group (DIN) to 39 (PPID Ref Change) and turn on the terminal block to apply reference 2.
PPID-04 Feedback Value	Displays current feedback value of the PID controller by applying the preset unit, gain, and scale.
PPID-05 Error Value	Displays the current reference value of the PID controller by applying the preset unit, gain, and scale. Displays the error value of the PID controller, which is the difference between the current reference and feedback value, by applying the preset unit, gain, and scale.

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PPID-10 Reference1 Source,
PPID-15 Reference2 Source</td><td>Selects the reference input for the PID control. The same sources are not configurable for both the reference source (PPID-10 and 15) and feedback source (PPID-25).
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Keypad</td><td>Smart Operator</td></tr>
<tr><td>1</td><td>Analog Input 1</td><td rowspan="3">AI terminal of the terminal block (analog input terminal)</td></tr>
<tr><td>2</td><td>Analog Input 2</td></tr>
<tr><td>3</td><td>Analog Input 3</td></tr>
<tr><td>4</td><td>Pulse Input</td><td>TI Terminal of the terminal block
(pulse input terminal, input pulse of 0-32 kHz)</td></tr>
<tr><td>5</td><td>Internal Comm.</td><td>RS-485 input terminal</td></tr>
<tr><td>6</td><td>USB Comm.</td><td>USB Port</td></tr>
<tr><td>7</td><td>Option Comm. [15]</td><td>Communication option</td></tr>
<tr><td>8</td><td>UserSequence</td><td>User sequence</td></tr>
<tr><td>9</td><td>Ext PID-1 Output [16]</td><td>Extension I/O</td></tr>
<tr><td>10</td><td>X-Analog Input 1 [16]</td><td rowspan="3">Analog input terminal for extension I/O</td></tr>
<tr><td>11</td><td>X-Analog Input 2 [16]</td></tr>
<tr><td>12</td><td>X-Analog Input 3 [16]</td></tr>
</table></td></tr>
<tr><td>PPID-11 Ref1 Keypad Set</td><td>When PPID-10 (PID control reference input) is set to 0 (Keypad), reference values can be entered.</td></tr>
</table>

[15] Configurable only when equipped with communication options
[16] Configurable only when equipped with extension I/O options

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PPID-12 Ref1 Auxiliary Src</td><td>Selects an external input source for PID control references. The reference value is determined by the input source at PPID-10 and formula at PPID-13 if selected as an external input source.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>Not used</td></tr>
<tr><td>1</td><td>Analog Input 1</td><td rowspan="3">AI terminal of the terminal block (analog input terminal)</td></tr>
<tr><td>2</td><td>Analog Input 2</td></tr>
<tr><td>3</td><td>Analog Input 3</td></tr>
<tr><td>4</td><td>Pulse Input</td><td>TI Terminal of the terminal block
(pulse input terminal, input pulse of 0-32 kHz)</td></tr>
<tr><td>5</td><td>X-Analog Input 1 [17]</td><td rowspan="3">Analog input terminal for extension I/O</td></tr>
<tr><td>6</td><td>X-Analog Input 2 [17]</td></tr>
<tr><td>7</td><td>X-Analog Input 3 [17]</td></tr>
</table></td></tr>
<tr><td>PPID-13 Ref1 Auxiliary Mode</td><td>If the value for PPID-12 is anything other than 0 (None), the final reference 1 value is determined by the formula set at PPID-13 with a source input at PPID-10 and one at PPID-12.
<table>
<tr><th colspan="2">Configuration</th></tr>
<tr><td>0</td><td>M + (G * A)</td></tr>
<tr><td>1</td><td>M * (G * A)</td></tr>
<tr><td>2</td><td>M / (G * A)</td></tr>
<tr><td>3</td><td>M+(M*(G*A))</td></tr>
<tr><td>4</td><td>M+G*2*(A-50)</td></tr>
<tr><td>5</td><td>M*(G*2*(A-50))</td></tr>
<tr><td>6</td><td>M/(G*2*(A-50))</td></tr>
<tr><td>7</td><td>M+M*G*2*(A-50)</td></tr>
<tr><td>8</td><td>(M-A)^2</td></tr>
<tr><td>9</td><td>M^2+A^2</td></tr>
<tr><td>10</td><td>MAX(M,A)</td></tr>
<tr><td>11</td><td>MIN(M,A)</td></tr>
<tr><td>12</td><td>(M+A)/2</td></tr>
</table></td></tr>
</table>

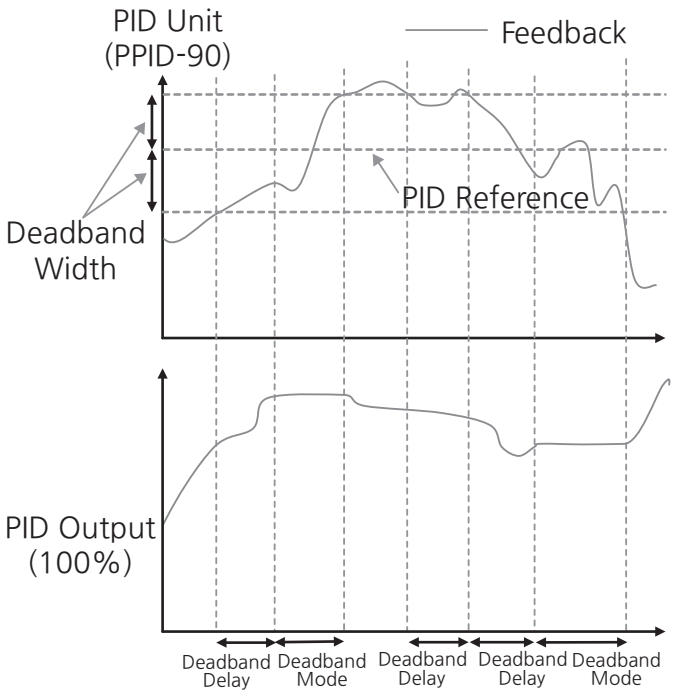
[17] Configurable only when equipped with extension I/O options

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PPID-13 Ref1 Auxiliary Mode</td><td>If the value for PPID-12 is anything other than 0 (None), the final reference 1 value is determined by the formula set at PPID-13 with a source input at PPID-10 and one at PPID-12.
<table>
<tr><th colspan="2">Configuration</th></tr>
<tr><td>0</td><td>M + (G * A)</td></tr>
<tr><td>1</td><td>M * (G * A)</td></tr>
<tr><td>2</td><td>M / (G * A)</td></tr>
<tr><td>3</td><td>M+(M*(G*A))</td></tr>
<tr><td>4</td><td>M+G*2*(A-50)</td></tr>
<tr><td>5</td><td>M*(G*2*(A-50))</td></tr>
<tr><td>6</td><td>M/(G*2*(A-50))</td></tr>
<tr><td>7</td><td>M+M*G*2*(A-50)</td></tr>
<tr><td>8</td><td>(M-A)^2</td></tr>
<tr><td>9</td><td>M^2+A^2</td></tr>
<tr><td>10</td><td>MAX(M,A)</td></tr>
<tr><td>11</td><td>MIN(M,A)</td></tr>
<tr><td>12</td><td>(M+A)/2</td></tr>
</table>
• M = Value from the set source at PPID-1
• G = Gain value set at PPID-14
• A = Value from the set source at PPID-12</td></tr>
<tr><td>PPID-14 Ref1 Auxiliary Gain</td><td>Gain value required for the formula at PPID-13.</td></tr>
<tr><td>PPID-20 Reference Acc Time, PPID-21 Reference Dec Time</td><td>Sets acceleration and deceleration times for final reference values.</td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PPID-25 Feedback Source</td><td>Selects feedback input for PID control. The same sources are not configurable for both the reference source (PPID-10 and 15) and feedback source (PPID-25).
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Analog Input 1</td><td rowspan="3">AI terminal of the terminal block (analog input terminal)</td></tr>
<tr><td>1</td><td>Analog Input 2</td></tr>
<tr><td>2</td><td>Analog Input 3</td></tr>
<tr><td>3</td><td>Pulse Input</td><td>TI Terminal of the terminal block
(pulse input terminal, input pulse of 0-32 kHz)</td></tr>
<tr><td>4</td><td>Internal Comm.</td><td>RS-485 input terminal</td></tr>
<tr><td>5</td><td>USB Comm.</td><td>USB Port</td></tr>
<tr><td>6</td><td>Option Comm. [18]</td><td>Communication option</td></tr>
<tr><td>7</td><td>UserSequence</td><td>User sequence</td></tr>
<tr><td>8</td><td>Ext PID-1 Output [19]</td><td>Extension I/O</td></tr>
<tr><td>9</td><td>X-Analog Input 1 [19]</td><td rowspan="3">Analog input terminal for extension I/O</td></tr>
<tr><td>10</td><td>X-Analog Input 2 [19]</td></tr>
<tr><td>11</td><td>X-Analog Input 3 [19]</td></tr>
</table></td></tr>
<tr><td>PPID-26 Fdb Auxiliary Src</td><td>Selects an external input source for PID control feedback. The feedback value is determined by the input source at PPID-25 and formula at PPID-27 if selected an external input source.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>Not used</td></tr>
<tr><td>1</td><td>Analog Input 1</td><td rowspan="3">AI terminal of the terminal block (analog input terminal)</td></tr>
<tr><td>2</td><td>Analog Input 2</td></tr>
<tr><td>3</td><td>Analog Input 3</td></tr>
<tr><td>4</td><td>Pulse Input</td><td>TI Terminal of the terminal block
(pulse input terminal, input pulse of 0-32 kHz)</td></tr>
<tr><td>5</td><td>X-Analog Input 1</td><td rowspan="3">Analog input terminal for extension I/O</td></tr>
<tr><td>6</td><td>X-Analog Input 2</td></tr>
<tr><td>7</td><td>X-Analog Input 3</td></tr>
</table></td></tr>
</table>

[18] Configurable only when equipped with communication options
[19] Configurable only when equipped with extension I/O options

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PPID-27 Fdb Auxiliary Mode</td><td>If the value for PPID-26 is anything other than 0 (None), the final feedback value is determined by the formula set at PPID-27 with a source input at PPID-25 and one at PPID-26.
<table><tr><th colspan="2">Configuration</th></tr><tr><td>0</td><td>M+(G*A)</td></tr><tr><td>1</td><td>M*(G*A)</td></tr><tr><td>2</td><td>M/(G*A)</td></tr><tr><td>3</td><td>M+(M*(G*A))</td></tr><tr><td>4</td><td>M+G*2*(A-50)</td></tr><tr><td>5</td><td>M*(G*2*(A-50))</td></tr><tr><td>6</td><td>M/(G*2*(A-50))</td></tr><tr><td>7</td><td>M+M*G*2*(A-50)</td></tr><tr><td>8</td><td>(M-A)^2</td></tr><tr><td>9</td><td>M^2+A^2</td></tr><tr><td>10</td><td>MAXIMUM(M,A)</td></tr><tr><td>11</td><td>MINIMUM(M,A)</td></tr><tr><td>12</td><td>(M+A)/2</td></tr></table>• M = Value from the set source at PPID-25
• G = Gain value set at PPID-27
• A = Value from the set source at PPID-26</td></tr>
<tr><td>PPID-28 Fdb Auxiliary Gain</td><td>Gain value required for the formula at PPID-27.</td></tr>
</table>

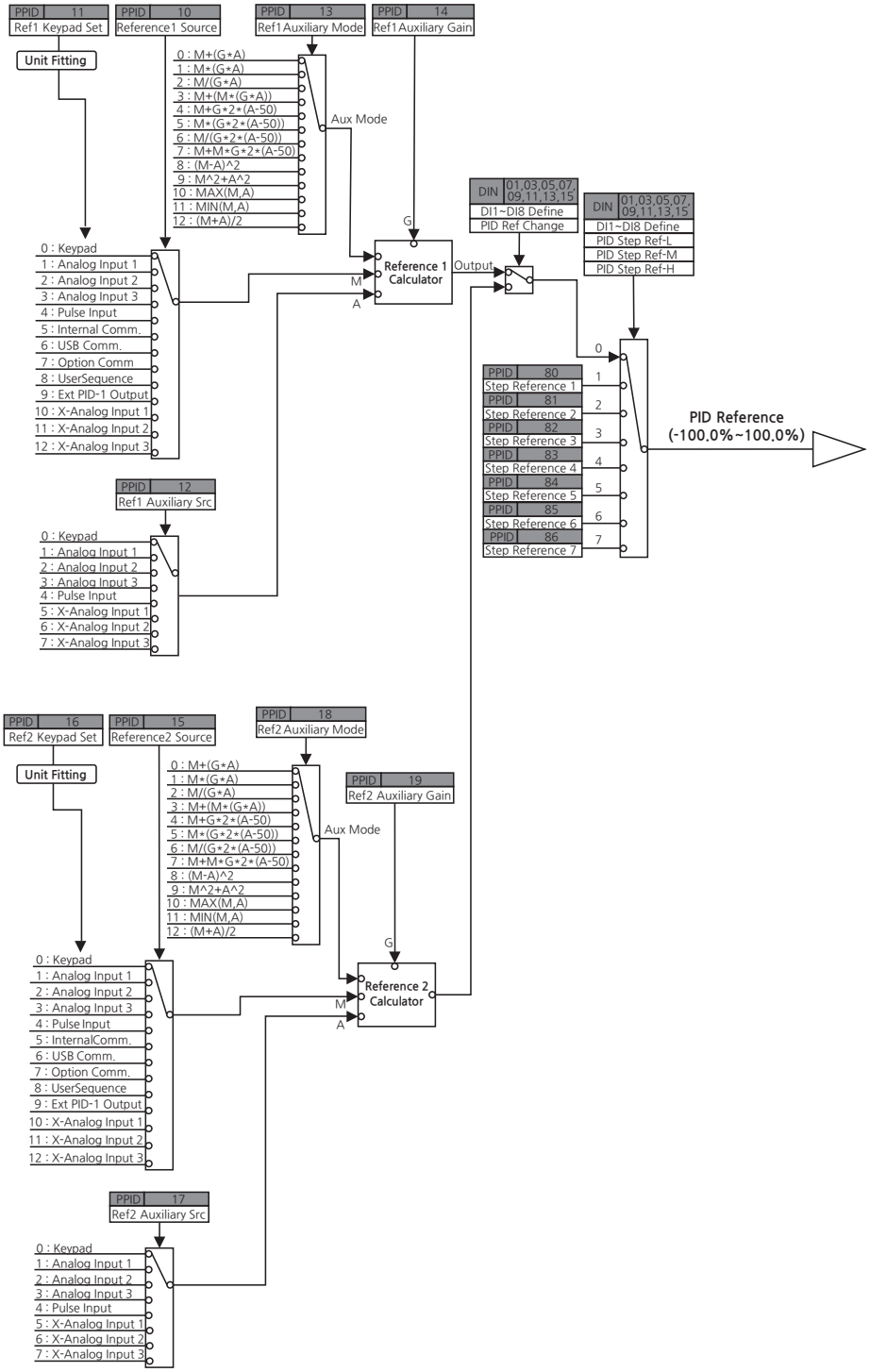
Code and Functions	Description
PPID-29 Deadband Width, PPID-30 Deadband Delay	Holds the PID output when the feedback value is within the upper and lower limits, which are Deadband Width set at PPID-29 added to or subtracted from the reference value, for longer than the time set at PPID-30.  **[Image 11. An Example of PID Output Holding Based on Feedback Value]**
PPID-35 Proportional Gain1, PPID-40 Proportional Gain2	Sets the output ratio for differences (errors) between reference and feedback. If you set the Proportional Gain as 50%, the value that is 50% of error will be output. Proportional Gain 1 is set by default. Set Define code of DI1-DI8 of terminal input group (DIN) to 40 (PPID Gain Change) and turn on the terminal block to apply Proportional Gain 2.

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PPID-36 Integral Time1, PPID-41 Integral Time2</td><td>Sets the time to output accumulated errors. When the error is 100%, the time taken for 100% output will be set. When the integral time is set to one second, 100% will be output one second after the error reaches 100%. Differences in a normal state can be reduced by Integral Time settings.
Set Define code of DI1-DI8 of terminal input group (DIN) to 41 (PPID I-Term Clear) and turn on the terminal block to delete all cumulative integral quantity.
• PID output (final target frequency of the inverter) changes according to the set gain values at PPID-36 and PPID-41. Set the gain values and acceleration and deceleration times in consideration of the impacts from changes in acceleration and deceleration times to reach the operating frequency that meets this PID output based on preset values at DRV-05 (Acc Time) and DRV-06 (Dec Time).
Integral Time 1 is set by default. Set Define code of DI1-DI8 of terminal input group (DIN) to 40 (PPID Gain Change) and turn on the terminal block to apply Integral Time 2.</td></tr>
<tr><td>PPID-37 Derivative Time1, PPID-42 Derivative Time2</td><td>Sets the output volume for the rate of change in errors. If the Derivative time is set to 1 ms and the rate of change in errors per second is 100 %, 1% will be output every 10 ms.
Derivative Time 1 is set by default. Set Define code of DI1-DI8 of terminal input group (DIN) to 40 (PPID Gain Change), and turn on the terminal block to apply Derivative Time 2.</td></tr>
<tr><td>PPID-38 FeedForward Gain</td><td>Sets the ratio that adds the target to the PID output. Adjusting this value leads to a faster response.</td></tr>
<tr><td>PPID-45 Output Mode</td><td>Sets whether to select PID output mode for frequency output by PID calculation, to add values from frequency setting sources at DRV-11 (1st Freq Ref Src) to PID calculation value, or to add External PID output. There are five modes in total. Refer to the following:
<table><tr><th colspan="2">Configuration</th></tr><tr><td>0</td><td>Not Use Output</td></tr><tr><td>1</td><td>Only PID Freq Out</td></tr><tr><td>2</td><td>PID+Main Freq</td></tr><tr><td>3</td><td>Only PID Trq Out</td></tr><tr><td>4</td><td>PID+EPID1 Out</td></tr><tr><td>5</td><td>PID+EPID1+Main</td></tr></table></td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PPID-46 Output Limit Low, PPID-47 Output Limit High</td><td>Limits the output of the controller.</td></tr>
<tr><td>PPID-48 Output Scale</td><td>Adjusts the volume of the controller output.</td></tr>
<tr><td>PPID-49 Output LPF Gain</td><td>Used when the output of the PID controller changes too fast or the entire system is unstable due to severe oscillation. In general, a lower value (the default value is 0) is used to speed up the response, but in some cases a higher value is used to increase stability. The higher the value, the more stable the PID controller output is, but the slower the response time.</td></tr>
<tr><td>PPID-50 Output Inverse</td><td>Set Output Inverse to 1 (Yes) and the difference (error) between the reference and feedback values are set as a feedback reference value.</td></tr>
<tr><td>PPID-80~86 Step Reference 1~7</td><td>Select a Define code for DI1-DI8 of terminal input group (DIN) among 45-47 (PPID Step Ref -L, PPID Step Ref -M, and PPID Step Ref -H).
PPID Step Ref -L, PPID Step Ref -M, and PPID Step Ref -H are recognized as binary codes and references set at PPID-80-86 are selected for operation.</td></tr>
<tr><td>PPID-90 Unit Select</td><td>Sets the unit of the control variable.
<table>
<tr><td>0</td><td>CUST</td><td>11</td><td>Hz</td><td>22</td><td>m³/h</td><td>33</td><td>f³/s</td></tr>
<tr><td>1</td><td>%</td><td>12</td><td>rpm</td><td>23</td><td>l/s</td><td>34</td><td>f³/m</td></tr>
<tr><td>2</td><td>PSI</td><td>13</td><td>V</td><td>24</td><td>l/m</td><td>35</td><td>f³/h</td></tr>
<tr><td>3</td><td>°F</td><td>14</td><td>A</td><td>25</td><td>l/h</td><td>36</td><td>lb/s</td></tr>
<tr><td>4</td><td>°C</td><td>15</td><td>kW</td><td>26</td><td>kg/s</td><td>37</td><td>lb/m</td></tr>
<tr><td>5</td><td>inWC</td><td>16</td><td>HP</td><td>27</td><td>kg/m</td><td>38</td><td>lb/h</td></tr>
<tr><td>6</td><td>inM</td><td>17</td><td>mpm</td><td>28</td><td>kg/h</td><td>39</td><td>ppm</td></tr>
<tr><td>7</td><td>Bar</td><td>18</td><td>ft</td><td>29</td><td>gl/s</td><td>40</td><td>pps</td></tr>
<tr><td>8</td><td>mBar</td><td>19</td><td>m/s</td><td>30</td><td>gl/m</td><td></td><td></td></tr>
<tr><td>9</td><td>Pa</td><td>20</td><td>m³/s</td><td>31</td><td>gl/h</td><td></td><td></td></tr>
<tr><td>10</td><td>kPa</td><td>21</td><td>m³/m</td><td>32</td><td>ft/s</td><td></td><td></td></tr>
</table>
</td></tr>
</table>

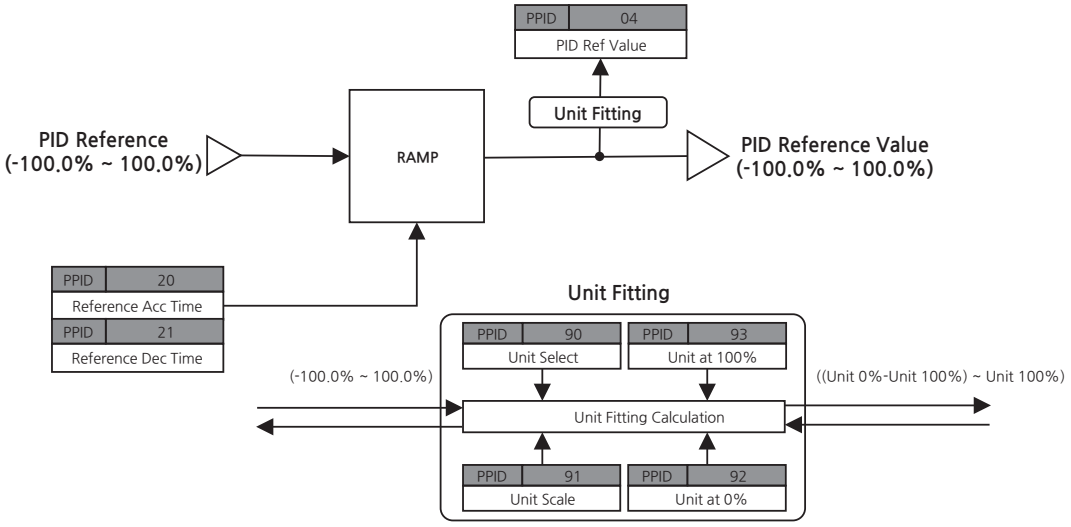
Code and Functions	Description
PPID-91 Unit Scale	Adjusts the size according to the unit selected at PPID-90.
PPID-92 Unit at 0 % PPID-93 Unit at100%	Sets PID Unit 0% value and PID Unit 100% value as the minimum and maximum values of the unit set at PPID-90.

PID Command Selection Block



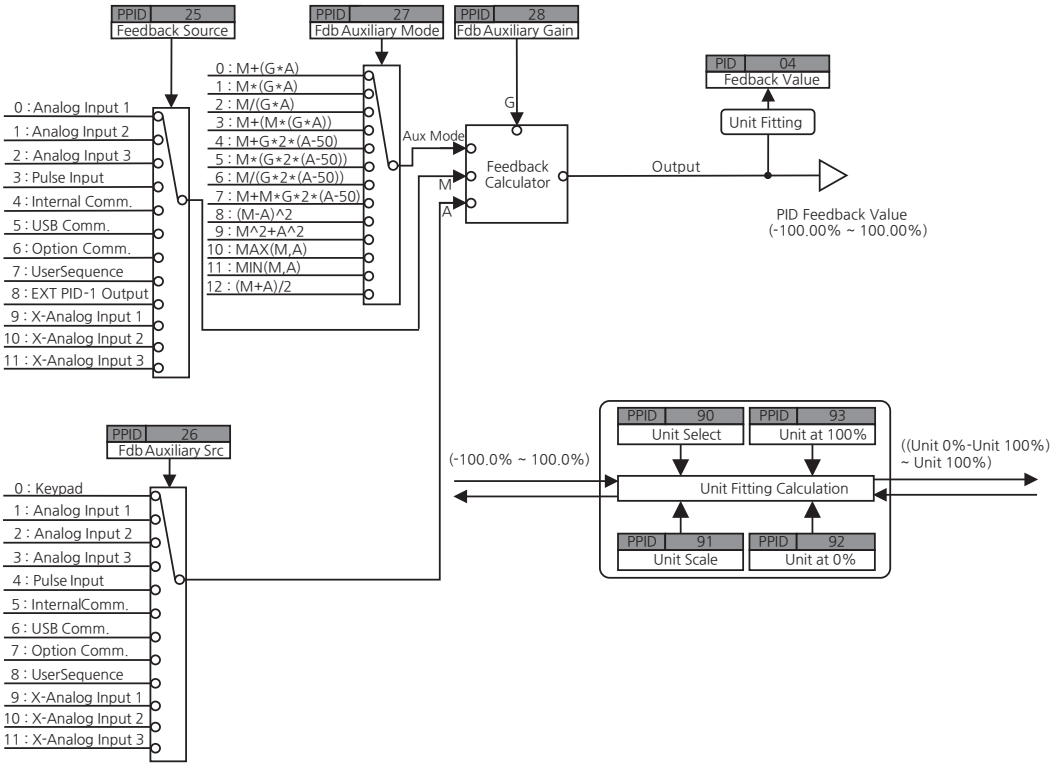
[Image 12. PID Command Selection Block]

PID Command Scale Block



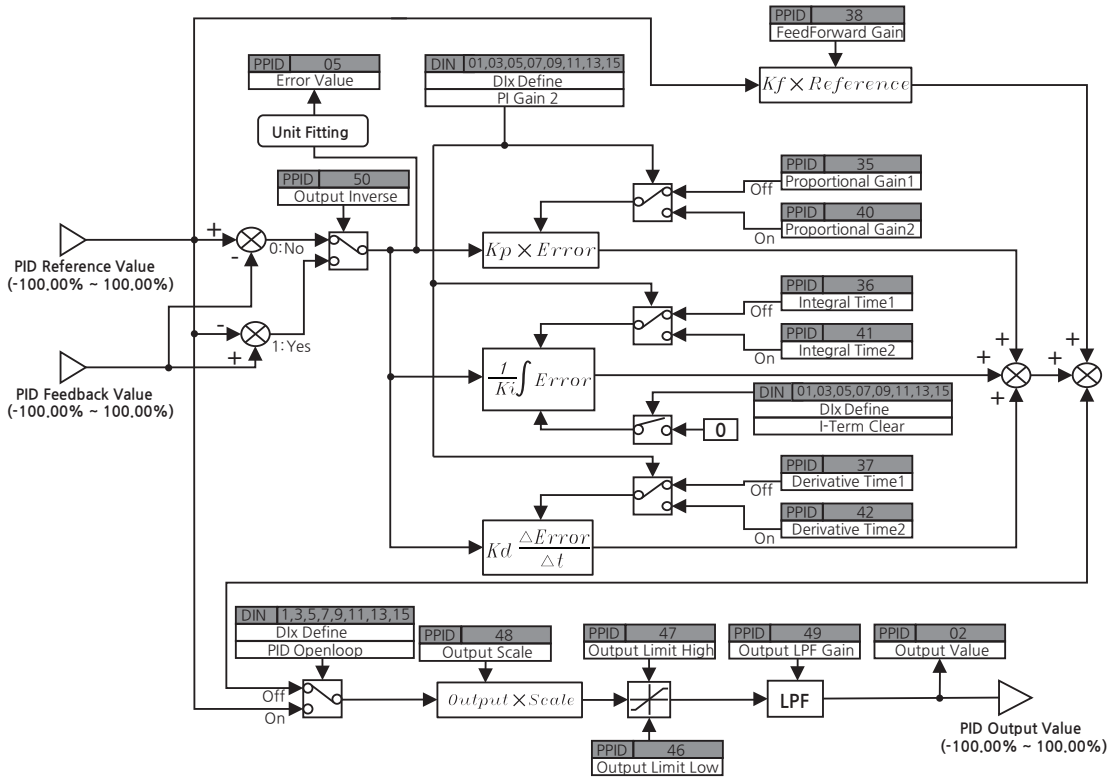
[Image 13. PID Command Scale Block]

PID feedback



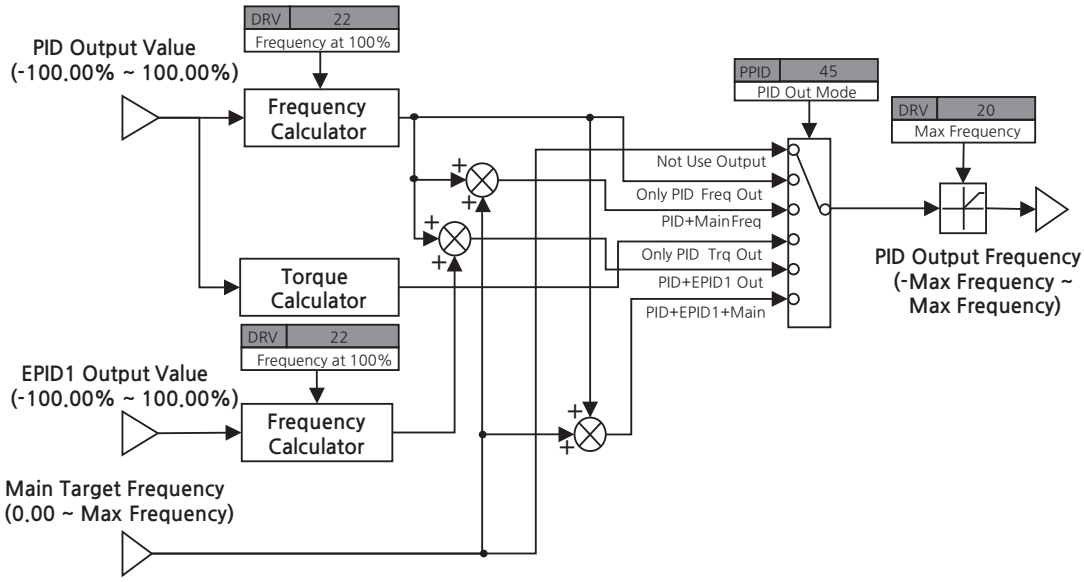
[Image 14. PID Feedback Block]

PID output



[Image 15. PID Output Block]

PID Output Mode



[Image 16. PID Output Mode Block]

7.7.2 PID Operation Sleep Mode

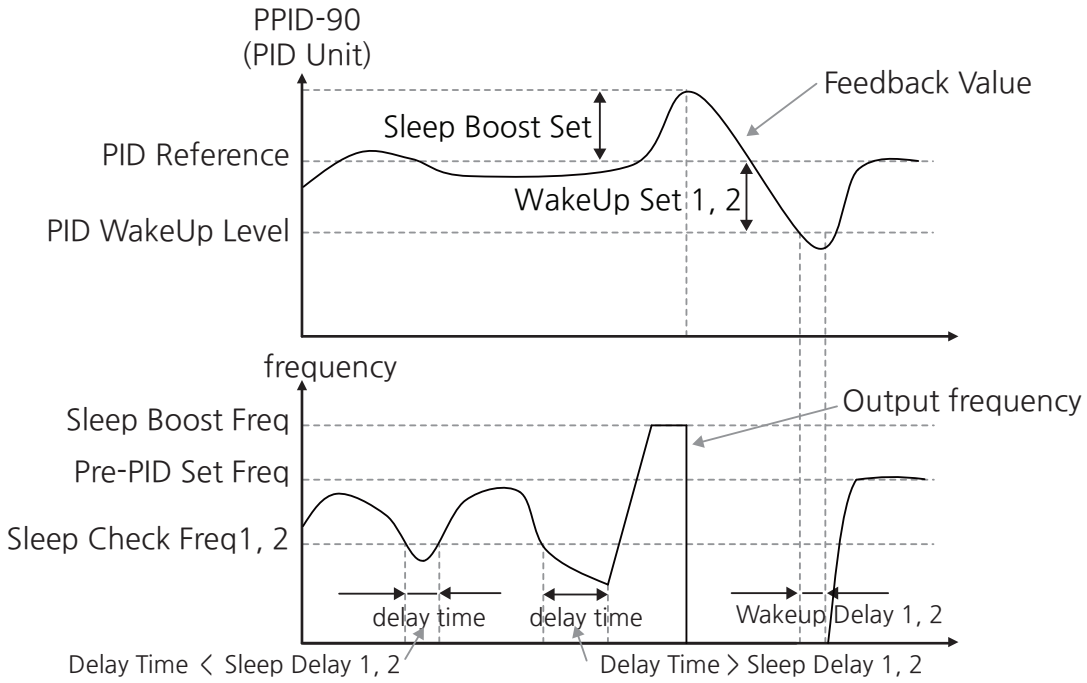
If operation continues at a frequency under the operational condition for PID for a certain amount of time, it will increase the PID reference and boost the will operate to maintain PID operation sleep mode longer before entering into sleep mode. The PID operation starts again when the PID feedback becomes lower than the PID Wakeup level, and the input will be maintained longer than the time set at PPID-68 (WakeUp Delay1) or PPID-74 (WakeUp Delay2) after entering PID operation sleep mode. PID Wakeup level is PPID-67 (Wakeup Set1) or PPID-73 (Wakeup Set2) subtracted from PPID-03 (reference Value).

For PID operation sleep mode, two sets are configurable for sleep mode frequency (Sleep Check Freq), sleep mode delay time (Sleep Delay), wakeup deviation, and wake-up delay time (Wakeup Delay). You can select them based on multifunction input terminal settings and input status.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PPID	60	Sleep Mode	0	None	0~2	0	
			1	Always Enable			
			2	DI Dependent			
PPID	61	Sleep Boost Set	0		0~Unit Max [20]/2	0	PID Unit [21]
	62	Sleep Boost Freq	0.00		0.00~Max Frequency [22]	0.00	Hz
	63	Sleep Boost Spd	0		0~Maximum Speed [23]	0	rpm
	64	Sleep Check Freq1	0.00		0.00~Max Frequency [22]	0.00	Hz
	65	Sleep Check Spd1	0		0~Maximum Speed [23]	0	rpm
	66	Sleep Delay 1	60.0		0.0~600.0	60.0	sec
	67	WakeUp Set1	0		0~Unit Default [24]	0	PID Unit [21]
	68	WakeUp Delay1	60.0		0.0~600.0	60.0	sec
	70	Sleep Check Freq2	0.00		0.00~Max Frequency [22]	0.00	Hz
	71	Sleep Check Spd2	0		0~Maximum Speed [23]	0	rpm
	72	Sleep Delay 2	60.0		0.0~600.0	60.0	sec
	73	WakeUp Set2	0		0~Unit Default [24]	0	PID Unit [21]
	74	WakeUp Delay2	60.0		0~600.0	60.0	sec
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	43	PPID Sleep ON	-	1, 2, 4, 5, 10, 11, 12, 9	
			44	PPID Sleep Change			

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

[20] PPID-93(Unit at 100%)
[21] PPID-90(Unit Select)
[22] DRV-20(Max Frequency)
[23] DRV-21(Maximum Speed)
[24] (PPID-93(Unit at 100%) - PPID-92(Unit at0%))/2



[Image 17. An Example of PID Operation Sleep Mode]

7.7.3 Pre-PID Operation

This function minimizes the error value by increasing feedback to reach a certain level up to preset reference value.

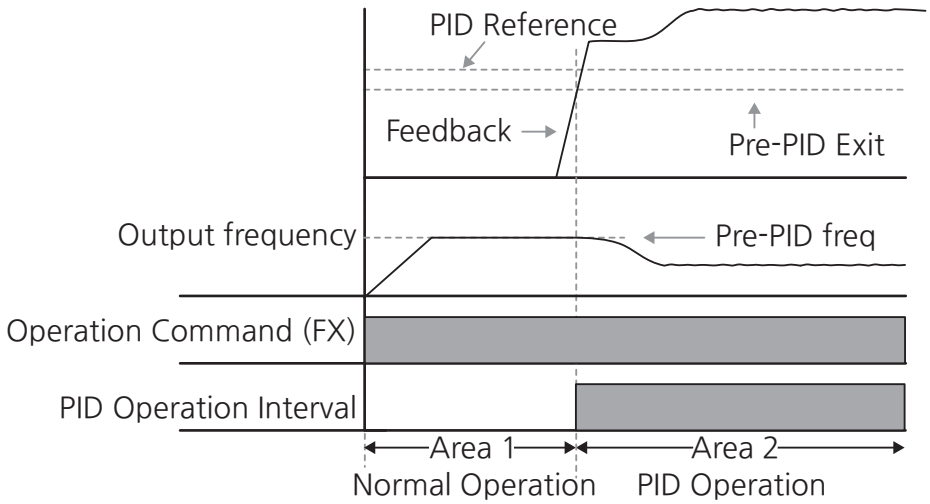
Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
PPID	55	Pre-PID Set Freq	0.00	0.00~Max Frequency [25]	0.00	Hz
	56	Pre-PID Set Spd	0	0~Maximum Speed [26]	0	rpm
	57	Pre-PID Exit	0.00	Unit Min [27]~Unit Max [28]	0.00	PID Unit [29]
	58	Pre-PID Delay	60.0	0.0~600.0	60.0	sec

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

[25] DRV-20(Max Frequency)
[26] DRV-21(Maximum Speed)
[27] 2 x PPID-92(Unit at 0%) - PPID-93(Unit at 100%)
[28] PPID-93(Unit at 100%)
[29] PPID-90(Unit Select)

Pre-PID Operation Setting Details

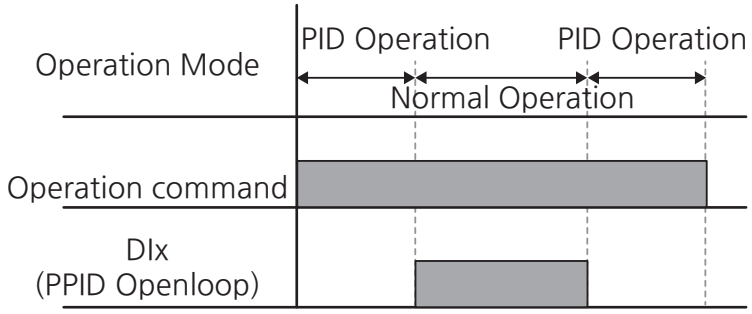
Code and Functions	Description
PPID-55 Pre-PID Set Freq, PPID-56 Pre-PID Set Spd	Enter frequency or rotational speed up to the general acceleration when general acceleration is required without PID control. For example, when PPID-55 is set as 30 Hz, it continues general operation at 30 Hz until the controlled variable (PID feedback variable) is higher than what is set at PPID-57.
PPID-57 Pre-PID Exit	When the input feedback variable (controlled variable) of PID controller is higher than the value set at PPID-57, PID control operation begins.
PPID-58 Pre-PID Delay	When less feedback than Pre PID Set Freq or Pre PID Set Spd is maintained for longer than the Pre-PID Delay time, a Pre-PID Fail trip will occur and output will be blocked.



[Image 18. An Example of a Pre-PID Operation]

7.7.4 PID Operation Switch (PID Openloop)

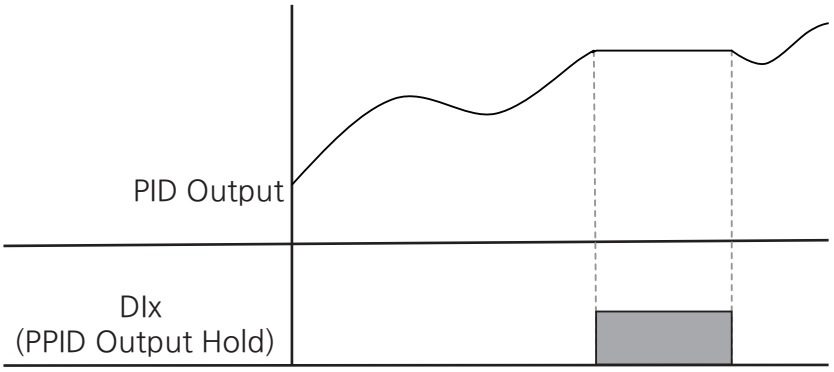
When a terminal to which 38 (PPID Open Loop) is set among multifunction input terminal codes (DI1-DI8 Define) for terminal input group (DIN-01, 03, 05, 07, 09, 11, 13, and 15) turns on, PID operation will be stopped and switched to a general operation. When the terminal turns Off, the PID operation will start again.



[Image 19. An Example of a PID Operation Switch]

7.7.5 PID Output Hold Operation

When a terminal to which 42 (PPID Output Hold) is set among multifunction input terminal codes (DI1-DI8 Define) for terminal input group (DIN-01, 03, 05, 07, 09, 11, 13, and 15) turns on, the current PID output will be maintained. When the terminal turns Off, the PID operation will start again.



[Image 20. An Example of a PID Output Hold Operation]

7.8 External PID (EPID)

It includes PID functions except for basic PID for inverter control. External PID (EPID) output can overlap PID output based on PID output mode (PPID-45 OutputMode) settings. External output is available according to analog output (OUT-01 and 10) settings.

EPID control enables the following functions:

Table 3. Usage and Functionalities of External PID Control

Usage	Functionality
Speed Control	Controls speed by giving feedback on the current speed of the device or equipment to be controlled. It helps maintain a consistent speed or operate at a target speed.
Pressure Control	Controls pressure by giving feedback on the current pressure of the device or equipment to be controlled. It helps maintain consistent pressure or operate at the target pressure.
Flow Control	Controls flow by giving feedback on the amount of current flow in the device or equipment to be controlled. It helps maintain a consistent flow or operate at a target flow.
Temperature Control	Controls temperature by giving feedback on the current temperature of the device or equipment to be controlled. It helps maintain a consistent temperature or operate at a target temperature.

7.8.1 Basic EPID Operation

S300 allows using two EPIDs simultaneously. Each EPI are configurable with two parameter groups (EPI1 and EPI2) as follows:

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	02	ExternalPID Enable	1	Yes	-	0	-
EPI1, EPI2	01	Control State	0	Idle	0~4	0	-
			1	Pre-PID			
			2	RUN			
			3	Sleep Boost			
			4	Sleep			
	02	Output Value	-		-100.00~ 100.00	-	%
	03	Reference Value	-		Unit Min [30]~ Unit Max [31]	-	PID Unit [32]
	04	Feedback Value	-		Unit Min [30]~ Unit Max [31]	-	PID Unit [32]
	05	Error Value	-		Unit Min [30]~ Unit Max [31]	-	PID Unit [32]
	06	Mode	1	Always Enable	1~3	0	-
	10	Reference Source	0	Keypad	0~9	0	-
	11	Ref Keypad Set	0		-Unit at 100%~ Unit at 100%	0	PID Unit [32]
	25	Feedback Source	0	Analog Input 1	0~8	0	-
	35	Proportional Gain	50.0		0.0~1000.0	50.0	%
	36	Integral Time	10.00		0.00~200.00	10.00	sec

[30] 2 x EPI1, EPI2-92(Unit at 0%) - EPI1, EPI2-93(Unit at 100%)
[31] EPI1,2-93(Unit at 100%)
[32] EPI1, EPI2-90(Unit Select)

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
EPI1, EPI2	37	Derivative Time	0		0~1000	0	msec
	38	FeedForward Gain	0.0		0.0~1000.0	0.0	%
	46	Output Limit Low	0.00		-100.00~ Output Limit High	0.00	%
	47	Output Limit High	100.00		Output Limit Low~100.00	100.00	%
	49	Output LPF Gain	0		0~10000	0	msec
	90	Unit Select	1	%	0~40	1	-
	91	Unit Scale	2	X1	0~4	2	-
	92	Unit at 0%	0.00		0.00~Unit at 100%	0.00	PID Unit [32]
	93	Unit at 100%	100.00		Unit at 0%~ 300.00 %	100.00	PID Unit [32]
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	51	EPID1 Run	-	1, 2, 4, 5, 10, 11, 12, 9	-
			52	EPID1 I-Term Clear			
			53	EPID2 Run			
			54	EPID2 I-Term Clear			

Note

EPID 1 and 2 outputs (PID OUT) are bipolar and restricted by EPI1, EPI2-47 (Output Limit High), and 48 (Output Limit Low) settings.

Basic EPID Operation Setting Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>APP-02 ExternalPID Enable</td><td>Set the code to 1 (Yes) to set functions for the External PID.</td></tr>
<tr><td>EPI1, EPI2-01 Control State</td><td>Displays the current status of the EPID control (Idle, RUN, Pre-PID, Sleep, or Sleep Boost).</td></tr>
<tr><td>EPI1, EPI2-02 Output Value</td><td>Displays the current output of the EPID controller. The preset unit, gain, and scale will be applied and displayed.</td></tr>
<tr><td>EPI1, EPI2-03 Reference Value</td><td>Displays the current reference value of the EPID controller. The preset unit, gain, and scale will be applied and displayed.</td></tr>
<tr><td>EPI1, EPI2-04 Feedback Value</td><td>Displays the current feedback value of the EPID controller. The preset unit, gain, and scale will be applied and displayed.</td></tr>
<tr><td>EPI1, EPI2-05 Error Value</td><td>Displays the error value, which is the difference between the current reference and feedback value of the EPID controller. The displayed value reflects the applied unit, gain, and scale settings. The value will update only while the EPID is operating.</td></tr>
<tr><td>EPI1, EPI2-06 Mode</td><td>Sets how to use EPID1 and 2.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>Do not use EPID.</td></tr>
<tr><td>1</td><td>Always On</td><td>Always run EPID.</td></tr>
<tr><td>2</td><td>Run In Drv Run</td><td>Run during inverter operation only.</td></tr>
<tr><td>3</td><td>DI Dependent</td><td>Run when there is input at the terminal block (terminals set as EPID1, 2 Run).</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>EPI1, EPI2-10 Reference Source</td><td>Selects the reference input for the PID control. Same sources are not configurable for both the reference source (EPI1 and EPI2-10) and feedback source (EPI1 and EPI2-25).
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Keypad</td><td>Smart Operator</td></tr>
<tr><td>1</td><td>Analog Input 1</td><td rowspan="3">AI terminal of the terminal block
(analog input terminal)</td></tr>
<tr><td>2</td><td>Analog Input 2</td></tr>
<tr><td>3</td><td>Analog Input 3</td></tr>
<tr><td>4</td><td>Pulse Input</td><td>TI Terminal of the terminal block
(pulse input terminal, input pulse of 0-32 kHz)</td></tr>
<tr><td>5</td><td>Internal Comm.</td><td>RS-485 input terminal</td></tr>
<tr><td>6</td><td>USB Comm.</td><td>USB Port</td></tr>
<tr><td>7</td><td>Option Comm. [33]</td><td>Communication option</td></tr>
<tr><td>8</td><td>UserSequence</td><td>User sequence</td></tr>
<tr><td>9</td><td>Ext PID-1 Output [34]</td><td>Extension I/O</td></tr>
<tr><td>10</td><td>X-Analog Input 1 [34]</td><td rowspan="3">Analog input terminal for extension I/O</td></tr>
<tr><td>11</td><td>X-Analog Input 2 [34]</td></tr>
<tr><td>12</td><td>X-Analog Input 3 [34]</td></tr>
</table></td></tr>
<tr><td>EPI1, EPI2-11 Ref Keypad Set</td><td>When the reference sources (EPI1 and EPI2-10) of EPID control are set to 0 (Keypad), reference values can be entered.</td></tr>
</table>

[33] Configurable only when equipped with communication options
[34] Configurable only when equipped with extension I/O options

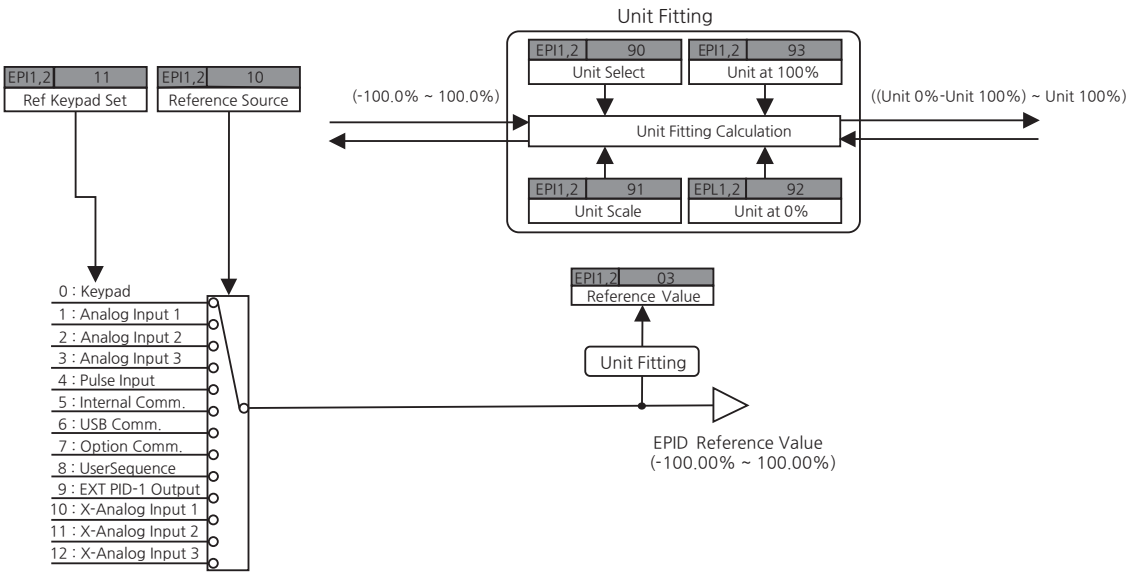
<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>EPI1, EPI2-25 Feedback Source</td><td>Selects feedback input for EPID control. Same sources are not configurable for both the reference source (EPI1, EPI2-10) and feedback source (EPID-25).
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Analog Input 1</td><td rowspan="3">AI terminal of the terminal block
(analog input terminal)</td></tr>
<tr><td>1</td><td>Analog Input 2</td></tr>
<tr><td>2</td><td>Analog Input 3</td></tr>
<tr><td>3</td><td>Pulse Input</td><td>TI Terminal of the terminal block
(pulse input terminal, input pulse of 0-32 kHz)</td></tr>
<tr><td>4</td><td>Internal Comm.</td><td>RS-485 input terminal</td></tr>
<tr><td>5</td><td>USB Comm.</td><td>USB Port</td></tr>
<tr><td>6</td><td>Option Comm. [35]</td><td>Communication option</td></tr>
<tr><td>7</td><td>UserSequence</td><td>User sequence</td></tr>
<tr><td>8</td><td>Ext PID-1 Output [36]</td><td>Extension I/O</td></tr>
<tr><td>9</td><td>X-Analog Input 1 [36]</td><td rowspan="3">Analog input terminal for extension I/O</td></tr>
<tr><td>10</td><td>X-Analog Input 2 [36]</td></tr>
<tr><td>11</td><td>X-Analog Input 3 [36]</td></tr>
</table></td></tr>
<tr><td>EPI1, EPI2-35 Proportional Gain</td><td>Sets the output ratio for differences (errors) between reference and feedback. If you set the value as 50%, the value that is 50% of error will be output.</td></tr>
</table>

[35] Configurable only when equipped with communication options
[36] Configurable only when equipped with extension I/O options

Code and Functions	Description
EPI1, EPI2-36 Integral Time	Sets the time to output accumulated errors. When the error is 100%, the time taken for 100% output will be set. When the integral time is set to one second, 100% will be output one second after the error reaches 100%. Differences in a normal state can be reduced by Integral Time settings. Set Define code of DI1-DI8 of terminal input group (DIN) as 52 and 54 (EPID I-Term Clear) and turn on the terminal block to delete all cumulative integral quantity. • EPID output (final target frequency of the inverter) changes according to the set gain values at EPI-1 and 2-36. Set the gain values and acceleration and deceleration times after considering the impacts from changes in acceleration and deceleration times to reach the operating frequency that meets this EPID output based on the preset values at DRV-05 (Acc Time) and DRV-06 (Dec Time).
EPI1, EPI2-37 Derivative Time	Sets the output volume for the rate of change in errors. If the Derivative time is set to 1 ms and the rate of change in errors per second is 100 %, 1% will be output every 10 ms.
EPI1, EPI2-38 FeedForward Gain	Sets the ratio that adds preset target to EPID output. Adjusting this value leads to a faster response.
EPI1, EPI2-46 Output Limit Low, EPI1, EPI2-47 Output Limit High	Limits the output of the controller.
EPI1, EPI2-49 Output LPF Gain	Used when the output of the EPID controller changes too fast or the entire system is unstable due to severe oscillation. In general, a lower value (the default value is 0) is used to speed up the response, but in some cases a higher value is used to increase stability. The higher the value, the more stable the EPID controller output is, but the slower the responsiveness.

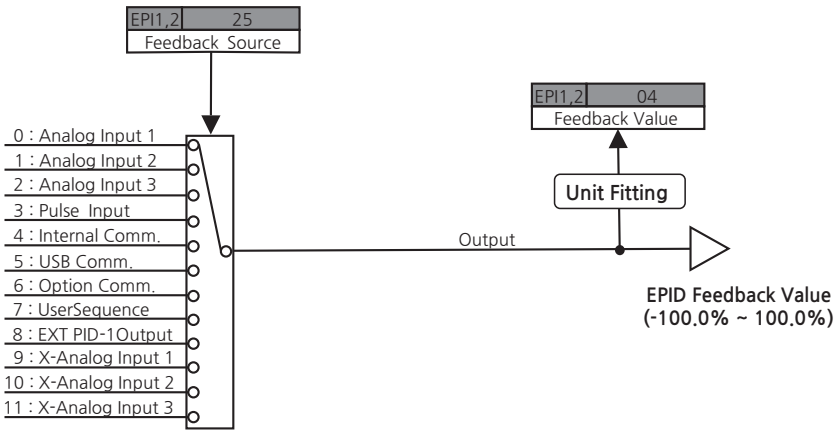
<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>EPI1, EPI2-90 Unit Select</td><td>Sets the unit of the control variable.
<table>
<tr><td>0</td><td>CUST</td><td>11</td><td>Hz</td><td>22</td><td>m³/h</td><td>33</td><td>f³/s</td></tr>
<tr><td>1</td><td>%</td><td>12</td><td>rpm</td><td>23</td><td>l/s</td><td>34</td><td>f³/m</td></tr>
<tr><td>2</td><td>PSI</td><td>13</td><td>V</td><td>24</td><td>l/m</td><td>35</td><td>f³/h</td></tr>
<tr><td>3</td><td>°F</td><td>14</td><td>A</td><td>25</td><td>l/h</td><td>36</td><td>lb/s</td></tr>
<tr><td>4</td><td>°C</td><td>15</td><td>kW</td><td>26</td><td>kg/s</td><td>37</td><td>lb/m</td></tr>
<tr><td>5</td><td>inWC</td><td>16</td><td>HP</td><td>27</td><td>kg/m</td><td>38</td><td>lb/h</td></tr>
<tr><td>6</td><td>inM</td><td>17</td><td>mpm</td><td>28</td><td>kg/h</td><td>39</td><td>ppm</td></tr>
<tr><td>7</td><td>Bar</td><td>18</td><td>ft</td><td>29</td><td>gl/s</td><td>40</td><td>pps</td></tr>
<tr><td>8</td><td>mBar</td><td>19</td><td>m/s</td><td>30</td><td>gl/m</td><td></td><td></td></tr>
<tr><td>9</td><td>Pa</td><td>20</td><td>m³/s</td><td>31</td><td>gl/h</td><td></td><td></td></tr>
<tr><td>10</td><td>kPa</td><td>21</td><td>m³/m</td><td>32</td><td>ft/s</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>EPI1, EPI2-91 Unit Scale</td><td>Adjusts the size according to the unit selected at EPI1 and EPI2-90.</td></tr>
<tr><td>EPI1, EPI2-92 Unit at 0 %
EPI1, EPI2-93 Unit at100%</td><td>Sets the unit at 0% and 100% as the minimum and maximum values for the units set at EPI1 and EPI2-90.</td></tr>
<tr><td>DIx Define (DIx: DI1~DI8)</td><td>Sets it to 51 (EPID1 Run) or 53 (EPID2 Run) and executes relative EPID operation when the set terminal block is input.</td></tr>
</table>

7.8.2 EPID Command Block



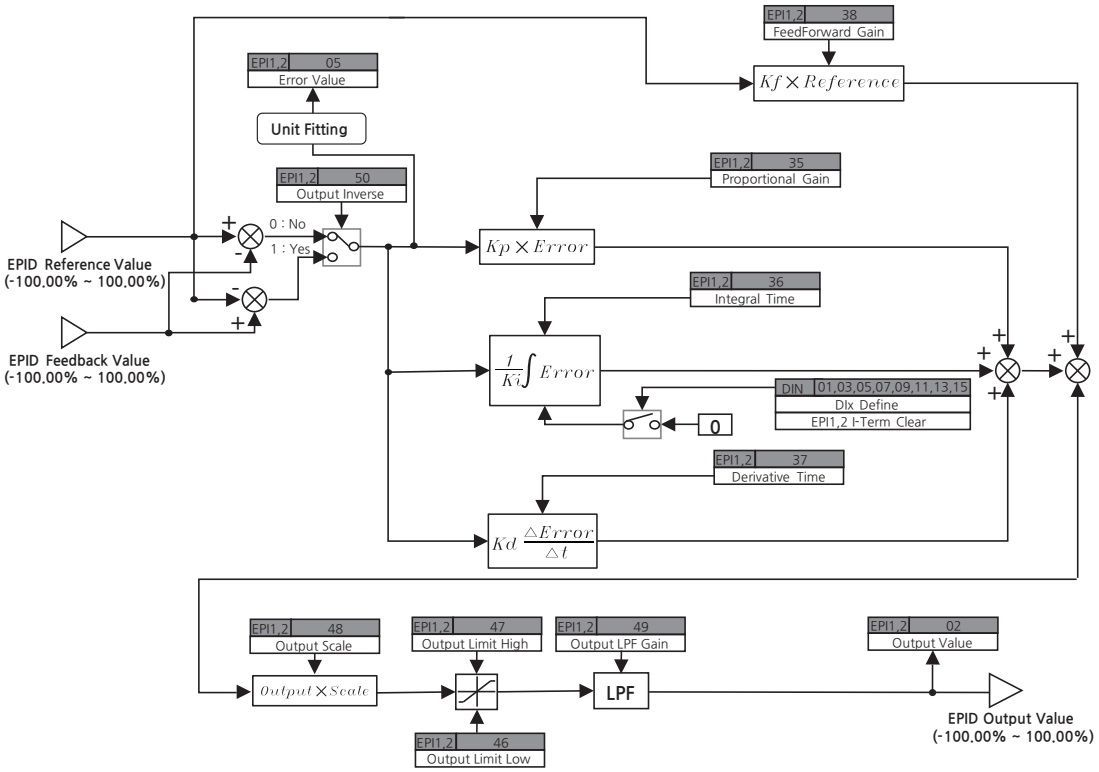
[Image 21. EPID Command Block]

7.8.3 EPID Feedback



[Image 22. EPID Feedback Block]

7.8.4 EPID Output



[Image 23. EPID Output Block]

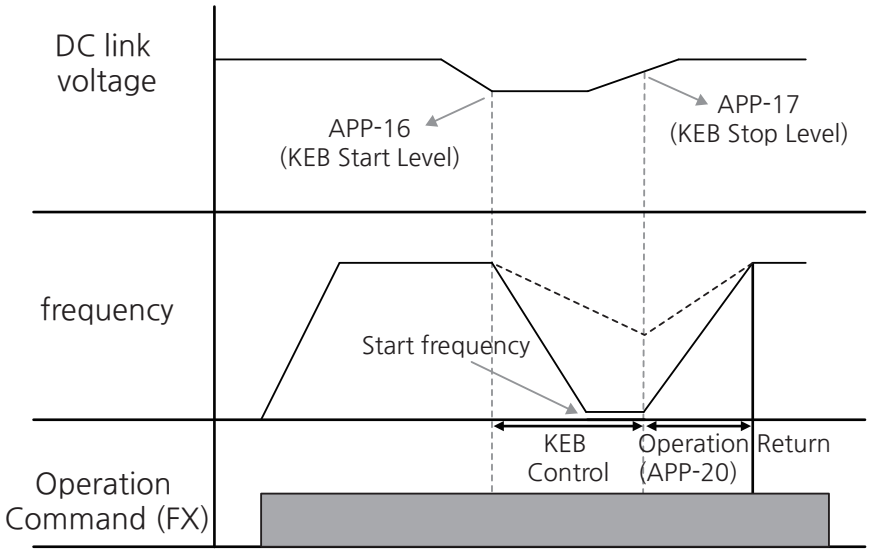
7.9 Kinetic Energy Buffering Operation

When there is interruption of input power, the inverter's DC link voltage will decrease, causing a low voltage trip and blocking output. Kinetic energy buffering operation maintains DC link voltage with regenerative energy from the motor during the interruption. This extends the time taken until a low voltage trip occurs, after an instantaneous power interruption.

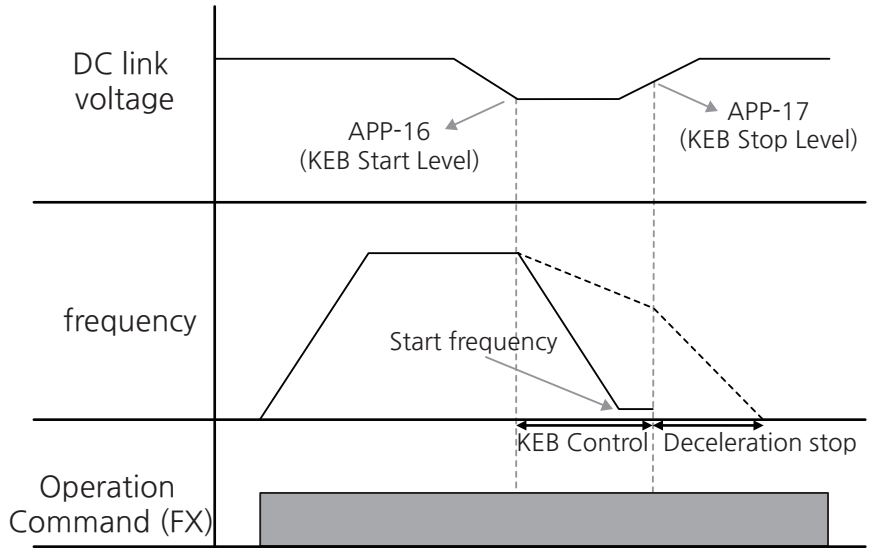
Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	15	KEB Mode	1	KEB Ride-Through	0~2	0	-
	16	KEB Start Level	80.0		70.0~ (KEB Stop Level - 5.0)	80.0	%
	17	KEB Stop Level	90.0		(KEB Start Level + 5.0)~ 95.0	90.0	%
	18	KEB Control Gain	100.0		0.0~1000.0	100.0	%
	19	KEB Damping Gain	100		0~300	100	%
	20	KEB Acc Time	10.00		0.00~60.00	10.00	sec
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3	35	KEB Operating	-	24, 14, 0	-

KEB Operation-Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>APP-15
KEB Mode</td><td colspan="3">Selects a KEB operation to use when the input power is interrupted. If 1 or 2 is selected, it will control the inverter's output frequency and charge the DC link (inverter's DC part) with regenerative energy from the motor.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>Do not use the KEB operation. It will execute general operation until a low voltage trip occurs, then will enter a free run.</td></tr>
<tr><td>1</td><td>KEB Ride-Through</td><td>Charges the DC link with regenerative energy when the input power is interrupted, so that low voltage trip will not occur. If input power is recovered before a low voltage trip, it will return to normal operation with the command frequency from the KEB operation. The time set at APP-20 will be applied as the operating frequency acceleration time when restoring to normal operation. The KEB operation will not be executed when there is a low voltage trip.</td></tr>
<tr><td>2</td><td>KEB Safety Stop</td><td>It will charge the DC link with regenerative energy when the input power is interrupted, so that a low voltage trip will not occur. If input power is recovered before a low voltage trip, it will change to a deceleration stop operation from KEB operation. The time set at PRT-1 (Trip Dec Time) will be applied as the operating frequency deceleration time during the deceleration stop operation.</td></tr>
</table></td></tr>
<tr><td>APP-16
KEB Start Level,
APP-17
KEB Stop Level</td><td colspan="3">Sets the start and stop times of the kinetic energy buffering operation. When stopping the inverter, the APP-17 KEB stop level and APP-16 KEB start level should be set to have more than a 5% difference with 100% of the DC link voltage.</td></tr>
<tr><td>APP-
18 KEB
Control
Gain</td><td colspan="3">Sets the controller P gains to maintain the voltage of the DC power unit during KEB operation. Change the setting value for operation when a low voltage trip occurs right after a power interruption.</td></tr>
<tr><td>APP-
19 KEB
Damping
Gain</td><td colspan="3">Sets control gains to reduce voltage changes in DC unit at the start of KEB operation. If a low voltage trip right after a power interruption is not resolved by increasing P gains, increase the damping gains and operate.</td></tr>
<tr><td>APP-20
KEB Acc
Time</td><td colspan="3">Sets the acceleration time for the operating frequency when returning from kinetic energy buffering operation to normal operation as the input power is recovered when selecting 1 (KEB Ride-Through) mode at APP-15. However, setting 0.00 sec applies acceleration time for general operation.</td></tr>
</table>



[Image 24. An Example of KEB Ride Through Operation]



[Image 25. An Example of KEB Safety Stop Operation]

Note

There may be performance differences according to load status (capacity, inertia, and etc.) for KEB operation. You can adjust the gain related to KEB operation for enhancement.

- When a low voltage trip occurs right after an instantaneous power interruption, increase the setting values of APP-18 (KEB Control Gain) if the load inertia is small or the load is big.
- If a low voltage trip occurs right after even when you increase APP-18 (KEB Control Gain) setting values, increase the setting values of APP-16 (KEB Start Level) or APP-19 (KEB Damping Gain).
- Reduce the setting values of APP-18 (KEB Control Gain) and APP-19 (KEB Damping Gain) when there is motor vibration or big changes in the current or DC link voltage.

ⓘ Caution

- Depending on the duration of an instantaneous power interruption and the load inertia, a low voltage trip may occur when decelerating even during a KEB operation. Motors may vibrate during KEB operation for loads other than variable torque load (for example, fan or pump loads).
- When there is a big change in DC link voltage due to an imbalance or phase of input power, KEB operation may not run stably and may cause severe changes in the DC link voltage, which may lead to an overvoltage trip (OVT).
- Starting under the minimum input power voltage specification (200 V Type: 200V, 400V Type: 380 V) may cause a low voltage trip simultaneously with KEB operation.

7.10 Current Hunting Prevention (Anti-Hunting Regulator)

Current hunting (current distortion or oscillation) occurs during V/F control due to mechanical resonance, which may have a negative impact on the load system. Current hunting prevention (anti-hunting regulator) is a function used to prevent such issues.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
V/F1, V/F2	71	AHR Enable	1	Yes	0~1	1	-
	72	AHR P-Gain	50		0~1000	50	%
	73	AHR Limit	2		0~100	2	%

Current Hunting Prevention-Setting Details

Code and Functions	Description
V/F1, V/F2-71 AHR Enable	Selects use of current hunting prevention operation. Item: 0 – No – Do not use current hunting prevention. Item: 1 – Yes – Use current hunting prevention.
V/F1, V/F2-72 AHR P-Gain	The bigger it is set, the faster the response characteristics are, allowing better execution of current hunting prevention, but setting it too high may destabilize the current.
V/F1, V/F2-73 AHR Limit	Limits output of anti-hunting regulator with reference % value of phase voltage.

7.11 Fire Mode

It protects other systems by allowing continuous operation of the inverter during emergencies, including fire from the inhalation fan or exhaust fan and excluding hardware malfunction or serious trips. It continuously operates at a set frequency in Fire Mode.

When a multifunction terminal set as 48 (Fire Mode Fwd) or 49 (Fire Mode Rev) is turned on among multifunction terminals DI1-DI8, the inverter ignores all commands and operates at the direction and frequency of the relative terminal block. Trips excluding certain ones (Arm Short, Over Current, Over Voltage, Ground Fault, and Main System Error) will be ignored and continuous operation will be executed.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	90	Fire Mode Password	9251		0000 ~ 9999	9251	-
	91	Fire Mode Select	0	None	0~2	0	-
			1	Fire Mode			
			2	Test Mode			
	93	FireMode Frequency	60.00		0.00 ~ Max Frequency [37]	60.00	Hz
	94	FireMode Speed	1800		0 ~ Maximum Speed [38]	1800	rpm
	95	Fire Mode Count	0		-	0	-
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	48	Fire Mode Fwd	-	1, 2, 4, 5, 10, 11, 12, 9	-
			49	Fire Mode Rev			
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	49	Fire Mode	-	24, 14, 0	-

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

[37] DRV-20(Max Frequency)
[38] DRV-21(Maximum Speed)

Fire Mode-Setting Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PRT-90
Fire Mode Password</td><td>Set a password to select Fire Mode.
The initial password for Fire Mode is 9251.
By entering the password, you can change the setting value of Fire Mode Select at PRT-91 once.</td></tr>
<tr><td>PRT-91
Fire Mode Select</td><td>Sets Fire Mode.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>Do not use Fire Mode.</td></tr>
<tr><td>1</td><td>Fire Mode</td><td>A normal Fire Mode.</td></tr>
<tr><td>2</td><td>Test Mode</td><td>A mode for testing the Fire Mode.
It processes trips when occurred during Fire Mode operation and the operation count (PRT-95) will not increase.</td></tr>
</table></td></tr>
<tr><td>PRT-93
Fire Mode Frequency,
PRT-94
Fire Mode Speed</td><td>Fire Mode operation is run based on the set speed commands in these items.</td></tr>
<tr><td>PRT-95
Fire Mode Count</td><td>Shows the number of Fire Mode operations. The count only increases when the setting value of PRT-91 is 1 (Fire Mode).</td></tr>
</table>

⚠ Caution

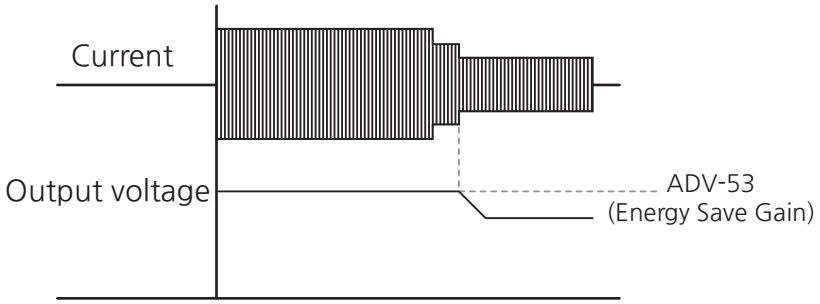
- The product is not guaranteed after the Fire Mode has worked. However, trips during Test Mode operation do not enable PRT-05 (Reset Restart) and are processed as trips with no increase in the PRT-95 (Fire Mode Count) value.
- When you stop operation after Fire Mode operation, the inverter will stop.

7.12 Energy Saving Operation

7.12.1 Manual Energy Saving Operation

If the output current of the inverter is small, the output voltage is reduced to as much as set at ADV-53 (Energy Save Gain). The voltage before the energy saving operation is the base value of the percentage (%). The output voltage reduction rate may have errors when there is a change in the DC link voltage with the motor rated voltage set as 0. Manual energy saving operation does not work during inverter acceleration or deceleration.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
ADV	52	Energy Save Mode	1	Manual	-	0	-
	53	Energy Save Gain	0		0~30	0	%



[Image 26. Manual Energy Saving Operation]

7.12.2 Automatic Energy Saving Operation

The level of energy saving will automatically be calculated based on the rated motor current (MOT1 and MOT2-26 Rated Current) and the no-load current (MOT1, and MOT2-35 No-load Current) and output voltage will be adjusted.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
ADV	52	Energy Save Mode	2	Auto	-	0	-

⚠ Caution

Note that the actual working time may be longer than the preset acceleration and deceleration times due to the time required to return to the normal operation from an energy saving operation when accelerating or decelerating from a change in the operating frequency or a stop command during an energy saving operation.

7.13 Speed Search Operation

This operation is used to prevent fault trips that can occur while the inverter outputs voltage when the motor is free-running with the inverter output voltage disconnected. Because this feature estimates the rotational speed of the motor approximately based on the inverter output current, it does not detect the exact speed.

The speed search operation is available for a general acceleration operation, a start operation when powering on, a restart operation after a power interruption, an auto-restart operation after a trip, and an emergency stop operation.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	05	SpeedSearch Mode	0	Current Detect	0~1	0	-
	06	SS Block Time	1.0		0.0~60.0	1.0	sec
	07	SS Sup-Current	90		0~200	90	%
	09	SS Bandwidth	100		1~300	100	%
	10	PM SS Curr Peak	15		10~100	15	%
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	19	Speed Search	-	24, 14 ,0	-

Speed Search Operation Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>APP-05 Speed Search Mode</td><td colspan="3">Selects a speed search mode.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Current Detect</td><td>Limits the current that flows in the motor and starts.</td></tr>
<tr><td>1</td><td>Speed Estimate</td><td>Detects the rotational speed of the motor and starts.</td></tr>
</table></td></tr>
<tr><td>APP-06 SS Block Time</td><td colspan="3">This parameter prevents speed search operation from working after the operation command is input, as it may cause an overcurrent trip from counter-electromotive force, depending on the motor capacity. Speed search will start when the time set to the SS Block Time or the free-run restart prevention time expires, whichever is later.</td></tr>
<tr><td>APP-07 SS Sup-Current</td><td colspan="3">Adjusts the size of current during speed search based on rated current (MOT1 and MOT2-26) of the motor. Change the size of SS Sup-Current to a smaller value if the load during speed search operation is too small.</td></tr>
</table>

Code and Functions	Description
APP-09 SS Bandwidth	Adjusts the gain for a speed search.
APP-10 SS PM SS Curr Peak	This parameter adjusts the size of current during speed search. Accuracy may be decreased due to noise if the value is too small, while a speed search may be difficult at a high speed if the value is too big.

⚠ Caution

Set BAS-01 (Start Mode) to 2 (Speed Search) and enable a speed search operation during acceleration to start the operation smoothly at free run. If the speed search function is not set, an overcurrent trip or overload trip may occur.

Note

For synchronous motor operation, rotational speed of the motor is detected before starting regardless of APP-05 (SpeedSearch Mode).

7.13.1 General Acceleration Operation

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
BAS	01	Start Mode	2	Speed Search	-	0	-
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	19	Speed Search	-	24, 14, 0	-

Speed Search During General Acceleration Operation Setting Details

Code and Functions	Description
BAS-01 Start Mode	Sets the value as 2 (Speed Search). It accelerates to speed search operation upon operation command input at the inverter. When the inverter is rotating by the load environment, a fault trip may occur if the operation command is input for the inverter to output voltage. The speed search function prevents such fault trips in such cases and enables acceleration.

7.13.2 Start Operation While Powering On

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
ADV	02	Power-on Run	2	Speed Search	-	0	-
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	19	Speed Search	-	24, 14, 0	-

Speed Search During Start Operation While Powering On-Setting Details

Code and Functions	Description
ADV-02 Power-on Run	Sets the value as 2 (Speed Search). If inverter input power is supplied while the inverter operation command is on, the speed search operation will accelerate the motor up to the target frequency.

7.13.3 Restart Operation After Power Interruption

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	03	Intrp Restart	2	Speed Search	-	0	-
	04	Intrp Time	60.0		10.0~60.0	60.0	sec
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	19	Speed Search	0~49	24, 14, 0	-

Speed Search During Restart Operation After Power Interruption Setting Details

Code and Functions	Description
PRT-03 Intrp Restart, PRT-04 Intrp Time	Sets the value for operation during an interruption (PRT-03) as 2 (Speed Search). If the trip is lifted within the interruption decision time (PRT-04) when there is a low voltage trip with the inverter operation command input, the speed search operation will accelerate the motor to the target frequency.

7.13.4 Auto Restart Operation After A Trip

Refer to **7.14.2 Auto Restart for Speed Search**.

7.13.5 Emergency Operation

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	85	BX Restart Mode	2	Speed Search	-	1	-
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	19	Speed Search	-	24, 14, 0	-

Speed Search During Emergency Operation Setting Details

Code and Functions	Description
PRT-85 BX Restart Mode	Sets the value as 2 (Speed Search). If an emergency stop is lifted while the inverter operation command is on, the speed search operation will accelerate the motor to the target frequency.

7.14 Auto Restart Setting

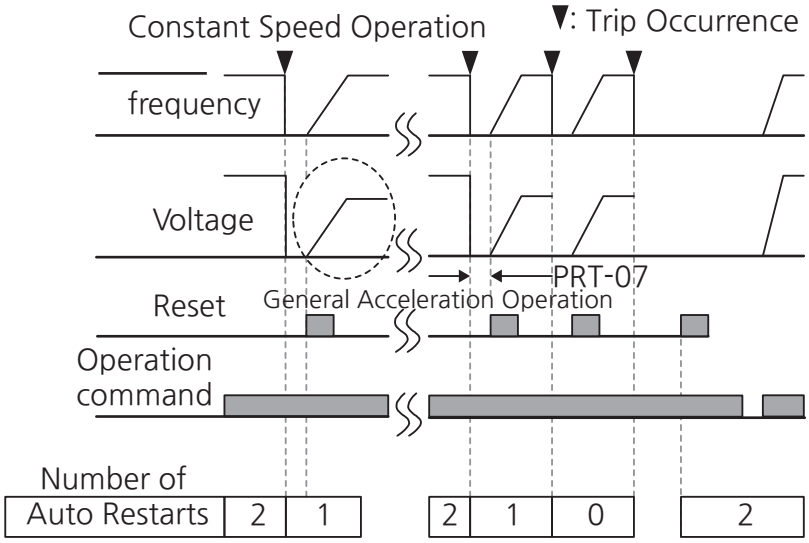
Used to restart the inverter automatically based on the setting values when a trip is lifted after the operation stops from an inverter abnormality.

7.14.1 Auto Restart for General Acceleration

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	05	Reset Restart	1	Start Mode	-	0	-
	06	Retry Number	1		1~10	1	-
	07	Retry Delay	1.0		0.0~60.0	1.0	sec
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	33	Reset Restart F Trip	-	24, 14, 0	-

Auto Restart for General Acceleration Setting Details

Code and Functions	Description
PRT-05 Reset Restart, PRT-06 Retry Number, PRT-07 Retry Delay	When PRT-05 is set as 1 (Start Mode), it will accelerate as general acceleration and operate. Auto restart count is set at PRT-06. If a fault trip occurs during operation, the inverter will automatically restart after the time set at PRT-07. At each restart, the internal S/W of the inverter will decrease the number of attempts by 1. When the retry count reaches 0 after the number of trips set, the inverter will no longer attempt an auto restart. After an auto restart, if a trip does not occur again within 60 seconds, the inverter will increase the auto restart count that was previously reduced by the internal S/W. The maximum number of increases is limited by the set auto restart count.



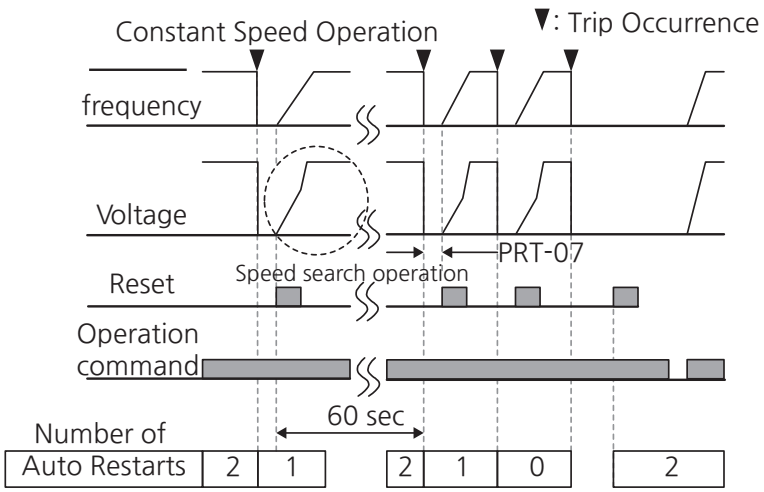
[Image 27. An Example of Operation When Auto Restart Count for General Acceleration Is Set as 2]

7.14.2 Auto Restart for Speed Search

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	05	Reset Restart	2	Speed Search	-	0	-
	06	Retry Number	1		1~10	1	-
	07	Retry Delay	1.0		0.0~60.0	1.0	sec
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	33	Reset Restart F Trip	0~49	24, 14, 0	-

Auto Restart for Speed Search Setting Details

Code and Functions	Description
PRT-05 Reset Restart, PRT-06 Retry Number, PRT-07 Retry Delay	When PRT-05 is set as 2 (Speed Search), it will accelerate as a speed search and operate. Auto restart count is set at PRT-06. If a fault trip occurs during operation, the inverter will automatically restart after the time set at PRT-07. At each restart, the internal S/W of the inverter will decrease the number of attempts by 1. When the retry count reaches 0 after the number of trips set, the inverter will no longer attempt an auto restart. After an auto restart, if a trip does not occur again within 60 seconds, the inverter will increase the auto restart count that was previously reduced by the internal S/W. The maximum number of increases is limited by the set auto restart count.



[Image 28. An Example of Operation When Auto Restart Count for Speed Search Is Set as 2]

ⓘ Caution

- If PRT-05 (Reset Restart) is set as anything other than 0 (None), note that it will automatically restart when a trip is lifted, rotating the motor.
- Note that when auto-restart is selected while the motor is rotating when PRT-05 (Reset Restart) is set as 1 (Start Mode) and the trip is lifted, it may abruptly decelerate the motor before operating as a general acceleration or cause overvoltage trip or overcurrent trip.

Note

If the inverter stops due to a low voltage trip, emergency stop (BX), inverter overheat (Drive Over Heat), or hardware abnormalities (HW Diag), auto restart is not activated.

7.15 Operational Noise Settings (Change of Carrier Frequency Settings)

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	26	PWM* Mode	0	Normal PWM	0~1	1	-
			1	LowLeakage PWM			
	27	Carrier Frequency	2		1~15	5	kHz

* PWM: Pulse width modulation

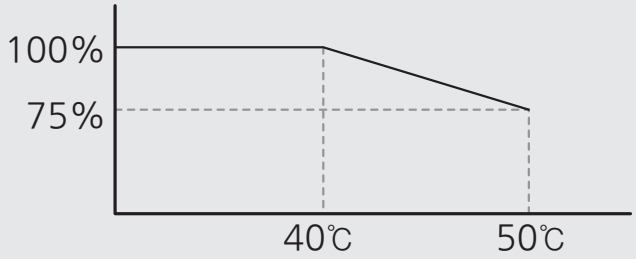
Operational Noise Setting Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>DRV-26 PWM Mode</td><td>Heat loss and leakage current from the inverter can be reduced depending on the load factor. Selecting 1 (LowLeakage PWM) will reduce heat loss and leakage current compared to selecting 0 (Normal PWM); however, noise from the motor will increase. Low leakage PWM uses two-phase PWM, minimizing performance degradation while reducing switching loss of about 1/3.
<table>
<tr><th rowspan="2">Items</th><th colspan="2">Carrier frequency</th></tr>
<tr><th>1kHz</th><th>15kHz</th></tr>
<tr><th></th><th>Low Leakage PWM</th><th>Normal PWM</th></tr>
<tr><td>Operational noise of motor</td><td>↑</td><td>↓</td></tr>
<tr><td>Heat occurrence</td><td>↓</td><td>↑</td></tr>
<tr><td>Noise occurrence</td><td>↓</td><td>↑</td></tr>
<tr><td>Leakage current</td><td>↓</td><td>↑</td></tr>
</table></td></tr>
<tr><td>DRV-27 Carrier Frequency</td><td>Selects operational noise of the motor by changing carrier frequency settings. Power transistors (IGBT) in the inverter generate and supply high-frequency switching voltage to the motor. The switching speed during this process is called the carrier frequency. If the carrier frequency is set high, it will reduce operational noise from the motor, and if the carrier frequency is set low, it will increase operational noise from the motor.</td></tr>
</table>

Note

S300 Series Inverter Derating Standard

- S300 series inverters are designed to respond to two types of load factors: Heavy loading (heavy duty) and light loading (normal duty). The overload rate represents an acceptable load amount that exceeds the rated load, and is expressed in a ratio of excess to the rated load. The overload withstand of the S300 series inverters is 150%/1 min for heavy loading and 120%/1 min for light loading.
  The current rating differs from the load rating, as it also has an ambient temperature limit.
- The following image shows the limit of the rated current for ambient temperature under a light load operation.



[Image 29. Rated Current Limit per Ambient Temperature]

- The following table shows the maximum value for the carrier frequency that guarantees 100% rated current. For more information about derating standards, refer to **16.7.1 Continuous Rated Current Derating**.

Maximum carrier frequency that guarantees 100% rated current by inverter capacity

Inverter capacity		Normal load Low Leakage/ Normal	Heavy load Low Leakage/ Normal
200 V class	0.4~22kW	3kHz/2kHz	8kHz/5kHz
	30~45kW	3kHz/2kHz	5kHz/3kHz
	55~75kW	2kHz	4kHz
400 V class	0.4~37kW	3kHz/2kHz	8kHz/5kHz
	45~75kW	3kHz/2kHz	5kHz/3kHz
	90~220kW	2kHz	3kHz/2kHz

7.16 Second Motor Operation

The second motor operation is used when a single inverter switch-operates two motors. The parameters for the second motor are configurable in the second motor operation function. The second motor is operated when a multifunction input terminal defined for the second functions is turned on.

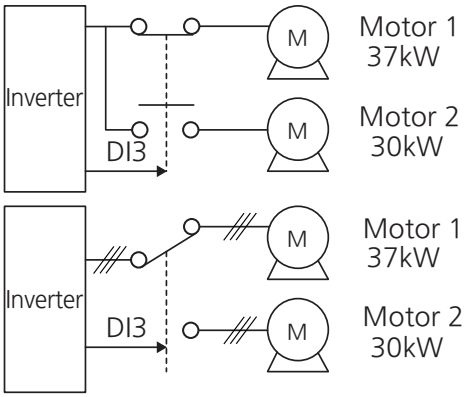
Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	27	2nd Motor	-	1, 2, 4, 5, 10, 11, 12, 9	-

Second Motor Operation-Setting Details

Code and Functions	Description
DIN-01~15 DIx Define (DIx: DI1~DI8)	MOT2 (second motor) group, V/F2 (second V/F control) group, and VEC2 (second vector control) group will be displayed when you set a multifunction terminal as 27 (2nd Motor). A signal input at the multifunction terminal set to second motor will operate the motor according to the code settings listed below. However, when the inverter is in operation, signal input at the multifunction terminal does not induce operating with parameters set at MOT2 (second motor) group, V/F2 (second V/F control) group, and VEC2 (second vector control) group.

Table 4. An Example of Second Motor Operation

An Example of Second Motor Operation
Set as follows to switch-operate to 30 kW in DI3 terminal with a 37 kW motor using second motor operation:



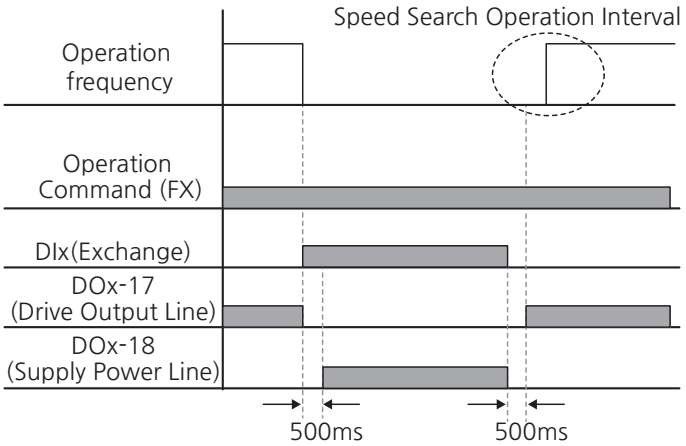
[Image 30. Second Motor Operation Settings]

7.17 Switching Operation to Commercial Power

Power switching operation is used to switch motor operation from the inverter to commercial power or the other way around.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	21	Exchange	-	1, 2, 4, 5, 10, 11, 12, 9	-
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	17	Drive Output Line	-	24, 14, 0	-
			18	Supply Power Line			

Supply Power Transition Setting Details

Code and Functions	Description
DIN-01~15 DIx Define (DIx: DI1~DI8)	To switch input power for the motor from inverter output to commercial power, select a terminal to use and set the code value to 21 (Exchange). Power will be switched when the selected terminal is on. To switch the input power back to the inverter output terminal from commercial power, turn off the set terminal.
OUT-50~54 DOx Define (DOx: DO1~DO3)	This function sets the multifunction output terminal to no. 17, inverter output line (Drive Output Line) and no. 18, supply power line. The operation sequence is as follows:  **[Image 31. An Example of Switching Operation to Commercial Power]**

7.18 Input Power Frequency Settings and Voltage Monitoring

The inverter input power voltage you monitor can be displayed in a line-to-line RMS value.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	30	Ref AC Input Volt	200 V class	-	200~240	-	V
			400 V class	-	380~480	-	
	31	60/50 Hz Select	0	60Hz	0~1	0	-
			1	50Hz			

Input Power Frequency Settings and Voltage Monitoring Setting Details

Code and Functions	Description
DRV-30 Ref AC Input Volt	The inverter input power voltage you monitor is displayed in a line-to-line RMS value. The value is renewed only when the inverter is at a stop without a trip and the values of input power voltage monitoring are within the set range. Base voltage for low voltage trip occurrence/lift and KEB start/end automatically change based on this voltage.
DRV-31 60/50 Hz Select	Select the frequency for inverter input power. If the frequency changes from 60 Hz to 50 Hz, all the frequencies set above 60 Hz (or rpm) and related items (maximum frequency, base frequency, and etc.) will change to 50 Hz as well. Likewise, changing the input power frequency setting from 50 Hz to 60Hz will change all related function settings from 50 Hz to 60 Hz.

7.19 Second Operation Mode Settings

Apply two types of operation modes and switch between them as required. Set the second command mode aside from the main command mode for operation commands and frequency settings with the multifunction input terminal. Mode switching can be used to stop remote control, to switch operation mode to operate via local panel, or to operate the inverter from another remote control room during a remote operation using a communication option.

Select one of the Define codes of DI1-DI8 of terminal input group (DIN) as 20 (2nd Source).

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	10	1st Command Source	1	Fx/Rx-1	0~7	1	-
	11	1st Freq Ref Src	0	Keypad	0~12	0	-
	12	1st Torque Src	0	Keypad	0~11	0	-
	40	2nd Command Src	1	Fx/Rx-1	0~7	1	-
	41	2nd Freq Ref Src	0	Keypad	0~12	0	-
	42	2nd Torque Src	0	Keypad	0~11	0	-
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	20	2nd Source	0~87	1, 2, 4, 5, 10, 11, 12, 9	-

Second Operation Mode Setting Details

Code and Functions	Description
DRV-40 2nd Command Src, DRV-41 2nd Freq Ref Src, DRV-43 Acc/ DecTimeSrc	If signals are provided to the multifunction terminal set as the second command source (2nd Source), the operation can be performed using the set values at DRV-40-42 instead of ones at DRV-10-12. You cannot change to the second operation mode while operating in the first operation mode.

Caution

- When you set the multifunction input terminal to second command source (2nd Source) and turn on the signal, operation status will change, as all the frequency settings and operation commands change to the second commands. Therefore, before inputting functions to the multifunction terminal, ensure that the second commands are correctly set. Note that if deceleration time is too short or inertia of the load is too high, an overvoltage fault trip may occur.
- Depending on the settings for the operation commands, the inverter may stop when you switch the command modes during operation.

7.20 Regeneration Avoidance

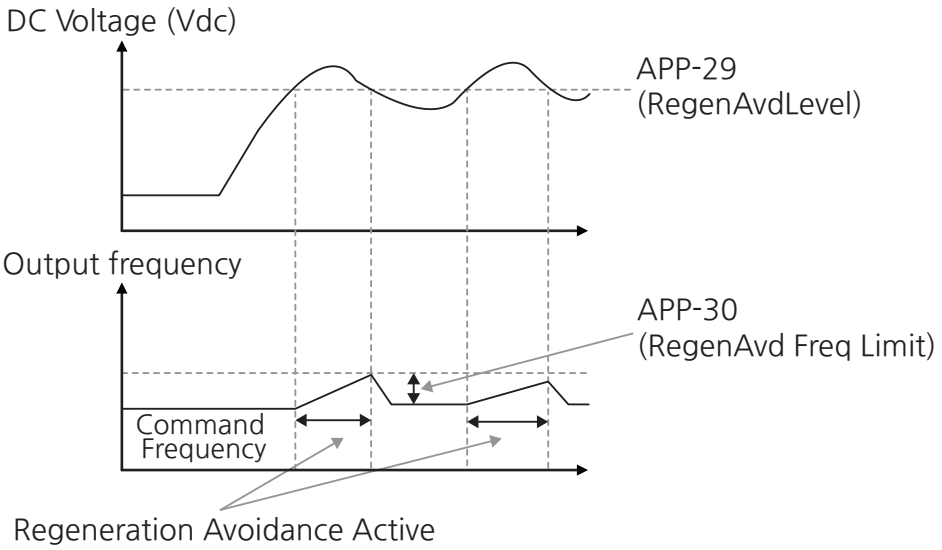
Regeneration avoidance is used during temporary regenerative operations to avoid braking. If a motor regenerates during inverter operation, the operation speed will automatically go up to prevent regeneration zone.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	25	RegenAvd Enable	1	Yes	-	1	-
	29	RegenAvd Level	200 V class	350	300~400	350	V
			400 V class	700	600~800	700	
	30	RegenAvd FreqLimit	10.00		0.00~10.00	10.00	Hz
	31	RegenAvd Spd Limit	300		0~300	300	rpm
	32	RegenAvd Gain	100		0~200	100	%
	33	RegenAvd FF Gain	100		0~200	100	%

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Regeneration Avoidance Setting Details

Code and Functions	Description
APP-25 RegenAvd Sel	Frequent occurrence of regenerative voltage during motor operation at a constant speed may force excessive work on the brake unit, which may damage the brake or shorten its life. To prevent this situation, select this to suppress the DC link voltage and disable operation of the brake unit.
APP-29 RegenAvd Level	Sets the brake operation avoidance level voltage when the DC link voltage goes up due to regenerative voltage.
APP-30 RegenAvd Freq Limit, APP-31 RegenAvd Spd Limit	Sets the width for the frequency (speed) that is changeable compared to the actual operating frequency when avoiding regeneration zone.
APP-32 RegenAvd Gain	Sets the gain for the DC link voltage regulator to avoid regeneration zone.
APP-33 RegenAvd FF-Gain	Sets the ratio that adds preset target amount to the controller output. Adjusting this value leads to a faster response.



[Image 32. An Example of Regeneration Avoidance]

7.21 Load Speed

You can display load speed in monitor mode in the scale and unit of your choice.

The load speed is displayed with values to which MOT1, MOT2-96 (Load Speed Gain) and MOT1, MOT2-97 (Load Speed Scale) are applied in the unit of rpm or mpm, whichever is set at MOT1 and MOT2-98 (Load Speed Unit).

Refer to **12.2.3 Operation Status Monitor Settings** for how to set the load speed in monitor mode.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
MOT1, MOT2	96	Load Speed Gain	100.0		0.1~6000.0	100.0	%
	97	Load Speed Scale	0	x1	0~4	0	-
			1	x0.1			
			2	x0.01			
			3	x0.001			
			4	x0.0001			
	98	Load Speed Unit	0	rpm	0~1	0	-
			1	mpm			

7.22 Output Power Display

You can adjust the scale of the output power displayed in the monitor mode.

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
DRV	45	Trim Power %	100	70~130	100	%

Refer to **12.2.1 Item Change in Monitor Display Mode** and select 4 (Output Power) among monitor items. Then, increase the setting value appropriately if the output power displayed in the Smart Operator is smaller than expected. On the contrary, decrease the setting value appropriately if the output power displayed on the loader is bigger than expected.

Output power is displayed as a calculation of the voltage and current, and there may be errors in the output power if the power factor is low.

Refer to **4.2.4.2 Monitor mode type** for monitor mode types and **12.2.1 Item Change in Monitor Display Mode** for item change in monitor display mode.

7.23 Motor Pre-Heating

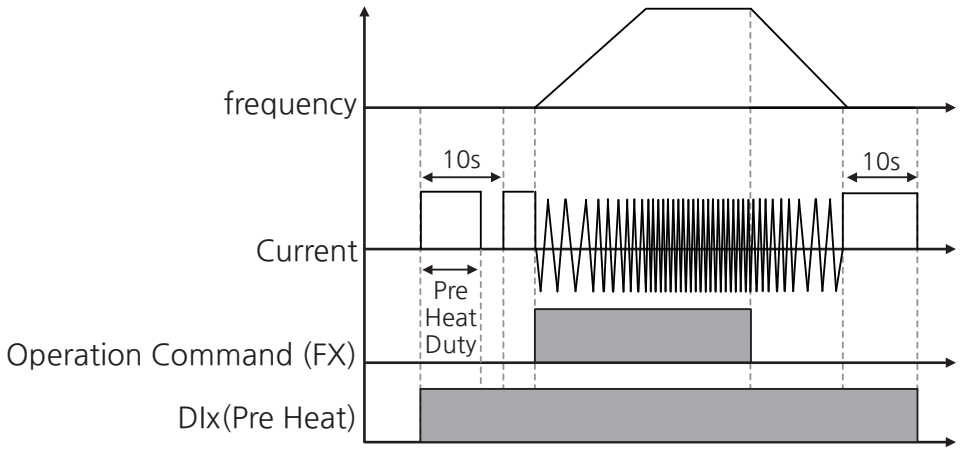
You can heat the motor or pump by supplying a constant current to prevent freezing when the motor or pump is at stop.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	40	Pre-Heat Level	20		1~100	20	%
	41	Pre-Heat Duty	30		1~100	30	%
	42	Pre-Heat Delay T	60.0		0.0~600.0	0.0	sec
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: D1~D8)	50	Pre Heat	-	1, 2, 4, 5, 10, 11, 12, 9	-

Motor Pre-Heating Setting Details

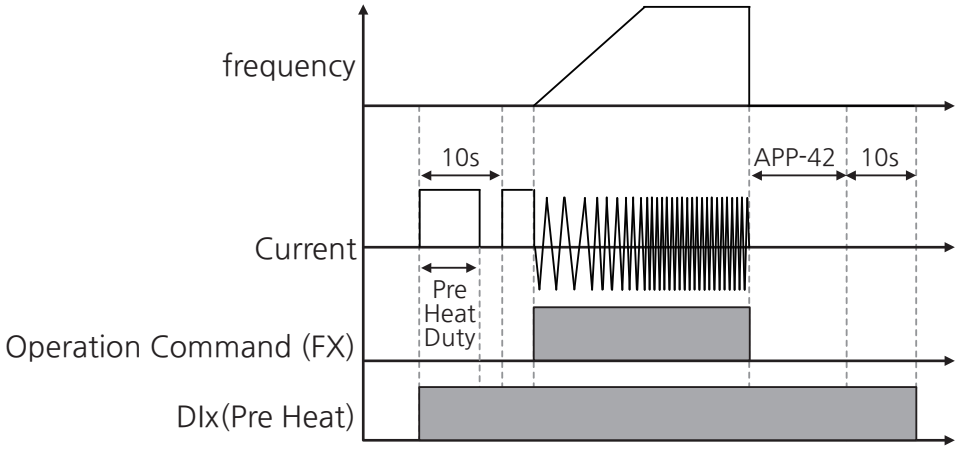
Code and Functions	Description
APP-40 Pre-Heat Level	Sets the injectable current for initial heating. The pre-heat current is set in % value compared to rated current of the motor.
APP-41 Pre-Heat Duty	Sets the duty (time) for current flow during 10 seconds of initial heating in a % value.
APP-42 Pre-Heat Delay T	Sets a certain delay time to prevent an overcurrent trip from DC input during free-run stop of the motor.
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	You need to set the code of the terminal you want (DI1-DI8 Define) as 50 (Pre Heat) for initial heating.

Motor pre-heating continuously work until there is an inverter command when the set multifunction input terminal is turned on. The inverter operation starts immediately upon inverter command input during motor pre-heating.



[Image 33. An Example of Operation Command Input During Motor Pre-Heating]

If a terminal block for initial heating is turned on after the inverter operation command is turned off, the inverter will stop operation and perform motor pre-heating.



[Image 34. An Example of Motor Pre-Heating When Free-Run Stops]

The above image is a waveform for APP-42 (Pre-Heat Delay T). When the inverter stop mode (BAS-02 Stop mode) is set to 2 (CoastStop(FreeRun)) and the pre-heat signal is input at the multifunction input terminal, motor pre-heating will be performed until there is an inverter operation command. When the inverter operation command is turned on, it will accelerate then operates at a constant speed according to the target frequency. When the operation command is turned off, the motor will free run for the time set at APP-42 (Pre-Heat Delay T) before starting motor pre-heating.

ⓘ Caution

- If the setting value for APP-40 (Pre Heat Level) exceeds the rated current of the inverter, the value will be limited to the rated current.
- Setting the APP-40 (Pre Heat Level) value too high or having a long DC current output time may overheat or damage the motor, causing an inverter overload trip. Reduce DC output current or time in such a case.

7.24 DC Injection by Terminal Block

This function secures flux by supplying DC current to the induction motor via an external sequence. It only works when the inverter is stopped. When an operation command is applied and the operation starts, DC injection will stop even if the terminal block is turned on. When the terminal block for DC injection is turned on when inverter operation command is already input, the inverter will stop its operation and start performing a DC injection.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
BAS	10	DC Injection Level [39]	50		1~100	50	%
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	28	DC Injection	-	1, 2, 4, 5, 10, 11, 12, 9	-

DC Injection Setting Details

Code and Functions	Description
BAS-10 DC Injection Level	Sets in % value compared to rated current of the motor.
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	You need to set the code of the terminal you want (DI1-DI8 Define) as 28 (DC Injection) to perform a DC injection.

Caution

- If the setting value for BAS-10 (DC Injection Level) exceeds the rated current of the inverter, the value is limited to the rated current.
- Setting the BAS-10 (DC Injection Level) value too high or having a long DC current output time may overheat or damage the motor, causing an inverter overload trip. Reduce DC output current or time in such a case.

[39] The percentage to the peak of rated current of the motor
e.g.) where the setting value is 60% and rated current of the motor is 30 Arms, the DC output is $30 \times \sqrt{2} \times 0.6 = 25.45$ A.

7.25 Brake Control

Used to control the On/Off operation of the load's electronic braking system.

If the DI1-DI8 Define code of the terminal block input group (DIN) is anything other than 55 (Brake Monitor Sel), the brake release delay time and brake engage delay time will be ignored.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	43	Brake Enable	0	No	0~1	0	-
			1	Yes			
ADV	40	Br Control State	0	DISABLE	0~4	0	-
			1	RELEASING			
			2	RELEASE			
			3	ENGAGING			
			4	ENGAGE			
	41	Br Release Load	50.00		0.00~180.00	50.00	%
	42	Br Load Req Delay	1.00		0.00~10.00	1.00	sec
	43	Br Release Delay	1.00		0.00~10.00	1.00	sec
	44	Br Release FwdFreq	1.00		0.00~Max Frequency [40]	1.00	Hz
	45	Br Release Fwd Spd	30		0~Maximum Speed [41]	30	rpm
	46	Br Release RevFreq	1.00		0.00~Max Frequency [40]	1.00	Hz
	47	Br Release Rev Spd	30		0~Maximum Speed [41]	30	rpm
	48	Br Engage Delay	1.00		0.00~10.00	1.00	sec
	49	Br Engage Freq	1.00		0.00~Max Frequency [40]	2.00	Hz
	50	Br Engage Speed	30		0~Maximum Speed [41]	60	rpm

[40] DRV-20(Max Frequency)
[41] DRV-21(Maximum Speed)

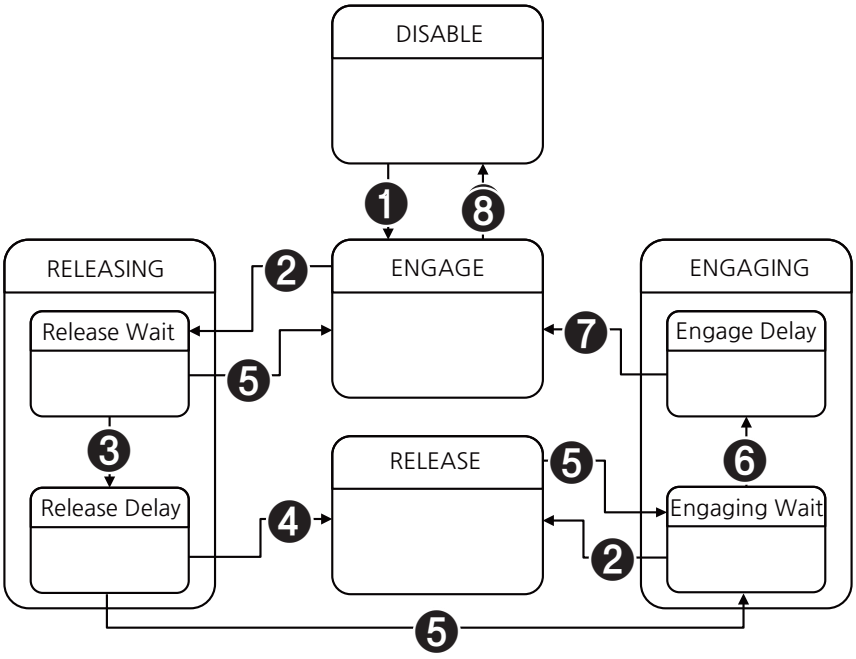
Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07, 09, 11, 13, 15	DI1~DI8 Define	55	Brake Monitor Sel	-	1, 2, 4, 5, 10, 11, 12, 9	-
OUT	50, 52, 54	DO1~DO3 Define	30	Brake Control	-	24, 14, 0	-

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Brake Control Setting Details

Code and Functions	Description
APP-43 Brake Enable	Set the code to 1 (Yes) to set the functions for brake control.
ADV-40 Br Control State	Displays the current status of brake control (DISABLE, RELEASING, RELEASE, ENGAGE, or ENGAGING).
ADV-41 Br Release Load, ADV- 42 Br Load Req Delay	When the output load exceeds brake release load (ADV-41 Br Release Load) after reaching the brake release frequency, the brake release signal will be output via the output relay set for the brake control or multifunction output terminal after brake release request delay (ADV-42 Br Load Req Delay) time.
ADV-43 Br Release Delay	Sets brake release delay time. It will accelerate after maintaining the frequency for a set amount of time.
ADV-44 Br Release FwdFreq, ADV-45 Br Release Fwd Spd, ADV-46 Br Release RevFreq, ADV-47 Br Release Rev Spd	If an operation command is input when the motor is stopped, the inverter will accelerate to the brake release frequency (ADV-44 Br Release FwdFreq, ADV-46 Br Release RevFreq) or rotation count (ADV-45 Br Release Fwd Spd, ADV-47 Br Release Rev Spd) depending on the direction; forward or reverse.
ADV-49 Br Engage Freq, ADV-50 Br Engage Speed	If a stop command is input during operation, the motor will decelerate. Once the output frequency reaches the brake engage frequency (ADV-49 Br Engage Freq) or rotation count (ADV-50 Br Engage Speed), the motor will stop deceleration and output a brake engage signal to a preset output terminal.
ADV-48 Br Engage Delay	Sets the brake engage delay time. The frequency will be maintained for a set amount of time before the output frequency becomes 0.

Brake Status Diagram



[Image 35. Brake Status Block]

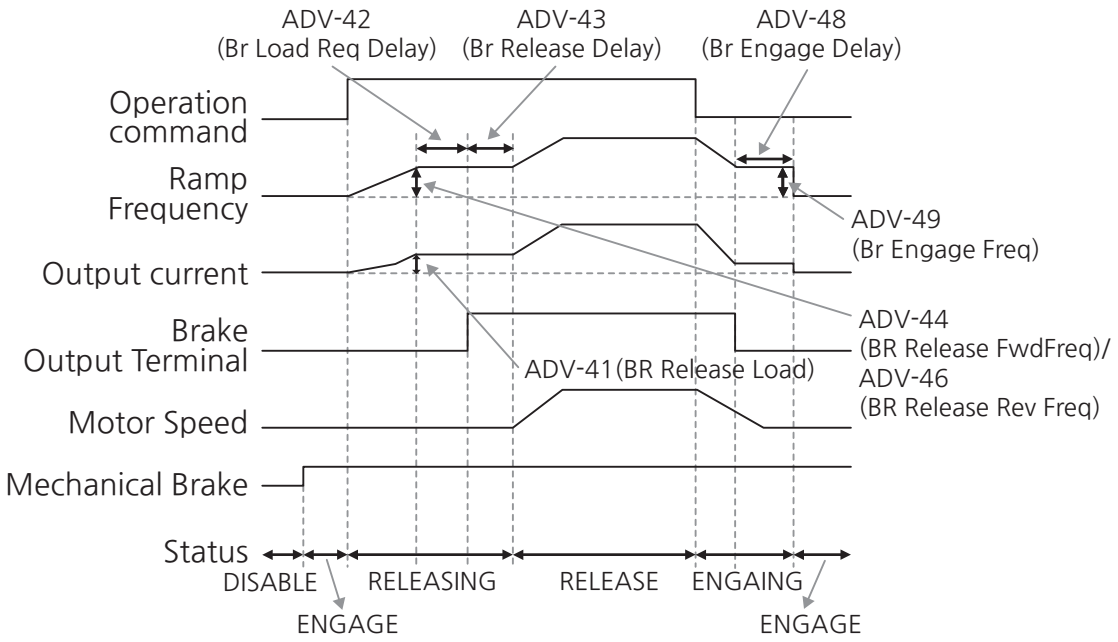
Table 5. Brake Operation Status

Status Name	Description
DISABLE	Impossible to control the brake.
RELEASING	
Releasing Wait	Enters when there is a brake release request. It makes the ramp frequency (frequency that went through acceleration and deceleration functions) to reach the frequency set at ADV-44 (Br Release FwdFreq) or ADV- 46 (Br Release RevFreq). If the motor load (output current or output torque) is bigger than the set value at ADV-41 (Br Release Load) during a certain time (ADV-42 Br Load Req Delay), the output of the terminal block where 30 (Brake Control) is set will turn on. A Br Release Invalid trip occurs if the motor load is not fulfilled after the time set at ADV-42 (Br Load Req Delay).
Release Delay	When you select 55 (Brake Monitor Sel) for the DI1-DI8 Define code of the terminal block input group (DIN), a Br Releasing Fail trip will occur if the input at that terminal block is not on (brake engaged) within the ADV-43 (Br Release Delay) time.
RELEASE	The brake will be released and the inverter will normally accelerate to the target frequency before operating at a constant speed.

Status Name	Description
ENGAGING	
Engaging Wait	Enters when there is a brake engage request. The inverter will decelerate to compare the ramp frequency with the frequency set at ADV-49 (Br Engage Freq). If the ramp frequency goes below the frequency set at ADV-49 Br Engage Freq) during deceleration, the output of the terminal block where 30 (Brake Control) is set will turn off.
Engage Delay	When you select 55 (Brake Monitor Sel) for the DI1-DI8 Define code of the terminal block input group (DIN), a Br Engaging Fail trip will occur if the terminal block input is not off (brake released) within the ADV-48 (Br Engage Delay) time.
ENGAGE	The brake will be engaged and the inverter will be stopped (no PWM output).

Table 6. Brake Status Change Criteria

No.	Description
❶	When you set App-43 (Brake Enable) as 1 (Yes).
❷	When there is an operation command input.
❸	When the motor load exceeds the setting value of ADV-41 (Br Release Load) within the time set at ADV-42 (Br Load Req Delay).
❹	When the time set at ADV-43 Br Release Delay) has passed under Release Delay.
❺	When there is a stop command input.
❻	When reaching the brake engage speed (ADV-49 Br Engage Freq, ADV-50 Br Engage Speed) while decelerating.
❼	When the time set at ADV-48 (Engage Delay) has passed after reaching the brake engage speed.
❽	When you set APP-43 (Brake Enable) as 0 (No).



[Image 36. An Example of Brake Control]

7.26 Position Control

Position control helps move to the target position in a preset speed pattern.

7.26.1 Installation, Wiring, and Operation Preparation

For position control, an encoder must be installed to figure out the position. Refer to the encoder option manual for its installation.

Prepare for position control in the following order:

1 Check the rotational direction of the motor and tune the encoder.

- Set the rotational direction of the motor and encoder parameters (ENC-11 Enc Output Phase, ENC-12 Pulse/Revolution) according to encoder manual.

2 Set motor parameters and execute auto-tuning.

- Set MOT1-05 (Control Mode) as 4 (Vector).
- Check the rating plate of the motor and set MOT1, MOT2-04 (Motor Type), 21 (Motor Capacity), 23 (Base Frequency), 24 (Rated Speed), 25 (Number of Polse), 26 (Rated Current), 27 (Rated Voltage), and 28 (Efficiency). Refer to **3.1 Setting Up Motor Rating Plate Information** for details.
- Set BAS-20 (Auto Tuning) to 1 (Auto Tuning) and tune motor parameters. Refer to **3.4 Auto Tuning** for details.

7.26.2 Independent Position Control Operation

The inverter can output proper frequency to help the load reach the target position according to current position (Cur Position) and target position (Tar Position) commands.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	44	Pos Ctrl Enable	0	No	0~1	0	-
			1	Yes			
POS1	01	Pos Ctrl State	0	Stop	0-6	-	-
			1	POS Run			
			2	POS Run Pre-Posi			
			3	POS Run Relative			
			4	Trip			
			5	POS Run Home			
			6	POS Home			
	02	Pos Ctrl Mode	0	Pos Single		0	
			1	Multi Sync Pos			
	03	Tar Position	-		0~65000	-	UC
	04	Cur Position	-		0~65000	-	UC
	05	Pre Position	0		0~65000	0	UC
	06	Error Value	-		0~65000	-	Puls
	07	Reference Value	-		0~65000	-	Puls
	08	Feedback Value	-		0~65000	-	Puls
	09	Total Move Time	-		0.00~650.00	-	sec

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
POS1	10	Cmd Source	0	DI Dependent	0~5	0	-
			1	Keypad			
			2	Internal Comm.			
			3	USB Comm.			
			4	Option Comm. [42]			
			5	UserSequence			
	11	Cmd Keypad Set	0	Stop	0~3	0	-
			1	POS Run			
			2	POS Run Pre-Posi			
			3	POS Run Relative			
	12	Multi Sync Time	0.00		0.00~650.00	0.00	sec
	15	Stop Homing	0	No	0~1	0	-
			1	Yes			
	20	Proportional Gain	50.0		0.0~1000.0	50.0	%
	21	FeedForward Gain	100.0		0.0~1000.0	100.0	%
	22	Output LPF Gain	0		10000	0	msec
	30	SW Limit Prot Mode	0	Trip	0~1	0	-
			1	Warning			
	31	SW Limit Hi Enable	0	No	0~1	0	-
			1	Yes			
	32	SW Limit Lo Enable	0	No	0~1	0	-
			1	Yes			
	33	Pos SW Limit High	60000		Pos SW Limit Low~65000	60000	UC
	34	Pos SW Limit Low	5000		0~Pos SW Limit High	5000	UC

[42] Configurable only when equipped with communication options

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
POS1	35	HW Limit Prot Mode	0	Trip	-	0	-
			1	Warning			
	36	Max Track Pulse	30000		0~65000	30000	Puls
	37	Tar Bound Pulse	200		0~65000	200	Puls
	40	Error Stop Mode	0	CoastStop (FreeRun)	0~1	0	-
			1	Trip Dec Stop			
	50	Homing Type	0	Inverse + index	0~3	0	-
			1	Inverse + No Index			
			2	Index			
			3	No Index			
	51	Homing Dir	0	FWD	0~1	0	-
			1	REV			
	52	Homing Freq	2.00		0.00~Max Frequency [43]	2.00	Hz
	53	Homing Speed	1800		0~ Maximum Speed [44]	1800	rpm
	54	Homing Ramp Time	10.00		6000.00	10.00	sec
	55	Run Relative Dir	0	FWD	0~1	0	-
			1	REV			
	60	UC Numerator	1		1~65000	1	-
	61	UC Denominator	1		1~65000	1	-
POS2	01	TRJ Tar Pos-01	30000		0~65,000	30000	UC
	02	TRJ Tar Freq-01	60.00		1.00~Max Frequency [43]	60.00	Hz
	03	TRJ Tar Spd-01	1800		0~Maximum Speed [44]	1800	rpm

[43] DRV-20(Max Frequency)
[44] DRV-21(Maximum Speed)

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
POS2	04	TRJ Acc Time-01	10.00	0.00~ 6000.00	10.00	sec
	05	TRJ Dec Time-01	10.00	0.00~ 6000.00	10.00	sec
	07	TRJ Tar Pos-02	30000	0~65000	30000	UC
	08	TRJ Tar Freq-02	60.00	1.00~Max Frequency [43]	60.00	Hz
	09	TRJ Tar Spd-02	1800	0~Maximum Speed [44]	1800	rpm
	10	TRJ Acc Time-02	10.00	0.00~ 6000.00	10.00	sec
	11	TRJ Dec Time-02	10.00	0.00~ 6000.00	10.00	sec
	13	TRJ Tar Pos-03	30000	0~65000	30000	UC
	14	TRJ Tar Freq-03	60.00	1.00~Max Frequency [43]	60.00	Hz
	15	TRJ Tar Spd-03	1800	0~Maximum Speed [44]	1800	rpm
	16	TRJ Acc Time-03	10.00	0.00~ 6000.00	10.00	sec
	17	TRJ Dec Time-03	10.00	0.00~ 6000.00	10.00	sec
	19	TRJ Tar Pos-04	30000	0~65000	30000	UC
	20	TRJ Tar Freq-04	60.00	1.00~Max Frequency [43]	60.00	Hz
	21	TRJ Tar Spd-04	1800	0~Maximum Speed [44]	1800	rpm
	22	TRJ Acc Time-04	10.00	0.00~ 6000.00	10.00	sec
	23	TRJ Dec Time-04	10.00	0.00~ 6000.00	10.00	sec
	25	TRJ Tar Pos-05	30000	0~65000	30000	UC
	26	TRJ Tar Freq-05	60.00	1.00~Max Frequency [43]	60.00	Hz

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
POS2	27	TRJ Tar Spd-05	1800	0~Maximum Speed [44]	1800	rpm
	28	TRJ Acc Time-05	10.00	0.00~ 6000.00	10.00	sec
	16	TRJ Dec Time-05	10.00	0.00~ 6000.00	10.00	sec
	31	TRJ Tar Pos-06	30000	0~65000	30000	UC
	32	TRJ Tar Freq-06	60.00	1.00~Max Frequency [43]	60.00	Hz
	33	TRJ Tar Spd-06	1800	0~Maximum Speed [44]	1800	rpm
	34	TRJ Acc Time-06	10.00	0.00~ 6000.00	10.00	sec
	35	TRJ Dec Time-06	10.00	0.00~ 6000.00	10.00	sec
	37	TRJ Tar Pos-07	30000	0~65000	30000	UC
	38	TRJ Tar Freq-07	6000	1.00~Max Frequency [43]	6000	Hz
	39	TRJ Tar Spd-07	1800	0~Maximum Speed [44]	1800	rpm
	40	TRJ Acc Time-07	10.00	0.00~ 6000.00	10.00	sec
	41	TRJ Dec Time-07	10.00	0.00~ 6000.00	10.00	sec
	43	TRJ Tar Pos-08	30000	0~65000	30000	UC
	44	TRJ Tar Freq-08	60.00	1.00~Max Frequency [43]	60.00	Hz
	45	TRJ Tar Spd-08	1800	0~Maximum Speed [44]	1800	rpm
	46	TRJ Acc Time-08	10.00	0.00~ 6000.00	10.00	sec
	47	TRJ Dec Time-08	10.00	0.00~ 6000.00	10.00	sec

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
POS2	49	TRJ Tar Pos-09	30000	0~65000	30000	UC
	50	TRJ Tar Freq-09	60.00	1.00~Max Frequency [43]	60.00	Hz
	51	TRJ Tar Spd-09	1800	0~Maximum Speed [44]	1800	rpm
	52	TRJ Acc Time-09	10.00	0.00~ 6000.00	10.00	sec
	53	TRJ Dec Time-09	10.00	0.00~ 6000.00	10.00	sec
	55	TRJ Tar Pos-10	30000	0~65000	30000	UC
	56	TRJ Tar Freq-10	60.00	1.00~Max Frequency [43]	60.00	Hz
	57	TRJ Tar Spd-10	1800	0~Maximum Speed [44]	1800	rpm
	58	TRJ Acc Time-10	10.00	0.00~ 6000.00	10.00	sec
	59	TRJ Dec Time-10	10.00	0.00~ 6000.00	10.00	sec
	61	TRJ Tar Pos-11	30000	0~65000	30000	UC
	62	TRJ Tar Freq-11	60.00	1.00~Max Frequency [43]	60.00	Hz
	63	TRJ Tar Spd-11	1800	0~Maximum Speed [44]	1800	rpm
	64	TRJ Acc Time-11	10.00	0.00~ 6000.00	10.00	sec
	65	TRJ Dec Time-11	10.00	0.00~ 6000.00	10.00	sec
	67	TRJ Tar Pos-12	30000	0~65000	30000	UC
	68	TRJ Tar Freq-12	60.00	1.00~Max Frequency [43]	60.00	Hz
	69	TRJ Tar Spd-12	1800	0~Maximum Speed [44]	1800	rpm

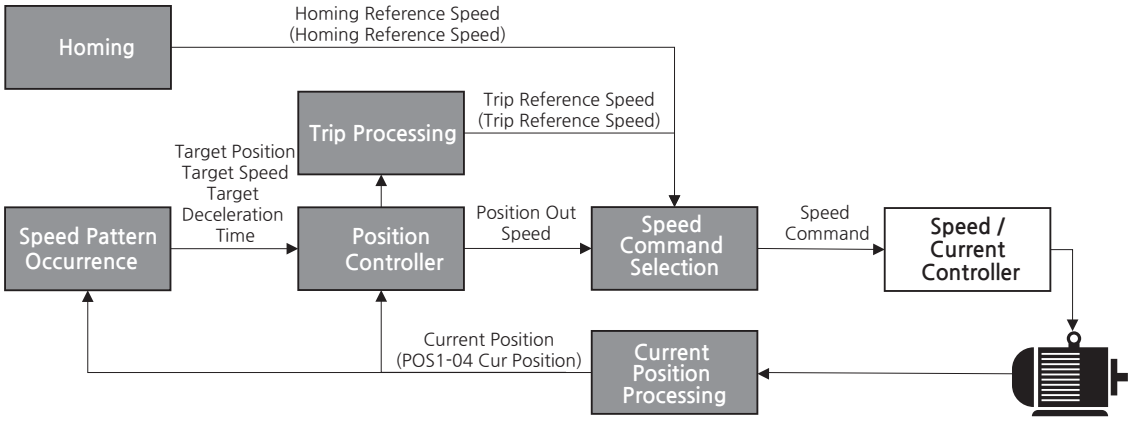
Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
POS2	70	TRJ Acc Time-12	10.00	0.00~ 6000.00	10.00	sec
	71	TRJ Dec Time-12	10.00	0.00~ 6000.00	10.00	sec
	72	TRJ Tar Pos-13	30000	0~65000	30000	UC
	73	TRJ Tar Freq-13	60.00	1.00~Max Frequency [43]	60.00	Hz
	74	TRJ Tar Spd-13	1800	0~Maximum Speed [44]	1800	rpm
	75	TRJ Acc Time-13	10.00	0.00~ 6000.00	10.00	sec
	76	TRJ Dec Time-13	10.00	0.00~ 6000.00	10.00	sec
	78	TRJ Tar Pos-14	30000	0~65000	30000	UC
	79	TRJ Tar Freq-14	60.00	1.00~Max Frequency [43]	60.00	Hz
	80	TRJ Tar Spd-14	0	0~Maximum Speed [44]	0	rpm
	81	TRJ Acc Time-14	10.00	0.00~ 6000.00	10.00	sec
	82	TRJ Dec Time-14	10.00	0.00~ 6000.00	10.00	sec
	84	TRJ Tar Pos-15	30000	0~65000	30000	UC
	85	TRJ Tar Freq-15	60.00	1.00~Max Frequency [43]	60.00	Hz
	86	TRJ Tar Spd-15	1800	0~Maximum Speed [44]	1800	rpm
	87	TRJ Acc Time-15	10.00	0.00~ 6000.00	10.00	sec
	88	TRJ Dec Time-15	10.00	0.00~ 6000.00	10.00	sec
	90	TRJ Tar Pos-16	30000	0~65000	30000	Hz rpm

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
POS2	91	TRJ Tar Freq-16	60.00		1.00~Max Frequency [43]	60.00	Hz
	92	TRJ Tar Spd-16	1800		0~Maximum Speed [44]	1800	rpm
	93	TRJ Acc Time-16	10.00		0.00~ 6000.00	10.00	sec
	94	TRJ Dec Time-16	10.00		0.00~ 6000.00	10.00	sec
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	56	POS Home	-	1, 2, 4, 5, 10, 11, 12, 9	-
			57	POS Run Home			
			58	POS HW Lmt L			
			59	POS HW Lmt H			
			60	POS Pattern-L			
			61	POS Pattern-M			
			62	POS Pattern-H			
			63	POS Pattern-X			
			64	POS Run			
			65	POS Run Pre-Posi			
			66	POS Run Relative			

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

7.26.2.1 Overall Block Diagram

Independent position control operation mode consists of five functional blocks: Speed pattern occurrence, position control, speed command selection, current position processing, and homing.



[Image 37. Block Diagram of Overall Position Control Operation]

The speed pattern occurrence block makes a speed profile in a trapezoid shape using information such as the current position, target position, acceleration and deceleration times, and maximum frequency.

The position control block makes proper frequency commands by PI controlling position reference pulse and position feedback pulse.

Speed command selection block is responsible for exception handling (homing, trip processing) during position control operation.

The current position processing block properly processes or monitors pulse from feedback.

Selecting Operation Command Source

If you set App-44 (Pos Ctrl Enable) to 1 (Yes), operation command source is determined by POS1-10 (Cmd Source) regardless of the settings at DRV-10 (1st Command Source) and DRV-11 (1st Freq Ref Src).

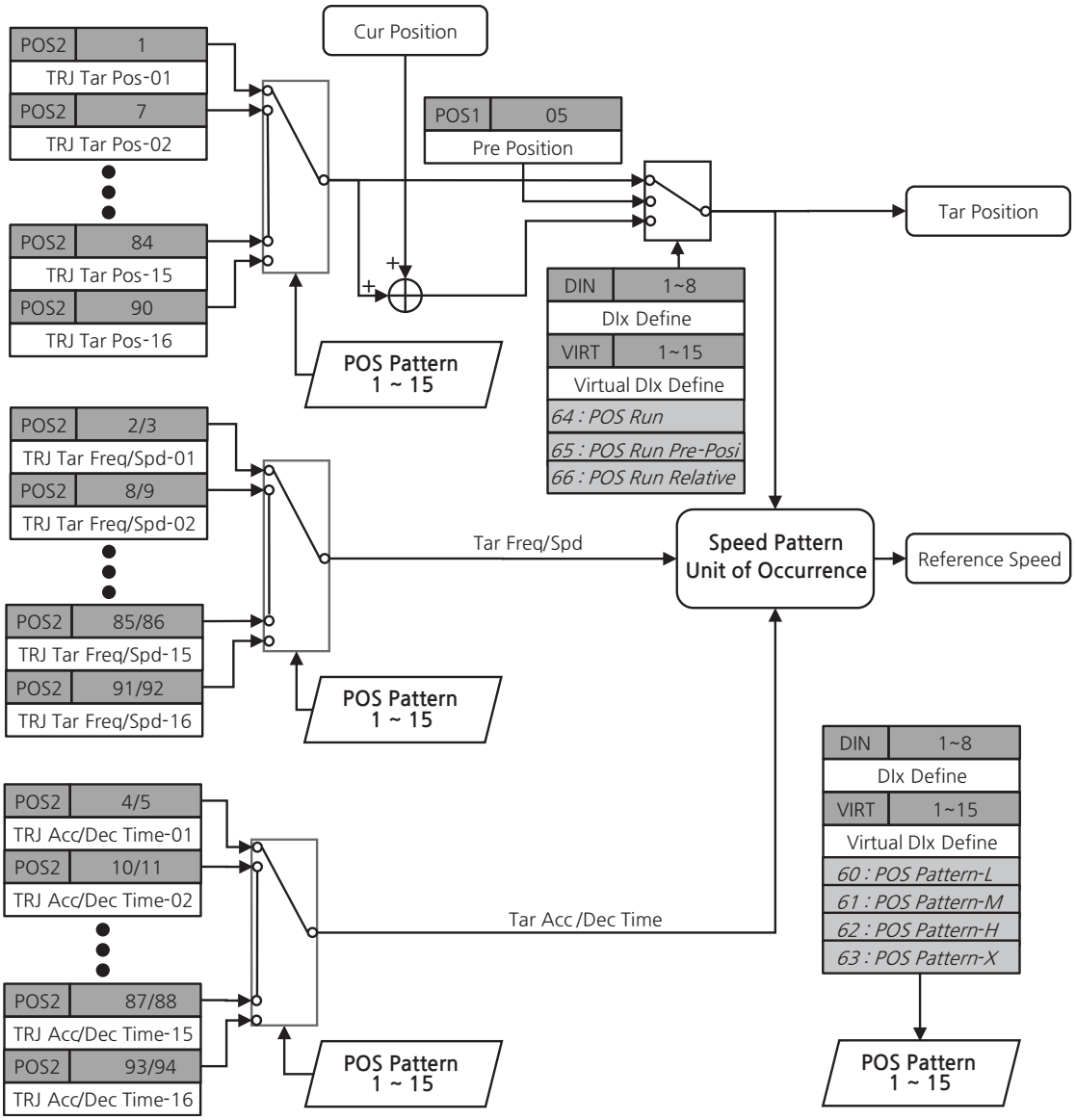
The position control operation for each source of POS1-10 (Cmd Source) is as follows:

Code and Functions	Item		Functionality		Remark
POS1-10 Cmd Source	0	DI Dependent	Set the Define code for DI1-DI8 of the terminal input group (DIN) as 63 (POS Run) for position control operation.		
	1	Keypad	Set the following values for POS1-11 (Cmd Keypad Set) and the relative position control operation will start.		
			1	POS Run	
			2	POS Run Pre-Posi	
			3	POS Run Relative	
	2	Internal Comm.	Allows position control operation via built-in 485 communication.		Allows position control via common area parameter communication address, 0606h.
	3	USB Comm.	Allows position control operation via USB port on the control board.		
	4	Option Comm. [45]	Allows position control operation via communication option card.		
	5	UserSequence	Allows for position control operation via the user sequence function in the inverter.		

[45] Configurable only when equipped with communication options

7.26.2.2 Position Path Selection and Speed Pattern Occurrence Block

Select a target path and create a required path profile (trapezoid speed pattern of "acceleration → constant speed → deceleration") to reach the target position from the current position using the target position, acceleration time, deceleration time, and maximum speed according to the target path.



[Image 38. Position Path Selection and Speed Pattern Occurrence Block]

Current position (POS1-04 Cur Position), target position (POS2 TRJ Tar Pos-1116), path acceleration time (POS2 TRJ Acc Time-1-16), path deceleration time (POS2 TRJ Dec Time-1-16), and path normal speed (POS2 TRJ Freq/Spd-1-16) are required for speed profile algorithm.

In POS2 group, there are 16 position control paths in total, each path consisting of four parameters (target position, acceleration time, deceleration time, and frequency/ speed).

You can set each code of four multifunction input terminals (DIN DI1-DI8 Define) to 60-63 (POS Pattern-L, POS Pattern-M, POS Pattern-H, and POS Pattern-X) and select one of the 16 position paths in POS2 group for position control operation.

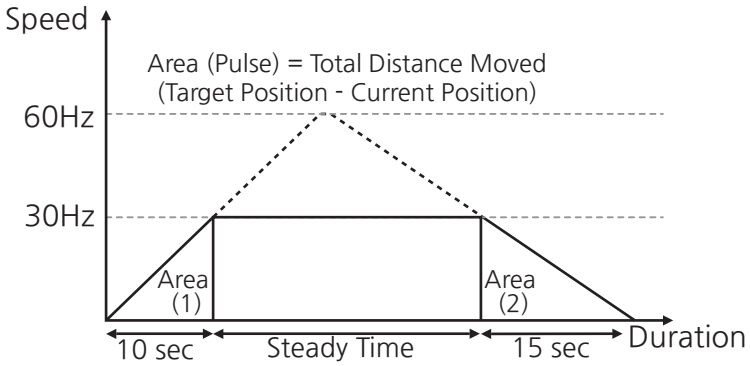
The position path information can only be changed when stopped. The terminal block input for path change during position operation will not change the path for operation. Position path is changed according to the information at the terminal block when position operation ends.

Table 7. An Example of Position Control Operation Path Profile Settings

POS2 TRJ Index	POS Pattern-X	POS Pattern-H	POS Pattern-M	POS Pattern-L	Remark
1					Select the TRJ-01 value at POS2
2				On	Select the TRJ-02 value at POS2
3			On		Select the TRJ-03 value at POS2
4			On	On	Select the TRJ-04 value at POS2
5		On			Select the TRJ-05 value at POS2
6		On		On	Select the TRJ-06 value at POS2
7		On	On		Select the TRJ-07 value at POS2
8		On	On	On	Select the TRJ-08 value at POS2
9	On				Select the TRJ-09 value at POS2
10	On			On	Select the TRJ-10 value at POS2
11	On		On		Select the TRJ-11 value at POS2
12	On		On	On	Select the TRJ-12 value at POS2
13	On	On			Select the TRJ-13 value at POS2
14	On	On		On	Select the TRJ-14 value at POS2
15	On	On	On		Select the TRJ-15 value at POS2
16	On	On	On	On	Select the TRJ-16 value at POS2

An Example of Position Control Path Reference

- TRJ Tar Pos-xx: 14400UC
- TRJ Freq-xx: 30.00 Hz (based on TRJ Spd-x: 900 rpm, 4 Poles)
- TRJ Acc Time-xx: 20sec
- TRJ Dec Time-xx: 30sec
- ENC-12 Pulse/Revolution: 1024
- Multiplication: 4 multiplication (ENC-11 Enc Out Phase value as (A + B) or – (A + B))



[Image 39. An Example of Operation Based on Position Control Path Settings]

Related Parameters-Setting Details

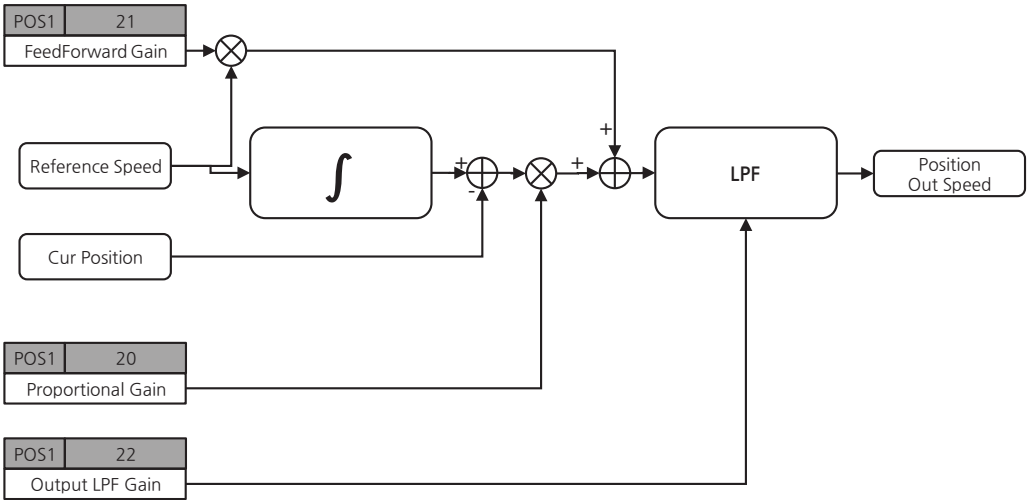
Code and Functions	Description
POS1-03 Tar Position	Read-only with the unit of UC. It shows target position information (POS2 TRJ Tar Pos-xx) currently selected in POS2 group via four multifunction inputs; POS Pattern-L, POS Pattern-M, POS Pattern-H, and POS Pattern-X.
POS1-04 Cur Position	Read-only with the unit of UC. It shows the current position.
POS1-60 UC Numerater (Unit Change Numerator: unit change numerator), POS1-61 UC Denominator (Unit Change Denominator: unit change denominator)	Sets the ratio for unit change to change the position unit from a pulse to the user unit. Unit of parameters whose unit changes from Unit Change are expressed in UC. The formula is as follows: $[UC] = \frac{\text{UC Numerater}}{\text{UC DeNominator}} \times [\text{Pulse}]$ Input range of POS1-60 and POS1-61 is 1-65535 respectively. Therefore, when the denominator is too big compared to the numerator, fix the numerator as 1 and reduce the denominator appropriately to make it less than 32768 before inputting.

Caution

- Make sure the value of 65535 * UC Denominator / UC Numerator does not exceed 2,147,483,647. That is, the position control does not work properly when the value of UC Denominator / UC Numerator is smaller than 1 / 32768.
- Note that when the value of UC Denominator / UC Numerator is bigger than 1, UC unit value is bigger than 1 pulse and position control does not work properly.

7.26.2.3 Position Controller Block

The position profile is created by integrating speed profile from the speed profile block. The position profile becomes the position reference pulse in the position controller. The position reference pulse and position feedback pulse from S300 encoder option are p-controlled (proportional control) to make a reference speed command.



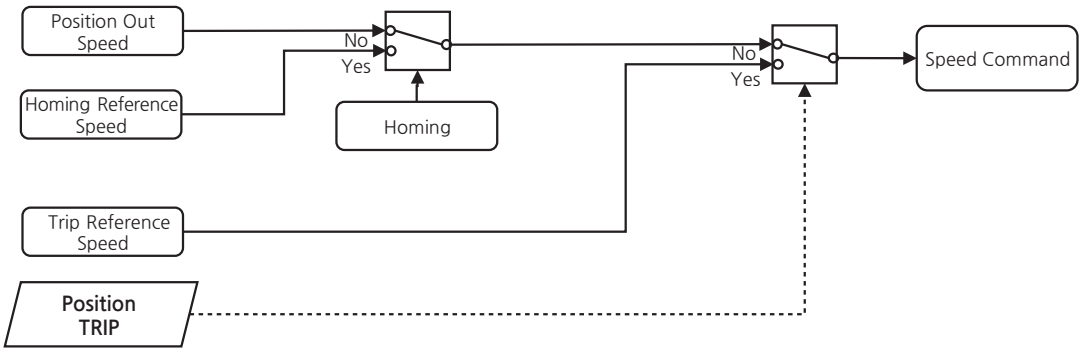
[Image 40. Position Control Block]

Related Parameters-Setting Details

Code and Functions	Description
POS1-6 Error Value	Displays the difference (pulses) between the position reference pulse and position feedback pulse real-time during position control operation. It is always 0 in other operation modes.
POS1-20 Porportional Gain	Enter P gain (%). For example, where the P gain is 10% with 2 πrad of position error based on mechanical angle of the motor, 10% of normal speed of position control (POS-2 TRJ Tar Freq-xx or Tar Spd-xx) will be generated as the output of position controller. For example, where POS2 TRJ Freq-xx is 60.00 Hz, 6.00 Hz is the output of the position controller.
POS1-21 Feed Forward Gain	Sets the feed forward (FF) gain (%). It enhances responsiveness and stability of the position controller by feedforward-compensating speed profile (presumable information).

7.26.2.4 Speed Command Selection Block

It selects speed via operation by homing or trips from position control operation during position control operations.

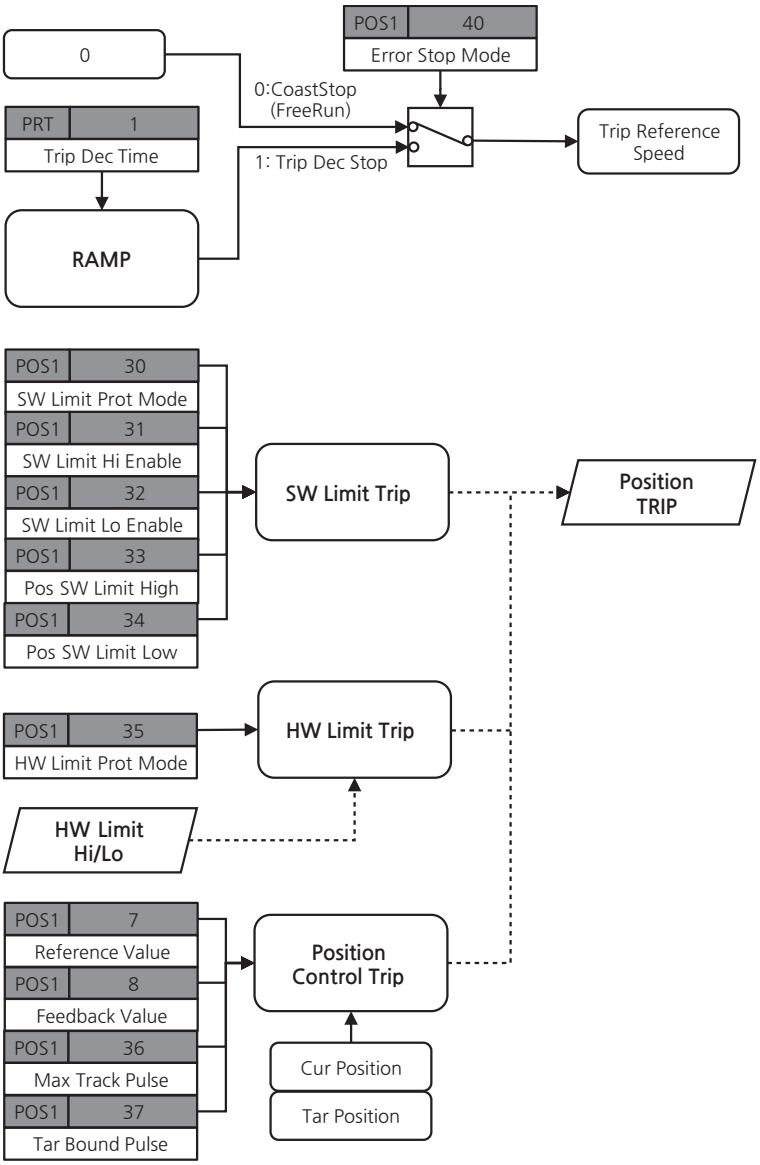


[Image 41. Speed Command Selection Block]

7.26.3 Trip Processing Block

It processes trips regarding position control operation during position control operation. You can monitor upper and lower limit hardware switch (Pos HW Limit High/Low) or upper and lower limit software switch (Pos SW Limit Low/High) inputs.

When it is in the relative status, it will operate according to the set mode at POS1-40 Error Stop Mode (0: CoastStop(FreeRun)/1: Trip Dec Stop).



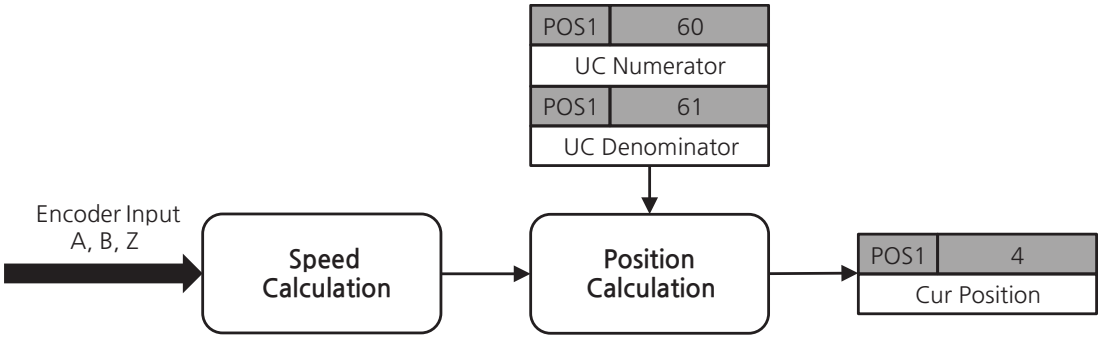
[Image 42. Trip Processing Block]

List of Related Parameters

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>POS1-07 Reference Value</td><td>Current command position value.</td></tr>
<tr><td>POS1-08 Feedback Value</td><td>Current position value.</td></tr>
<tr><td>POS1-40 Error Stop Mode</td><td>Selects operation mode when there is a trip from control operation.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>CoastStop (FreeRun)</td><td>Immediately blocks inverter output. When an external brake control is in use, the brake will be closed at the same time the inverter output is blocked.</td></tr>
<tr><td>1</td><td>Trip Dec Stop</td><td>The motor will decelerate to the time set at PRT-1 Trip Dec Time and then stop.</td></tr>
</table></td></tr>
<tr><td>POS1-31 SW Limit Hi Enable</td><td>Sets use of upper limit software switch. When the value is 0 (No), the upper limit software switch will not work.</td></tr>
<tr><td>POS1-32 SW Limit Lo Enable</td><td>Sets use of lower limit software switch. When the value is 0 (No), the lower limit software switch does not work.</td></tr>
<tr><td>POS1-33 Pos SW Limit High</td><td>The upper limit level (UC) is configurable when POS1-30 is 1 (Yes).</td></tr>
<tr><td>POS1-34 Pos SW Limit Low</td><td>The lower limit level (UC) is configurable when POS1-30 is 1 (Yes).</td></tr>
<tr><td>POS1-36 Max Track Pulse</td><td>When the difference between POS1-7 and POS1-8 in the position control block is bigger than POS1-36 during the inverter operation, it will operate in the mode set at POS1-40 (0: CoastStop(FreeRun)/1: Trip Dec Stop).</td></tr>
<tr><td>POS1-37 Tar Bound Pulse</td><td>Tar Bound Error occurs when the difference between POS1-03 (Tar Position) and POS1-04 (Cur Position) in the position control block is bigger than POS1-37.</td></tr>
<tr><td>PRT-01 Trip Dec Time</td><td>The inverter will decelerate to the set amount of time and then stop. If an external brake control is in use, the brake will close at brake engage frequency (ADV-49 Br Engage Freq or ADV-50 Br Engage Speed).</td></tr>
</table>

7.26.3.1 Current Position Calculation Block

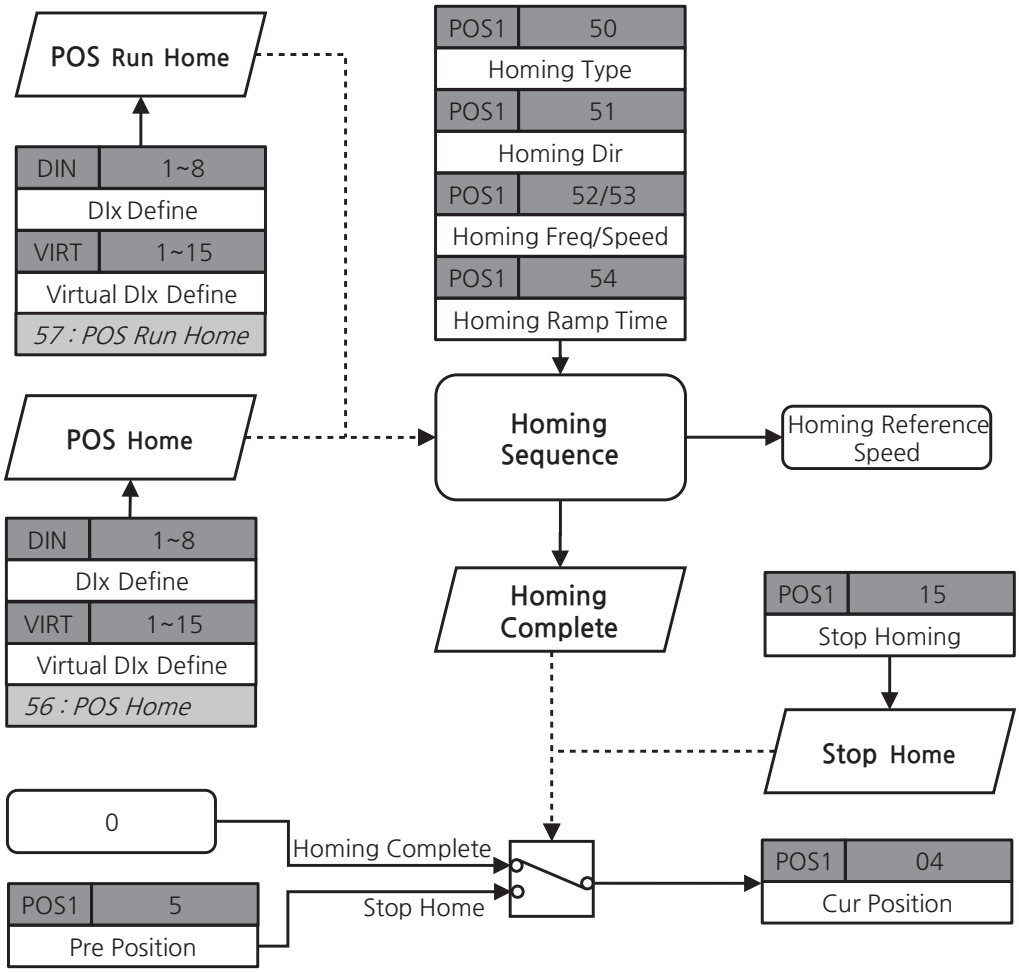
Performs functions such as monitoring and position change for pulses from encoder feedback.



[Image 43. Current Position Calculation Block]

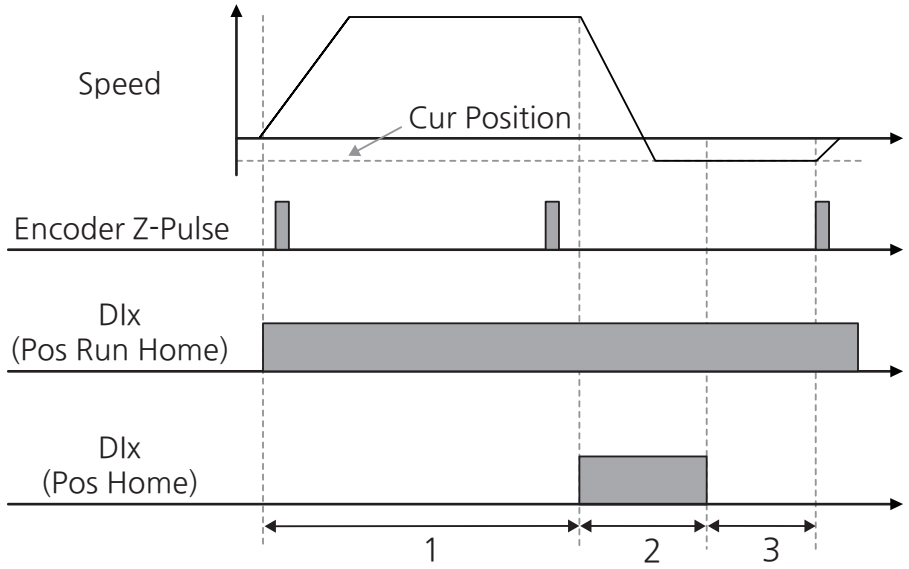
7.26.3.2 Homing Operation

Moves according to certain speed and certain acceleration and deceleration times by multifunction input signals and determines the position reference using various methods when it reaches position reference.

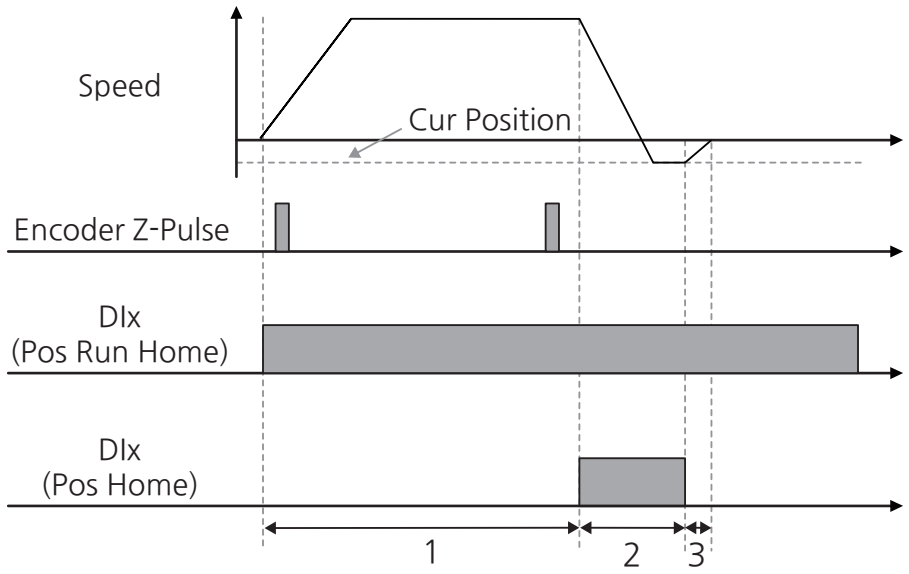


[Image 44. Homing Operation Block]

Homing operation according to POS1-50 Homing Type is as follows:



[Image 45. An Example of Homing Operation (Fwd [Rev] + Index)]



[Image 46. An Example of Homing Operation (Fwd [Rev] + No Index)]

Code and Functions	Item		Section	Functionality
POS1-50 Homing Type	0	Rev +Index	1	When the multifunction terminal that is set as 57 (POS Run Home) is turned on, it will operate according to the settings at POS1-51 (Homing Dir), POS1-52, 53 (Homing Freq, Homing Speed), and POS1-54 (Homing Ramptime).
			2	The rotational direction will change as soon as the multifunction terminal with 56 (POS Home) setting turns on and the operation is conducted at 20% speed of setting values at POS1-52 and 53 (Homing Freq and Homing Speed).
			3	When the input at multifunction terminal with 56 (POS Home) setting is out, that is, when the multifunction terminal is turned off, the current position (POS1-04 Cur Position) will be initialized to user-set position (POS1-05 Pre Position) at the first-met Index Pulse (encoder Z pulse) and the motor will be stopped.
	1	Rev +No Index	1	When the multifunction terminal that is set as 57 (POS Run Home) is turned on, it will operate according to the settings at POS1-51 (Homing Dir), POS1-52, 53 (Homing Freq, Homing Speed), and POS1-54 (Homing Ramptime).
			2	The rotational direction will change as soon as the multifunction terminal with 56 (POS Home) setting turns on and the operation is conducted at 20% speed of setting values at POS1-52 and 53 (Homing Freq and Homing Speed).
			3	When the input at the multifunction terminal with the 56 (POS Home) setting is out, that is, when the multifunction terminal is turned off, the current position (POS1-04 Cur Position) will be initialized to the user-set position (POS1-05 Pre Position) and the motor will be stopped.

Code and Functions	Item		Section	Functionality
POS1-50 Homing Type	2	Fwd +Index	1	When the multifunction terminal that is set as 57 (POS Run Home) is turned on, it will operate according to the settings at POS1-51 (Homing Dir), POS1-52, 53 (Homing Freq, Homing Speed), and POS1-54 (Homing Ramptime).
			2	As soon as the multifunction terminal with the 56 (POS Home) setting turns on, the operation will be conducted at 20% speed of the setting values at POS1-52 and 53 (Homing Freq and Homing Speed).
			3	When the input at multifunction terminal with 56 (POS Home) setting is out, that is, when the multifunction terminal is turned off, the current position (POS1-04 Cur Position) will be initialized to the user-set position (POS1-05 Pre Position) at the first-met Index Pulse (encoder Z pulse) and the motor will be stopped.
	3	Fwd +No Index	1	When the multifunction terminal that is set as 57 (POS Run Home) is turned on, it will operate according to the settings at POS1-51 (Homing Dir), POS1-52, 53 (Homing Freq, Homing Speed), and POS1-54 (Homing Ramptime).
			2	As soon as the multifunction terminal with the 56 (POS Home) setting turns on, the operation will be conducted at 20% speed of the setting values at POS1-52 and 53 (Homing Freq and Homing Speed).
			3	When the input at the multifunction terminal with the 56 (POS Home) setting is out, that is, when the multifunction terminal is turned off, the current position (POS1-04 Cur Position) will be initialized to the user-set position (POS1-05 Pre Position) and the motor will be stopped.

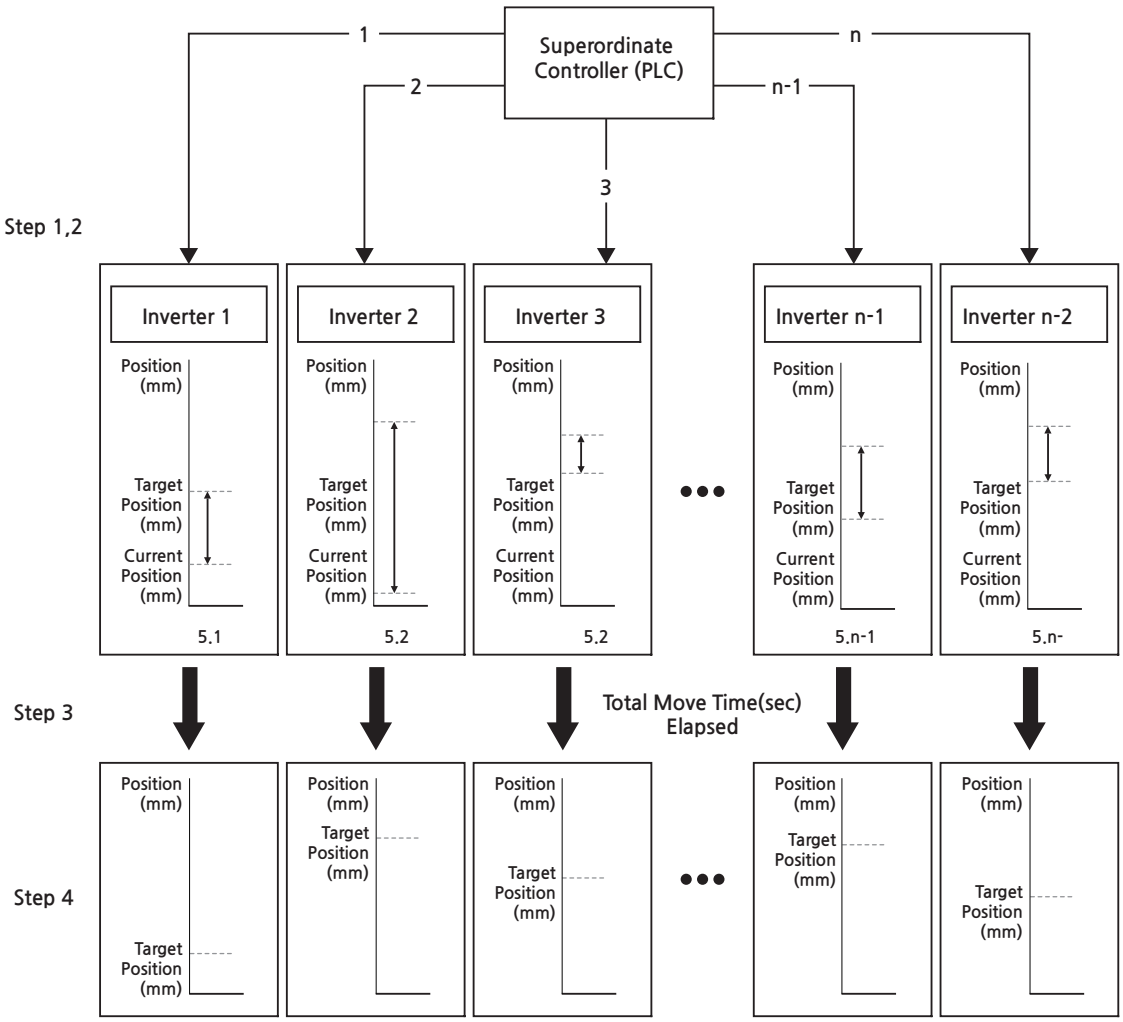
7.26.4 Proportional Synchronous Position Control

It is an operation mode where multiple inverters reach their respective target positions within the same time frame. All inverters must be connected to the master inverter that uses the user sequence or superordinate controller via communication, as information exchange (current position, and etc.) among the inverters at a stop is compulsory.

This function is useful for applications (e.g.: stage settings) that require multiple inverters to reach their respective target positions within the same time frame.

7.26.4.1 Implementation of Proportional Synchronous Position Control System

In proportional synchronous position control operation mode, multiple inverters reach respective target position (mm) at the same time. The following image shows implementation of proportional synchronous control system using superordinate controller and inverters.



[Image 47. Proportional Synchronous Position Control System]

The following is the implementation of proportional synchronous position control operation per each step from the above image.

Step 1 Setting proportional synchronous position control operation mode

Select 1 (Multi Sync Pos) at POS1-02 (Pos Ctrl Mode) for all inverters (1-n) to set proportional synchronous position control operation mode.

Step 2 Setting the target position and synchronization time for each inverter

Set the target position (UC, POS1-03 Tar Position) and target synchronization time (POS1-12 Multi Sync Time or communication address 0605h proportional synchronization target operation time) for each inverter. Refer to **10 Using Built-in Communication Features** for details on setting synchronization time with communication address.

Pos Multi Sync F trip occurs when the set target synchronization time is smaller than the travel time (POS1-09 Total Move Time) of the relevant inverter.

Step 3 Starting synchronous operation

Provide operation commands to each inverter through multifunction terminal which is set to 64 (POS Run) according to operation command source (POS1-10 Cmd Source) or RS485 communication (communication address 0606h position control operation command). Each inverter moves to their target positions from their current positions according to the target synchronization time.

Step 4 Ending synchronous operation

Provide stop commands to each inverter through the multifunction terminal set to 64 (POS Run) according to the operation command source (POS1-10 Cmd Source) or RS485 communication (communication address 0606h position control operation command) when each inverter reaches their target positions.

7.26.5 Cause of Abnormalities and Inspection

When there is a trip related to position control, refer to the following depending on the type of trips for inspection:

Table 8. Position Control-Related Trips

Trip	Cause of Abnormality	Inspections
POS SW Limit High	Occurs when the setting value of POS1-04 (Cur Position) is higher than one of POS1-33 (Pos SW Limit High).	Check if the setting values of POS1-03 (Tar Position) and POS1-05 (Pre Position) are in between the setting values of POS1-33 (Pos SW Limit High) and POS1-34 (Pos SW LimitLow).
POS SW Limit Low	Occurs when the setting value of POS1-04 (Cur Position) is lower than POS1-34 (Pos SW Limit Low).	
POS HW Limit High	Occurs when there is an input signal at the multifunction terminal to which 59 (POS HW Lmt H) is set for the Define code of DI1-DI8 of the terminal input group (DIN).	Check wiring for the multifunction terminal block of the set inverter.
POS HW Limit Low	Occurs when there is an input signal at the multifunction terminal where 58 (POS HW Lmt L) is set for the Define code of DI1-DI8 of the terminal input group (DIN).	
Pos Max Track Err	Occurs when the difference between the reference pulse and position feedback pulse is bigger than the setting value of POS1-36 (Max Track Pulse).	Check the load status, as high inertia of the load connected to the motor may cause a trip.
Pos Tar Bound Err	Occurs when the difference between the target position and actual position is bigger than the setting values of POS1-37 (Tar Bound Pulse) after performing position control.	

7.27 Using User Sequence

User sequence is used to implement a simple sequence by utilizing the combination of various function blocks via DriveView9, the PC software for inverter connection from our company. For instructions on connecting the inverter to a PC, refer to **12.4 USB mode**. For detailed software usage, refer to the Drive View9 manual.

7.27.1 Operation Preparations

To use a user sequence, implement the user sequence with DriveView9 and download related parameters to S300, and then operate with the user sequence.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	03	UserSeq Enable	1	Yes	-	0	-
US	01	UserSeqCtrl OnOff	1	On	0~1	0	-
	02	UserSeq Loop Time	10		10~1000	10	msec
	03	All Blk Exec Time	-		-	-	usec
	04	User Seq Mode	0	Manual	-	-	-
			1	DI Dependent			
	05	Power On Run	0	No	0~1	0	-
			1	Yes			
	06	Last Error	-		-	-	-
	07	BlockID of LastErr	-		-	-	-
	08	IO Index of LastErr	-		-	-	-
	09	LastError Reset	0	No	0~1	0	-
			1	Yes			
	10	Run Forward	0	Off	0~1	0	-
			1	On			
	11	Run Reverse	0	Off	0~1	0	-
			1	On			
	15	Command Frequency	0.00		0.00~Max Frequency [46]	0.00	Hz
	16	Command Speed	0		0~Maximum Speed [47]	0	rpm

[46] DRV-20(Max Frequency)
[47] DRV-21(Maximum Speed)

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
US	17	Command Torque	0.0		-320.0~320.0	0.0	%
	18	Acc Time	20.00		0.00~ 6000.00	20.00	sec
	19	Dec Time	30.00		0.00~ 6000.00	30.00	sec
	20	Output Current	-		-	-	A
	21	Output Frequency	-		-	-	Hz
	22	Output RPM	-		-	-	rpm
	23	Output Voltage	-		-	-	V
	24	DC Link Voltage	-		-	-	V
	25	Output Power	-		-	-	kW
	26	Output Torque	-		-	-	%
	27	SearchCurrent Trip 1	-		-	-	-
	28	Trip 1 Occurred?	0	No	0~1	0	-
			1	Yes			
	29	SearchCurrent Trip 2	-		-	-	-
	30	Trip 2 Occurred?	0	No	0~1	0	-
			1	Yes			
	31	SearchCurrent Trip 3	-		-	-	-
	32	Trip 3 Occurred?	0	No	0~1	0	-
			1	Yes			
	33	SearchCurrent Warn 1	-		-	-	-
	34	Warn 1 Occurred?	0	No	0~1	0	-
			1	Yes			
	35	SearchCurrent Warn 2	-		-	-	-
	36	Warn 2 Occurred?	0	No	0~1	0	-
			1	Yes			
	37	SearchCurrent Warn 3	-		-	-	-

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
US	38	Warn 3 Occurred?	0	No	0~1	0	-
			1	Yes			
	40	Speed Searching	0	Off	0~1	-	-
			1	On			
	41	Acceleration	0	Off	0~1	-	-
			1	On			
	42	ConstRate Operating	0	Off	0~1	-	-
			1	On			
	43	Deceleration	0	Off	0~1	-	-
			1	On			
	44	Dec to stop	0	Off	0~1	-	-
			1	On			
	45	H/W OCS	0	Off	0~1	-	-
			1	On			
	46	S/W OCS	0	Off	0~1	-	-
			1	On			
	47	Dwell Operating	0	Off	0~1	-	-
			1	On			
	48	Stopped	0	Off	0~1	-	-
			1	On			
	49	Forward Direction	0	Off	0~1	-	-
			1	On			
	50	Reverse Direction	0	Off	0~1	-	-
			1	On			
	51	DC Operating	0	Off	0~1	-	-
			1	On			
	52	Warned	0	Off	0~1	-	-
			1	On			
	53	Tripped	0	Off	0~1	-	-
			1	On			

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

User Sequence Setting Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>APP-03 UserSeq Enable</td><td>Set this parameter to 1 (Yes) and five parameter groups related to user sequence (US, USL, USV, USP, and USM) will be displayed in the Smart Operator.</td></tr>
<tr><td>US-01 UserSeqCtrl OnOff</td><td>Set this parameter to 1 (Yes) to operate with the user sequence saved in S300.</td></tr>
<tr><td>US-02 UserSeq Loop Time</td><td>Sets execution cycle for the user sequence.</td></tr>
<tr><td>US-03 All Blk Exec Time</td><td>Displays the total execution time of all functions used for the user sequence.</td></tr>
<tr><td>US-04 User Seq Mode</td><td>
<table>
<tr><th colspan="2">Configuration</th><th>Functionality</th></tr>
<tr><td>0</td><td>Manual</td><td>The user sequence is executed according to the US-01 (UserSeqCtrl OnOff) parameter setting.</td></tr>
<tr><td>1</td><td>DI Dependent</td><td>The user sequence is executed by the multifunction digital input terminal set to UserSeqCtrl OnOff.</td></tr>
</table>
</td></tr>
<tr><td>US-05 Power On Run</td><td>
<table>
<tr><th colspan="2">Configuration</th><th>Functionality</th></tr>
<tr><td>0</td><td>No</td><td>Even if inverter power is supplied while the terminal User Seq command is ON, the user sequence is not executed.</td></tr>
<tr><td>1</td><td>Yes</td><td>If inverter power is supplied while the terminal User Seq command is ON, the user sequence is executed immediately.</td></tr>
</table>
</td></tr>
<tr><td>US-06 Last Error</td><td>Error values recently occurred while executing a user sequence.</td></tr>
<tr><td>US-07 BlockID of LastErr</td><td>Function block ID where the error occurred.</td></tr>
<tr><td>US-08 IO Indexof LastErr</td><td>This is the IO Index of the block where an error occurred.</td></tr>
<tr><td>US-09 LastError Reset</td><td>Initializes errors.</td></tr>
<tr><td>US-10 Run Forward</td><td>Forward operation command.</td></tr>
<tr><td>US-11 Run Reverse</td><td>Reverse operation command.</td></tr>
<tr><td>US-12 Stop</td><td>Stop command.</td></tr>
</table>

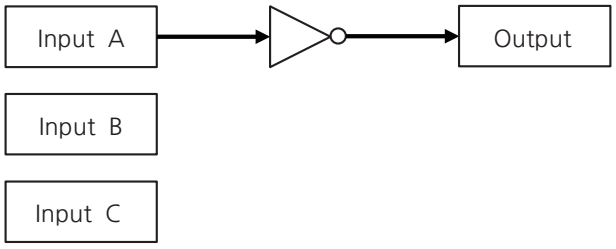
Code and Functions	Description
US-15 command Frequency	Target operating speed (Hz).
US-16 command Speed	Target operating speed (rpm).
US-17 command Torque	Target operating torque.
US-18 Acc Time	Acceleration time.
US-19 Dec Time	Deceleration time.
US-20 Output Current	Current output current.
US-21 Output Frequency	Current output speed (Hz).
US-22 Output RPM	Current output speed (rpm).
US-23 Output Voltage	Current output voltage.
US-24 DC Link Voltage	DC link voltage.
US-25 Output Power	Current output power.
US-26 Output Torque	Current output torque.
US-27,29,31 SearchCurrentTripx	Specifies the trip to search for in the currently active alarm list.
US-28,30,32 Tripx Occurred?	Indicates whether the trip specified in SearchCurrentTripx has occurred as the current trip.
US-33,35,37 SearchCurrent Warnx	Specifies the alarm to search for in the currently active alarm list.
US-34,36,38 Tripx Occurred?	Indicates whether the alarm specified in SearchCurrentWarnx has occurred as the current alarm.

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>US-40-53</td><td>Indicates the current inverter status.
<table>
<tr><th>Code</th><th>parameter</th><th>Inverter status</th></tr>
<tr><td>40</td><td>Speed Searching</td><td>Speed searching</td></tr>
<tr><td>41</td><td>Acceleration</td><td>Accelerating</td></tr>
<tr><td>42</td><td>ConstRateOperating</td><td>Constant Speed Operation</td></tr>
<tr><td>43</td><td>Deceleration</td><td>Decelerating</td></tr>
<tr><td>44</td><td>Dec to stop</td><td>Stopping the deceleration</td></tr>
<tr><td>45</td><td>H/W OCS</td><td>H/W overcurrent suppression</td></tr>
<tr><td>46</td><td>S/W OCS</td><td>S/W overcurrent suppression</td></tr>
<tr><td>47</td><td>Dwell Operating</td><td>Dwell operating</td></tr>
<tr><td>48</td><td>Stopped</td><td>Stopped</td></tr>
<tr><td>49</td><td>Forward Direction</td><td>Forward operating</td></tr>
<tr><td>50</td><td>Reverse Direction</td><td>Reverse operating</td></tr>
<tr><td>51</td><td>DC Operating</td><td>DC braking</td></tr>
<tr><td>52</td><td>Warned</td><td>Alarm</td></tr>
<tr><td>53</td><td>Tripped</td><td>Trip</td></tr>
</table></td></tr>
<tr><td>US-84 First Trip Index</td><td>First trip index. For the index of each trip, refer to communication address 0400h in <u>10.3.2.4 Parameters for Inverter Trip Mode Area (Read Only)</u>.</td></tr>
<tr><td>US-85 First Warn Index</td><td>First alarm index. For the index of each alarm, refer to communication address 0420h in <u>10.3.2.4 Parameters for Inverter Trip Mode Area (Read Only)</u>.</td></tr>
</table>

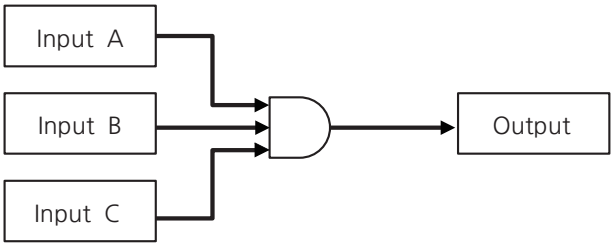
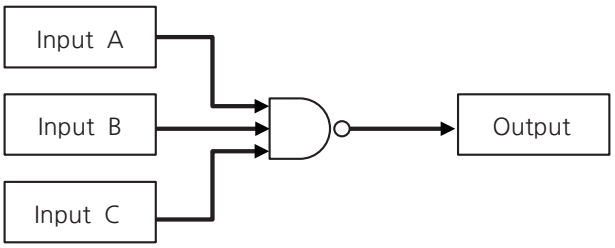
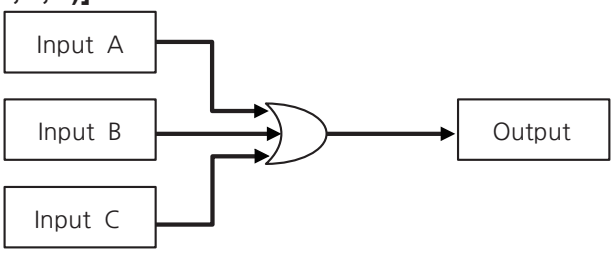
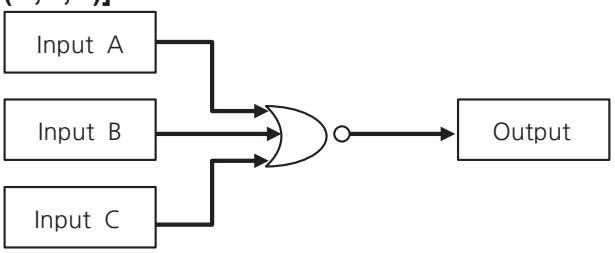
<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>US-99 UserSeq Para Form</td><td>Sets the display mode for parameters used in the user sequence.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Signed 0 dec. pl.</td><td>Signed integer, decimal number</td></tr>
<tr><td>1</td><td>Signed 1 dec. pl.</td><td>Signed real number to one decimal place, decimal number</td></tr>
<tr><td>2</td><td>Signed 2 dec. pl.</td><td>Signed real number to two decimal places, decimal number</td></tr>
<tr><td>3</td><td>Signed 3 dec. pl.</td><td>Signed real number to three decimal places, decimal number</td></tr>
<tr><td>4</td><td>Signed 4 dec. pl.</td><td>Signed real number to four decimal places, decimal number</td></tr>
<tr><td>5</td><td>Unsigned 0 dec. pl.</td><td>Unsigned integer, decimal number</td></tr>
<tr><td>6</td><td>Unsigned 1 dec. pl.</td><td>Unsigned real number to one decimal place, decimal number</td></tr>
<tr><td>7</td><td>Unsigned 2 dec. pl.</td><td>Unsigned real number to two decimal places, decimal number</td></tr>
<tr><td>8</td><td>Unsigned 3 dec. pl.</td><td>Unsigned real number to three decimal places, decimal number</td></tr>
<tr><td>9</td><td>Unsigned 4 dec. pl.</td><td>Unsigned real number to four decimal places, decimal number</td></tr>
<tr><td>10</td><td>16bit Hex</td><td>16-bit hexadecimal</td></tr>
<tr><td>11</td><td>32bit Hex</td><td>32-bit hexadecimal</td></tr>
</table></td></tr>
</table>

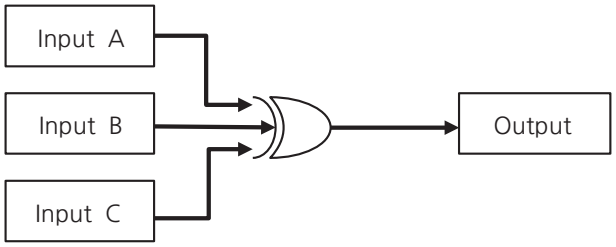
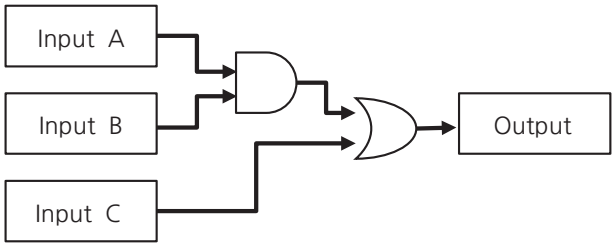
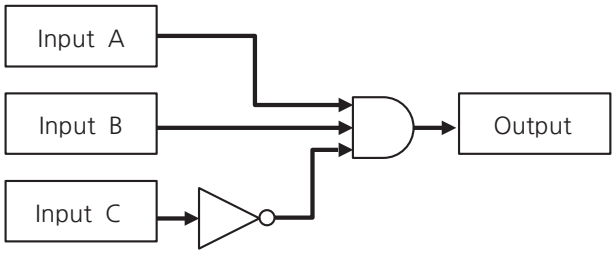
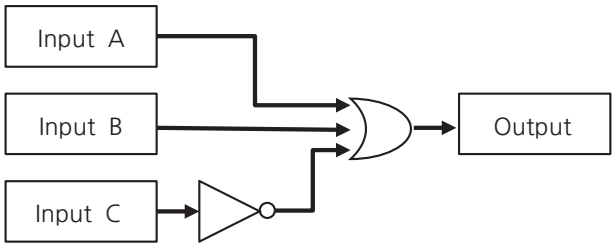
7.27.2 Logic Function

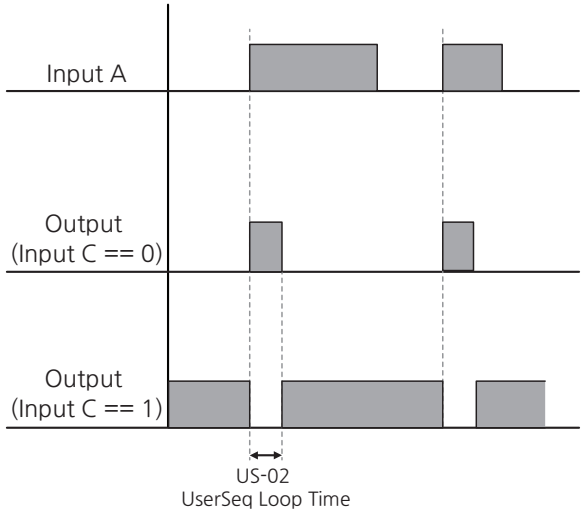
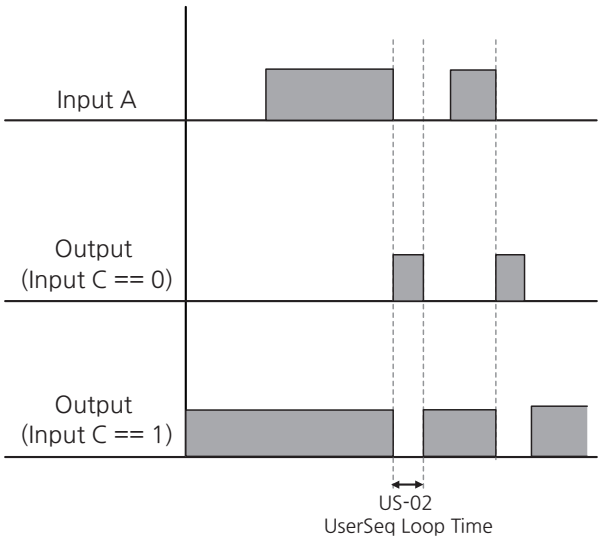
It is a function block used for user sequence and logic operations.

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>USL-
05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75
Logicxx Type
(Logicxx: Logic02~Logic15)</td><td>Selects an operator for a logic operation.
<table>
<tr><th colspan="2">Operator</th></tr>
<tr><td>0</td><td>NOT(A)</td></tr>
<tr><td>1</td><td>AND(A,B,C)</td></tr>
<tr><td>2</td><td>NAND(A,B,C)</td></tr>
<tr><td>3</td><td>OR(A,B,C)</td></tr>
<tr><td>4</td><td>NOR(A,B,C)</td></tr>
<tr><td>5</td><td>XOR(A,B)</td></tr>
<tr><td>6</td><td>(A AND B) OR C</td></tr>
<tr><td>7</td><td>AND(A,B,!C)</td></tr>
<tr><td>8</td><td>OR(A,B,!C)</td></tr>
<tr><td>9</td><td>R-EDGE-DETECT(A)</td></tr>
<tr><td>10</td><td>F-EDGE-DETECT(A)</td></tr>
</table>
Description by main logic
[0 : NOT(A)]


[Image 48. Logic function (0 : NOT(A))]</td></tr>
</table>

Code and Functions	Description
USL- 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Logicxx Type (Logicxx: Logic02~Logic15)	**[1 : AND(A,B,C)]**  **[Image 49. Logic function (1 : AND(A,B,C))]** **[2 : NAND(A,B,C)]**  **[Image 50. Logic function (2 : NAND(A,B,C))]** **[3 : OR(A,B,C)]**  **[Image 51. Logic function (3 : OR(A,B,C))]** **[4 : NOR(A,B,C)]**  **[Image 52. Logic function (4 : NOR(A,B,C))]**

Code and Functions	Description
USL- 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Logicxx Type (Logicxx: Logic02~Logic15)	**[5 : XOR(A,B,C)]**  **[Image 53. Logic function (5 : XOR(A,B,C))]** **[6 : (A AND B) OR C]**  **[Image 54. Logic function (6 : (A AND B) OR C)]** **[7 : AND(A,B,C)]**  **[Image 55. Logic function (7 : AND(A,B,C))]** **[8 : OR(A,B,C)]**  **[Image 56. Logic function (8 : OR(A,B,C))]**

Code and Functions	Description
USL- 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Logicxx Type (Logicxx: Logic02~Logic15)	**[9 : R-EDGE-DETECT(A)]**  **[Image 57. Logic function (9 : R-EDGE-DETECT(A))]** **[10 : F-EDGE-DETECT(A)]**  **[Image 58. Logic function (10 : F-EDGE-DETECT(A))]**

Code and Functions	Description
USL-06, 11, 16, 21, 26, 31, 36, 41, 46, 51, 56, 61, 66, 71, 76 Valuexx InputA (Valuexx: Value01~Value15)	Input A value of each logic block.
USL-07, 12, 17, 22, 27, 32, 37, 42, 47, 52, 57, 62, 67, 72, 77 Valuexx InputB (Valuexx: Value01~Value15)	Input B value of each logic block.
USL- 8, 13, 18, 23, 28, 33, 38, 43, 48, 53, 58, 63, 68, 73, 78 Valuexx InputC (Valuexx: Value01~Value15)	Input C value of each logic block.
USL- 9, 14, 19, 24, 29, 34, 39, 44, 49, 54, 59, 64, 69, 74, 79 Valuexx Output (Valuexx: Value01~Value15)	Output value of each logic block.

7.27.3 Arithmetic Function (Value Function)

It is a function block used for user sequence and arithmetic operations.

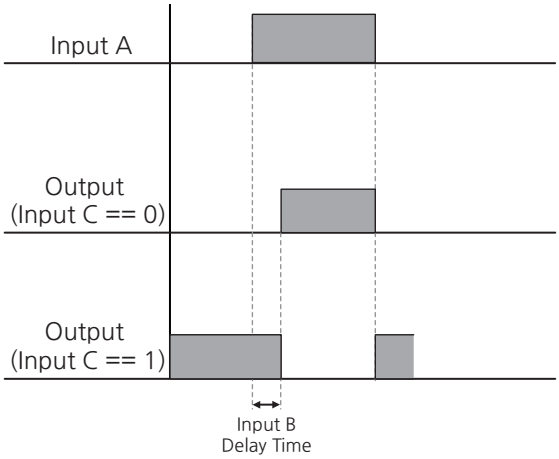
<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td rowspan="16">USV-05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Valuexx Type (Valuexx: Value01~Value15)</td><td colspan="3">Selects an operator for an arithmetic operation.</td></tr>
<tr><td colspan="2">Operator</td><td>Description</td></tr>
<tr><td>0</td><td>A+B+C</td><td>Outputs A + B + C.</td></tr>
<tr><td>1</td><td>A-B-C</td><td>Outputs A - B - C.</td></tr>
<tr><td>2</td><td>A+B-C</td><td>Outputs A + B - C.</td></tr>
<tr><td>3</td><td>ABS(A+B+C)</td><td>Outputs absolute value of A + B + C.</td></tr>
<tr><td>4</td><td>A mod B</td><td>Outputs the remainder of A divided by B.</td></tr>
<tr><td>5</td><td>(A*B)/C</td><td>Outputs (A * B) / C.
Outputs 0 if C equals 0.</td></tr>
<tr><td>6</td><td>MIN(A,B,C)</td><td>Outputs the smallest value among A, B, and C.</td></tr>
<tr><td>7</td><td>MAX(A,B,C)</td><td>Outputs the biggest value among A, B, and C.</td></tr>
<tr><td>8</td><td>SWITCH(A) B/C</td><td>Outputs B if A equals 0, and C if not 0.</td></tr>
<tr><td>9</td><td>BitTest(A,B)</td><td>Outputs 1 if the bit at position B of A is 1, and 0 if it is 0.</td></tr>
<tr><td>10</td><td>BitSet(A,B)</td><td>Sets the bit at position B of A to 1 and outputs.
B is a value in between 0-16, and is recognized as 16 if it is over 16.
Output is always 0 if B equals 0.</td></tr>
<tr><td>11</td><td>BitClear(A,B)</td><td>Sets the bit at position B of A to 0 and outputs.
B is a value in between 0-16, and is recognized as 16 if it is over 16.
Output is always A if B equals 0.</td></tr>
<tr><td>12</td><td>Up Counter</td><td rowspan="2">It counts up/down based on C according to the change in A value.
Output ranges between 0-32767.</td></tr>
<tr><td>13</td><td>Down Counter</td></tr>
<tr><td>14</td><td>BINARY DECODE</td><td>Decodes according to C, B, and A values and outputs.</td></tr>
</table>

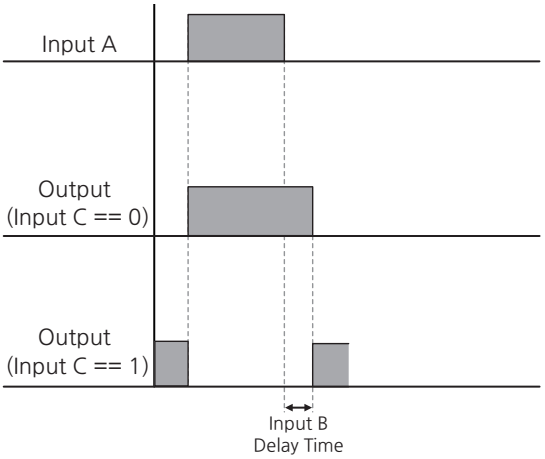
Code and Functions	Description		
USV-05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Valuexx Type (Valuexx: Value01~Value15)	Operator		Description
	15	A>B+/-C	Implements hysteresis band C to B value.
	16	A>=B	Outputs 1 if A >= B, and 0 if not.
	17	A<=B	Outputs 1 if A <= B, and 0 if not.
	18	A(1+B)	Outputs A * (1 + B / 100).
	19	(A*B)/100)+C	Outputs (A * B) / 100) + C.
	20	ABS(A)> ABS(B)+/-C	Implements hysteresis band C to absolute value (B).
	21	ABS(A)>= ABS(B)	Outputs 1 if absolute value (A))>= absolute value (B), and 0 if not.
	22	IF(C)-A	Outputs A if C equals 0, and -A if not.
	23	IF(A==B)	Outputs 1 if A equals B, and 0 if not.
	24	IF(A!=B)	Outputs 1 if A is not B, and 0 if it is.
	25	IF(C) HOLD(A)	Outputs previous A value if C equals 1, and current A value if C equals 0.
	26	ON DELAY	Delays On operation for as long as B time for A input, and outputs.
	27	OFF DELAY	Delays Off operation for as long as B time for A input, and outputs.
	28	Timer	100 msec timer.
	29	Window	Detects if A input is within a fixed band. The polarity of output is determined by C.
	30	Window C <=A<=B	Detects if C input is within a fixed band. The polarity of output is determined by the size of A and B.
	31	Lowpass Filter	Low-pass filter.
	32	LimitA UprB LwrC	Limits A value with the upper limit (C) and lower limit (B).

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td rowspan="8">USV-05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Valuexx Type (Valuexx: Value01~Value15)</td><td colspan="2">Operator</td><td>Description</td></tr>
<tr><td>33</td><td>ExtractBits</td><td>Outputs A value as bits as many as C at the bit position of B. The bit starts from no. 0.</td></tr>
<tr><td>34</td><td>Minimum Pulse</td><td>Limits the minimum pulse width (B) for input A and the outputs, depending on the polarity setting (C).</td></tr>
<tr><td>35</td><td>Pulse Train</td><td>While input A is True, it outputs pulses according to OnTime (B) and OffTime (C).</td></tr>
<tr><td>36</td><td>Profile Squrt</td><td rowspan="5">Outputs values according to the respective formulas based on the input value of A.</td></tr>
<tr><td>37</td><td>Profile Linear</td></tr>
<tr><td>38</td><td>Profile X^2</td></tr>
<tr><td>39</td><td>Profile X^3</td></tr>
<tr><td>40</td><td>Profile X^4</td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>USV-05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Valuexx Type (Valuexx: Value01~Value15)</td><td>
Additional descriptions on main functions

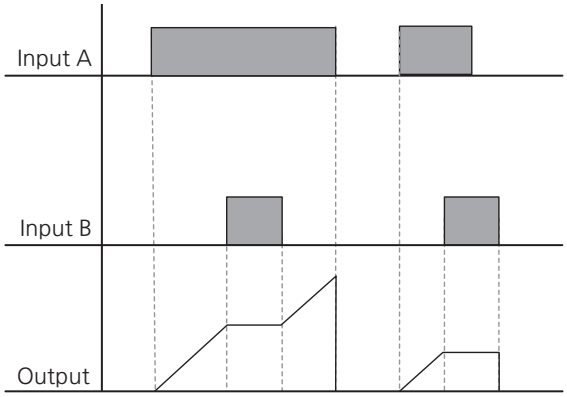
[12/13 : Up/Down Counter]
Count works under the following conditions:
<table>
<tr><th>C</th><th>Condition A for Count Operation</th></tr>
<tr><td>0</td><td>0→1</td></tr>
<tr><td>1</td><td>1→0</td></tr>
<tr><td>2</td><td>Change A</td></tr>
</table>
[14 : BINARY DECODE]
Decoded output according to C, B, and A values follow below conditions:
<table>
<tr><th>C</th><th>B</th><th>A</th><th>Output</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>Value other than 0</td><td>1</td></tr>
<tr><td>0</td><td>Value other than 0</td><td>0</td><td>2</td></tr>
<tr><td>0</td><td>Value other than 0</td><td>Value other than 0</td><td>3</td></tr>
<tr><td>Value other than 0</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>Value other than 0</td><td>0</td><td>Value other than 0</td><td>5</td></tr>
<tr><td>Value other than 0</td><td>Value other than 0</td><td>0</td><td>6</td></tr>
<tr><td>Value other than 0</td><td>Value other than 0</td><td>Value other than 0</td><td>7</td></tr>
</table>
[15 : A>B+/-C]
Output works under the following conditions:
<table>
<tr><th>Condition</th><th>Output</th></tr>
<tr><td>A > (B+C)</td><td>1</td></tr>
<tr><td>A < (B-C)</td><td>0</td></tr>
<tr><td>(B-C) < A < (B+C)</td><td>No change</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>USV-05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Valuexx Type (Valuexx: Value01~Value15)</td><td>
[20 : ABS(A)>ABS(B)+/-C]
Output works under the following conditions:
<table>
<tr><th>Condition</th><th>Output</th></tr>
<tr><td>ABS(A) > ABS(B)+C</td><td>1</td></tr>
<tr><td>ABS(A) < ABS(B)-C</td><td>0</td></tr>
<tr><td>ABS(B)-C < ABS(A) < ABS(B)+C</td><td>No change</td></tr>
</table>
[26 : ON DELAY]


[Image 59. Logic function (26 : ON DELAY)]
[27 : OFF DELAY]


[Image 60. Logic function (27 : OFF DELAY)]
</td></tr>
</table>

Code and Functions	Description
USV-05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Logicxx Type (Logicxx: Logic02~Logic15)	**[28 : TIMER]**

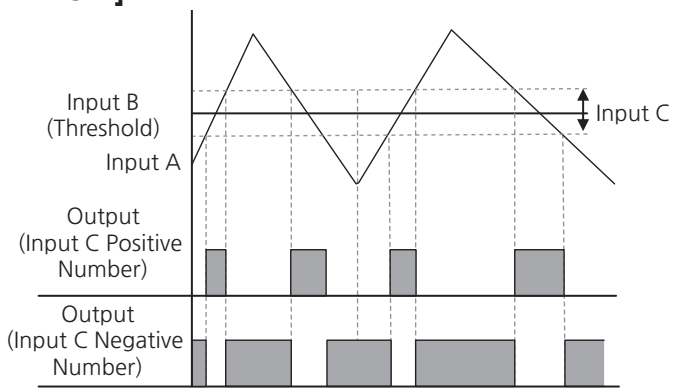


[Image 61. Logic function (28 : TIMER)]

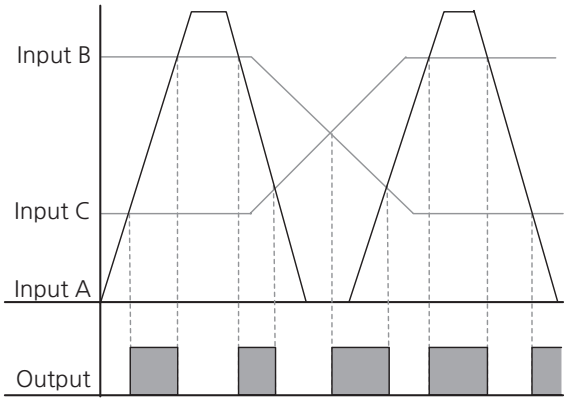
Timer works under the following conditions:

A	B	C	Output
0	-	-	0
Value other than 0	0	0	Increase by 1 every 100 msec, 0 after 99999999
		Value other than 0	Increase by 1 every 100 msec, 0 after C value
Value other than 0	1	-	Keep previous output

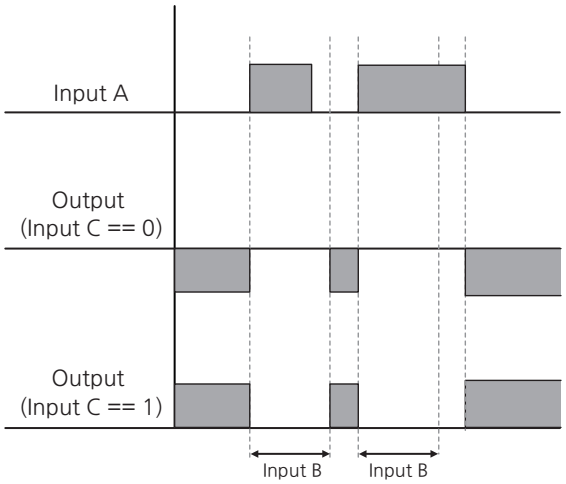
[29 : WINDOW]



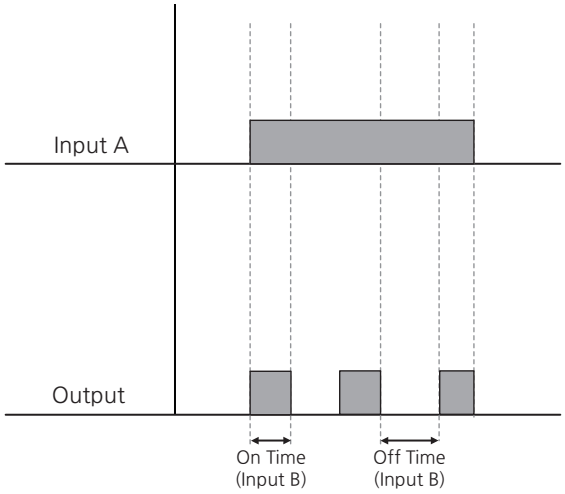
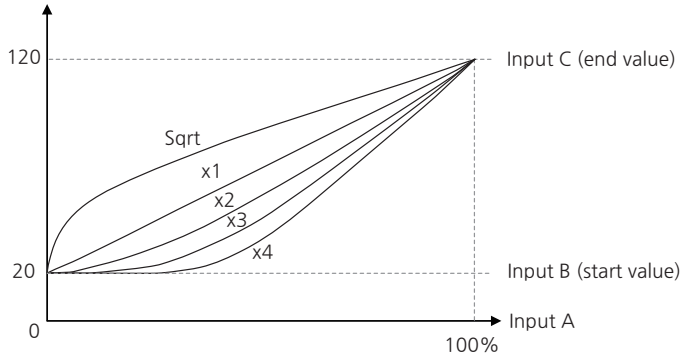
[Image 62. Logic function (29 : WINDOW)]

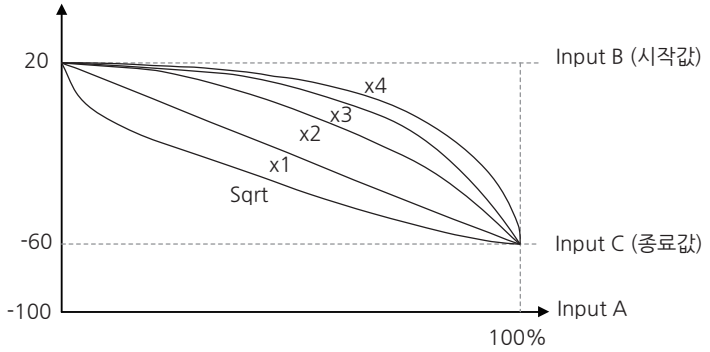
<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>USV-05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Valuexx Type (Valuexx: Value01-Value15)</td><td>
[30 : WINDOW C<= A<=B]


[Image 63. Logic function (30 : WINDOW C <= A <= B)]

[31 : Lowpass Filter]
A function that applies a low-pass filter to input A and outputs C.
<table>
<tr><th colspan="2">Input</th><th>Description</th></tr>
<tr><td>A</td><td>Data</td><td>Input</td></tr>
<tr><td>B</td><td>Filter time constant</td><td>Time required to reach 63.2% of the output when the A value is input</td></tr>
<tr><td>C</td><td>Filter disabled</td><td>If 1, A is output directly to C without filtering.</td></tr>
</table>
[34: Minimum Pulse]


</td></tr>
</table>

Code and Functions	Description
USV-05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Valuexx Type (Valuexx: Value01-Value15)	• Input A: If 1 (True), output pulse generation starts. If 0 (False), output pulse generation stops. • Input B: Minimum pulse holding time (1 = 1 ms). The generated pulse is maintained for at least the Input B time. The minimum pulse holding time cannot be lower than the US-02 (UserSeqLoop Time) value. • Input C: If True, the output is inverted. The initial value is 0. **[35: Pulse Train]**  • Input A: If 1 (True), output pulse generation starts. If 0 (False), output pulse generation stops. • Input B: Pulse ON time (On Time) (1 = 1 msec) • Input C: Pulse OFF time (Off Time) (1 = 1 msec) **[36-40: PatternGen]** **Example)** Start value (Input B): 20, End value (Input C): 120 

Code and Functions	Description
USV-05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75 Valuexx Type (Valuexx: Value01-Value15)	**Example)** Start value (Input B): 20, End value (Input C): -60  • Input A: 0 to 100% (or fixed range 0 to 10000) • Input B: Start value (initial output value) • Input C: End value (final target output value) The initial output value is 0 and is limited to the range between Input B and Input C. The output value is generated according to various formula patterns as shown below. $PatternGen\ Sqrt\ Output = Start\ value + (End\ value - Start\ value) \times X^{0.5}$ $PatternGen\ X^1\ Output = Start\ value + (End\ value - Start\ value) \times X^1$ $PatternGen\ X^2\ Output = Start\ value + (End\ value - Start\ value) \times X^2$ $PatternGen\ X^3\ Output = Start\ value + (End\ value - Start\ value) \times X^3$ $PatternGen\ X^4\ Output = Start\ value + (End\ value - Start\ value) \times X^4$

7.27.4 Parameter Function (ParaSet Function)

This function sets parameters registered in the block by getting inputs of rising edge or falling edge values from the user sequence.

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>USP-01, 03, 05, 07, 09, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39
Parasetxx In</td><td>Sets event parameter values of your choice.</td></tr>
<tr><td>USP-02, 04, 06, 08, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40
Paraset01-20 Type</td><td>Sets event type for parameter operations.
<table>
<tr><th colspan="2">Configuration</th><th>Functionality</th></tr>
<tr><td>0</td><td>0-1 EDGE</td><td>Sets event type as rising edge.</td></tr>
<tr><td>1</td><td>1-0 EDGE</td><td>Sets event type as falling edge.</td></tr>
</table></td></tr>
<tr><td>USP 91-95
UserDataToSave
01-05</td><td>Parameters for user only. Saved when inverter power is turned off.</td></tr>
</table>

7.27.5 Special Function

It is a special function used in the user sequence.

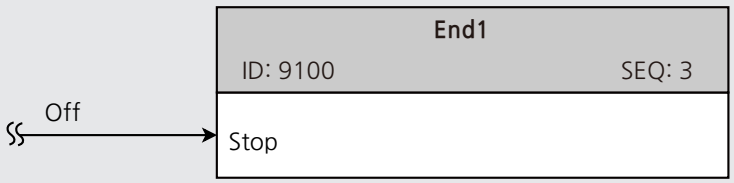
Code and Functions	Description
USM-01-16 Mux1 Inputxx (Inputxx: Input01-Input16), USM-17 Mux1 Output	MUX is a function that converts individual bit state inputs (MUX1 Input01 to Input16) into one 16-bit data output (MUX1 Output). The least significant bit is MUX1 Input01.
USM-18 Demux1 Input USM-19-34, Demux1 Outputxx (Outputxx: Output01-Output16)	DMUX is a function that converts a 16-bit input (DMUX1 Input) value into individual output bits (DMUX1 Out01 to 16). Input data and output value for DEMUX1. The least significant bit is DMUX1 Output01.
USM-35 PI Run Enable, USM-36 Reference Value, USM-38 Proportional Gain, USM-39 Integral Time, USM-46 PID Limit Lo, USM-47 PID Limit Hi, USM-49 Output Scale, USM-50 I-Term Clear, USM-51 Output Value, USM-52 Error Value	Exclusive PI controller for user sequence. For detailed functions, refer to **7.8 External PID (EPID)**.

ⓘ Caution

If a "stop operation" command is not issued when the user sequence ends, the inverter remains in the run state when the user sequence is restarted, and execution of the user sequence may be restricted due to write-prohibited parameters. In this case, if the run command method (DRV-10 1st Command Source) is set to 7 (User Sequence), the inverter operation can be stopped using the US-12 (Stop) command.

Note

The End1 block is executed when the user sequence ends. When the user adds parameters as block inputs and enters values, those parameters retain those values when the user sequence ends. This is mainly used when parameters need to be restored to their original state at the end of the user sequence.

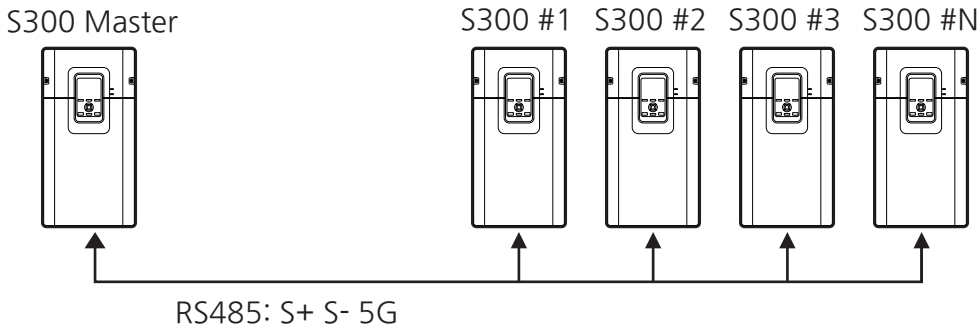


7.27.6 Simple Master

Simple master allows you to operate multiple inverters as slaves by having one of the inverters acting as a communication master through the user sequence.

7.27.6.1 Simple Master

Simple master consists of the following:



[Image 64. Simple Master Composition]

7.27.6.2 Simple-Master-Related Communication Parameter Settings

Refer to **10.2.2 Parameter Settings for Slave Communication** for inverters that are slaves.

For the inverter that is the master, following parameters need to be additionally set aside from slave communication parameter settings.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
INTC	02	Protocol	0	Modbus RTU	0~2	0	-
			1	LS Inv 485			
			2	Modbus RTU Master			

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
INTM	01	Comm Enable Mode	1	Always Enable	0~2	0	-
	02, 09, 16, 23, 30, 37, 44, 51, 58, 65	P01~10-Slave RW Mode	0	Not Used	0~3	0	-
	3, 10, 17, 24, 31, 38, 45, 52, 59, 66	P01~10-SlaveStationID	1		1~64	0	-
	4, 11, 18, 25, 32, 39, 46, 53, 60, 67	P01~10-Data Count	1		1~4	0	-
	5, 12, 19, 26, 33, 40, 47, 54, 61, 68	P01~10-Slave DataAddr	0000h		0000h~ FFFFh	0000h	-
	6, 13, 20, 27, 34, 41, 48, 55, 62, 69	P01~10-MasterDataAddr	0000h		0000h~ FFFFh	0000h	-
	7, 14, 21, 28, 35, 42, 49, 56, 63, 70	P01~10-Time Period	0.10		0.10~1.00	0.10	sec
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: D1~D8)	67	Modbus Master En	-	1, 2, 4, 5, 10, 11, 12, 9	-

Communication Parameters Setting Details

Code and Functions	Description
INTC-02 Protocol	Sets the value to 2 (Modbus RTU Master). The inverter plays as a self-communication master and allows for communication with subordinate inverters.
INTM-01 Comm Enable Mode	Sets simple master operations.

Item		Functionality
0	None	Deactivates the simple master.
1	Always Enable	Activates the simple master.
2	DI Dependent	Simple master works when the multifunction terminal with 67 (Modbus Master En) setting for the Define code of DI1-DI8 of the terminal input group (DIN) turns on.

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>INTM-02, 09, 16, 23, 30, 37, 44, 51, 58 P01~10-Slave RW Mode</td><td>Sets read/write mode for communication frames with each slave, P1-10.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Not Used</td><td>P1-10 frames are not used.</td></tr>
<tr><td>1</td><td>Read Mode</td><td>Reads parameters from the slaves.</td></tr>
<tr><td>2</td><td>Write Mode</td><td>Writes parameters on the slaves.</td></tr>
<tr><td>3</td><td>Broadcast Write</td><td>Writes parameters by broadcast on all slaves.</td></tr>
</table></td></tr>
<tr><td>INTM-03, 10, 17, 24, 31, 38, 45, 52, 59 P01~10-SlaveStation ID</td><td>Sets communication station numbers for communication frames with each slave, P1-10.</td></tr>
<tr><td>INTM-04, 11, 18, 25, 32, 39, 46, 53, 60 P01~10-Data Count</td><td>Sets the number of data for communication frames with each slave, P1-10.</td></tr>
<tr><td>INTM-05, 12, 19, 26, 33, 40, 47, 54, 61 P01~10-Slave DataAddr</td><td>Sets the starting address of parameters for communication frames with each slave, P1-10.</td></tr>
<tr><td>INTM-06, 13, 20, 27, 34, 41, 48, 55, 62 P01~10-MasterDataAddr</td><td>Sets the starting address of the master parameter for communication frames with each slave, P1-10.</td></tr>
<tr><td>INTM-07, 14, 21, 28, 35, 42, 49, 56, 63 P01~10-Time Period</td><td>Sets the communication cycle for communication frames with each slave, P1-10.</td></tr>
</table>

7.28 Operating Winder/Unwinder

Also called a spooler, a winder winds web materials (iron wire, iron sheet, steel wire, etc.) while maintaining consistent tension. While, unwinder unwinds the web materials while maintaining consistent tension.

The inverter's winder and unwinder functions are used in a closed-loop tension control system, which winds or unwinds tensions by basically using the analog feedback from tension control/detection devices, including a dancer and load cell, to operate the PID controller. The PID controller used in a closed-loop tension control system is called a Web PID because it differs from the existing PID controller. However, even in open-loop tension control systems without Web PID or tension control detection devices like dancers or load cells, the inverter's winder and unwinder functions can still be utilized.

The tension control operation for the S300 inverter can be roughly categorized into winder/unwinder, closed-loop/open-loop, and speed/tension command operations.

$$Motor\ speed\ [rpm] = \frac{Flux\ [mpm]}{\pi \cdot diameter\ [m]}$$

Formula 1

Operating winder

The actual diameter (m) of the winder increases as the process progresses. **Formula 1** As shown in Formula 1, to maintain the flux (mpm), the motor speed (rpm) should decrease with the increasing diameter. The speed of the motor (i.e. the inverter's output frequency) is decreased by the Web PID controller. In addition, the increasing diameter is calculated and presumed internally. The calculated diameter is used to decrease the inverter's output frequency.

Unlike the winder, the unwinder's diameter (m) will decrease as the process progresses. **Formula 1** As shown in the Formula 1, to maintain the flux (mpm), the motor speed (rpm) should increase with the decreasing diameter. In a closed-loop tension control system, the motor speed (i.e. the inverter's output frequency) is increased by the Web PID controller. In addition, the decreasing diameter is calculated and presumed internally. The calculated diameter is used to increase the inverter's output frequency.

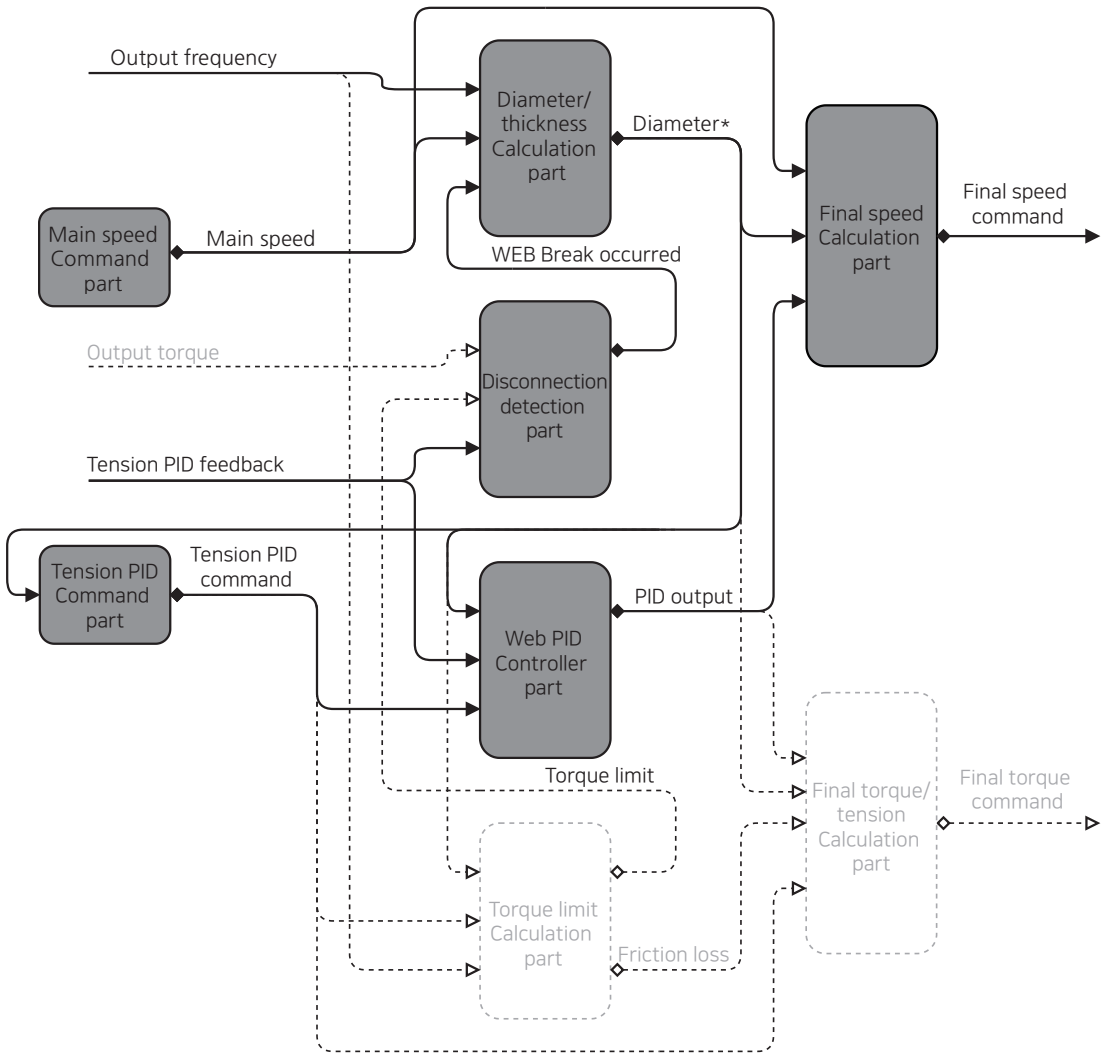
These methods result in much more stable performance than the existing method that only uses a PID controller to control the tension of the winder. The diameter calculated internally compensates the inverter's output frequency once more, so the role of the Web PID controller in the inverter's output frequency is much smaller. Therefore, the Web PID controller output's saturation risk is removed, and the I controller output oscillation significantly decreases. Other major functions are as follows:

- Function to remove transient phenomena of a dancer or load cell during powering on (Related code: WEB1-42)

- Inertia compensation function (Related code: WEB1-47, 48)
- Function to maintain the tension and conduct emergency stop operation (Related code: APP-46)
- Function to detect web material before broken (Related code: WEB1-80~84)

7.28.1 Overall Compositions

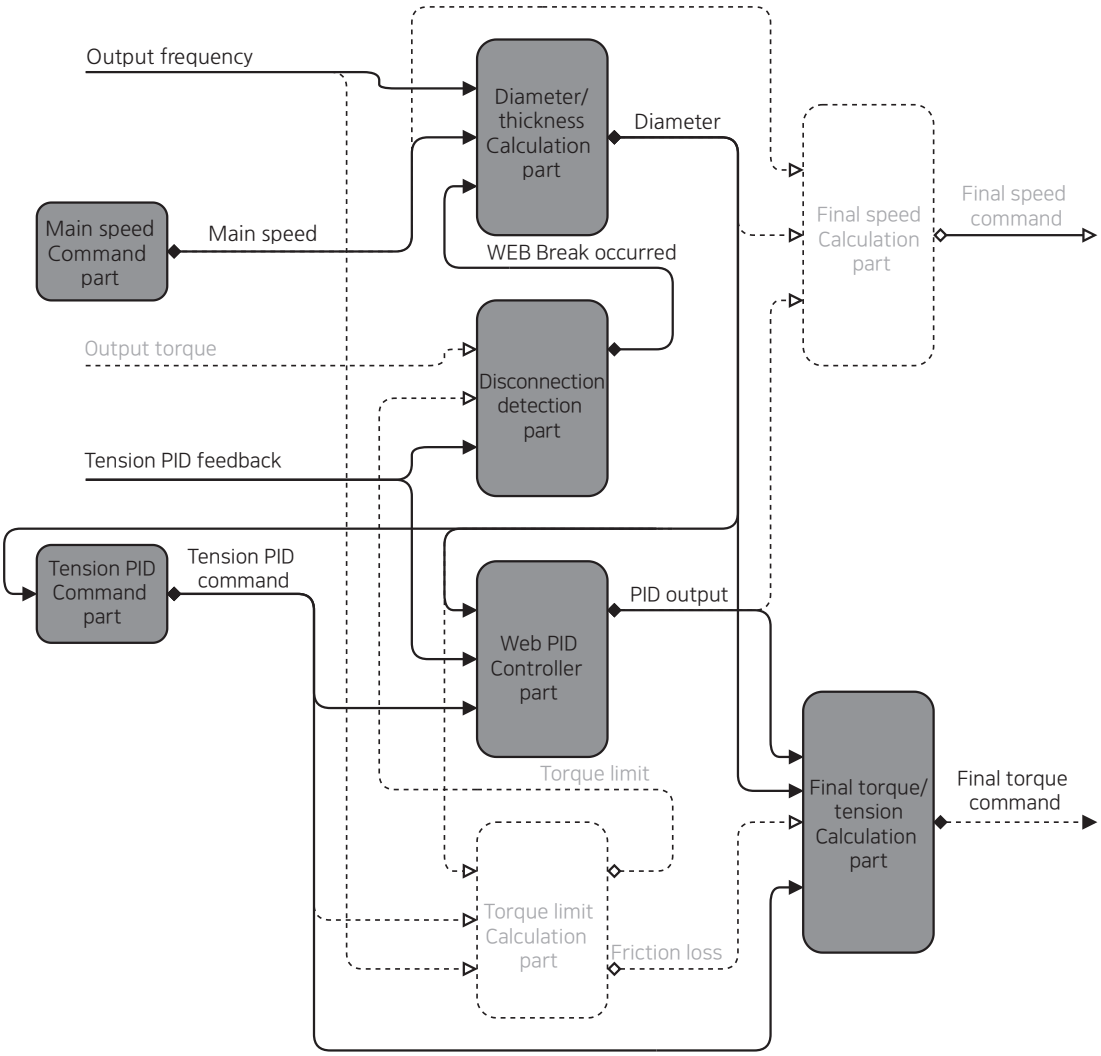
7.28.1.1 Speed Control Mode with a Tension Sensor (Capstan Operation)



*Diameter: Thickness is applied when operating capstan.

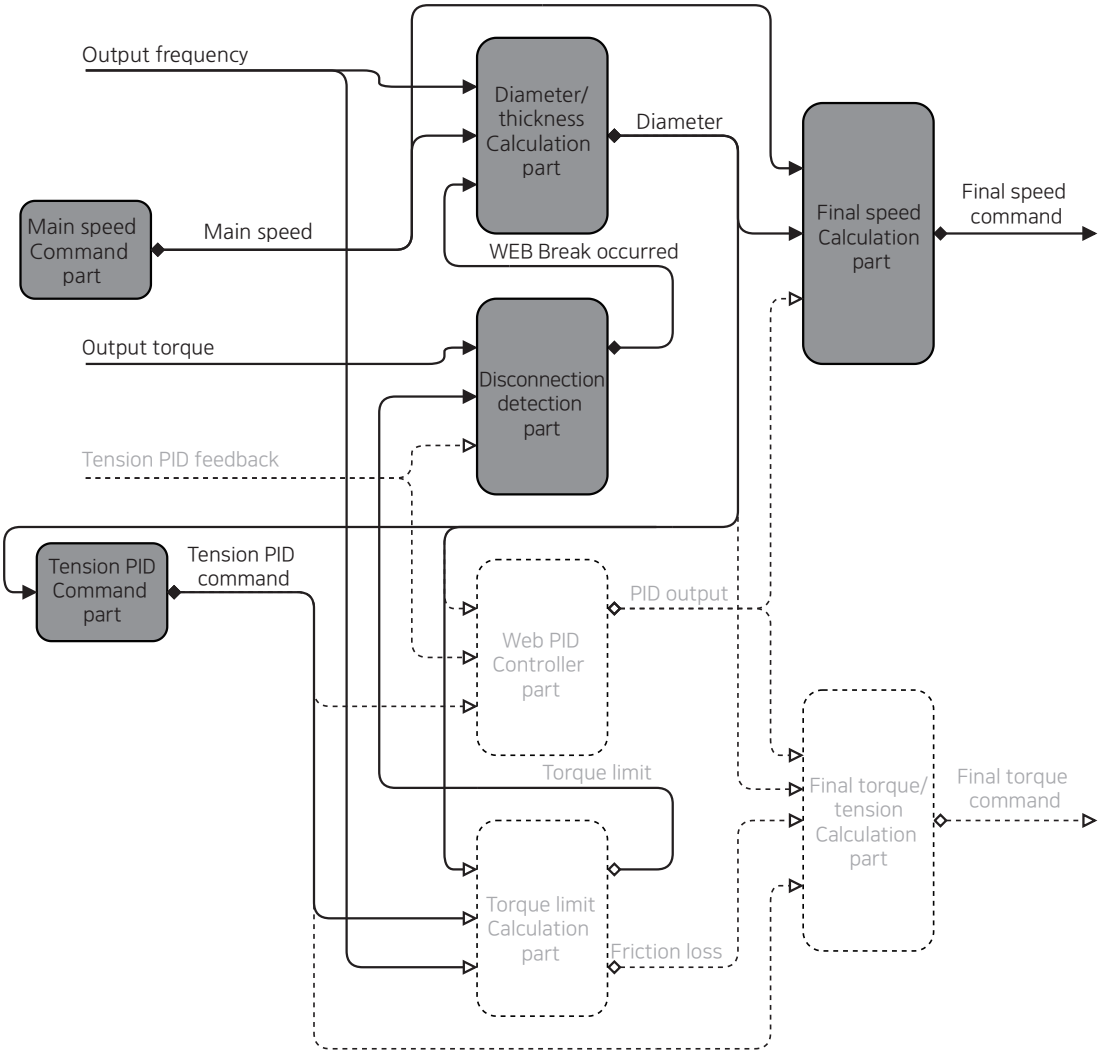
[Image 65. Speed Control mode with a tension sensor (Capstan operation)]

7.28.1.2 Torque Control Mode with a Tension Sensor



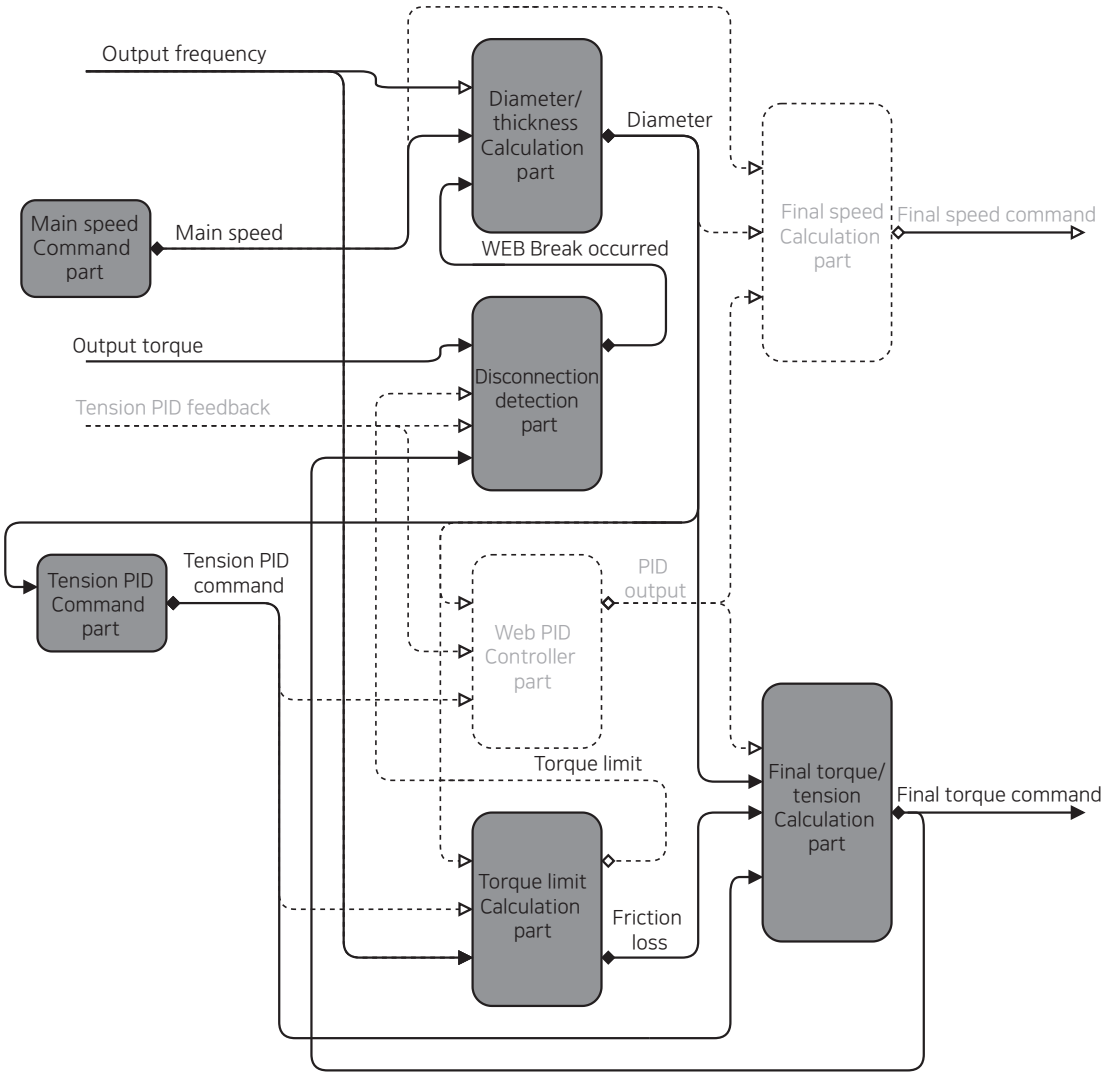
[Image 66. Torque Control mode with a tension sensor]

7.28.1.3 Speed Control Mode without a Tension Sensor



[Image 67. Speed Control mode without a tension sensor]

7.28.1.4 Torque Control Mode without a Tension Sensor

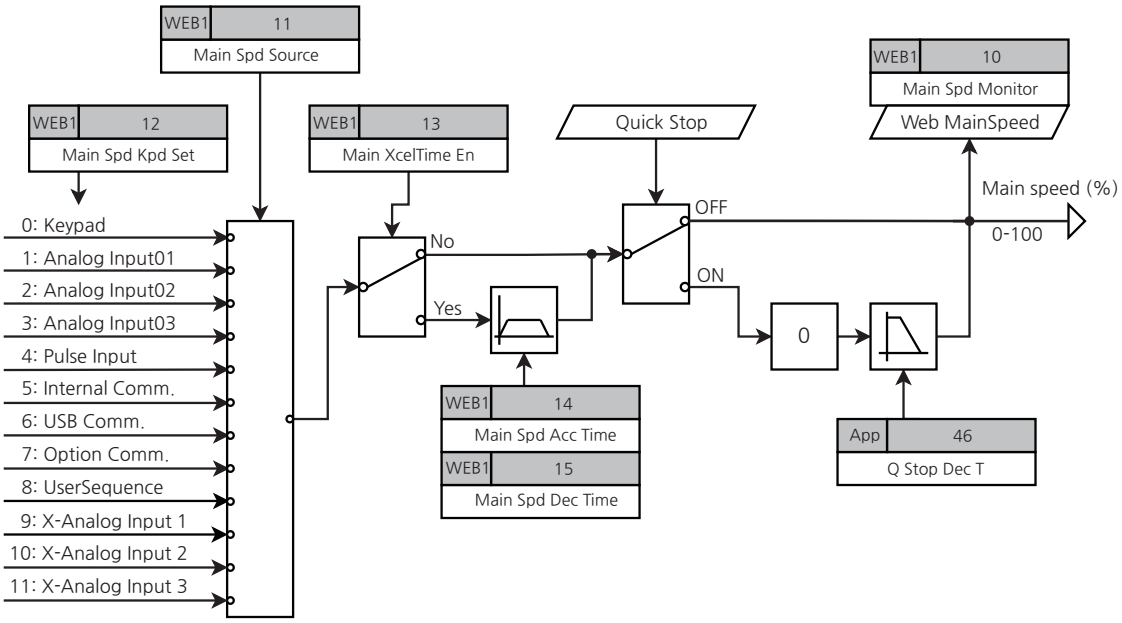


[Image 68. Torque Control mode without a tension sensor]

7.28.2 Main Speed Command Part

The unit for the main speed command is percent (%) and is the same concept as the flux (mpm). For example, there is a system with a maximum flux of 800 mpm, and if you want to operate the system at 400 mpm, set the main speed command to 50% (400/800x100%).

You can send the command by using Smart Operator, analog input, communication, etc.



[Image 69. Main speed command part]

7.28.2.1 Main Speed Command

Main Speed Command Settings

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	10	Main Spd Monitor	-	-	-	-	
	11	Main Spd Source	0	Keypad	0-11	0	-
	12	Main Spd Kpd Set	-		0.00-100.00	0.00	%
	13	Main XcelTime En	0	No	0-1	0	-
			1	Yes			
	14	Main Spd Acc Time	-		0.00-300.00	10.00	sec
	15	Main Spd Dec Time	-		0.00-300.00	20.00	sec
OUT	1	AO1 Define	16	Web MainSpeed	0-17	0	-
	10	AO2 Define	16	Web MainSpeed	0-17	0	-

Main Speed Command Settings Details

Code and Functions	Description
WEB1-10 Main Spd Monitor	Shows the main speed (%). Shows targeted main speed when the inverter is stopped and ramp main speed when the inverter is in operation.
WEB1-11 Main Spd Source	Select the method for main speed command. 5(Internal Comm.), 7(Option Comm.) Alternately, selecting 8 (UserSequence.) allows you to set the main speed command value by up to two decimal places. For example, if you want to use 60.00% of the main speed command, enter 6,000 at the common area address, 0x03C0, in the built-in 485 communication or communication option card.

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>WEB1-11 Main Spd Source</td><td>
<table>
<tr><th colspan="2">Operator</th><th>Description</th></tr>
<tr><td>0</td><td>Keypad</td><td>Operates at the main speed input in the WEB1-12.</td></tr>
<tr><td>1</td><td>Analog Input 1</td><td rowspan="3">AI terminal of the terminal block (analog input terminal)</td></tr>
<tr><td>2</td><td>Analog Input 2</td></tr>
<tr><td>3</td><td>Analog Input 3</td></tr>
<tr><td>4</td><td>Pulse Input</td><td>TI Terminal of the terminal block (pulse input terminal, input pulse of 0-32 kHz)</td></tr>
<tr><td>5</td><td>Internal Comm.</td><td>RS-485 input terminal</td></tr>
<tr><td>6</td><td>USB Comm.</td><td>USB Port</td></tr>
<tr><td>7</td><td>Option Comm. [48]</td><td>Communication options</td></tr>
<tr><td>8</td><td>User Sequence</td><td>User sequence</td></tr>
<tr><td>9</td><td>X-Analog Input 1 [49]</td><td rowspan="3">Analog input terminal for expansion I/O</td></tr>
<tr><td>10</td><td>X-Analog Input 2 [49]</td></tr>
<tr><td>11</td><td>X-Analog Input 3 [49]</td></tr>
</table>
</td></tr>
<tr><td>WEB1-12 Main Spd Kpd Set</td><td>Operates at the main speed input in this code when selecting WEB1=11 value as 0 (Keypad).</td></tr>
<tr><td>WEB1-13 Main XcelTime En</td><td>You can set the acceleration and deceleration times of the main speed. Selecting this code value as 1 (Yes) will increase/decrease ramp at the main speed at the acceleration and deceleration times in the WEB1-14 and Web1-15. The initial value is 0 (No). In this case, the main speed should be set to increase or decrease ramp at the external superordinate controller. If failed, the main speed command may be entered in the steps, resulting in unstable operation of the system.</td></tr>
<tr><td>WEB1-14 Main Spd Acc Time, WEB1-15 Main Spd Dec Time</td><td>Activated when WEB1-13 value is 1 (Yes). You can set the acceleration and deceleration times of the main speed. The reference for the acceleration and deceleration times is 100% of the main speed. For example, when the WEB1-14 is set to 10.00 sec, which is the set value shipped from the factory, it will take 5 seconds (10 sec x 50%/100%) to accelerate the main speed from 0% to 50%.</td></tr>
<tr><td>OUT-01, 10 AOx Define (AOx: AO1, AO2)</td><td>Setting the value to 16 (Web MainSpeed) allows monitoring of the main speed via analog output.</td></tr>
</table>

[48] Configurable only when equipped with communication options
[49] Configurable only when equipped with expansion I/O options

7.28.2.2 Emergency Stop (Quick Stop)

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	46	Q Stop Dec T	-		0.00-6000.00	5.00	sec
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	69	Quick Stop	-	1, 2, 4, 5, 10, 11, 12, 9	-

A closed-loop tension control system that uses a dancer or load cell may maintain the tension during the emergency and execute an emergency stop for the system.

When the terminal input set to 69 (Quick Stop) value is entered, the system will start the deceleration stop according to the set deceleration time in APP-46 (Q Stop Dec T). The deceleration time is always consistent regardless of the current inverter's output frequency.

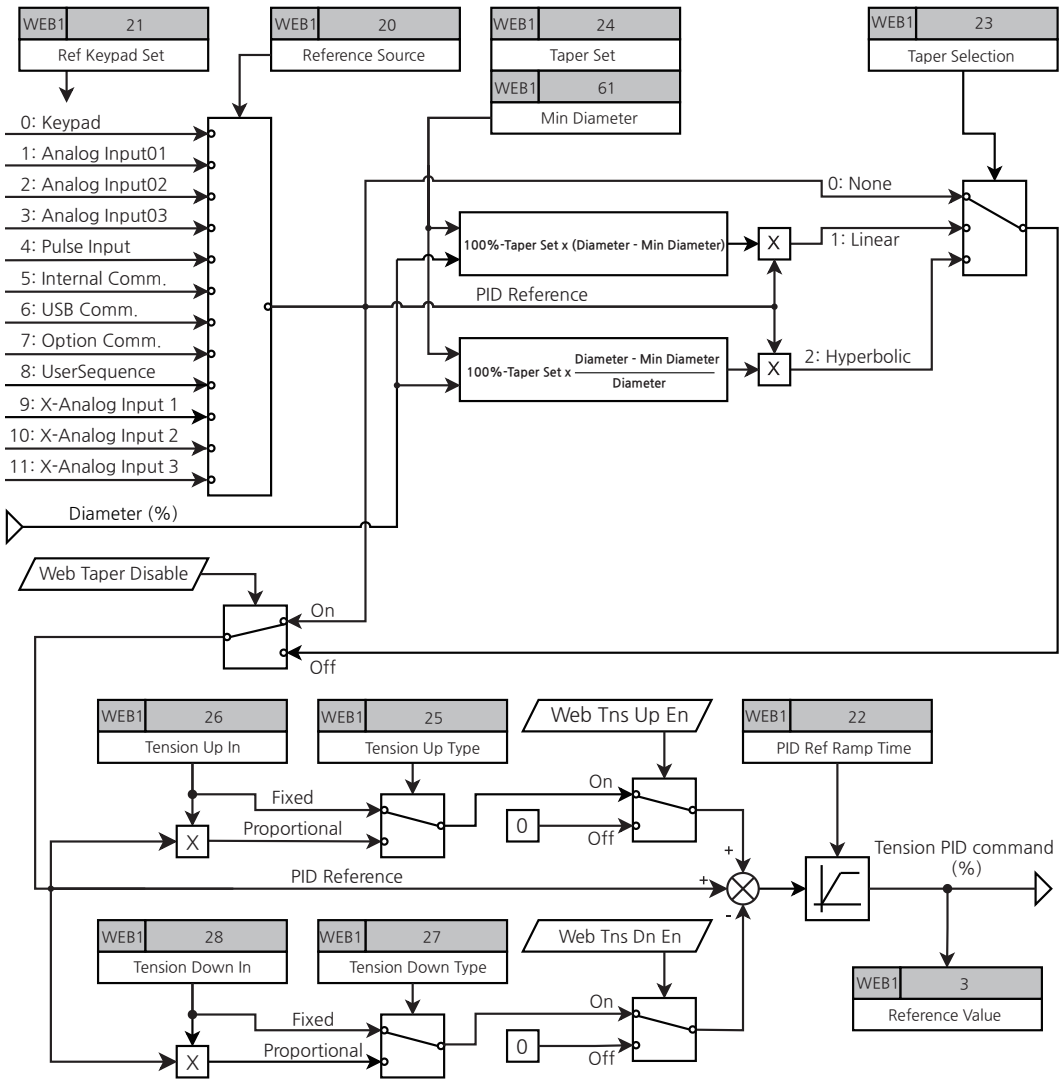
For example, assuming inverters 1, 2, and 3 are associated and operated in the system and the current output frequency is 25 Hz, 40 Hz, and 60 Hz, respectively, when the multifunction input terminals set to 69 (Quick Stop) are turned on, all three inverters decelerate for 5 seconds, which is the initial value for APP-46 (Quick Stop Dec T).

In this case, the output of the Web PID controller is valid, so the inverter output is not blocked and the tension is maintained.

7.28.3 Tension Command Part

The unit for the tension command is percent (%) and is the same concept as the force (kgf). For example, if you want to maintain the value of 10 kgf in the system with the load cell's maximum measured load (force) of 2 kgf, set the tension command to 50% (10/20 x 100%).

In an open-loop system, the unit for the tension command is the same concept as the torque (%). Therefore, the output torque for the minimum diameter is the criterion. For example, the output torque to maintain the desired tension for the minimum diameter is 10%, and the tension command should be set to 10% to maintain the same tension at the maximum diameter. The tension command can be sent by using Smart Operator, analog input, communication, etc.



[Image 70. Tension PID command part]

7.28.4 Tension Command

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	03	Reference Value	-		-	-	%
	20	Reference Source	0	Keypad	0-8	0	-
			1	Analog Input 1			
			2	Analog Input 2			
			3	Analog Input 3			
			4	Pulse Input			
			5	Internal Comm.			
			6	USB Comm.			
			7	Option Comm. [50]			
			8	User Sequence			
			9	X-Analog Input 1 [51]			
			10	X-Analog Input 2 [51]			
			11	X-Analog Input 3 [51]			
	21	Ref Keypad Set	-		-100.00-100.00	20.00	%

[50] Configurable only when equipped with communication options
[51] Configurable only when equipped with expansion I/O options

Tension Command Settings Details

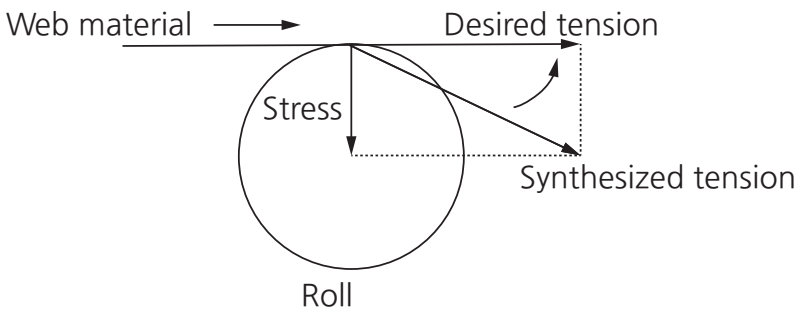
Code and Functions	Description
WEB1-08 Reference Value	Shows the current PID controller reference (%, tension).
WEB1-21 Ref Keypad Set	You can set the PID controller's reference value by using a Smart Operator. Activated when WEB1-20 value is 0 (Keypad).
WEB1-20 Reference Source	Selects the input type (analog, built-in communication, external communication, and extension IO).

7.28.4.1 Taper Function

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	23	Taper Selection	0	None	0-2	0	-
			1	Linear			
			2	Hyperbolic			
	24	Taper Set	-		-100.00-100.00	0	%
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	82	Web Taper Disable	-	1, 2, 4, 5, 10, 11, 12, 9	-

For roll winders, the larger the diameter, the higher the stress is to the center. The targeted tension is to the tangent line, but the stress creates the tension. Therefore, the sum of the two vectors is applied as the total tension. Therefore, the taper function is used to maintain the desired size of the tension, i.e., it decreases the PID reference values according to the calculated diameter to offset the vector created by the stress. For details, refer to the illustration below.

The taper function is used for the load applied with a load cell (weight sensor) rather than a dancer (location sensor) among the tension sensors.



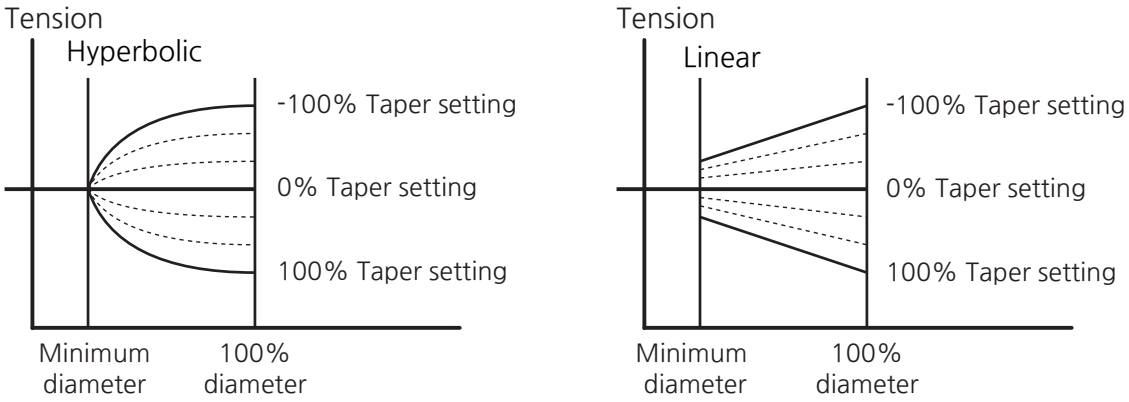
[Image 71. Changes in stress and tension according to the diameter of the roll winder]

Linear Taper

$$Tension\ Demand = Tension\ Spt \times (100\% - Taper\ Spt \times (Diameter - Core\ Size))$$

Hyperbolic Taper

$$Tension\ Demand = Tension\ Spt \times \left(100\% - Taper\ Spt \times \left(1 - \frac{Core\ Size}{Diameter}\right)\right)$$



[Image 72. Trend of the tension change according to the taper type and settings]

7.28.4.2 Tension Boost/Down Function

You can boost/down the tension (PID reference) by the set values.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	25	Tension Up Type	0	Fixed	0-1	0	-
			1	Proportional			
	26	Tension Up In	-		0.00-50.00	0.00	%
	27	Tension Down Type	0	Fixed	0-1	0	-
			1	Proportional			
	28	Tension Down In	-		0.00-50.00	0.00	%
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	80	Web Tns Up En	-	1, 2, 4, 5, 10, 11, 12, 9	-
			81	Web Tns Down En			

7.28.4.3 Tension Command Ramp

Increases the ramp for the final tension command with a taper function, which is applied or boosted/downed for the set time.

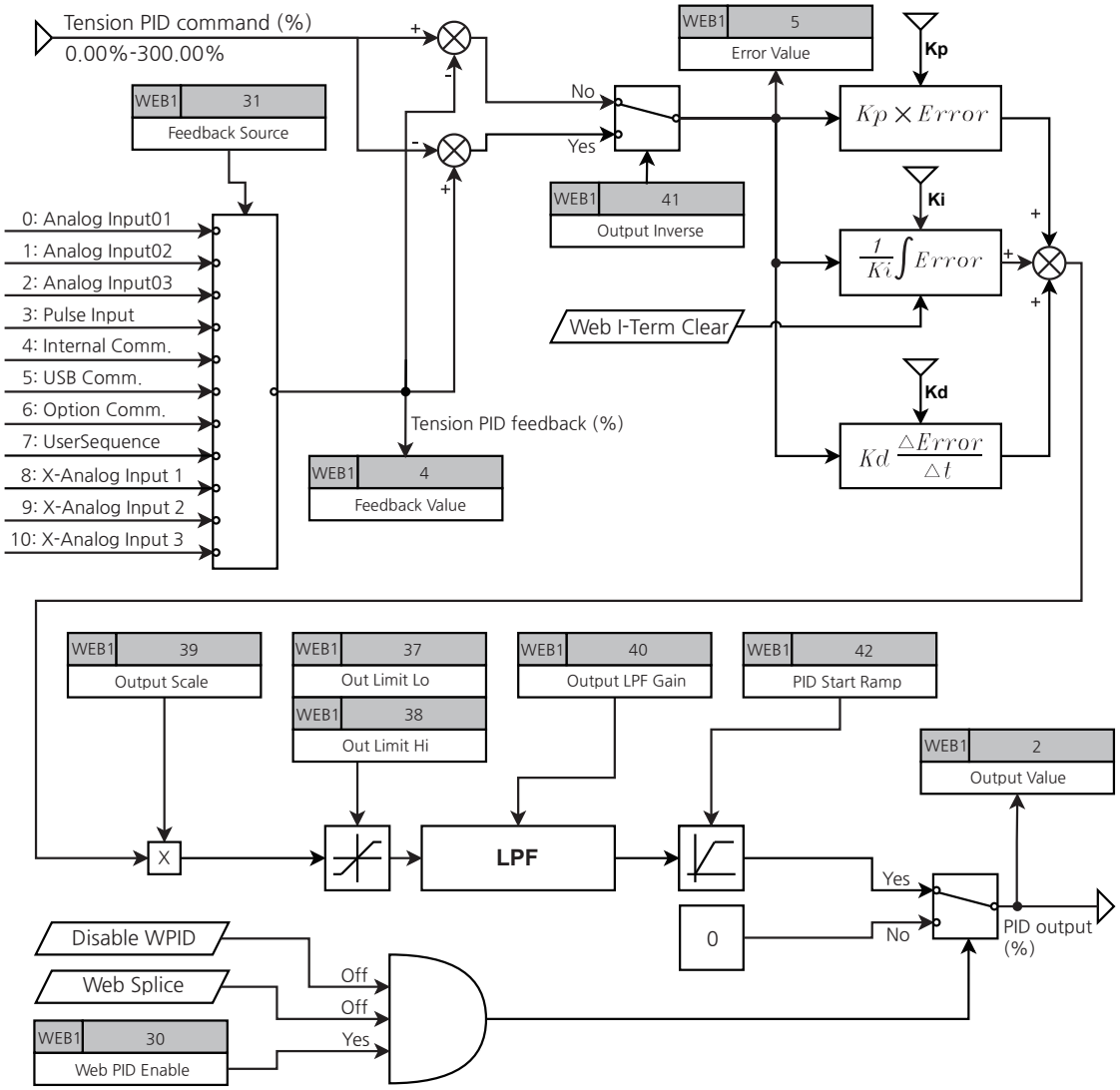
Setting the final tension command to WEB1-22 (PID Ref Ramp Time) allows for increasing the ramp for the set time. The gradient is set to tension command 100%. Prevents from PID output saturation due to difference between command and feedback values during the initial powering on and operation. It is used for smooth initial powering on for an open-loop system.

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
WEB1	03	Reference Value	-	-	-	%
	22	PID Ref Ramp Time	5.00	0.00-300.00	5.00	sec

7.28.5 Web PID Controller

Uses analog feedback from tension detection devices, including a dancer and load cell to determine the Web PID controller outputs in the closed-loop tension control system. The Web PID controller means the optimized PID controller for tension control system.

7.28.5.1 Web PID Control Part



[Image 73. Web PID control part]

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	02	Output Value	-		-100.00-100.00	-	%
	03	Reference Value	-		-300.00-300.00	-	%
	04	Feedback Value	-		-300.00-300.00	-	%
	05	Error Value	-		-300.00-300.00	-	%
	30	Web PID Enable	0	No	0-1	0	-
			1	Yes			
	31	Feedback Source	0	Analog Input 1	0-10	0	-
			1	Analog Input 2			
			2	Analog Input 3			
			3	Pulse Input			
			4	Internal Comm.			
			5	USB Comm.			
			6	Option Comm. [52]			
			7	UserSequence			
			8	X-Analog Input 1 [53]			
			9	X-Analog Input 2 [53]			
			10	X-Analog Input 3 [53]			
	37	Out Limit Low	-100.00		-100.00-100.00	-100.00	%
	38	Out Limit High	-100.00		-100.00-100.00	100.00	%
	39	Output Scale	30.0		0-1000.0	100.0	%
	40	Output LPF Gain	0		0-10000	0	msec
	41	Output Inverse	0	No	0-1	0	-
			1	Yes			
	42	PID Start Ramp	5.00		0.00-300.00	0.00	sec

[52] Configurable only when equipped with communication options
[53] Configurable only when equipped with expansion I/O options

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	78	Web I-Term Clear	-	1, 2, 4, 5, 10, 11, 12, 9	-
			77	Disable WPID			
			72	Web Splice			

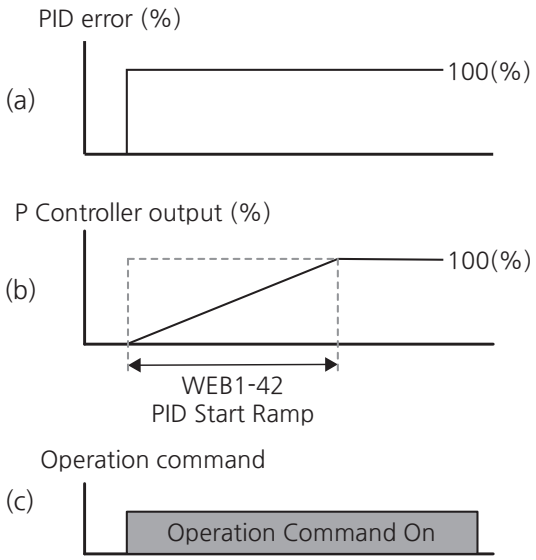
Web PID Controller Settings Details

Code and Functions	Description
WEB1-2 Output Value	Shows the current PID output value (%).
WEB1-3 Reference Value	Shows the current PID's reference value (%).
WEB1-4 Feedback Value	Shows the current PID's feedback value (%).
WEB1-5 Error Value	Shows the current PID's error value (%).
WEB1-30 Web PID Enable	Determines whether to use Web PID controller. Set the values to 1 (Yes) and use the Web PID controller when the terminals set to 77 (Disable WPID) value among the multifunction input terminals are turned off.
WEB1-31 Feedback Source	Selects PID controller feedback input type (analog, built-in communication, external communication, and extension IO).
WEB1-37 Out Limit Lo WEB1-38 Out Limit Hi	You can set the upper and lower limits for PID controller output. In addition, the accumulated values for the I controller are limited to the upper and lower limits set by this code.

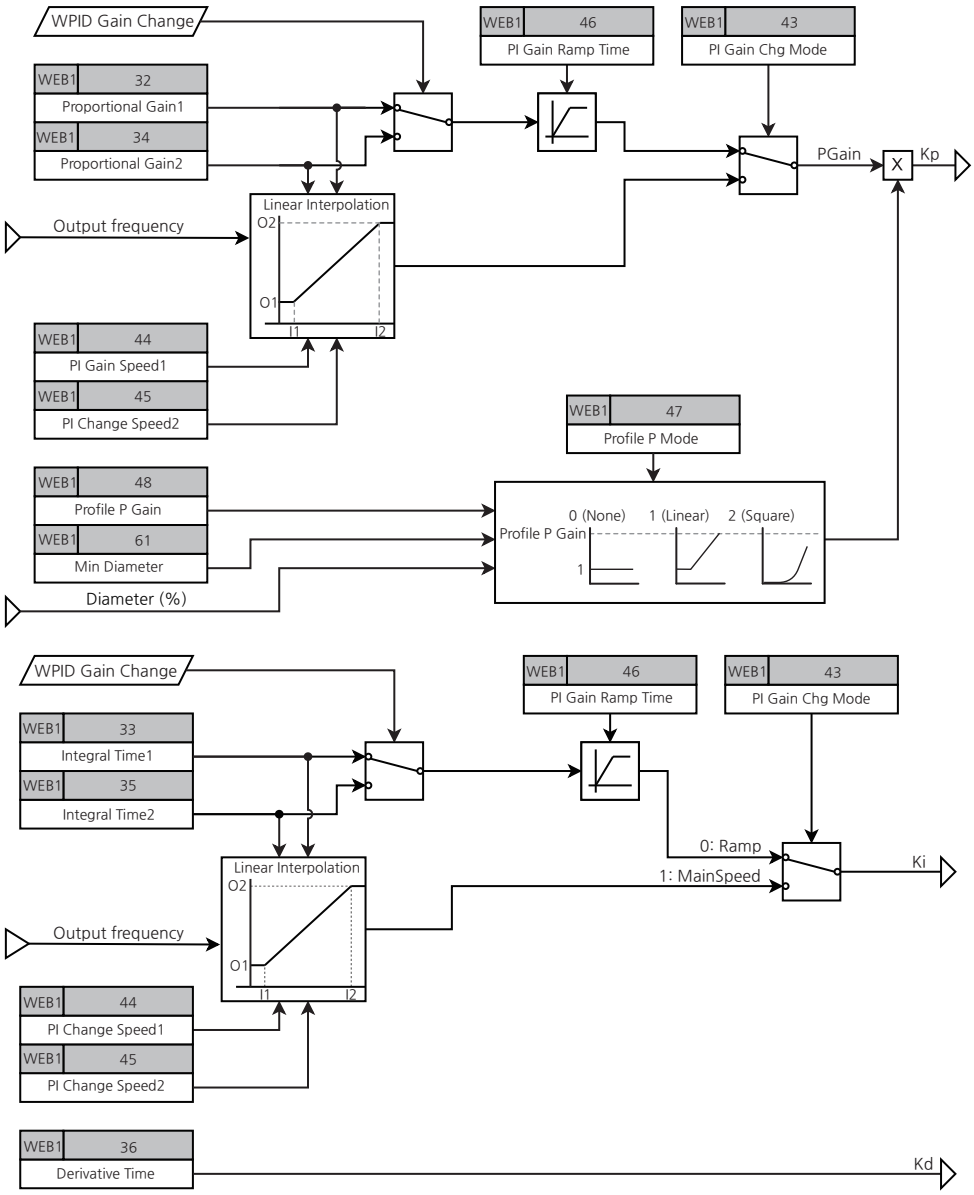
Table 9. How to select whether to use the Web PID controller

WEB1-30 (Web PID Enable)	The status of the multifunction input terminal set to a value of 77 (Disable WPID).	Whether to use the Web PID controller
1(Yes)	Off	O
1(Yes)	On	X
0(No)	Off	X
0(No)	On	X

Code and Functions	Description
WEB1-39 Output Scale	You can adjust the scale of the PID controller output. When assuming PID controller saturation, setting it to 100% will return 100% of the PID controller output, and setting it to 30% will return 30% of the PID controller output.
WEB1-40 Output LPF Gain	Sets the delay time constant of the PID controller output. Normally, it is set to 0 ms for quick response from the PID controller. Increasing the settings may decrease the PID controller's response speed but increase the stability.
WEB1-41 Output Inverse	Selects whether to invert the PID controller output. Selecting the value to 1 (Yes) results in inverse PID output symbols. It is useful when the orientation of the tension detection devices, including a dancer and load cell, is inversed.

Code and Functions	Description
WEB1-42 PID Start Ramp	The PID output can be increased ramp for a set time during the inverter's initial powering on. This function allows the smooth output of the PID controller during the initial powering on to improve transient phenomena, including fluctuations of a dancer or load cell during the initial powering on.  **[Image 74. How does WEB1-42 (PID Start Ramp) work]** Assuming the P gain is 100%, and the PID error is 100% during the powering on, the dotted line on (b) indicates the P controller's output when the PID Start Ramp is 0 seconds. The solid line on (b) indicates that the P controller's output will increase the ramp for PID Start Ramp time during the initial powering on, i.e., the output in a solid line rather than in a dotted line is more useful for improving transient phenomena during the initial powering on. In addition, the PID Start Ramp value uses 100% of the PID controller output as a criterion. For example, setting the PID Start Ramp to 5 seconds will take 5 seconds for the PID controller output to be 100% saturated during the initial powering on and 2.5 seconds to 50% saturated.
DIx Define (DIx: DI1-DI8)	Turning on the multifunction input terminal that sets Define codes of DI1-DI8 of terminal input group (DIN) to 77 (Disable WPID) will not trigger the Web PID. Setting the code value to 78 (Web I-Term Clear) and turning on the set terminal will remove all accumulated integrals.

7.28.5.2 Web PID Gain Calculation Part



[Image 75. Web PID gain calculation]

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	32	Proportional Gain1	100.0		0.00-100.00	5.00	%
	33	Integral Time1	10.00		0.00-200.00	10.00	sec
	34	Proportional Gain2	5.00		0.00-100.00	5.00	%
	35	Integral Time2	10.00		0.00-200.00	10.00	sec
	36	Derivative Time	10		0-1000	0	msec
	43	PI Gain Chg Mode	0	Ramp	0-1	0	-
			1	MainSpeed			
	44	PI Change Speed1	20.00		0.00-100.00	20.00	%
	45	PI Change Speed2	80.00		0.00-100.00	80.00	%
	46	PI Gain Ramp Time	30.00		0.00-300.00	0.00	sec
	47	Profile P Mode	0	None	0-2	0	-
			1	Linear			
			2	Square			
	48	Profile P Gain	-		0.01-10.00	1.00	%
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	73	WPID Gain Change	-	1, 2, 4, 5, 10, 11, 12, 9	-

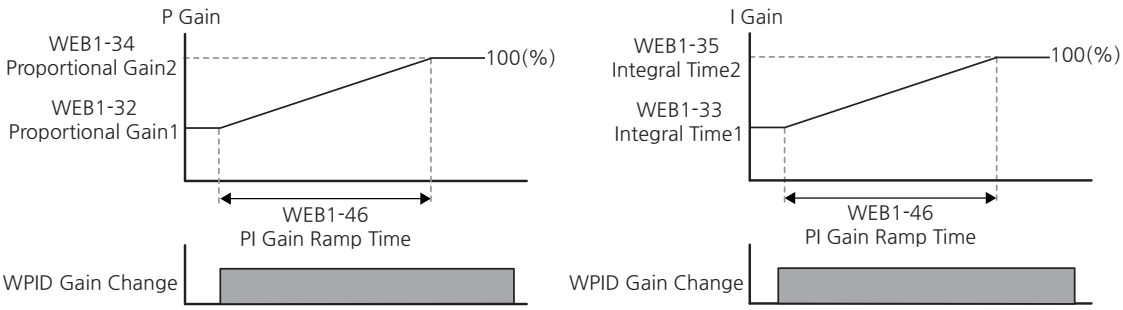
Web PID Gain Calculation Part Settings Details

Code and Functions	Description
WEB1-32 Proportional Gain1 WEB1-34 Proportional Gain2	Is a Proportional (P) gain for the PID controller. The P controller output is 100% when the P gain is 100% and the error value is 100%.
WEB1-33 Integral Time1 WEB1-35 Integral Time 2	It is the Integral Time (I) gain for the PID controller. The time spent until the I controller output is saturated to 100% is 10 seconds, when the I gain is 10 sec, and the error value is 100%.
WEB1-36 Derivate Time	It is the Derivate Time (D) gain for the PID controller. For example, the output will gradually decrease to 34% after 10 ms when the D controller output is 100%, the D gain is 10 ms, and the changed value for the error is 100%.
WEB1-43 PI Gain Chg Mode	Sets how to change the P/I gain. Set this value to 0 (Ramp) to change the P/I gain by setting the 73 (Timer Gain Change) value for one of the multifunction input terminals Set this value to 1 (MainSpeed) to change the P/I gain according to the inverter operation speed.
WEB1-44, 45 PI Change Speed1, 2	Sets the reference speed when changing the P/I gain according to the inverter operation speed.
WEB1-46 PI Gain Ramp Time	Is a ramp time applied when P/I gain switchover triggers due to a change in terminal input set to 73 (WPID Gain Change) during the inverter operation. It is also applied when the user uses the loader to change P/I gain during the inverter operation. The ramp time is switched over at 1000% for P gain and 200 sec for I gain. For example, when P/I Gain Ramp Time is set to 30 seconds and P gain is changed from 100% to 200%, it will take 3 seconds (30 sec x 100/1000).
WEB1-47 Profile P Mode	Is a P gain compensation method for inertia compensation according to the diameter.
WEB1-48 Profile P Gain	Sets the maximum amount of the compensation for P gain compensation.

P, I Gain Switchover Function

[Gain change according to the input change]

If something changes in the terminal input set to 73 (WPID Gain Change) during the inverter operation or the user changes the WEB1-32 (PID Proportional Gain1) and WEB1-33 (Integral Gain1) settings and P/I gain switchover is triggered temporarily without switchover ramp time, the system response may unstable. To prevent such risk, set the P/I gain switchover to gradient change according to the suitable settings of WEB1-46 (PI Gain Ramp Time).



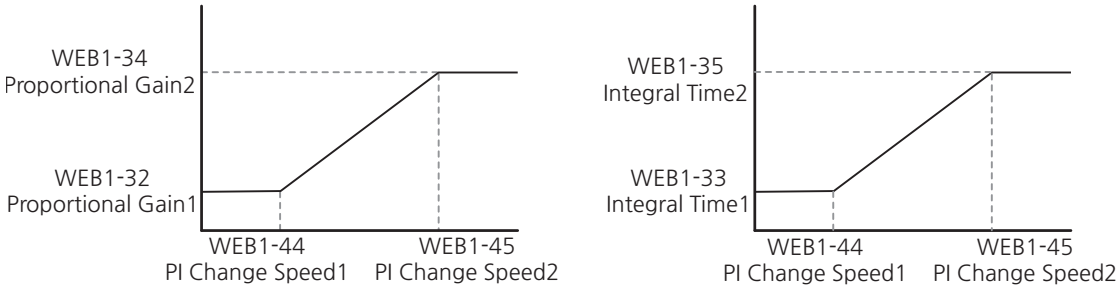
[Image 76. Gain change according to the multifunction input's WPID gain Change]

Table 10. P/I gain selection according to the multifunction input's "WPID Gain Change" status

The status of the terminal set to 73 (WPID Gain Change)	Selected P/I gain
Off	WEB1-32 Proportional Gain1
	WEB1-33 Integral Time1
On	WEB1-34 Proportional Gain2
	WEB1-35 Integral Time2

[Gain change according to the speed]

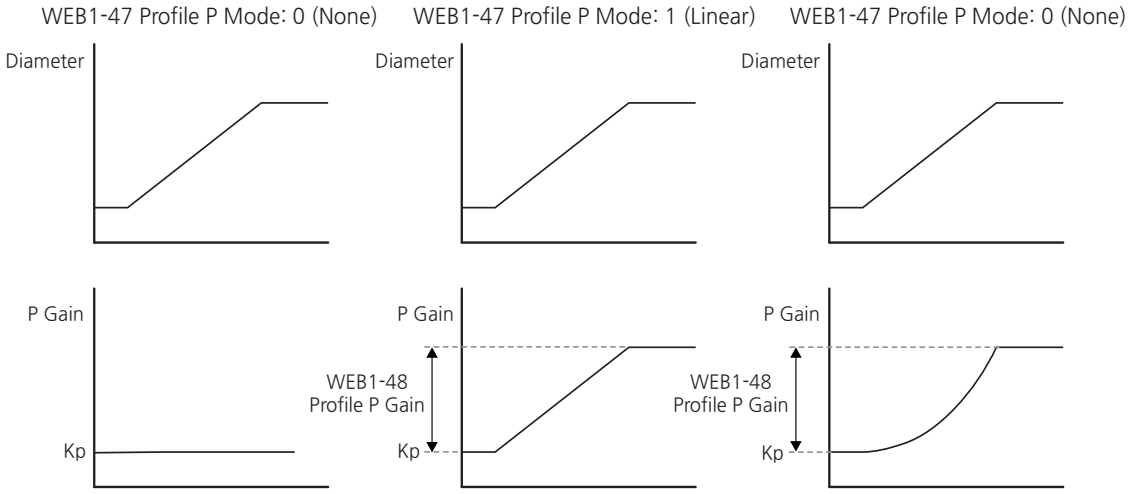
You can change the P/I gain to the ramp according to the inverter's operation speed changes.



[Image 77. P/I gain switchover according to the speed]

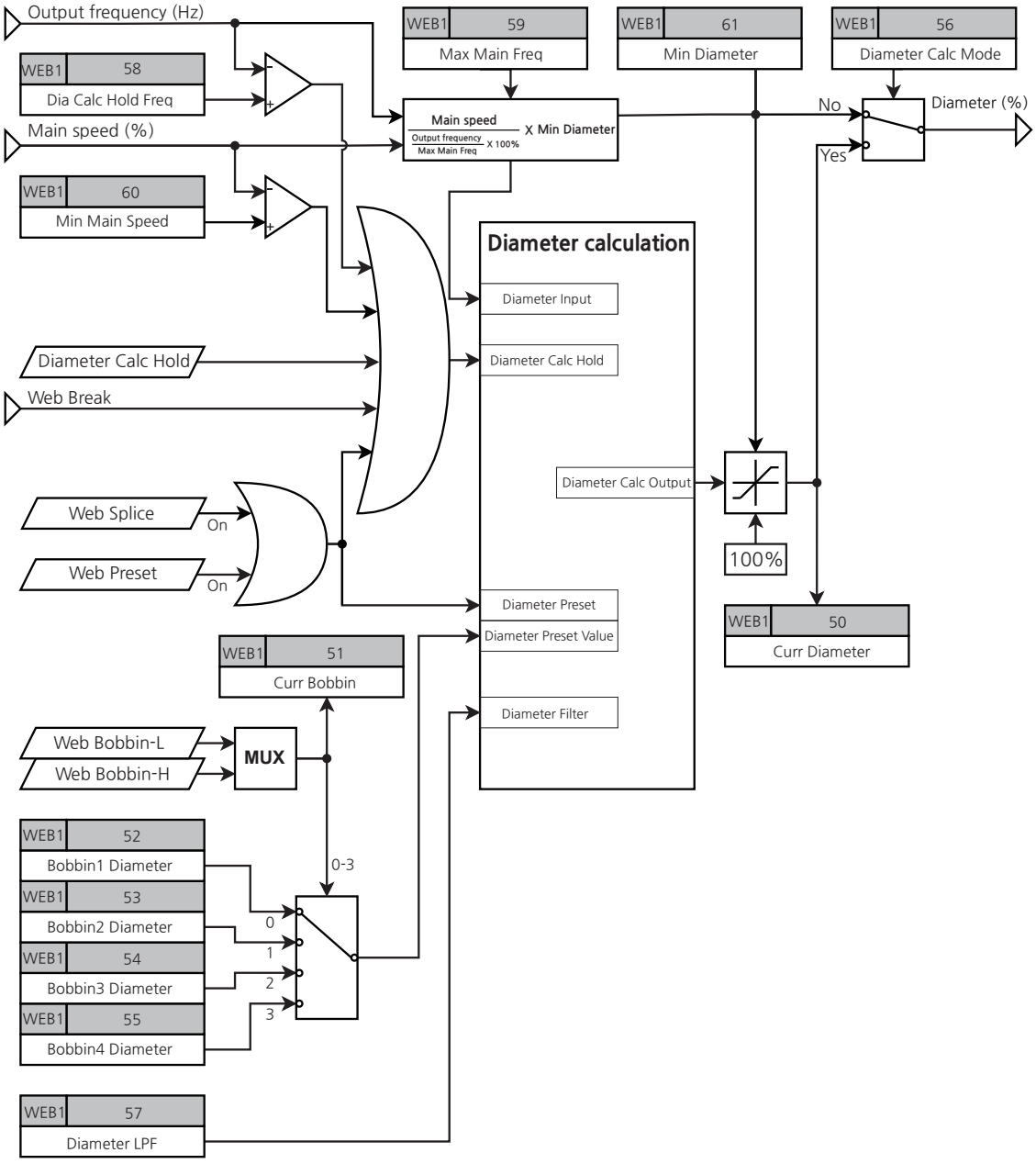
Inertia Compensation Function

The diameter of the winder increases as time passes, and the larger the diameter, the stronger the inertia, which requires a (+) inertia compensation by the increase. Conversely, the diameter of the unwinder decreases as time passes, and the smaller the diameter, the weaker the inertia, which requires a (-) inertia compensation by the decrease. For such inertia compensation, increase the P gain as the diameter increases.



[Image 78. Trend in P gain changes according to the Profile P Mode]

7.28.6 Diameter Calculation Part



[Image 79. Diameter calculation part]

The flux of the winder/unwinder, motor speed, and diameter in the tension control system has a correlation in the **Formula 2**.

$$Flux\,[mpm] = motor\ speed\ [rpm] \times (diameter \times \pi)\,[m] = consistent$$

Formula 2

In a closed-loop tension control system, the winder always has a consistent flux (MPM) unless the user adjusts it at their own discretion, and the winder's actual diameter (m) increases as time passes. Therefore, the tension to a dancer or load cell increases as the flux that should be consistent in the **Formula 2** increases, the Web PID controller's output becomes (-) values. In this case, the actual speed (rpm) of the motor decreases, so the flux in Formula 2 decreases again to maintain the certain value.

You can use winder's flux (always consistent) (mpm) and motor's actual speed (decrease) (rpm) to obtain the diameter calculation in **Formula 3**. The estimated diameter will increase as time passes.

$$Estimated\ diameter \times \pi\,[m] = \frac{Flux\ [mpm]}{Motor\ speed\ [rpm]}$$

Formula 3

The flux (MPM) is always consistent for the unwinder unless the users adjust the flux at their own discretion, and unlike the winder, the actual diameter (m) is decreased. Therefore, as the flux that should be consistent in the **Formula 2** decreases, the tension to a dancer or load cell increases, as it does for the winder. However, unlike the winder, the unwinder internally has inverted symbols of Web PID controller output. Therefore, the Web PID controller output becomes a (+) value. In this case, unlike the winder, the motor's actual speed (rpm) increases, so the flux in the **Formula 2** increases to maintain a consistent value. You can obtain the diameter calculation in the Formula 3 above by using the unwinder's flux (always consistent) (mpm) and motor's actual speed (increases) (rpm). The estimated diameter will decrease as time passes.

7.28.6.1 Bobbin Selection and Initializing Diameter Functions

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	51	Curr Bobbin	-		1-4	-	%
	52	Bobbin1	10.00		0.00-100.00	10.00	%
	53	Bobbin2	15.00		0.00-100.00	15.00	%
	54	Bobbin3	20.00		0.00-100.00	20.00	%
	55	Bobbin4	25.00		0.00-100.00	25.00	%
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	74	Web Bobbin-L	-	1, 2, 4, 5, 10, 11, 12, 9	-
			75	Web Bobbin-H			
			76	Web Preset			

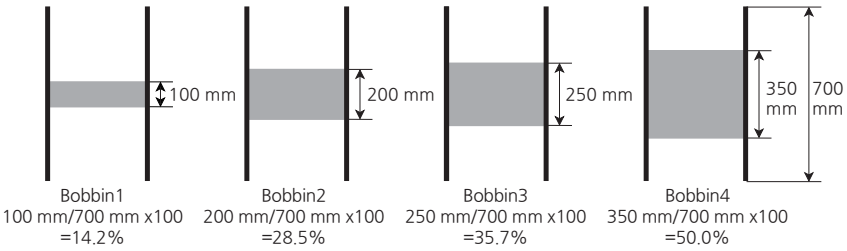
Bobbin Selection and Diameter Initialization Functions Settings Details

Code and Functions	Description
WEB1-51 Curr Bobbin	Shows currently selected bobbin numbers (1-4).

Code and Functions	Description
WEB1-52-55 Bobbin 1-4 Diameter	The bobbin diameter is selected as follows according to the combination of multifunction input terminals set to 74 (Web Bobbin-L) and 75 (Web Bobbin-H). When the bobbin is selected, initialize to the selected bobbin's diameter by turning the multifunction input terminal set to 76 (Web Preset) on and off.

The status of the multifunction input terminal set to 75 (Web Bobbin-H)	The status of the multifunction input terminal set to 74 (Web Bobbin-L)	Selected bobbin
Off	Off	Bobbin1 (WEB1-52)
Off	On	Bobbin2 (WEB1-53)
On	Off	Bobbin3 (WEB1-54)
On	On	Bobbin4 (WEB1-55)

For example, when there are four types of bobbin, as shown in the illustration below, enter the calculated 14.2%, 28.5%, 35.7%, and 50.0% to WEB1-52-55 (Bobbin 1-4 Diameter), respectively. Then, enter 14.2%, the percent (%) diameter of Bobbin1, the smallest bobbin, into WEB1-61 (Min Diameter). Select the currently installed bobbin using the combination of multifunction input terminals set to 74 (Web Bobbin-L) and 75 (Web Bobbin-H) and initialize it by turning on and off another multifunction input terminal, 76 (Web Preset).



[Image 80. When there are bobbins in various sizes]

⚠ Caution

The multifunction input terminals set to 76 (Web Preset) must be turned on or off when replacing the bobbin. You can't calculate the diameter when it is turned on.

7.28.6.2 Diameter Calculation Function

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	50	Curr Diameter	-		-	-	%
	57	Diameter LPF	30.00		0.00-300.00	1.00	sec
	59	Max Main Freq	-		0.00-Max Frequency [54]	60.00	Hz
	61	Min Diameter	10.00		5.00-100.00	10.00	%
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	77	Disable WPID	-	1, 2, 4, 5, 10, 11, 12, 9	-
			79	Diameter Calc Hold			
			72	Web Splice			
			76	Web Preset			

The previous **Formula 3** can be converted into a percent (%) to create **Formula 4**.

$$Estimated\ diameter\ [\%] = \frac{Main\ speed\ [\%]}{\frac{Output\ frequency\ [Hz]}{Max\ Main\ Freq} \times 100[\%]} \times Min\ Diameter$$

Formula 4

The main speed (%) is always consistent unless the users adjust it at their own discretion, as the bobbin's actual diameter increases as time passes. At the same time, the size of the tension to a dancer or load cell gradually increases. Therefore, the Web PID controller returns a (-) output, and the inverter's current output frequency (Hz) will decrease. Therefore, the estimated diameter (%) according to the **Formula 4** increases. The estimated diameter (%) range is limited from the upper 100% to the lower WEB1-61 (Min Diameter) value, and you can set the time constant value under WEB1-57 (Diameter LPF) to adjust the diameter (%) calculation speed.

The estimated diameter plays the key role in determining the final speed command (Hz). For more information, refer to the **7.28.7 Final Speed Calculation Part**.

[54] DRV-20(Max Frequency)

Diameter Calculation Function Details

Code and Functions	Description
WEB1-50 Curr Diameter	Displays the current bobbin's diameter (%). After turning on/off the multifunction terminal set to 76 (Web Preset), the diameter (%) of the selected bobbin will be displayed, and the calculated diameter (%) in the **Formula 4** will be updated during the operation.
WEB1-57 Diameter LPF	Sets the time constant value for the diameter (%) calculation. Normally, it is set to the traverse return time.
WEB1-59 Max Main Freq	Enter the maximum speed (Hz) at the diameter of the smallest bobbin without anything winding it when the main speed is 100 (%). For example, assuming that in the **[Image 15]** , the empty diameter of the smallest bobbin is 0.1 m (100 mm) and system's maximum flux is 350 mpm, the motor has 4-poles, and the belt ratio (motor is faster) is 2.3/1, the WEB1-59 (Max Main Freq) value is calculated as follows. $$WEB1\text{-}90\,(Max\ Main\ Freq) =$$ $$\frac{350\,[mpm]}{0.10\,[m]\times\pi}\times 2.3\,(Belt\ ratio)\times\frac{4\,(the\ number\ of\ poles)}{120}=85.46\,[Hz]$$ **Formula 5**
WEB1-61 Min Diameter	Enter the diameter ratio (%) of the bobbin without anything winding it to the full bobbin with fabric winding around it. If there are various types of bobbins, enter the smallest diameter ratio (%) of the smallest bobbin to the largest bobbin. **[Image 80]** As shown in Illustration 80, when the sizes of the bobbins are varied, enter 14.2%.

7.28.6.3 Stopping Diameter Calculation Function

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	58	Dia Calc Hold Freq	5.00		0.00-30.00	5.00	Hz
	60	Min Main Speed	3.00		0.00-100.00	1.00	%
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	79	Diameter Calc Hold	-	1, 2, 4, 5, 10, 11, 12, 9	-

Stop the diameter calculation during the calculation if: The diameter calculation is useful only during normal operation.

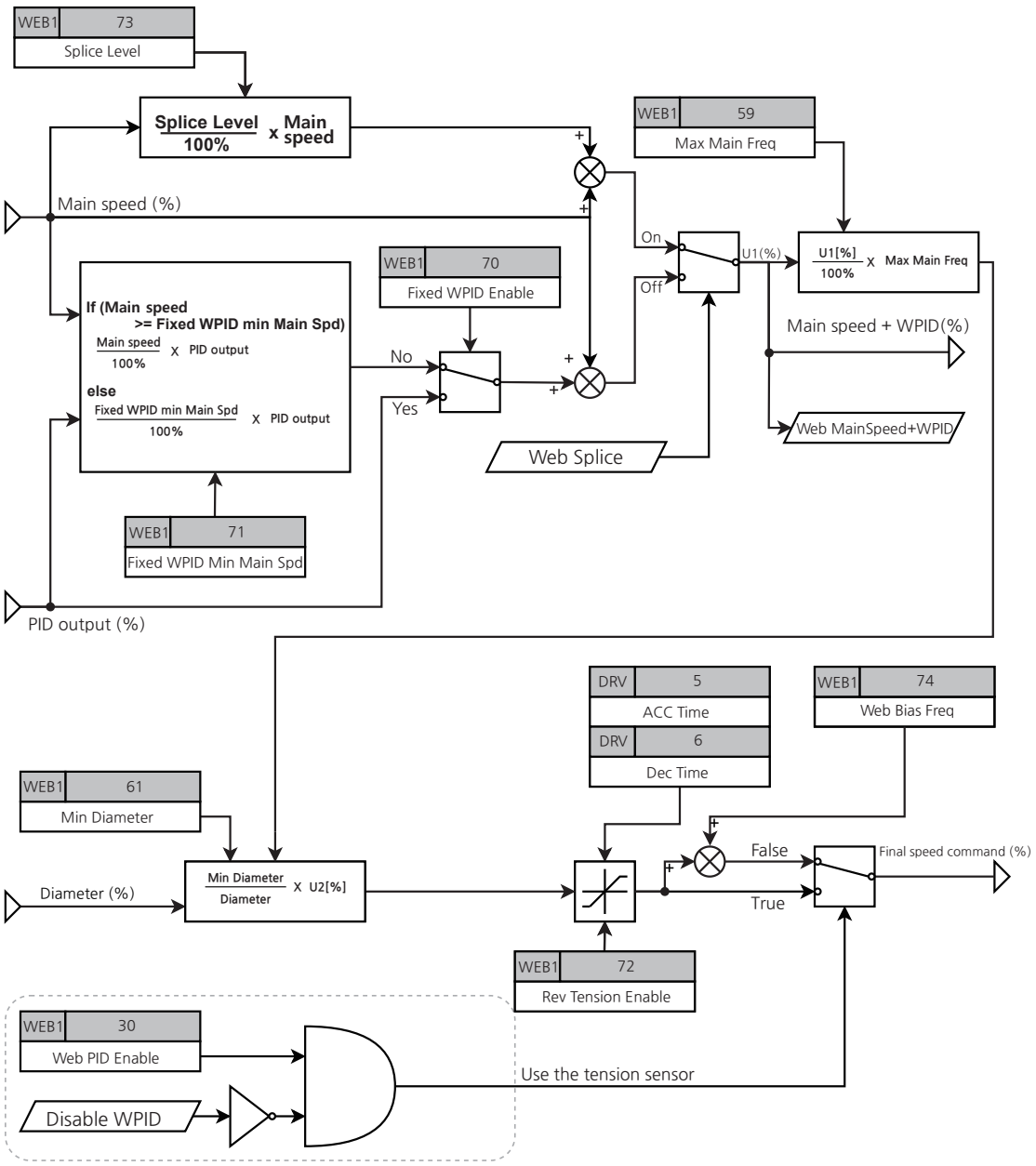
- Main speed command (%) < WEB1-60 (Min Main Speed)
- Output frequency (%) < WEB1-58 (Dia Calc Hold Freq)
- The multifunction input terminal set to 79 (Diameter Calc Hold) is turned on
- The multifunction terminal set to 69 (Quick Stop) is turned on (for an emergency stop)
- The multifunction terminal set to 77 (Disable WPID) is turned on
- The WEB1-80 (WebBreak Enable) value is 0 (disconnection detection is activated)
- The WEB1-30 (Web PID Enable) value is 0 (Web PID is unactivated)

7.28.6.4 Web Function without a Diameter Calculation

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	56	Diameter Calc Mode	0	No	0-1	1	-
			1	Yes			

Selecting the WEB1-56 (Diameter Calc Mode) value to 0 (No) will make the current diameter into the minimum diameter (WEB1-61 Min Diameter) regardless of the diameter value, so it virtually doesn't affect the tension control.

7.28.7 Final Speed Calculation Part



[Image 81. Final speed calculation part]

The final speed calculation part uses the main speed (%) calculated in the main speed command part, PID output (%) calculated in the Web PID controller part, and diameter (%) calculated in the diameter calculation part to determine the inverter's final speed command (Hz).

7.28.7.1 How does PID output works (for fixed /unfixed PID controller)

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	70	Fixed WPID Enable	0	No	0-1	1	-
			1	Yes			
	71	Fixed WPID Min Main Spd	10.00		0.00-50.00	10.00	%

Code and Functions	Description
WEB1-70 Fixed WPID Enable	Setting the EB1-70 (Fixed WPID Enable) value to 1 (Yes), the PID output (%), which is the Web PID controller's output in the **Formula 6**, will always be consistent regardless of the size of the main speed (%). $Final\ PID\ output\ [\%] = PID\ output\ [\%]$ **Formula 6** Setting the WEB1-70 (Fixed WPID Enable) value to 0 (No), the PID output (%), which is the Web PID controller's output in the **Formula 7**, will be proportional to the size of the main speed (%). i.e., the share of the PID output (%) in the main speed will be maintained consistently. The mechanism behind such proportions works when the main speed (%) is lower, the PID output (%) is proportionally decreased to the value, and vice versa. $Final\ PID\ output\ [\%] = PID\ output\ [\%] \times \frac{Main\ speed\ command\ [\%]}{100.00\ [\%]}$ **Formula 7**

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>WEB1-71 Fixed WPID Min Main Spd</td><td>
Prevent Web PID controller's output becomes too small when the WEB1-70 value is 0 (No) and the system receives the main speed (%) command below the value set in the Fixed WPID Min Main Spd or lower.

$$Final\ PID\ output\ [\%] = PID\ output\ [\%] \times \frac{Fixed\ WPID\ Min\ Main\ Spd}{100.00\ [\%]}$$

Formula 8

The table below shows how the final PID output (%) is determined according to the Fixed WPID Enable settings, assuming the WEB1-39 (Output Scale) value is 20%, WEB1-71 is 10%, and the PID output is 20% saturated.

Table 11. PID output comparison depending on the PID controller type
<table>
<tr><th>Main speed command (%)</th><th>When WEB1-70 value is 1 (Yes)</th><th>When WEB1-70 value is 0 (No)</th></tr>
<tr><td>2.0</td><td>20.0</td><td>2.0 [55]</td></tr>
<tr><td>8.0</td><td>20.0</td><td>2.0 [55]</td></tr>
<tr><td>20.0</td><td>20.0</td><td>4.0 [56]</td></tr>
<tr><td>80.0</td><td>20.0</td><td>16.0 [56]</td></tr>
</table>
</td></tr>
</table>

[55] Because the main speed is below **Fixed WPID Min Main Spd** (10%), it is determined according to the **Formula 8**.

[56] Because the main speed is **Fixed WPID Min Main Spd** (10%) or higher, it is determined according to the **Formula 9**.

7.28.7.2 Final Speed (Hz) Calculation

[Image 81] In the Illustration 81, the U1 (%) is the main speed command (%) = PID output (%), and it is converted to frequency (Hz) as follows:

$$Main\ speed + PID\ output\,[Hz] = \frac{Main\ Speed + PID\ output\ [\%]}{100.0\,[\%]} \times WEB1\text{-}59\,(Max\ Main\ Freq)$$

Formula 9

7.28.6 Diameter Calculation Part The variation of the **Formula 2** is as follows. The inverter's final speed (Hz) is calculated and outputted according to the formula below.

$$Final\ speed\ [Hz] = \frac{WEB1\text{-}61\,(Min\ Diameter)}{Estimated\ material\ diameter\ [\%]} \times (Main\ speed + PID\ output\,[Hz])$$

Formula 10

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
OUT	1.10	AOx Define (AOx: AO1-AO2)	17	Web MainSpeed +WPID	0-17	1, 2, 4, 5, 10, 11, 12, 9	-

You can monitor the final speed through analog output by setting one of the multifunction terminals DI1-DI8 values to 17 (Web MainSpeed+WPID)

Caution

The final speed (Hz), which is the result of the Formula 10 and calculated periodically in the final speed calculation part changes constantly. In this case, the acceleration and deceleration times are DRV-05 (ACC Time) and DRV-06 (Dec Time). You can set other values for DRV-05 (ACC Time) and DRV-06 (Dec Time). However, you must set them at 2.0 seconds or lower for a faster reflection of the final speed.

7.28.7.3 Reverse Extremely Slow Speed Function

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	72	Rev Tension Enable	1	Yes	0-1	1	-

[Image 81] When the symbol of the U1 (%), or the main speed command (%) + PID output (%) is (-) in Illustration 81, select WEB1-72 (Rev Tension Enable) code to 1 (Yes) value and send forward operation command will operate the system reverse orientation by the absolute value of the PID output (%). It allows to maintain the tension of the web materials to the closed-loop tension control system.

Setting the WEB1-72 (Rev Tension Enable) code to 0 (No) and sending the forward operation command will limit the output frequency to 0 Hz.

7.28.7.4 Splicing Function

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	73	Splice Level	0.00		0.00-100.00	0.00	%
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	79	Web Splice	-	1, 2, 4, 5, 10, 11, 12, 9	-

A splicing system is a system allowing bobbin replacement during operation by controlling the motors by two motors. In this case, the bobbin replacement must conducted without a flux change. When the multifunction input terminal set to 79 (Web Splice) value turns on, the PID controller output is blocked, and the inverter's final speed command is determined only by the combination of the main speed command and WEB1-73(Splice Level) according to the **Formula 11**-**Formula 13**.

Dramatic load changes occur when the new bobbin is winded with materials, so the material may hang down. To prevent such an event, speed it up by WEB1-73 (Splice Level) once again, as shown in the **Formula 10** when the new bobbin is winded with materials.</1994> For example, when WEB1-73 (Splice Level) value is 20%, the main speed command is 50%, and the multifunction input set to 79 (Web Splice) turns on, the main speed command (%) becomes 60% (50% + 50% x 20%/100%).

$$Main\ speed\ command\,[\%] =$$

$$Main\ speed\,[\%] + Main\ speed\,[\%] \times \frac{WEB1\text{-}73\,(Splice\ Level)\,[\%]}{100\,[\%]}$$

Formula 11

The figure converted into frequency (Hz) is as follows:

$$Main\ speed\ command\,[\%] =$$

$$\frac{Final\ main\ speed\ command\ \ [\%]}{100\,[\%]} \times WEB1\text{-}59\ \ (Max\ Main\ Freq)\,[Hz]$$

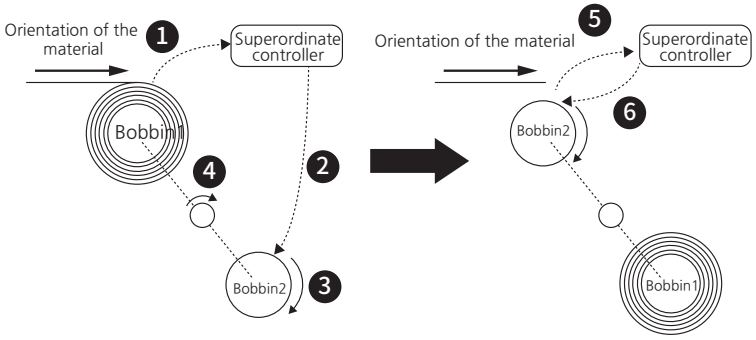
Formula 12

Finally, the inverter's final speed command output is obtained via the formula below. When the multifunction terminal is set to 72 (Web Splice) value turned on, the diameter of the bobbin is initialized to the diameter selected among WEB1-52-55 (Bobbin1-4) values.

$$Final\ speed\ command\,[\%] = Main\ speed\ command\,[Hz] \times \frac{WEB1\text{-}61\,(Min\ Diameter)}{WEB1\text{-}52\text{-}55\,(Bobbin1\text{-}4)}$$

Formula 13

The splicing system of the winder has the structure below:



[Image 82. Splicing Diagram]

Table 12. Explanation for splicing diagram

No.	Description
❶	The Bobbin 1, wrapped with materials, will send a signal to the superordinate controller when it nears its maximum diameter.
❷	The superordinate controller will send an On signal to the multifunction terminal set to 72(Web Splice), which controls currently empty Bobbin 2.
❸	While the Web PID controller's output is blocked, the inverter starts to operate empty Bobbin 2 only with a combination of command of the main speed command (%) and WEB1-45 (Splice Level) as shown in the **Formula 11**-**Formula 13**.
❹	The replacement shaft for bobbin rotates 180 degrees to change the location of Bobbin 1 and Bobbin 2.
❺	Sending the signal that the switchover for Bobbin 2 is completed to the superordinate controller.
❻	The superordinate controller stops the splicing behavior by sending an Off signal to the multifunction input terminal set to 72 (Web Splice), which controls Bobbin 2. Now, the Web PID operation and the diameter calculation resume, and the inverter's output frequency is determined by the **Formula 10**.

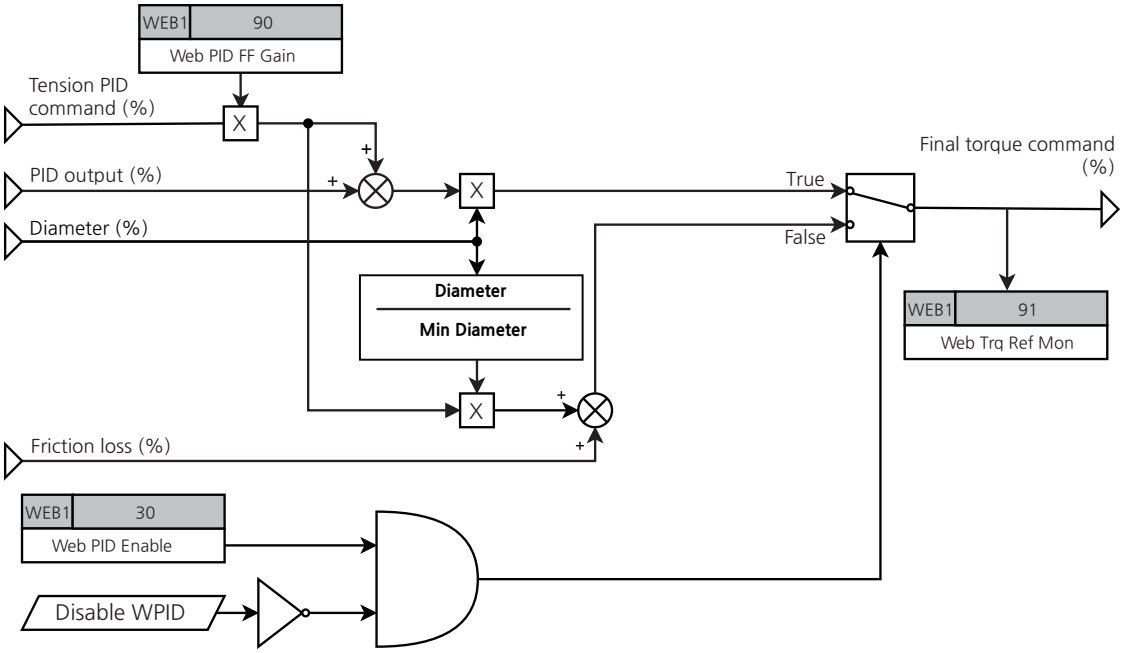
7.28.7.5 Speed Bias Function

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
WEB1	74	Web Bias Freq	0.00	0.00-60.00	0.00	%

Add the frequency value by the WEB1-74 (Web Bias Freq) to the command speed to output final command speed. This setting is only valid for open-loop speed control mode.

By adding the speed bias, the speed controller in the open-loop speed control mode will be saturated, and the torque limit output will be obtained during the operation.

7.28.8 Final Tension Calculation Part



[Image 83. Final tension calculation part]

The final tension calculation is used for an open-loop/closed-loop tension control system.

The closed-loop tension system outputs the final torque command by using the tension command, Web PID output, and diameter.

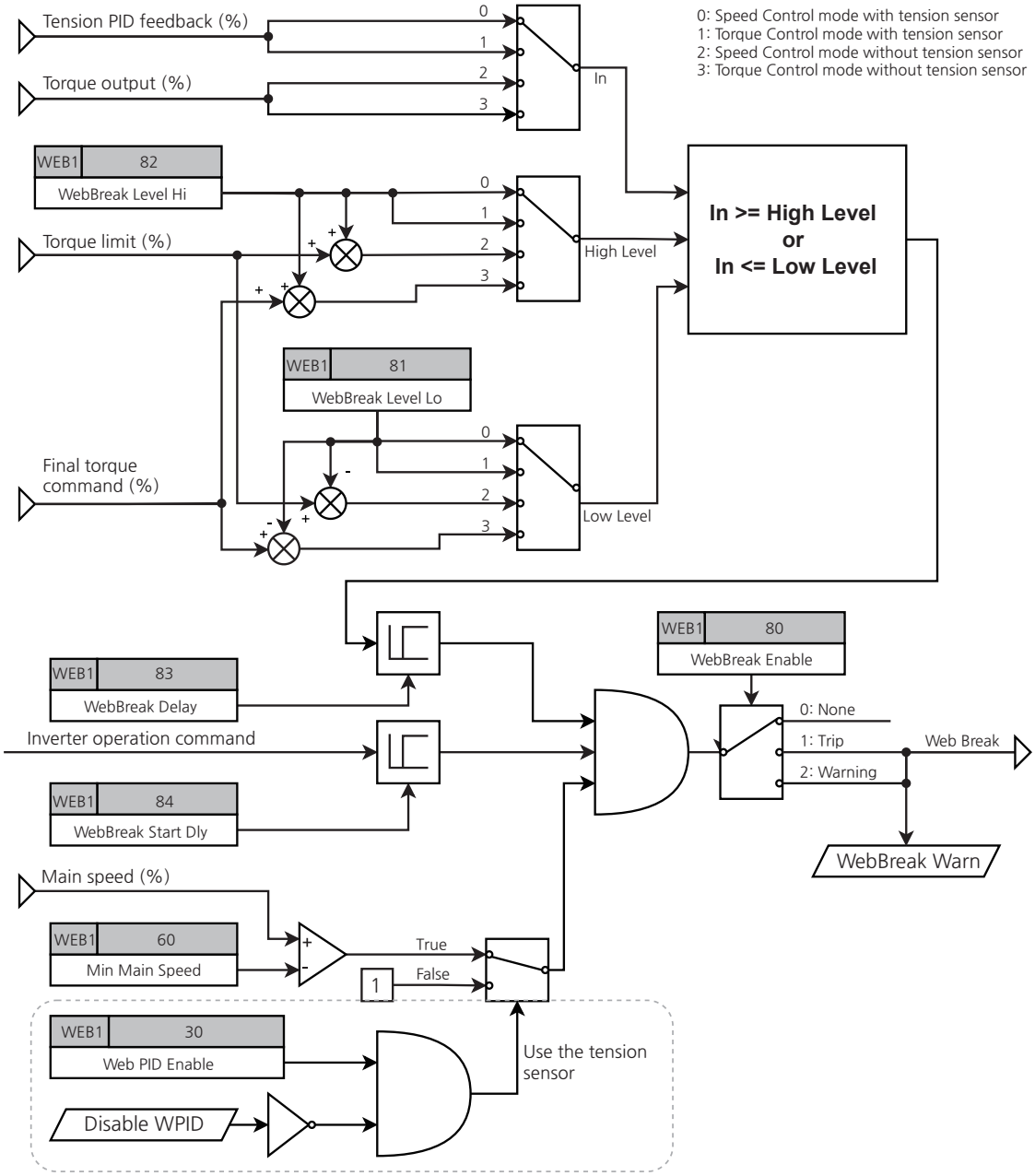
The open-loop tension system do not use Web PID output and uses tension command, diameter, and friction loss to output final torque command.

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
WEB1	90	Web PID FF Gain	100.0	0.0-1000.0	100.00	%

The gain set in WEB1-90 (Web PID FF Gain) adjusts the scale of the tension command from the tension command part.

The open-loop tension system requires the WEB1-90 (Web PID FF Gain) values to be at 100%, a set value shipped from the factory. The closed-loop tension system allows other values for faster tension response.

7.28.9 Disconnection Detection Part



[Image 84. Disconnection detection part]

The closed-loop tension control system uses tension detection devices, including a dancer and load cell. When the feedback from the tension detection device is maintained at too-higher or too-lower values for longer than the set time, the inverter sends signals to the superordinate controller via contact with a multifunction output and starts suitable protection behavior to prevent web materials from breaking.

The open-loop tension control system has no tension detection devices, so it determines the possibility of web material breaking by using the final torque output. If the final torque command differs by more than a certain range, disconnection detection behavior is triggered to start protection behavior according to the settings.

The open-loop speed control tension system triggers disconnection detection when the torque output is maintained higher than the set values for the torque limit.

Table 13. Criteria for disconnection detection by WEB behavior modes

Whether there is a tension sensor	Control mode	Disconnection detection input	Criteria for disconnection detection
Closed-loop	Speed control	Tension PID feedback	High Level: WEB1-82(WebBreak Level Hi) Low Level: WEB1-81(WebBreak Level Lo)
	Tension control		
Open-loop	Speed control	Torque output	High Level: Torque limit + WEB1-82(WebBreak Level Hi) Low Level: Torque limit - WEB1-81(WebBreak Level Lo)
	Tension control		High Level: Final torque command + WEB1-82(WebBreak Level Hi) Low Level: Final torque command - WEB1-81(WebBreak Level Lo)

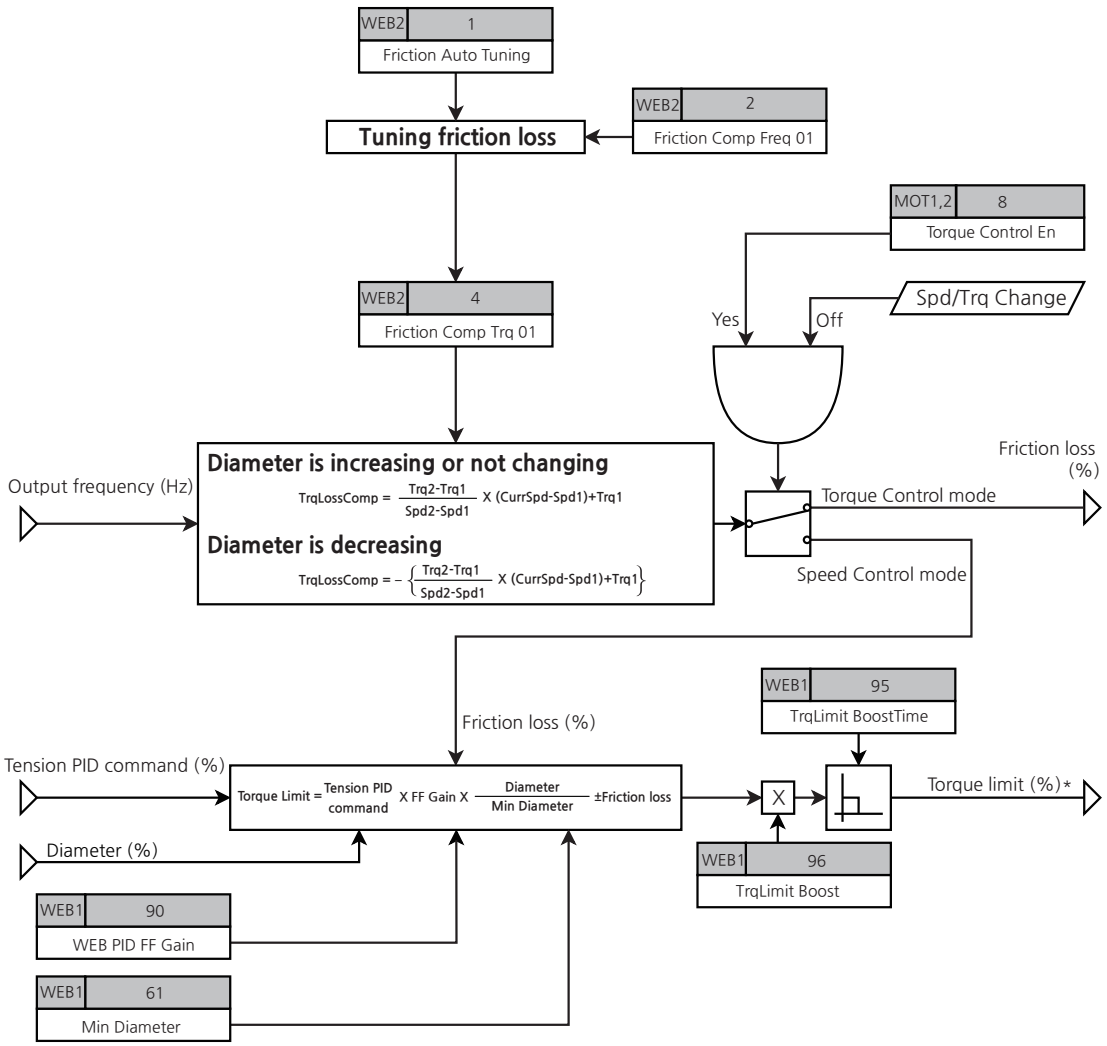
Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB1	80	WebBreak Enable	2	Warning	0~2	2	-
	81	WebBreak Level Lo	20.00		0.00-100.00	20.00	%
	82	WebBreak Level Hi	80.00		0.00-100.00	80.00	%
	83	WebBreak Delay	5.00		0.00-300.00	5.00	sec
	84	WebBreak Start Dly	10.00		0.00-300.00	10.00	sec

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
OUT	50, 52, 54	DOx Define (DOx: DO1-DO3)	50	WebBreak Warn	0-50	24, 14, 0	-

Disconnection Detection Part Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>WEB1-80
WebBreak Enable</td><td>Sets whether to use the disconnection detection function.
<table>
<tr><th colspan="2">Configuration</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>Disconnection detection function is not operating.</td></tr>
<tr><td>1</td><td>Trip</td><td>The inverter stops by free run when disconnection is detected.</td></tr>
<tr><td>2</td><td>Warning</td><td>The inverter keeps operating without a free-run stop when disconnection is detected. The warning will be displayed in the digital loader. If a multifunction output terminal is set to 50 (WebBreak Warn), only that terminal will be turned on. When the user sends the stop command to execute deceleration stop for the inverter, the warning displayed in the digital loader will be turned off, and the multifunction output terminal set to 50 (WebBreak Warn) will be turned off.</td></tr>
</table></td></tr>
<tr><td>WEB1-81
WebBreak Level Lo</td><td>Disconnection detection function is triggered when the analog feedback from a dancer or load cell is lower than the WebBreak Level Lo settings. For an open-loop tension system, the behavior is triggered when the output torque is lower than a figure the torque limit (speed control) or final torque command (tension control) minus set values.</td></tr>
<tr><td>WEB1-82
WebBreak Level Hi</td><td>Disconnection detection function is triggered when the analog feedback from a dancer or load cell is higher than the WebBreak Level Hi settings.</td></tr>
<tr><td>WEB1-83
WebBreak Delay</td><td>Consider it in the Disconnection (Web Break) status when the analog feedback from a dancer or load cell is the disconnection detection level (WEB1-82) or higher or disconnection detection level (WEB1-81) or lower and remains for the time set to WebBreak Delay.</td></tr>
<tr><td>WEB1-84
WebBreak Start Dly</td><td>The disconnection detection function is not triggered until the set time for this code from the initial powering on of the inverter. It is because the disconnection detection function may malfunction due to the unstable location of a dancer or load cell at the initial powering on.</td></tr>
</table>

7.28.10 Torque Limit Calculation Part



*The above torque limit is only available when the source of the torque limit is set to "System."

[Image 85. Torque limit calculation part]

7.28.10.1 Torque Limit Calculation

It only exists in the open-loop speed control tension system. It uses tension command, diameter, and friction loss value to calculate the torque limits as follows:

$$Torque\ Limit\,[\%] = Tension\ command\ [\%] \times \frac{Current\ diameter\ [\%]}{Minimum\ diameter} \pm friction\ loss$$

Formula 14

7.28.10.2 Measuring Friction Loss

Friction occurs for all mechanical equipment during operations. It decreases the system control performance and results in loss. When the materials are connected by a certain tension, for example, a tension control system, the friction loss from the roll may affect the materials' tension.

In a closed-loop tension system, Web PID will compensate for the friction loss. However, in an open-loop tension system, Web PID is not used, so the roll's friction loss is measured before system operation and compensated during the tension control operation.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
WEB2	1	Friction Auto Tuning	0	No	0~1	0	-
			1	Yes			
	2	Fric Comp Freq 1	6.00		1.00~ Fric Comp Freq 2	6.00	Hz
	3	Fric Comp Spd 1	180		30~ Fric Comp Spd 2	180	rpm
	4	Fric Comp Trq 1	0.00		0.00~100.00	0.00	%
	5	Fric Comp Freq 2	12.00		Fric Comp Freq 1~ Fric Comp Freq 3	12.00	Hz
	6	Fric Comp Spd 2	360		Fric Comp Spd 1~ Fric Comp Spd 3	360	rpm
	7	Fric Comp Trq 2	0.00		0.00~100.00	0.00	%
	8	Fric Comp Freq 3	18.00		Fric Comp Freq 2~ Fric Comp Freq 4	18.00	Hz
	9	Fric Comp Spd 3	540		Fric Comp Spd 2~ Fric Comp Spd 4	540	rpm
	10	Fric Comp Trq 3	0.00		0.00~100.00	0.00	%
	11	Fric Comp Freq 4	24.00		Fric Comp Freq 3~ Fric Comp Freq 5	24.00	Hz
	12	Fric Comp Spd 4	720		Fric Comp Spd 3~ Fric Comp Spd 5	720	rpm
	13	Fric Comp Trq 4	0.00		0.00~100.00	0.00	%
	14	Fric Comp Freq 5	30.00		Fric Comp Freq 4~ Fric Comp Freq 6	30.00	Hz

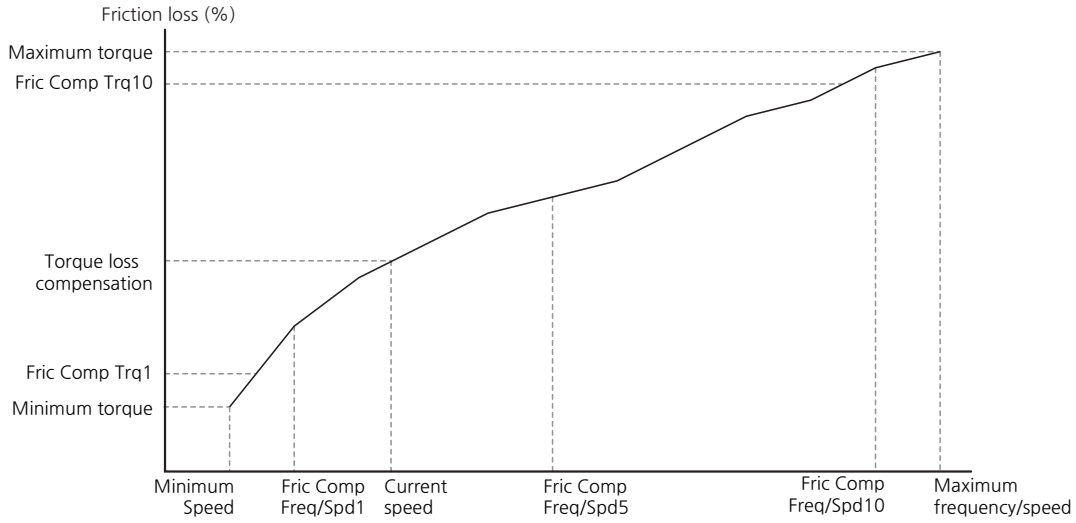
Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
WEB2	15	Fric Comp Spd 5	900	Fric Comp Spd 4~ Fric Comp Spd 6	900	rpm
	16	Fric Comp Trq 5	0.00	0.00~100.00	0.00	%
	17	Fric Comp Freq 6	36.00	Fric Comp Freq 5~ Fric Comp Freq 7	36.00	Hz
	18	Fric Comp Spd 6	1080	Fric Comp Spd 5~ Fric Comp Spd 7	1080	rpm
	19	Fric Comp Trq 6	0.00	0.00~100.00	0.00	%
	20	Fric Comp Freq 7	42.00	Fric Comp Freq 6~ Fric Comp Freq 8	42.00	Hz
	21	Fric Comp Spd 7	1260	Fric Comp Spd 6~ Fric Comp Spd 8	1260	rpm
	22	Fric Comp Trq 7	0.00	0.00~100.00	0.00	%
	23	Fric Comp Freq 8	48.00	Fric Comp Freq 7~ Fric Comp Freq 9	48.00	Hz
	24	Fric Comp Spd 8	1440	Fric Comp Spd 7~ Fric Comp Spd 9	1440	rpm
	25	Fric Comp Trq 8	0.00	0.00~100.00	0.00	%
	26	Fric Comp Freq 9	54.00	Fric Comp Freq 8~ Fric Comp Freq 10	54.00	Hz
	27	Fric Comp Spd 9	1620	Fric Comp Spd 8~ Fric Comp Spd 10	1620	rpm
	28	Fric Comp Trq 9	0.00	0.00~100.00	0.00	%
	29	Fric Comp Freq 10	60.00	Fric Comp Freq 9~ Max Frequency [57]	60.00	Hz
	30	Fric Comp Spd 10	1800	Fric Comp Spd 9~ Maximum Speed [58]	1800	rpm
	31	Fric Comp Trq 10	0.00	0.00~100.00	0.00	%

* The gray shaded area is activated when the speed unit is in rpm. 1 (select rpm Display) at (DRV-32, Hz/rpm Select)

[57] DRV-20(Max Frequency)
[58] DRV-21(Maximum Speed)

Friction Loss Measurement Settings Details

Code and Functions	Description
WEB2-1 Friction Auto Tuning	Select 1 (Yes) after installing an empty bobbin not connected to the materials to the roll to measure the friction loss. The friction loss measurement is triggered when selecting the function. The friction loss is measured by 10 speed intervals set in WEB2-2-31 and at acceleration or operation at a constant speed. The motor will stop by free run after friction loss is measured. After auto-tuning, the measured values for each interval are saved in WEB2-4, 7, 10, 13, 16, 19, 22, 25, 28, and 31.
WEB2-2-31 Fric Comp Freq/ Spd 1-10	Sets the speed to measure friction loss. The default value is divided into 10 intervals of 60 Hz (1800 rpm). The speed range is under DRV20 (Max Frequency) or DRV21 (Maximum Speed). Users can change the measured speed at their own discretion.
WEB2-4, 7, 10, 13, 16, 19, 22, 25, 28, 31 Fric Comp Trq 1-10	The friction loss (%) for the set speed is saved after measuring the friction loss. Users can change the set values at their discretion. The measured friction loss is calculated and compensated by the speed as shown in the illustration below.



[Image 86. Friction loss according to the speed]

7.28.10.3 Initial Tension Boost

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
WEB1	95	TrqLimit BoostTime	1.00	0.1-60.00	1.00	sec
	96	TrqLimit Boost	150.00	100.00-500.00	150.00	%

Initial Tension Boost Details

Code and Functions	Description
WEB1-95 TrqLimit BoostTime	Outputs the torque limit of the initial boost for the set time. This set value is only valid in the open-loop speed control mode.
WEB1-96 TrqLimit Boost	Increases the tension by the set value for the calculated final torque limit at the initial operation. This set value is only valid in the open-loop speed control mode. It allows fast tension response characteristics at the initial operation by increasing the initial tension.

7.28.11 How to set parameters

7.28.11.1 How to activate WEB groups

To use the WEB functions, APP-45 (Tension Ctrl En) code value is set to 1 (Yes). When the WEB1 and WEB2 groups are activated, you can set the WEB related parameters. Using the vector control method is recommended. First, enter the parameter values and conduct auto tuning (BAS-20 Auto Tuning).

7.28.11.2 How to set parameters

You can determine the main speed of the inverter from the currently using applications' flux (mpm). The motor speed when the bobbin is in minimum diameter should be the main speed. Calculate the motor speed by using the formula below and set the value to the WEB1-12 (Main Spd Kpd Set). [59] Calculate the number of poles using the set values in MOT1-25 (Number of Poles).

$$Motor\ speed\,[rpm] = \frac{Flux\ [mpm]}{\pi \cdot diameter\ [m]} \times\ belt\ ratio$$

Formula 15

$$Motor\ speed\,[Hz] = Motor\ speed\,[rpm] \times \frac{Pole\ number}{120}$$

Formula 16

Then, set the desired tension value in the application. The tension settings are in percent (%), meaning the ratio to the system's maximum tension. When there is a tension sensor, the force meant by the percent (%) value may vary depending on the tension sensor settings.

For example, the output of the tension sensor is 5 kg or 5 N, which is 5 V for output voltage, the inverter recognizes the value as 50% when receiving it by the analog input [60].

Then, enter the bobbin's diameter. Measure the maximum diameter and consider the measurement to be 100%. Then, measure the minimum and current diameters and calculate them with the formula below to set the values for WEB1-61 (Min Diameter) and WEB1-52 (Bobbin1 Diameter).

$$Minimum\ diameter\,[\%] = \frac{Minimum\ diameter\ [m]}{Maximum\ diameter\ [m]} \times 100\%$$

Formula 17

$$Current\ diameter\,[\%] = \frac{Current\ diameter\ [m]}{Maximum\ diameter\ [m]} \times 100\%$$

Formula 18

[59] When WEB1-11 (Main Spd Source) is set to 0 (Keypad)
[60] Input range: 0-10V(0-100%)

Finally, select No. 70 (WebCtrl Fwd Run) or 71 (WebCtrl Rev Run) to Define codes of DI1-DI8 of the terminal input group (DIN) to send the operation command.

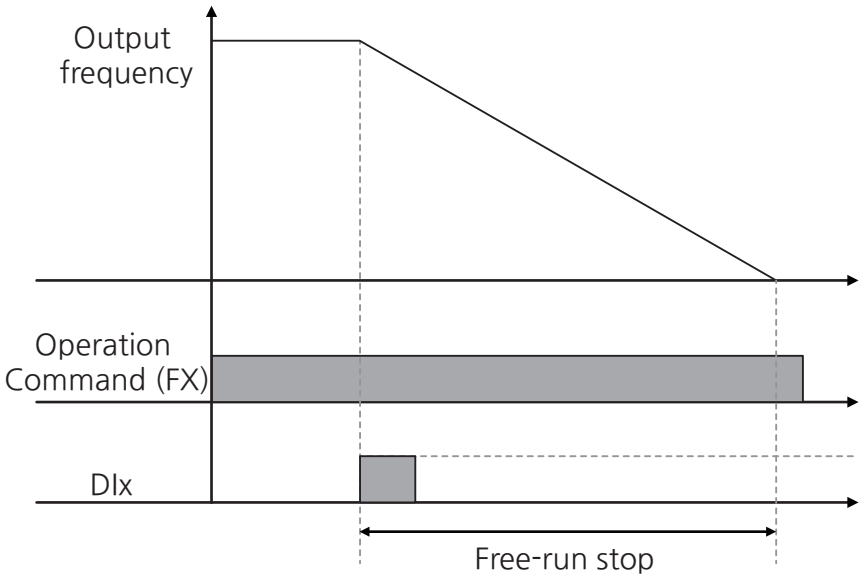
Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	70	WebCtrl Fwd Run	-	1, 2, 4, 5, 10, 11, 12, 9	-
			71	WebCtrl Rev Run			

7.29 System Stop (Quick Stop)

The function stops to set the deceleration time through multifunction inputs during an emergency.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	46	Q Stop Dec T	5.00		0.00~6000.00	5.00	sec
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	69	Quick Stop	-	1, 2, 4, 5, 10, 11, 12, 9	-

During normal operation, if a multifunction input terminal set to 69 (Quick Stop) is activated, the motor will decelerate and stop according to the deceleration time set in APP-46 (Q Stop Dec T). The deceleration time in such a case is the Delta Frequency mode (select 1 (Delta Frequency) at BAS-76 (Ramp Time Mode).



[Image 87. An Example of System Stop]

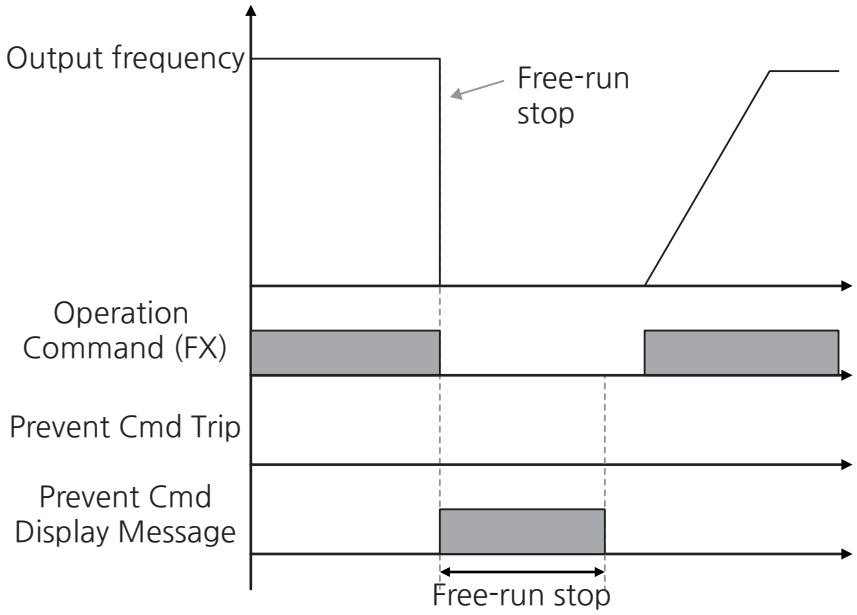
7.30 No Restart after a Free-Run Stop

It prevents trips by prohibiting the restart command when restarting after a free-run stop due to free-run stop during an operation or a trip. When using this function, restart commands are prohibited for a predetermined period set by the inverter, depending on the inverter's capacity or starting method.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
BAS	1	Start Mode	0	Acceleration	0-2	0	-
			1	DC Start			
			2	Speed Search			
	13	RunCmd After Coast	0	Prevent Run Cmd	0-2	0	-
			1	Delay Run Cmd			
			2	Speed Search			
ENC	10	Auto Flying Start	0	No	0-1	1	-
			1	Yes			

An Example of Normal Operation

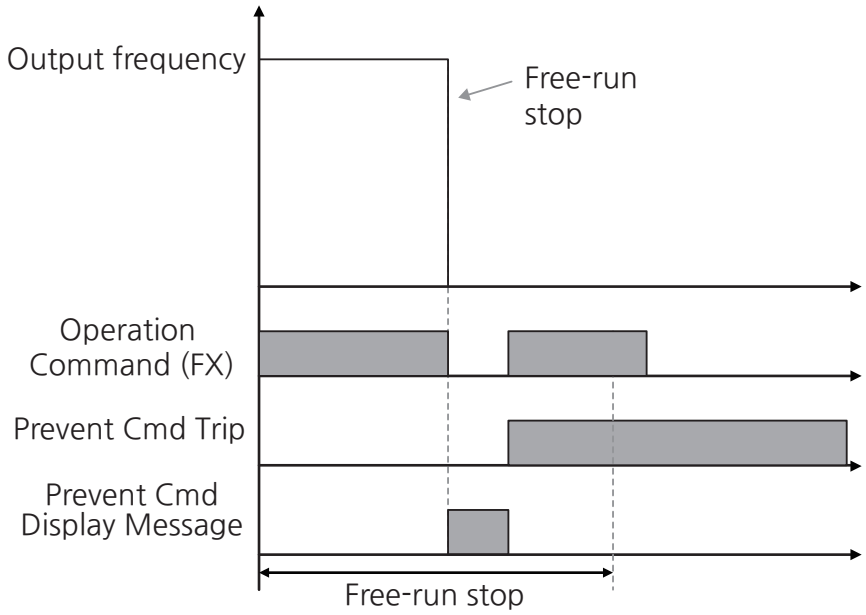
It runs a normal operation when there is an operation command after the prohibition time of a free-run stop after a free-run stop or a trip.



[Image 88. An Example of an Operation upon Operation Command Input after a free-run Stop]

An Example of an Operation during a free-run Stop and Restart Prohibition

A prevent Cmd trip occurs when there is an operation command during a free-run stop and restart prohibition after a free-run stop or a trip.



[Image 89. An Example of an Operation during Restart Prohibition after a free-run/Trip]

Table 14. When the encoder option is not installed, or when ENC-10 (Auto Flying Start) is 0 (No) after installing the encoder option

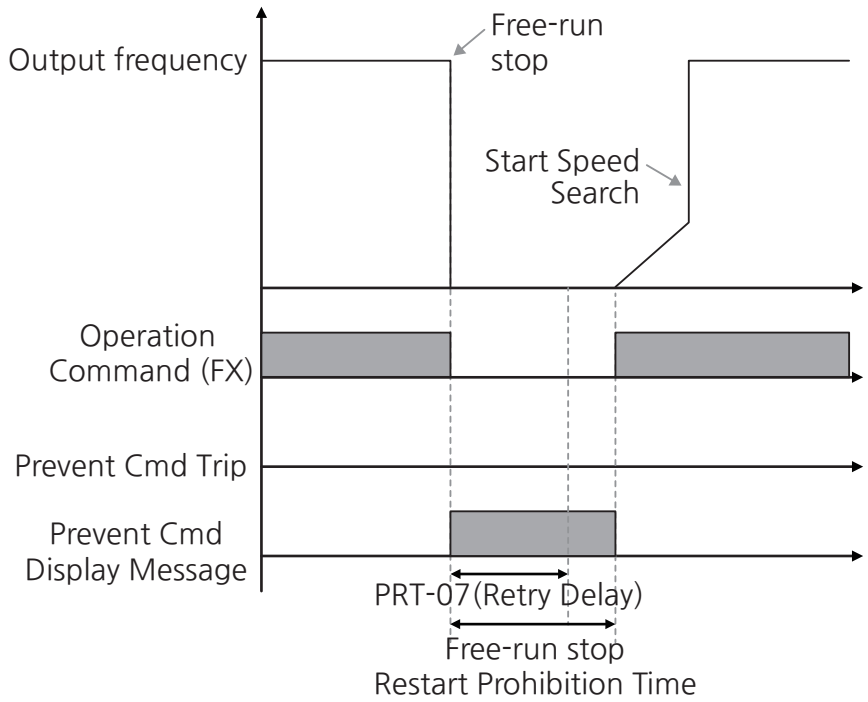
BAS-13 RunCmd After Coast	BAS-1 Start Mode		
	0(Acceleration)	1(DC Start)	2(Speed Search)
0(Prevent Run Cmd)	Prevent Cmd trip occurred		Start after speed search
1(Delay Run Cmd)	Start after the prohibition time for command input has elapsed		
2(Speed Search)	Start after speed search		

Table 15. When the encoder option is installed and ENC-10 (Auto Flying Start) is 1 (Yes)

BAS-13 RunCmd After Coast	BAS-1 Start Mode		
	0(Acceleration)	1(DC Start)	2(Speed Search)
0(Prevent Run Cmd)	Prevent Cmd trip occurred		Start after automatic speed search
1(Delay Run Cmd)	Start in automatic speed search mode after the prohibition time for command input has elapsed		
2(Speed Search)	Start after automatic speed search		

An Example of a Restart after Reset (Reset Restart) during a free-run Stop and Restart Prohibition

When you run speed search restart after free-run stop or a trip, speed search starts after a free-run stop and the restart prohibition time. A longer time between PRT-07 (Retry Delay) and a free-run stop and restart prohibition apply for the start time for speed search restart.



[Image 90. An Example of a Restart after a CoastStop(FreeRun)/Trip]

7.31 Timer Settings

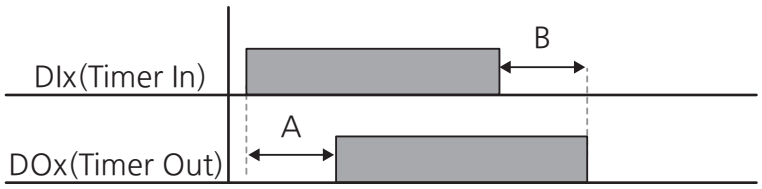
Use a timer function of the multifunction input terminal to control the On/Off for a relay and multifunction output according to the timer settings.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07, 09, 11, 13, 15	DI1~DI8 Define	32	Timer Input	-	1, 2, 4, 5, 10, 11, 12, 9	-
	25, 28, 31, 34, 37, 40, 43, 46	DI1~DI8 On Delay	0		0~100000	0	msec
	26, 29, 32, 35, 38, 41, 44, 47	DI1~D8 Off Delay	0		0~100000	0	msec
OUT	50, 52, 54	DO1~DO3 Define	23	Timer Output	-	24, 14, 0	-
	60, 63, 66	DO1~DO3 On Delay	0		0~100000	0	msec
	61, 64, 67	DO1~D3 Off Delay	0		0~100000	0	msec

Timer Setting Details

Code and Functions	Description
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	Choose one of the multifunction input terminals for the timer and set it to 32 (Timer Input).
OUT-50, 52, 54 DOx Define (DOx: DO1~DO3)	Set a multifunction output terminal or relay for the timer to 23 (Timer Output).
DIN-25, 28, 31, 34, 37, 40, 43, 46 DIx On Delay, DIN-26, 29, 32, 35, 38, 41, 44, 47 DIx Off Delay (DIx: DI1~DI8), OUT-60, 63, 66 DOx On Delay, OUT-61, 64, 67 DOx Off Delay (DOx: DO1~DO3)	When a signal input (On) is received by the terminal set as a timer (Timer Input), the timer output (Timer Output) activates once the time set in the DO1-DO3 On Delay code has passed. When the multifunction input terminal is turned off, the multifunction output or relay will turn off after the time set in the DI1-DI8 Off Delay + DO1-DO3 Off Delay code.

- DI1~DI8 On Delay + DO1~DO3 On Delay = A
  DI1~DI8 Off Delay + DO1~DO3 Off Delay = B



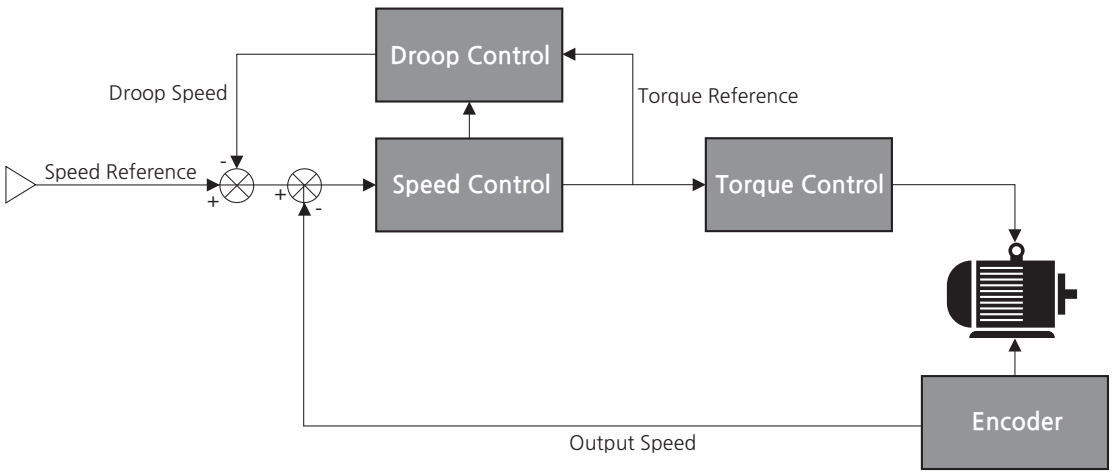
[Image 91. An Example of Timer Settings at Multifunction Terminal]

7.32 Droop Control

When driving a single load with multiple motors, this can be used for load balancing control or to prevent saturation of the speed controller in vector control.

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
VEC1	63	Droop Percent	-	0.0~100.0	0	%
	64	Droop Start Torque	50.0	0.0~100.0	50.0	%
	65	Droop FreqLfp Gain	500	0~1000	500	msec
	66	Droop Start Freq	10.00	0.00~ 600.00	10.00	Hz
	67 [61]	Droop Start Spd	300	0~36000	300	rpm

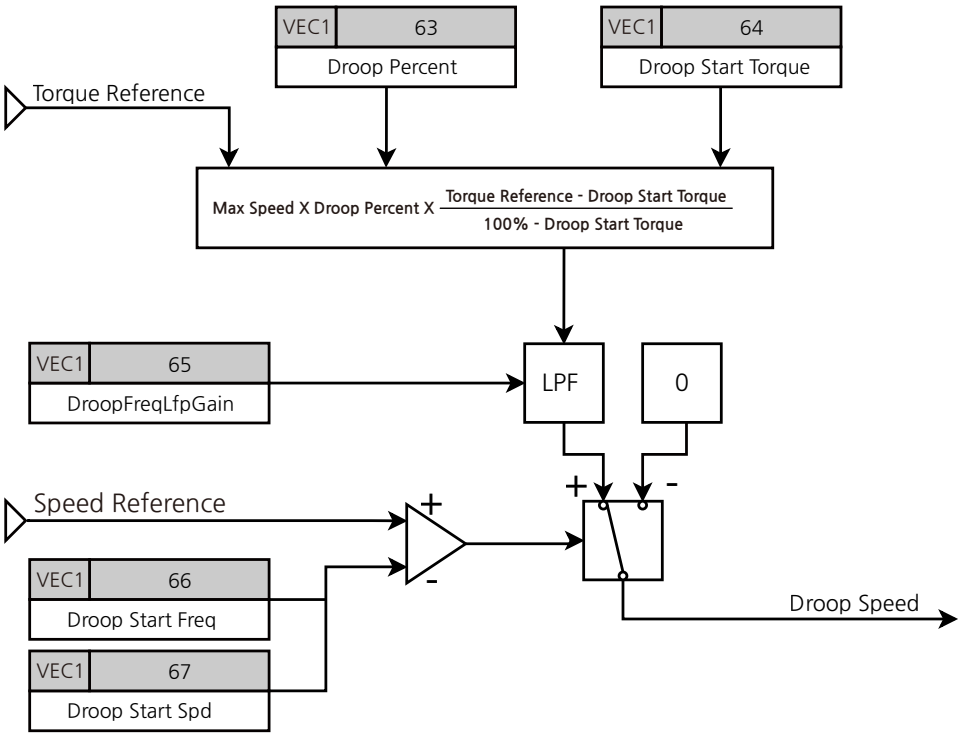
Droop control adjusts speed in the speed control mode based on the load conditions.



[Image 92. Basic Configuration Diagram of Droop Control]

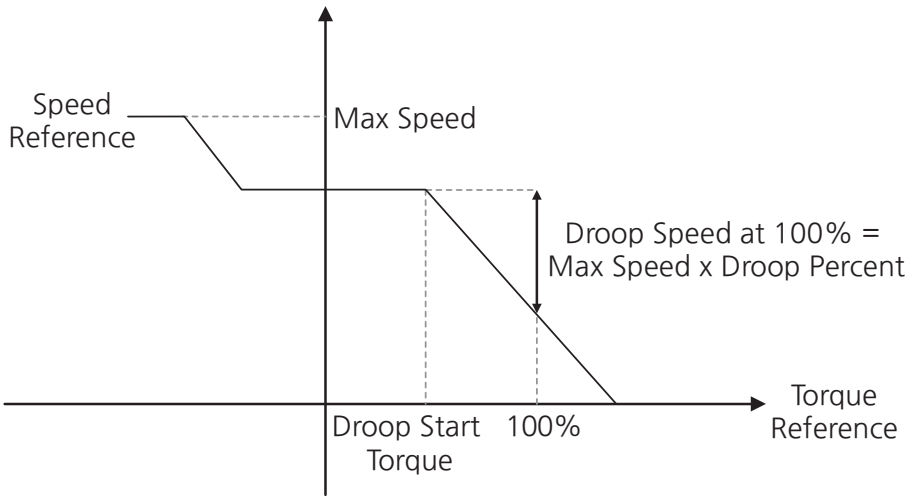
The droop control block in **[Image 92]** is as follows.

[61] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display).



[Image 93. Droop Control Block]

In **[Image 94]**, it shows the speed reference is reduced by the amount of the droop speed when the speed reference exceeds VEC1-66 (Droop Start Freq) or VEC1-67 (Droop Start Spd) and the load factor reaches 100%.



[Image 94. Output Speed Adjustment Based on Load]

7.33 Anti-sway (preventing crane sway)

This function minimizes sway when a crane transports a load through the air to a destination.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	49	ETM Mode	0	Single Mode	0-1	0	-
			1	Multi Mode			
	50	Natural Freq 1	-		0.05-100.00	1.00	Hz
	51	Natural Freq 2	-		0.05-100.00	1.00	Hz
	52	DampRatio For ETM	-		0.01-0.20	0.05	-
DIN	01, 03, 05, 07, 09, 11, 13, 15	DIx Define (DIx: DI1-DI8)	87	Anti-sway Enable	-	1, 2, 4, 5, 10, 11, 12, 9	-

Detailed anti-sway (preventing crane sway) settings

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>APP-49
ETM Mode</td><td>Sets the operation mode of the Anti-sway function.
<table>
<tr><th colspan="2">Configuration</th><th>Functionality</th></tr>
<tr><td>0</td><td>Single Mode</td><td>Anti-sway operates based on a single system natural frequency (APP-50 Natural Freq 1).</td></tr>
<tr><td>1</td><td>Multi Mode</td><td>Anti-sway operates based on a range of system natural frequencies (APP-51 Natural Freq 2 to APP-50 Natural Freq 1). Acceleration time may be slightly longer than in Single Mode.</td></tr>
</table></td></tr>
<tr><td>APP-52
DampRatio For ETM</td><td>This parameter adjusts the speed at which system vibration stops. The smaller the setting value, the slower the system vibration stops.</td></tr>
</table>

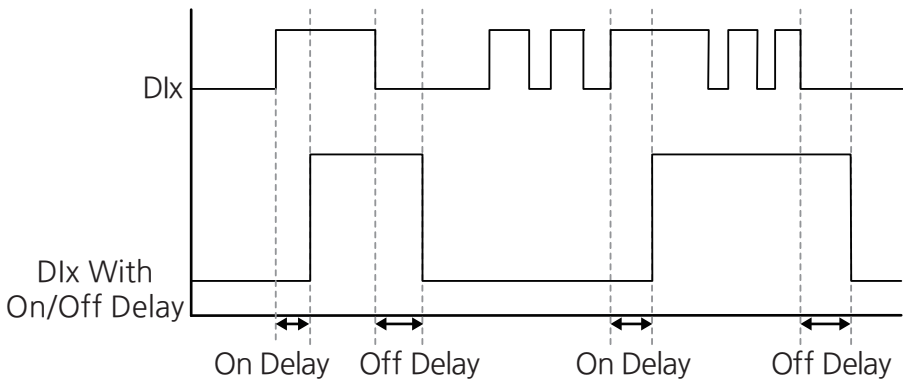
8 Functions of Terminal Block

8.1 Multifunction Digital Inputs

8.1.1 Delay Time Settings for Multifunction Input Terminals

You can set the time constant of filters for the multifunction input terminals. It is used to improve the responsiveness of the input terminals.

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
DIN	25, 28, 31, 34, 37, 40, 43, 46	DI1~DI8 On Delay	0	0~100000	10	msec
	26, 29, 32, 35, 38, 41, 44, 47	DI1~DI8 Off Delay	0	0~100000	3	msec



[Image 1. An Example of Delay Time Settings for Multifunction Input Terminal]

Delay Time for Multifunction Input Terminal Setting Details

Code and Functions	Description
DIN-25, 28, 31, 34, 37, 40, 43, 46 DIx On Delay, DIN-26, 29, 32, 35, 38, 41, 44, 47 DIx Off Delay (DIx: DI1~D8)	Sets the DI1-DI8 On Delay and Off Delay values for each input terminal. It is not used when set to 0. When you change the set time while a function is working during the time set for the parameter, the time will be measured from the time of change again. For example, when you set the DI1-DI8 On Delay time as 50 seconds and change it to 70 seconds after 20 seconds, 70 seconds are measured from 20 seconds after.

8.1.2 Contact Settings for Multifunction Input Terminals

You can set a type of contact for the multifunction input terminals.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	27, 30, 33, 36, 39, 42, 45, 48	DI1~D8 NC/NO	0	Normal Open	0~1	0	-
			1	Normal Close			

Contact of Multifunction Input Terminal Setting Details

Code and Functions	Description
DIN-27, 30, 33, 36, 39, 42, 45, 48 DIx NC/NO Sel (DIx: DI1~DI8)	You can select a type of contact for an input terminal and use it for contact A (Normal Open) and contact B (Normal Close)

8.1.3 Multifunction Input Identification

You can check the status of the multifunction input terminals.

For example, when you select an input terminal as contact A (normal Open) and input at the relevant terminal, the status of the input terminal becomes On.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	02, 04, 06, 08, 10, 12, 14, 16	DI1~D8 Status	0	Off	0~1	-	-
			1	On			

8.1.4 Multifunction Digital Input

Code and Functions	Item		Functionality
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	0	User Defined Func	Multifunction terminal input is not used.
	1	FX	Refer to **5.2.1.2 Terminal Block as a Command Input Device (Assigning Fx/Rx Terminals)**.
	2	RX	
	3	RST	Refer to **9.4.3 Trip Status Reset**.
	4	BX	Refer to **9.2.7 Output Block by Multifunction Terminal**.
	5	External Trip-1	Refer to **9.2.2 External Trip Signal**.
	6	External Trip-2	
	7	External Trip-3	
	8	External Trip-4	
	9	JOG	Refer to **7.2 Jog operation**.
	10	Speed-L	Refer to **5.1.2.4 Multistep Frequency Configuration**.
	11	Speed-M	
	12	Speed-H	
	13	Speed-X	

Code and Functions	Item		Functionality
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	14	XEL-L	Refer to **5.3.1.3 Multi-stage Acc/Dec Time Setting with Multifunction Terminals**.
	15	XEL-M	
	16	XEL-H	
	17	XEL-Stop	Refer to **5.3.2.2 Acc/Dec Stop Command Settings**.
	18	Run Enable	Refer to **7.4 Safe Operation Mode**.
	19	3-Wire	Refer to **7.3 3-Wire Operation**.
	20	2nd Source	Refer to **7.19 Second Operation Mode Settings**.
	21	Exchange	Refer to **7.17 Switching Operation to Commercial Power**.
	22	Up	Refer to **5.1.1.7 Up-Down Operation**.
	23	Down	
	24	Up/Down Clear	
	25	Up/Down Save	
	26	Cmd Frequency Hold	Refer to **5.1.2.2 Holding Operating Frequency**.
	27	2nd Motor	Refer to **7.16 Second Motor Operation**.
	28	DC Injection	Refer to **7.24 DC Injection by Terminal Block**.
	29	Spd/Trq Change	Refer to **6.6.3 Speed/Torque Switch**.
	30	Reserved	-
	31	Reserved	-
	32	Timer Input	Refer to **7.31 Timer Settings**.
	33	Reserved	-
	34	Disable Aux Ref	Refer to **7.1 Auxiliary Frequency Operation**.

Code and Functions	Item		Functionality
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	35	Forward JOG	Refer to **7.2.2 Jog Operation by Terminal Block 2-Forward / Reverse Jog**.
	36	Reverse JOG	
	37	PPID Run Enable	Refer to **7.7.1 Basic PID Operation**.
	38	PPID Open Loop	Refer to **7.7.4 PID Operation Switch (PID Openloop)**.
	39	PPID Ref Change	Refer to **7.7.1 Basic PID Operation**.
	40	PPID Gain Change	
	41	PPID I-Term Clear	
	42	PPID Output Hold	Refer to **7.7.5 PID Output Hold Operation**.
	43	PPID Sleep ON	Refer to **7.7.2 PID Operation Sleep Mode**.
	44	PPID Sleep Change	
	45	PPID Step Ref-L	Refer to **7.7.1 Basic PID Operation**.
	46	PPID Step Ref-M	
	47	PPID Step Ref-H	
	48	Fire Mode Fwd	Refer to **7.11 Fire Mode**.
	49	Fire Mode Rev	
	50	Pre Heat	Refer to **7.23 Motor Pre-Heating**.
	51	EPID1 Run	Refer to **7.8.1 Basic EPID Operation**.
	52	EPID1 I-Term Clear	
	53	EPID2 Run	
	54	EPID2 I-Term Clear	
	55	Brake Monitor Sel	Refer to **7.25 Brake Control**.
	56	POS Home	Refer to **7.26.3.2 Homing Operation**.
	57	POS Run Home	

Code and Functions	Item		Functionality
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	58	POS HW Lmt L	Refer to **7.26.3 Trip Processing Block**.
	59	POS HW Lmt H	
	60	POS Pattern-L	Refer to **7.26.2.2 Position Path Selection and Speed Pattern Occurrence Block**.
	61	POS Pattern-M	
	62	POS Pattern-H	
	63	POS Pattern-X	
	64	POS Run	Refer to **7.26.2.1 Overall Block Diagram**.
	65	POS Run Pre-Posi	Refer to **7.26.2.2 Position Path Selection and Speed Pattern Occurrence Block**.
	66	POS Run Relative	
	67	Modbus Master En	Refer to **7.27.6.2 Simple-Master-Related Communication Parameter Settings**.
	68	UserSeqCtrl OnOff	-
	69	Quick Stop	Refer to **7.29 System Stop (Quick Stop)**.
	70	WebCtrl Fwd Run	Refer to **7.28.11 How to set parameters**.
	71	WebCtrl Rev Run	
	72	Web Splice	Refer to **7.28.7.4 Splicing Function**.
	73	WPID Gain Change	Refer to **7.28.5.2 Web PID Gain Calculation Part**.
	74	Web Bobbin-L	Refer to **7.28.6.1 Bobbin Selection and Initializing Diameter Functions**.
	75	Web Bobbin-H	
	76	Web Preset	
	77	Disable WPID	Refer to **7.28.5.1 Web PID Control Part**.
	78	Web I-Term Clear	
	79	Diameter Calc Hold	Refer to **7.28.6.3 Stopping Diameter Calculation Function**.
	80	Web Tns Up En	Refer to **7.28.4.2 Tension Boost/Down Function**.
	81	Web Tns Down En	
	82	Web Taper Disable	Refer to **7.28.4.1 Taper Function**.
	87	Anti-sway Enable	Refer to **7.33 Anti-sway (preventing crane sway)**.

8.2 Analog Input

8.2.1 Analog Input Mode

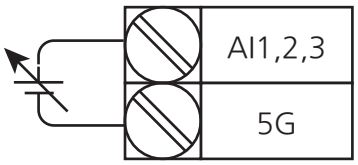
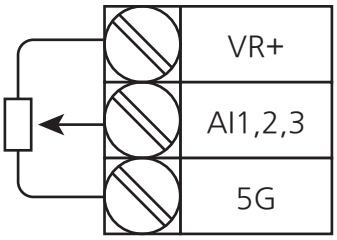
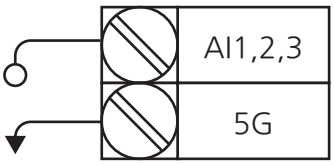
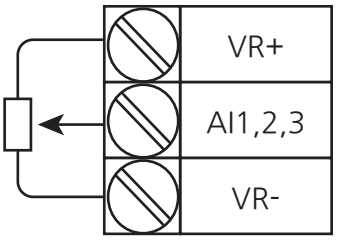
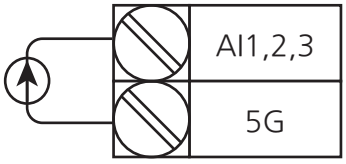
You can use Unipolar Voltage/Bipolar Voltage/Current inputs according to analog input mode settings.

To use current mode, turn on SW4 at the relevant input port.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
AIN	01, 16, 31	AIx Type Select (AIx: A1~A3)	0	Unipolar Voltage	0~2	0	-
			1	Bipolar Voltage			
			2	Current			
	02, 17, 32	AIx Value [1] (AIx: A1~A3)	-		-10.00~ 10.00	-	V
					0.00~ 20.00		mA
	03, 18, 33	AIx Monitor[%] (AIx: A1~A3)	-		0.00~ 100.00	-	%

[1] The unit changes depending on the mode selection: Voltage or current.

Analog Input Terminal Setting Details

Code and Functions	Description
AIN-01, 16, 31 AIx Type Select (AIx: AI1~AI3)	You can select and use the types of analog input terminals as follows: Unipolar Voltage: Input voltage of 0-10 V  **[Image 2. External Power Source Connection]**  **[Image 3. Internal Power Source Connection]** Bipolar Voltage: input voltage of -10-10 V  **[Image 4. External Power Source Connection]**  **[Image 5. Internal Power Source Connection]** Current: Input current of 4-20 mA, select SW4 as I1-I3 current (in the direction of ON) to use the current mode.  **[Image 6. External Current Source Connection]**
AIN-02, 17, 32 AIx Value (AIx: AI1~AI3)	Check the size of the voltage (V) / current (mA) input at the AI1 terminal. (Displays the voltage if AI1-AI3 Type Select is not set to 2 [Current].)
AIN-03, 18, 33 AIx Monitor[%] (AIx: AI1~AI3)	Displays the magnitude of the voltage (V) input to the AI1 terminal as a percentage (%) converted by the analog input scale. For details, refer to **8.2.2 The Scale of Analog Input**.

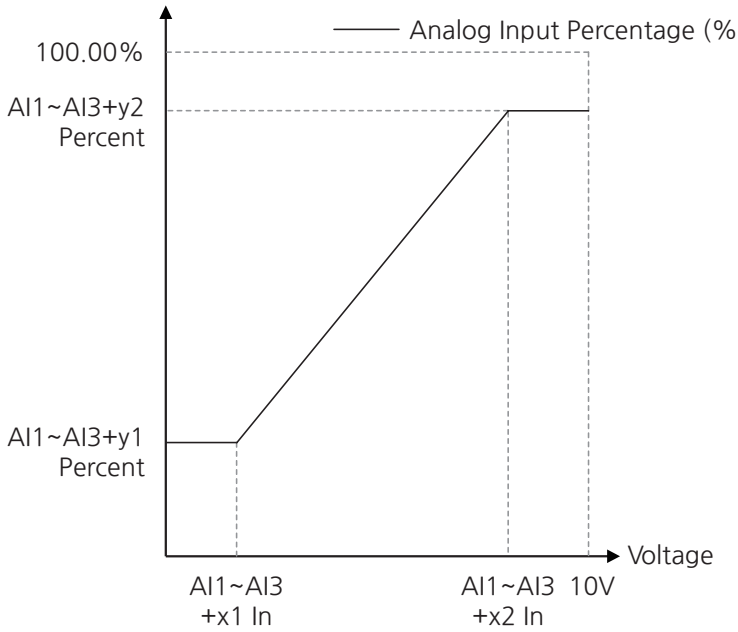
8.2.2 The Scale of Analog Input

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
AIN	05	AI1 + x1 In	0.00	0.00~AI1 + x2 In	0.00	V
					4.00	mA
	06	AI1 + y1 Percent	-10.00	-100.00~100.00	0.00	%
	07	AI1 + x2 In	-100.00	AI1 + x1 In~10.00	10.00	V
			0.00	AI1 + x1 In~20.00	20.00	mA
	08	AI1 + y2 Percent	0.00	-100.00~100.00	100.0	%
	09	AI1 - x1 In	10.00	AI1 - x2 In~0.00	0.00	V
	10	AI1 - y1 Percent	20.00	-100.00~100.00	0.00	%
	11	AI1 - x2 In	100.00	-10.00~AI1 - x1 In	-10.00	V
	12	AI1 - y2 Percent	0.00	-100.00~100.00	-100.00	%
	20	AI2 + x1 In	0.00	0.00~AI2 + x2 In	0.00	V
					4.00	mA
	21	AI2 + y1 Percent	-10.00	-100.00~100.00	0.00	%
	22	AI2 + x2 In	-100.00	AI2 + x1 In~10.00	10.00	V
			0.00	AI2 + x1 In~20.00	20.00	mA
	23	AI2 + y2 Percent	0.00	-100.00~100.00	100.00	%
	24	AI2 - x1 In	10.00	AI2 - x2 In~0.00	0.00	V
	25	AI2 - y1 Percent	20.00	-100.00~100.00	0.00	%
	26	AI2 - x2 In	100.00	-10.00~AI2 - x1 In	-10.00	V
	27	AI2 - y2 Percent	0.00	-100.00~100.00	-100.00	%
	35	AI3 + x1 In	0.00	0.00~AI3 + x2 In	0.00	V
					4.00	mA
	36	AI3 + y1 Percent	-10.00	-100.00~100.00	0.00	%
	37	AI3 + x2 In	-100.00	AI3 + x1 In~10.00	10.00	V
			0.00	AI3 + x1 In~20.00	20.00	mA
AIN	38	AI3 + y2 Percent	0.00	-100.00~100.00	100.00	%
	39	AI3 - x1 In	10.00	AI3 - x2 In~0.00	0.00	V
	40	AI3 - y1 Percent	20.00	-100.00~100.00	0.00	%
	41	AI3 - x2 In	100.00	-10.00~AI3 - x1 In	-10.00	V
	42	AI3 - y2 Percent	0.00	-100.00~100.00	-100.00	%

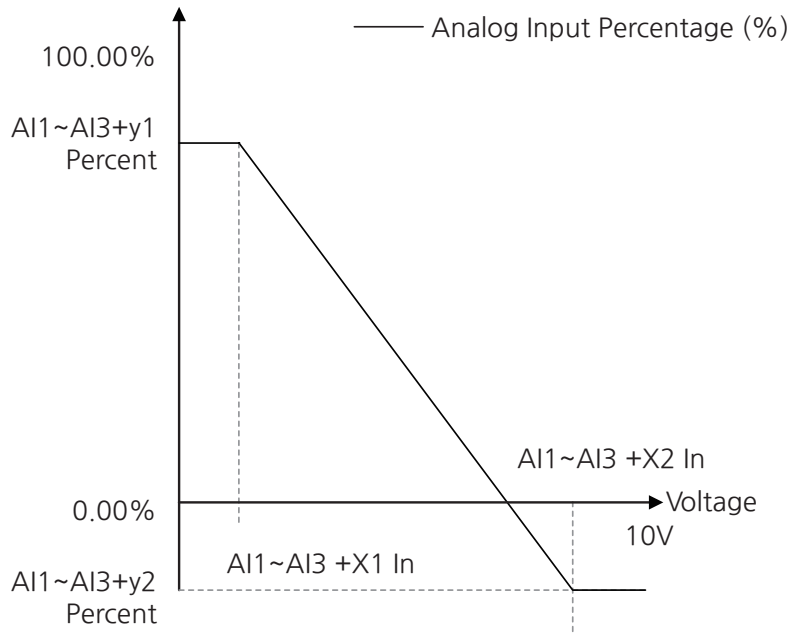
* The gray-shaded area is shown when the type of analog input terminal is bipolar voltage (select 1 [Bipolar Voltage] at AIN-01, 16, and 31 [AI1-AI3 Type Select]).

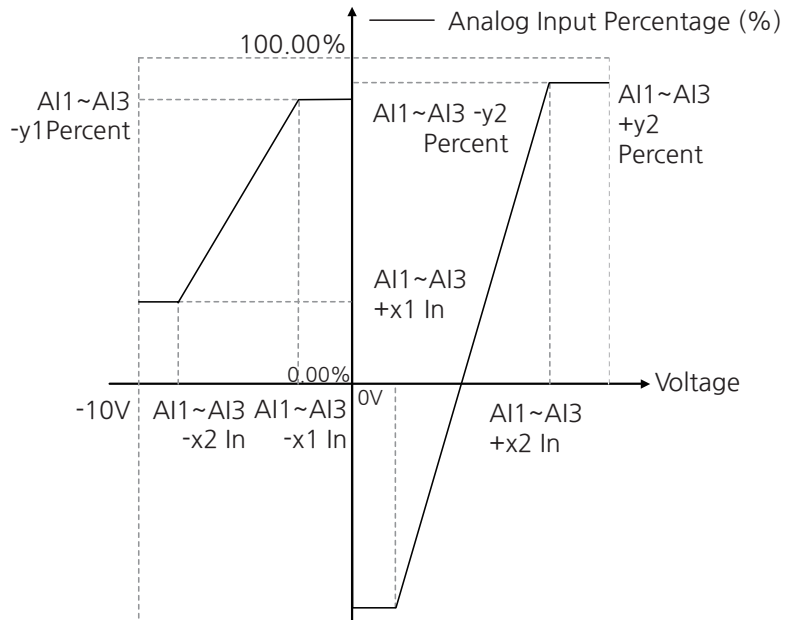
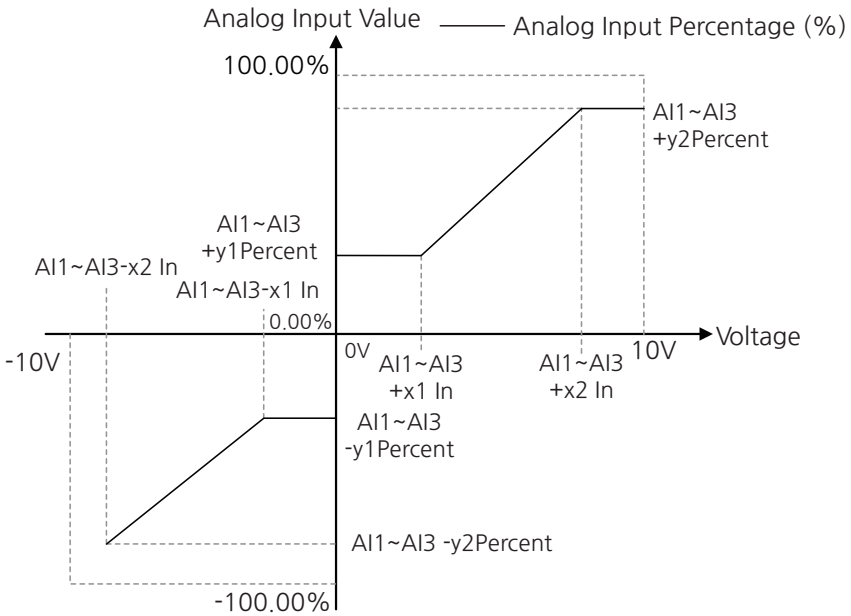
The Size of Analog Input Setting Details

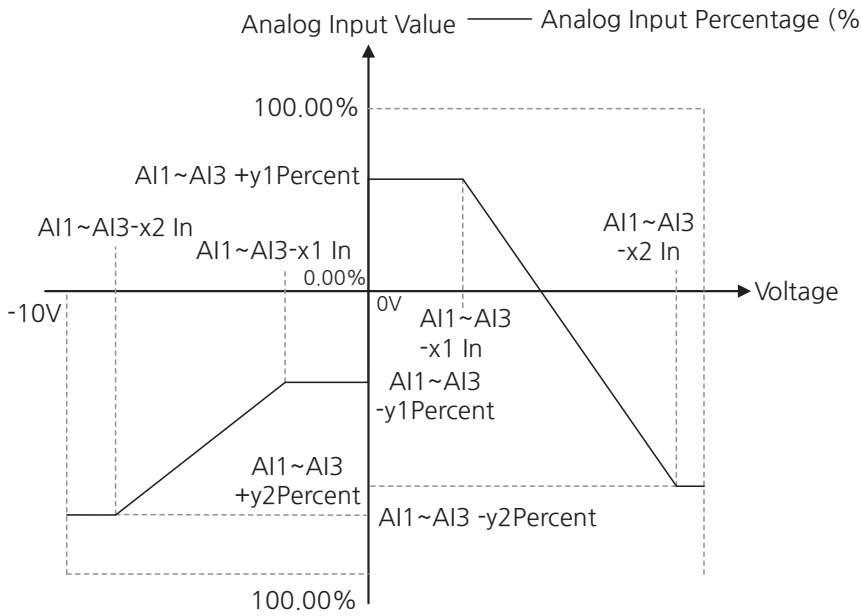
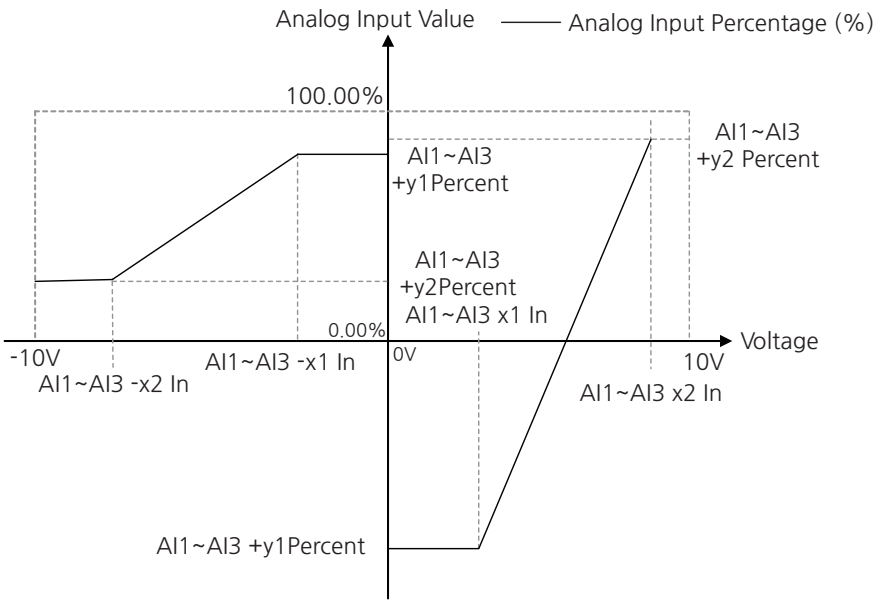
Code and Functions	Description
AIN-05, 20, 35 AIx + x1 In, AIN-06, 21, 36 AIx+ y1 Percent, AIN-07, 22, 37 AIx + x2 In, AIN-08, 23, 38 AIx + y2 Percent (AIx: AI1~AI3)	These parameters are used to configure the gradient level and offset the values of the output frequency, based on the size of the input voltage. When the voltage value is smaller than the setting values of AIN-05, 20, and 35, the setting values of AIN-06, 21, and 36 will be applied to more than 0 V. When it is bigger than the setting values of AIN-07, 22, and 37, the setting values of AIN-08, 23, and 38 will be applied to less than 10 V.

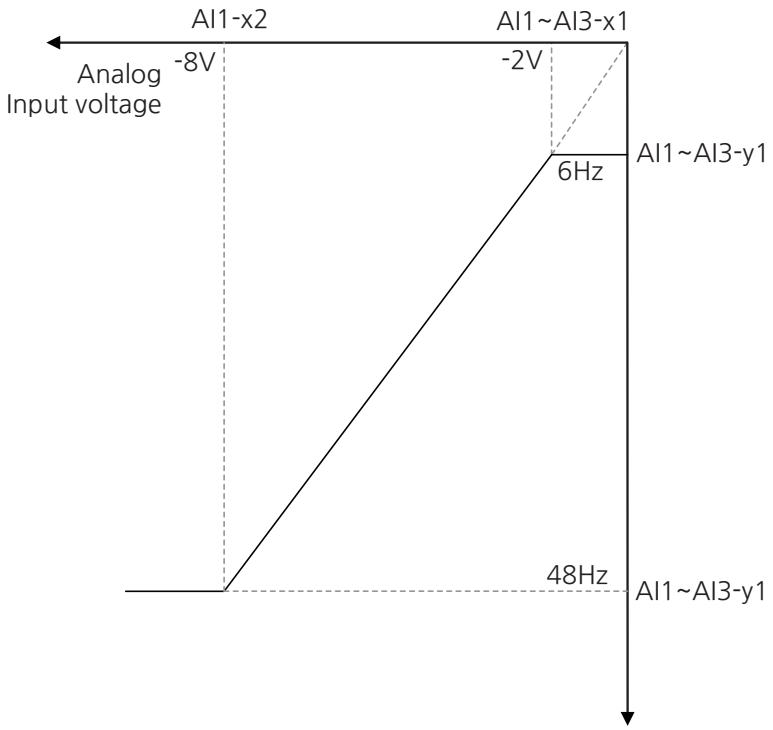


[Image 7. The Size of Analog Input Based on Analog Voltage Input - 1]

Code and Functions	Description
AIN-05, 20, 35 Alx + x1 In, AIN-06, 21, 36 Alx+ y1 Percent, AIN-07, 22, 37 Alx + x2 In, AIN-08, 23, 38 Alx + y2 Percent (Alx: AI1~AI3)	 **[Image 8. The Size of Analog Input Based on Analog Voltage Input - 2]**
AIN-09, 24, 39 Alx-x1 In AIN-10, 25, 40 Alx-y1 Percent AIN-11, 26, 41 Alx-x2 In AIN-12, 27, 42 Alx-y2 Percent (Alx: AI1~AI3)	These parameters are used to configure the gradient level and offset values of the output frequency, based on the input voltage. It will only be displayed when AIN-01, 16, and 31 (AI1-AI3 Type Select) are set to 1 (Bipolar Voltage). When it is bigger than the setting values of AIN-09, 24, and 39, the setting values of AIN-10, 25, and 40 will be applied to less than 0 V. When it is bigger than the setting values of AIN-11, 26, and 41, the setting values of AIN-12, 27, and 42 will be applied to more than -10 V.

Code and Functions	Description
AIN-09, 24, 39 Alx-x1 In AIN-10, 25, 40 Alx-y1 Percent AIN-11, 26, 41 Alx-x2 In AIN-12, 27, 42 Alx-y2 Percent (Alx: AI1~AI3)	 **[Image 9. The Size of the Analog Input Based on Analog Voltage Input (Bipolar Voltage) - 1]**  **[Image 10. The Size of the Analog Input Based on Analog Voltage Input (Bipolar Voltage) - 2]**

Code and Functions	Description
AIN-09, 24, 39 AIx-x1 In AIN-10, 25, 40 AIx-y1 Percent AIN-11, 26, 41 AIx-x2 In AIN-12, 27, 42 AIx-y2 Percent (AIx: AI1~AI3)	 **[Image 11. The Size of the Analog Input Based on Analog Voltage Input (Bipolar Voltage) - 3]**  **[Image 12. The Size of the Analog Input Based on Analog Voltage Input (Bipolar Voltage) - 4]**

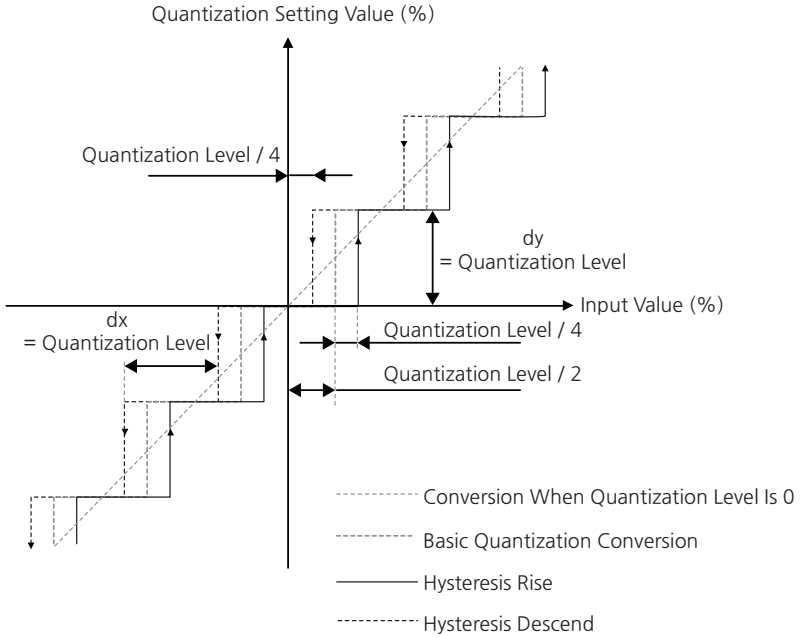
Code and Functions	Description
AIN-09, 24, 39 AIx-x1 In AIN-10, 25, 40 AIx-y1 Percent AIN-11, 26, 41 AIx-x2 In AIN-12, 27, 42 AIx-y2 Percent (AIx: AI1~AI3)	For instance, when you set AI1-AI3-x1 In (AIN-9, 24, and 39) as -2 V, AI1-AI3-y1 Percent (AIN-10, 25, and 40) as 10%, AI1-AI3-x2 In (AIN-11, 26, and 41) as -8 V, and AI1-AI3-y2 Percent (AIN-12, 27, and 42) as 80%, the output frequency moves in between 6 and 48 Hz.  **[Image 13. The Size of the Analog Input Based on Analog Voltage Input (Bipolar Voltage) - 5]**

8.2.3 Quantization

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
AIN	13, 28, 43	AI1~AI3 Quantizing	0.04	0.00 [2]~10.00	0.04	%

[2] Quantization is disabled if set to 0.

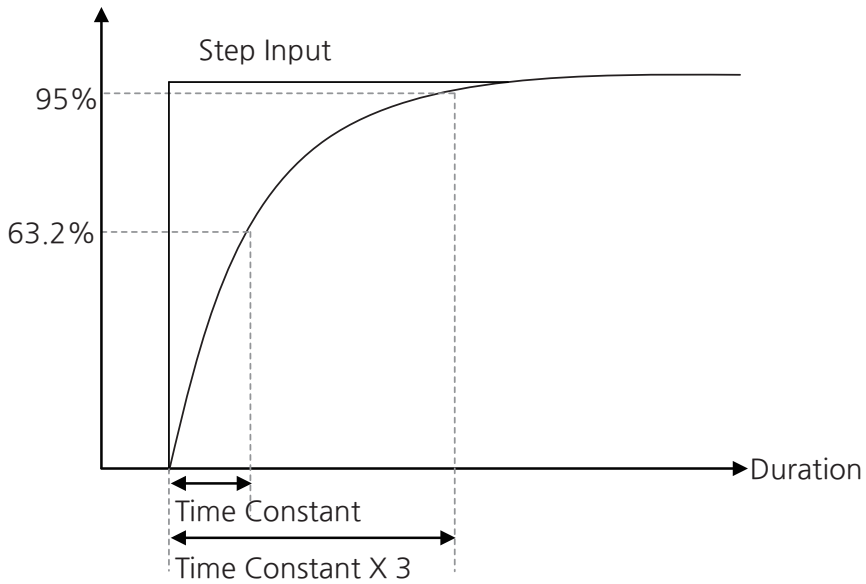
Quantization Setting Details

Code and Functions	Description
AIN-13, 28, 43 AIx Quantizing (AIx: AI1~AI3)	Sets values for quantization. The inverter outputs the frequency by measuring (quantizing) the height (value) of the input signal at a consistent interval when quantization values are set. This means that the delicate control on the output frequency (power resolution) is low, but the noise is reduced, so it is suitable for systems that are sensitive to noise. The setting values for quantization is a percentage of the maximum analog input. Therefore, if the value is set to 1% when the maximum analog input is 10 V at the maximum frequency of 60 Hz, the output frequency will change by 0.6 Hz at 0.1 V intervals. To reduce the effect of the input signal changes (runout of height) on the operation frequency, the output frequency during increase or decrease of input signal value (height) is applied differently. When the input signal value increases, the output frequency will start to change if the height becomes equivalent to 3/4 of the quantization value. From then on, the output frequency will increase according to the quantization value. On the contrary, when the input signal decreases, the output frequency will start decreasing if the height becomes equivalent to 1/4 of the quantization value. Although the noise can be reduced using a low-pass filter (AIN-04, 19, and 34), the responsiveness on the input signal takes longer as the set value gets higher. Since it becomes difficult to control the frequency if the input signal is delayed, a long cycle of pulsation (ripple) may occur on the output frequency.  **[Image 14. Frequency Change Based on Quantization Settings]**

8.2.4 Filter

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
AIN	04, 19, 34	AI1~AI3 LPF Gain	10	0 [3]~10000	10	msec

Filter-Setting Details

Code and Functions	Description
AIN-04, 19, 34 AIx LPF Gain (AIx: AI1~AI3)	Sets time constant for the low-pass filter. Use this when the change in frequency settings is too big from too much noise. When used, it filters the analog signal to pass only the clean input signals. The higher the time constant of a filter, the lower the variation in frequency. However, this slows down the time and affects the responsiveness. The setting value, or time constant (time) indicates the time required for the frequency to reach 63% of the set frequency inside the inverter when there is a step input of voltage from an external power source.  **[Image 15. An Example of Operation Based on Time Constant Settings for Low-Pass Filter]**

[3] A low-pass filter is not used when set to 0.

8.2.5 Analog input level detection

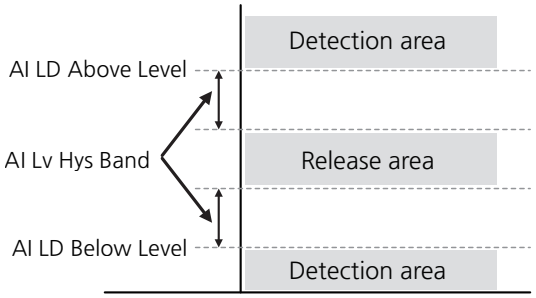
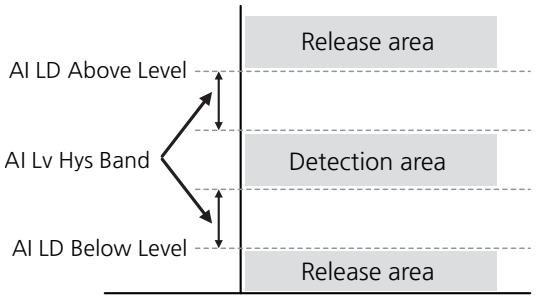
This function generates a trip or alarm based on the analog input value.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
AIN	80	AI Lv Detect Src	0	Keypad	0-7	0	-
	81	AI Lv Detect Act	1	CoastStop (FreeRun)	0-4	0	-
	82	Ana In Lv Monitor	-		-100.00-100.00	-	%
	83	Ana In Detect Sts	0	None	0-1	-	-
			1	Yes			
	84	AI Lv Detect Above	-		-100.00-100.00	0.00	%
	85	AI Lv Detect Below	-		-100.00-100.00	0.00	%
	86	AI Lv Detect Freq	-		0.00-Max Frequency	0.00	Hz
	87	AI Lv Detect Speed	-		0-Maximum Speed	0	rpm
	88	AI Lv Detect Delay			0.0-999.9	2.0	sec
	89	AI Lv Hys Band			0.00-10.00	0.00	%
	90	AI LvD Cancel Dly			0.0-999.9	0.0	sec
	91	AI LvD RestartMode	0	None	0-2	0	-
			1	Start Mode			
			2	Speed Search			
OUT	50, 52, 54	DO1-DO3 Define	52	Ana In Lvl Detect	-	24, 14, 0	-

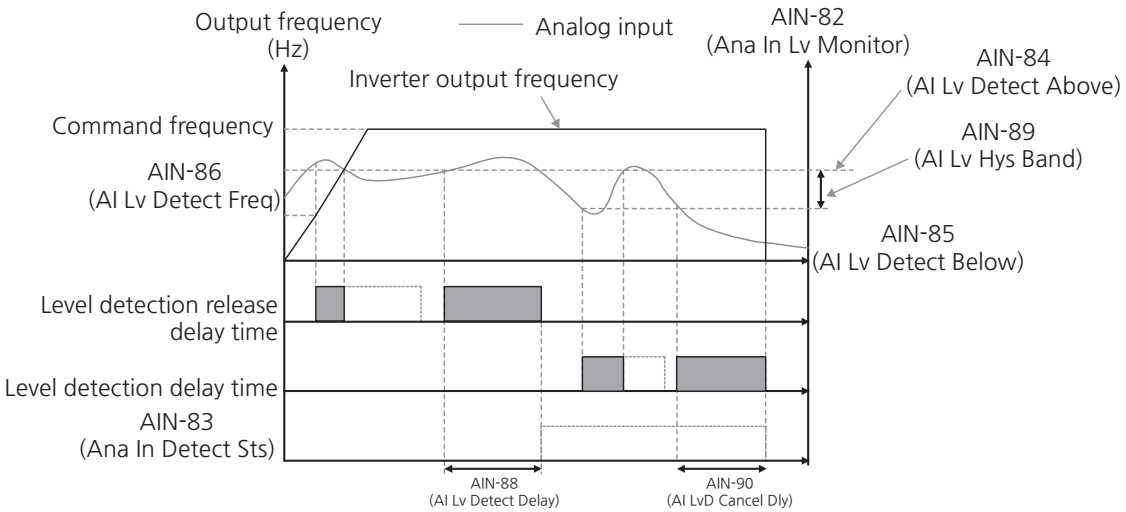
Multifunction Output Terminal and Relay Settings Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>AIN-80
AI Lv Detect Src</td><td>Selects the analog input to command analog input level detection.
<table>
<tr><th colspan="2">Configuration</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>Analog input level detection function is not used.</td></tr>
<tr><td>1</td><td>Analog Input 1</td><td rowspan="3">AI terminal (analog input terminal) on the terminal block</td></tr>
<tr><td>2</td><td>Analog Input 2</td></tr>
<tr><td>3</td><td>Analog Input 3</td></tr>
<tr><td>4</td><td>Pulse Input</td><td>TI Terminal of the terminal block
(pulse input terminal, input pulse of 0-32 kHz)</td></tr>
<tr><td>5</td><td>X-Analog Input 1 [4]</td><td rowspan="3">Analog input terminal for expansion I/O</td></tr>
<tr><td>6</td><td>X-Analog Input 2 [4]</td></tr>
<tr><td>7</td><td>X-Analog Input 3 [4]</td></tr>
</table></td></tr>
<tr><td>AIN-81
AI Lv Detect Act</td><td>Sets the operation when the analog input level detection condition is satisfied.
<table>
<tr><th colspan="2">Configuration</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>No action is taken.</td></tr>
<tr><td>1</td><td>FreeRun</td><td>The inverter output is immediately shut off.</td></tr>
<tr><td>2</td><td>Trip Dec Stop</td><td>Decelerates and stops using the time set in PRT-01 (Trip Dec Time).</td></tr>
<tr><td>3</td><td>Warning</td><td>The Ana In Lvl Detect alarm message is displayed on the Smart Operator.</td></tr>
<tr><td>4</td><td>Lost Preset</td><td>Operates at the frequency set at PRT-14 (Lost Preset Freq).</td></tr>
</table></td></tr>
</table>

[4] Configurable only when equipped with expansion I/O options

Code and Functions	Description
AIN-82 Ana In Lv Monitor	Displays the input value of the configured analog input source.
AIN-83 Ana In Detect Sts	Displays whether the analog input level detection condition is satisfied.
AIN-84 AI Lv Detect Above AIN-85 AI Lv Detect Below AIN-89 AI Lv Hys Band	Selects the detection and release levels of the selected analog input source value. The following shows the detection and release ranges according to the magnitudes of the AIN-84 and AIN-85 values. • AIN-84(AI Lv Detect Above) > AIN-85(AI Lv Detect Below)  • AIN-84(AI Lv Detect Above) < AIN-85(AI Lv Detect Below)  If AIN-84 or AIN-85 is 0, the corresponding detection function does not operate. If AIN-84 is 0 and AIN-85 is not 0, level detection operates only on AIN-85.
AIN-86 AI Lv Detect Freq, AIN-87 AI Lv Detect Speed	This is the reference speed for level detection operation. Detection is performed only when the speed is equal to or higher than the set speed.
AIN-88 AI Lv Detect Delay	This is the delay time for level detection confirmation. Level detection is performed only when the condition is maintained for the set time.

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>AIN-89 AI Lv Hys Band</td><td colspan="3">This is the hysteresis band for releasing the level detection.</td></tr>
<tr><td>AIN-90 AI LvD Cancel Delay</td><td colspan="3">This is the level detection release delay time. Release occurs only when the release condition is maintained for the set time.</td></tr>
<tr><td>AIN-91
AI LD Restart Mode</td><td colspan="3">Sets the restart mode when level detection is released.
<table><tr><th colspan="2">Configuration</th><th>Functionality</th></tr><tr><td>0</td><td>None</td><td>No restart is performed.</td></tr><tr><td>1</td><td>Start Mode</td><td>When level detection is released, the inverter accelerates and starts using the same method as a normal start.</td></tr><tr><td>2</td><td>Speed Search</td><td>When level detection is released, the inverter starts using the same method as speed search operation.</td></tr></table></td></tr>
</table>



[Image 16. Example of analog input level detection operation]

- AIN-85(AI Lv Detect Below): 0%
- AI Lv Detect Act: 1(CoastStop(FreeRun))

8.3 Multifunction Digital Output

8.3.1 Multifunction Output Terminal Settings

Multifunction output terminal and relay settings

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
OUT	50, 52, 54	DO1~DO3 Define	0	User Defined Func	0~54	24, 14, 0	-
			14	Run			
			24	Trip			
VIRT	50, 52, 54, 56	Virtual DO1~DO4 Define	0	User Defined Func	0~54	0	-

- DO1 Define: Selects items that control outputs at A1, C1, and B1 terminals dedicated to relay 1.
- DO2 Define: Selects items that control outputs at A2 and C2 terminals dedicated to relay 2.
- DO3 Define: Selects items that control outputs at Q3 and EG terminals dedicated to open collector output.
- Refer to **2.2.4 Step 4 Control Terminal Wiring** for terminal block names.

FDT Detection Settings

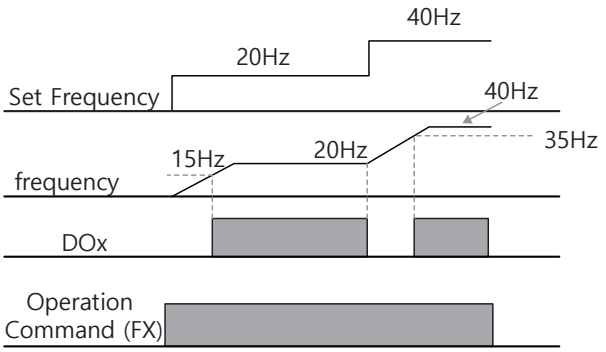
Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
OUT	75	FDT Frequency	30.00	0.00~Max Frequency [5]	30.00	Hz
	76	FDT Frequency Band	10.00	0.00~Max Frequency [5]	10.00	Hz
	77	FDT Speed	900	0~Maximum Speed [6]	900	rpm
	78	FDT Speed Band	300	0~Maximum Speed [6]	300	rpm

[5] DRV-20(Max Frequency)
[6] DRV-21(Maximum Speed)

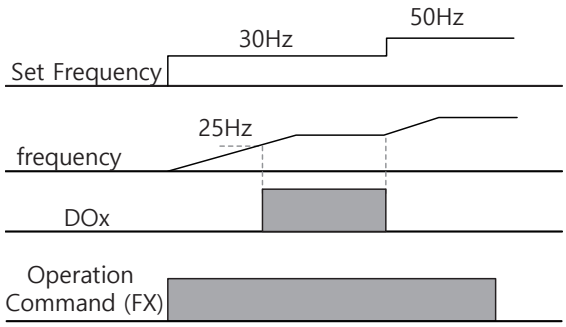
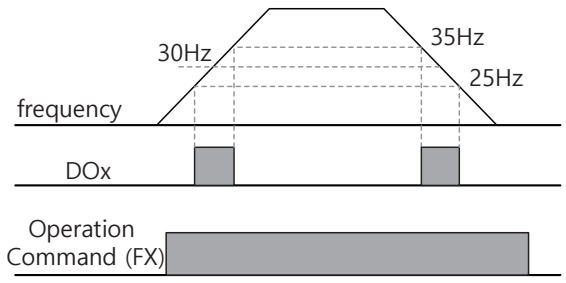
Torque Detection Settings

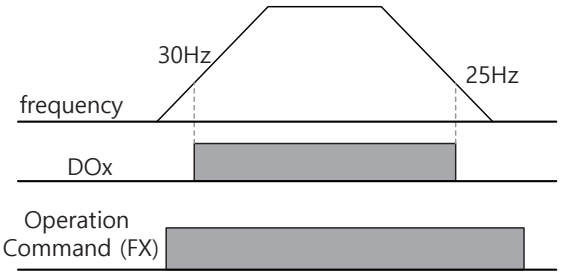
Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
OUT	80	Torque Detect Level	100.0	0.0~150.0	100.0	%
	81	Torque Detect Band	50.0	0.0~100.0	50.0	%

Multifunction Output Terminal and Relay Settings Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td rowspan="3">OUT-50, 52, 54 DOx Define, VIRT-50, 52 ,54, 56 Virtual DOx Define (DOx: DO1~DO4)</td><td colspan="3">Sets terminal items for relay 1, 2, and open collector output.</td></tr>
<tr><td>Item</td><td colspan="2">Functionality</td></tr>
<tr><td>0</td><td>User Defined Func</td><td>Outputs according to set values at OUT 70, 71, and 72.</td></tr>
<tr><td></td><td>1</td><td>FDT-1</td><td>Detects inverter output frequency reaching the user set frequency. Outputs signal when the conditions below are satisfied.
• Absolute value
(set frequency - output frequency) < detected frequency band / 2
FDT-1 operation with the detected frequency band of 10 Hz is as follows:


[Image 17. An Example of Torque Detection - 1]</td></tr>
</table>

Code and Functions	Description		
	Item		Functionality
OUT-50, 52, 54 DOx Define, VIRT-50, 52 ,54, 56 Virtual DOx Define (DOx: DO1~DO4)	2	FDT-2	Outputs a signal when the user-set frequency and detected frequency (OUT-75 FDT Frequency) are equal, and fulfills no. 1 above, FDT-1 conditions at the same time. • [Absolute value (set frequency - detected frequency) < detected frequency band / 2] & [FDT-1] FDT-2 output is as follows when the detected frequency band is 10 Hz and the detected frequency is 30 Hz.  **[Image 18. An Example of Torque Detection - 2]**
	3	FDT-3	Outputs signal when the operation frequency below meets the conditions. • Absolute value (output frequency - operating frequency) < detected frequency band / 2 FDT-3 output is as follows when the detected frequency band is 10 Hz and the detected frequency is 30 Hz:  **[Image 19. An Example of Torque Detection - 3]**

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td rowspan="13">OUT-50, 52, 54 DOx Define, VIRT-50, 52 ,54, 56 Virtual DOx Define (DOx: DO1~DO4)</td><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>4</td><td>FDT-4</td><td>Output signal can be separately set for acceleration and deceleration conditions.
• In acceleration: Operating frequency ≧ detected frequency
• In deceleration: Operating frequency > (detected frequency - detected frequency band / 2)
FDT-4 output is as follows when the detected frequency band is 10 Hz and the detected frequency is 30 Hz:


[Image 20. An Example of Torque Detection - 4]</td></tr>
<tr><td>5</td><td>Over Load Warn</td><td>Outputs a signal when there is a motor overload warning</td></tr>
<tr><td>6</td><td>Drv Over Load Warn</td><td>Outputs a signal when there is a Drive Over Load warning as an inverse time characteristics protection due to an inverter overload.</td></tr>
<tr><td>7</td><td>Under Load Warn</td><td>Outputs a signal when there is a warning for motor light loading.</td></tr>
<tr><td>8</td><td>MainFan Warn</td><td>Outputs a signal when there is a fan fault warning.</td></tr>
<tr><td>9</td><td>Stall</td><td>Outputs a signal when a motor is overloaded and stalled.</td></tr>
<tr><td>10</td><td>Over Voltage Trip</td><td>Outputs a signal when the inverter DC link voltage rises above the protective operating voltage.</td></tr>
<tr><td>11</td><td>Low Voltage</td><td>Outputs a signal when the inverter DC link voltage drops below the level of low voltage protection.</td></tr>
<tr><td>12</td><td>Drv Over Heat Trip</td><td>Outputs signal when the inverter overheats.</td></tr>
</table>

Code and Functions	Description		
	Item		Functionality
OUT-50, 52, 54 DOx Define, VIRT-50, 52 ,54, 56 Virtual DOx Define (DOx: DO1~DO4)	13	Lost Int Comm Warn	Outputs a signal when there is a warning for RS-485 communication command loss at the terminal block.
	14	Run	Outputs a signal when an operation command is entered and the inverter outputs voltage (including during auto tuning). No signal is output during DC braking and initial excitation time.
	15	Stop	Outputs a signal at operation command off, and when there is no inverter output voltage.
	16	Steady	Outputs a signal while operating at a constant speed.
	17	Drive Output Line	Outputs a signal while the motor is driven by the inverter line. It outputs a signal when the multifunction input terminal (DI1-DI8 Define) with the 21 (Exchange) setting turns off.
	18	Supply Power Line	Outputs a signal during switching operation to commercial power. It outputs a signal when the multifunction input terminal (DI1-DI8 Define) with the 21 (Exchange) setting turns on.
	19	Speed Search	Outputs a signal during inverter speed search operation.
	20	Ready	Outputs a signal when the inverter is normally operating while being on standby for external operation commands.
	21	Zero Speed Detect	Used to detect a motor rotational speed of 0 rpm while operating with the vector setting for the control mode. There may be errors when turning on/off due to noise from encoder signals or the time constant of filters since the relay operates based on the rotation count (encoder signal) of the motor.
	22	Torque Detect	Works when the torque generated while operating with the control mode is set as sensorless or vector is within the level set at OUT-80 (Torque Detect Level) and OUT-81 (Torque Detect Band).
	23	Timer Output	This is a feature to activate the contact output after a certain period of time using the multifunction terminal block. Refer to **7.31 Timer Settings** for details.

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td rowspan="14">OUT-50, 52, 54 DOx Define, VIRT-50, 52 ,54, 56 Virtual DOx Define (DOx: DO1~DO4)</td><td colspan="2">Item</td><td>Functionality</td></tr>
<tr><td>24</td><td>Trip</td><td>Outputs a signal after a fault trip.</td></tr>
<tr><td>25</td><td>Lost Keypad Warn</td><td>Outputs a signal when there is a warning for Smart Operator command loss.</td></tr>
<tr><td>26</td><td>DB Warn%ED</td><td>Outputs a signal when there is a warning for braking resistance utilization.
Refer to <u>9.2.6 Dynamic Braking (DB) Resistor Configuration</u> for details.</td></tr>
<tr><td>27</td><td>Encoder Tune Warn</td><td>Outputs a signal when auto-tuning with no encoder card.</td></tr>
<tr><td>28</td><td>Encoder Dir Warn</td><td>Outputs a warning signal by detecting the wrong settings of the rotational direction for the motor by the encoder. It outputs a signal by sending out contact output when auto-tuning, while the encoder card is installed, but with incorrect wiring.</td></tr>
<tr><td>31</td><td>Run with Zero Spd</td><td>Outputs a signal when operation command is entered and the inverter outputs voltage. It outputs a signal during DC braking as well.</td></tr>
<tr><td>32</td><td>STO Monitor</td><td>Outputs a signal when the connection of one or more signals for safety A and B (SA and SB) terminals connected to SP are turned off.</td></tr>
<tr><td>33</td><td>Rst Restart F Trip</td><td>Outputs a signal when there is a Reset Restart Fail trip from PRT-06 (Retry Number) reducing to 0. Refer to <u>5.2.3.3 Reset and Restart after A Trip (Reset Restart)</u> for details.</td></tr>
<tr><td>34</td><td>Lost USB Warn</td><td>Outputs a signal when there is a warning for USB command loss.</td></tr>
<tr><td>35</td><td>KEB Operating</td><td>Outputs a signal during KEB operation.</td></tr>
<tr><td>36</td><td>Lost AI-1 Warn</td><td>Outputs a signal when there is an input loss warning for the AI1 terminal (analog input terminal) at the control terminal block.</td></tr>
<tr><td>37</td><td>Lost AI-2 Warn</td><td>Outputs a signal when there is an input loss warning for the AI2 terminal (analog input terminal) at the control terminal block.</td></tr>
<tr><td>38</td><td>Lost AI-3 Warn</td><td>Outputs a signal when there is an input loss warning for the AI3 terminal (analog input terminal) at the control terminal block.</td></tr>
</table>

Code and Functions	Description		
	Item		Functionality
OUT-50, 52, 54 DOx Define, VIRT-50, 52 ,54, 56 Virtual DOx Define (DOx: DO1~DO4)	39	E24V EPI Monitor	Outputs the connection status of external 24 V power.
	40	Main Cap Repl Warn	Outputs a signal when there is a warning for main capacitor replacement.
	41	MainFan Repl Warn	Outputs a signal when there is a warning for main fan replacement.
	42	AuxFan Repl Warn	Outputs a signal when there is a warning for auxiliary fan replacement.
	43	MainCap Diag Alarm	Outputs a signal when there is a warning to check the life of the main capacitor.
	44	Pos Tar Bound Err	Occurs when the difference between the target position and actual position is bigger than the setting values of PC1-37 (Tar Bound Pulse) after performing position control.
	45	Pos Max Track Err	Occurs when the difference between the reference pulse and position feedback pulse is bigger than the setting value of PC1-36 (Max Track Pulse).
	46	OCS Run	Outputs a signal when SW overcurrent suppression is active.
	47	FWD Run	Outputs a signal during forward operation.
	48	REV Run	Outputs a signal during reverse operation.
	49	Fire Mode	Outputs a signal during Fire Mode operation. Refer to **7.11 Fire Mode**.
	50	WebBreak Warn	Outputs a signal when wire break detection occurs. Refer to **7.28.9 Disconnection Detection Part**.
	51	Lost Optcomm Warn	Outputs a signal when a **Lost Option Comm** alarm occurs on the communication option card. For details, refer to the user manual of the corresponding communication option card.
	52	Ana In Lvl Detect	Outputs a signal when the analog input level is detected.
	53	SPD Sync Complete	Outputs a signal when speed and position synchronization are complete. For details, refer to the user manual of the S300 synchronization option board.
	54	POS Sync Complete	

Code and Functions	Description
OUT-51, 53, 55 DOx Status (DOx: 1~3)	Shows the on/off status of the multifunction output.

8.3.2 Delay Time Settings for Digital Output Terminals

You can set time constant of filters for the digital output terminals. It is used to improve the responsiveness of the output terminals.

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
OUT	60, 63, 66	DO1~DO3 On Delay	5	0~100000	0	msec
	61, 64, 67	DO1~DO3 Off Delay	5	0~100000	0	msec

On/Off Delay for Digital Output Terminal Setting Details

Code and Functions	Description
OUT-60, 63, 66 DO1~DO3 On Delay OUT-61, 64, 67 DO1~DO3 Off Delay	You can set on/off delay values for output terminals, respectively. It is not used when set to 0.

8.3.3 Contact Settings for Digital Output Terminals

You can set the contact type for digital output terminals.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
OUT	62, 65, 68	DO1~DO3 NC/NO	0	Normal Open	0~1	0	-
			1	Normal Close			

Contact of Multifunction Input Terminal Setting Details

Code and Functions	Description
OUT-62, 65, 68 DOx NC/NO (DOx: DO1~DO3)	You can select a type of contact for output terminals and use it for contact A (Normal Open) and contact B (Normal Close).

8.3.4 Digital Output Identification

You can check the status of the digital output terminals. For example, when you select an output terminal as contact A (Normal Open), the relevant terminal turns on when there is an output.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
OUT	51, 53, 55	DO1~DO3 Status	0	Off	0~1	-	-
			1	On			
VIRT	51, 53, 55, 57	Virtual DO1~DO4 Status	0	Off	0~1	-	-
			1	On			

8.3.5 Multifunction Digital Output

Code and Functions	Item		Functionality
OUT-50, 52, 54 DOx Define (DOx: DO1~ DO3)	0	User Defined Func	Outputs according to the values set in OUT-70, 71, 72 (DO1 to DO3 Constant).
	1	FDT-1	Refer to **8.3.1 Multifunction Output Terminal Settings**.
	2	FDT-2	
	3	FDT-3	
	4	FDT-4	
	5	Over Load Warn	
	6	Drv Over Load Warn	
	7	Under Load Warn	
	8	MainFan Warn	
	9	Stall	
	10	Over Voltage Trip	
	11	Low Voltage	
	12	Drv Over Heat Trip	
	13	Lost Int Comm Warn	
	14	Run	
	15	Stop	
	16	Steady	
	17	Drive Output Line	
	18	Supply Power Line	
	19	Speed Search	
	20	Ready	
	21	Zero Speed Detect	
	22	Torque Detect	

Code and Functions	Item		Functionality
OUT-50, 52, 54 DOx Define (DOx: DO1~ DO3)	23	Timer Output	Refer to **8.3.1 Multifunction Output Terminal Settings**.
	24	Trip	
	25	Lost Keypad Warn	
	26	DB Warn %ED	
	27	Encoder Tune Warn	
	28	Encoder Dir Warn	
	29	On/Off Control	
	30	Brake Control	
	31	Run with Zero Spd	
	32	STO Monitor	
	33	Rst Restart F Trip	
	34	Lost USB Warn	
	35	KEB Operating	
	36	Lost AI-1 Warn	
	37	Lost AI-2 Warn	
	38	Lost AI-3 Warn	
	39	E24V Monitor	
	40	Main Cap Repl Warn	
	41	MainFan Repl Warn	
	42	AuxFan Repl Warn	
	43	MainCap Diag Alarm	
	44	Pos Tar Bound Err	
	45	Pos Max Track Err	
	46	OCS Run	
	47	FWD Run	

Code and Functions	Item		Functionality
OUT-50, 52, 54 DOx Define (DOx: DO1~ DO3)	48	REV Run	Refer to **8.3.1 Multifunction Output Terminal Settings**.
	49	Fire Mode	
	50	WebBreak Warn	
	51	Lost OptComm Warn	
	52	Ana In Lvl Detect	
	53	SPD Sync Complete	
	54	POS Sync Complete	

8.3.6 Direct Control over Multifunction Output

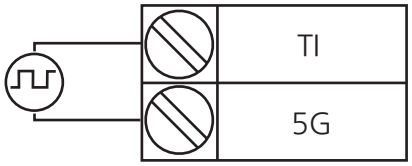
You can control the digital output terminals directly. Set OUT-50, 52, and 54 (DO1-DO3 Define) to 0 (User Defined Func) to directly operate multifunction output terminals according to OUT-70, 71, and 72 (DO1-DO3 Constant).

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
OUT	50, 52, 54	DO1~DO3 Define	0	User Defined Func	-	24	-
	70, 71, 72	DO1~DO3 Constant	0	Off	0~1	0	-
			1	On			
VIRT	50, 52, 54, 56	Virtual DO1~DO4 Define	0	User Defined Func	-	0	-
	58, 59, 60, 61	Virtual DO1~DO4 Const	0	Off	0~1	0	-
			1	On			

8.4 Pulse Input

8.4.1 Pulse Input Scale

Wire the pulse input terminal as follows and input the pulse frequency in between 0.00-32.00 kHz for use:



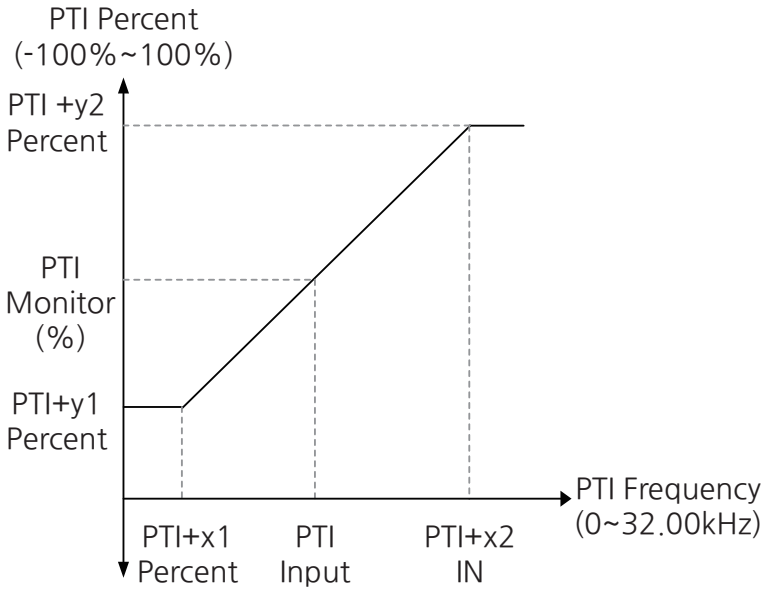
[Image 21. Connecting External Pulse Train]

Related Parameters

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
AIN	45	PTI Monitor[kHz]	-	0.00~32.00	-	kHz
	46	PTI Monitor[%]	-	-100.00~100.00	-	%
	48	PTI +x1 In	0.00	0.00~PTI +x2 In	0.00	kHz
	49	PTI +y1 Percent	0.00	-100.00~100.00	0.00	%
	50	PTI +x2 In	0.00	PTI +x1 In~32.00	0.00	kHz
	51	PTI +y2 Percent	100.00	-100.00~100.00	100.00	%

Setting Details

Code and Functions	Description
AIN-45 PTI Monitor[kHz]	Checks frequency of the pulse input at the TI Terminal.
AIN-46 PTI Monitor[%]	Displays frequency of the pulse input at the TI Terminal in a percentage. (Displays percentage of the final pulse input to which all of filter, scale, and quantization are applied.)

Code and Functions	Description
AIN-48 PTI+x1 In, AIN-49 PTI+y1 Percent, AIN-50 PTI+x2 In, AIN-51 PTI+y2 Percent	Pulse Monitor[%] = ([PTI Input] - [PTI +x1 In]) × ([PTI +y2 Percent] - [PTI +y1 Percent]) / ([PTI +x2 In] - [PTI +x1 In])) + [PTI +y1 Percent]  **[Image 22. Pulse Input Frequency Monitor]**

8.4.2 Pulse Input Filter

Related Parameters

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
AIN	47	PTI LPF Gain [7]	10	10~10000	10	msec

Setting Details

Code and Functions	Description
AIN-47 PTI LPF Gain	It is the same as **8.2.4 Filter**.

8.4.3 Pulse Input Quantization

Related Parameters

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
AIN	52	PTI Quantizing	0.04	0.04 [8]~10.00	0.04	%

Setting Details

Code and Functions	Description
AIN-52 Pulse Quantizing	It is the same as **8.2.3 Quantization**.

[7] The time constant of the filter less than that is meaningless, as pulse input detection is performed every 100 ms.

[8] Quantization is disabled if set to 0.

8.5 Analog Output

AO1 and AO2 terminals of the control terminal block provide output of -10 V –10 V voltage or 0~20 mA current.

Select SW2 and SW3 as VO1 and VO2 for voltage output and select them as IO1 and IO2 for the current output.

8.5.1 Analog Output of Voltage and Current

You can select output items and adjust the size of the output or change output type (voltage/current) by switching the direction of the SW2 and SW3 switches.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
OUT	02	AO1 Type Select	0	Unipolar Voltage	0~2	0	-
			1	Bipolar Voltage			
			2	Current			
	01	AO1 Define	0	Frequency	0~15	0	-
	03	AO1 Gain	100.00		-1000.00~1000.00	100.00	%
	04	AO1 Bias	0.00		-100.00~100.00	0.00	%
	05	AO1 LPF Gain	5		0~10000	5	msec
	06	AO1 Constant % [9]	0.00		-100.00~100.00	0.00	%
	07	AO1 Monitor	-		-100.00~100.00	-	%
	08	AO1 Data Monitor	-		-300.00~300.00	-	%
	11	AO2 Type Select	0	Unipolar Voltage	0~2	0	-
			1	Bipolar Voltage			
			2	Current			
	10	AO2 Define	0	Frequency	0~15	0	-
	12	AO2 Gain	100.00		-1000.00~1000.00	100.00	%
	13	AO2 Bias	0.00		-100.00~100.00	0.00	%

[9] Set OUT-01 and 10 (A01, A02 Define) to 15 (Constant) to apply OUT-06 and 15 (O1, AO2 Constant %) values.

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
OUT	14	AO2 LPF Gain	5	0~10000	5	msec
	15	AO2 Constant% [9]	0.00	-100.00~100.00	0.00	%
	16	AO2 Monitor	-	-100.00~100.00	-	%
	17	AO2 Data Monitor	-	-300.00~300.00	-	%

8.5.2 Setting Details of Analog Output of Voltage and Current

<table>
<tr><th>Code and Functions</th><th colspan="4">Description</th></tr>
<tr><td>OUT-02, 11 AOx Type Select (AOx: AO1, AO2)</td><td colspan="4">Select 0 (Unipolar Voltage) and 0-+10 V of voltage is output.
Select 1 (Bipolar Voltage) and -10-+10 V of voltage is output.
Select 2 (Current) and 0-20 mA of current is output.
Select IO1 and IO2 for SW2 and SW3 when selecting 2 (Current).</td></tr>
<tr><td>OUT-01, 10 AOx Define (AOx: AO1, AO2)</td><td colspan="4">Sets terminal items for relay 1, 2, and open collector output.
<table>
<tr><th colspan="2">Configuration</th><th>Description</th><th colspan="2">Max (100% Output) Reference Value</th></tr>
<tr><td>0</td><td>Frequency</td><td>Outputs the operating frequency</td><td colspan="2">The frequency set at DRV-20 (Max Frequency)</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Output Current</td><td rowspan="2">Outputs the inverter sensing current</td><td>Heavy duty (HD)</td><td>200% of the rated inverter HD current</td></tr>
<tr><td>Normal duty (ND)</td><td>150% of the rated inverter ND current</td></tr>
</table></td></tr>
</table>

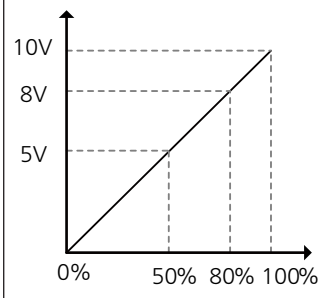
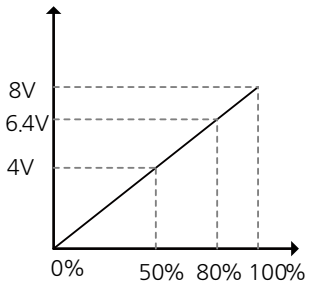
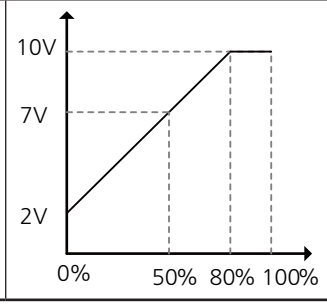
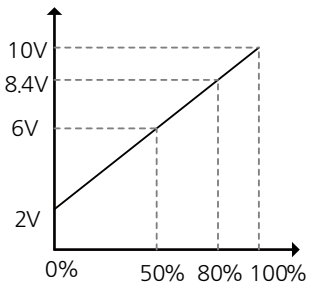
<table>
<tr><th>Code and Functions</th><th colspan="5">Description</th></tr>
<tr><td rowspan="11">OUT-01, 10 AOx Define
(AOx: AO1, AO2)</td><td colspan="2">Configuration</td><td>Description</td><td colspan="2">Max (100% Output) Reference Value</td></tr>
<tr><td>2</td><td>Output Voltage</td><td>Inverter output voltage</td><td colspan="2">Voltage set at MOT1 and MOT2-27 (Rated Voltage)
• If Rated Voltage is 0, DRV-30 (Ref AC Input Volt)</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">DC Link Voltage</td><td rowspan="3">Inverter DC link voltage</td><td colspan="2">Overvoltage trip (OVT) voltage</td></tr>
<tr><td>200 V Type Inverter</td><td>410 V</td></tr>
<tr><td>400 V Type Inverter</td><td>820 V</td></tr>
<tr><td>4</td><td>Torque</td><td>Inverter output torque</td><td colspan="2">250% of rated torque</td></tr>
<tr><td>5</td><td>Output Power</td><td>Inverter output power</td><td colspan="2">200% of the rated output power</td></tr>
<tr><td>6</td><td>Target Frequency</td><td>Set frequency output</td><td colspan="2">The frequency set at DRV-20 (Max Frequency)</td></tr>
<tr><td>7</td><td>Ramp Frequency</td><td>The frequency that went through acceleration and deceleration functions (There may be difference with the actual output frequency.)</td><td colspan="2">The frequency set at DRV-20 (Max Frequency)</td></tr>
<tr><td>8</td><td>Speed Feedback</td><td>Speed information input via encoder option card</td><td colspan="2">The frequency set at DRV-20 (Max Frequency)</td></tr>
<tr><td>9</td><td>Speed Deviation</td><td>Deviation between speed reference (command) and rotational speed of the motor input via an encoder option card</td><td colspan="2">Twice of the PRT-67 (Speed Dev Band Freq)</td></tr>
</table>

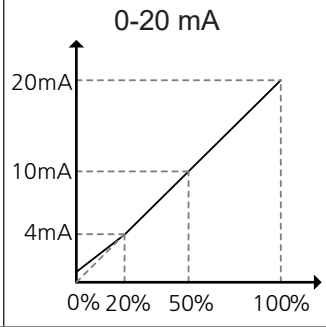
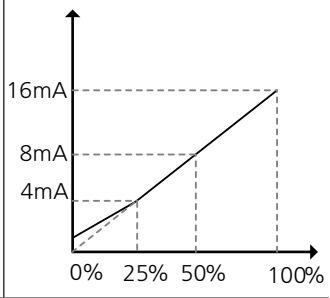
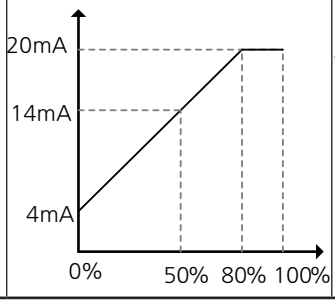
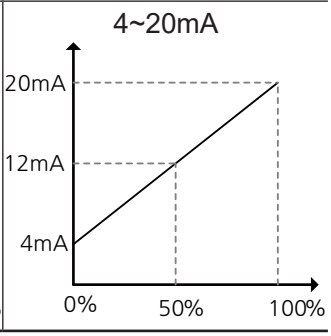
<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>OUT-01, 10 AOx Define
(AOx: AO1, AO2)</td><td>
<table>
<tr><th colspan="2">Configuration</th><th>Description</th><th>Max (100% Output) Reference Value</th></tr>
<tr><td>10</td><td>PPID Reference</td><td>Command value of the PID controller</td><td>1.5 times the 100% value of the controller command</td></tr>
<tr><td>11</td><td>PPID Feedback</td><td>Feedback value of the PID controller</td><td>1.5 times the 100% value of the controller feedback</td></tr>
<tr><td>12</td><td>PPID Output</td><td>Output value of the PID controller</td><td>100% of the controller output</td></tr>
<tr><td>13</td><td>EPID1 Output</td><td>Output value of the EPID1 controller</td><td>100% of the controller output</td></tr>
<tr><td>14</td><td>EPID2 Output</td><td>Output value of the EPID2 controller</td><td>100% of the controller output</td></tr>
<tr><td>15</td><td>Constant</td><td>Values set at OUT-06 AO1 Constant % and OUT-15 AO2 Constant %</td><td>100%</td></tr>
<tr><td>16</td><td>Web MainSpeed</td><td>Main speed (%) value during winder/ unwinder operation</td><td>100% of the controller output</td></tr>
<tr><td>17</td><td>Web MainSpeed +WPID</td><td>Final speed value during winder/ unwinder operation</td><td>100% of the controller output</td></tr>
</table>
</td></tr>
<tr><td>OUT-03, 12 AOx Gain
(AOx: AO1, AO2)
OUT-04, 13 AOx Bias
(AOx: AO1, AO2)</td><td>Adjusts output value and offset.
It is calculated by adding a bias value to the ratio of the current value based on the maximum value multiplied by the gain value.
$\text{Analog Output}[\%] = \frac{\text{Current value of Analog Output 1 and 2}}{\text{Maximum value of Analog Output 1 and 2 items}} \times \text{Gain value} + \text{Bias value}$
For example, if OUT-01 or OUT-10 is set to 0 (Frequency), the value calculated by the following formula will be displayed:
$\text{AO1, 2 Monitor}[\%] = \frac{\text{Current frequency}}{\text{Maximum frequency(DRV-20 Max Frequency)}} \times \text{Gain value} + \text{Bias value}$</td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>OUT-03, 12 AOx Gain
(AOx: AO1, AO2)
OUT-04, 13 AOx Bias
(AOx: AO1, AO2)</td><td>
In the following image, Y-axis represents analog output voltage (0-10 V) whereas X-axis represents the percentage (%) value of the output item.

When AO1 Type Select is 0 (Unipolar Voltage)

For instance, where the maximum frequency is 60 Hz with a current frequency of 30 Hz, the X-axis is 50%.

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="2">OUT-03 AO1 Gain</th></tr>
<tr><th>100% (Factory Default)</th><th>80.0%</th></tr>
<tr><td rowspan="2">OUT-04 AO1 Bias</td><td>0.0% (Factory Default)</td><td>
</td><td>
</td></tr>
<tr><td>20.0%</td><td>
</td><td>
</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>OUT-03, 12 AOx Gain
(AOx: AO1, AO2)
OUT-04, 13 AOx Bias
(AOx: AO1, AO2)</td><td>
When AO1 Type Select is 2 (Current)
If the output is less than 4 mA, the error may be large.
<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="2">OUT-03 AO1 Gain</th></tr>
<tr><th>100% (Factory Default)</th><th>80.0%</th></tr>
<tr><td rowspan="2">OUT-04 AO1 Bias</td><td>0.0% (Factory Default)</td><td>
</td><td>
</td></tr>
<tr><td>20.0%</td><td>
</td><td>
</td></tr>
</table>
</td></tr>
<tr><td>OUT-05, 14 AOx LPF Gain
(AOx: AO1, AO2)</td><td>Sets the time constant of filters on an analog output.
Refer to <u>8.2.4 Filter</u> AIN-04, 19, 34 (AI1 to AI3 LPF Gain) items in .</td></tr>
<tr><td>OUT-06, 15 AOx Constant %
(AOx: AO1, AO2)</td><td>If codes 1 and 2 of an analog output (OUT-01 AO1 Define and OUT-10 AO2 Define) are set to 15 (Constant), the analog voltage according to the set values at these parameters (0-100%) will be output.</td></tr>
<tr><td>OUT-07, 16 AOx Monitor
(AOx: AO1, AO2)</td><td>Monitors analog output values. It is displayed in a percentage (%) based on the maximum output voltage (10 V).</td></tr>
<tr><td>OUT-08, 17 AOx Data Monitor
(AOx: AO1, AO2)</td><td>Displays the percentage (%) of the value set in AO1, AO2 Define.</td></tr>
</table>

8.6 Pulse Output

POT terminal of the control terminal block can output a pulse of 0-32.00 kHz.

8.6.1 Pulse Output Settings

You can select output items and adjust the size of the output.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
OUT	20	PTO Define	0	Frequency	It is the same as OUT-01 (AO1 Define) and OUT-10 (AO2 Define) items of **8.5.2 Setting Details of Analog Output of Voltage and Current**.	0	-
	21	PTO Gain	0.00		-100.00~100.00	0.00	%
	22	PTO Bias	0.00		-100.00~100.00	0.00	%
	23	PTO LPF Gain	5		0~10000	5	msec
	24	PTO Constant %	0.00		0.00~100.00	0.00	%
	25	PTO Monitor	-		0.00~100.00	-	%

8.6.2 Pulse Output Setting Details

Code and Functions	Description
OUT-20 PTO Define	It is the same as OUT-01 (AO1 Define) and OUT-10 (AO2 Define) items of **8.5.2 Setting Details of Analog Output of Voltage and Current**.
OUT-21 PTO Gain, OUT-22 PTO Bias	It is the same as the OUT-03 (AO1 Gain), OUT-12 (AO2 Gain), OUT-04 (AO1 Bias), and OUT-13 (AO2 Bias) items of **8.5.2 Setting Details of Analog Output of Voltage and Current**.
OUT-23 PTO LPF Gain	Sets the time constant of a low-pass filter for the pulse output. Refer to AIN-04, 19, 34 (AI1-3 LPF Gain) in **8.2.4 Filter**.
OUT-24 Constant %	It is the same as the OUT-06 (AO1 Constant %) and OUT-15 (AO2 Constant %) items of **8.5.2 Setting Details of Analog Output of Voltage and Current**.
OUT-25 PTO Monitor	It is the same as the OUT-07 (AO1 Monitor) and OUT-16 (AO2 Monitor) items of **8.5.2 Setting Details of Analog Output of Voltage and Current**.

9 Learning Protection Functions

This chapter describes the protection functions provided by the S300 series. Protection functions are categorized into two types: Protection from overheating and damage to the motor, and protection of the inverter itself and protection against inverter malfunction.

9.1 Motor Protection

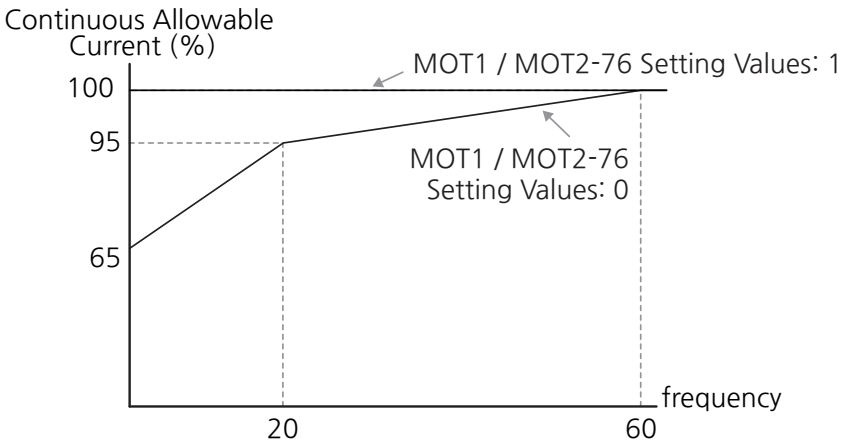
9.1.1 Electronic Thermal (ETH) Prevention

ETH is a protective function that uses the output current of the inverter without a separate temperature sensor, to predict a rise in motor temperature to protect the motor based on its heat characteristics.

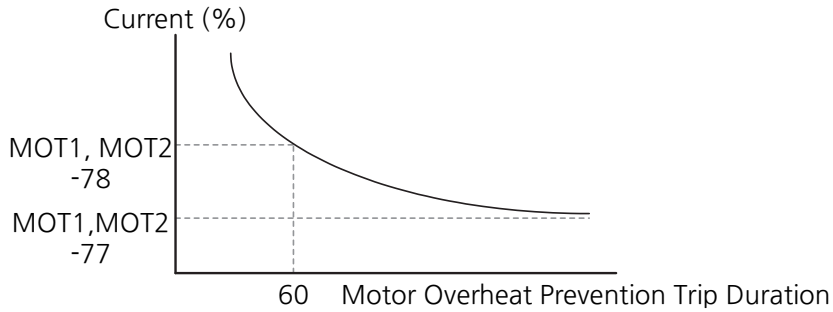
Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
MOT1, MOT2	75	ETH Enable	0	None	0~2	0	-
	76	Motor Cooling	0	Self-Cool	0~1	0	-
	77	ETH Cont Current	120		50~150	120	%
	78	ETH 1min Current	150		120~200	150	%

Electronic Thermal (ETH) Prevention Function Setting Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>MOT1, MOT2-75
ETH Enable</td><td>It is possible to select how the inverter operates when an electronic thermal (ETH) prevention trip occurs. In the Smart Operator, it will be displayed as E-Thermal.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>The ETH function is not activated.</td></tr>
<tr><td>1</td><td>CoastStop (FreeRun)</td><td>In the event of an electronic thermal (ETH) prevention trip, the inverter output will be blocked and the motor will enter a free run due to inertia.</td></tr>
<tr><td>2</td><td>Dec</td><td>If a fault trip occurs, the motor will decelerate and stop. However, for the deceleration stop time, the time set in PRT-01 Trip Dec Time will be applied.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>MOT1, MOT2-76
Motor Cooling</td><td>Sets according to whether the cooling fan of the motor is integrated with the motor or the power is supplied separately. Make sure you check the cooling fan structure of the motor you are using and enter it.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Self-Cool</td><td>As the cooling fan is connected to the motor axis, the cooling effect will vary based on motor speed. Most universal induction motors have this design.</td></tr>
<tr><td>1</td><td>Forced-Cool</td><td>Additional power is supplied to operate the cooling fan. This provides extended operation at low speeds. Motor designed for inverters typically have this design.</td></tr>
</table>


[Image 1. Example of allowable current value by frequency according to cooling fan type]</td></tr>
</table>

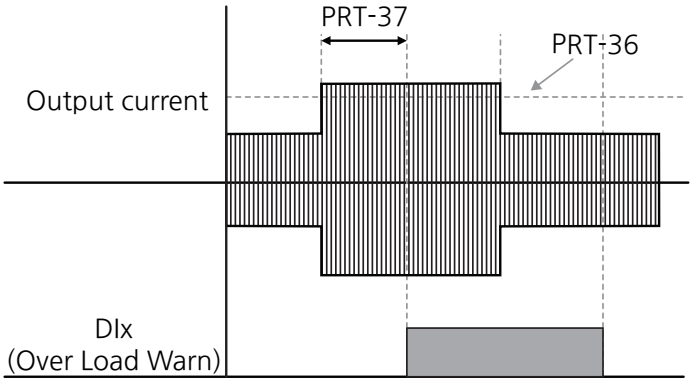
Code and Functions	Description
MOT1, MOT2-77 ETH Cont Current	Sets the amount of current with the ETH function activated. The range below details the set values that can be used during continuous operation without the protection function.  **[Image 2. The trip time according to the current size of electronic thermal (ETH) prevention]**
MOT1, MOT2-78 ETH 1min Current	Inputs the amount of input current that can be continuously supplied to the motor for 1 minute, based on the motor-rated current (MOT1, MOT2-26 Rated Current).

9.1.2 Overload Early Warning and Trip

Based on the rated current of the motor, it generates a warning signal or handles a trip when an overload is supplied to the motor. The amount of current for warnings and trips can be set separately.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	35	OL Warn Select	1	Yes	-	0	-
	36	OL Warn Level	150		30~200	150	%
	37	OL Warn Time	10.0		0.0~600.0	10	sec
	38	OL Trip Select	1	CoastStop (FreeRun)	0~2	1	-
	39	OL Trip Level	180		30~200	180	%
	40	OL Trip Time	60.0		0~60.0	60.0	sec
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	5	Over Load Warn	5, 24	24	-
			24	Trip			

Overload Early Warning and Trip Setting Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PRT-35 OL Warn Select</td><td>If the overload reaches the warning level, the terminal block multifunction output terminals will be used to output a warning signal. If 1 (Yes) is selected, it will operate. If 0 (No) is selected, it will not operate.</td></tr>
<tr><td>PRT-36 OL Warn Level,
PRT-37 OL Warn Time</td><td>When the current supplied to the motor is greater than the preset value at the overload warning level (PRT-36) and exceeds the overload warning time (PRT-37), an overload warning signal will be output to the multifunction output terminal block. The multifunction output terminal block will output a signal when OUT-50, 52, 54 is set to 5 (Over Load Warn). At this time, the inverter output will not be blocked.


[Image 3. Example of an overload warning signal output]</td></tr>
<tr><td>PRT-38 OL Trip Select</td><td>Selects how the inverter operates in the event of an overload fault trip.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>No protective action is taken.</td></tr>
<tr><td>1</td><td>CoastStop (FreeRun)</td><td>In the event of an overload fault trip, inverter output will be blocked and the motor will enter a free run due to inertia.</td></tr>
<tr><td>2</td><td>Trip Dec Time Stop</td><td>If a fault trip occurs, the motor will decelerate and stop. However, for the deceleration stop time, the time set in PRT-01 (Trip Dec Time) is applied.</td></tr>
</table></td></tr>
<tr><td>PRT-39 OL Trip Level,
PRT-40 OL Trip Time</td><td>When the current supplied to the motor is greater than the preset value at the overload trip level (OL Trip) and exceeds the overload trip time (OL Trip Time), the inverter output will either be blocked according to the preset value from PRT-38 or slow to a stop after deceleration.</td></tr>
</table>

Note

Overload warnings warn of an overload before an overload fault trip occurs. The overload warning signal may not work in an overload fault trip situation, if the overload warning level (OL Warn Level) and the overload warning time (OL Warn Time) are set higher than the overload trip level (OL Trip Level) and overload trip time (OL Trip Time).

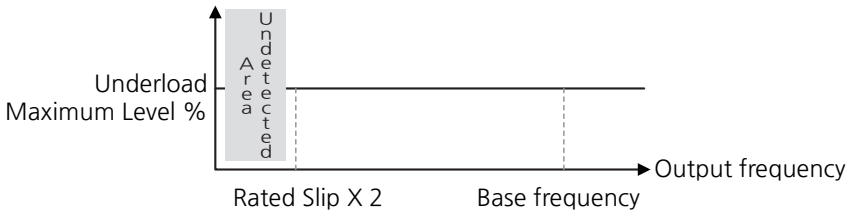
9.1.3 Underload Fault Trip and Warning

It is a feature that detects a motor underload. If this feature is operated, a trip and warning will occur if the motor load falls below the set under load level.

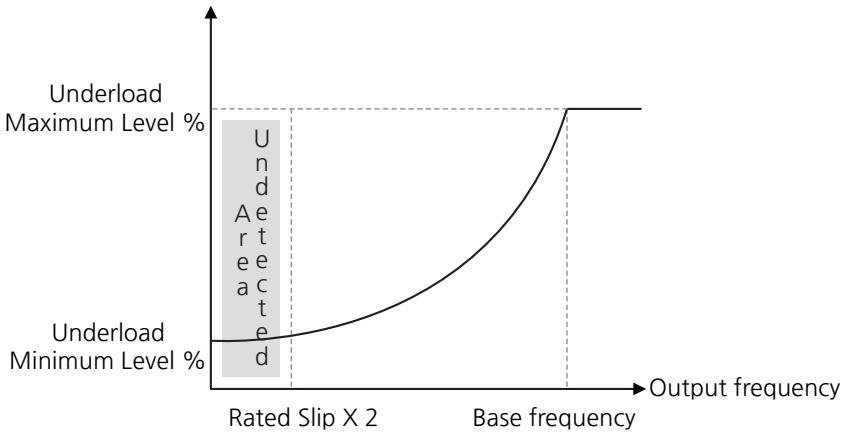
Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	25	Load Duty Select	1	Normal Duty	0~1	1	-
PRT	45	UL Warn Select	1	Yes	0~1	0	-
	46	UL Warn Time	10.0		0.0~600.0	10.0	sec
	47	UL Trip Select	1	CoastStop (FreeRun)	0~2	0	-
	48	UL Trip Time	30.0		0.0~600.0	30.0	sec
	49	UL LF Level	30		10~30	30	%
	50	UL BF Level	30		10~30	30	%
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	7	Under Load Warn	0~39	24, 14, 10	-

Underload Trip and Warning Setting Details

Code and Functions	Description
PRT-45 UL Warn Select	Sets the operation of the underload warning. When the warning operation selection is set to 1 (Yes) and the code for the multifunction output terminals of OUT-50, 52, and 54 is set to 7 (Under Load Warn), a signal will be output in the underload warning condition.

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PRT-47 UL Trip Select</td><td>Select how the inverter operates in the event of an underload fault trip.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>No protective action is taken.</td></tr>
<tr><td>1</td><td>CoastStop (FreeRun)</td><td>In the event of an underload fault trip, the inverter output will be blocked and the motor will enter a free run due to inertia.</td></tr>
<tr><td>2</td><td>Trip Dec Time Stop</td><td>If an underload fault trip occurs, the motor will decelerate and stop. However, for the deceleration stop time, the time set in PRT-01 (Trip Dec Time) will be applied.</td></tr>
</table></td></tr>
<tr><td>PRT-46 UL Warn Time
PRT-48 UL Trip Time</td><td>Sets the underload warning and fault trip occurrence time. The protection function operates when the under load warning and fault trip occurrence conditions are maintained during the underload warning time or underload trip time under the underload upper and lower limit levels described below.</td></tr>
<tr><td>PRT-49 UL LF Level,
PRT-50 UL BF Level</td><td>[When the preset value of DRV-25 (Load Duty Select) is 1 (Heavy Duty)]
• PRT-49 (underload lower limit level) is not a supported parameter.
• In PRT-50 (underload upper limit level), the underload rate is set based on the motor rated current (MOT1, MOT2-26 Rated Current).


[Image 4. The underload trip occurrence area according to frequency (load class: Heavy load)]</td></tr>
</table>

Code and Functions	Description
PRT-49 UL LF Level, PRT-50 UL BF Level	**[When the preset value of DRV-25 (Load Duty Select) is 0 (Normal Duty)]** • In PRT-49 (underload lower limit level), the underload rate is set at the frequency twice the rated slip of the motor. However, the rated slip of the motor is calculated from base frequency (MOT1, MOT2-23 Base Frequency), motor rated speed (MOT1, MOT2-24 Rated Speed), and number of poles (MOT1, MOT2-25 Number of Poles) in the inverter's internal S/W. • In PRT-50 (underload upper limit level), the underload rate is set at the base frequency (MOT1, MOT2-23 Base Frequency). The upper and lower limit levels are based on the motor rated current (MOT1, MOT2-26 Rated Current).  **[Image 5. The underload trip occurrence area according to frequency (load class: Underload)]**

Note

Underload fault trip and warning functions do not operate during energy saving operation (ADV-50 Energy Save Mode).

9.1.4 Stall Prevention

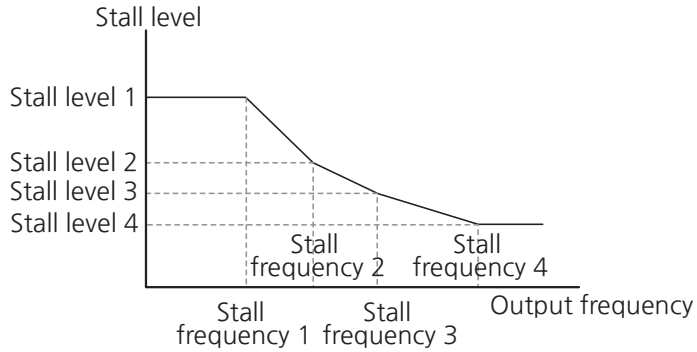
The stall prevention function is a protective function that prevents motor stalling caused by overloads. If this function is used, the inverter output frequency will be adjusted automatically according to the load size. When a stall is caused by an overload, high currents are induced in the motor and may cause motor overheating or damage to the motor and interrupt the operation of the motor-driven devices.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
VF1, VF2	76	Stall Prevent Acc	1	Yes	0~1	0	-
	77	Stall Prevent Dec	1	Yes	0~1	0	-
	78	Stall Prevent Std	1	Yes	0~1	0	-
	79	Stall Frequency-1	60.00		Start frequency-Stall Frequency-2	15.00	Hz
	80	Stall Speed-1	1800		Start speed-Stall Speed-2	1800	rpm
	81	Stall Level-1	180		30~250	180	%
	82	Stall Frequency-2	60.00		Stall Frequency1~Stall Frequency-3	30.00	Hz
	83	Stall Speed-2	1800		Stall Speed-1~Stall Speed-3	1800	rpm
	84	Stall Level-2	180		30~250	180	%
	85	Stall Frequency-3	60.00		Stall Frequency-2~Stall Frequency-4	45.00	Hz
	86	Stall Speed-3	1800		Stall Speed-2~Stall Speed-4	1800	rpm
	87	Stall Level-3	180		30~250	180	%
	88	Stall Frequency-4	60.00		Stall Frequency-3~Max Frequency [1]	60.00	Hz
	89	Stall Speed-4	1800		Stall Speed-4~Maximum Speed [2]	1800	rpm
	90	Stall Level-4	180		30~250	180	%
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	9	Stall	0~39	24, 14, 0	-

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

1 DRV-20(Max Frequency)
2 DRV-21(Maximum Speed)

Stall Prevention Setting Details

Code and Functions	Description
VF1, VF2-76 Stall Prevent Acc	The output frequency will be adjusted and accelerated within the set stall level range if the magnitude of the inverter output current exceeds the set stall level (VF1, VF2-81, 84, 87, 90) during acceleration. If current level stays above the stall level, the motor will decelerate to the start frequency (VF1, VF2-15). If the output current level decreases below the preset level while operating the stall prevention function, the motor will terminate the stall prevention function and resume acceleration.
VF1, VF2-77 Stall Prevent Dec	The inverter will decelerate and keep the DC link voltage below a certain level to prevent an overvoltage fault trip during deceleration. The stall prevention function is terminated when the DC link voltage falls within the normal range, and deceleration is performed according to the set slope. The actual deceleration time may be longer than the set deceleration time depending on the load.
VF1, VF2-78 Stall Prevent Std	Similar to the stall protection function during acceleration, the output frequency will decelerate when the current level exceeds the preset stall level while operating at constant speed. As the load current decreases and falls below the set level, it will accelerate again below the set acceleration slope and the stall prevention function will be terminated when the target frequency is reached.
VF1, VF2-79 Stall Frequency-1~ VF1, VF2 90 Stall Level-4	Stall protection levels can be configured for different frequencies, based on the load type. In addition, as shown in the illustration below, the stall level can be set above the base frequency. Lower and upper limits are set in accordance with stall frequency numbers. For example, in the setting range of Stall Frequency 2 (VF1, VF2-82), stall frequency 1 (VF1, VF2-79 Stall Frequency-1) will become the lower limit, and stall frequency 3 (VF1, VF2-85 Stall Frequency-3) will become the upper limit.  **[Image 6. Stall prevention level by frequency band]**

Note

- To obtain the shortest and most optimal deceleration performance by avoiding an overvoltage trip in a load with large inertia but short deceleration time, set BAS-85 (Flux Brake Enable) to 1 (Yes) with stall prevention during deceleration. Do not use this function when frequent deceleration of the load is required, as the motor can overheat and may be damaged easily.
- The stall level is the percentage (%) of the motor rated current (MOT1, MOT2-26 Rated Current).
- During DC operation (DC Start, DC Brake, etc.), KEB operation or speed search operation, the stall prevention function will not operate during acceleration or while operating at a constant speed.

Note

To resolve the problem if operation is impossible while the stall prevention function is operating, follow these steps.

- By adjusting the amount of manual torque boost to a small amount or by using the auto torque boost feature, reduce the initial operating current.
- Set the stall prevention operating reference current level to a high value (VF1, VF2-81 Stall Level-1). Set the value considering the motor's current capacity. It is possible for the motor to be damaged by fire if the setting is too high.

⚠ Caution

Use caution when decelerating while using stall protection, as depending on the load, the actual deceleration time can take longer than the set deceleration time.

9.1.5 Flux Braking

Flux braking is used to gain the optimum deceleration time without the braking resistance. If the deceleration time is too short, an overvoltage trip may occur due to regeneration energy generated from the motor. When using flux braking, braking can be performed with the optimal deceleration time without an overvoltage trip because regenerative energy is controlled to be consumed by the motor.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
BAS	95	Flux Brake Enable	1	Yes	0~1		-

Note

Flux braking may be less effective if the input voltage (DRV-30 Ref AC Input Volt) is high.

⚠ Caution

- Flux braking will operate simultaneously only during deceleration. Do not use this function when frequent deceleration of the load is required, as the motor can overheat and may be damaged easily.
- When installing the braking unit, motor vibration may occur depending on the amount of regenerative energy generated by the flux braking operation. In this case, disable the flux braking.

9.1.6 Electronic Thermal (ETH) Prevention through Motor Overheat Sensor

Connect the electronic thermal temperature sensor attached to the motor to the analog input terminal of the inverter terminal block so that the protection function can be activated in the event of motor overheating.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	60	Thermal-T Mode	1	CoastStop (FreeRun)	1~4	0	-
	61	Thermal-T Source	3	Analog Input 3	0~7	3	-
	62	Thermal-T Level	50.0		0.0~100.0	58.0	%
	63	Thermal-T Area	1	Over Level	0~1	1	-
DIN	27, 30, 33, 36, 39, 42, 45, 48	DI1~D8 NC/NO	1	Normal Close	0~1	0	-
OUT	01, 10	AO1, AO2 Define	15	Constant	0~15	0	-
	02, 11	AO1, AO2 Type Select	2	Current	0~2	0	-
	06, 15	AO1, AO2 Constant %	100.00		0.00~100.00	0.00	%

Motor Overheat Sensor Input Setting Details

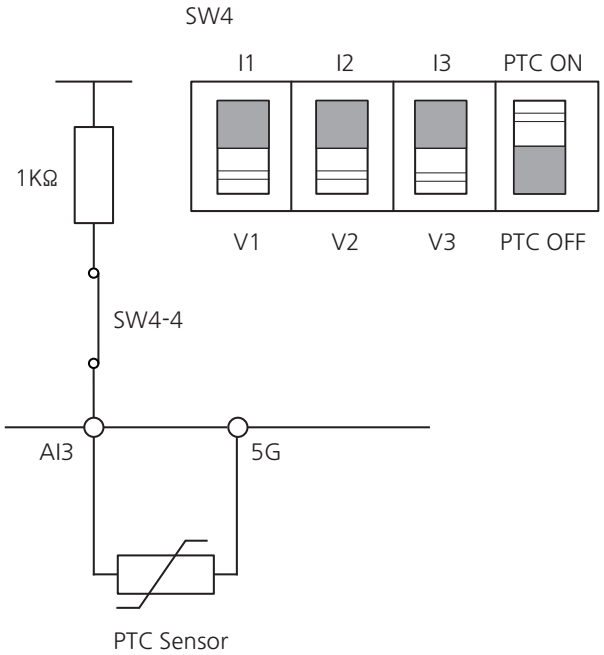
<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>PRT-60
Thermal-T Mode</td><td colspan="3">Sets the inverter operation status when the motor is overheated.
<table><tr><th colspan="2">Item</th><th>Functionality</th></tr><tr><td>0</td><td>None</td><td>No protective action is taken.</td></tr><tr><td>1</td><td>CoastStop (FreeRun)</td><td>In the event of an electronic thermal (ETH) fault trip, the inverter output will be blocked and the motor will enter a free run due to inertia.</td></tr><tr><td>2</td><td>Trip Dec Stop</td><td>If an electronic thermal (ETH) fault trip occurs, the motor will decelerate and stop. However, for the deceleration stop time, the time set in PRT-01 (Trip Dec Time) will be applied.</td></tr><tr><td>3</td><td>Warning</td><td>Motor Over Heat warning message will be displayed on the Smart Operator. It does not affect inverter operation. In the event of lost Smart Operator communication, it will operate at the frequency set in PRT-14 (Lost Preset Freq).</td></tr><tr><td>4</td><td>Lost Preset</td><td>If the motor overheats, it will operate at the frequency set in PRT-14 Lost Preset Freq.</td></tr></table></td></tr>
<tr><td>PRT-61
Thermal-T Source</td><td colspan="3">Selects the terminal type when connecting the motor overheat sensor to the analog input terminal of the inverter terminal block.
<table><tr><th colspan="2">Item</th><th>Functionality</th></tr><tr><td>0</td><td>None</td><td>The motor overheat sensor connection is not used.</td></tr><tr><td>1</td><td>Analog Input 1</td><td>Sets the motor overheat sensor connection to the AI1 terminal (analog input terminal) of the control terminal block.</td></tr><tr><td>2</td><td>Analog Input 2</td><td>Sets the motor overheat sensor connection to the AI2 terminal (analog input terminal) of the control terminal block.</td></tr><tr><td>3</td><td>Analog Input 3</td><td>Sets the motor overheat sensor connection to the AI3 terminal (analog input terminal) of the control terminal block.</td></tr></table></td></tr>
<tr><td>PRT-62
Thermal-T Level</td><td colspan="3">Sets the motor overheat detection sensor trip level.</td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PRT-63
Thermal-T Area</td><td>
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Under Level</td><td>Operates when the motor overheat sensor input is less than PRT-62.</td></tr>
<tr><td>1</td><td>Over Level</td><td>Operates when the motor overheat sensor input is greater than PRT-62.</td></tr>
</table>
</td></tr>
<tr><td>OUT-01, 10 AOx Define,
OUT-02, 11 AOx Type Select,
OUT-06, 15 AOx Constant %
(AOx: AO1, AO2)</td><td>They are used to supply constant current to the temperature sensor via the analog output terminal and to receive it via the analog input terminal.</td></tr>
</table>

When using a temperature sensor such as PTC by connecting it to the analog input terminal

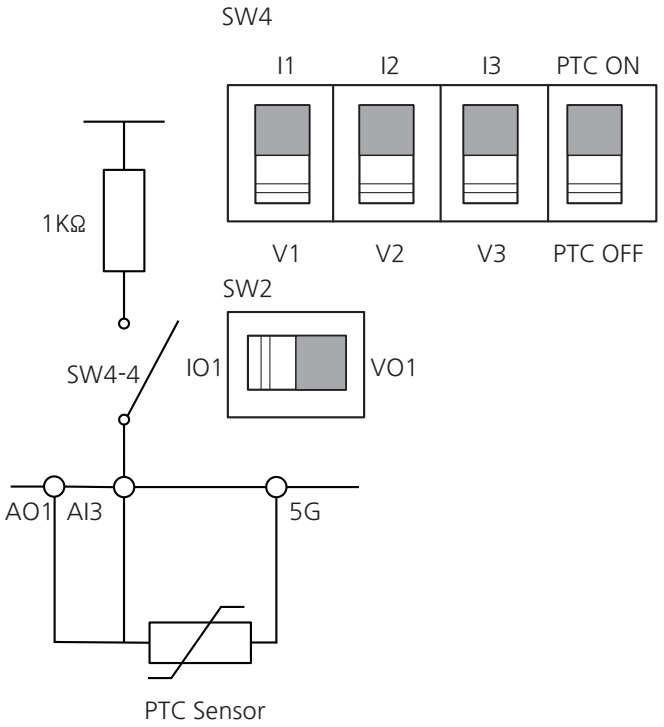
The PTC sensor can be connected in two ways: a 2-wire connection or a 3-wire connection.

- 2-wire connection: Set PRT-61 (Thermal-T Source) to 3 (Analog Input 3). Select the switch (SW4) as V3, and set the PTC selection switch to the PTC state.



[Image 7. PTC sensor 2-wire connection method]

- 3-wire connection: Set PRT-61 (Thermal-T Source) to 3 (Analog Input 3). Select the switch (SW4) as V3, and set the PTC selection switch to the Off state. Select the switch (SW2) as IO1. When using the analog output (AO1) terminal to supply a constant current to the temperature sensor and receive the sensor through the analog input (AI3) terminal, wire as follows.



[Image 8. PTC sensor 3-wire connection method]

9.2 Inverter and Sequence Protection

9.2.1 Input/output open-phase protection

Open-phase protection is used to prevent overcurrent levels induced at the inverter inputs due to an open-phase within the input power supply. Furthermore, if there is a open-phase between the motor and the inverter output, there might be motor stall due to a lack of torque. The output open-phase protection function is used to prevent this from occurring.

9.2.1.1 Input Open-phase Protection

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	10	In Phase Open Chk	1	Yes	0~1	0	-
	11	IPO Voltage Band	20		1~100	20	V

Input Open-phase Check Setting Details

Code and Functions	Description
PRT- 11 IPO Voltage Band	It is the reference voltage to check the input open-phase.

Note

- The input open-phase can be checked only when a load of 50% or more of the inverter rated current is input.
- Use caution when setting the input open-phase detection voltage band (PRT-11 IPO Voltage Band) too small, since the open-phase may be checked even if there is no actual input open-phase.
- Use caution when setting the input open-phase detection voltage band (PRT-11 IPO Voltage Band) too big, since the open-phase cannot be checked even if there is an actual input open-phase.

9.2.1.2 Output Open-phase Protection

In the event of an open-phase in the connection between the motor and the inverter output, there may be motor stall due to a lack of torque. In the event of one or more open-phases of U, V, or W of the inverter output terminal block, the inverter will detect the output open-phase, cut off the output, and display a trip.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	12	Out Phase Open Chk	1	Yes	0~1	0	-

Note

- The output open-phase will not be detected in the case of trip status, initial excitation, flux build-up, speed search operation, and motor parameter tuning mode.
- The output open-phase is not detected when the inverter is stopped.
- Each phase for which the output open-phase is checked will display the output open-phase trip message (**OutputPhase U Open**, **OutputPhase V Open**, **OutputPhase W Open**).
- In case of output open-phase of 2 or more phases, **No Motor Trip** will be displayed.

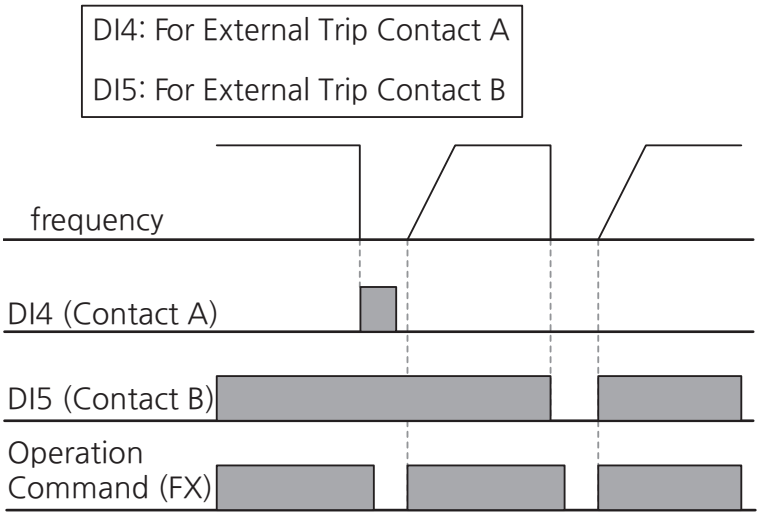
9.2.2 External Trip Signal

If the DI1-DI8 Define codes of the terminal block input group (DIN) are set to 5-8 (External Trip-1 to External Trip-4, external trip), it is possible to stop the inverter operation by using an external signal.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	5	External Trip-1	-	1, 2, 4, 5, 10, 11, 12, 9	-
			6	External Trip-2			
			7	External Trip-3			
			8	External Trip-4			
	27, 30, 33, 36, 39, 42, 45, 48	DIx NC/NO (DIx: DI1~DI8)	0	Normal Open	0~1	0	-
PRT	78, 79, 80, 81	Ext-Trip x Mode (x: 1~4)	0	Latch	0~1	0	-

External Trip Signal Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>DIN-27, 30, 33, 35, 39, 42, 45, 48
DIx NC/NO
(DIx: DI1~DI8)</td><td colspan="3">Selects the type of multifunction input contact.
<table><tr><th colspan="2">Item</th><th>Functionality</th></tr><tr><td>0</td><td>Normal Open</td><td>Operates as an A contact (Normal Open).</td></tr><tr><td>1</td><td>Normal Close</td><td>Operates as a B contact (Normal Close).</td></tr></table></td></tr>
<tr><td>PRT-78~81</td><td colspan="3">You can select the trip attributes for each external trip signal.
<table><tr><th colspan="2">Item</th><th>Functionality</th></tr><tr><td>0</td><td>Latch</td><td>Even if the external trip signal is cleared, the inverter will remain in a trip state. You must perform a reset through the terminal block or Smart Operator to clear the trip.</td></tr><tr><td>1</td><td>Level</td><td>The trip will be cleared immediately when the external trip signal is cleared.</td></tr></table></td></tr>
</table>



[Image 9. Example of External Trip Signal Settings]

9.2.3 Inverter Overload Protection

When the inverter input current exceeds the rated current, a protective function is activated to prevent damages to the inverter based on inverse proportional characteristics.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	25	Load Duty Select	1	Heavy Duty	0~1	1	-
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	6	Drv Over Load Warn	6, 24	24, 14, 0	-
			24	Trip			

Inverter Overload Protection Setting Details

Code and Functions	Description
DRV-25 Load Duty Select	Select the load level.
OUT-50, 52, 54 DOx Define (DOx:DO1~DO3	When 60% of the overload trip standard load amount is reached, the terminal block output set to 6 (Drive Over Load Warn) will turn on. When an overload trip occurs, the terminal block output set to 24 (Trip) will turn on.

Item		Functionality
0	Normal Duty	VT (Variable Torque) load settings for loads such as fans and pumps (overload capacity: based on VT rated current) [3]
1	Heavy Duty	CT (Constant Torque) load settings for loads such as hoists, cranes, and parking facilities (overload capacity: CT rated current 150%, 1 minute)

Note

A warning signal output can be provided in advance by the multifunction relay terminal before the inverter overload protection function (IOLT) operates. When 60% (150%, 36 sec) of the accumulated time that the inverter overload protection operation (150%, 1 min) occurs, a warning signal output will be provided

[3] 200V: 45 kW or less 120%, 1 minute / 55 kW or more 110%, 1 minute
400V: 75 kW or less 120%, 1 minute / 90 kW or more 110%, 1 minute

Note

When DRV-25 (Load Duty Select) is set, the initial value of DRV-27 Carrier Frequency is changed in accordance with the inverter's capacity.

Table 1. Initial value of carrier frequency for each load

Configuration		Initial value of carrier frequency		
0	Normal Duty	200V 400V	Full capacity	2kHz
1	Heavy Duty	200V	0.4~45kW	5kHz
			55~75kW	4kHz
		400V	0.4~75kW	5kHz
			90~160kW	3kHz
			185~220kW	2kHz

9.2.4 Using external 24V power (External 24V)

When the inverter input power is cut off, it supplies power to the control board immediately through the terminal block (EPI, 5G), allowing it to be used as backup power for the control unit. In this case, only limited functions are available, such as setting parameters through the Smart Operator operation and communicating with the upper-level controller. If PRT-89 (Ext 24V Pwr Lost) is set to 1 (Yes), a trip will be displayed when an external 24V power supply is not available.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	89	Ext 24V Pwr Lost	0	No	0~1	0	-
			1	Yes			

External 24V Power Setting Details

Code and Functions	Description
PRT-89 Ext 24V Pwr Lost	Selects whether a Lost External 24V trip will occur if the external 24V power supply is disconnected. In the event that the external 24V power supply is connected while the Lost External 24V trip has occurred, pressing the STOP/RESET key will cancel the trip.

ⓘ Caution

- **Definition of inverter operating status when an external 24 V power supply is applied without an internal drive power supply**

Table 2. Inverter operation items when using an external 24V power supply

Disabled items	Enabled items
Inverter operation is unavailable (When the Smart Operator inputs an operation command, the frequency will be maintained at 0 Hz).	Enabled communication options
The Lost Sensor, Low Voltage, STO Feedback A/B, and ADC Offset trips will be disabled and the corresponding trips will not occur.	Smart Operator enabled (parameter configuration available)
All digital/analog terminal block input/output functions will not operate.	Control board status LED enabled
Power-related functions will not operate. (cannot control cooling fan and cannot detect trip, cannot control magnetic contactor [MC], cannot communicate between control boards, cannot recognize temperature sensor [NTC], cannot recognize capacity, cannot detect fuse trip)	-

- **External 24V power supply specifications:** 21.6 VDC~26.4 VDC, 500 mA

9.2.5 Loss of Input Value by Inverter Unit

You can select the inverter operating method when the input value is lost due to disconnection of the signal line of the analog input of the terminal block, internal communication, communication option, USB or Smart Operator.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	14	Lost Preset Freq	60.00		0.00~Max Frequency [4]	0.00	Hz
	15	Lost Preset Speed	15		0~Maximum Speed [5]	0	rpm
	16	Lost Keypad Mode	1	CoastStop (FreeRun)	0~4	0	-
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	25	Lost Keypad Warn	25	24, 14, 0	-

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Lost Smart Operator Communication Setting Details

Code and Functions	Description
PRT-14 Lost Preset Freq	In situations where the operation of the lost Smart Operator communication (PRT-16 Lost Keypad Mode) is set to 4 (Lost Preset), the protection function will operate and set the frequency to continue operation.

[4] DRV-20(Max Frequency)
[5] DRV-21(Maximum Speed)

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PRT-16
Lost Keypad Mode</td><td>Selects how the inverter operates when Smart Operator communication is lost.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>The protection function for lost Smart Operator communication will not operate.</td></tr>
<tr><td>1</td><td>CoastStop (FreeRun)</td><td>In the event of lost Smart Operator communication, the inverter output is blocked and the motor will enter a free run due to inertia.</td></tr>
<tr><td>2</td><td>Trip Dec Stop</td><td>The motor will decelerate and then stop when Smart Operator communication is lost. However, for the deceleration stop time, the time set in PRT-01 (Trip Dec Time) is applied.</td></tr>
<tr><td>3</td><td>Warning</td><td>When the DO1-DO3 Define code of the output terminal block group (OUT-50, 52, 54) is set to 25 (Lost Keypad Warn), the corresponding warning signal will be output to the multifunction output terminal block when Smart Operator communication is lost.</td></tr>
<tr><td>4</td><td>Lost Preset</td><td>In the event of lost Smart Operator communication, it will operate at the frequency set at PRT-14.</td></tr>
</table></td></tr>
</table>

Note

In the event of a communication error between the Smart Operator and the inverter control board lasting for more than two seconds, it will be considered lost, and it will be operated according to the method set out in PRT-16 (Lost Keypad Mode).

- If the set value of PRT-16 (Lost Keypad Mode) is 1 (CoastStop(FreeRun)) or 2 (Trip Dec Stop), it will operate as a level trip.
- If the set value of PRT-16 (Lost Keypad Mode) is 3 (Warning) or 2 (Lost Preset), it will operate as a warning.

9.2.5.1 Lost Internal Communication

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	14	Lost Preset Freq	60.00		0.00~Max Frequency [6]	0.00	Hz
	15	Lost Preset Speed	15		0~Maximum Speed [7]	0	rpm
	17	Lost IntComm Mode	1	CoastStop (FreeRun)	0~4	0	-
	18	Lost IntComm Time	1.0		0.1~120.0	1.0	sec
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	13	Lost Internal Comm	13	24, 14, 0	-
PRT	14	Lost Preset Freq	60.00		0.00~Max Frequency [6]	0.00	Hz
	15	Lost Preset Speed	15		0~Maximum Speed [7]	0	rpm
	17	Lost IntComm Mode	1	CoastStop (FreeRun)	0~4	0	-
	18	Lost IntComm Time	1.0		0.1~120.0	1.0	sec
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	13	Lost Internal Comm	13	24, 14, 0	-

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

[6] DRV-20(Max Frequency)
[7] DRV-21(Maximum Speed)

Lost Internal Communication Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>PRT-14 Lost Preset Freq</td><td colspan="3">In situations where the operation of the lost internal communication (PRT-17 Lost IntComm Mode) is set to 5 (Lost Preset), the protection function will operate and sets the frequency to continue operation.</td></tr>
<tr><td>PRT-17 Lost IntComm Mode</td><td colspan="3">Selects the operation method when Smart Operator communication is lost.
<table><tr><th colspan="2">Item</th><th>Functionality</th></tr><tr><td>0</td><td>None</td><td>The protection function for lost internal communication will not operate.</td></tr><tr><td>1</td><td>CoastStop (FreeRun)</td><td>In the event of lost internal communication, the inverter output will be blocked and the motor will enter a free run due to inertia.</td></tr><tr><td>2</td><td>Trip Dec Time Stop</td><td>The motor will decelerate and then stop when internal communication is lost.
However, for the deceleration stop time, the time set in PRT-01 (Trip Dec Time) is applied.</td></tr><tr><td>3</td><td>Warning</td><td>When the DO1-DO3 Define code of the output terminal block group (OUT-50, 52, 54) is set to 13 (Lost Internal Comm), the corresponding warning signal is output to the multifunction output terminal block when internal communication is lost.</td></tr><tr><td>4</td><td>Lost Preset</td><td>In the event of lost internal communication, it will operate at the frequency set at PRT-14.</td></tr></table></td></tr>
<tr><td>PRT-18 Lost IntComm Time</td><td colspan="3">Sets the time to judge the lost internal communication from the moment of lost internal communication until the loss continues.</td></tr>
</table>

Note

- If the set value of PRT-17 (Lost IntComm Mode) is 1 (CoastStop(FreeRun)) or 2 (Trip Dec Stop), it operates as a level trip.
- If the set value of PRT-17 (Lost IntComm Mode) is 3 (Warning) or 2 (Lost Preset), it will operate as a warning.

9.2.5.2 Lost USB

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	14	Lost Preset Freq	60.00		0.00~Max Frequency [8]	0.00	Hz
	15	Lost Preset Speed	15		0~Maximum Speed [9]	0	rpm
	19	Lost USB Mode	1	CoastStop (FreeRun)	0~4	0	-
	20	Lost USB Time	1.0		0.1~120.0	1.0	sec
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	34	Lost USB Warn	0~39	24, 14, 0	-

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Lost USB Setting Details

Code and Functions	Description
PRT-14 Lost Preset Freq	In situations where the operation of the lost USB (PRT-19 Lost USB Mode) is set to 5 (Lost Preset), the protection function will operate and set the frequency to continue operation.

[8] DRV-20(Max Frequency)
[9] DRV-21(Maximum Speed)

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PRT-19
Lost USB Mode</td><td>Selects how the inverter operates when USB is lost.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>The protection function for lost USB will not operate.</td></tr>
<tr><td>1</td><td>CoastStop (FreeRun)</td><td>In the event of lost USB, the inverter output will be blocked and the motor will enter a free run due to inertia.</td></tr>
<tr><td>2</td><td>Trip Dec Stop</td><td>The motor decelerates and then stops when USB is lost. However, for the deceleration stop time, the time set in PRT-01 (Trip Dec Time) is applied.</td></tr>
<tr><td>3</td><td>Warning</td><td>When the DO1-DO3 Define code of the output terminal block group (OUT-50, 52, 54) is set to 13 (Lost Int Comm Warn), the corresponding warning signal will be output to the multifunction output terminal block when USB communication is lost.</td></tr>
<tr><td>4</td><td>Lost Preset</td><td>In the event of lost USB, it will operate at the frequency set at PRT-14.</td></tr>
</table></td></tr>
<tr><td>PRT-20
Lost USB Time</td><td>Sets the time to judge USB loss from the moment of USB loss until the loss continues.</td></tr>
</table>

Note

- If the set value of PRT-19 (Lost USB Mode) is 1 (CoastStop(FreeRun)) or 2 (Trip Dec Stop), it will operate as a level trip.
- If the set value of PRT-19 (Lost USB Mode) is 3 (Warning) or 2 (Lost Preset), it will operate as a warning.

9.2.5.3 Lost Analog Input

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	14	Lost Preset Freq	60.00		0.00~Max Frequency [10]	0.00	Hz
	15	Lost Preset Speed	15		0~Maximum Speed [11]	0	rpm
	25, 28, 31	Lost AIx Mode (AIx: AI1~AI3)	1	CoastStop (FreeRun)	0~5	0	-
	26, 29, 32	Lost AIx Chk Level (AIx: AI1~AI3)	0	Half of Low Limit	0~2	0	-
	27, 30, 33	Lost AIx Time (AIx: AI1~AI3)	1.0		0.1~120.0	1.0	sec
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	36	Lost AI-1 Warn	36~39	24, 14, 0	-
			37	Lost AI-2 Warn			
			38	Lost AI-3 Warn			

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

Lost Analog Input Setting Details

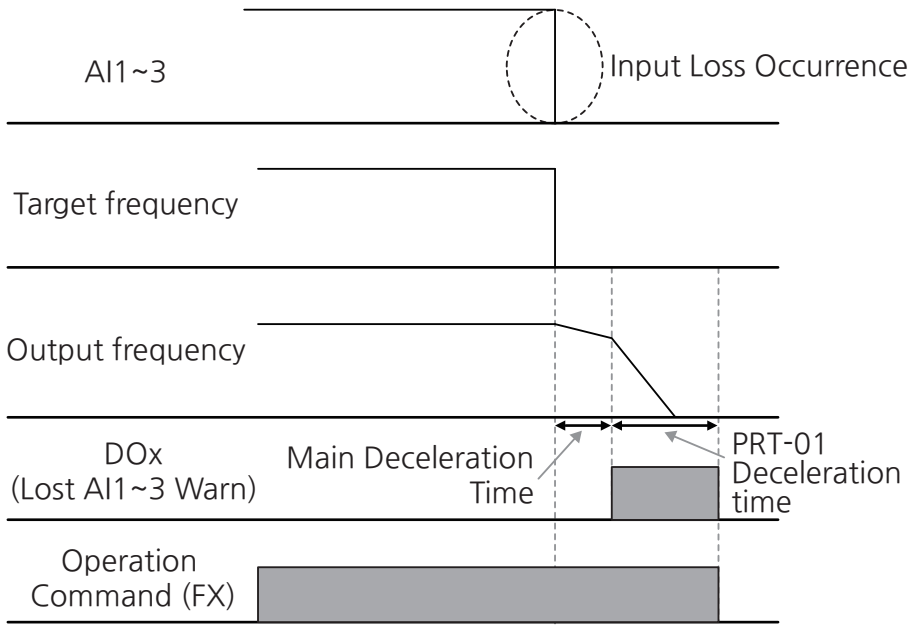
Code and Functions	Description
PRT-14 Lost Preset Freq,	In situations where the operation of the lost analog input (PRT-25, 28, 31 Lost AI1-AI3 Mode) is set to 5 (Lost Preset), the protection function will operate and set the frequency to continue operation.

[10] DRV-20(Max Frequency)
[11] DRV-21(Maximum Speed)

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PRT-25, 28, 31
Lost AIx Mode
(AIx: AI1~AI3)</td><td>Selects how the inverter operates when analog input is lost.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>None</td><td>The protection function for lost analog input will not operate.</td></tr>
<tr><td>1</td><td>CoastStop (FreeRun)</td><td>In the event of lost analog input, the inverter output will be blocked and the motor will enter a free run due to inertia.</td></tr>
<tr><td>2</td><td>Trip Dec Time Stop</td><td>The motor will decelerate and then stop when analog input is lost.
However, for the deceleration stop time, the time set in PRT-01 (Trip Dec Time) is applied.</td></tr>
<tr><td>3</td><td>Hold Input</td><td>In the event of lost analog input, operation will continue with the analog input value at the time when the input loss was determined.</td></tr>
<tr><td>4</td><td>Hold Output</td><td>In the event of lost analog input, operation will continue with the analog output value at the time when the input loss was determined.
For example, in an inverter that accelerates with a constant input value and whose analog input value is defined as the speed command, if it is deemed that analog input is lost, the speed command at that point will be used as the output value and the inverter will continue to operate.</td></tr>
<tr><td>5</td><td>Lost Preset</td><td>In the event of lost analog input, it will operate at the frequency set at PRT-14.</td></tr>
</table></td></tr>
<tr><td>PRT-26, 29, 32
Lost AIx Chk Level
(AIx: AI1~AI3)</td><td>Sets the criterion level for lost analog input.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Half of Low Limit</td><td>When the analog input value is within the range of the following table (that is, 1/2 of the set value), it will be considered lost analog input, depending on the settings of AIN-01, 16, 31 (AI1-AI3 Type Select).
<table>
<tr><td>Unipolar Voltage</td><td>0 <= Analog input value <= (AIN-05, 20, 35 AIx + x1 In)/2</td></tr>
<tr><td>Bipolar Voltage</td><td>Analog input value <= ABS[(AIN-05, 20, 35 AIx + x1 In)/2]</td></tr>
<tr><td>Current</td><td>0 <= Analog input value <= (AIN-05, 20, 35 AIx + x1 In)/2</td></tr>
</table></td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>PRT-26, 29, 32
Lost AIx Chk Level
(AIx: AI1~AI3)</td><td>
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>1</td><td>Below Low Limit</td><td>When the analog input value is within the range of the following table (that is, set value), it will be considered an analog input loss, depending on the settings of AIN-01, 16, 31 (AI1-AI3 Type Select).
<table>
<tr><td>Unipolar Voltage</td><td>0 <= Analog input value <= (AIN-05, 20, 35 AIx + x1 In)</td></tr>
<tr><td>Bipolar Voltage</td><td>Analog input value <= ABS[(AIN-05, 20, 35 AIx + x1 In)]</td></tr>
<tr><td>Current</td><td>0 <= Analog input value <= (AIN-05, 20, 35 AIx + x1 In)</td></tr>
</table></td></tr>
<tr><td>2</td><td>Below Or Maximum</td><td>When the analog input value is within the range of the following table (that is, set value), it will be considered an analog input loss, depending on the settings of AIN-01, 16, 31 (AI1-AI3 Type Select).
<table>
<tr><td>Unipolar Voltage</td><td>0 <= Analog input value <= (AIN-05, 20, 35 AIx + x1 In) or analog input value >= (AIN-07, 22, 37 AIx + x2 In)-2% or more</td></tr>
<tr><td>Bipolar Voltage</td><td>Analog input value <= ABS[(AIN-05, 20, 35 AIx + x1 In)] or analog input value >= ABS[(AIN-07, 22, 37 AIx + x2 In)-2%]</td></tr>
<tr><td>Current</td><td>0 <= Analog input value <= (AIN-05, 20, 35 AIx + x1 In) or analog input value >= (AIN-07, 22, 37 AIx + x2 In)-2% or more</td></tr>
</table></td></tr>
</table>
• ABS: The absolute value, y <= ABS[x], and y is a value that satisfies between -x <=y and y <=x.
</td></tr>
<tr><td>PRT-27, 30, 33
Lost AIx Time
(AIx: AI1~AI3)</td><td>Sets the time to judge the analog input loss from the moment of meeting the conditions of the judgment level (PRT-26, 29, 32) in the event of set analog input loss until it continues to the time set in PRT-27, 30, 33.</td></tr>
</table>

If analog input is lost when the analog input definition is used as a speed command, PRT-25 (Lost AI1 Mode) is set to 2 (Trip Dec Time Stop), PRT-26 (Lost AI1 Chk Level) is set to 1 (Below Low Limit), and PRT-27 (Lost AI1 Time) is set to 5.0 sec, it will operate as follows:



[Image 10. Example of operation in case of lost analog input]

Note

- If the set value of PRT-25, 28, 31(Lost AI1-AI3 Mode) is 1 (CoastStop(FreeRun)) or 2 (Trip Dec Time Stop), it will operate as a level trip.
- If the set value of PRT-25, 28, 31(Lost AI1-AI3 Mode) is 3 (Hold Input) or 4 (Hold Output), it will operate as a warning.

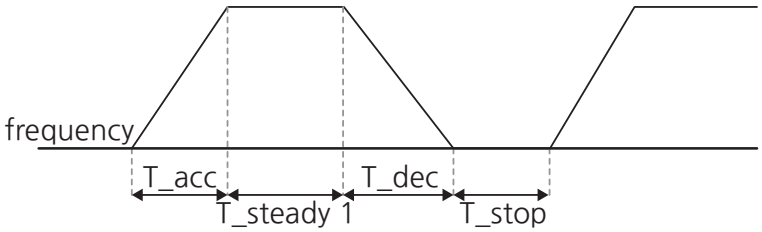
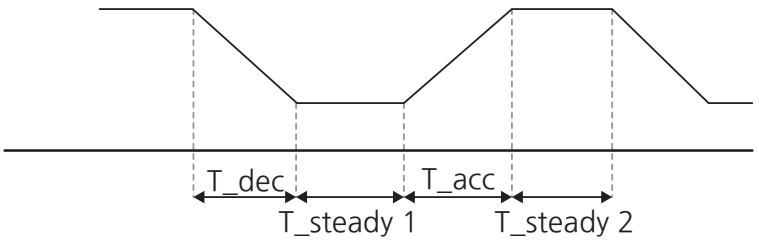
9.2.6 Dynamic Braking (DB) Resistor Configuration

It is possible to adjust the DC link voltage through a braking resistor. The products with 200V class 18.5kW or less and 400V class 37kW or less are equipped with a built-in braking unit to prevent overvoltage caused by an increase in the DC link voltage during regenerative operation. For products without a built-in brake unit, a separately mounted brake unit can be used. For more details on available brake unit, refer to **16.6 Braking Unit and Braking Resistor Specifications**.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
APP	35	DB Turn On Level	200 V class	390	350~400	390	V
			400 V class	780	600~800	780	
	36	DB Warn %ED Enable	1	Yes	0~1	0	-
	37	DB Warn %ED	5		1~30	5	%
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	26	DB Warn %ED	0~39	24, 14, 0	-

Dynamic Braking (DB) Resistor Setting Details

Code and Functions	Description
APP-35 DB Turn On Level	Turns on the brake circuit when the DC link voltage exceeds the set value.
APP-36 DB Warn %ED Enable	Selects whether to enable the dynamic braking resistor function. The inverter will decelerate and keep the DC link voltage below a certain level to prevent an overvoltage fault trip during deceleration. The actual deceleration time may be longer than the set deceleration time depending on the load.

Code and Functions	Description
APP-37 DB Warn %ED	Sets dynamic braking (DB) resistor (% ED: Einschaltdauer). Braking resistor configuration sets the rate at which the braking resistor operates for one operation cycle. The maximum time for continuous braking is 15 sec and the braking resistor signal will not be output from the inverter after the 15 sec period has expired. An example of dynamic braking resistor set up is as follows:  $\%ED = \frac{T_dec}{T_acc + T_steady _T_dec + T_stop} \times 100\%$ **[Image 11. Example of dynamic braking resistor setting-1]**  $\%ED = \frac{T_dec}{T_dec + T_steady1 + T_acc + T_steady2} \times 100\%$ **[Image 12. Example of dynamic braking resistor setting-2]** • T_acc: Acceleration time to set frequency • T_steady: Constant speed operation time at set frequency • T_dec: Deceleration time to a frequency lower than constant speed operation or the stop time from constant speed operation frequency • T_stop: Stop time until operation resumes

⚠ Caution

Do not set the braking resistor to exceed the resistor's power rating. If overloaded, it can overheat and cause a fire. When using a resistor with a heat sensor, the sensor output can be used as an external trip signal for the inverter's multifunction input.

9.2.7 Output Block by Multifunction Terminal

When the multifunction input terminal is set as the output block signal terminal and the signal is input to the terminal, then the operation stops.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	4	BX	-	1, 2, 4, 5, 10, 11, 12, 9	-
PRT	83	BX Stop Mode	0	CoastStop (FreeRun)	0~2	0	-
	84	BX Dec TIme	-		0.01~ 6000.00	3.00	sec
	85	BX Restart Mode	0	None	0~2	1	-

Output Block by Multifunction Terminal Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>DIx Define
(DIx: DI1~DI8)</td><td colspan="3">If the DI1-DI8 Define code of the terminal block input group (DIN) is set to 4 (BX), the inverter will block the output and display BX in the Smart Operator pop-up window when the signal is input (On) during operation.
While BX is displayed on the Smart Operator pop-up window, the inverter’s operation information including the operation frequency and current at the time of BX signal can be monitored.</td></tr>
<tr><td>PRT-83 BX Stop Mode</td><td colspan="3"><table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>CoastStop (FreeRun)</td><td>In the event of an emergency stop, inverter output will be blocked and the motor will enter a free run due to inertia.</td></tr>
<tr><td>1</td><td>Trip Dec Stop</td><td>If a fault trip occurs, the motor will decelerate and stop. However, for the deceleration stop time, the time set in PRT-01 (Trip Dec Time) is applied.</td></tr>
<tr><td>2</td><td>BX Dec Stop</td><td>If a fault trip occurs, the motor will decelerate and stop. However, for the deceleration stop time, the time set in PRT-84 (BX Dec Time) is applied.</td></tr>
</table></td></tr>
</table>

Code and Functions	Description		
PRT-85 BX Restart Mode	Item		Functionality
	0	None	Does not restart the motor even if the emergency stop operation is reset.
	1	Start Mode	Accelerates and operates in the same way as normal acceleration operation when the emergency stop operation is reset.
	2	Speed Search	Operates in the same way as a speed search operation when the emergency stop operation is reset.

⚠ Caution

When the multifunction terminal with the DI1-DI8 Define code of the terminal block input group (DIN) set to 4 (BX) is turned off while the operation command is input, the motor will accelerate again. Therefore, before releasing the emergency stop operation, make sure to check the motor rotation status and the set value of PRT-85 (BX Restart Mode).

9.2.8 Over Speed Error

It is a function that operates based on the control mode parameter (MOT1-05, MOT2-05). It is active when the set value of MOT1-05 is 3 (Sensorless) or 4 (Vector) and when the set value of MOT2-05 is 3 (Sensorless).

If the motor rotates at a speed higher than the over speed level (PRT-64 Over Speed Level) during the over speed detection time (PRT-65 Over Speed Time), the inverter output will be blocked.

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
PRT	64	Over Speed Level	120.0	20.0~120.0	120.0	%
	65	Over Speed Time	0.01	0.01~10.00	0.01	sec

9.2.9 Speed Deviation Error

It is a function that operates based on the control mode parameter (MOT1-05, MOT2-05). It is active when the set value of MOT1-05 is 3 (Sensorless) or 4 (Vector) and when the set value of MOT2-05 is 3 (Sensorless).

If the motor rotates at a speed higher than the speed deviation (PRT-67 Speed Dev BandFreq) for the set detection time (PRT-69 Speed Dev Time), the inverter output will be blocked.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	66	Speed Deviation En	1	Yes	0~1	0	%
	67	Speed Dev BandFreq	20.00		2.00~Max Frequency [12]	20.00	Hz
	68	Speed Dev Band Spd	600		60~ Maximum Speed [13]	600	rpm
	69	Speed Dev Time	1.0		0.1~1000.0	1.0	sec

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

9.2.10 Cooling Fan Control

This function turns the inverter cooling fan on and off. It is used in situations where the load stops and starts frequently, or noise free environment is required. The correct use of cooling fan control can extend the cooling fan's life.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	50	Fan Control	0	During Run	0~2	0	-

[12] DRV-20(Max Frequency)
[13] DRV-21(Maximum Speed)

Cooling Fan Control Setting Details

Code and Functions	Description		
	Item		Functionality
DRV-50 Fan Control	0	During Run	Cooling fan runs when the power is supplied to the inverter and the operation command is on. The cooling fan stops when the power is supplied to the inverter and the operation command is off. When the inverter power unit temperature is higher than its set value, the cooling fan will operate automatically regardless of its operation command source.
	1	Always Run	The cooling fan runs constantly if the Input power is supplied to the inverter.
	2	Temp. Control	With input power connected and the run operation command on, if the setting is in Temp Control, the cooling fan will not operate unless the temperature in the heat sink reaches the set temperature.

Note

Despite setting DRV-50 (Fan Control) to 0 (During Run), if the heat sink temperature reaches a set level by current input harmonic wave or noise, the cooling fan may run as a protection function. That is, even if the inverter is not running, the cooling fan may operate when the inverter power unit reaches a certain temperature.

9.2.11 Cooling Fan Trip Detection

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	75	MainFan Trip Mode	1	Warning	0~1	1	-
	77	AuxFan Trip Mode	1	Warning	0~1	1	-
OUT	50, 52, 54	DO1~DO3 Define	8	MainFan Warn	0~54	24, 14, 0	-

Cooling Fan Trip Detection Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td rowspan="3">PRT-75 MainFan Trip Mode,
PRT-77 AuxFan Trip Mode</td><td colspan="2">Item</td><td>Functionality</td></tr>
<tr><td>0</td><td>Trip</td><td>The inverter output will be blocked and the fan trip will be displayed when a cooling fan error is detected.</td></tr>
<tr><td>1</td><td>Warning</td><td>When OUT-50, 52, 54 DO1-DO3 Define is set to 8 (MainFan Warn), the fan error signal will be output and the operation will continue.</td></tr>
<tr><td>OUT-50, 52, 54 DOx Define
(DOx: DO1~DO3)</td><td colspan="3">When the code value is set to 8 (MainFan Warn), the fan error signal will be output and the operation will continue. However, when the inverter inside temperature rises above a certain level, output is blocked due to activation of overheat protection.</td></tr>
</table>

9.3 Diagnostic Functions

9.3.1 Main Capacitor Diagnostic Function

Using the change in electric capacity value, it is possible to indirectly verify the degree of deterioration of the inverter's main capacitor. An induction motor [14] must be connected and DIAG-01 (Main Cap Diag En) must be set to 1 (Yes) in order to perform a measurement. Measure in the following order:

1 Set DIAG-02 (Main Cap Diag Mode) to 1 (Diagnosed Capacity).
In the pop-up window of the Smart Operator, the message "Power Off Please" will appear.

2 Cut off the power supply to the inverter.
A Main Cap Diag Fail trip will occur if the power is not cut off within 10 seconds. It is safe since the motor output does not come out until the power is cut off.

3 In order to measure the electric capacity of the main capacitor, DC is momentarily output, and the measured capacitor capacity will be displayed on DIAG-04 (MainCap MeasuredLv) as a percent (%). DIAG-05 (MainCap Diag Time) displays the total time the capacitor has been operated.

4 The Smart Operator pop-up window will display a **Main Cap Damaged** warning message if the displayed capacitor capacity is less than the value displayed in DIAG-06 (MainCap Warn Level).

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIAG	01	MainCap Diag En	1	Yes	0~1	1	-
	02	MainCap Diag Mode	1	Diagnosed Capacity	0~1	0	-
	03	MainCap Diag Sts	0	None	0~2	0	-
	04	MainCap MeasuredLv	-		0.00~100.00	-	%
	05	MainCap Diag Time	-		-	-	-
	06	MainCap Warn Level	70.0		50.0~90.0	70.0	%

[14] Synchronous motors do not operate.

Caution

AC 190V/370V is the minimum input voltage for measuring the electric capacity of the main capacitor. A Main Cap Diag Fail trip will occur when the input voltage falls below the minimum.

9.3.2 Main Capacitor Diagnostic Check Alarm Function

Displays an alarm so that periodic testing of the main capacitor can be performed.

To perform this function, DIAG-07 Cap Diag Alarm En must be set to 1 (Yes).

When the time set in DIAG-08 (CapDiag AlarmCycle) elapses, from the time set in DIAG-05 (MainCap Diag Time) to the capacitor operation time set in DIAG-97 (MainCap Used Time), the **MainCap CheckAlarm** warning message will be displayed on the Smart Operator.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIAG	07	Cap Diag Alarm En	1	Yes	0~1	1	-
	08	CapDiag AlarmCycle	18000		2000~50000	18000	hour

9.3.3 Main Capacitor Life Diagnostic Function

When the cumulative run time of the main capacitor reaches the main capacitor replacement diagnostic level, a warning message will be displayed.

To perform this function, DIAG-11 (MainCap Repl En) must be set to 1 (Yes).

When DIAG-13 (MainCap Used Level) reaches DIAG-12 (MainCap Repl Level), a **Main Cap Repl Warn** warning message will be displayed. It is possible to check the usage time of the main capacitor in DIAG-97 MainCap Used Time.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIAG	11	MainCap Repl En	1	Yes	0~1	1	-
	12	MainCap Repl Level	90.00		10.00~100.00	70.00	%
	13	MainCap Used Level	-		0.00~100.00	0.00	%
	97	MainCap Used Time	-		-	0	-

9.3.4 Main Fan Life Diagnostic Function

When the cumulative run time of the main fan reaches the replacement diagnostic level, a warning message will be displayed.

To perform this function, DIAG-52 (MainFan Repl En) must be set to 1 (Yes).

When DIAG-54 (MainFan Used Level) reaches the value set in DIAG-53 (MainFan Repl Level), a **MainFan Repl Warn** warning message will be displayed.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIAG	52	MainFan Repl En	1	Yes	0~1	0	-
	53	MainFan Repl Level	90.00		10.00~100.00	90.00	%
	54	MainFan Used Level	-		0.00~100.00	0.00	%

9.3.5 Aux Fan Life Diagnostic Functions

When the cumulative run time of the aux fan reaches the replacement diagnostic level, a warning message will be displayed.

To perform this function, DIAG-62 (AuxFan Repl En) must be set to 1 (Yes).

When DIAG-64 (AuxFan Used Level) reaches the value set in DIAG-63 (AuxFan Repl Level), an **AuxFan Repl Warn** warning message will be displayed.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIAG	62	AuxFan Repl En	1	Yes	0~1	0	-
	63	AuxFan Repl Level	90.00		10.00~100.00	90.00	%
	64	AuxFan Used Level	-		0.00~100.00	0.00	%

9.3.6 Pre-charge Relay Life Diagnostic Function

When the cumulative number of relay operations used for pre-charge reaches the replacement diagnostic level, a warning message will be displayed.

To perform this function, DIAG-40 (PreChargerWarn Sel) must be set to 1 (Yes).

When DIAG-42 (PreCharger Used Lv) reaches the value set in DIAG-41 (PreCharger Repl Lv), a **PreChargerReplWarn** warning message will be displayed.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIAG	40	PreChargerWarn Sel	1	Yes	0~1	0	-
	41	PreCharger Repl Lv	90.00		10.00~100.00	90.00	%
	42	PreCharger Used Lv	-		0.00~100.00	0.00	%

9.3.7 Monitoring Operation Time

It is possible to monitor the operation time of the inverter and the fan.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIAG	90	MainFan Time	-		-	-	-
	91	MainFan Time Reset	0	No	0~1	0	-
			1	Yes			
	95	AuxFan Time	-		-	-	-
	96	AuxFan Time Reset	0	No	0~1	0	-
			1	Yes			
	98	Drive On Time	-		-	-	-
	99	Drive Run Time	-		-	-	-

Monitoring Operation Time Setting Details

Code and Functions	Description
DIAG-90 MainFan Time, DIAG-95 AuxFan Time	Displays the cumulative operation time of the inverter cooling fan. The information is displayed in the form of “day hour:minute (0 days 00:00).”
DIAG-91 MainFan Time Reset DIAG-96 AuxFan Time Reset	When set to 1 (Yes), both the cumulative cooling fan operating time (On-time) and cumulative operating time (Run-time) will be deleted and displayed as 0 days 00:00.
DRV-98 Drive On Time	Displays the cumulative time when power is supplied to the inverter. The information is displayed in the form of “day hour:minute (0 days 00: 00)”.
DRV-99 Drive Run Time	Displays the cumulative time when the operation command is entered and the inverter outputs voltage. The information is displayed in the form of “day hour:minute (0 days 00:00).”

9.4 Operation Settings related to Trip Occurrence

9.4.1 Operation related to Low Voltage Trip

When inverter input power is lost and the internal DC link voltage drops below a certain voltage level, the inverter will stop output and a low voltage trip will occur.

A trip occurs only during operation, and not when input voltage drops due to power off during stop.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	02	LV Trip Mode	0	Latch	0~1	0	-
OUT	50, 52, 54	DOx Define (DOx: DO1~DO3)	11	Low Voltage	0~39	24, 14, 0	-

If the voltage is reset again after a low voltage trip occurs, the voltage can be changed by the value set in DRV-30 (Ref AC Input Volt).

Trip occurrence voltage (based on DC link voltage)

- 220 V level: 1.414 * DRV-30 Ref AC Input Volt * 65%, minimum 180V
- 400 V level: 1.414 * DRV-30 Ref AC Input Volt * 65%, minimum 350V

Trip reset voltage (based on DC Link voltage)

- 200 V level: 1.414 * DRV-30 Ref AC Input Volt * 80% (about 249V for 220V)
- 400 V level: 1.414 * DRV-30 Ref AC Input Volt * 80% (about 430V for 380V)

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	30	Ref AC Input Volt	200 V class	-	200~240	-	V
			400 V class	-	380~480	-	

9.4.2 Operation related to Safety Trip

This function sets the reset operation mode when a safety trip occurs.

In the case of PRT-82 (Safety Trip Mode) set to 0 (Latch), the inverter will maintain the trip even if the safety signal is input, and the trip will be released only when it is forcibly reset through the terminal block or Smart Operator. When PRT-82 (Safety Trip Mode) is set to 1 (Level), the trip will be immediately reset upon receipt of the safety signal.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	82	Safety Trip Mode	0	Latch	0~1	0	-

9.4.3 Trip Status Reset

This function restarts the inverter after resetting the trip with the Smart Operator or the multifunction input terminal.

Restarting the inverter can be accomplished using the STOP/RESET key on the Smart Operator or the multifunction input terminal.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DIN	01, 03, 05, 07 09, 11, 13, 15	DIx Define (DIx: DI1~DI8)	3	RST	-	1, 2, 4, 5, 10, 11, 12, 9	-

Trip Status Reset Setting Details

Code and Functions	Description
DIN-01, 03, 05, 07, 09, 11, 13, 15 DIx Define (DIx: DI1~DI8)	Set the DI1-DI8 Define code of the terminal block input group (DIN) to 3 (RST) and input the signal to the terminal in a trip state to reset the trip status. Only latch-type trips will be reset. When two or more latch-type trips occur at the same time, the trips will be released upon reset only when all conditions for trip release have been met.

9.5 Trip/Warning List

The following list shows the types of trips and warnings that can occur while using the S300 inverter. Please refer to **9 Learning Protection Functions** for details about trips and warnings.

9.5.1 Trip List

Table 3. Trip list

LCD Display	Description	Property	Remark
Watch Dog	CPU watchdog trip	Fatal	-
Data Storage Error	Internal memory error	Fatal	-
Main System Error	Inverter internal S/W error	Fatal	-
ADC OffSet	Analog input error	Latch	-
Arm Short	ARM short current fault trip	Latch	-
AuxiliaryFan Fault	Aux fan error	Latch	Reserved
Br Engaging Fail	Brake operation failure	Latch	Brake control
Br Release Invalid	Brake release invalid	Latch	Brake control
Br Releasing Fail	Brake release failure	Latch	Brake control
BX	Trip by BX terminal input	Level	-
CAN Bus Error	Option interface fault	Latch	Communication or extended IO option
Control Fan Fault	Control fan fault	Latch	Reserved
Cur Pos Overf Err	Current position calculation error	Latch	Position control
Drive Over Heat	Inverter overheat trip	Latch	-
Drive Over Load	Inverter overload	Latch	-
Enc Wrong Direct	Encoder direction error	Latch	Encoder option
Encoder Error	Encoder error	Latch	Encoder option
Encoder No Connect	Encoder wiring error	Latch	Encoder option
Encoder Tuning Err	Encoder tuning failure	Latch	Encoder option
E-Thermal	Electronic thermal	Latch	Disabled by default
External Trip-1	External signal trip	Latch/ Level	-
External Trip-2			
External Trip-3			
External Trip-4			

LCD Display	Description	Property	Remark
Fuse Open	Fuse open	Latch	Reserved
Gate Power Loss	Power supply circuit error	Latch	-
Ground Fault Trip	Ground fault occurrence	Latch	-
Hw OCS Fail	Overcurrent control operation fault	Latch	-
If Tune Fail	If tuning failure	Latch	-
Input Phase Open	In phase open trip	Latch	-
IO Board Trip	IO board connection trip	Latch	-
KEB Safety Stop	KEB safety stop	Latch	-
Line To Line Short	Short circuit between output phases	Latch	-
Lost Analog In-1	Lost analog input 1	Level	Disabled by default
Lost Analog In-2	Lost analog input 2	Level	Disabled by default
Lost Analog In-3	Lost analog input 3	Level	Disabled by default
Lost Analog In-4	Lost analog input 4	Level	Disabled by default
Lost Ext Ana In-1	Extended IO lost analog input 1	Level	Extended IO option, disabled by default
Lost Ext Ana In-2	Extended IO lost analog input 2	Level	Extended IO option, disabled by default
Lost Ext Ana In-3	Extended IO lost analog input 3	Level	Extended IO option, disabled by default
Lost Ext Ana In-4	Extended IO lost analog input 4	Level	Extended IO option, disabled by default
Lost External 24V	Lost external 24V power	Latch	-
Lost Internal Comm	Lost Internal Communication	Level	Disabled by default
Lost Keypad	Lost keypad (Smart Operator)	Level	Disabled by default
Lost Option Comm	Lost option card communication	Level	-
Lost Power MCU	Power unit fault	Latch	-

LCD Display	Description	Property	Remark
Lost USB	Lost USB connection	Level	Disabled by default
Low Voltage	Inverter low voltage	Latch / Level	-
Ls Tune Fail	Ls tuning failure	Latch	-
Lsigma Tune Fail	Lsigma tuning failure	Latch	-
Main Cap Diag Fail	Main capacitor diagnosis failure	Latch	-
Main Fan Fault	Fan trip	Latch	Default warning output
MC Fault	MC fault	Latch	-
Mechanical Brake	Mechanical brake fault	Latch	-
Motor Over Heat	Motor temperature sensor overheat	Latch/ Warning	Disabled by default
No Motor Trip	Motor connection fault	Latch	-
NTC Open	Temperature sensor open	Latch	-
NTC Short	Temperature sensor short circuit	Latch	-
Option Trip-1	Option 1 installation fault	Latch	Communication option
Option Trip-2	Option 2 installation fault	Latch	Encoder option
Option Trip-3	Option 3 installation fault	Latch	Extension I/O
OutputPhase U Open	Output open phase (U terminal)	Latch	Disabled by default
OutputPhase V Open	Output open phase (V terminal)	Latch	Disabled by default
OutputPhase W Open	Output open phase (W terminal)	Latch	Disabled by default
Over Current	Overcurrent	Latch	-
Over Load	Motor overload	Latch	-
Over Speed	Overspeed	Latch	-
Over Voltage	Overvoltage	Latch	-
Para Write Trip	Parameter writing error	Latch	-
Pole Pos Detect F	PM motor stimulus estimation failure	Latch	-
Pos HW Limit High	H/W upper limit	Latch/ Warning	Position control

LCD Display	Description	Property	Remark
Pos HW Limit Low	H/W lower limit	Latch/ Warning	Position control
Pos Max Track Err	Position control deviation fault	Latch	Position control
Watch Dog	CPU watchdog trip	Fatal	-
Pos Multi Sync F	Multi-position sync failure	Latch	Position control
Pos SW Limit High	S/W upper limit	Latch/ Warning	Position control
Pos SW Limit Low	S/W lower limit	Latch/ Warning	Position control
Pos Tar Bound Err	Target position reach deviation fault	Latch	Position control
Power Index Error	Power unit capacity recognition circuit fault	Level	-
Precharge Fail	Pre-charge relay fault	Latch	-
Pre-PID Fail	Pre-PID failure	Latch	-
Reset Restart Fail	Restart after reset failure	Latch	-
Rs Tune Fail	Rs tuning failure	Latch	-
Speed Deviation	Speed deviation	Latch	-
STO Feedback A	STO A signal fault	Latch/ Level	-
STO Feedback B	STO B signal fault	Latch/ Level	-
STO P05 Fault	Safety circuit fault	Latch	-
STO P24 Fault	Safety circuit fault	Latch	-
System Error-1	CPU fault	Latch	-
Tr Tune Fail	Tr tuning failure	Latch	-
Under Load	Motor under load	Latch	Disabled by default
Prevent Cmd Trip	Operation during the prohibition time for free-run stop restart	Latch	-
Ambient Sensor Flt	Ambient temperature sensor failure	Latch	-
Ambient Over Heat	Ambient temperature overheating	Latch/Warning	Basic Warning
Ambient Under Heat	Ambient temperature low abnormality	Lactch/Warning	Disabled by default

LCD Display	Description	Property	Remark
Ana In Lvl Detect	Analog input level detection abnormality	Latch/Warning	Disabled by default
RP Wire Error	Return pulse connection abnormality	Latch	-

9.5.2 Warning List

Table 4. Warning list

LCD Display	Description	Property	Remark
Over Load Warn	Motor overload	Warning	-
Under Load Warn	Motor under load	Warning	-
Drv Over Load Warn	Inverter overload	Warning	-
Lost Int Comm Warn	Lost Internal Communication	Warning	-
Lost Option Comm	Lost option card communication	Warning	-
Lost Keypad Warn	Lost Smart Operator	Warning	-
Lost USB Warn	Lost USB connection	Warning	-
DB Warn %ED	Exceeding the dynamic braking resistor	Warning	-
Lost Analog In-1	Lost analog input 1	Warning	-
Lost Analog In-2	Lost analog input 2	Warning	-
Lost Analog In-3	Lost analog input 3	Warning	-
Lost Ext Ana In-1	Extended IO lost analog input 1	Warning	-
Lost Ext Ana In-2	Extended IO lost analog input 2	Warning	-
Lost Ext Ana In-3	Extended IO lost analog input 3	Warning	-
MainFan Warning	Fan Warning	Warning	-
AuxFan Warning	Aux fan warning	Warning	-
MainFan Repl Warn	Fan replacement	Warning	-
AuxFan Repl Warn	Aux fan replacement	Warning	-
CtrlFan Repl Warn	Control fan replacement	Warning	-

LCD Display	Description	Property	Remark
PreChargerReplWarn	Pre-charge resistor replacement	Warning	-
Speed->Torque	Speed → torque control change	Status display	-
Torque->Speed	Torque → speed control change	Status display	-
Main Cap Repl Warn	Main capacitor replacement	Warning	-
Low Capacity Warn	Low main capacitor capacity	Warning	-
MainCap Diag Alarm	Main capacitor diagnosis	Warning	-
Power Off Please	Main capacitor diagnosis requires power off	Main capacitor diagnosis	-
AC Input Over Volt	Exceeding the allowable input power	Warning	-
Running Auto Tune	Auto tuning	Status display	-
Pos SW Limit High	S/W upper limit	Warning	-
Pos SW Limit Low	S/W lower limit	Warning	-
Pos HW Limit High	H/W upper limit	Warning	-
Pos HW Limit Low	H/W lower limit	Warning	-
Motor Over Heat	Motor temperature sensor overheat	Warning	-
AC Input Low Volt	Low allowable input power warning	Warning	-
Fire Mode	Operating in Fire Mode	Status display	-
Prevent Run Cmd	Free-run stop prohibition time for restart	Warning	
WebBreak Warn	WEB wire break	Warning	
Ambient Over Heat	Ambient temperature overheating	Warning	
Ambient Under Heat	Ambient temperature low abnormality	Warning	
Ana In Lvl Detect	Analog input level detection abnormality	Warning	
ParameterReset Warn	Parameter abnormal initialization	Warning	
Sync Lost Detect	Sync failed	Warning	

10 Using Built-in Communication Features

This section in the user manual explains how to control the inverter with a PLC or a computer over a long distance using RS485 communication features. To use the RS485 communication features, connect the communication cables and set the communication parameters on the inverter. Refer to the communication protocols and parameters to use RS485 communication features.

10.1 Communication Standards

The S300 product group supports Multi-Drop Link System via RS485 standard communication and offers an interface that is strongly resistant to noise. Please refer to the following table for details about the communication standards.

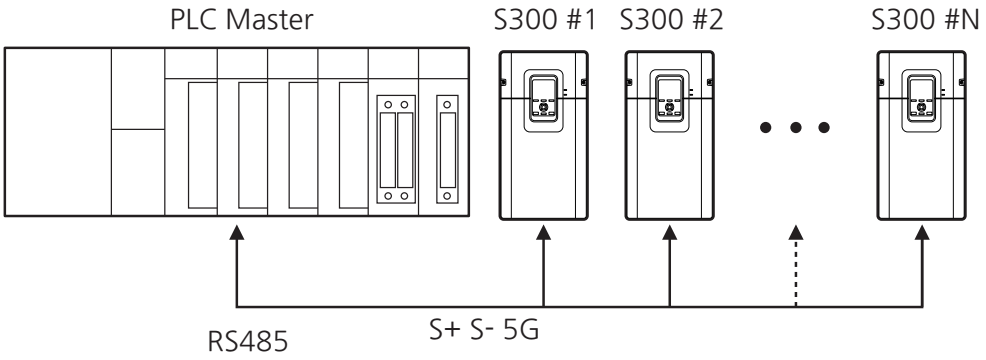
Table 1. S300 Communication Standards

Items	Standard	
	Slave	Simple Master
Communication method/ Transmission type	RS485/Bus, Multi-Drop Link System	
Protocol	Modbus-RTU, LS INV 485	Modbus-RTU
Number of Inverter Connections	Maximum of 31	• For reading and writing in each slave: Maximum of 5 • For reading or writing in each slave: Maximum of 10
Transmission Distance	Maximum of 1,200 m (recommended distance: within 700 m)	
Recommended cable size	0.75 mm^2 (18 AWG), shielded twisted pair	
Installation type	Connect to dedicated terminals (S+, S-, and 5G) of the control terminal block	
Communication speed	1200/2400/4800/9600/19200/38400/57600/115200 bps available	
Control procedure	Asynchronous communication system	
Communication system	Half duplex system	
Stop bit length	1-bit/2-bit	
Frame error check	2 bytes	
Parity Check	None/Even/Odd	

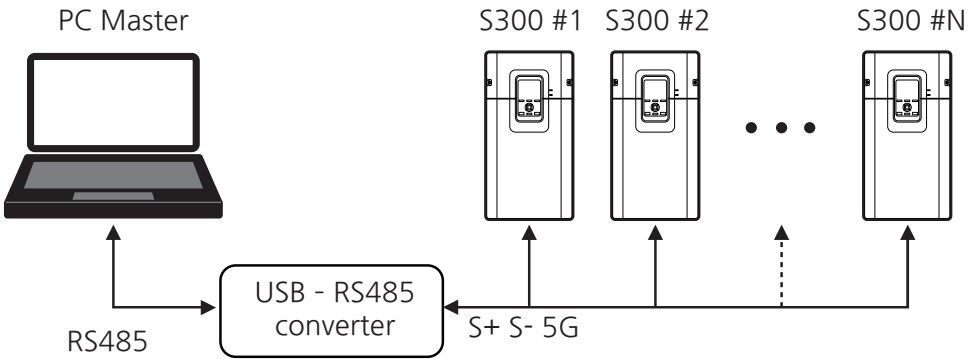
10.2 Communication System Configuration

In the RS485 communication system, the S300 basically works as a slave and can be connected via various superordinate controllers.

10.2.1 Slave Inverter Composition



[Image 1. Slave Inverter Composition (Superordinate Controller: PLC)]



[Image 2. Slave Inverter Composition (Superordinate Controller: PC)]

- Connecting to RS485 terminal: Connect to S+, S-, or 5G of the terminal block.
- Always terminate (set INTC-07 Termi Resistor En to 1 [ON]) both ends of the wiring.
- Number of connectible inverters: You can connect up to 31 inverters (up to 10 inverters for simple master composition).
- Number of expandable station IDs: 1-250
- Valid length of communication line: The maximum length of communication line is 1,200 meters, but it is recommended to use no more than 700 meters of communication line to ensure stable communication.
- Use a repeater to enhance communication speed when using lines longer than 1,200 meters or a large number of devices. Repeaters are effective for environments with severe noise.

10.2.2 Parameter Settings for Slave Communication

Before proceeding with setting communication configurations, make sure that the communication lines are connected properly. Turn on the inverter and set the communication parameters.

Group	Code	LCD Display	Set Value		Setting Range		Initial Value	Unit
INTC	01	Station ID	1		Modbus RTU	1~250 [1]	1	-
					LS INV 485	1~31 [2]		
					RTU Master	1~250 [1]		
	02	Protocol	0	ModBus RTU	0~2		0	-
	03	Baud Rate	3	9600 bps	0~7		3	-
	04	RS485 Mode	0	D8 / PN / S1	0~3		0	-
	05	Response Delay	5		0~1000		5	msec
	06	Modbus Addr Mode	0	No	0~1		1	-
			1	Yes				
	07	Termi Resistor En	0	Off	0~1		0	-
			1	On				
	98	Error Count	-		-		0	-
	99	Error Count Reset	0	No	0~1		0	-
			1	Yes				

[1] Shown when communication protocol (INTC-02 Protocol) is 0 (Modbus RTU).
[2] Shown when communication protocol (INTC-02 Protocol) is other than 0 (Modbus RTU).

Communication Parameters Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td>INTC-01 Station ID</td><td colspan="3">Sets the station ID of the inverter.
You can set station ID between 1-250 or 1-31 depending on the setting values at INTC-02.</td></tr>
<tr><td>INTC-02 Protocol</td><td colspan="3">Select one of the two built-in protocols: Modbus-RTU or LS INV 485.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Modbus RTU</td><td>Modbus-RTU compatible protocol</td></tr>
<tr><td>1</td><td>LS INV 485</td><td>Dedicated protocol for the LS inverter</td></tr>
<tr><td>2</td><td>Modbus RTU Master</td><td>Refer to manual of DriveVIew 9,
the PC software used to connect our inverters</td></tr>
</table></td></tr>
<tr><td>INTC-03 Baud Rate</td><td colspan="3">Sets the communication speed. You can set it up to 115200 bps.
The maximum setting range depends on the protocol.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>1200bps</td><td>a communication speed of 1200 bps</td></tr>
<tr><td>1</td><td>2400bps</td><td>a communication speed of 2400 bps</td></tr>
<tr><td>2</td><td>4800bps</td><td>a communication speed of 4800 bps</td></tr>
<tr><td>3</td><td>9600bps</td><td>a communication speed of 9600 bps</td></tr>
<tr><td>4</td><td>19200bps</td><td>a communication speed of 19200 bps</td></tr>
<tr><td>5</td><td>38400bps</td><td>a communication speed of 38400 bps</td></tr>
<tr><td>6</td><td>56000bps</td><td>a communication speed of 56000 bps</td></tr>
<tr><td>7</td><td>115Kbps</td><td>a communication speed of 115200 bps</td></tr>
</table></td></tr>
<tr><td>INTC-04 RS485 Mode</td><td colspan="3">Set a communication configuration. Set the data length, parity check method, and the number of stop bits.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>D8 / PN / S1</td><td>8-bit data / no parity check / 1 stop bit</td></tr>
<tr><td>1</td><td>D8 / PN/ S2</td><td>8-bit data / no parity check / 2 stop bits</td></tr>
<tr><td>2</td><td>D8 / PE / S1</td><td>8-bit data / even parity / 1 stop bit</td></tr>
<tr><td>3</td><td>D8 / PO / S1</td><td>8-bit data / odd parity / 1 stop bit</td></tr>
</table></td></tr>
<tr><td>INTC-05 Response Delay</td><td colspan="3">Sets time for the slave (inverter) to respond to the master (PLC or inverter). Response time is used in a system where the slave device response is too fast for the master device to process. Set this code to an appropriate value for smooth master-slave communication.</td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>INTC-06 Modbus AddrMode</td><td>
When using modbus-RTU, the modbus address will be 1 subtracted from the parameter address of the inverter.
However, to use the inverter parameter address as itself, set this parameter to 0 (No), and you can use the same address for modbus and inverter parameter.
When it is currently operating at 60.00 Hz with the output current of 1.0 A, if you read the output frequency (0311h) as follows, the inverter will respond as follows according to the setting values at INTC-06:

[Master → Slave]
<table>
<tr><th>Station ID</th><th>Function</th><th>Address (Hi)</th><th>Address (Lo)</th><th>#of Points (Hi)</th><th>#of Points (Lo)</th><th>CRC Lo</th><th>CRC Hi</th></tr>
<tr><td>01</td><td>03</td><td>03</td><td>12</td><td>00</td><td>01</td><td>xx</td><td>xx</td></tr>
</table>
[Slave→ Master]
When INTC-06 is set to 1 (Yes)

Modbus address: 0312h
Inverter communication address: 0311h (output frequency of 60.00 Hz)

<table>
<tr><th>Station ID</th><th>Function Code</th><th>Byte Count</th><th>Data (Hi)</th><th>Data (Hi)</th><th>Data (Lo)</th><th>CRC Lo</th><th>CRC Hi</th></tr>
<tr><td>01</td><td>03</td><td>02</td><td>17</td><td>70</td><td>xx</td><td>xx</td><td>xx</td></tr>
</table>
</td></tr>
<tr><td>INTC-06 Modbus AddrMode</td><td>
When INTC-06 is set to 0 (No)

Modbus address: 0312h
Inverter communication address: 0312h (output current of 1.0 A)

<table>
<tr><th>Station ID</th><th>Function Code</th><th>Byte Count</th><th>Data (Hi)</th><th>Data (Hi)</th><th>Data (Lo)</th><th>CRC Lo</th><th>CRC Hi</th></tr>
<tr><td>01</td><td>03</td><td>02</td><td>00</td><td>0A</td><td>xx</td><td>xx</td><td>xx</td></tr>
</table>
</td></tr>
<tr><td>INTC-07 Termi Resistor En</td><td>Set this parameter to 1 (On) to activate terminating resistance of the built-in RS485 communication.</td></tr>
<tr><td>INTC-98 Error Count
INTC-99 Error Count Reset</td><td>INTC-98 counts and displays the number of error responses from the built-in communication. You can check incorrect function codes or data from the master in this count. Set INTC-99 to 1 (Yes) to initialize the count to 0.</td></tr>
</table>

10.2.3 Setting Operation Command and Frequency

Set DRV-10 (1st Command Source) to 4 (Internal Comm.) and DRV-11 (1st Freq Ref Src) code to 6 (Internal Comm.) in order to set the operation command and frequency to the parameters in the common area via communication. Refer to **5.2.1 Setting Methods of Operation Commands** for operation commands and **5.1.1 Operating Frequency Settings** for set frequency commands.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
DRV	10	1st Command Source	4	Internal Comm.	0~6	-	
	11	1st Freq Ref Src	6	Internal Comm.	0~8	-	

10.2.4 Command Loss Protection Settings

Configure decision standards and protective operations when a communication problem lasts for a specified period of time.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
PRT	01	Trip Dec Time	30.00		0.00~6000.00	30.00	sec
	14	Lost Preset Freq	0.00		0.00~Max Frequency [3]	0.00	Hz
	15	Lost Preset Speed	0		0~Maximum Speed [4]	0	rpm
	17	Lost IntComm Mode	0	None	0~4	0	-
	18	Lost IntComm Time	1.0		0.1~120.0	1.0	sec

* When the speed unit is rpm (select 1 [rpm Display] in DRV-32 [Hz/rpm Select]), gray shaded areas will be visible.

[3] DRV-20(Max Frequency)
[4] DRV-21(Maximum Speed)

Command Loss Protective Operation Setting Details

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td rowspan="6">PRT-17 Lost IntComm Mode, PRT-18 Lost IntComm Time</td><td colspan="3">Selects inverter operation to run when a communication error has occurred and lasted for the time set at PRT-18.</td></tr>
<tr><td colspan="2">Item</td><td>Functionality</td></tr>
<tr><td>0</td><td>None</td><td>The speed command immediately becomes the operation frequency without any protection function.</td></tr>
<tr><td>1</td><td>CoastStop (FreeRun)</td><td>The inverter output is blocked. The motor will CoastStop(FreeRun).</td></tr>
<tr><td>2</td><td>Trip Dec Time Stop</td><td>The motor will decelerate and then stop at the frequency set at PRT-01 (Trip Dec Time).</td></tr>
<tr><td>3</td><td>Warning</td><td>Operates at the previous command speed under warning.</td></tr>
<tr><td>4</td><td>Lost Preset</td><td>Operates at the frequency set at PRT-14 (Lost Preset Freq).</td></tr>
</table>

10.3 Communication Parameter Address Operation

10.3.1 Parameters for Common Area

Communication Address	parameter	Scale	Unit	Details	
0000h	Inverter model	-	-	0x11	S300
0001h	Inverter capacity	-	-	1	0 .4kW
				2	0.75kW
				3	1.1kW
				4	1.5kW
				5	2.2lW
				6	3kW
				7	3.7kW
				8	4kW
				9	5.5kW
				10	7.5kW
				11	11kW
				12	15kW
				13	18.5kW
				14	22kW
				15	30kW
				16	37kW
				17	45kW
				18	55kW
				19	75kW
				20	90kW
				21	110kW
				22	132kW
				23	160kW
				24	185kW
				25	220kW

Communication Address	parameter	Scale	Unit	Details	
0002h	Inverter input voltage	-	-	0	200 V class
				1	400 V class
0003h	Inverter software version	-	-	0066h	Version 1.00 (Example)
0004h	Reserved	-	-	-	
0005h	Command frequency	0.01	Hz	-	
0006h	Operation command	-	-	B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5	Reserved
				B4	CoastStop(FreeRun) stop
				B3	Fault reset
				B2	Rev
				B1	Fwd
				B0	Stopped
0007h	Acceleration time	0.1	sec	-	
0008h	Deceleration time	0.1	sec	-	
0009h	Output current	0.1	A	-	
000Ah	Output frequency	0.01	Hz	-	
000Bh	Output voltage	1	V	-	
000Ch	DC link voltage	1	V	-	
000Dh	Output power	0.1	kW	-	

Communication Address	parameter	Scale	Unit	Details	
000Eh	Operation status	-	-	B15 B14 B13 B12 B11 B10 B9 B8 B7 B6	Reserved
				B5	Decelerating
				B4	Accelerating
				B3	Fault (trip)
				B2	Operating in reverse direction
				B1	Operating in forward direction
				B0	Stopped
000Fh	Fault trip information	O	-	0	Normal state
				1	Tripped

Communication Address	parameter	Scale	Unit	Details	
0010h	Input terminal information	-	-	B15 B14 B13 B12 B11 B10 B9 B8	Reserved
				B7	DI8
				B6	DI7
				B5	DI6
				B4	DI5
				B3	DI4
				B2	DI3
				B1	DI2
				B0	DI1
0011h	Output terminal information	-	-	B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3	Reserved
				B2	DO3
				B1	DO2
				B0	DO1
0012h	AI1	0.01	%	-	
0013h	AI2	0.01	%	-	
0014h	AI3	0.01	%	-	
0015h	Rotational speed of the motor	1	rpm	-	

Communication Address	parameter	Scale	Unit	Details
001Ah	Displays the Hz or rpm	-	-	-
001Bh	Displays the number of poles of the motor	-	-	-
001Ch~00FFh	Reserved	-	-	-

10.3.2 Parameters for Expanded Common Area

10.3.2.1 Monitored Area

<table>
<tr><th>Communication Address</th><th>parameter</th><th>Scale</th><th>Unit</th><th colspan="3">Details</th></tr>
<tr><td>0300h</td><td>Inverter model</td><td>-</td><td>-</td><td>S300</td><td colspan="2">0011h</td></tr>
<tr><td rowspan="15">0301h</td><td rowspan="15">Inverter capacity</td><td rowspan="15">-</td><td rowspan="15">-</td><td colspan="3">Definition by Data Bit</td></tr>
<tr><td>B15</td><td colspan="2">Unit</td></tr>
<tr><td rowspan="3">B14</td><td>0</td><td>W</td></tr>
<tr><td>1</td><td>kW</td></tr>
<tr><td>10</td><td>MW</td></tr>
<tr><td>B13
B12
B11
B10
B9
B8
B7
B6
B5
B4</td><td colspan="2">Capacity above the decimal point</td></tr>
<tr><td>B3
B2
B1
B0</td><td colspan="2">Capacity below the decimal point</td></tr>
<tr><td colspan="3">Value per Capacity (Example)</td></tr>
<tr><td>400W</td><td colspan="2">1900h</td></tr>
<tr><td>1.5kW</td><td colspan="2">4015h</td></tr>
<tr><td>7.5kW</td><td colspan="2">4075h</td></tr>
<tr><td>18.5kW</td><td colspan="2">4125h</td></tr>
<tr><td>75kW</td><td colspan="2">44B0h</td></tr>
<tr><td>220kW</td><td colspan="2">4DC0h</td></tr>
<tr><td>280kW</td><td colspan="2">5180h</td></tr>
</table>

Communication Address	parameter	Scale	Unit	Details		
0302h	Inverter input	-	-	Voltage/Power Type (Single Phase, Three Phase)		Cooling type
				0231h	200 V / 3-phase	Powerful cooling
				0431h	400 V / 3-phase	Powerful cooling
0303h	Inverter software version	-	Hex	0066h	Version 1.00 (Example)	
0304h	Inverter capacity	-	Hp	-		

Communication Address	parameter	Scale	Unit	Details		
0305h	Inverter operation state	-	-	B15	0	Trip occurred
				B14	2	Warning occurred
				B13	4	Operation disabled
				B12	8	Normal state
				B11 B10 B9 B8	Reserved	
				B7 B6 B5 B4	1	Speed searching
					2	Accelerating
					3	At constant speed
					4	Decelerating
					5	Decelerating to stop
					6	H/W overcurrent suppression
					7	S/W overcurrent suppression
					8	Dwell operating
				B3 B2 B1 B0	0	Stopped
					1	Operating in forward direction
					2	Operating in reverse direction
					3	Operating DC

Communication Address	parameter	Scale	Unit	Details		
0306h	Inverter operation, frequency command source	-	-	B15 B14 B13 B12 B11 B10 B9 B8	Operation command source	
					0	Smart Operator
					1	Communication option
					3	Built-in RS485 communication
					4	Terminal block
					5	USB
				B7 B6 B5 B4 B3 B2 B1 B0	Frequency command source	
					0	Smart Operator speed
					1	Smart Operator torque
					2~4	Up/down operation speed
					5	AI1
					6	AI2
					7	AI3
					9	Pulse
					10	Built-in RS485 communication
					11	Communication option
					13	Jog
					14	PID
					15	USB
					25	Multi-step

Communication Address	parameter	Scale	Unit	Details	
0307h	Smart Operator software version	-	-	0064h	Version 1.00 (example)
0308h	Smart Operator title version	-	-	0065h	Version 1.01 (example)
0309h	Reserved	-	-	-	
030Ah	Target frequency	-	Hz	Final target frequency applied to the inverter	
030Bh	Target speed	-	rpm	Final target speed applied to the inverter	
030Ch	Target torque	-	%	Final target torque applied to the inverter	
030Dh	Acceleration time	-	sec	Final acceleration time applied to the inverter	
030Eh	Deceleration time	-	sec	Final deceleration time applied to the inverter	
030Fh	AC input voltage	-	V	-	
0310h	Output current	0.1	A	-	
0311h	Output frequency	0.01	Hz	-	
0312h	Output rpm	0	rpm	-	
0313h	Feedback speed of the motor	-	-	-	
0314h	Output voltage	1	V	-	
0315h	DC link voltage	1	V	-	
0316h	Output power	0.1	kW	-	
0317h	Output torque	0.1	%	-	
0318h	PPID reference	0.1	%	PID reference value	
0319h	PPID feedback	0.1	%	PID feedback value	
031Ah	Number of poles of motor 1	-	-	Displays the number of poles of the 1st motor	
031Bh	Number of poles of motor 2	-	-	Displays the number of poles of the 2nd motor	
031Ch	Number of poles of the motor	-	-	Displays the number of poles of the selected motor	

Communication Address	parameter	Scale	Unit	Details	
031Dh	rpm/Hz	-	-	0	Unit of Hz
				1	Unit of rpm
031Eh	Reserved	-	-	-	
031Fh	Reserved	-	-	-	
0320h	Digital input information	-	-	B15 B14 B13 B12 B11 B10 B9 B8	Reserved
				B7	DI8
				B6	DI7
				B5	DI6
				B4	DI5
				B3	DI4
				B2	DI3
				B1	DI2
				B0	DI1

Communication Address	parameter	Scale	Unit	Details	
0321h	Digital output information	-	-	B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3	Reserved
				B2	DO3
				B1	DO2
				B0	DO1

Communication Address	parameter	Scale	Unit	Details	
0322h	Virtual digital input information	-	-	B15	Virtual DI16
				B14	Virtual DI15
				B13	Virtual DI14
				B12	Virtual DI13
				B11	Virtual DI12
				B10	Virtual DI11
				B9	Virtual DI10
				B8	Virtual D 9
				B7	Virtual DI8
				B6	Virtual DI7
				B5	Virtual DI6
				B4	Virtual DI5
				B3	Virtual DI4
				B2	Virtual DI3
				B1	Virtual DI2
				B0	Virtual DI1

Communication Address	parameter	Scale	Unit	Details	
0323h	Virtual digital output information	-	-	B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4	Reserved
				B3	Virtual DO4
				B2	Virtual DO3
				B1	Virtual DO2
				B0	Virtual DO1
0324h	Information on analog input 1 (V1, I1)	0.01	%	AI1	
0325h	Information on analog input 2 (V2, I2)	0.01	%	AI2	
0326h	Information on analog input 3 (V3, I3)	0.01	%	AI3	
0327h	Reserved	-	-	-	
0328h	Information on analog output 1	0.01	%	AO1(I/O board)	
0329h	Information on analog output 2	0.01	%	AO2(I/O board)	
032Ah	Reserved	-	-	-	
032Bh	Reserved	-	-	-	
032Ch	Reserved	-	-	-	
032Dh	Temperature	1	℃	NTC temperature	

Communication Address	parameter	Scale	Unit	Details
032Eh	Inverter power consumption	-	kWh	-
032Fh	Inverter power consumption	-	MWh	-
0330h	Reserved	-	-	-
0331h	Reserved	-	-	-
0332h	Reserved	-	-	-
0333h	Reserved	-	-	-
0334h	Reserved	-	-	-
0335h~ 0339h	Reserved	-	-	-
033Ah	PPID Output	0.1	%	PPID output
033Bh	PPID Reference Unit	Unit	Unit	Value according to PPID Reference and PPID Unit settings
033Ch	PPID Feedback Unit	Unit	Uint	Value according to PPID Feedback and PPID Unit settings
033Dh- 0339h	Reserved	-	-	-
0340h	Power time (date)	0	day	Total number of days the inverter has been powered on
0341h	Power time (minute)	0	min	Total number of minutes excluding the total number of days in power time
0342h	Operating time (date)	0	day	Total number of days the inverter has driven the motor for
0343h	Operating time (minute)	0	min	Total number of minutes excluding the total number of days in operating time
0344h	Fan time (date)	0	day	Total number of days the heat sink fan has been running
0345h	Fan time (minute)	0	min	Total number of minutes excluding the total number of days in fan time
0346h- 034Fh	Reserved	-	-	-
0350h	EPID1 output	0.1	%	EPID1 output

Communication Address	parameter	Scale	Unit	Details
0351h	EPID1 reference	0.1	%	EPID1 reference
0352h	EPID1 feedback value	0.1	%	EPID1 feedback value
0353h	EPID1 unit reference	Unit	Unit	Value according to EPID1 Reference and EPID1 Unit settings
0354h	EPID1 unit feedback value	Unit	Unit	Value according to EPID1 feedback value and EPID1 Unit settings
0355h-0356h	Reserved	-	-	-
0357h	EPID2 output	0.1	%	EPID2 output
0358h	EPID2 reference	0.1	%	EPID2 reference
0359h	EPID2 feedback value	0.1	%	EPID2 feedback value
035Ah	EPID2 unit reference	Unit	Unit	Value according to EPID2 Reference and EPID2 Unit settings
035Bh	EPID2 unit feedback value	Unit	Unit	Value according to EPID2 feedback value and EPID2 Unit settings

10.3.2.2 Parameters for Inverter Control Area

Communication Address	parameter	Scale	Unit	Details		
0380h	Frequency command	0.01	Hz	Set command frequencies		
0381h	rpm command	1	rpm	Command rpm settings		
0382h	Operation command	-	-	B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4	Reserved	
				B3	CoastStop(FreeRun) stop	
				B2	Trip reset	
				B1	0	Rev
					1	Fwd
				B0	Run	
0383h	Acceleration time	0.1	sec	Acceleration time setting		
0384h	Deceleration time	0.1	sec	Deceleration time setting		

Communication Address	parameter	Scale	Unit	Details	
0385h	Virtual digital input control (0: Off, 1: On)	-	-	B15	Virtual DI16
				B14	Virtual DI15
				B13	Virtual DI14
				B12	Virtual DI13
				B11	Virtual DI12
				B10	Virtual DI11
				B9	Virtual DI10
				B8	Virtual DI9
				B7	Virtual DI8
				B6	Virtual DI7
				B5	Virtual DI 6
				B4	Virtual DI 5
				B3	Virtual DI 4
				B2	Virtual DI 3
				B1	Virtual DI 2
				B0	Virtual DI 1

Communication Address	parameter	Scale	Unit	Details	
0386h	Virtual digital output control (0: Off, 1: On)	-	-	B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4	Reserved
				B3	Virtual DO4 Const
				B2	Virtual DO3 Const
				B1	Virtual DO2 Const
				B0	Virtual DO1 Const
0387h	Reserved	-	-	-	
0388h	PID reference	0.1	%	-	
0389h	PID feedback value	0.1	%	-	
038Ah	Reserved	-	-	-	
038Bh	Reserved	-	-	-	
038Ch	Forward speed limit	-	Hz	Sets the forward limit frequency	
038Dh	Reverse speed limit	-	Hz	Sets the reverse limit frequency	
038Eh	Reserved	-	-	-	
038Fh	Reserved	-	-	-	
0390h	Torque command	0.1	%	Sets the command torque	
0391h	Forward motoring torque limits	0.1	%	Sets the forward motoring torque limit	

Communication Address	parameter	Scale	Unit	Details
0392h	Forward regenerative torque limits	0.1	%	Sets the forward regenerative torque limits
0393h	Reverse motoring torque limits	0.1	%	Sets the reverse motoring torque limit
0394h	Reverse regenerative torque limits	0.1	%	Sets the reverse regenerative torque limit
0395h	Reserved	-	-	-
0396h	Forward speed limit	1	rpm	Sets the forward limit speed
0397h	Reverse speed limit	1	rpm	Sets the reverse limit speed
0398h ~0399h	Reserved	-	-	-
039Ah	Anytime Parameter items	-	-	Sets Smart Operator Anytype Parameter items (refer to **12.2 Monitoring Settings**)
039Bh	Monitor 1 line-1 item	-	-	Sets Smart Operator monitor 1 items (refer to **12.2 Monitoring Settings**)
039Ch	Monitor 1 line-2 item	-	-	
039Dh	Monitor 1 line-3 item	-	-	
039Eh ~039Fh	Reserved	-	-	-
03A0h	EPID1 reference	0.1	%	EPID1 reference
03A1h	EPID1 feedback value	0.1	%	EPID1 feedback value
03A2h	EPID1 unit reference	EPID Unit	EPID Unit	EPID1 unit reference
03A3h	EPID1 unit feedback value	EPID Unit	EPID Unit	EPID1 unit feedback value
03A4h	Reserved	-	-	-
03A5h	EPID2 reference	0.1	%	EPID2 reference

Communication Address	parameter	Scale	Unit	Details
03A6h	EPID2 feedback value	0.1	%	EPID2 feedback value
03A7h	EPID2 unit reference	EPID Unit	EPID Unit	EPID2 unit reference
03A8h	EPID2 unit feedback value	EPID Unit	EPID Unit	EPID2 unit feedback value
03A9h ~03AFh	Reserved	-	-	-
03B0h	Monitor 2 line-1 item	-	-	Sets Smart Operator monitor 2 items (refer to **12.2 Monitoring Settings**)
03B1h	Monitor 2 line-2 item	-	-	
03B2h	Monitor 2 line-3 item	-	-	
03B3h	Monitor 2 line-4 item	-	-	
03B4h	Monitor 2 line-5 item	-	-	
03B5h	Monitor 2 line-6 item	-	-	
03B6h	Monitor gauge item	-	-	
03B7h	Monitor graph item	-	-	
03B8h-03BFh	Reserved	-	-	-
03C0h	WEB main speed value	0.01	%	Main speed value during winder/ unwinder operation
03C1h	WEB PID reference	0.01	%	PID reference value during winder/ unwinder operation
03C2h	WEB PID feedback	0.01	%	PID feedback value during winder/ unwinder operation

10.3.2.3 Parameters for Inverter Memory Control Area

Communication Address	parameter	Scale	Unit	Details
03E0h	Save parameters	-	-	Save parameters
03E1h	Monitor mode initialization	-	-	Monitor mode initialization
03E2h	Parameter initialization	-	-	Parameter initialization (Refer to **12.1.4 Parameter Initialization**.)
03E3h	Changed parameter display	-	-	Changed parameter display
03E4h	Reserved	-	-	-
03E5h	Delete all trip history	-	-	Delete all trip history
03E6h	Reserved	-	-	-
03E7h	Hide parameter mode	-	-	Hide parameter mode
03E8h	Lock parameter edit	-	-	Lock/lift parameter edit (toggle available)
03E9h	Reserved	-	-	-
03EAh	Reserved	-	-	-
03EBh	Initialize the cumulative inverter operation time	-	-	Initialize the cumulative inverter operation time
03ECh	Initialize the cumulative cooling fan operation time	-	-	Initialize the cumulative cooling fan operation time

10.3.2.4 Parameters for Inverter Trip Mode Area (Read Only)

Communication Address	parameter	Scale	Unit	Details	
0400h	Index of the first current trip	-	-	0	ADC Offset
				1	Watchdog
				2	Gate Power Loss
				3	Main OS Error
				4	Over Load
				5	Under Load
				6	Inverter Over Load
				7	E-Thermal
				8	Ground Fault
				9	Out Phase U Open
				10	In Phase Open
				11	Over Speed
				12	Speed Deviation
				13	Drv Over Heat
				14	NTC Open
				15	NTC Short
				16	Over Current
				17	Over Voltage
				18	IO Board
				19	BX
				20	Mechanical Brake
				21	External 1
				22	External 2
				23	External 3
				24	External 4
				25	Arm Short

Communication Address	parameter	Scale	Unit	Details	
0400h	Index of the first current trip	-	-	26	Fuse Open
				27	Encoder
				28	Encoder No Connection
				29	Encoder Wrong Dir
				30	Motor Over Heat
				31	Main Fan Fault
				32	Parameter Write
				33	Pre PID Fail
				34	No Motor
				35	Option 1
				36	Option 2
				37	Option 3
				38	Low Voltage
				39	Lost Sensor
				40	Lost Int Comm
				41	Lost Opt Comm
				42	Lost Keypad
				43	Lost USB
				44	Lost AI 1
				45	Lost AI 2
				46	Lost AI 3
				47	Lost AI 4
				48	Lost Ext AI 1
				49	Lost Ext AI 2
				50	Lost Ext AI 3
0400h	Index of the first current trip	-	-	51	Lost Ext AI 4
				52	STO Feedback A

Communication Address	parameter	Scale	Unit	Details	
0400h	Index of the first current trip	-	-	53	STO Feedback B
				54	STO P24 Fault
				55	STO P5 Fault
				56	Aux Fan Fault
				57	Control Fan Fault
				58	Data Storage
				59	Precharge Fail
				60	H/W OCS Fail
				61	TR Tune Fail
				62	RS Tune Fail
				63	SLS Tune Fail
				64	LS Tune Fail
				65	IF Tune Fail
				66	MC Fault
				67	Reserved
				68	Lost P24V
				69	Out Phase V Open
				70	Out Phase W Open
				71	Reset/Restart Fail
				72	Outline Short
				73	KEB Safety Stop
				74	System Error-1
				75	Br Release Invalid
				76	Br Releasing Fail
				77	Br Engaging Fail
				78	Main Cap Diag Fail
				79	Encoder Tuning Err

Communication Address	parameter	Scale	Unit	Details	
0400h	Index of the first current trip	-	-	80	Pole Pos Detect F
				81	Pos Max Track Err
				82	Pos Tar Bound Err
				83	Pos SW Limit High
				84	Pos SW Limit Low
				85	Pos HW Limit High
				86	Pos HW Limit Low
				87	Pos Multi Sync F
				88	Cur Pos Overf Err
				89	Power Index Error
				90	CAN Bus Error
				91	Prevent Cmd Trip
				92	WebBreak Trip
				93	Ambient Sensor Flt
				94	Ambient Over Heat
				95	Ambient Under Heat
				96	Ana In Lvl Detect
				97	RP Wire Error
				FFFFh	None
0401h	Index of the second current trip	-	-	Same as 0400h	
0402h	Index of the third current trip	-	-		
0403h	Index of the fourth current trip	-	-	Same as 0400h	
0404h	Index of the fifth current trip	-	-		
0405h	Output frequency right before a trip	0.00	Hz	Displays the output frequency	

Communication Address	parameter	Scale	Unit	Details	
0406h	Output current right before a trip	-	-	Displays output current	
0407h	Inverter status right before a trip	0		0	Stopped
				1	Zero speed operation
				2	Acceleration operation
				3	Deceleration operation
				4	Operation at a constant speed
				5	Torque operation
0408h	DC Link voltage right before a trip	0	V	Displays DC link voltage	
0409h	Status of the input terminal block right before a trip	-	BIT	B15 B14 B13 B12 B11 B10 B9 B8	Reserved
				B7	DI8 (default I/O)
				B6	DI7 (default I/O)
				B5	DI6 (default I/O)
				B4	DI5 (default I/O)
				B3	DI4 (default I/O)
				B2	DI3 (default I/O)
				B1	DI2 (default I/O)
				B0	DI1 (default I/O)

Communication Address	parameter	Scale	Unit	Details	
040Ah	Status of the output terminal block right before a trip	-	BIT	B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3	Reserved
				B2	DO3 (default I/O)
				B1	DO2 (default I/O)
				B0	DO1 (default I/O)
040Bh	Total time of power supply to the inverter LO WORD	-	-	Displays the total time of power supply to the inverter (However, time of trip occurrence will be displayed when there is an RTC option to tell the exact time.)	
040Ch	Total time of power supply to the inverter HI WORD	-	-		
040Dh	Total time of inverter operation LO WORD	-	-	Displays the total time of motor operation by the inverter	
040Eh	Total time of inverter operation HI WORD	-	-		
040Fh	Reserved	-	-	-	
0410h	Inverter temperature right before a trip	0	°C	-	
0411h~ 041Fh	Reserved	-	-	-	

Communication Address	parameter	Scale	Unit	Details	
0420h	Index of current warning	-	-	0	Over Load
				1	Under Load
				2	Inverter Over Load
				3	Lost Int Comm
				4	Lost Opt Comm
				5	Lost Keypad
				6	Lost USB
				7	Dynamic Brake
				8	Lost AI1
				9	Lost AI2
				10	Lost AI3
				11	Lost AI4
				12	Lost Ext AI1
				13	Lost Ext AI2
				14	Lost Ext AI3
				15	Lost Ext AI4
				16	Main Fan Lock
				17	Aux Fan Lock
				18	Control Fan Lock
				19	Main Fan Replace
				20	Aux Fan Replace
				21	Control Fan Replace
				22	Precharger Replace
				23	Torque->Speed
				24	Speed->Torque
				25	Main Cap Repl Warn
				26	Low Capacity Warn

Communication Address	parameter	Scale	Unit	Details	
0420h	Index of current warning	-	-	27	MainCap Diag Alarm
				28	Power Off Please
				29	AC Input Over Volt
				30	Running Auto Tune
				31	Pos SW Limit High
				32	Pos SW Limit Low
				33	Pos HW Limit High
				34	Pos HW Limit Low
				35	Motor Over Heat
				36	AC Input Low Volt
				37	Fire Mode
				38	Prevent Run Cmd
				39	WebBreak Warn
				40	Ambient Over Heat
				41	Ambient Under Heat
				42	Ana In Lvl Detect
				43	ParameterReset Warn
				44	Sync Lost Detect
0422h	Output frequency right before an alarm occurrence	0.00	Hz	Displays the output frequency	
0423h	Output current right before an alarm occurrence	0.0	A	Displays output current	

Communication Address	parameter	Scale	Unit	Details	
0424h	Inverter status right before an alarm occurrence	0	-	0	Stopped
				1	Acceleration operation
				2	Deceleration operation
				3	Operation at a constant
				4	speed
				5	Torque operation
0425h	DC Link voltage right before an alarm occurrence	0	V	Displays DC link voltage	
0426h	Input terminal block status right before an alarm occurrence	-	-	B15 B14 B13 B12 B11 B10 B9 B8	Reserved
				B7	DI8(default I/O)
				B6	DI7(default I/O)
				BI5	DI6(default I/O)
				B4	DI5(default I/O)
				B3	DI4(default I/O)
				B2	DI3(default I/O)
				B1	DI2(default I/O)
				B0	DI1(default I/O)

Communication Address	parameter	Scale	Unit	Details	
0427h	Output terminal block status right before an alarm occurrence	-	-	B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3	Reserved
				B2	DO3(default I/O)
				B1	DO2(default I/O)
				B0	DO1(default I/O)
0428h	Total time of power supply to the inverter LO WORD	-	-	Displays the total time of power supply to the inverter (However, time of trip occurrence will be displayed when there is a RTC option to tell the exact time.)	
0429h	Total time of power supply to the inverter HI WORD	-	-		
042Ah	Total time of inverter operation LO WORD	-	-	Displays the total time of motor operation by the inverter	
042Bh	Total time of inverter operation HI WORD	-	-		
042Ch	Reserved	-	-	-	
042Dh	Inverter temperature right before alarm occurrence	0	°C	-	
042Eh~ 042Fh	Reserved	-	-	-	

Communication Address	parameter	Scale	Unit	Details
0430h	Current number of recorded trip histories	-	-	-
0430h	Select trip history	-	-	Trip history ID to be displayed from 0432h to 0442h (0~4) • Trip history ID 0: Most recent occurrence • Trip history ID 4: Oldest occurrence
0432h	First trip type	-	-	Trip history ID set in 0431h
0433h	Second trip type	-	-	Trip history ID set in 0431h
0434h	Third trip type	-	-	Trip history ID set in 0431h
0435h	Fourth trip type	-	-	Trip history ID set in 0431h
0436h	Fifth trip type	-	-	Trip history ID set in 0431h
0437h	Output frequency at the time of trip occurrence	0.00	Hz	Trip history ID set in 0431h
0438h	Output current	0.0	A	Trip history ID set in 0431h
0439h	Inverter status right before a trip	0	-	Trip history ID set in 0431h 0 Stopped 1 Zero speed operation 2 Acceleration operation 3 Deceleration operation 4 Operation at a constant speed
043Ah	DC Link voltage right before a trip	0	V	Trip history ID set in 0431h

Communication Address	parameter	Scale	Unit	Details	
043Bh	Status of the input terminal block right before a trip	-	-	Trip history ID set in 0431h	
				B15 B14 B13 B12 B11 B10 B9 B8	Reserved
				B7	DI8(default I/O)
				B6	DI7(default I/O)
				BI5	DI6(default I/O)
				B4	DI5(default I/O)
				B3	DI4(default I/O)
				B2	DI3(default I/O)
				B1	DI2(default I/O)
				B0	DI1(default I/O)
043Ch	Status of the output terminal block right before a trip	-	-	Trip history ID set in 0431h	
				B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3	Reserved
				B2	DO3(default I/O)
				B1	DO2(default I/O)
				B0	DO1(default I/O)

Communication Address	parameter	Scale	Unit	Details
043Dh	Total time of power supply to the inverter LO WORD	-	-	Trip history ID set in 0431h
043Eh	Total time of power supply to the inverter HI WORD			Displays the total time of power supply to the inverter (However, time of trip occurrence will be displayed when there is a RTC option to tell the exact time.)
043Fh	Total time of inverter operation	-	-	Trip history ID set in 0431h
0440h	Total time of inverter operation HI WORD			Displays the total time of motor operation by the inverter
0441h	Reserved	-	-	-
0442h	Inverter temperature right before alarm occurrence	0	°C	-

Note

Writing the total time of power supply to and operation of the inverter

Time is a LONG type variable that uses minutes as the unit. That is, LO WORD and HI WORD are combined to make a variable of a LONG type before dividing a year into 12 months, a month into 30 days, a day into 24 hours, and an hour into 60 minutes, which are written in year, month, day, time, and minute. The reference time is 0 hour 0 minute, 0 month 0 day, 0 year, increasing one hour when the minute turns to 0 after 59. One day will be added after 23 hours and 59 minutes, instead of turning to 24 hours, and one month will be added after 23 hours and 59 minutes of 29 days, instead of turning to 30 days. Therefore, one year will increase after 23 hours and 59 minutes of 11 months and 29 days. Because this is only a calculation of time, not one for exact time.

However, with an RTC option, the total time of power supply to the inverter will change to the time of trip occurrence. The reference for that is 0 hour 0 minute, January 1, 2000 and it shows exact time. The calculation is the same as above, but on a 31-day basis for one month. It is because 31 days are multiplied for one month when converting time data of year, month, day, hour, and minute from the RTC option.

10.3.2.5 Position Control Parameters

Communication Address	parameter	Scale	Unit	Details		
0605h	Target of proportional synchronous operation time	0.00	sec	Synchronous time required to be set for slaves from the master or PLC in proportional synchronous control		
0606h	Position control operation command	-	-	0	STOP	
				1	POS Run	
				2	POS Run Pre-Posi	
				3	POS Run Relative	
0607h	Operation status	-	-	B15	Status of Position Control Mode	
					0	Pos Single
					1	Multi Sync Pos
				B14	Same as B15	
				B13 B12 B11 B10 B9 B8	Status of Position Control Operation	
					0	IDLE
					1	PRE-PROCESS
					2	ACC
					3	DEC
					4	STEADY
					5	WAIT FOR FINISH

Communication Address	parameter	Scale	Unit	Details		
0607h	Operation status	-	-	B7 B6 B5 B4 B3 B2 B1	Status of Position Control	
					0	STOP
					1	POS Run
					2	POS Run Pre-Posi
					3	POS Run Relative
					4	TRIP
				B0	Status of Position Control Activation	
					0	Off
					1	On
0608h	Total operation time	0.00	sec	Total time of position control		

10.3.3 Virtual Multifunction Input Settings

You can control virtual multifunction inputs via built-in communication (communication address 0385h) or Smart Operator parameters (VIRT-03, 06, 09, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48 Virtual DI1~DI16 Const). Set DRV-10 (1st Command Source) to 1, 2, or 3 (Fx/Rx-1, Fx/Rx-2, or 3-Wire) for inverter operation with virtual multifunction inputs.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
VIRT	01, 04, 07, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40, 43, 46	Virtual DIx Define (DIx: DI1~DI16)	1	FX	0~49	0	-
	02, 05, 08, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44, 47	Virtual DIx Status (DIx: DI1~DI16)	0	Off	0~1	-	-
			1	On			
	03, 06, 09, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48	Virtual DIx Const (DIx: DI1~DI16)	0	Off	0~1	0	-
			1	On			
DRV	10	1st Command Source	1	Fx/ Rx-1	0~7	0	-

Virtual Multifunction Input Setting Details

Code and Functions	Description
VIRT-01, 04, 07, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40, 43, 46 Virtual DIx Define, (DIx: DI1~DI16)	Set the desired functions in the Virtual DI1-DI16 Define codes and set the bit value with the desired function settings in communication address 0385h to 1, and functions set at each bit starts operating. Virtual multifunction operates independently from DIN-01-31 codes and duplicate settings are not allowed. For example, to control common area of virtual multifunction input with built-in communication and send forward operation commands, set VIRT-01 to 1 (FX). Then give 0001h value to communication address 0385h for forward operation to work.
VIRT-02, 05, 08, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44, 47 Virtual DIx Status, VIRT-03, 06, 09, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48 Virtual DIx Const (DIx: DI1~DI16)	Set Virtual DI1-DI16 Const value to 1 (On) to activate virtual multifunction inputs. Virtual multifunction input can be monitored easily using Virtual DIx Status code.

10.3.4 Virtual Multifunction Output Settings

You can control multifunction outputs via built-in communication (communication address 0386h) or Smart Operator parameters (VIRT-03, 06, 09, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48 Virtual DIx Const). Refer to **8.3 Multifunction Digital Output** for related functions.

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
VIRT	50, 52, 54, 56	Virtual DOx Define (Dox: DO1~DO4)	0	User Defined Func	0~45	0	-
	51, 53, 55, 57	Virtual DOx Status (Dox: DO1~DO4)	0	Off	0~1	-	-
			1	On			
	58~61	Virtual DOx Const (Dox: DO1~DO4)	0	Off	0~1	0	-
			1	On			

10.3.5 Communication Memory Map

Communication Area	Memory Map	Description
Common Communication Area Compatible with Other Inverter Models (S100, G100, M100, H100, iS7, etc.)	0000h~00FFh	Area partially compatible with S100, G100, M100, H100, iS7

Communication Area	Memory Map	Description	
Expanded common area	0100h~010Fh	For built-in RS485 communication	Area registered in INTC-11-26 Para Status-1-16
		For USB communication	Area registered in USBC-11-26 Para Status-1-16
	0110h~011Fh	For built-in RS485 communication	Area registered in INTC-31-46
		For USB communication	Area registered in USBC-31-46
	0120h~01FFh	Reserved	
	0200h~023Fh	Reserved	
	0240h~027Fh	Reserved	
	0280h~02FFh	Reserved	
	0300h~037Fh	Inverter monitoring area	
	0380h~03DFh	Inverter control area	
	03E0h~03FFh	Inverter memory control area	
	0400h~042Fh	Area for trip-related information	
	0430h~0FFFh	Reserved	
S300 parameter 16 bit area	1000h~4FFFh	Refer to **13 Table of Functions** for communication address of each parameter in inverter parameter address area when accessing 16-bit parameter data.	
S300 parameter 32 bit area	9000h~CFFFh	Refer to **13 Table of Functions** for communication address of each parameter in inverter parameter address area when accessing 32-bit parameter data.	
Reserved	9000h~FFFFh	Reserved	

10.3.6 Parameter Group for Data Transmission

By defining a parameter group, the communication addresses registered in the communication-related function group (INTC) can be used in communication. The parameter group for data transmission may be defined to transmit multiple parameters at once, in a single communication frame.

Registering Parameter Address for Built-in Communication

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
INTC	11~26	Para Status-xx (xx: 01~16)	-	0000~FFFF	0000 [5]	Hex
	31~46	Para Control-xx (xx: 01~16)	-	0000~FFFF	0000 [6]	Hex

Communication Address Accessing Parameters Registered in Para Status-01-16 and Para Control-01-16.

Communication Area	Memory Map	Description
0100h~010Fh	Status Parameter-1~Status Parameter-16	Parameter values registered in INTC-11-26 Para Status 01-16 codes (read-only)
0110h~011Fh	Control Parameter-1~Control Parameter-16	Parameter values registered in INTC-31-46 Para Control -01-16 codes (read/write)

Note

When registering control parameters, set the operation speed (0005h, 0380h, and 0381h) and operation command (0006h and 0382h) parameters at the end of the parameter control frame (Para Control Frame). Register the operation speed and operation commands in the highest numbers of the codes you want to use.
For example, when you use five control parameters, Para Control-01-05, register operation speed in Para Control-04 and operation commands in Para Control-05.

[5] The initial values of Para Status-01, Para Status-02, and ParaStatus-03 are 000A, 000E, and 000F, respectively.

[6] The initial values of Para Control-01 and Para Control-02 are 0005 and 0006 respectively.

10.4 Built-in Communication Protocol

10.4.1 LS INV 485 protocol

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 x 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

- A request starts with ENQ and ends with EOT.
- A normal response starts with ACK and ends with EOT.
- An error response starts with NAK and ends with EOT.
- A station ID indicates the inverter number and is displayed as a two-byte ASCII-HEX string. ASCII-HEX is a hexadecimal notation composed of numbers between “0”-”9” and letters between “A”-”F.”
- CMD uses capitals and returns an “IF” error if lowercase characters are encountered. Refer to the following table:

Table 2. LS INV 485 CMD Characters

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

* Single quotation mark (") indicates characters.

- Data are written in ASCII-Hex (where data value is 3000: 3000 (decimal) → 0BB8h (Hex) → 30h 42h 42h 38h (ASCII-Hex)).
- Error codes are written in ASCII-HEX (refer to **10.4.1.5 ASCII Hex Code**).
- Transmission/reception buffer size: transmission = 39 bytes, reception = 44 bytes.
- Monitor registration buffer: 8 Words
- SUM: Checks communication errors via sum.
- SUM = a total of the lower 8 bit values for station ID, command and data (Station ID + CMD + Data) in ASCII-HEX.

e.g.) for a read request to read one content from address 3000,

The SUM is calculated as follows: SUM = '0' + '1' + 'R' + '3' + '0' + '0' + '0' + '1' = 30h + 31h + 52h + 33h + 30h + 30h + 30h + 31h = 1A7h. Control values such as ENQ, ACK, and NAK are excluded in the calculation. SUM takes a single lower byte, which makes it A7h.

ENQ	Station ID	CMD	Address	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

* Total byte = 12, single quotation mark (") indicates characters.

Note

BroadCast

BroadCast sends commands to all inverters connected to the network simultaneously. When commands are sent from station ID 255, each inverter acts on the command regardless of the station ID. However, no response is given.

10.4.1.1 Detailed Read Protocol

Read Request

For a read request of successive n words from address XXXX

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 byte = 12, single quotation mark (') indicates characters.

Read Normal Response

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01'~'FA'	'R'	'XXXX'	'XX'	04h
1 byte	2 bytes	1 byte	n x 4 bytes	2 bytes	1 byte

* Total byte = 7 + n * 4 = maximum of 39, single quotation mark (') indicates characters.

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 byte = 9, single quotation mark (') indicates characters.

Note

If there is invalid data among the consecutive numbers of data from XXXX address, the data returns "FFFF". i.e., the system reads DRV-05-08(1205h-1208h) and returns "FFFF" for data corresponding to the two parameters below, as DRV-07 and 08 don't exist:

Request

ENQ	Station ID	CMD	Address	Number of Addresses	SUM	EOT
05h	'01'	'R'	'1205'	'4'	'AF'	04h

Response

Acceleration time: 20.0 sec (200, 00C8h), deceleration time: 30.0sec(300, 012Ch)

ENQ	Station ID	CMD	Data	SUM	EOT
06h	'01'	'R'	'00C8 012C FFFF FFFFF'	'94'	04h

10.4.1.2 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 x 4 bytes	2 bytes	1 byte

* Total byte = 12 + n * 4 = maximum of 44, single quotation mark (') indicates characters.

Write Normal Response

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01'~'FA'	'W'	'XXXX…'	'XX'	04h
1 byte	2 bytes	1 byte	n x 4 bytes	2 bytes	1 byte

* Total byte = 7 + n * 4 = maximum of 39, single quotation mark (') indicates characters.

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 byte = 9, single quotation mark (‘) indicates characters.

Note

If there is invalid data among the consecutive numbers of data from XXXX address, the data returns "FFFF". i.e., the system reads DRV-05-08(1205h-1208h) and returns "FFFF" for data corresponding to the two parameters below, as DRV-07 and 08 don't exist:

Request

Acceleration time: 20.0 sec (200, 00C8h), deceleration time: 30.0sec(300, 012Ch)

ENQ	Station ID	CMD	Address	Number of Addresses	SUM	EOT
05h	'01'	‘W	‘1205‘	'3'	'AF'	04h

Response

ENQ	Station ID	CMD	Data	SUM	EOT
06h	'01'	'R'	'00C8 012C FFFF FFFFF'	'94'	04h

10.4.1.3 Monitor Registration Detailed Protocol

A monitor registration request is made to designate the type of data that requires continuous monitoring and periodic updating.

Request monitor registration

Registration requests for n addresses (where n refers to the number of addresses. The addresses do not have to be contiguous.)

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 x 4 bytes	2 bytes	1 byte

* Total byte = 8 + n * 4 = maximum of 40, single quotation mark (‘) indicates characters.

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 byte = 7, single quotation mark (') indicates characters.

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 byte = 9, single quotation mark (') indicates characters.

Monitor Registration Execution Request

A data read request for a registered address, received from a 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 byte = 7, single quotation mark (') indicates characters.

Monitor Registration Execution Normal Response

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01'~'FA'	'Y'	'XXXX…'	'XX'	04h
1 byte	2 bytes	1 byte	n x 4 bytes	2 bytes	1 byte

* Total byte = 7 + n * 4 = maximum of 39, single quotation mark (') indicates characters.

Monitor Registration Execution 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 byte = 9, single quotation mark (') indicates characters.

10.4.1.4 Exception Code

Table 3. LS INV 485 Exception Code

Items	Abbreviation	Description
ILLEGAL FUNCTION	IF	The requested function cannot be performed by a slave, the corresponding function does not exist.
ILLEGAL DATA ADDRESS	IA	The received parameter address is not valid in the slave, the number of addresses is 9 or more
ILLEGAL DATA VALUE	ID	The received parameter data is invalid at the slave.
WRITE MODE ERROR	WM	Tried writing (W) to a parameter that does not allow writing (read-only parameters, or when writing is prohibited during operation)
FRAME ERROR	FE	The frame size does not match.

10.4.1.5 ASCII Hex Code

Table 4. LS INV 485 ASCII Hex Code

Character	Hex	Character	Hex	Character	Hex
A	41	s	73	^	5E
B	42	t	74	_	5F
C	43	u	75	`	60
D	44	v	76	{	7B
E	45	w	77	|	7C
F	46	x	78	}	7D
G	47	y	79	~	7E
H	48	z	7A	BEL	07
I	49	0	30	BS	08
J	4A	1	31	CAN	18
K	4B	2	32	CR	0D
L	4C	3	33	DC1	11
M	4D	4	34	DC2	12
N	4E	5	35	DC3	13
O	4F	6	36	DC4	14
P	50	7	37	DEL	7F
Q	51	8	38	DLE	10

Character	Hex	Character	Hex	Character	Hex
R	52	9	39	EM	19
S	53	space	20	ACK	06
T	53	!	21	ENQ	05
U	55	"	22	EOT	04
V	56	#	23	ESC	1B
W	57	$	24	ETB	17
X	58	%	25	ETX	03
Y	59	&	26	FF	0C
Z	5A	’	27	FS	1C
a	61	(	28	GS	1D
b	62	)	29	HT	09
c	63	*	2A	LF	0A
d	64	+	2B	NAK	15
e	65	,	2C	NUL	00
f	66	-	2D	RS	1E
g	67	.	2E	S1	0F
h	68	/	2F	SO	0E
i	69	:	3A	SOH	01
j	6A	;	3B	STX	02
k	6B	<	3C	SUB	1A
l	6C	=	3D	SYN	16
m	6D	>	3E	US	1F
n	6E	?	3F	VT	0B
o	6F	@	40		
p	70	[	5B		
q	71	\	5C		
r	72	]	5D		

10.4.2 Modbus-RTU

10.4.2.1 Function Code and Protocol (unit: byte)

Station ID is INTC-01 (Station ID), the start communication address is the communication address, and the unit is bytes. Refer to **10.3.1 Parameters for Common Area** for communication address.

The communication address of the modbus is 1 subtracted from the parameter address of our inverter by default. However, set INTC-06 (Modbus Addr Mode) to 0 (No) for built-in RS485 communication to use the same address for the modbus and inverter parameter.

Read Holding Registers (Function Code: 0x03)

This is a protocol that reads consecutive parameters of the inverter as many as set numbers. Read Holding Registers and Read Input Registers (function code: 0X04) are processed the same by the inverter.

- Starting address: Starting address-1 of the inverter parameter (common area or Smart Operator) you want to read
- Number of registers: The number (maximum of 16) of inverter parameters (common area or Smart Operator) you want to read
- Number of bytes: The number of bytes of normal response values depending on the number of registers
- Value: The value of the inverter parameter (common area or Smart Operator) you want to read
- Exception code: The error response code (refer to **10.4.2.2 Exception Code**)

Request

Slave Station ID	Function Code	Starting Address (Hi)	Starting Address (Lo)	Number of Registers (Hi)	Number of Registers (Lo)	CRC (Lo)	CRC (Hi)
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte

Normal Response

Slave Station ID	Function Code	Number of Bytes	Value (Hi)	Value (Lo)	...	Value (Hi)	Value (Lo)	CRC (Lo)	CRC (Hi)
1 byte	1 byte	1 byte	1 byte	1 byte	…	1 byte	1 byte	1 byte	1 byte

* The number of values (Hi) and values (Lo) is dependent on the number of registers.

When an invalid parameter address is read, the data will respond as FFFFh. If all parameter addresses are invalid, the following error responses will be received.

Note

If there is invalid data among the consecutive numbers of data from XXXX address, the data returns "FFFF". i.e., the system reads DRV-05-08(1205h-1208h) and returns "FFFF" for data corresponding to the two parameters below, as DRV-07 and 08 don't exist:

Request

Slave Station ID	Function Code	Starting Address		Number of Registers		CRC	
		Hi	Lo	Hi	Lo	Lo	Hi
01	03	12	04	00	04	00	B0

Response

Acceleration time: 20.0 sec (200, 00C8h), deceleration time: 30.0sec(300, 012Ch)

Slave Station ID	Function Code	Number of Bytes	Register1		Register2		Register3		Register4		CRC	
			Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Lo	Hi
01	03	08	00	C8	01	2C	FF	FF	FF	FF	4D	98

Write Single Registers (Function Code: 0x06)

It is a protocol that writes a single inverter parameter value.

- Address: Address-1 of the inverter parameter (common area or Smart Operator) you want to write
- Value: The value of the inverter parameter (common area or Smart Operator) you want to write
- Exception code: The error response code

Request

Slave Station ID	Function Code	Address (Hi)	Address (Lo)	Value (Hi)	Value (Lo)	CRC(Lo)	CRC(Hi)
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte

Normal Response

Slave Station ID	Function Code	Address (Hi)	Address (Lo)	Value (Hi)	Value (Lo)	CRC(Lo)	CRC(Hi)
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte

Error Response

Slave Station ID	Function Code	Exception Code	CRC(Lo)	CRC (Hi)
1 byte	1 byte	1 byte	1 byte	1 byte

* The function code of error response is required function code + 0x80.

Write Multiple Registers (Function Code: 0x10)

This is a protocol that writes consecutive parameters of the inverter as many as set numbers.

- Starting address: Starting address-1 of the inverter parameter (common area or Smart Operator) you want to write
- Number of registers: The number (maximum of 16) of inverter parameters (common area or Smart Operator) you want to write
- Register value: The values of the inverter parameters (common area or Smart Operator) you want to write
- Error code: The error response code

Request

Slave Station ID	Function Code	Starting Address (Hi)	Starting Address (Lo)	Starting Address (Hi)	Starting Address (Lo)	Number of Bytes	Register Value (Hi)	Register Value (Lo)	CRC (Lo)	CRC (Hi)
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte

Normal Response

Slave Station ID	Function Code	Starting Address (Hi)	Starting Address (Lo)	Number of Registers (Hi)	Number of Registers (Lo)	CRC (Lo)	CRC (Hi)
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte

When you have tried to write an invalid address or parameter that cannot be written, the rest of the parameters, except for the relative ones, will be normally written and responded to.

When you failed to write all parameters, the following error responses will be received:

Error Response

Slave Station ID	Function Code	Exception Code	CRC(Lo)	CRC(Hi)
1 byte	1 byte	1 byte	1 byte	1 byte

* The exception code of error response is required function code + 0x80.

Note

If there is invalid data among the consecutive numbers of data from XXXX address, the value is written only for the normal address register and returns a normal response. i.e., when you write 5.00 sec (500,01F4h) for each DRV-05-08 (1205h-1208h), 5.00 sec (500,01F4h) value will be written for each DRV05 and 06 and returns a normal response.

Request

Slave Station ID	Function Code	Starting Address		Number of Registers		Data1		Data2		Data3		Data4		CRC	
		Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Lo	Hi
01	10	12	04	00	04	01	F4	01	F4	01	F4	01	F4	FA	79

Response

Normal Response

Slave Station ID	Function Code	Starting Address		Number of Registers		CRC	
		Hi	Lo	Hi	Lo	Lo	Hi
01	10	12	04	00	04	85	73

10.4.2.2 Exception Code

Table 5. Modbus-RTU Exception Code

Items		Description
01	ILLEGAL FUNCTION	The requested function cannot be performed by the inverter (the corresponding function does not exist)
02	ILLEGAL DATA ADRESS	All the parameter addresses (for multiple data read/write) for the inverter to receive and process are invalid • For read, data with valid addresses are responded to with the relevant data, whereas invalid parameter addresses are responded to with FFFFh • For write, only the data with valid addresses are processed and normally responded to
03	ILLEGAL DATA VALUE	The received parameter data is invalid at the slave.

Items		Description
06	SLAVE DEVICE BUSY	The slave is performing other commands
14	Write-Protection	The write command is not executable

Table 6. An Example Modbus-RTU Communication

Example of Modbus-RTU Communication in Use
The example assumes the acceleration time (communication address 0383h) was changed to 5.0 seconds and the deceleration time (communication address 0384h) was changed to 10.0 seconds.

Frame Transmission from Master to Inverter

Items	Station ID	Function	Starting Address	Number of Registers	Number of Bytes	Data Value 1	Data Value 2	CRC
Hex	0x01	0x10	0382h	0002h	0x04	0032h	0064h	1202h
Description	INTC -01 Station ID	Preset Multiple Register	Starting commu-nication address-1 (0383h-1)	-	-	50 (equivalent to 5.0 seconds of acceleration time)	100 (equivalent to 10.0 seconds of deceleration time)	-

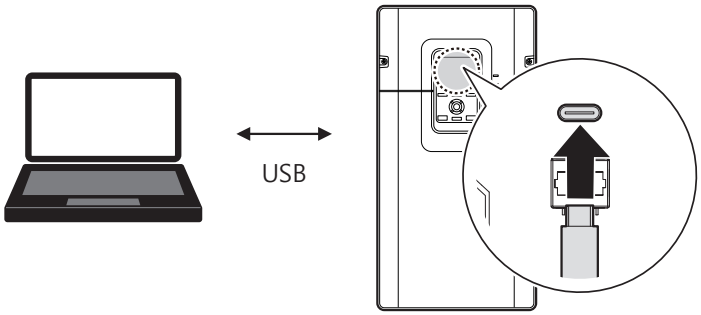
Frame Transmission from Slave to Master (Response)

Items	Station ID	Function	Starting Address	Number of Registers	CRC
Hex	0x01	0x10	0382h	0002h	E534h
Description	INTC-01 Station ID	Preset Multiple Register	Starting communication address-1 (0383h-1)	-	-

11 Using USB Communication Functions

The S300 has a built-in USB Type-C port, which can be used to connect to PC and control the S300 with modbus-RTU protocols. Refer to **10.4.2 Modbus-RTU** for more details on modbus-RTU protocols.

The USB port is located above the RJ45 port on the main inverter unit. Separate the Smart Operator from the main inverter unit and connect the USB Type-C cable to a PC and the inverter.



[Image 1. Connecting Inverter and PC with USB]

Note

- You do not need to separate the Smart Operator from the main inverter unit if your inverter is the 400 V class 185-220 kW standard, as it has a USB port on the front cover. Refer to **400 V Class 185-220 kW** for the location of USB port for your model.
- The USB cable is sold separately.

11.1 Parameter Settings for USB Communication

Check if USB cable is connected properly and set the following communication parameters:

Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
USBC	05	Response Delay	5		0~1000	5	msec
	06	Modbus Addr Mode	0	No	0~1	1	-
			1	Yes			
	98	Error Count	-		-	0	-
	99	Error Count Reset	0	No	0~1	0	-
			1	Yes			

Communication Parameters Setting Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>INTC-05
Response Delay</td><td>Sets time for the slave (inverter) to respond to the master (PLC or inverter). Response time is used in a system where the slave device response is too fast for the master device to process. Set this code to an appropriate value for smooth master-slave communication.</td></tr>
<tr><td>USBC-06
ModbusAddrMode</td><td>When using modbus-RTU, the modbus address will be 1 subtracted from the parameter address of the inverter.
However, to use the inverter parameter address as itself, set this parameter to 0 (No) and you can use the same address for the modbus and inverter parameter.
When it is operating at 60.00 Hz with the output current of 1.0 A, if you read the output frequency (0311h), the inverter will respond as follows according to the setting values at USBC-06:

[Master → Slave]
<table>
<tr><th>Station ID</th><th>Function Code</th><th>Address (Hi)</th><th>Address (Lo)</th><th>#of Points(Hi)</th><th>#of Points (Lo)</th><th>CRC Lo</th><th>CRC Hi</th></tr>
<tr><td>01</td><td>03</td><td>03</td><td>12</td><td>00</td><td>01</td><td>xx</td><td>xx</td></tr>
</table>
[Slave→ Master]
When USBC-06 is set to 1 (Yes)
• Modbus address: 0312h
• Inverter communication address: 0311h (output frequency of 60.00 Hz)
<table>
<tr><th>Station ID</th><th>Function Code</th><th>Number of Bytes</th><th>Data (Hi)</th><th>Data (Lo)</th><th>CRC Lo</th><th>CRC Hi</th></tr>
<tr><td>01</td><td>03</td><td>02</td><td>17</td><td>70</td><td>xx</td><td>xx</td></tr>
</table>
When USBC-06 is set to 0 (No)
• Modbus address: 0312h
• Inverter communication address: 0312h (output current of 1.0 A)
<table>
<tr><th>Station ID</th><th>Function Code</th><th>Number of Bytes</th><th>Data (Hi)</th><th>Data (Lo)</th><th>CRC Lo</th><th>CRC Hi</th></tr>
<tr><td>01</td><td>03</td><td>02</td><td>00</td><td>0A</td><td>xx</td><td>xx</td></tr>
</table></td></tr>
<tr><td>USBC-98 Error Count,
USBC-99 Error Count Reset</td><td>USBC-98 counts and displays the number of error responses from the built-in communication. You can check incorrect function codes or data from the master in this count. Set USBC-99 to 1 (Yes) to initialize the count to 0.</td></tr>
</table>

11.2 Parameter Group for Data Transmission

By defining a parameter group, the communication addresses registered in the communication related function group (USBC) can be used in communication. The parameter group for data transmission may be defined to transmit multiple parameters at once, in a single communication frame.

Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
INTC	11~26	Para Status-xx (xx: 01~16)	-	0000~FFFF	0000 [1]	Hex
	31~46	Para Control-xx (xx: 01~16)	-	0000~FFFF	0000 [2]	Hex

Communication Address Accessing Parameters Registered in Para Status-01-16 and Para Control-01-16.

Communication Address	parameter	Description
0100h~010Fh	Status Parameter-1~ Status Parameter-16	Parameter values registered in the USB-11-26 codes (read-only)
0110h~011Fh	Control Parameter-1~ Control Parameter-16	Parameter values registered in the USB-31-46 codes (read/ write)

[1] The initial values of Para Status-01, Para Status-02, and ParaStatus-03 are 000A, 000E, and 000F, respectively.

[2] The initial values of Para Control-01 and Para Control-02 are 0005 and 0006 respectively.

12 Inverter Setting Mode

12.1 Parameter Management

12.1.1 Setting Mode Parameters

Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
Setting	Operator Set	01	Language Select	0	English	0~8	0	-
				1	Russian			
				2	Spanish			
				3	Italian			
				4	Turkish			
				5	Polish			
				6	Persian			
				7	Chinese			
				8	Korean			
		02	LCD Contrast	Level 10		Level 0-20	Level 10	-
		03	LCD BackLight	Level 10		Level 0-20	Level 10	-
		04	LCD SleepMode Time	5		0~600	5	Min
		05	Buzzer Setting	0	All Off	0~2	1	-
				1	PowerUp/ LongkeyOn			
				2	All On			
		06	Intro Display On	On/Off [1]		0~1	On	-
	Operator Set	07	Logo Display Time	2		1~10	2	sec
		08	Menu Map On	On/Off		0~1	Off	-

[1] This is displayed in a pop-up window as a button.

Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
Setting	Drive Set	10	Drive S/W Ver.	-		-	-	-
	Operator Set	11	Operator S/W Ver.	-		-	-	-
		12	Operator TitleVer.	-		-	-	-
	Drive Set	15	Multi Key Select	0	Local/ Remote [2]	0~2	0	-
				1	JOG Key [3]			
				2	Favorite Add/Del [4]			
	Drive Set	19	Mon Command Edit	Yes/No		0~1	Yes	-
		20	Anytime Parameter	Refer to **12.2 Monitoring Settings**.				
		21	Monitor Page-1.1					
		22	Monitor Page-1.2					
		23	Monitor Page-1.3					
		24	Monitor Page-2.1					
		25	Monitor Page-2.2					
		26	Monitor Page-2.3					
		27	Monitor Page-2.4					
		28	Monitor Page-2.5					
		29	Monitor Page-2.6					

[2] Refer to **5.2.2 Local/Remote Switching Operations with Multifunction Keys in the Smart Operator**.
[3] Refer to **7.2.4 Jog Operation with Smart Operator**.
[4] Refer to **4.5.1 Register/delete favorite parameters**.

Mode	Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
Setting	Drive Set	30	Monitor Gauge	Refer to **12.2 Monitoring Settings**.			
		31	Monitor Graph				
		32	Graph Time Period				
		35	I/O Type	Standard IO	-	-	-
		36	Option-1 Type	None	-	-	-
		37	Option-2 Type				
		38	Option-3 Type				
	Operator Set	39	Parameter Init	Refer to **12.1.4 Parameter Initialization**.			
		40	Para Read from Drv	Refer to **12.1.3 Reading and Writing Parameters**.			
		41	Para Write to Drv				
		42	Parameter Save	Refer to **12.1.8 Saving parameters**.			
		47	Macro Select	Refer to **4.6.1 Selecting macro**.			
		48	Erase All Trip	Yes/No	0-1	No	-
		49	View Changed Para	Refer to **12.1.7 Changed parameter display**.			
		50	ParaView Lock	Refer to **12.1.5 Parameter Mode Lock**.			
		51	ParaViewLock PwSet				
		52	ParaEdit Lock	Refer to **12.1.6 parameter lock**.			
		53	ParaEditLock PwSet				
	Drive Set	60	Add Title Update	Yes/No	0-1	No	-
		61	Easy Start On	Refer to **12.1.2 Parameter Easy Start (Easy Start On)**.			
		62	WHour Count Reset	Yes/No	0-1	No	-

Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
Setting	Operator Set	80	Operator Temp	-	-	-	℃	
		85	Date Time Set	-	-	-	-	
		86	Date Type Set	0	yyyy/mm/dd	0-2	0	-
				1	mm/dd/yyyy			
				2	dd/mm/yyyy			
		89	Init Op Setting	0	No	0-1	0	-
				1	Yes			
		92	Drive Firmware Write	Refer to **12.4 USB mode**.				
		93	USB Mode					

Setting Mode Parameter Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>Operator Set-01
Language Select</td><td>Sets a language for the Smart Operator.</td></tr>
<tr><td>Operator Set-02
LCD Contrast</td><td>Adjusts the LCD contrast ratio on the Smart Operator.
Press the ∧ key while holding the MULTI key.

Adjust with the ‹ / › keys when the contrast ratio setting pop-up is displayed.</td></tr>
<tr><td>Operator Set-03
LCD Backlight</td><td>Adjusts brightness of LCD backlight on the Smart Operator.
Press the ∨ key while holding the MULTI key.

Adjust with the ‹ / › keys when the contrast ratio setting pop-up is displayed.</td></tr>
<tr><td>Operator Set-04
LCD SleepMode Time</td><td>Sets the turn-off time for the LCD backlight on the Smart Operator.
Set it to 0 to keep the LCD backlight on.</td></tr>
<tr><td>Operator Set-05
Buzzer Setting</td><td>Sets the buzzer sound effect.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>All Off</td><td>Turns off all buzzer sound effects.</td></tr>
<tr><td>1</td><td>PowerUp/ Longkey On</td><td>The buzzer sounds when the power is supplied to the Smart Operator and the LongKey works.</td></tr>
<tr><td>2</td><td>All On</td><td>The buzzer sounds when the power is supplied to the Smart Operator and the LongKey or general key works.</td></tr>
</table>
• An example of a LongKey operation: When pressing and holding ENTER key in Monitor mode</td></tr>
<tr><td>Operator Set-06
Intro Display On</td><td>When set as On, the intro (logo of our company) will be displayed first on the screen upon power supply to Smart Operator.</td></tr>
<tr><td>Operator Set-07
Logo Display Time</td><td>Sets the duration of version and inverter capacity display.</td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>Operator Set-08
Menu Map On</td><td>Sets initial screen of the Smart Operator.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>On</td><td>Menu is displayed as the initial screen upon power supply to the Smart Operator.</td></tr>
<tr><td>1</td><td>Off</td><td>The monitoring screen is displayed as the initial screen upon power supply to the Smart Operator.</td></tr>
</table></td></tr>
<tr><td>Operator Set-35
I/O Type</td><td>Check the type of control terminal board.</td></tr>
<tr><td>Operator Set-37~39
Option Type</td><td>Checks the type of option card installed on the option slot.</td></tr>
<tr><td>Operator Set-48
Erase All Trip</td><td>Deletes all saved trip history if set as Yes.</td></tr>
<tr><td>Operator Set-60
Add Title Update</td><td>Used to manually update the LCD code display when a code is added after a S/W version update on the main inverter unit.</td></tr>
<tr><td>Operator Set-62
WHour Count Reset</td><td>Initializes the cumulative power consumption if set as Yes.</td></tr>
<tr><td>Operator Set-80
Operator Temp</td><td>Displays the internal temperature of the Smart Operator.</td></tr>
<tr><td>Operator Set-85
Date Time Set</td><td>Sets the time and date in the Smart Operator.</td></tr>
<tr><td>Operator Set-86
Date Type Set</td><td>Sets the date display format in the Smart Operator.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>yyyy/mm/dd</td><td>Displayed as year/month/day.</td></tr>
<tr><td>1</td><td>mm/dd/yyyy</td><td>Displayed as month/day/year.</td></tr>
<tr><td>2</td><td>dd/mm/yyyy</td><td>Displayed as day/month/year.</td></tr>
</table></td></tr>
</table>

12.1.2 Parameter Easy Start (Easy Start On)

You can easily set basic parameters for operating a motor with Easy Start On. You can also set this function in **Wizard** mode on the main menu screen.
Refer to **4.2.4.7 Wizard mode** for details.

Go to the Drive Set tab in Setting mode, and set 61 (Easy Start On) as Yes. Turn the inverter off then on.

Mode	Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
Setting	Drive Set	61	Easy Start On	Yes/No [5]	0~1	0	-

Easy Start On Setting Details

Code and Functions	Description
Drive Set-61 Easy Start On	Set up Easy Start On according to the following steps: **1** In Drive Set tab, set 61 (Easy Start On) as Yes. **2** Turn the inverter off then on. Easy Start On starts. **3** When the message **Easy Start?** is displayed on a pop-up window, press Yes. **4** The settings consist of seven steps in total. Select an item for each step. • Step 1: Language • Step 2: Motor capacity • Step 3: Number of poles of the motor • Step 4: Motor rated voltage • Step 5: Motor rated frequency • Step 6: Command Source • Step 7: Command frequency When you are done with all of the above, the minimum parameters for the motor operation are all set. You can now operate the motor with the operation commands you set. Press ESC key to stop setting up.

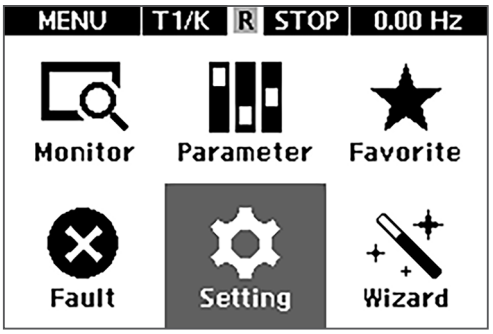
[5] This is displayed in a pop-up window as a button.

12.1.3 Reading and Writing Parameters

Reading and writing parameters enable users to copy parameter settings saved in the main inverter unit to the Smart Operator memory or copy parameter settings saved in the Smart Operator memory to the main inverter unit.

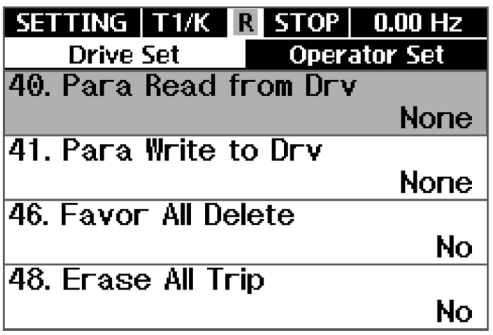
Mode	Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
Setting	Operator Set	40	Para Read from Drv	-	1~20	0	-
		41	Para Write to Drv	-	1~20	0	-

An Example of Reading Parameter Settings from the Inverter



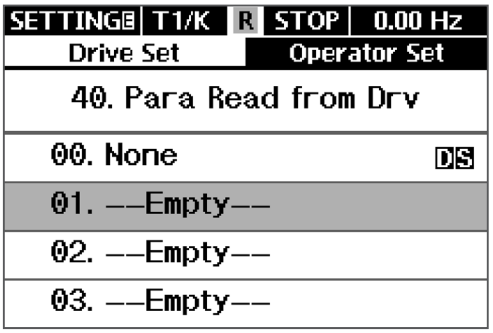
[Image 1. Main Menu]

- Move to **Setting** mode by pressing the MODE key on the menu screen.



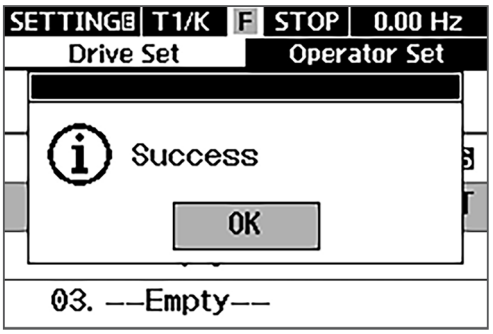
[Image 2. Parameter Reading Selection in Setting Mode]

- Press the ◁▷ key in the Operator Set tab and move to code no. 40.
- Press the ENTER key.



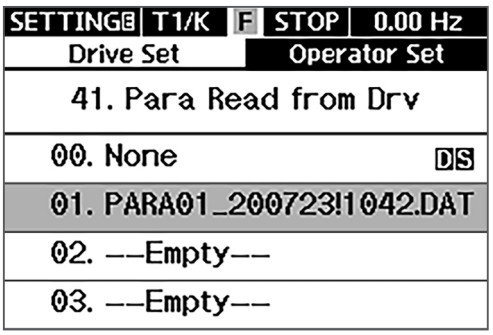
[Image 3. Saving Parameter Settings]

- Press ▲/▼ keys to select an empty slot you want to save parameter settings in.
- Press the ENTER key.



[Image 4. The Screen after Successfully Reading Parameters]

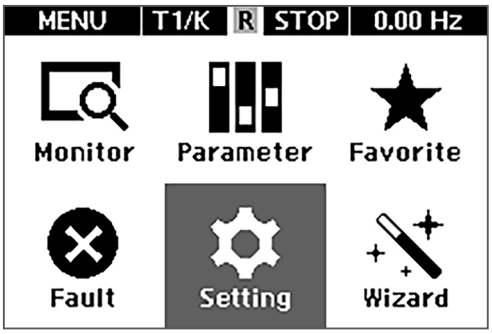
- When you successfully read parameter settings from the inverter, the pop-up window will display the **Success** message.



[Image 5. Parameter Saved]

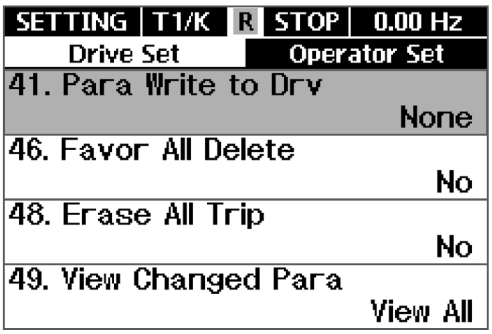
- The parameter settings from the inverter will be saved in the internal memory of the Smart Operator, and the name of file saved in the selected slot will be displayed.

An Example of Writing Parameter Settings in the Inverter



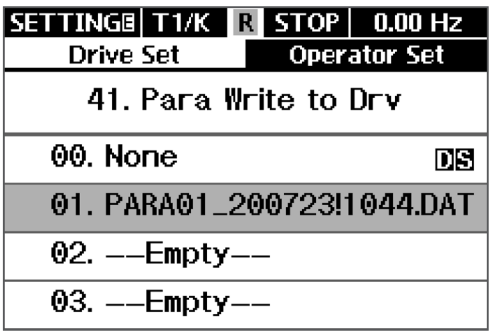
[Image 6. Main Menu]

- Move to **Setting** mode by pressing MODE key on the menu screen.



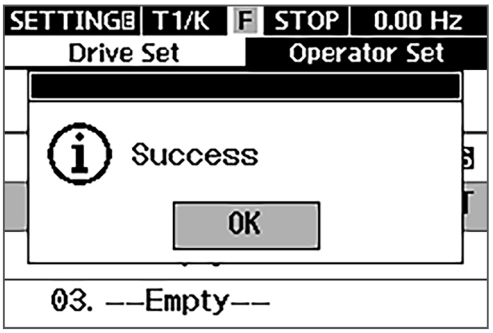
[Image 7. Parameter Writing Selection in Setting Mode]

- Press the key in the Operator Set tab and move to code no. 41.
- Press the ENTER key.



[Image 8. Parameter Settings Selection]

- Press / keys to select saved parameter settings.
- Press the ENTER key.



[Image 9. The Screen after Successfully Writing Parameters]

- When you successfully write parameter settings in the inverter, the pop-up window will display the **Success** message.

12.1.4 Parameter Initialization

You can initialize changed parameter settings collectively or by group.

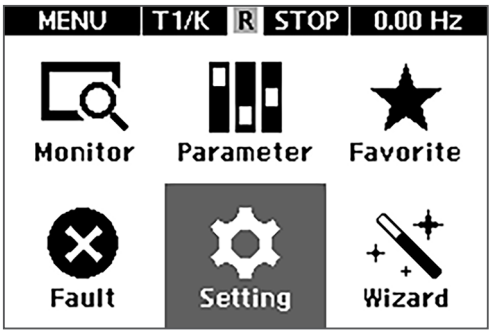
However, during a fault trip or inverter operation, parameter settings cannot be initialized.

Select 1 (All Group) to initialize all groups.

Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
Setting	Operator Set	39	Parameter Init	0	No	0~35	0	-
				1	All Group			
				2	DRV Group			
				3	BAS Group			
				4	MOT1 Group			
				5	V/F1 Group			
				6	VEC1 Group			
				7	MOT2 Group			
				8	V/F2 Group			
				9	VEC2 Group			
				10	ADV Group			
				11	APP Group			
				12	DIN Group			
				13	AIN Group			

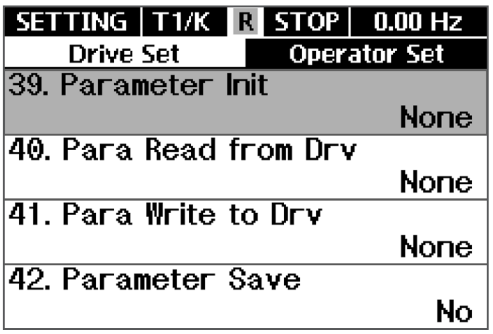
Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
Setting	Operator Set	39	Parameter Init	14	OUT Group	0~35	0	-
				15	XDIN Group			
				16	XAIN Group			
				17	XOUT Group			
				18	PPID Group			
				19	SYNC Group			
				20	PRT Group			
				21	DIAG Group			
				22	RSR2 Group			
				23	INTC Group			
				24	INTM Group			
				25	USBC Group			
				26	RSR3 Group			
				27	RSR4 Group			
				28	VIRT Group			
				29	ENC Group			
				30	EPI1 Group			
				31	EPI2 Group			
				32	POS1 Group			
				33	POS2 Group			
				34	WEB1 Group			
				35	WEB2 Group			
				36	OPC1 group			
				37	OPC2 Group			

An Example of Parameter Initialization



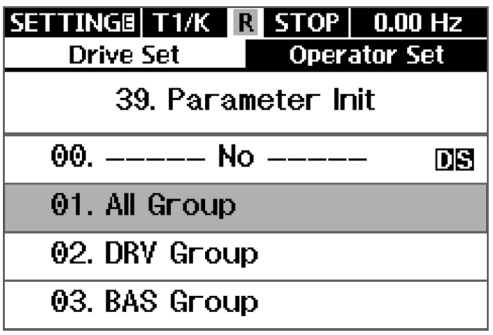
[Image 10. Setting mode screen]

- Move to **Setting** mode by pressing MODE key on the menu screen.



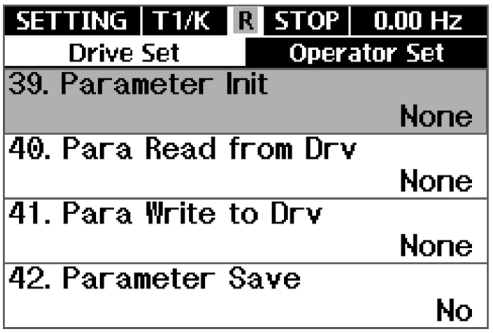
[Image 11. Parameter Initialization Selection in Setting Mode]

- Press the ∨ key in the Operator Set tab and move to code no. 39.
- Press the ENTER key.



[Image 12. Parameter Initialization Item Selection]

- Press ∧/∨ keys and select 1 (All Group) among parameter initialization items.
- Press the ENTER key.



[Image 13. Parameter Initialization Selection in Setting Mode]

- It returns to the initialization selection screen once initialization is complete.

12.1.5 Parameter Mode Lock

You can use a registered password to make the parameter mode inaccessible.

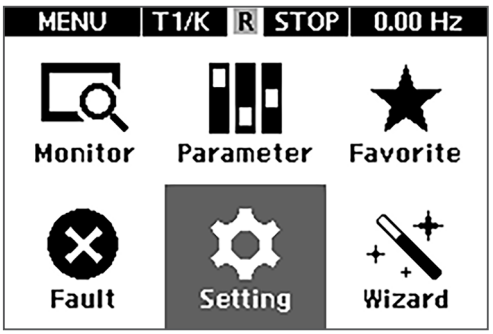
Mode	Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
Setting	Operator Set	50	ParaView Lock	Unlocked	-	Unlocked	-
		51	ParaViewLock PwSet	0000	0~9999	0000	-

Parameter Mode Lock Setting Details

Code and Functions	Description
Operator Set-50 ParaViewLock	Locks parameter mode or disables the lock. • Locking parameter mode: Enter the previously registered password. The initial password is 0000 if using it for the first time. If the password you entered matches the set password, the lock icon (🔒) will be displayed when you enter parameter mode in the Smart Operator and the list of parameters will be hidden. • Disabling parameter mode hide: Enter the password again. If the password you entered matches the set password, the lock icon (🔒) will disappear when you enter parameter mode in the Smart Operator, showing the list of parameters.

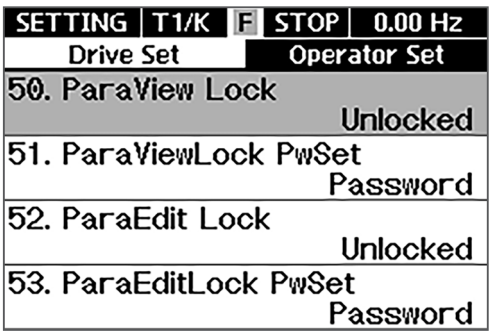
Code and Functions	Description
Operator Set-51 ParaViewLock PwSet	Registers the password to lock parameter mode. Follow the procedures below to register password. **1** Press the ENTER key in Smart Operator. **2** Enter 0000 upon initial registration, or enter the previous password if you already have one. If the password you entered matches your previous password, a pop-up window will be displayed for you to register a new one (if the password you entered does not match your previous password, the pop-up window will display **Password Mismatch!** message). **3** Register a new password. The **Password Changed** message will be displayed in the pop-up window once registration is complete.

An Example of Parameter Mode Lock



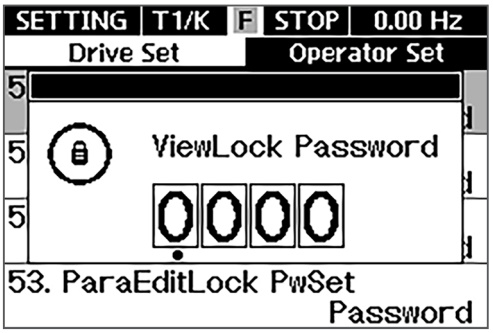
[Image 14. Setting mode screen]

- Move to **Setting** mode by pressing MODE key on the menu screen.



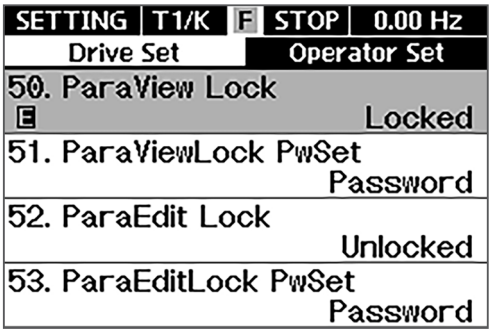
[Image 15. Parameter Mode Lock Selection in Setting Mode]

- Press the key in the Operator Set tab and move to code no. 50.
- Press the ENTER key.



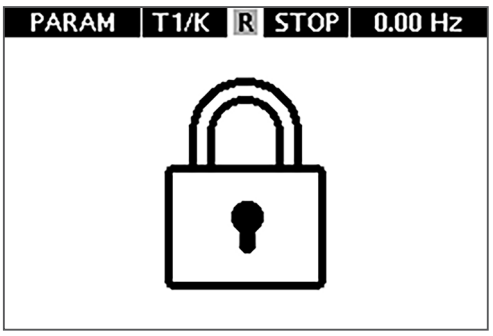
[Image 16. Password Setting for Parameter Mode Lock]

- Enter the password.
  (The initial password is 0000.)
- Press the ENTER key.



[Image 17. Screen after Parameter Mode Lock Setting]

- The ParaView Lock code value is changed to Locked and parameter mode lock is set.



[Image 18. Screen with Parameter Mode Lock Setting]

- Press the MODE key and move to parameter mode and check if the icon is displayed.

12.1.6 parameter lock

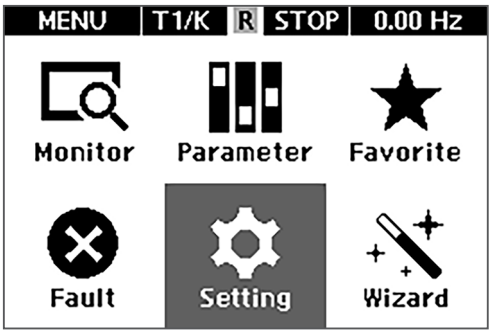
You can use registered password to prohibit changing parameter values in parameter mode.

Mode	Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
Setting	Operator Set	52	ParaEdit Lock	Unlocked	-	Unlocked	-
		53	ParaEditLock PwSet	0000	0~9999	0000	-

Parameter Lock Setting Details

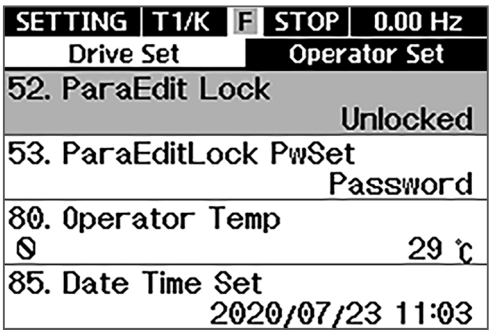
Code and Functions	Description
Operator Set-52 ParaEditLock	Prohibits changing parameter values in parameter mode or lifts prohibition. • Prohibiting parameter value edit: Enter the previously registered password. The initial password is 0000 if using it for the first time. If the password you entered matches the set password, items in the parameter mode in the Smart Operator will be deactivated and you will not be able to change parameter values. • Disabling prohibition of parameter value changes: Enter the password again. If the password you entered matches the set password, items in the parameter mode in the Smart Operator will be activated and you can change parameter values.
Operator Set-53 ParaEditLock PwSet	Registers the password to prohibit parameter value changes in parameter mode. Follow the procedures below to register password. **1** Press the ENTER key in Smart Operator. **2** Enter 0000 upon initial registration, or enter the previous password if you already have one. If the password you entered matches your previous password, a pop-up window will be displayed for you to register a new one (if the password you entered does not match your previous password, the pop-up window will display **Password Mismatch!** message). **3** Register a new password. The **Password Changed** message will be displayed in the pop-up window once registration is complete.

An Example of a Parameter Change Prohibition



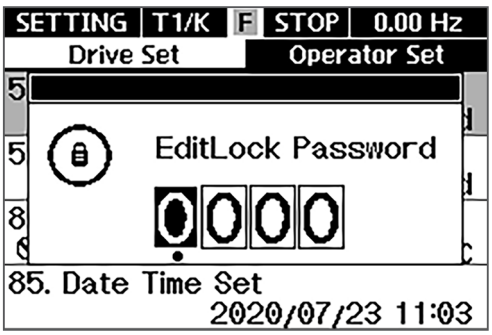
[Image 19. Setting mode screen]

- Move to **Setting** mode by pressing MODE key on the menu screen.



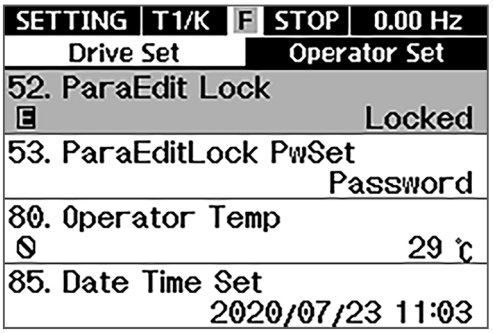
[Image 20. Parameter Change Prohibition Selection in Setting Mode]

- Press the ◇ key in the Operator Set tab and move to code no. 52.
- Press the ENTER key.



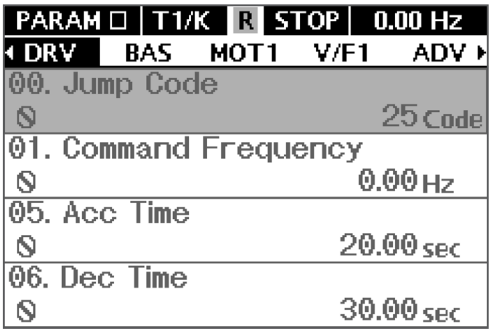
[Image 21. Password Setting for Parameter Change Prohibition]

- Enter the password.
  (The initial password is 0000.)
- Press the ENTER key.



[Image 22. Screen after Parameter Change Prohibition Setting]

- The ParaEdit Lock code value is changed to Locked and parameter change prohibition is set.



[Image 23. Screen with Parameter Change Prohibition Setting]

- Press the MODE key and move to parameter mode and check if parameter items are deactivated.

ⓘ Caution

If parameter mode lock and parameter change prohibition are enabled, no functions related to inverter operation can be changed. Therefore, it is very important that you memorize the password if you have a registered password.

12.1.7 Changed parameter display

It exclusively shows parameters with different settings from the factory default in parameter mode. Use this feature to track changed parameters.

Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
Setting	Operator Set	49	View Changed Para	Yes [6]	View Changed	-	No	-
				No [3]	View All			

Changed Parameter Display Setting Details

Code and Functions	Description
Operator Set-49 View Changed Para	All parameters will be displayed in the parameter mode if set as No, and only the ones with changed values will be displayed if set as Yes.

12.1.8 Saving parameters

When inverter parameters are changed, the values are saved in the internal memory when the inverter power is blocked. However, it may not be saved upon abnormal power block events. Therefore, you can save it right after changing the parameter. Save the current parameters by setting the 42 (Parameter Save) values under Operator Set tap to “Yes.”

Mode	Group	Code	LCD Display	Set Value	Setting Range	Initial Value	Unit
Setting	Operator Set	42	Parameter Save	Yes/No [6]	-	No	-

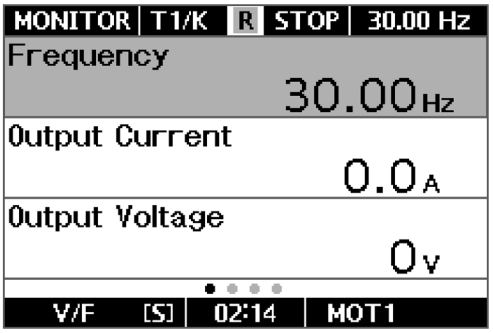
[6] This is displayed in a pop-up window as a button.

12.2 Monitoring Settings

12.2.1 Item Change in Monitor Display Mode

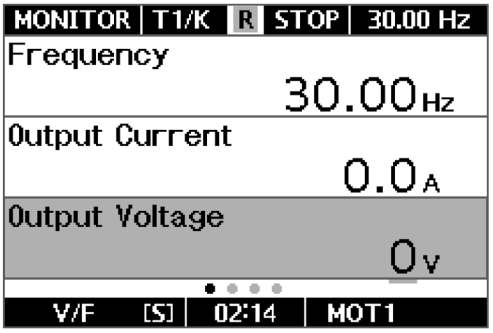
You can monitor three items simultaneously in monitor mode. You can also change monitoring items. Refer to **4.2.4.1 Monitor mode** for details on screen composition and items of the monitor mode.

The following is an example of changing a monitor display item. You can select monitoring items in the setting mode.



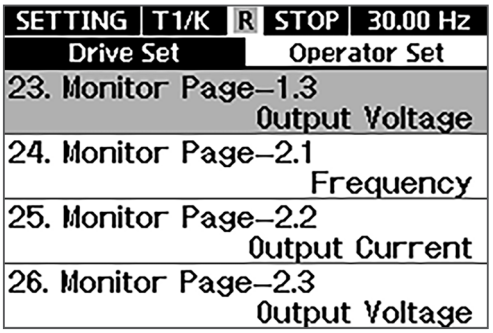
[Image 24. Monitor mode screen]

- It is the initial screen of monitor mode.
- The Output **Frequency**, **Output Current**, and **Output Voltage** are set as monitoring items by default.



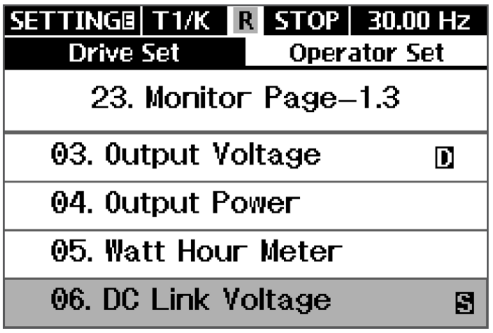
[Image 25. Item Selection in Monitor Mode]

- Press the ENTER key for one second after selecting the third item.



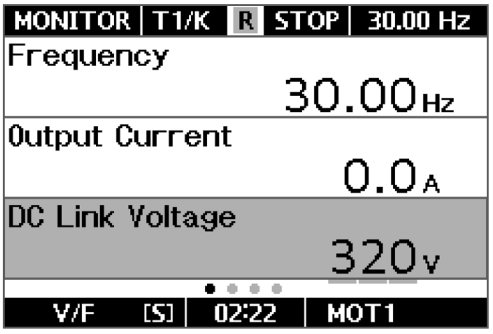
[Image 26. Selecting Monitor Items to Change in Setting Mode]

- The screen moves to code no. 23 in the Operator Set tab in Setting mode.
- Press the ENTER key and set the items to display in Monitor mode.
  (You may change parameter values directly in the Operator Set tab in Setting mode instead of pressing the ENTER key for one second.)



[Image 27. Selecting Monitor Items to Display]

- Press the ▲/▼ keys and move the cursor to 6 (**DC Link Voltage**).
- Press the ENTER key to change the setting.

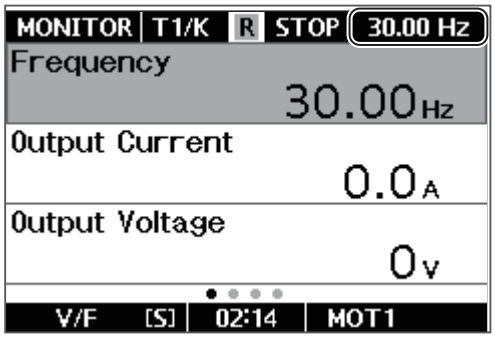


[Image 28. Screen with Monitor Items Changed]

- Press the MODE key, move to Monitor mode from the Menu screen, and check if the third item has changed to **DC Link Voltage**.

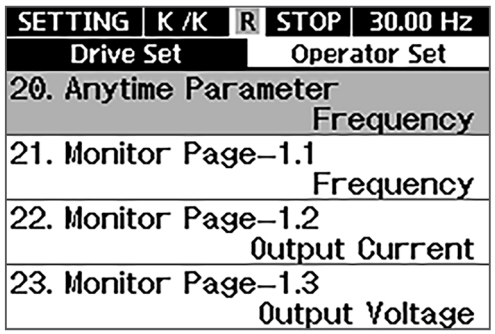
12.2.2 Monitoring Item Settings for Top Status Bar

Items displayed on the right of top status bar in Smart Operator are always displayed regardless of the mode. Therefore, if you register parameters of your choice in the top status bar, you can always check the values even when you move or change modes. The initial value of this item is frequency. The command frequency is displayed when stopped, whereas current output frequency is displayed during operation. The following shows an example of changing monitoring values in the top status bar.



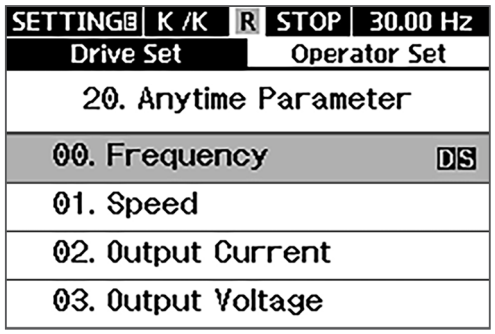
[Image 29. Monitor mode screen]

- It is the initial screen of **Monitor** mode.
- The frequency is displayed in the top status bar by default.



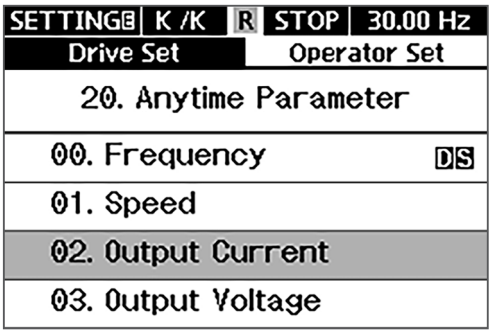
[Image 30. Selecting Monitoring Items to Change in Top Status Bar in Setting Mode]

- Press the ⌔ key in the Drive Set tab in **Setting** mode and move to code no. 20.



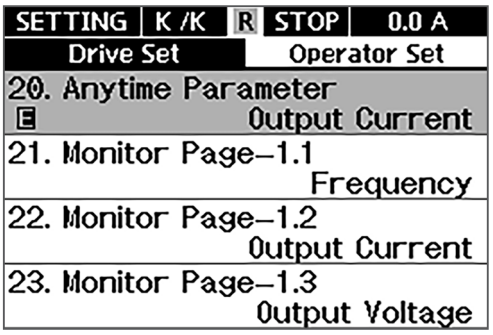
[Image 31. Selecting Monitoring Items in Top Status Bar]

- Press the ENTER key to locate the cursor on the currently set value.



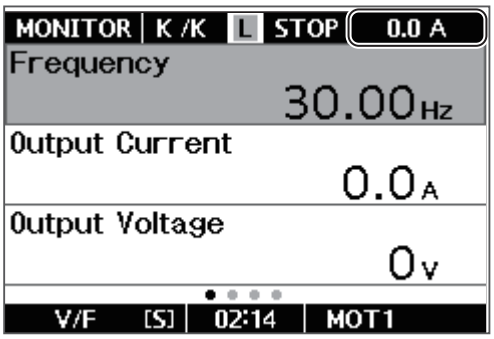
[Image 32. Selecting the Output Current among Monitoring Items in the Top Status Bar]

- Press the ▲/▼ keys and move the cursor to 2 (Output Current).
- Press the ENTER key to change the setting.



[Image 33. The Screen after a Monitor Item Change in the Top Status Bar]

- The changed item will be displayed in code no. 20 in the Drive Set tab. Check if the item in the top status bar has changed from output frequency to output current.



[Image 34. Top Status Bar with Monitoring Item Changed]

- Press the MODE key to move to Monitor mode from the Menu screen, and check if the item in the top status bar is the output current.

12.2.3 Operation Status Monitor Settings

The following are setting mode parameters for the operation status monitor. You can set additional features with the Smart Operator.

Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
Setting	Drive Set	20	Anytime Para	0	Frequency	0~24	0	-
		21	Monitor Page-1.1	Same as Anytime Para			0	-
		22	Monitor Page -1.2				2	-
		23	Monitor Page -1.3				3	-
		24	Monitor Page -2.1				0	-
		25	Monitor Page -2.2				2	-
		26	Monitor Page -2.3				3	sec
		27	Monitor Page -2.4				6	-
		28	Monitor Page -2.5				23	-
		29	Monitor Page -2.6				7	-
		30	Monitor Gauge				0	-
		31	Monitor Graph				0	-
		32	Graph TimePeriod	0	6 Sec	0~5	3	-
				1	12 Sec			
				2	1 Min			
				3	5 Min			
				4	10 Min			
				5	30 Min			
		33	Monitor Mode Init	Yes/No [7]			0	-

[7] This is displayed in a pop-up window as a button.

Operation Status Monitor Parameters Settings Details

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>Drive Set-20 Anytime Parameter</td><td>Select the items to display on the status bar in the top-right corner of the Smart Operator. Select setting values for the information to be displayed from below. Drive Set-21-31 have the same setting values. Refer to <u>12.2.2 Monitoring Item Settings for Top Status Bar</u> for more details on this parameter.
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>0</td><td>Frequency</td><td>Set frequency is displayed when stopped and operating frequency that is currently being output is displayed in Hz during operation.</td></tr>
<tr><td>1</td><td>Speed</td><td>Works the same as no. 0, and the operation status is displayed in rpm.</td></tr>
<tr><td>2</td><td>Output Current</td><td>Displays the output current.</td></tr>
<tr><td>3</td><td>Output Voltage</td><td>Displays the output voltage.</td></tr>
<tr><td>4</td><td>Output Power</td><td>Displays the output power.</td></tr>
<tr><td>5</td><td>Watt Hour Meter</td><td>Displays the inverter power consumption.</td></tr>
<tr><td>6</td><td>DC Link Voltage</td><td>Displays the DC link voltage inside the inverter.</td></tr>
<tr><td>7</td><td>Digital In Status</td><td>Displays the status of input terminals of the terminal block. It is displayed from the right.</td></tr>
<tr><td>8</td><td>Digital Out Status</td><td>Displays the status of the output terminals of the terminal block. It is displayed from the right.</td></tr>
<tr><td>9</td><td>AI1 Value</td><td>Displays the analog input values of the terminal block.</td></tr>
<tr><td>10</td><td>AI1 Monitor[%]</td><td>Displays the analog input values of the terminal block as a percentage (-100 - 100%).</td></tr>
<tr><td>11</td><td>AI2 Value</td><td rowspan="4">Same as 9 and 10.</td></tr>
<tr><td>12</td><td>AI2 Monitor[%]</td></tr>
<tr><td>13</td><td>AI3 Value</td></tr>
<tr><td>14</td><td>AI3 Monitor[%]</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Code and Functions</th><th>Description</th></tr>
<tr><td>Drive Set-20 Anytime Parameter</td><td>
<table>
<tr><th colspan="2">Item</th><th>Functionality</th></tr>
<tr><td>15</td><td>PID Output</td><td>Displays output of the PID controller.</td></tr>
<tr><td>16</td><td>PID Reference</td><td>Displays the size of reference value of the PID controller and the PID reference values are configurable.</td></tr>
<tr><td>17</td><td>PID Feedback</td><td>Displays the feedback volume of the PID controller.</td></tr>
<tr><td>18</td><td>Torque</td><td>Displays the torque.</td></tr>
<tr><td>19</td><td>Torque Limit</td><td>Displays the torque limits.</td></tr>
<tr><td>20</td><td>Torque Monitor[Nm]</td><td>Displays the torque output (Nm).</td></tr>
<tr><td>21</td><td>Speed Limit</td><td>Displays the speed limits.</td></tr>
<tr><td>22</td><td>Load Speed</td><td>Displays the load speed.</td></tr>
<tr><td>23</td><td>Ac Input Volt</td><td>Displays the AC input voltage.</td></tr>
<tr><td>24</td><td>Temperature</td><td>Displays the inverter temperature.</td></tr>
</table>
</td></tr>
<tr><td>Setting-21~23 Monitor Page-x.x (x.x: 1.1~1.3)</td><td>Selects items to display on Monitor mode screen-1. All three items from Monitor Page-1.1 to Monitor Page-1.3 can be displayed concurrently.</td></tr>
<tr><td>Setting-24~29 Monitor Page-x.x (x.x: 2.1~2.6)</td><td>Selects items to display on Monitor mode screen-2. All six items from Monitor Page-2.1 to Monitor Page-2.6 can be displayed concurrently.</td></tr>
<tr><td>Setting-30 Monitor Gauge</td><td>Selects the items to display for the Monitor mode gauge. One item can be displayed.</td></tr>
<tr><td>Setting-31 Monitor Graph</td><td>Selects items to display in Monitor mode graph. One item can be displayed.</td></tr>
<tr><td>Setting-32 Graph TimePeriod</td><td>Sets the maximum time for X-axis in the monitor mode graph.</td></tr>
<tr><td>Setting-33 Monitor Mode Init</td><td>Select Yes and Drive Set-20-32 will be initialized.</td></tr>
</table>

Note

Watt Hour Meter (inverter power consumption)

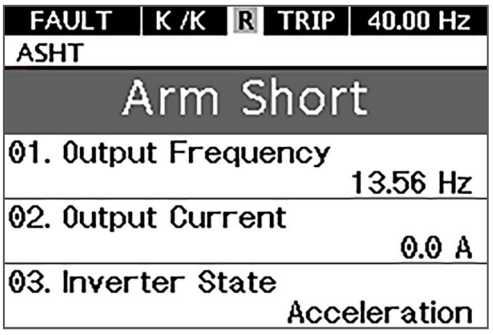
Among the codes of Drive Set-20, 5 (Watt Hour Meter, inverter power consumption) uses calculations with voltage and current and is accumulated based on the power calculated every second. Power consumption is displayed as follows:

- For less than 1000 kW, it will be displayed as 999.9 kWh in the unit of kW.
- For 1 - 99 MW, it will be displayed as 99.99 MWh in the unit of MW.
- For 100 - 999 MW, it will be displayed as 999.9 MWh in the unit of MW.
- For 1000 MW and more, it will be displayed as 9999 MWh in the unit of MW up to 65535 MWh.
- For 65535 MW and more, it will be initialized to 0 and displayed as 999.9 kWh in the unit of kW.
- You can manually initialize cumulative power consumption if you set 62 (WHour Count Reset) in the Operator Set tab in Setting mode as Yes.

12.3 Trip Status Monitoring

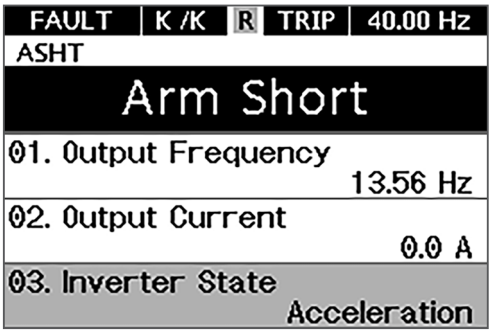
12.3.1 For a Trip During Operation

The following example demonstrates how to monitor output current in the operation group using the Smart Operator.



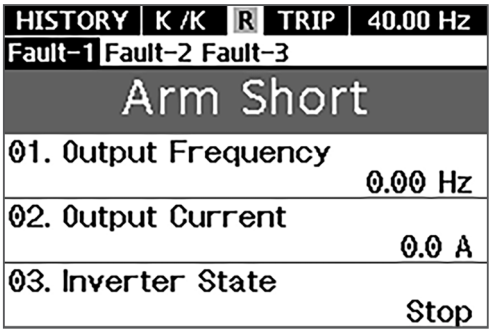
[Image 35. Trip Occurred]

- When there is a trip during operation, it will automatically switch to the trip mode screen and display the type of current trip.



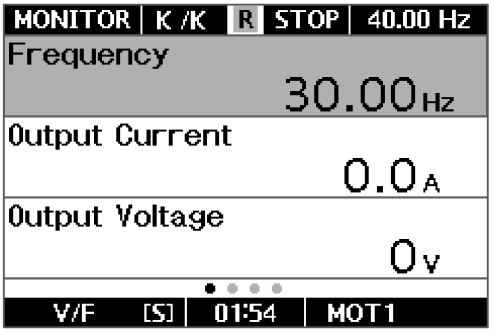
[Image 36. Trip Status Selection]

- To check information such as output frequency, current, or operation status at the time of a trip occurrence, press the key and move to the relevant position.



[Image 37. Trip History Selection]

- If there is a trip history, press the keys and check the status of the trip at that moment.
- The Fault-1 tab shows the latest trip.

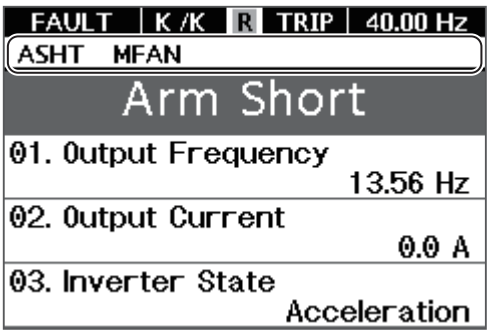


[Image 38. Trip Disabled]

- When the trip is disabled from reset, it will return to the screen before the trip.

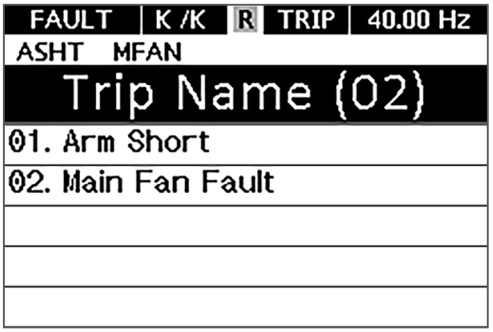
12.3.2 For Concurrent Trips of Two or More

The following example demonstrates how to monitor output current in the operation group using the Smart Operator.



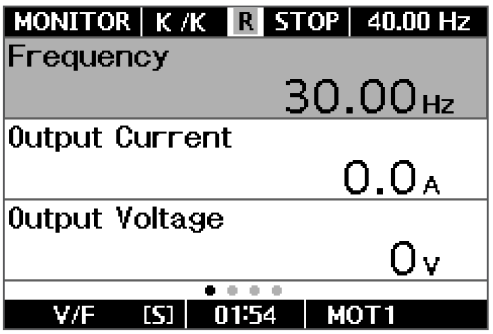
[Image 39. Multiple Trips]

- When there are two or more trips, the list of trips will be displayed at the top of the screen.
- Press the (ENTER) key.



[Image 40. The Type and Number of Multiple Trips]

- It will display the type and number of concurrent trips.



[Image 41. Trip Disabled]

- When a trip is disabled from reset, it will return to the screen before the trip.

12.4 USB mode

The S300 has a built-in USB Type-C port, which can be used to access various functions. For the location of the USB port on the S300 and a description of the USB communication functions, refer to **11 Using USB Communication Functions**.

Caution

Connect the USB only after the main power is applied. If the main power is applied while the USB is connected, an error or malfunction may occur.
If USB connection or disconnection is required when the main power is not applied, use it with an external 24 V power supply connected.

Mode	Group	Code	LCD Display	Set Value		Setting Range	Initial Value	Unit
Setting	Operator Set	92	Drive Firmware Write [8]	0	None	-	-	-
		93	USB Mode	0	USB Comm	0-2	-	-
				1	USB Memory			
				2	USB Power Only			

[8] This is a function for firmware updates. For details, contact our customer support center.

Detailed USB mode setting

<table>
<tr><th>Code and Functions</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4">Operator Set-93 USB Mode</td><td colspan="3">Sets the USB connection mode.</td></tr>
<tr><td colspan="2">Configuration</td><td>Functionality</td></tr>
<tr><td>0</td><td>USB Comm</td><td>This function allows the inverter to be connected to DriveView9, our PC software for inverter connection, via USB. When the PC is successfully connected, the following screen is displayed.

</td></tr>
<tr><td>1</td><td>USB Memory</td><td>Allows the PC to recognize the Smart Operator as an independent USB storage device. When the PC is successfully connected, the following screen is displayed.

</td></tr>
<tr><td>2</td><td>USB PowerOnly</td><td>Operates only the Smart Operator with the inverter power not applied, enabling limited operations such as parameter storage.</td></tr>
</table>

13 Table of Functions

This chapter lists all the function settings for S300 series inverter. Set the parameters required for operation according to the table of functions.

The parameter address when accessing the inverter parameter with communication is calculated as follows:

16-bit parameter address = 16 bit group code + code number
32-bit parameter address = 32 bit group code + code number *2

If you want to get the process PID output via communication, its parameter is PPID-02 (Output Value) and the parameter address when accessing with 16-bit parameter is as follows:

2000h + 2 = 2002h

The parameter address when accessing with a 32-bit parameter is as follows:

A000h + 2 * 2 = A004h (read two consecutively)

By default, when accessing 32-bit parameters, the parameter addresses must be even numbers. If accessed with an odd number, the inverter will respond with an address that is 1 less. For example, the 32-bit parameter address of PPID-02 (Output Value) is A004h. However, if accessed with A005h, the inverter will recognize it as A004h and respond accordingly.

The group codes for each parameter are as follows:

Group	16-Bit	32-Bit	Group	16-Bit	32-Bit
DRV	1200h	9200h	INTC	2700h	A700h
BAS	1300h	9300h	INTM	2800h	A800h
MOT1	1400h	9400h	USBC	2900h	A900h
VF1	1500h	9500h	VIRT	2C00h	AC00h
VEC1	1600h	9600h	ENC	2D00h	AD00h
MOT2	1700h	9700h	EPI1	2E00h	AE00h
VF2	1800h	9800h	EPI2	2F00h	AF00h
VEC2	1900h	9900h	POS1	3000h	B000h
ADV	1A00h	9A00h	POS2	3100h	B100h
APP	1B00h	9B00h	WEB1	3200h	B200h
DIN	1B00h	9B00h	WEB2	3300h	B300h

Group	16-Bit	32-Bit	Group	16-Bit	32-Bit
AIN	1C00h	9C00h	US	3900h	B900h
OUT	1D00h	9D00h	USL	3A00h	BA00h
PPID	2200h	A200h	USV	3B00h	BB00h
PRT	2400h	A400h	USP	3C00h	BC00h
DIAG	2500h	A500h	USM	3D00h	BD00h

13.1 Drive Group (DRV)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range	Initial Value	Unit	Property[1]	Ref.	Communication address/scale	
							16-Bit	32-Bit
00	Jump Code	1-99	25	-	O	4.3.3	1200h	9200h
01	Command Frequency	0.00-Max Frequency	0.00	Hz	O	5.1.1.2	1201h	9202h
							0.01	0.01
02 [2]	Command Speed	0-Maximum Speed	0 [3]	rpm	O	5.1.1.2	1202h	9204h
							1	1
03	Command Torque	-320.0~320.0	0.0	%	O	6.3.2.1	1203h	9206h
							0.1	0.1
05	Acc Time	0.00-6000.00	20.00 [4]	sec	O	5.3.1	1205h	920Ah
			60.00 [5]				0.1	0.01

1 O: Writable during operation, △: Writable when stopped, X: Not writable
2 Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display).
3 The rpm value varies according to the motor rating pole number (MOT1, 2-25).
4 For an inverter capacity of 75 kW or less (Refer to **16.8 Parameter Default Values Based on the Motor Capacity**)
5 For an inverter capacity 90 kW or more (Refer to **16.8 Parameter Default Values Based on the Motor Capacity**)

Code	LCD Display	Setting Range		Initial Value	Unit	Property[1]	Ref.	Communication address/scale	
								16-Bit	32-Bit
06	Dec Time	0.00-6000.00		30.00	sec	O	5.3.1	1206h	920Ch
								0.1	0.01
10	1st Command Source	0	Keypad	1	-	△	5.2.1	120ah	9214h
		1	Fx/Rx-1						
		2	Fx/Rx-2						
		3	3-Wire						
		4	Internal Comm						
		5	USB Comm.						
		6	Option Comm.						
		7	UserSequence						
11	1st Freq Ref Src	0	Keypad	0	-	△	5.1.1.1	120bh	9216h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Up Down Drive						
		6	Internal Comm.						
		7	USB Comm.						
		8	Option Comm.						
		9	UserSequence						
		10	X-Analog Input 1						
		11	X-Analog Input 2						
		12	X-Analog Input 3						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[1]	Ref.	Communication address/scale	
								16-Bit	32-Bit
12 [6]	1st Torque Ref Src	0	Keypad	0	-	△	6.3.2	120ch	9218h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Internal Comm.						
		6	USB Comm.						
		7	Option Comm.						
		8	UserSequence						
		9	X-Analog Input 1						
		10	X-Analog Input 2						
		11	X-Analog Input 3						
15	Jog Frequency	0.00-Max Frequency		10.00	Hz	O	7.2.1	120fh	921Eh
								0.01	0.01
16 [2]	Jog Speed	0-Maximum Speed		300 [3]	rpm	O	7.2.1	1210h	9220h
								1	1
17	Jog Acc Time	0.00-6000.00		20.00	sec	O	7.2.1	1211h	9222h
								0.1	0.01
18	Jog Dec Time	0.00-6000.00		30.00	sec	O	7.2.1	1212h	9224h
								0.1	0.01
20	Max Frequency	10.00-590.00		60.00	Hz	△	5.1.2.5	1214h	9228h
								0.01	0.01
21 [2]	Maximum Speed	300-17700		1800 [3]	rpm	△	5.1.2.5	1215h	922Ah
								1	1
22	Frequency at 100%	0.00-Max Frequency		60.00	Hz	O	5.1.1.3	1216h	922Ch
								0.01	0.01
23 [2]	Speed at 100%	0-Maximum Speed		1800 [3]	rpm	O	5.1.1.3	1217h	922Eh
								1	1

[6] Activated when the MOT1-8 (Torque Control En) value is 1 (Yes).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[1]	Ref.	Communication address/scale	
								16-Bit	32-Bit
24 [6]	Torque at 100%	0.0-200.0		100.0	%	O	6.3.2.2	1218h	9230h
								0.1	0.1
25	Load Duty Select	0	Normal Duty	1	-	△	9.1.3	1219h	9232h
		1	Heavy Duty				9.1.2		
26	PWM Mode	0	Normal PWM	1	-	△	7.15	121ah	9234h
		1	Low Leakage PWM						
27	Carrier Frequency	1-15		2	kHz	O	7.15	121bh	9236h
								1	1
28	OVM Mode Enable	0	No	1	-	O	-	121Ch	9238h
		1	Yes						
30	Ref AC Input Volt	**200 V class**	200-240V	-	V	X	7.18	121eh	923Ch
								1	1
		400 V class	380-480V	-			7.18	121fh	923Eh
								1	1
31	60/50 Hz Select	0	60Hz	0	-	△	7.18	1220h	9240h
		1	50Hz						
32	Hz/rpm Select	0	Hz Display	0	-	△	5.1.2.3	1223h	9246h
		1	rpm Display						
35	Auxiliary Ref Src	0	None	0	-	△	7.1	1224h	9248h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[1]	Ref.	Communication address/scale	
								16-Bit	32-Bit
36 [7]	Auxiliary Cal Type	0	M + (G * A)	0	-	△	7.1	1225h	924Ah
		1	M * (G * A)						
		2	M / (G * A)						
		3	M+(M*(G*A))						
		4	M+G*2*(A-50)						
		5	M*(G*2*(A-50))						
		6	M/(G*2*(A-50))						
		7	M+M*G*2*(A-50)						
		8	(M-A)^2						
		9	M^2 + A^2						
		10	MAX(M,A)						
		11	MIN(M,A)						
		12	(M+A)/2						
37 [7]	Auxiliary Ref Gain	-200.0-200.0		100.0	%	O	7.1	1228h	9250h
								0.1	0.1
40 [8]	2nd Command Src	0	Keypad	1	-	△	7.18	1229h	9252h
		1	Fx/Rx-1						
		2	Fx/Rx-2						
		3	3-Wire						
		4	Internal Comm.						
		5	USB Comm.						
		6	Option Comm.						
		7	UserSequence						

[7] Activated when the DRV-35 (Auxiliary Ref Src) value is not 0 (None).
[8] Activated when one of the DIN-01, 03, 05, 07, 09, 11, 13, and 15 (DI1-DI8 Define) values is 20 (2nd Source).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[1]	Ref.	Communication address/scale	
								16-Bit	32-Bit
41 [8]	2nd Freq Ref Src	0	Keypad	0	-	O	7.18	122ah	9254h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Up Down Drive						
		6	Internal Comm.						
		7	USB Comm.						
		8	Option Comm.						
		9	UserSequence						
		10	X-Analog Input 1						
		11	X-Analog Input 2						
		12	X-Analog Input 3						
42 [8]	2nd Torque Src	0	Keypad	0	-	O	7.18	122ah	9254h
		1	Analog Input01						
		2	Analog Input02						
		3	Analog Input03						
		4	Pulse Input						
		5	Internal Comm.						
		6	USB Comm.						
		7	Option Comm.						
		8	UserSequence						
		9	X-Analog Input 1						
		10	X-Analog Input 2						
		11	X-Analog Input 3						
45	Trim Power %	70-130		100	%	O	7.22	122dh	925Ah
								1	1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[1]	Ref.	Communication address/scale	
								16-Bit	32-Bit
50	Fan Control	0	During Run	0	-	O	9.2.10	1232h	9264h
		1	Always Run						
		2	Temp. Control						
85	Temperature	-		-	℃	X	-	1255h	92AAh
								0.1	0.1
86	Sync Frequency	-		-	Hz	X	-	1256h	92ACh
								0.01	0.01

13.2 Basic Function Group (BAS)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range		Initial Value	Unit	Property[9]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		20	-	O	4.3.3	1300h	9300h
01	Start Mode	0	Acceleration	0	-	△	5.2.4	1301h	9302h
		1	DC Start						
		2	Speed Search						
02	Stop Mode	0	Deceleration	0	-	△	5.2.5	1302h	9304h
		1	Dc Brake						
		2	CoastStop (FreeRun)						
		3	Reserved						
		4	Power Braking						
03 [10]	DC Start Time	0.01-60.00		1.00	sec	△	5.2.4.2	1303h	9306h
								0.01	0.01
04 [10]	DC Start Level	1-200		50	%	△	5.2.4.2	1304h	9308h
								1	1
05 [11]	DC Brake Block Time	0.00-60.00		0.10	sec	△	5.2.5.2	1305h	930ah
								0.01	0.01
06 [11]	DC Brake Time	0.01-60.00		1.00	sec	△	5.2.5.2	1306h	930ch
								0.01	0.01
07 [11]	DC Brake Level	1-200		50	%	△	5.2.5.2	1307h	930eh
								1	1
08 [11]	DC Brake Frequency	0.00-60.00		5.00	Hz	△	5.2.5.2	1308h	9310h
								0.01	0.01

[9] O: Writable during operation, △: Writable when stopped, X: Not writable
[10] Activated when the BAS-1 (Start Mode) value is 1 (DC Start).
[11] Activated when the BAS-02(Stop Mode) value is 1 (DC Brake).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[9]	Ref.	Communication address/scale	
								16-Bit	32-Bit
09 [12]	DC Brake Speed	0-1800		150 [13]	rpm	△	5.2.5.2	1309h	9312h
								1	1
10 [14]	DC Injection Level	1-200		50	%	△	7.24	130ah	9314h
								1	1
11 [15]	PwrBrk BandWidth	0-500		100	%	△	5.2.5.4	130bh	9316h
								1	1
12 [15]	PwrBrk FluxBrkGain	0-200		100	%	△	5.2.5.4	130ch	9318h
								1	1
16	Torque Limit Src	0	Keypad	0	-	△	6.6.1	130bh	9316h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Internal Comm.						
		6	USB Comm.						
		7	Option Comm.						
		8	UserSequence						
		9	System						

[12] Activated when the BAS-2 (Stop Mode) value is 1 (DC Brake) and the DRV-32 (Hz/rpm Select) value is 1 (rpm Display).
[13] The rpm value varies according to the motor rating pole number (MOT1, 2-25).
[14] Activated when one of the DIN-01, 03, 05, 07, 09, 11, 13, and 15 (DI1-DI8 Define) values is 28 (DC Injection).
[15] Activated when the BAS-2 (Stop Mode) value is 4 (Power Braking).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[9]	Ref.	Communication address/scale	
								16-Bit	32-Bit
17 [16]	TrqMode SpdLmt Src	0	Keypad	0	-	△	6.6.2	130ch	9318h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Up Down Drive						
		6	Internal Comm.						
		7	USB Comm.						
		8	Option Comm						
20	Auto Tuning	0	None	0	-	△	3.4	130fh	931eh
		1	Auto Tuning						
22	Ldq Tune Freq Perc	80-150		150	%	△	-	1318h	9330h
								1	1
23	Ldq Tune Curr Perc	20-50		35	%	△	-	1319h	9332h
								1	1
31	Step Frequency-01	0.00-Max Frequency		10.00	Hz	O	5.1.2.4	131fh	933eh
								0.01	0.01
32	Step Frequency-02	0.00-Max Frequency		20.00	Hz	O	5.1.2.4	1320h	9340h
								0.01	0.01
33	Step Frequency-03	0.00-Max Frequency		30.00	Hz	O	5.1.2.4	1321h	9342h
								0.01	0.01
34	Step Frequency-04	0.00-Max Frequency		40.00	Hz	O	5.1.2.4	1322h	9344h
								0.01	0.01
35	Step Frequency-05	0.00-Max Frequency		50.00	Hz	O	5.1.2.4	1323h	9346h
								0.01	0.01
36	Step Frequency-06	0.00-Max Frequency		60.00	Hz	O	5.1.2.4	1324h	9348h
								0.01	0.01
37	Step Frequency-07	0.00-Max Frequency		60.00	Hz	O	5.1.2.4	1325h	934ah
								0.01	0.01

[16] Activated when the MOT1-8 (Torque Control En) value is 1 (Yes).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[9]	Ref.	Communication address/scale	
							16-Bit	32-Bit
38	Step Frequency-08	0.00-Max Frequency	55.00	Hz	O	5.1.2.4	1326h	934ch
							0.01	0.01
39	Step Frequency-09	0.00-Max Frequency	50.00	Hz	O	5.1.2.4	1327h	934eh
							0.01	0.01
40	Step Frequency-10	0.00-Max Frequency	45.00	Hz	O	5.1.2.4	1328h	9350h
							0.01	0.01
41	Step Frequency-11	0.00-Max Frequency	40.00	Hz	O	5.1.2.4	1329h	9352h
							0.01	0.01
42	Step Frequency-12	0.00-Max Frequency	35.00	Hz	O	5.1.2.4	132ah	9354h
							0.01	0.01
43	Step Frequency-13	0.00-Max Frequency	25.00	Hz	O	5.1.2.4	132bh	9356h
							0.01	0.01
44	Step Frequency-14	0.00-Max Frequency	15.00	Hz	O	5.1.2.4	132ch	9358h
							0.01	0.01
45	Step Frequency-15	0.00-Max Frequency	5.00	Hz	O	5.1.2.4	132dh	935ah
							0.01	0.01
46 [12]	Step Speed-01	0-Maximum Speed	300 [13]	rpm	O	5.1.2.4	132eh	935ch
							1	1
47 [12]	Step Speed-02	0-Maximum Speed	600 [13]	rpm	O	5.1.2.4	132fh	935eh
							1	1
48 [12]	Step Speed-03	0-Maximum Speed	900 [13]	rpm	O	5.1.2.4	1330h	9360h
							1	1
49 [12]	Step Speed-04	0-Maximum Speed	1200 [13]	rpm	O	5.1.2.4	1331h	9362h
							1	1
50 [12]	Step Speed-05	0-Maximum Speed	1500 [13]	rpm	O	5.1.2.4	1332h	9364h
							1	1
51 [12]	Step Speed-06	0-Maximum Speed	1800 [13]	rpm	O	5.1.2.4	1333h	9366h
							1	1
52 [12]	Step Speed-07	0-Maximum Speed	1800 [13]	rpm	O	5.1.2.4	1334h	9368h
							1	1

Code	LCD Display	Setting Range	Initial Value	Unit	Property[9]	Ref.	Communication address/scale	
							16-Bit	32-Bit
53 [12]	Step Speed-08	0-Maximum Speed	1650 [13]	rpm	O	5.1.2.4	1335h	936ah
							1	1
54 [12]	Step Speed-09	0-Maximum Speed	1500 [13]	rpm	O	5.1.2.4	1336h	936ch
							1	1
55 [12]	Step Speed-10	0-Maximum Speed	1350 [13]	rpm	O	5.1.2.4	1337h	936eh
							1	1
56 [12]	Step Speed-11	0-Maximum Speed	1200 [13]	rpm	O	5.1.2.4	1338h	9370h
							1	1
57 [12]	Step Speed-12	0-Maximum Speed	1050 [13]	rpm	O	5.1.2.4	1339h	9372h
							1	1
58 [12]	Step Speed-13	0-Maximum Speed	750 [13]	rpm	O	5.1.2.4	133ah	9374h
							1	1
59 [12]	Step Speed-14	0-Maximum Speed	450 [13]	rpm	O	5.1.2.4	133bh	9376h
							1	1
60 [12]	Step Speed-15	0-Maximum Speed	150 [13]	rpm	O	5.1.2.4	133ch	9378h
							1	1
66	Acc Pattern	0 Linear 1 S-Curve	0	-	△	5.3.2.1	1342h	9384h
67 [17]	Acc S-Curve Start	1-100	40	%	△	5.3.2.1	1343h	9386h
							1	1
68 [17]	Acc S-Curve End	1-100	40	%	△	5.3.2.1	1344h	9388h
							1	1
69	Dec Pattern	0 Linear 1 S-Curve	0	-	△	5.3.2.1	1345h	938ah
70 [18]	Dec S-Curve Start	1-100	40	%	△	5.3.2.1	1346h	938ch
							1	1

[17] Activated when the BAS-66 (Acc Pattern) value is 1 (S-Curve).
[18] Activated when the BAS-69 (Dec Pattern) value is 1 (S-Curve).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[9]	Ref.	Communication address/scale	
								16-Bit	32-Bit
71 [18]	Dec S-Curve End	1-100		40	%	△	5.3.2.1	1347h	938eh
								1	1
76	Ramp Time Mode	0	Max Frequency	0	-	△	5.3.2.1	134ch	9398h
		1	Delta Frequency						
77	Pattern UpdateBand	0.0-1.0		0.3	Hz	△	5.3.2.1	134dh	939ah
								0.1	0.1
78 [19]	Acc Time-1	0.00-6000.00		20.00	sec	O	5.3.1.3	134eh	939ch
								0.1	0.01
79 [19]	Dec Time-1	0.00-6000.00		20.00	sec	O	5.3.1.3	134fh	939eh
								0.1	0.01
80 [19]	Acc Time-2	0.00-6000.00		30.00	sec	O	5.3.1.3	1350h	93a0h
								0.1	0.01
81 [19]	Dec Time-2	0.00-6000.00		30.00	sec	O	5.3.1.3	1351h	93a2h
								0.1	0.01
82 [19]	Acc Time-3	0.00-6000.00		40.00	sec	O	5.3.1.3	1352h	93a4h
								0.1	0.01
83 [19]	Dec Time-3	0.00-6000.00		40.00	sec	O	5.3.1.3	1353h	93a6h
								0.1	0.01
84 [19]	Acc Time-4	0.00-6000.00		50.00	sec	O	5.3.1.3	1354h	93a8h
								0.1	0.01
85 [19]	Dec Time-4	0.00-6000.00		50.00	sec	O	5.3.1.3	1355h	93aah
								0.1	0.01
86 [19]	Acc Time-5	0.00-6000.00		60.00	sec	O	5.3.1.3	1356h	93ach
								0.1	0.01
87 [19]	Dec Time-5	0.00-6000.00		60.00	sec	O	5.3.1.3	1357h	93aeh
								0.1	0.01
88 [19]	Acc Time-6	0.00-6000.00		70.00	sec	O	5.3.1.3	1358h	93b0h
								0.1	0.01

[19] Activated when one of the DIN-01, 03, 05, 07, 09, 11, 13, and 15 (DI1-DI8 Define) values is 14, 15, and 16 (XCEL_L, XCEL_M, XCEL_H).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[9]	Ref.	Communication address/scale	
								16-Bit	32-Bit
89 [19]	Dec Time-6	0.00-6000.00		70.00	sec	O	5.3.1.3	1359h	93b2h
								0.1	0.01
90 [19]	Acc Time-7	0.00-6000.00		80.00	sec	O	5.3.1.3	135ah	93b4h
								0.1	0.01
91 [19]	Dec Time-7	0.00-6000.00		80.00	sec	O	5.3.1.3	135bh	93b6h
								0.1	0.01
95	Flux Brake Enable	0	No	0	-	O	9.1.5	135fh	93beh
		1	Yes						

13.3 First Motor Group (MOT1)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[20]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		35	-	O	4.3.3	1400h	9400h
04	Motor Type	0	Induction Motor	0	-	△	3.1	1404h	9408h
		1	Perm Magnet Motor						
		2	Sync Reluc Motor						
05	Control Mode	0	V/F	0	-	△	3.1	1405h	940ah
		1	Slip Comp.						
		2	V/F PG						
		3	Sensorless						
		4	Vector						
08 [21]	Torque Control En	0	No	0	-	△	3.2	1408h	9410h
		1	Yes						
15	Start Frequency	0.00-10.00		0.50	Hz	△	5.1.2.5	140fh	941eh
								0.01	0.01
16 [22]	Start Speed	0-300		15 [23]	rpm	△	5.1.2.5	1410h	9420h
								1	1
17	Stop Frequency	0.00-10.00		0.00	Hz	△	5.2.5.1	1411h	9422h
								0.01	0.01
18 [22]	Stop Speed	0-300		0 [23]	rpm	△	5.2.5.1	1412h	9424h
								1	1

[20] O: Writable during operation, △: Writable when stopped, X: Not writable
[21] Activated when the MOT1-05 (Control Mode) value is 3 (Sensorless) or 4 (Vector).
[22] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display).
[23] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[20]	Ref.	Communication address/scale	
								16-Bit	32-Bit
21	Motor Capacity	0	0.2 kW	-	-	△	3.1	1415h	942ah
		1	0.4 kW						
		2	0.75 kW						
		3	1.5 kW						
		4	2.2 kW						
		5	4 kW						
		6	5.5 kW						
		7	7.5 kW						
		8	11 kW						
		9	15 kW						
		10	18.5 kW						
		11	22 kW						
		12	30 kW						
		13	37 kW						
		14	45 kW						
		15	55 kW						
		16	75 kW						
		17	90 kW						
		18	110 kW						
		19	132 kW						
		20	160 kW						
		21	185 kW						
		22	200 kW						
		23	220 kW						
		24	280 kW						
		25	315 kW						
		26	375 kW						
		27	450 kW						
23	Base Frequency	5.00-590.00		60.00	Hz	△	3.1	1417h	942eh
								0.01	0.01

Code	LCD Display	Setting Range	Initial Value	Unit	Property[20]	Ref.	Communication address/scale	
							16-Bit	32-Bit
24	Rated Speed	150~17700	16.8 Note	rpm	△	3.1	1418h	9430h
							1	1
25	Number of Poles	2-100	4	Pole	△	3.1	1419h	9432h
							1	1
26	Rated Current	1.0-1000.0	16.8 Note	A	△	3.1	141ah	9434h
							0.1	0.1
27	Rated Voltage	0, 180-480	0	V	△	3.1	141bh	9436h
							1	1
28	Efficiency	70-100	16.8 Note	%	△	3.1	141ch	9438h
							1	1
35	No-load Current	0.5-1000.0	16.8 Note	A	△	3.1	1423h	9446h
							0.1	0.1
36	Stator Resistance	0.0000-99.9999	16.8 Note	Ω	△	3.4	1424h	9448h
							0.0001[24]	0.0001
37	Leakage Inductance	0.000-99.999	16.8 Note	mH	△	3.4	1425h	944ah
							0.001[24]	0.001
38	Stator Inductance	0.000-999.999	16.8 Note	mH	△	3.4	1426h	944ch
							0.001[24]	0.001
39	Rotor TimeConstant	25-5000	16.8 Note	msec	△	3.4	1427h	944eh
							1	1
40 [25]	q-axis Inductance	0.000-99.999	10.000	mH	△	3.4	1428h	9450h
							0.01	0.001
41 [25]	d-axis Inductance	0.000-99.999	10.000	mH	△	3.4	1429h	9452h
							0.01	0.001
42 [25]	PM Rotor Flux	0.000-65.000	0.100	-	△	3.4	142ah	9454h
							0.001	0.001

[24] For products with 200 V 15 kW or more or 400 V 18.5 kW or more. For other capacities, refer to **Table 1**.

[25] Activated when the MOT1-04 (Motor Type) value is 1 (Perm Magnet Motor).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[20]	Ref.	Communication address/scale	
								16-Bit	32-Bit
43 [26]	SynRM q-axis Inductance	0.000-999.999		10.000	mH	△	3.4	142bh	9456h
								0.01	0.001
45 [26]	SynRM d-axis Inductance	0.000-999.999		10.000	mH	△	3.4	142ch	9458h
								0.01	0.001
51	ACR Bandwidth	50-400		100	%	O	6.2	1433h	9466h
								1	1
52	Active Resistance	0-1000		0	%	O	6.2	1434h	9468h
								1	1
54	ASR Adjust Gain	1-10		4	-	O	6.2	1436h	946ch
								1	1
61 [25]	IPPE Enable	0	No	1	-	O	6.5.1	143dh	947ah
		1	Yes						
62 [25]	IPPE Volt Ref Perc	10-100		50	%	O	6.5.1	143eh	947ch
								1	1
63 [25]	IPPE Curr Peak Per	10-150		120	%	O	6.5.1	143fh	947eh
								1	1
75	ETH Enable	0	None	0	-	O	9.1.1	144bh	9496h
		1	CoastStop (FreeRun)						
		2	Dec						
76	Motor Cooling	0	Self-Cool	0	-	O	9.1.1	144ch	9498h
		1	Forced-Cool						
77	ETH Cont Current	50-150		120	%	O	9.1.1	144dh	949ah
								1	1
78	ETH 1min Current	120-200		150	%	O	9.1.1	144eh	949ch
								1	1
96	Load Speed Gain	0.1-6000.0		100.0	%	O	7.21	1460h	94c0h
								0.1	0.1

[26] Activated when the MOT1-04 (Motor Type) value is 2 (Sync Reluc Motor).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[20]	Ref.	Communication address/scale	
								16-Bit	32-Bit
97	Load Speed Scale	0	x 1	0	-	O	7.21	1461h	94c2h
		1	x 0.1						
		2	x 0.01						
		3	x 0.001						
		4	x 0.0001						
98	Load Speed Unit	0	rpm	0	-	O	7.21	1462h	94c4h
		1	mpm						

Note

Table 1. Parameter with different scales depending on the motor capacity when accessing with a 16-bit parameter data

Voltage category	Motor capacity	MOT1,2-36 (Stator Resistance)	MOT1,2-37 (Leakage Inductance)	MOT1,2-38 (Stator Inductance)
200 V	Below 0.4 kW	0.01	0.1	0.1
	0.75-11 kW	0.001	0.01	0.01
	Above 15 kW	0.0001	0.001	0.001
400 V	Below 1.5 kW	0.01	0.1	0.1
	2.2-15 kW	0.001	0.01	0.01
	18.5 kW or more	0.0001	0.001	0.001

13.4 The First Motor V/F Group (VF1)

This group is activated when the MOT1-05 (Control Mode) value is 0 (V/F) or 1 (Slip Comp.).

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range	Initial Value	Unit	Property[27]	Ref.	Communication address/scale	
							16-Bit	32-Bit
00	Jump Code	1-99	31	-	O	4.3.3	1500h	9500h
01	V/F Pattern	0 Linear 1 Square 2 User V/F 3 Square 2	0	-	△	6.1.3	1501h	9502h
02	User Frequency-1	0.00-User Frequency-2	15.00	Hz	△	6.1.3	1502h 0.01	9504h 0.01
03 [28]	User Speed-1	0 - User Speed-2	450 [29]	rpm	△	6.1.3	1503h 1	9506h 1
04	User Voltage-1	0-100	25	%	△	6.1.3	1504h 1	9508h 1
05	User Frequency-2	User Frequency-1-User Frequency-3	30.00	Hz	△	6.1.3	1505h 0.01	950ah 0.01
06 [28]	User Speed-2	User Speed-1-User Speed-3	900 [29]	rpm	△	6.1.3	1506h 1	950ch 1
07	User Voltage-2	0-100	50	%	△	6.1.3	1507h 1	950eh 1
08	User Frequency-3	User Frequency-2-User Frequency-4	45.00	Hz	△	6.1.3	1508h 0.01	9510h 0.01
09 [28]	User Speed-3	User Speed-2-User Speed-4	1350 [29]	rpm	△	6.1.3	1509h 1	9512h 1

[27] O: Writable during operation, △: Writable when stopped, X: Not writable
[28] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display).
[29] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[27]	Ref.	Communication address/scale	
								16-Bit	32-Bit
10	User Voltage-3	0-100		75	%	△	6.1.3	150ah	9514h
								1	1
11	User Frequency-4	User Frequency-3-Max Frequency		60.00	Hz	△	6.1.3	150bh	9516h
								0.01	0.01
12 [28]	User Speed-4	User Speed-3-Maximum Speed		1800 [29]	rpm	△	6.1.3	150ch	9518h
								1	1
13	User Voltage-4	0-100		100	%	△	6.1.3	150dh	951ah
								1	1
21	Slip Comp Mode	0	Basic Comp.	0	-	△	6.1.4.2	1515h	952ah
		1	Advanced Comp.						
22	SlipGain Mot-Low	0-300		100	%	O	6.1.4.2	1516h	952ch
								1	1
23	SlipGain Mot-High	0-300		100	%	O	6.1.4.2	1517h	952eh
								1	1
24	SlipGain Gen-Low	0-300		100	%	O	6.1.4.2	1518h	9530h
								1	1
25	SlipGain Gen-High	0-300		100	%	O	6.1.4.2	1519h	9532h
								1	1
26	SlipComp LPF Gain	1-10000		300	msec	O	6.1.4.2	151ah	9534h
								1	1
27	SlipGain SwOv Freq	0.00-20.00		9.00	Hz	O	6.1.4.2	151bh	9536h
								0.01	0.01
28 [28]	SlipGain SwOv Spd	0-600		270 [29]	rpm	O	6.1.4.2	151ch	9538h
								1	1
31	Torque Boost Mode	0	Manual	0	-	△	7.6	151fh	953eh
		1	Auto						
32	Forward Boost	0-15.0		2.0 [30]	%	△	7.6	1520h	9540h
				1.0 [31]				0.1	0.1

[30] For an inverter capacity of 75 kW or less (Refer to **16.8 Parameter Default Values Based on the Motor Capacity**)

[31] For an inverter capacity 90 kW or more (Refer to **16.8 Parameter Default Values Based on the Motor Capacity**)

Code	LCD Display	Setting Range	Initial Value	Unit	Property[27]	Ref.	Communication address/scale	
							16-Bit	32-Bit
33	Reverse Boost	0-15.0	2.0 [30]	%	△	7.6	1521h	9542h
			1.0 [31]				0.1	0.1
34	ATB Mot-Gain	0.0-300.0	100.0	%	O	7.6.2	1522h	9544h
							0.1	0.1
35	ATB Gen-Gain	0.0-300.0	100.0	%	O	7.6.2	1523h	9546h
							0.1	0.1
36	ATB LPF Gain	1-10000	3	msec	△	7.6.2	1524h	9548h
							1	1
54 [32]	PM V/F HPF Gain	0-1.0	0.7	-	O	-	1536h	956ch
							0.1	0.1
55 [32]	PM V/F HPF Wcut	0.0-3	1	Hz	O	-	1537h	956eh
							1	1
56 [32]	PM V/F CurrLmtGain	0-200	150	%	O	-	1538h	9570h
							1	1
57 [32]	PM VF DC Inj Perc	0-150	100	%	O	-	1539h	9572h
							1	1
58 [32]	PM VF Idse Limit	0-150	70	%	O	-	153ah	9574h
							1	1
60 [33]	SynRM V/f HPF Gain	0-10.0	0.7	-	O	3.4	153ch	9578h
							0.1	0.1
61 [33]	SynRM V/f HPF Wcut	0-3	1	Hz	O	3.4	153dh	957ah
							1	1
62 [33]	SynRM V/f CurrLmtG	0-200	150	%	O	3.4	153eh	957ch
							1	1
63 [33]	SynRM Vf Voffset	0-300	100	%	O	3.4	153fh	957eh
							1	1

[32] Activated when the MOT1-04 (Motor Type) value is 1 (Perm Magnet Motor).
[33] Activated when the MOT1-04 (Motor Type) value is 2 (Sync Reluc Motor).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[27]	Ref.	Communication address/scale	
								16-Bit	32-Bit
64 [33]	SynRM Reac Pwr Ref	50-300		130	%	O	3.4	1540h 1	9580h 1
71	AHR Enable	0	No	1	-	O	7.10	1547h	958eh
		1	Yes						
72	AHR P-Gain	0-1000		50	%	O	7.10	1548h 1	9590h 1
73	AHR Limit	0-100		2	%	O	7.10	1549h 1	9592h 1
76	Stall Prevent Acc	0	No	0	-	△	9.1.4	154ch	9598h
		1	Yes						
77	Stall Prevent Dec	0	No	0	-	△	9.1.4	154dh	959ah
		1	Yes						
78	Stall Prevent Std	0	No	0	-	△	9.1.4	154eh	959ch
		1	Yes						
79	Stall Frequency-1	0.00-Stall Frequency-2		15.00	Hz	O	9.1.4	154fh 0.01	959eh 0.01
80 [28]	Stall Speed-1	0-Stall Speed-2		450 [29]	rpm	O	9.1.4	1550h 1	95a0h 1
81	Stall Level-1	30-250		180	%	O	9.1.4	1551h 1	95a2h 1
82	Stall Frequency-2	Stall Frequency-1 - Stall Frequency-3		30.00	Hz	O	9.1.4	1552h 0.01	95a4h 0.01
83 [28]	Stall Speed-2	Stall Speed-1-Stall Speed-3		900 [29]	rpm	O	9.1.4	1553h 1	95a6h 1
84	Stall Level-2	30-250		180	%	O	9.1.4	1554h 1	95a8h 1
85	Stall Frequency-3	Stall Frequency-2-Stall Frequency-4		45.00	Hz	O	9.1.4	1555h 0.01	95aah 0.01

Code	LCD Display	Setting Range	Initial Value	Unit	Property[27]	Ref.	Communication address/scale	
							16-Bit	32-Bit
86 [28]	Stall Speed-3	Stall Speed-2-Stall Speed-4	1350 [29]	rpm	O	9.1.4	1556h	95ach
							1	1
87	Stall Level-3	30-250	180	%	O	9.1.4	1557h	95aeh
							1	1
88	Stall Frequency-4	Stall Frequency-3-Max Frequency	60.00	Hz	O	9.1.4	1558h	95b0h
							0.01	0.01
89 [28]	Stall Speed-4	Stall Speed-3-Maximum Speed	1800 [29]	rpm	O	9.1.4	1559h	95b2h
							1	1
90	Stall Level-4	30-250	180	%	O	9.1.4	155ah	95b4h
							1	1

13.5 First Motor Control Group (VEC1)

This group is activated when the MOT1-05 (Control Mode) value is 3 (Sensorless) or 4 (Vector).

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range		Initial Value	Unit	Property[34]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		21	-	O	4.3.3	1600h	9600h
09	Hold Time	0.00-60.00		1.00	sec	O	6.2	1609h	9612h
								0.01	0.01
14	Pre-Excite Time	0.00-60.00		1.00	sec	O	6.2	160eh	961ch
								0.01	0.01
15	FluxCtrl Bandwidth	50-400		100	%	O	6.2	160fh	961eh
								1	1
16	Flux Forcing	100.0-200.0		150.0	%	O	6.2	1610h	9620h
								0.1	0.1
18	FluxWeak Ctrl Mode	0	None	2	-	O	6.2	1612h	9624h
		1	Adjust by Freq						
		2	Adjust by Volt						
19	FW Volt Ref Ratio	85.0-100.0		95.0	%	O	6.2	1613h	9626h
								0.1	0.1
20	FW Control Gain	10-1000		100	%	O	6.2	1614h	9628h
								1	1
21	Fwd +Torque Limit	0.0-320.0		180.0	%	O	6.6.1	1615h	962ah
								0.1	0.1
22	Fwd -Torque Limit	0.0-320.0		180.0	%	O	6.6.1	1616h	962ch
								0.1	0.1

[34] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range	Initial Value	Unit	Property[34]	Ref.	Communication address/scale	
							16-Bit	32-Bit
23	Rev +Torque Limit	0.0-320.0	180.0	%	O	6.6.1	1617h 0.1	962eh 0.1
24	Rev -Torque Limit	0.0-320.0	180.0	%	O	6.6.1	1618h 0.1	9630h 0.1
26	TrqMode FwdFreqLmt	0.00-Max Frequency	60.00	Hz	O	6.6.2	161ah 0.01	9634h 0.01
27	TrqMode RevFreqLmt	0.00-Max Frequency	60.00	Hz	O	6.6.2	161bh 0.01	9636h 0.01
28 [35]	TrqMode Fwd SpdLmt	0-Maximum Speed	1800 [36]	rpm	O	6.6.2	161ch 1	9638h 1
29 [35]	TrqMode Rev SpdLmt	0-Maximum Speed	1800 [36]	rpm	O	6.6.2	161dh 1	963ah 1
30	TrqMode SpdLmtGain	1.0-100.0	20.0	%	O	6.6.2	161eh 0.1	963ch 0.1
31	Torque Ramp Time	0-10000	0	msec	O	6.6.4	161fh 1	963eh 1
34	IMSD Trq Comp	10-500	100	%	O	6.2.2	1622h 1	9644h 1
37	IMSL SpdComp Noload	95-110	100	%	O	6.2.1	1625h 1	964Ah 1
38	IMSL Torque Comp	10-500	100	%	O	6.2.1	1626h 1	964Ch 1
39	IMSL Speed Comp	10-500	100	%	O	6.2.1	1627h 1	964Eh 1
40	IMSL LSpd Trq Comp	10-500	105	%	O	6.2.1	1628h 1	9650h 1

[35] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display).
[36] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[34]	Ref.	Communication address/scale	
							16-Bit	32-Bit
63	Droop Percent	0.0~100.0	0.0	%	O	7.32	163fh	967eh
							0.1	0.1
64	Droop Start Torque	0.0~100.0	50.0	%	O	7.32	1640h	9680h
							0.1	0.1
65	Droop FreqLpf Gain	0~1000	500	msec	O	7.32	1641h	9682h
							1	1
66	Droop Start Freq	0.00~600.00	10.00	Hz	△	7.32	1642h	9684h
							0.01	0.01
67 [35]	Droop Start Spd	0~36000	300 [36]	rpm	△	7.32	1643h	9686h
							1	1

13.6 Second Motor Group (MOT2)

This group is activated when one of the DIN-01, 03, 05, 07, 09, 11, 13, and 15 (DI1-DI8 Define) values is 27 (2nd Motor).

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[37]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		35	-	O	4.3.3	1700h	9400h
01	Command Frequency	0.00~Max Frequency		0.00	Hz	O	5.1.1.2	1701h	9702h
								0.01	0.01
02 [38]	Command Speed	0~Maximum Speed		0 [39]	rpm	O	5.1.1.2	1702h	9704h
								1	1
03	Command Torque	-320.0~320.0		250.0	%	O	6.3.2.1	1703h	9706h
								0.1	0.1
04	Motor Type	0	Induction Motor	0	-	△	3.1	1704h	9708h
		1	Perm Magnet Motor						
		2	Sync Reluc Motor						
05	Control Mode	0	V/F	0	-	△	3.1	1705h	970ah
		1	Slip Comp.						
		2	V/F PG						
		3	Sensorless						
08	Torque Control En	0	No	0	-	△	3.2	1708h	9710h
		1	Yes						
15	Start Frequency	0.00-10.00		0.50	Hz	△	5.1.2.5	170fh	971eh
								0.01	0.01
16 [38]	Start Speed	0-300		15 [39]	rpm	△	5.1.2.5	1710h	9720h
								1	1

[37] O: Writable during operation, △: Writable when stopped, X: Not writable

[38] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[39] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[37]	Ref.	Communication address/scale	
								16-Bit	32-Bit
17	Stop Frequency	0.00-10.00		0.00	Hz	△	5.2.5.1	1711h	9722h
								0.01	0.01
18 [38]	Stop Speed	0-300		0 [39]	rpm	△	5.2.5.1	1712h	9724h
								1	1
21	Motor Capacity	0	0.2 kW	-	-	△	3.1	1715h	972ah
		1	0.4 kW						
		2	0.75 kW						
		3	1.5 kW						
		4	2.2 kW						
		5	4 kW						
		6	5.5 kW						
		7	7.5 kW						
		8	11 kW						
		9	15 kW						
		10	18.5 kW						
		11	22 kW						
		12	30 kW						
		13	37 kW						
		14	45 kW						
		15	55 kW						
		16	75 kW						
		17	90 kW						
		18	110 kW						
		19	132 kW						
		20	160 kW						
		21	185 kW						
		22	200 kW						
		23	220 kW						
		24	280 kW						
		25	315 kW						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[37]	Ref.	Communication address/scale	
								16-Bit	32-Bit
21	Motor Capacity	26	375 kW	-	-	△	3.1	1715h	972ah
		27	450 kW						
23	Base Frequency	5.00-590.00		60.00	Hz	△	3.1	1717h	972eh
								0.01	0.01
24	Rated Speed	900-24000		16.8 Note	rpm	△	3.1	1718h	9730h
								1	1
25	Number of Poles	2-100		4	Pole	△	3.1	1719h	9732h
								1	1
26	Rated Current	1.0-1000.0		16.8 Note	A	△	3.1	171ah	9734h
								0.1	0.1
27	Rated Voltage	0, 180-480		0	V	△	3.1	171bh	9736h
								1	1
28	Efficiency	70-100		16.8 Note	%	△	3.1	171ch	9738h
								1	1
35	No-load Current	0.5-1000.0		16.8 Note	A	△	3.1	1723h	9746h
								0.1	0.1
36	Stator Resistance	0.0000-99.9999		16.8 Note	Ω	△	3.4	1724h	9748h
								0.0001[40]	0.0001
37	Leakage Inductance	0.000-99.999		16.8 Note	mH	△	3.4	1725h	974ah
								0.001[40]	0.001
38	Stator Inductance	0.000-999.999		16.8 Note	mH	△	3.4	1726h	974ch
								0.001[40]	0.001
39	Rotor TimeConstant	25-5000		16.8 Note	msec	△	3.4	1727h	974eh
40[41]	q-axis Inductance	0.000-99.999		10.000	mH	△	3.4	1728h	9750h
								0.01	0.001

[40] For products that are 200 V class 15 kW or 400 V class 18.5 kW or more. For other capacities, refer to **Table 1** in **13.3 First Motor Group (MOT1)**.

[41] Activated when the MOT2-04 (Motor Type) value is 1 (Perm Magnet Motor).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[37]	Ref.	Communication address/scale	
							16-Bit	32-Bit
41 [41]	d-axis Inductance	0.000-99.999	10.000	mH	△	3.4	1729h	9752h
42 [41]	PM Rotor Flux	0.000-65.000	0.100	-	△	3.4	172ah	9754h
							0.001	0.0001
43 [42]	SynRM q-axis Inductance	0.000-999.999	10.000	mH	△	3.4	172bh	9756h
							0.01	0.001
45 [42]	SynRM d-axis Inductance	0.000-999.999	10.000	mH	△	3.4	172ch	9758h
							0.01	0.001
51	ACR Bandwidth	50-400	100	%	O	6.2	1733h	9766h
							1	1
54	ASR Adjust Gain	1-10	4	-	O	6.2	1736h	976ch
							1	1
61 [41]	IPPE Enable	0 No 1 Yes	1	-	O	6.5.1	173dh	977ah
62 [41]	IPPE Volt Ref Perc	10-100	50	%	O	6.5.1	173eh	977ch
							1	1
63 [41]	IPPE Curr Peak Per	10-150	120	%	O	6.5.1	173fh	977eh
							1	1
75	ETH Enable	0 None 1 CoastStop (FreeRun) 2 Dec	0	-	O	9.1.1	174bh	9796h
76	Motor Cooling	0 Self-Cool 1 Forced-Cool	0	-	O	9.1.1	174ch	9798h
77	ETH Cont Current	50-150	120	%	O	9.1.1	174dh	979ah
							1	1
78	ETH 1min Current	120-200	150	%	O	9.1.1	174eh	979ch
							1	1
96	Load Speed Gain	0.1-6000.0	100.0	%	O	7.21	1760h	97c0h
							0.1	0.1

[42] Activated when the MOT2-04 (Motor Type) value is 2 (Sync Reluc Motor).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[37]	Ref.	Communication address/scale	
								16-Bit	32-Bit
97	Load Speed Scale	0	x 1	0	-	O	7.21	1761h	97c2h
		1	x 0.1						
		2	x 0.01						
		3	x 0.001						
		4	x 0.0001						
98	Load Speed Unit	0	rpm	0	-	O	7.21	1762h	97c4h
		1	mpm						

13.7 Second Motor V/F Group (VF2)

This group is activated when one of the DIN-01, 03, 05, 07, 09, 11, 13, and 15 (DI1-DI8 Define) values is 27 (2nd Motor) and the MOT2-05 (Control Mode) value is 0 (V/F) or 1 (Slip Comp.).

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range		Initial Value	Unit	Property[43]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		31	-	O	4.3.3	1800h	9800h
01	V/F Pattern	0	Linear	0	-	△	6.1.3	1801h	9802h
		1	Square						
		2	User V/F						
		3	Square 2						
02	User Frequency-1	0.00 - User Frequency-2		18.00	Hz	△	6.1.3	1802h	9804h
								0.01	0.01
03 [44]	User Speed-1	0 - User Speed-2		450 [45]	rpm	△	6.1.3	1803h	9806h
								1	1
04	User Voltage-1	0-100		25	%	△	6.1.3	1804h	9808h
								1	1
05	User Frequency-2	User Frequency-1-User Frequency-3		30.00	Hz	△	6.1.3	1805h	980ah
								0.01	0.01
06 [44]	User Speed-2	User Speed-1 - User Speed-3		900 [45]	rpm	△	6.1.3	1806h	980ch
								1	1
07	User Voltage-2	0-100		50	%	△	6.1.3	1807h	980eh
								1	1

[43] O: Writable during operation, △: Writable when stopped, X: Not writable

[44] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[45] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[43]	Ref.	Communication address/scale	
								16-Bit	32-Bit
08	User Frequency-3	User Frequency-2- User Frequency-4		45.00	Hz	△	6.1.3	1808h	9810h
								0.01	0.01
09 [44]	User Speed-3	User Speed-2- User Speed-4		1350 [45]	rpm	△	6.1.3	1809h	9812h
								1	1
10	User Voltage-3	0-100		75	%	△	6.1.3	180ah	9814h
								1	1
11	User Frequency-4	User Frequency-3- Max Frequency		60.00	Hz	△	6.1.3	180bh	9816h
								0.01	0.01
12 [44]	User Speed-4	User Speed-3- Maximum Speed		1800 [45]	rpm	△	6.1.3	180ch	9818h
								1	1
18	User Voltage-4	0-100		100	%	△	6.1.3	180dh	981ah
								1	1
21	Slip Comp Mode	0	Basic Comp.	0	-	△	6.1.4.2	1815h	982ah
		1	Advanced Comp.						
22	SlipGain Mot-Low	0-300		100	%	O	6.1.4.2	1816h	982ch
								1	1
23	SlipGain Mot-High	0-300		100	%	O	6.1.4.2	1817h	982eh
								1	1
24	SlipGain Gen-Low	0-300		100	%	O	6.1.4.2	1818h	9830h
								1	1
25	SlipGain Gen-High	0-300		100	%	O	6.1.4.2	1819h	9832h
								1	1
26	SlipComp LPF Gain	1-10000		300	msec	O	6.1.4.2	181ah	9834h
								1	1
27	SlipGain SwOv Freq	0.00-20.00		9.00	Hz	O	6.1.4.2	181bh	9836h
								0.01	0.01
28 [44]	SlipGain SwOv Spd	0-600		270 [45]	rpm	O	6.1.4.2	181ch	9838h
31	Torque Boost Mode	0	Manual	0	-	△	7.6	181fh	983eh
		1	Auto						

Code	LCD Display	Setting Range	Initial Value	Unit	Property[43]	Ref.	Communication address/scale	
							16-Bit	32-Bit
32	Forward Boost	0.0-15.0	2.0 [46] 1.0 [47]	%	△	7.6	1820h 0.1	9840h 0.1
33	Reverse Boost	0.0-15.0	2.0 [46] 1.0 [47]	%	△	7.6	1821h 0.1	9842h 0.1
34	ATB Mot-Gain	0.0-300.0	100.0	%	O	7.6.2	1822h 0.1	9844h 0.1
35	ATB Gen-Gain	0.0-300.0	100.0	%	O	7.6.2	1823h 0.1	9846h 0.1
36	ATB LPF Gain	1-10000	3	msec	△	7.6.2	1824h 1	9848h 1
54 [48]	PM V/F HPF Gain	0.0-1.0	0.7	-	O	6.4	1836h 0.1	986ch 0.1
55 [48]	PM V/F HPF Wcut	0-3	1	Hz	O	6.4	1837h 1	986eh 1
56 [48]	PM V/F CurrLmtGain	0-200	150	%	O	6.4	1838h 1	9870h 1
57 [48]	PM VF DC Inj Perc	0-150	100	%	O	6.4	1839h 1	9872h 1
58 [48]	PM VF Idse Limit	0-150	70	%	O	6.4	183ah 1	9874h 1
60 [49]	SynRM V/f HPF Gain	0-10.0	0.7	-	O	3.4	183ch 0.1	9878h 0.1
61 [49]	SynRM V/f HPF Wcut	0-3	1	Hz	O	3.4	183dh 1	987ah 1

[46] For 75 kW or less (Refer to **16.8 Parameter Default Values Based on the Motor Capacity**)

[47] For 90 kW or less (Refer to **16.8 Parameter Default Values Based on the Motor Capacity**)

[48] Activated when the MOT1-04 (Motor Type) value is 1 (Perm Magnet Motor).

[49] Activated when the MOT2-04 (Motor Type) value is 2 (Sync Reluc Motor).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[43]	Ref.	Communication address/scale	
							16-Bit	32-Bit
62 [49]	SynRM V/f CurrLmtG	0-200	150	%	O	3.4	183eh	987ch
							1	1
63 [49]	SynRM Vf Voffset	0-300	100	%	O	3.4	183fh	987eh
							1	1
64 [49]	SynRM Reac Pwr Ref	50-300	130	%	O	3.4	1840h	9880h
							1	1
71	AHR Enable	0 No 1 Yes	1		O	7.10	1847h	988eh
72	AHR P-Gain	0-1000	50	%	O	7.10	1848h	9890h
							1	1
73	AHR Limit	0-100	2	%	O	7.10	1849h	9892h
							1	1
76	Stall Prevent Acc	0 No 1 Yes	0	-	△	9.1.4	184ch	9898h
77	Stall Prevent Dec	0 No 1 Yes	0	-	△	9.1.4	184dh	989ah
78	Stall Prevent Std	0 No 1 Yes	0	-	△	9.1.4	184eh	989ch
79	Stall Frequency-1	0.00- Stall Frequency-2	15.00	Hz	O	9.1.4	184fh	989eh
							0.01	0.01
80 [44]	Stall Speed-1	0-Stall Speed-2	450 [45]	rpm	O	9.1.4	1850h	98a0h
							1	1
81	Stall Level-1	30-250	180	%	O	9.1.4	1851h	98a2h
							1	1
82	Stall Frequency-2	Stall Frequency-1 - Stall Frequency-3	30.00	Hz	O	9.1.4	1852h	98a4h
							0.01	0.01
83 [44]	Stall Speed-2	Stall Speed-1- Stall Speed-3	900 [45]	rpm	O	9.1.4	1853h	98a6h
							1	1
84	Stall Level-2	30-250	180	%	O	9.1.4	1854h	98a8h
							1	1

Code	LCD Display	Setting Range	Initial Value	Unit	Property[43]	Ref.	Communication address/scale	
							16-Bit	32-Bit
85	Stall Frequency-3	Stall Frequency-2 - Stall Frequency-4	45.00	Hz	O	9.1.4	1855h	98aah
							0.01	0.01
86 [44]	Stall Speed-3	Stall Speed-2- Stall Speed-4	1350 [45]	rpm	O	9.1.4	1856h	98ach
							1	1
87	Stall Level-3	30-250	180	%	O	9.1.4	1857h	98aeh
							1	1
88	Stall Frequency-4	Stall Frequency-3 - Max Frequency	60.00	Hz	O	9.1.4	1858h	98b0h
							0.01	0.01
89 [44]	Stall Speed-4	Stall Speed-3 - Maximum Speed	1800 [45]	rpm	O	9.1.4	1859h	98b2h
							1	1
90	Stall Level-4	30-250	180	%	O	9.1.4	185ah	98b4h
							1	1

13.8 Second Motor Control Group (VEC2)

This group is activated when one of the DIN-01, 03, 05, 07, 09, 11, 13, and 15 (DI1-DI8 Define) values is 27 (2nd Motor) and the MOT2-05 (Control Mode) value is 3 (Sensorless).

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range	Initial Value	Unit	Property[50]	Ref.	Communication address/scale	
							16-Bit	32-Bit
00	Jump Code	1-99	21	-	O	4.3.3	1900h	9600h
09	Hold Time	0.00-60.00	1.00	sec	O	6.2	1909h	9912h
							0.01	0.01
14	Pre-Excite Time	0.00-60.00	1.00	sec	O	6.2	190eh	991ch
							0.01	0.01
15	FluxCtrl Bandwidth	50-400	100	%	O	6.2	190fh	991eh
							1	1
16	Flux Forcing	100.0-200.0	150.0	%	O	6.2	1910h	9920h
							0.1	0.1
18	FluxWeak Ctrl Mode	0 None 1 Adjust by Freq 2 Adjust by Volt	2	-	O	6.2	1912h	9924h
19	FW Volt Ref Ratio	85.0-100.0	95.0	%	O	6.2	1913h	9926h
							0.1	0.1
20	FW Control Gain	10-1000	100	%	O	6.2	1914h	9928h
							1	1
21	Fwd +Torque Limit	0.0-320.0	180.0	%	O	6.6.1	1915h	992ah
							0.1	0.1
22	Fwd -Torque Limit	0.0-320.0	180.0	%	O	6.6.1	1916h	992ch
							0.1	0.1

[50] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range	Initial Value	Unit	Property[50]	Ref.	Communication address/scale	
							16-Bit	32-Bit
23	Rev +Torque Limit	0.0-320.0	180.0	%	O	6.6.1	1917h	992eh
							0.1	0.1
24	Rev -Torque Limit	0.0-320.0	180.0	%	O	6.6.1	1918h	9930h
							0.1	0.1
26	TrqMode FwdFreqLmt	0.00-Max Frequency	60.00	Hz	O	6.6.2	191ah	9934h
							0.01	0.01
27	TrqMode RevFreqLmt	0.00-Max Frequency	60.00	Hz	O	6.6.2	191bh	9936h
							0.01	0.01
28 [51]	TrqMode Fwd SpdLmt	0-Maximum Speed	1800 [52]	rpm	O	6.6.2	191ch	9938h
							1	1
29 [51]	TrqMode Rev SpdLmt	0-Maximum Speed	1800 [52]	rpm	O	6.6.2	191dh	993ah
							1	1
30	TrqMode SpdLmtGain	1.0-100.0	20.0	%	O	6.6.2	191eh	993ch
							0.1	0.1
31	Torque Ramp Time	0-10000	0	msec	O	6.6.4	191fh	993eh
							1	1
34	IMSD Trq Comp	10-500	100	%	O	6.2.2	1922h	9944h
							1	1
36	IMSL Gain	30-200	100	%	O	6.2.1	1924h	9948h
							1	1
37	IMSL SpdComp Noload	95-110	100	%	O	6.2.1	1925h	994Ah
							1	1
38	IMSL Torque Comp	10-500	100	%	O	6.2.1	1926h	994Ch
							1	1
39	IMSL Speed Comp	10-500	100	%	O	6.2.1	1927h	994Eh
							1	1
40	IMSL LSpd Trq Comp	10-500	105	%	O	6.2.1	1928h	9950h
							1	1

[51] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[52] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

13.9 Advanced Function Group (ADV)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range		Initial Value	Unit	Property[53]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		50	-	O	4.3.3	1a00h	9a00h
01	Run Prevent Select	0	None	0	-	△	5.2.3.1	1a01h	9a02h
		1	Forward Prevent						
		2	Reverse Prevent						
02	Power-on Run	0	None	0	-	O	5.2.3.2	1a02h	9a04h
		1	Start Mode						
		2	Speed Search						
05	AccDwell Frequency	0.00-Max Frequency		5.00	Hz	△	7.5	1a05h	9a0ah
								0.01	0.01
06 [54]	AccDwell Speed	0- Maximum Speed		150 [55]	rpm	△	7.5	1a06h	9a0ch
								1	1
07	AccDwell Time	0.0-60.0		0.0	sec	△	7.5	1a07h	9a0eh
								0.1	0.1
08	DecDwell Frequency	0.00-Max Frequency		5.00	Hz	△	7.5	1a08h	9a10h
								0.01	0.01
09 [54]	DecDwell Speed	0-Maximum Speed		150 [55]	rpm	△	7.5	1a09h	9a12h
								1	1
10	DecDwell Time	0.0-60.0		0.0	sec	△	7.5	1a0ah	9a14h
								0.1	0.1
14	Cmd Freq Limit En	0	No	0	-	△	5.1.2.5	1a0eh	9a1ch
		1	Yes						

[53] O: Writable during operation, △: Writable when stopped, X: Not writable

[54] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[55] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[53]	Ref.	Communication address/scale	
								16-Bit	32-Bit
15 [56]	Cmd Freq Limit Lo	0.00-Cmd Freq Limit Hi		0.50	Hz	O	5.1.2.5	1a0fh	9a1eh
								0.01	0.01
16 [56]	Cmd Freq Limit Hi	Cmd Freq Limit Lo-Max Frequency		60.00	Hz	△	5.1.2.5	1a10h	9a20h
								0.01	0.01
17 [57]	Cmd Speed Limit Lo	0-Cmd Speed Limit Hi		15 [55]	rpm	O	5.1.2.5	1a11h	9a22h
								1	1
18 [57]	Cmd Speed Limit Hi	Cmd Speed Limit Lo-Maximum Speed		1800 [55]	rpm	△	5.1.2.5	1a12h	9a24h
								1	1
19	Jog Freq Limit En	0	No	1	-	O	7.2.3	1a13h	9a26h
		1	Yes						
20	Jump Cmd Freq En	0	No	0	-	△	5.1.2.5	1a14h	9a28h
		1	Yes						
21 [58]	Jump Cmd Freq Lo1	0.00 - Jump Cmd Freq Hi 1		10.00	Hz	O	5.1.2.5	1a15h	9a2ah
								0.01	0.01
22 [58]	Jump Cmd Freq Hi1	Jump Cmd Freq Lo 1-Max Frequency		15.00	Hz	O	5.1.2.5	1a16h	9a2ch
								0.01	0.01
23 [58]	Jump Cmd Freq Lo2	0.00-Jump Cmd Freq Hi 2		20.00	Hz	O	5.1.2.5	1a17h	9a2eh
								0.01	0.01
24 [58]	Jump Cmd Freq Hi2	Jump Cmd Freq Lo 2-Max Frequency		25.00	Hz	O	5.1.2.5	1a18h	9a30h
								0.01	0.01
25 [58]	Jump Cmd Freq Lo3	0.00 - Jump Cmd Freq Hi 3		30.00	Hz	O	5.1.2.5	1a19h	9a32h
								0.01	0.01
26 [58]	Jump Cmd Freq Hi3	Jump Cmd Freq Lo 3-Max Frequency		35.00	Hz	O	5.1.2.5	1a1ah	9a34h
								0.01	0.01

[56] Activated when the ADV-14 (Cmd Freq Limit En) value is 1 (Yes) and the DRV-32 (Hz/rpm Select) value is 0 (Hz Display).

[57] Activated when the ADV-14 (Cmd Freq Limit En) value is 1 (Yes) and the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[58] Activated when the ADV-20 (Jump Cmd Freq En) value is 1 (Yes) and the DRV-32 (Hz/rpm Select) value is 0 (Hz Display).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[53]	Ref.	Communication address/scale	
							16-Bit	32-Bit
27 [59]	Jump Cmd Speed Lo1	0 - Jump Cmd Speed Hi 1	300 [55]	rpm	O	5.1.2.5	1a1bh	9a36h
							1	1
28 [59]	Jump Cmd Speed Hi1	Jump Cmd Speed Lo 1-Maximum Speed	450 [55]	rpm	O	5.1.2.5	1a1ch	9a38h
							1	1
29 [59]	Jump Cmd Speed Lo2	0 - Jump Cmd Speed Hi 2	600 [55]	rpm	O	5.1.2.5	1a1dh	9a3ah
							1	1
30 [59]	Jump Cmd Speed Hi2	Jump Cmd Speed Lo 2-Maximum Speed	750 [55]	rpm	O	5.1.2.5	1a1eh	9a3ch
							1	1
31 [59]	Jump Cmd Speed Lo3	0-Jump Cmd Speed Hi 3	900 [55]	rpm	O	5.1.2.5	1a1fh	9a3eh
							1	1
32 [59]	Jump Cmd Speed Hi3	Jump Cmd Speed Lo 3-Maximum Speed	1050 [55]	rpm	O	5.1.2.5	1a20h	9a40h
							1	1
40 [60]	Br Control State	0 DISABLE 1 RELEASE 2 RELEASING 3 ENGAGE 4 ENGASING	-	-	X	7.25	1a28h	9a50h
41 [60]	Br Release Load	0.00-180.00	50.00	%	O	7.25	1a29h	9a52h
							0.01	0.01
42 [60]	Br Load Req Delay	0.00-10.00	1.00	sec	O	7.25	1a2ah	9a54h
							0.01	0.01
43 [60]	Br Release Delay	0.00-10.00	1.00	sec	O	7.25	1a2bh	9a56h
							0.01	0.01
44 [61]	Br Release FwdFreq	0.00-Max Frequency	1.00	Hz	O	7.25	1a2ch	9a58h
							0.01	0.01

[59] Activated when the ADV-20 (Jump Cmd Freq En) value is 1 (Yes) and the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[60] Activated when the APP-43 (Brake Enable) value is 1 (Yes).

[61] Activated when the APP-43 (Brake Enable) value is 1 (Yes) and the DRV-32 (Hz/rpm Select) value is 0 (Hz Display).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[53]	Ref.	Communication address/scale	
							16-Bit	32-Bit
45 [62]	Br Release Fwd Spd	0-Maximum Speed	30 [55]	rpm	O	7.25	1a2dh	9a5ah
							1	1
46 [61]	Br Release RevFreq	0.00-Max Frequency	1.00	Hz	O	7.25	1a2eh	9a5ch
							0.01	0.01
47 [62]	Br Release Rev Spd	0-Maximum Speed	30 [55]	rpm	O	7.25	1a2fh	9a5eh
							1	1
48 [60]	Br Engage Delay	0.00-10.00	1.00	sec	O	7.25	1a30h	9a60h
							0.01	0.01
49 [61]	Br Engage Freq	0.00-Max Frequency	2.00	Hz	O	7.25	1a31h	9a62h
							0.01	0.01
50 [62]	Br Engage Speed	0-Maximum Speed	60 [55]	rpm	O	7.25	1a32h	9a64h
							1	1
52	Energy Save Mode	0 None 1 Manual 2 Auto	0	-	△	7.12	1a34h	9a68h
53	Energy Save Gain	0-30	0	%	O	7.12	1a35h	9a6ah
							1	1
55	Acc Change Freq	0.00-Max Frequency	0.00	Hz	O	5.3.1.4	1a37h	9a6eh
							0.01	0.01
56 [54]	Acc Change Speed	0-Maximum Speed	0 [55]	rpm	O	5.3.1.4	1a38h	9a70h
							1	1
57	Acc Change AccTime	0.00-6000.00	20.00	sec	O	5.3.1.4	1a39h	9a72h
							0.1	0.01
58	Dec Change Freq	0.00-Max Frequency	0.00	Hz	O	5.3.1.4	1a3ah	9a74h
							0.01	0.01
59 [54]	Dec Change Speed	0-Maximum Speed	0 [55]	rpm	O	5.3.1.4	1a3bh	9a76h
							1	1
60	Dec Change DecTime	0.00-6000.00	20.00	sec	O	5.3.1.4	1a3ch	9a78h
							0.1	0.01

[62] Activated when the APP-43 (Brake Enable) value is 1 (Yes) and the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

Code	LCD Display	Setting Range		Initial Value	Unit	Property[53]	Ref.	Communication address/scale	
								16-Bit	32-Bit
71 [63]	Run Disable Stop	0	CoastStop (FreeRun)	0	-	△	7.4	1a47h	9a8eh
		1	Quick Stop						
		2	Quick Stop Resume						
72 [63]	Quick Stop Time	0.00-6000.00		5.00	sec	O	7.4	1a48h	9a90h
								0.1	0.01
75 [64]	Up/Down Mode	0	U/D Normal	0	-	O	5.1.1.7	1a4bh	9a96h
		1	U/D Step						
		2	U/D Step+Norm						
76 [64]	Up/Down Save Mode	0	No	0	-	O	5.1.1.7	1a4ch	9a98h
		1	Yes						
77 [65]	Up/Down Step Freq	0.00-Max Frequency		0.00	Hz	O	5.1.1.7	1a4dh	9a9ah
								0.01	0.01
78 [66]	Up/Down Step Speed	0-Maximum Speed		0 [55]	rpm	O	5.1.1.7	1a4eh	9a9ch
								1	1
79 [65]	Up/Down Save Freq	0.00-Max Frequency		0.00	Hz	X	5.1.1.7	1a4fh	9a9eh
								0.01	0.01
80 [66]	Up/Down Save Speed	0-Maximum Speed		0 [55]	rpm	X	5.1.1.7	1a50h	9aa0h
								1	1

[63] Activated when one of the DIN-01, 03, 05, 07, 09, 11, 13, and 15 (DI1-DI8 Define) values is 18 (Run Enable).

[64] Activated when the DRV-11 (1st Freq Ref Src) or DRV-41 (2nd Freq Ref Src) value is 5 (Up Down Drive).

[65] Activated when the DRV-11 (1st Freq Ref Src) or DRV-41 (2nd Freq Ref Src) value is 5 (Up Down Drive) and the DRV-32 (Hz/rpm Select) value is 0 (Hz Display).

[66] Activated when the DRV-11 (1st Freq Ref Src) or DRV-41 (2nd Freq Ref Src) value is 5 (Up Down Drive) and the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

13.10 Application Function Group (APP)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[67]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1~99		25	-	O	4.3.3	1b00h	9b00h
01	Process PID Enable	0	No	0	-	O	7.7.1	1b01h	9b02h
		1	Yes						
02	ExternalPID Enable	0	No	0	-	O	7.8.1	1b02h	9b04h
		1	Yes						
03	UserSeq Enable	0	No	0	-	O	7.27	1b03h	9b06h
		1	Yes						
05	SpeedSearch Mode	0	Current Detect	0	-	△	7.13	1b05h	9b0ah
		1	Speed Estimate						
06	SS Block Time	0.0~60.0		1.0	sec	△	7.13	1b06h	9b0ch
								0.1	0.1
07	SS Sup-Current	0~200		90	%	O	7.13	1b07h	9b0eh
								1	1
09	SS Bandwidth	1~300		100	%	O	7.13	1b09h	9b12h
								1	1
10	PM SS Curr Peak	10~100		15	%	O	7.13	1b0ah	9b14h
								1	1
15	KEB Mode	0	None	0	-	△	7.9	1b0fh	9b1eh
		1	KEB Ride-Through						
		2	KEB Safety Stop						
16 [68]	KEB Start Level	70.0~ (KEB Stop Level - 5.0)		80.0	%	△	7.9	1b10h	9b20h
								0.1	0.1
17 [68]	KEB Stop Level	(KEB Start Level + 5.0)~95.0		90.0	%	△	7.9	1b11h	9b22h
								0.1	0.1

[67] O: Writable during operation, △: Writable when stopped, X: Not writable

[68] Activated when the APP-15 (KEB Mode) value is not 0 (None).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[67]	Ref.	Communication address/scale	
								16-Bit	32-Bit
18 [68]	KEB Control Gain	0.0~1000.0		100.0	%	O	7.9	1b12h	9b24h
								0.1	0.1
19 [68]	KEB Damping Gain	0~300		100	%	O	7.9	1b13h	9b26h
								1	1
20 [68]	KEB Acc Time	0.00~60.00		10.00	sec	O	7.9	1b14h	9b28h
								0.1	0.01
25	RegenAvd Enable	0	No	0	-	△	7.20	1b19h	9b32h
		1	Yes						
26 [69]	RegenAvd Acc En	0	No	0	-	△	7.20	1b1ah	9b34h
		1	Yes						
27 [69]	RegenAvd Steady En	0	No	0	-	△	7.20	1b1bh	9b36h
		1	Yes						
28 [69]	RegenAvd Dec En	0	No	0	-	△	7.20	1b1ch	9b38h
		1	Yes						
29 [69]	RegenAvd Level	200V급	300~400	350	V	△	7.20	1b1dh	9b3ah
		400V급	600~800	700				1	1
30 [70]	RegenAvd FreqLimit	0.00~10.00		10.00	Hz	△	7.20	1b1eh	9b3ch
								0.01	0.01
31 [71]	RegenAvd Spd Limit	0~300 [72]		300 [72]	rpm	△	7.20	1b1fh	9b3eh
								1	1
32 [69]	RegenAvd Gain	0~200		100	%	O	7.20	1b20h	9b40h
								1	1
33 [69]	RegenAvd FF Gain	0~200		100	%	O	7.20	1b21h	9b42h
								1	1

[69] Activated when the APP-25 (RegenAvd Enable) value is 1 (Yes).
[70] Activated when the APP-25 (RegenAvd Enable) value is 1 (Yes) and the DRV-32 (Hz/rpm Select) value is 0 (Hz Display).
[71] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)
[72] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[67]	Ref.	Communication address/scale	
								16-Bit	32-Bit
35	DB Turn On Level	200V급	350~400	390	V	△	9.2.6	1b23h	9b46h
		400V급	600~800	780				1	1
36	DB Warn %ED Enable	0	No	0	-	O	9.2.6	1b24h	9b48h
		1	Yes						
37	DB Warn %ED	1~30		5	%	O	9.2.6	1b25h	9b4ah
								1	1
40	Pre-Heat Level	1~100		20	%	△	7.23	1b28h	9b50h
								1	1
41	Pre-Heat Duty	1~100		30	%	△	7.23	1b29h	9b52h
								1	1
42	Per-Heat Delay T	0.0~600.0		0.0	sec	O	7.23	1b2ah	9b54h
								0.1	0.1
43	Brake Enable	0	No	0	-	O	7.25	1b2bh	9b56h
		1	Yes						
44	Pos Ctrl Enable	0	No	0	-	O	7.26.2	1b2ch	9b58h
		1	Yes						
45	Tension Ctrl En	0	No	0	-	O	7.28.11	1b2dh	9b5ah
		1	Yes						
46	Q Stop Dec T	0.0~6000.00		5.00	sec	O	7.29	1b2eh	9b5ch
								0.1	0.01
49	ETM Mode	0	Single Mode	0	-	△	7.33	1b31h	9b62h
		1	Multi Mode						
50	Natural Freq 1	0.05~100.00		1.00	Hz	△	7.33	1b32h	9b64h
								0.01	0.01
51	Natural Freq 2	0.05~100.00		1.00	Hz	△	7.33	1b33h	9b66h
								0.01	0.01
52	DampRatio For ETM	0.01~0.20		0.05	-	△	7.33	1b34h	9b68h
								0.01	0.01

13.11 Digital Input Terminal Block Group (DIN)

Code	LCD Display	Setting Range		Initial Value	Unit	Property[73]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		20	-	O	4.3.3	1c00h	9c00h
01	DI1 Define	0	User Defined Func	1	-	△	-	1c01h	9c02h
		1	FX						
		2	RX						
		3	RST						
		4	BX						
		5	External Trip-1						
		6	External Trip-2						
		7	External Trip-3						
		8	External Trip-4						
		9	JOG						
		10	SPEED_L						
		11	SPEED_M						
		12	SPEED_H						
		13	SPEED_X						
		14	XCEL_L						
		15	XCEL_M						
		16	XCEL_H						
		17	XCEL Stop						
		18	RUN Enable						
		19	3-Wire						
		20	2nd Source						
		21	Exchange						
		22	Up						

[73] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[73]	Ref.	Communication address/scale	
								16-Bit	32-Bit
01	DI1 Define	23	Down	1	-	△	-	1c01h	9c02h
		24	Up/Down Clear						
		25	Up/Down Save						
		26	Cmd Frequency Hold						
		27	2nd Motor						
		28	Dc Injection						
		29	Spd/Trq Change						
		30	Reserved						
		31	Reserved						
		32	Timer Input						
		33	Reserved						
		34	Disable Aux Ref						
		35	Forward JOG						
		36	Reverse JOG						
		37	PPID Run Enable						
		38	PPID Open Loop						
		39	PPID Ref Change						
		40	PPID Gain Change						
		41	PPID I-Term Clear						
		42	PPID Output Hold						
		43	PPID Sleep ON						
		44	PPID Sleep Change						
		45	PPID Step Ref-L						
		46	PPID Step Ref-M						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[73]	Ref.	Communication address/scale	
								16-Bit	32-Bit
01	DI1 Define	47	PPID Step Ref-H	1	-	△	-	1c01h	9c02h
		48	Fire Mode Fwd						
		49	Fire Mode Rev						
		50	Pre Heat						
		51	EPID1 Run						
		52	EPID1 I-Term Clear						
		53	EPID2 Run						
		54	EPID2 I-Term Clear						
		55	Brake Monitor Sel						
		56	POS Home						
		57	POS POS Run Home						
		58	POS HW Lmt L						
		59	POS HW Lmt H						
		60	POS Pattern-L						
		61	POS Pattern-M						
		62	POS Pattern-H						
		63	POS Pattern-X						
		64	POS Run						
		65	POS Run Pre-Posi						
		66	POS Run Relative						
		67	Modbus Master En						
		68	UserSeqCtrl OnOff						
		69	Quick Stop						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[73]	Ref.	Communication address/scale	
								16-Bit	32-Bit
01	DI1 Define	70	WebCtrl Fwd Run	1	-	△	-	1c01h	9c02h
		71	WebCtrl Rev Run						
		72	Web Splice						
		73	WPID Gain Change						
		74	Web Bobbin-L						
		75	Web Bobbin-H						
		76	Web Preset						
		77	Disable WPID						
		78	Web I-Term Clear						
		79	Diameter Calc Hold						
		80	Web Tns Up En						
		81	Web Tns Down En						
		82	Web Taper Disable						
		87	Anti-sway Enable						

Code	LCD Display	Setting Range	Initial Value	Unit	Property[73]	Ref.	Communication address/scale	
							16-Bit	32-Bit
02	DI1 Status	Same as DI Define	-	-	X	8.1.3	1c02h	9c04h
03	DI2 Define		2	-	△	-	1c03h	9c06h
04	DI2 Status		-	-	X	8.1.3	1c04h	9c08h
05	DI3 Define		4	-	△	-	1c05h	9c0ah
06	DI3 Status		-	-	X	8.1.3	1c06h	9c0ch
07	DI4 Define		5	-	△	-	1c07h	9c0eh
08	DI4 Status		-	-	X	8.1.3	1c08h	9c10h
09	DI5 Define		10	-	△	-	1c09h	9c12h
10	DI5 Status		-	-	X	8.1.3	1c0ah	9c14h
11	DI6 Define		11	-	△	-	1c0bh	9c16h
12	DI6 Status		-	-	X	8.1.3	1c0ch	9c18h
13	DI7 Define		12	-	△	-	1c0dh	9c1ah
14	DI7 Status		-	-	X	8.1.3	1c0eh	9c1ch
15	DI8 Define		9	-	△	-	1c0fh	9c1eh
16	DI8 Status		-	-	X	8.1.3	1c10h	9c20h
20	Step DI Check Time	1-60000	1	msec	O	5.1.2.4	1c14h 1	9c28h 1
25	DI1 On Delay	0-100000	10	msec	O	8.1.1	1c19h 1	9c32h 1
26	DI1 Off Delay	0-100000	3	msec	O	8.1.1	1c1ah 1	9c34h 1
27	DI1 NC/NO Sel	0 Normal Open 1 Normal Close	0	-	O	8.1.2	1c1bh	9c36h
28	DI2 On Delay	0-100000	10	msec	O	8.1.1	1c1ch 1	9c38h 1
29	DI2 Off Delay	0-100000	3	msec	O	8.1.1	1c1dh 1	9c3ah 1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[73]	Ref.	Communication address/scale	
								16-Bit	32-Bit
30	DI2 NC/NO Sel	0	Normal Open	0	-	O	8.1.2	1c1eh	9c3ch
		1	Normal Close						
31	DI3 On Delay	0-100000		10	msec	O	8.1.1	1c1fh	9c3eh
								1	1
32	DI3 Off Delay	0-100000		3	msec	O	8.1.1	1c20h	9c40h
								1	1
33	DI3 NC/NO Sel	0	Normal Open	0	-	O	8.1.2	1c21h	9c42h
		1	Normal Close						
34	DI4 On Delay	0-100000		10	msec	O	8.1.1	1c22h	9c44h
								1	1
35	DI4 Off Delay	0-100000		3	msec	O	8.1.1	1c23h	9c46h
								1	1
36	DI4 NC/NO Sel	0	Normal Open	0		O	8.1.2	1c24h	9c48h
		1	Normal Close						
37	DI5 On Delay	0-100000		10	msec	O	8.1.1	1c25h	9c4ah
								1	1
38	DI5 Off Delay	0-100000		3	msec	O	8.1.1	1c26h	9c4ch
								1	1
39	DI5 NC/NO Sel	0	Normal Open	0	-	O	8.1.2	1c27h	9c4eh
		1	Normal Close						
40	DI6 On Delay	0-100000		10	msec	O	8.1.2	1c28h	9c50h
								1	1
41	DI6 Off Delay	0-100000		3	msec	O	8.1.1	1c29h	9c52h
								1	1
42	DI6 NC/NO Sel	0	Normal Open	0	-	O	8.1.2	1c2ah	9c54h
		1	Normal Close						
43	DI7 On Delay	0-100000		10	msec	O	8.1.1	1c2bh	9c56h
								1	1
44	DI7 Off Delay	0-100000		3	msec	O	8.1.1	1c2ch	9c58h
								1	1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[73]	Ref.	Communication address/scale	
								16-Bit	32-Bit
45	DI7 NC/NO Sel	0	Normal Open	0	-	O	8.1.2	1c2dh	9c5ah
		1	Normal Close						
46	DI8 On Delay	0-100000		10	msec	O	8.1.1	1c2eh	9c5ch
								1	1
47	DI8 Off Delay	0-100000		3	msec	O	8.1.1	1c2fh	9c5eh
								1	1
48	DI8 NC/NO Sel	0	Normal Open	0	-	O	8.1.2	1c30h	9c60h
		1	Normal Close						

13.12 Analog Input Terminal Block Group (AIN)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[74]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1~99		31	-	O	4.3.3	1d00h	9d00h
01	AI1 Type Select	0	Unipolar Voltage	0	-	△	8.2.1	1d01h	9d02h
		1	Bipolar Voltage						
		2	Current						
02	AI1 Value	-10.00~10.00		-	V	X	8.2.1	1d02h	9d04h
		0.00~20.00		-	mA			0.01	0.01
03	AI1 Monitor[%]	0.00~100.00		-	%	X	8.2.1	1d03h	9d06h
								0.01	0.01
04	AI1 LPF Gain	0~10000		10	msec	O	8.2.4	1d04h	9d08h
								1	1
05	AI1 + x1 In	0.00~AI1 + x2 In		0.00	V	O	8.2.2	1d05h	9d0ah
				4.00	mA			0.01	0.01
06	AI1 + y1 Percent	-100.00~100.00		0.00	%	O	8.2.2	1d06h	9d0ch
								0.01	0.01
07	AI1 + x2 In	AI1 + x1 In~10.00		10.00	V	O	8.2.2	1d07h	9d0eh
		AI1 + x1 In~20.00		20.00	mA			0.01	0.01
08	AI1 + y2 Percent	-100.00~100.00		100.00	%	O	8.2.2	1d08h	9d10h
								0.01	0.01
09 [75]	AI1 - x1 In	AI1 - x2 In~0.00		0.00	V	O	8.2.2	1d09h	9d12h
								0.01	0.01
10 [75]	AI1 - y1 Percent	-100.00~100.00		0.00	%	O	8.2.2	1d0ah	9d14h
								0.01	0.01
11 [75]	AI1 - x2 In	-10.00~AI1 - x1 In		-10.00	V	O	8.2.2	1d0bh	9d16h
								0.01	0.01

[74] O: Writable during operation, △: Writable when stopped, X: Not writable
[75] Activated when the AIN-01 (AI1 Type Select) value is 1 (Bipolar Voltage).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[74]	Ref.	Communication address/scale	
								16-Bit	32-Bit
12 [75]	AI1 - y2 Percent	-100.00~100.00		-100.00	%	O	8.2.2	1d0ch	9d18h
								0.01	0.01
13	AI1 Quantizing	0.04~10.00		0.04	%	O	8.2.3	1d0dh	9d1ah
								0.01	0.01
16	AI2 Type Select	0	Unipolar Voltage	0	-	△	8.2.1	1d10h	9d20h
		1	Bipolar Voltage						
		2	Current						
17	AI2 Value	-10.00~10.00		-	V	X	8.2.1	1d11h	9d22h
		0.00~20.00		-	mA			0.01	0.01
18	AI2 Monitor[%]	0.00~100.00		-	%	X	8.2.1	1d12h	9d24h
								0.01	0.01
19	AI2 LPF Gain	0~10000		10	msec	O	8.2.4	1d13h	9d26h
								1	1
20	AI2 + x1 In	0.00~AI2 + x2 In		0.00	V	O	8.2.2	1d14h	9d28h
				4.00	mA				
21	AI2 + y1 Percent	-100.00~100.00		0.00	%	O	8.2.2	1d15h	9d2ah
								0.01	0.01
22	AI2 + x2 In	AI2 + x1 In~10.00		10.00	V	O	8.2.2	1d16h	9d2ch
		AI2 + x1 In~20.00		20.00	mA			0.01	0.01
23	AI2 + y2 Percent	-100.00~100.00		100.00	%	O	8.2.2	1d17h	9d2eh
								0.01	0.01
24 [76]	AI2 - x1 In	AI2 - x2 In~0.00		0.00	V	O	8.2.2	1d18h	9d30h
								0.01	0.01
25 [76]	AI2 - y1 Percent	-100.00~100.00		0.00	%	O	8.2.2	1d19h	9d32h
								0.01	0.01
26 [76]	AI2 - x2 In	-10.00~AI2 - x1 In		-10.00	V	O	8.2.2	1d1ah	9d34h
								0.01	0.01

[76] Activated when the AIN-16 (AI2 Type Select) value is 1 (Bipolar Voltage).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[74]	Ref.	Communication address/scale	
							16-Bit	32-Bit
27 [76]	AI2 - y2 Percent	-100.00~100.00	-100.00	%	O	8.2.2	1d1bh	9d36h
							0.01	0.01
28	AI2 Quantizing	0.04~10.00	0.04	%	O	8.2.3	1d1ch	9d38h
							0.01	0.01
31	AI3 Type Select	0 Unipolar Voltage 1 Bipolar Voltage 2 Current	0	-	△	8.2.1	1d1fh	9d3eh
32	AI3 Value	-10.00~10.00	-	V	X	8.2.1	1d20h	9d40h
		0.00~20.00	-	mA			0.01	0.01
33	AI3 Monitor[%]	0.00~100.00	-	%	X	8.2.1	1d21h	9d42h
							0.01	0.01
34	AI3 LPF Gain	0~10000	10	msec	O	8.2.4	1d22h	9d44h
							1	1
35	AI3 + x1 In	0.00~AI2 + x2 In	0.00	V	O	8.2.2	1d23h	9d46h
			4.00	mA			0.01	0.01
36	AI3 + y1 Percent	-100.00~100.00	0.00	%	O	8.2.2	1d24h	9d48h
							0.01	0.01
37	AI3 + x2 In	AI1 + x1 In~10.00	10.00	V	O	8.2.2	1d25h	9d4ah
		AI1 + x1 In~20.00	20.00	mA			0.01	0.01
38	AI3 + y2 Percent	-100.00~100.00	100.00	%	O	8.2.2	1d26h	9d4ch
							0.01	0.01
39 [77]	AI3 - x1 In	AI3 - x2 In~0.00	0.00	V	O	8.2.2	1d27h	9d4eh
							0.01	0.01
40 [77]	AI3 - y1 Percent	-100.00~100.00	0.00	%	O	8.2.2	1d28h	9d50h
							0.01	0.01
41 [77]	AI3 - x2 In	-10.00~AI3 - x1 In	-10.00	V	O	8.2.2	1d29h	9d52h
							0.01	0.01
42 [77]	AI3 - y2Percent	-100.00~100.00	-100.00	%	O	8.2.2	1d2ah	9d54h
							0.01	0.01

[77] Activated when the AIN-31 (AI3 Type Select) value is 1 (Bipolar Voltage).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[74]	Ref.	Communication address/scale	
								16-Bit	32-Bit
43	AI3 Quantizing	0.04~10.00		0.04	%	O	8.2.3	1d2bh	9d56h
								0.01	0.01
45	PTI Monitor[kHz]	0.00~32.00		-	kHz	X	8.4.1	1d2dh	9d5ah
								0.01	0.01
46	PTI Monitor[%]	-100.00~100.00		-	%	X	8.4.1	1d2eh	9d5ch
								0.01	0.01
47	PTI LPF Gain	10~10000		10	msec	O	8.4.2	1d2fh	9d5eh
48	PTI + x1 In	0.00~32.00		0	kHz	O	8.4.1	1d30h	9d60h
								0.01	0.01
49	PTI + y1 Percent	-100.00~100.00		0.00	%	O	8.4.1	1d31h	9d62h
								0.01	0.01
50	PTI + x2 In	0.00~32.00		32.00	kHz	O	8.4.1	1d32h	9d64h
								0.01	0.01
51	PTI + y2 Percent	-100.00~100.00		100.00	%	O	8.4.1	1d33h	9d66h
								0.01	0.01
52	PTI Quantizing	0.04~10.00		0.04	%	O	8.4.3	1d34h	9d68h
								0.01	0.01
80	AI Lv Detect Src	0	None	0	-	O	8.2.5	1d50h	9da0h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	X-Analog Input 1						
		6	X-Analog Input 2						
		7	X-Analog Input 3						
81	AI Lv Detect Act	0	None	0	-	O	8.2.5	1d51h	9da2h
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
		3	Warning						
		4	Lost Preset						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[74]	Ref.	Communication address/scale	
								16-Bit	32-Bit
82	Ana In Lv Monitor	-100.00~100.00		-	%	X	8.2.5	1d52h	9da4h
								0.01	0.01
83	Ana In Detect Sts	0	No	-	-	X	8.2.5	1d53h	9da6h
		1	Yes						
84	AI Lv Detect Above	-100.00~100.00		0.00	%	O	8.2.5	1d54h	9da8h
								0.01	0.01
85	AI Lv Detect Below	-100.00~100.00		0.00	%	O	8.2.5	1d55h	9daah
								0.01	0.01
86	AI Lv Detect Freq	0.00~Max Frequency		0.00	Hz	O	8.2.5	1d56h	9dach
								0.01	0.01
87	AI Lv Detect Speed	0~Maximum Speed		0	rpm	O	8.2.5	1d57h	9daeh
								1	1
88	AI Lv Detect Delay	0.0~999.9		2.0	sec	O	8.2.5	1d58h	9db0h
								0.1	0.1
89	AI Lv Hys Band	0.00~10.00		0.00	%	O	8.2.5	1d59h	9db2h
								0.01	0.01
90	AI LvD Cancel Dly	0.0~999.9		0.0	sec	O	8.2.5	1d5ah	9db4h
								0.1	0.1
91	AI LvD RestartMode	0	None	0	-	O	8.2.5	1d5bh	9db6h
		1	Start Mode						
		2	Speed Search						

13.13 Output Terminal Block Group (OUT)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range		Initial Value	Unit	Property[78]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		50	-	O	4.3.3	1e00h	9e00h
01	AO1 Define	0	Frequency	0	-	O	8.5	1e01h	9e02h
		1	Output Current						
		2	Output Voltage						
		3	DC Link Voltage						
		4	Torque						
		5	Output Power						
		6	Target Frequency						
		7	Ramp Frequency						
		8	Speed Feedback						
		9	Speed Deviation:						
		10	PPID Reference						
		11	PPID Feedback						
		12	PPID Output						
		13	EPID1 Output						
		14	EPID2 Output						
		15	Constant						
		16	Web MainSpeed						
		17	Web MainSpeed +WPID						
02	AO1 Type Select	0	Unipolar Voltage	0	-	O	8.5	1e02h	9e04h
		1	Bipolar Voltage						
		2	Current						

[78] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range	Initial Value	Unit	Property[78]	Ref.	Communication address/scale	
							16-Bit	32-Bit
03	AO1 Gain	-1000.00-1000.00	100.00	%	O	8.5	1e03h	9e06h
							0.01	0.01
04	AO1 Bias	-100.00-100.00	0.00	%	O	8.5	1e04h	9e08h
							0.01	0.01
05	AO1 LPF Gain	0-10000	5	msec	O	8.5	1e05h	9e0ah
							1	1
06	AO1 Constant %	-100.00-100.00	0.00	%	O	8.5	1e06h	9e0ch
							0.01	0.01
07	AO1 Monitor	-100.00-100.00	-	%	X	8.5	1e07h	9e0eh
							0.01	0.01
08	AO1 Data Monitor	-300.00~300.00	-	%	X	8.5	1e08h	9e10h
10	AO2 Define	Same as AO1 Define	0	-	O	8.5	1e0ah	9e14h
11	AO2 Type Select	0 Unipolar Voltage 1 Bipolar Voltage 2 Current	0	-	O	8.5	1e0bh	9e16h
12	AO2 Gain	-1000.00-1000.00	100.00	%	O	8.5	1e0ch	9e18h
							0.01	0.01
13	AO2 Bias	-100.00-100.00	0.00	%	O	8.5	1e0dh	9e1ah
							0.01	0.01
14	AO2 LPF Gain	0-10000	5	msec	O	8.5	1e0eh	9e1ch
							1	1
15	AO2 Constant %	-100.00-100.00	0.00	%	O	8.5	1e0fh	9e1eh
							0.01	0.01
16	AO2 Monitor	-100.00-100.00	-	%	X	8.5	1e10h	9e20h
							0.01	0.01
17	AO2 Data Monitor	-300.00~300.00	-	%	X	8.5	1e11h	9e22h
20	PTO Define	Same as AO1 Define	0	-	O	8.5	1e14h	9e28h

Code	LCD Display	Setting Range	Initial Value	Unit	Property[78]	Ref.	Communication address/scale	
							16-Bit	32-Bit
21	PTO Gain	-1000.00-1000.00	100.00	%	O	8.5	1e15h	9e2ah
							0.01	0.01
22	PTO Bias	-100.00-100.00	0.00	%	O	8.5	1e16h	9e2ch
							0.01	0.01
23	PTO LPF Gain	0-10000	5	msec	O	8.5	1e17h	9e2eh
							1	1
24	PTO Constant %	0.00-100.00	0.00	%	O	8.5	1e18h	9e30h
							0.01	0.01
25	PTO Monitor	0.00-100.00	-	%	X	8.5	1e19h	9e32h
							0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[78]	Ref.	Communication address/scale	
								16-Bit	32-Bit
50	DO1 Define	0	User Defined Func	24	-	O	8.3.1	1e32h	9e64h
		1	FDT-1						
		2	FDT-2						
		3	FDT-3						
		4	FDT-4						
		5	Over Load Warn						
		6	Drv Over Load Warn						
		7	Under Load Warn						
		8	MainFan Warn						
		9	Stall						
		10	Over Voltage Trip						
		11	Low Voltage						
		12	Drive Over Heat Trip						
		13	Lost Int Comm Warn						
		14	Run						
		15	Stop						
		16	Steady						
		17	Drive Output Line						
		18	Supply Power Line						
		19	Speed Search						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[78]	Ref.	Communication address/scale	
								16-Bit	32-Bit
50	DO1 Define	20	Ready	24	-	O	8.3.1	1e32h	9e64h
		21	Zero Speed Detect						
		22	Torque Detect						
		23	Timer Output						
		24	Trip						
		25	Lost Keypad Warn						
		26	DB Warn %ED						
		27	Encoder Tune Warn						
		28	Encoder Dir Warn						
		29	On/Off Control						
		30	Brake Control						
		31	Run with Zero Spd						
		32	STO Monitor						
		33	Reset Restart F Trip						
		34	Lost USB Warn						
		35	KEB Operating						
		36	Lost AI-1 Warn						
		37	Lost AI-2 Warn						
		38	Lost AI-3 Warn						
		39	E24V Monitor						
		40	Main Cap Repl Warn						
		41	MainFan Repl Warn						
		42	AuxFan Repl Warn						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[78]	Ref.	Communication address/scale	
								16-Bit	32-Bit
50	DO1 Define	43	MainCap Diag Alarm	24	-	O	8.3.1	1e32h	9e64h
		44	Pos Tar Bound Err						
		45	Pos Max Track Err						
		46	OCS Run						
		47	FWD Run						
		48	REV Run						
		49	Fire Mode						
		50	WebBreak Warn						
		51	Lost OptComm Warn						
		52	Ana In Lvl Detect						
		53	SPD Sync Complete						
		54	POS Sync Complete						
51	DO1 Status	0	OFF	0	-	X	8.3.1	1e33h	9e66h
		1	ON						
52	DO2 Define	Same as DO1 Define		14	-	O	8.3.1	1e34h	9e68h
53	DO2 Status	0	OFF	0	-	X	8.3.1	1e35h	9e6ah
		1	ON						
54	DO3 Define	Same as DO1 Define		0	-	O	8.3.1	1e36h	9e6ch
55	DO3 Status	0	OFF	0	-	X	8.3.1	1e37h	9e6eh
		1	ON						
60	DO1 On Delay	0-100000		0	msec	O	8.3.2	1e3ch	9e78h
								1	1
61	DO1 Off Delay	0-100000		0	msec	O	8.3.2	1e3dh	9e7ah
								1	1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[78]	Ref.	Communication address/scale	
								16-Bit	32-Bit
62	DO1 NC/NO Sel	0	Normal Open	0	-	O	8.3.3	1e3eh	9e7ch
		1	Normal Close						
63	DO2 On Delay	0-100000		0	msec	O	8.3.2	1e3fh	9e7eh
								1	1
64	DO2 Off Delay	0-100000		0	msec	O	8.3.2	1e40h	9e80h
								1	1
65	DO2 NC/NO Sel	0	Normal Open	0	-	O	8.3.3	1e41h	9e82h
		1	Normal Close						
66	DO3 On Delay	0-100000		0	msec	O	8.3.2	1e42h	9e84h
								1	1
67	DO3 Off Delay	0-100000		0	msec	O	8.3.2	1e43h	9e86h
								1	1
68	DO3 NC/NO Sel	0	Normal Open	0	-	O	8.3.3	1e44h	9e88h
		1	Normal Close						
70	DO1 Constant	0	Off	0	-	O	8.3.6	1e46h	9e8ch
		1	On						
71	DO2 Constant	0	Off	0	-	O	8.3.6	1e47h	9e8eh
		1	On						
72	DO3 Constant	0	Off	0	-	O	8.3.6	1e48h	9e90h
		1	On						
75	FDT Frequency	0.00-Max Frequency		30.00	Hz	O	8.3.1	1e4bh	9e96h
								0.01	0.01
76	FDT Frequency Band	0.00-Max Frequency		10.00	-	O	8.3.1	1e4ch	9e98h
								0.01	0.01
77 [79]	FDT Speed	0-Maximum Speed		900 [80]	rpm	O	8.3.1	1e4dh	9e9ah
								1	1

[79] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[80] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[78]	Ref.	Communication address/scale	
							16-Bit	32-Bit
78 [79]	FDT Speed Band	0-Maximum Speed	300 [80]	rpm	O	8.3.1	1e4eh	9e9ch
							1	1
80 [81]	TorqueDetect Level	0.0-150.0	100.0	%	O	8.3.1	1e50h	9ea0h
							0.1	0.1
81 [81]	TorqueDetect Band	0.0-10.0	5.0	%	O	8.3.1	1e51h	9ea2h
							0.1	0.1

[81] Activated when the MOT1-08 (Torque Control En) value is 1 (Yes).

13.14 Process PID Group (PPID)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

The values below have the following meanings:

- Unit Max: Unit at 100% (PPID-93)
- Unit Min: 2 * Unit at 0% (PPID-92) - Unit at 100% (PPID-93)
- Unit Default: (Unit at 100% - Unit at 0%) / 2
- PID Unit: Unit Select (PPID-90)

Code	LCD Display	Setting Range		Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		60	-	O	4.3.3	2200h	a200h
01	Control State	0	Idle	0	-	X	7.7.1	2201h	a202h
		1	Pre-PID						
		2	RUN						
		3	Sleep Boost						
		4	Sleep						
02	Output Value	-100.00-100.00		0.00	%	X	7.7.1	2202h	a204h
								0.01	0.01
03	Reference Value	Unit Min - Unit Max		-	PID Unit	X	7.7.1	2203h	a206h
								PID Unit	PID Unit
04	Feedback Value	Unit Min - Unit Max		-	PID Unit	X	7.7.1	2204h	a208h
								PID Unit	PID Unit
05	Error Value	Unit Min - Unit Max		-	PID Unit	X	7.7.1	2205h	a20ah
								PID Unit	PID Unit

[82] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
								16-Bit	32-Bit
10	Reference1 Source	0	Keypad	0	-	O	7.7.1	220ah	a214h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Internal Comm.						
		6	USB Comm.						
		7	Option Comm.						
		8	UserSequence						
		9	Ext PID-1 Output						
		10	X-Analog Input 1						
		11	X-Analog Input 2						
		12	X-Analog Input 3						
11	Ref1 Keypad Set	-Unit Max - Unit Max		50.00	PID Unit	O	7.7.1	220bh	a216h
								PID Unit	PID Unit
12	Ref1 Auxiliary Src	0	None	0	-	O	7.7.1	220ch	a218h
		1	Analog In 1						
		2	Analog In 2						
		3	Analog In 3						
		4	Pulse Input						
		5	X-Analog Input 1						
		6	X-Analog Input 2						
		7	X-Analog Input 3						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
								16-Bit	32-Bit
13	Ref1 Auxiliary Mode	0	M + (G * A)	0	-	O	7.7.1	220dh	a21ah
		1	M * (G * A)						
		2	M / (G * A)						
		3	M+(M*(G*A))						
		4	M+G*2*(A-50)						
		5	M*(G*2*(A-50))						
		6	M/(G*2*(A-50))						
		7	M+M*G*2*(A-50)						
		8	(M-A)^2						
		9	M^2 + A^2						
		10	MAX(M,A)						
		11	MIN(M,A)						
		12	dle 100% nit MAX] (M + A) / 2						
14	Ref1 Auxiliary Gain	-200.00-200.00		0.00	%	O	7.7.1	220eh	a21ch
								0.01	0.01
15	Reference2 Source	0	Keypad	0	-	O	7.7.1	220fh	a21eh
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Internal Comm.						
		6	USB Comm.						
16	Ref2 Keypad Set	Unit Min - Unit Max		50.00	PID Unit	O	7.7.1	2210h	a220h
								PID Unit	PID Unit

Code	LCD Display	Setting Range		Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
								16-Bit	32-Bit
17	Ref2 Auxiliary Src	0	None	0	-	O	7.7.1	2211h	a222h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
18	Ref2 Auxiliary Mode	0	M + (G * A)	0	-	O	7.7.1	2212h	a224h
		1	M * (G * A)						
		2	M / (G * A)						
		3	M+(M*(G*A))						
		4	M+G*2*(A-50)						
		5	M*(G*2*(A-50))						
		6	M/(G*2*(A-50))						
		7	M+M*G*2*(A-50)						
		8	(M-A)^2						
		9	M^2 + A^2						
		10	MAXIMUM(M,A)						
		11	MINIMUM(M,A)						
		12	(M+A)/2						
19	Ref2 AuxiliaryGain	-200.00-200.00		0.00	%	O	7.7.1	2213h	a226h
								0.01	0.01
20	Reference Acc Time	0.00-6000.00		20.00	sec	O	7.7.1	2214h	a228h
								0.01	0.01
21	Reference Dec Time	0.00-6000.00		30.00	sec	O	7.7.1	2215h	a22ah
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
								16-Bit	32-Bit
25	Feedback Source	0	Analog Input 1	0	-	O	7.7.1	2219h	a232h
		1	Analog Input 2						
		2	Analog Input 3						
		3	Pulse Input						
		4	Internal Comm.						
		5	USB Comm.						
		6	Option Comm.						
		7	UserSequence						
		8	Ext PID-1 Output						
		9	X-Analog Input 1						
		10	X-Analog Input 2						
		11	X-Analog Input 3						
26	Fdb Auxiliary Src	0	None	0	-	O	7.7.1	221ah	a234h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
								16-Bit	32-Bit
27	Fdb Auxiliary Mode	0	M + (G * A)	0	-	O	7.7.1	221bh	a236h
		1	M * (G * A)						
		2	M / (G * A)						
		3	M+(M*(G*A))						
		4	M+G*2*(A-50)						
		5	M*(G*2*(A-50))						
		6	M/(G*2*(A-50))						
		7	M+M*G*2*(A-50)						
		8	(M-A)^2						
		9	M^2 + A^2						
		10	MAXIMUM(M,A)						
		11	MINIMUM(M,A)						
		12	(M+A)/2						
28	Fdb Auxiliary Gain	-200.00-200.00%		0.00	%	O	7.7.1	221ch	a238h
								0.01	0.01
29	Deadband Width	0 - Unit Default		0	PID Unit	O	7.7.1	221dh	a23ah
								PID Unit	PID Unit
30	Deadband Delay	0.00-600.00		0.00	sec	O	7.7.1	221eh	a23ch
								0.01	0.01
35	Proportional Gain1	0.0-1000.0		50.0	%	O	7.7.1	2223h	a246h
								0.1	0.1
36	Integral Time1	0.00-200.00		10.00	sec	O	7.7.1	2224h	a248h
								0.01	0.01
37	Derivative Time1	0-1000		0	msec	O	7.7.1	2225h	a24ah
								1	1
38	FeedForward Gain	0.0-1000.0		0.0	%	O	7.7.1	2226h	a24ch
								0.1	0.1
40	Proportional Gain2	0.0-1000.0%		50.0	%	O	7.7.1	2228h	a250h
								0.1	0.1

Code	LCD Display	Setting Range	Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
							16-Bit	32-Bit
41	Integral Time2	0.00-200.00	10.00	sec	O	7.7.1	2229h 0.01	a252h 0.01
42	Derivative Time2	0-1000	0	msec	O	7.7.1	222ah 1	a254h 1
45	Output Mode	0 Not Use Output 1 Only PID Out 2 PID + Main Freq 3 Only PID Trq Out 4 PID+EPID1 Out 5 PID+EPID1+Main	2	-	O	7.7.1	222dh	a25ah
46	Output Limit Low	-100.00 - Output Limit High	0.00	%	O	7.7.1	222eh 0.01	a25ch 0.01
47	Output Limit High	Output Limit Low - 100.00	100.00	%	O	7.7.1	222fh 0.01	a25eh 0.01
48	Output Scale	0.1-1000.0	100.0	%	O	7.7.1	2230h 0.1	a260h 0.1
49	Output LPF Gain	0-10000	0	msec	O	7.7.1	2231h 1	a262h 1
50	Output Inverse	0 No 1 Yes	0	-	O	7.7.1	2232h	a264h
55	Pre-PID Set Freq	0.00-Max Frequency	0.00	Hz	O	7.7.3	2237h 0.01	a26eh 0.01
56 [83]	Pre-PID Set Spd	0-Maximum Speed	0 [84]	rpm	O	7.7.3	2238h 1	a270h 1
57	Pre-PID Exit	Unit Min - Unit Max	0.00	PID Unit	O	7.7.3	2239h PID Unit	a272h PID Unit

[83] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[84] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
							16-Bit	32-Bit
58	Pre-PID Delay	0.0-600.0	60.0	sec	O	7.7.3	223ah 0.1	a274h 0.1
60	Sleep Mode	0 None 1 Always Enable 2 DI Dependent	0	-	O	7.7.2	223ch	a278h
61	Sleep Boost Set	0.00 - Unit Max / 2	0.00	%	O	7.7.2	223dh PID Unit	a27ah PID Unit
62	Sleep Boost Freq	0.00-Max Frequency	0.00	Hz	O	7.7.2	223eh 0.01	a27ch 0.01
63 [83]	Sleep Boost Spd	0-Maximum Speed	0 [84]	rpm	O	7.7.2	223fh 1	a27eh 1
64	Sleep Check Freq1	0.00-Max Frequency	0.00	Hz	O	7.7.2	2240h 0.01	a280h 0.01
65 [83]	Sleep Check Spd1	0-Maximum Speed	0 [84]	rpm	O	7.7.2	2241h 1	a282h 1
66	Sleep Delay1	0.0-600.0	60.0	sec	O	7.7.2	2242h 0.1	a284h 0.1
67	WakeUp Set1	0 - Unit Default	0	PID Unit	O	7.7.2	2243h PID Unit	a286h PID Unit
68	WakeUp Delay1	0.0-600.0	60.0	sec	O	7.7.2	2244h 0.1	a288h 0.1
70	Sleep Check Freq2	0.00-Max Frequency	0.00	Hz	O	7.7.2	2246h 0.01	a28ch 0.01
71 [83]	Sleep Check Spd2	0-Maximum Speed	0 [84]	rpm	O	7.7.2	2247h 1	a28eh 1
72	Sleep Delay2	0.0-600.0	60.0	sec	O	7.7.2	2248h 0.1	a290h 0.1

Code	LCD Display	Setting Range	Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
							16-Bit	32-Bit
73	WakeUp Set2	0 - Unit Default	0	PID Unit	O	7.7.2	2249h PID Unit	a292h PID Unit
74	WakeUp Delay2	0.0-600.0	60.0	sec	O	7.7.2	224ah 0.1	a294h 0.1
80	Step Reference 1	Unit Min - Unit Max	50.00	PID Unit	O	7.7.1	2250h PID Unit	a2a0h PID Unit
81	Step Reference 2	Unit Min - Unit Max	50.00	PID Unit	O	7.7.1	2251h PID Unit	a2a2h PID Unit
82	Step Reference 3	Unit Min - Unit Max	50.00	PID Unit	O	7.7.1	2252h PID Unit	a2a4h PID Unit
83	Step Reference 4	Unit Min - Unit Max	50.00	PID Unit	O	7.7.1	2253h PID Unit	a2a6h PID Unit
84	Step Reference 5	Unit Min - Unit Max	50.00	PID Unit	O	7.7.1	2254h PID Unit	a2a8h PID Unit
85	Step Reference 6	Unit Min - Unit Max	50.00	PID Unit	O	7.7.1	2255h PID Unit	a2aah PID Unit
86	Step Reference 7	Unit Min - Unit Max	50.00	PID Unit	O	7.7.1	2256h PID Unit	a2ach PID Unit

Code	LCD Display	Setting Range		Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
								16-Bit	32-Bit
90	Unit Select	0	CUST	1	-	O	7.7.1	225ah	a2b4h
		1	%						
		2	PSI						
		3	°F						
		4	°C						
		5	inWC						
		6	inM						
		7	Bar						
		8	mBar						
		9	Pa						
		10	kPa						
		11	Hz						
		12	rpm						
		13	V						
		14	A						
		15	kW						
		16	HP						
		17	mpm						
		18	ft						
		19	m/s						
		20	m^3/s						
		21	m^3/m						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[82]	Ref.	Communication address/scale	
								16-Bit	32-Bit
90	Unit Select	22	m³/h	1	-	O	7.7.1	225ah	a2b4h
		23	l/s						
		24	l/m						
		25	l/h						
		26	kg/s						
		27	kg/m						
		28	kg/h						
		29	gl/s						
		30	gl/m						
		31	gl/h						
		32	ft/s						
		33	f³/s						
		34	f³/m						
		35	f³/h						
		36	lb/s						
		37	lb/m						
		38	lb/h						
		39	ppm						
		40	pps						
91	Unit Scale	0	X100	2	-	O	7.7.1	225bh	a2b6h
		1	X10						
		2	X1						
		3	X0.1						
		4	X0.01						
92	Unit at 0%	0.00 - Unit at 100%		0.00	%	O	7.7.1	225ch	a2b8h
								0.01	0.01
93	Unit at 100%	Unit at 0%-300.00		100.00	%	O	7.7.1	225dh	a2bah
								0.01	0.01

13.15 Protection Function Group (PRT)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range		Initial Value	Unit	Property[85]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		35	-	O	4.3.3	2400h	a400h
01	Trip Dec Time	0.00-6000.00		30.00	sec	O	7.9 7.26.3 9.1.1 9.1.3 9.1.6 9.2.5.1 9.2.5.2 9.2.5.3 9.2.7 10.2.4 9.2.5.3	2401h 0.1	a402h 0.1
02	LV Trip Mode	0	Latch	0	-	O	9.4.1	2402h	a404h
		1	Level						
03 [86]	Intrp Restart	0	None	0	-	O	7.13.3	2403h	a406h
		1	Start Mode						
		2	Speed Search						
04 [86]	Intrp Time	10.0-600.0		60.0	sec	O	7.13.3	2404h 0.1	a408h 0.1
05	Reset Restart	0	None	0	-	O	7.14.1	2405h	a40ah
		1	Start Mode						
		2	Speed Search						
06	Retry Number	1-10		1	-	O	7.14.1	2406h 1	a40ch 1

[85] O: Writable during operation, △: Writable when stopped, X: Not writable
[86] Activated when the PRT-02 (LV Trip Mode) value is 1 (Level).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[85]	Ref.	Communication address/scale	
								16-Bit	32-Bit
07	Retry Delay	0.0-60.0		1.0	sec	O	7.14.1	2407h	a40eh
								0.1	0.1
10	In Phase Open Chk	0	No	0	-	O	9.2.1.1	240ah	a414h
		1	Yes						
11	IPO Voltage Band	1-100		20	V	O	9.2.1.1	240bh	a416h
								1	1
12	Out Phase Open Chk	0	No	0	-	O	9.2.1.2	240ch	a418h
		1	Yes						
14	Lost Preset Freq	0.00-Max Frequency		0.00	Hz	O	9.2.5	240eh	a41ch
								0.01	0.01
15 [87]	Lost Preset Speed	0-Maximum Speed		0 [88]	rpm	O	9.2.5	240fh	a41eh
								1	1
16	Lost Keypad Mode	0	None	0	-	O	9.2.5	2410h	a420h
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
		3	Warning						
		4	Lost Preset						
17	Lost IntComm Mode	0	None	0	-	O	9.2.5.1	2411h	a422h
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
		3	Warning						
		4	Lost Preset						
18	Lost IntComm Time	0.1-120.0		1.0	sec	O	9.2.5.1	2412h	a424h
								0.1	0.1

[87] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[88] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[85]	Ref.	Communication address/scale	
								16-Bit	32-Bit
19	Lost USB Mode	0	None	0	-	O	9.2.5.2	2413h	a426h
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
		3	Warning						
		4	Lost Preset						
20	Lost USB Time	0.1-120.0		1.0	sec	O	9.2.5.2	2414h	a428h
								0.1	0.1
								2415h	a42ah
								0.1	0.1
								2416h	a42ch
								0.1	0.1
21	Lost OptComm Mode	0	None	0	-	O	-	2415h	a42ah
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
		3	Warning						
		4	Lost Preset						
22	Lost OptComm Time	0.1-120.0		1.0	sec	O	-	2416h	a42ch
								0.1	0.1
25	Lost AI1 Mode	0	None	0	-	O	9.2.5.3	2419h	a432h
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
		3	Hold Input						
		4	Hold Output						
		5	Lost Preset						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[85]	Ref.	Communication address/scale	
								16-Bit	32-Bit
26	Lost AI1 Chk Level	0	Half of Low Limit	0	-	O	9.2.5.3	241ah	a434h
		1	Below Low Limit						
		2	Below Or Maximum						
27	Lost AI1 Time	0.1-120.0		1.0	sec	O	9.2.5.3	241bh	a436h
								0.1	0.1
28	Lost AI2 Mode	0	None	0	-	O	9.2.5.3	241ch	a438h
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
		3	Hold Input						
		4	Hold Output						
		5	Lost Preset						
29	Lost AI2 Chk Level	0	Half of Low Limit	0	-	O	9.2.5.3	241dh	a43ah
		1	Below Low Limit						
		2	Below Or Maximum						
30	Lost AI2 TIME	0.1-120.0		1.0	sec	O	9.2.5.3	241eh	a43ch
								0.1	0.1
31	Lost AI3 Mode	0	None	0	-	O	9.2.5.3	241fh	a43eh
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
		3	Hold Input						
		4	Hold Output						
		5	Lost Preset						
32	Lost AI3 Chk Level	0	Half of Low Limit	0	-	O	9.2.5.3	2420h	a440h
		1	Below Low Limit						
		2	Below Or Maximum						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[85]	Ref.	Communication address/scale	
								16-Bit	32-Bit
33	Lost AI3 Time	0.1-120.0		1.0	sec	O	9.2.5.3	2421h	a442h
								0.1	0.1
35	OL Warn Select	0	No	0	-	O	9.1.2	2423h	a446h
		1	Yes						
36	OL Warn Level	30-200		150	%	O	9.1.2	2424h	a448h
								1	1
37	OL Warn Time	0.0-600.0		10.0	sec	O	9.1.2	2425h	a44ah
								0.1	0.1
38	OL Trip Select	0	None	1	-	O	9.1.2	2426h	a44ch
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
39	OL Trip Level	30-200		180	%	O	9.1.2	2427h	a44eh
								1	1
40	OL Trip Time	0.0-60.0		60.0	sec	O	9.1.2	2428h	a450h
								0.1	0.1
45	UL Warn Select	0	No	0	-	O	9.1.3	242dh	a45ah
		1	Yes						
46	UL Warn Time	0.0-600.0		10.0	sec	O	9.1.3	242eh	a45ch
								0.1	0.1
47	UL Trip Select	0	None	0	-	O	9.1.3	242fh	a45eh
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
48	UL Trip Time	0.0-600.0		30.0	sec	O	9.1.3	2430h	a460h
								0.1	0.1
49	UL LF Level	10-UL BF Level		30	%	O	9.1.3	2431h	a462h
								1	1
50	UL BF Level	UL LF Level - 100		30	%	O	9.1.3	2432h	a464h
								1	1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[85]	Ref.	Communication address/scale	
								16-Bit	32-Bit
60	Thermal-T Mode	0	None	0	-	O	9.1.6	243ch	a478h
		1	CoastStop (FreeRun)						
		2	Trip Dec Stop						
		3	Warning						
		4	Lost Preset						
61 [89]	Thermal-T Source	0	None	0	-	△	9.1.6	243dh	a47ah
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
62 [89]	Thermal-T Level	0.0-100.0		58.0	%	O	9.1.6	243eh	a47ch
								0.1	0.1
63 [89]	Thermal-T Area	0	Under Level	0	-	O	9.1.6	243fh	a47eh
		1	Over Level						
64 [90]	Over Speed Level	20.0-130.0		120.0	%	O	9.2.8	2440h	a480h
								0.1	0.1
65 [90]	Over Speed Time	0.01-10.00		0.01	sec	O	9.2.8	2441h	a482h
								0.01	0.01
66 [90]	Speed Deviation En	0	No	0	-	O	9.2.9	2442h	a484h
		1	Yes						
67 [90]	Speed Dev BandFreq	2.00-Max Frequency		20.00	Hz	O	9.2.9	2443h	a486h
								0.01	0.01
68 [91]	Speed Dev Band Spd	60-Maximum Speed		600 [88]	rpm	O	9.2.9	2444h	a488h
								1	1
69 [90]	Speed Dev Time	0.1-1000.0		1.0	sec	O	9.2.9	2445h	a48ah
								0.1	0.1

[89] Activated when the PRT-60 (Thermal-T Mode) value is not 0 (None).
[90] Activated when the MOT1-05 (Control Mode) value is 3 (Sensorless) or 4 (Vector).
[91] Activated when the MOT1-05 (Control Mode) value is 3 (Sensorless) or 4 (Vector) and the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

Code	LCD Display	Setting Range		Initial Value	Unit	Property[85]	Ref.	Communication address/scale	
								16-Bit	32-Bit
75	MainFan Trip Mode	0	Trip	1	-	O	9.2.11	244bh	a496h
		1	Warning						
77 [92]	AuxFan Trip Mode	0	Trip	1	-	O	9.2.11	244dh	a49ah
		1	Warning						
78	Ext-Trip 1 Mode	0	Latch	0	-	O	9.2.2	244eh	a49ch
		1	Level						
79	Ext-Trip 2 Mode	0	Latch	0	-	O	9.2.2	244fh	a49eh
		1	Level						
80	Ext-Trip 3 Mode	0	Latch	0	-	O	9.2.2	2450h	a4a0h
		1	Level						
81	Ext-Trip 4 Mode	0	Latch	0	-	O	9.2.2	2451h	a4a2h
		1	Level						
82	Safety Trip Mode	0	Latch	0	-	O	9.4.2	2452h	a4a4h
		1	Level						
83	BX Stop Mode	0	CoastStop (FreeRun)	0	-	O	9.2.7	2453h	a4a6h
		1	Trip Dec Time Stop						
		2	BX Dec Stop						
84	BX Dec Time	1.00~6000.00		3.00	sec	O	9.2.7	2454h	a4a8h
85	BX Restart Mode	0	None	1	-	O	9.2.7	2455h	a4aah
		1	Start Mode						
		2	Speed Search						
89	Ext 24V Pwr Lost	0	No	0	-	O	9.2.4	2459h	a4b2h
		1	Yes						
90 [93]	Fire Mode Password	-		0	-	△	7.11	245ah	a4b4h
								1	1

[92] Activated when an inverter is equipped with an auxiliary fan (Aux Fan).
[93] Activated when one of the DIN-01, 03, 05, 07, 09, 11, 13, and 15 (DI1-DI8 Define) values is 48 (Fire Mode Fwd) or 49 (Fire Mode Rev).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[85]	Ref.	Communication address/scale	
								16-Bit	32-Bit
91 [93]	Fire Mode Select	0	None	0	-	X [94]	7.11	245bh	a4b6h
		1	Fire Mode						
		2	Test Mode						
93 [93]	FireMode Frequency	0.00-Max Frequency		60.00	Hz	O	7.11	245dh	a4bah
								0.01	0.01
94 [95]	FireMode Speed	0-Maximum Speed		1800 [88]	rpm	O	7.11	245eh	a4bch
								1	1
95 [93]	Fire Mode Count	-		-	0	X	7.11	245fh	a4beh
								1	1

[94] When PRT-90 (Fire Mode Password) is entered, one-time writing is possible.

[95] Activated when one of the DIN-01, 03, 05, 07, 09, 11, 13, and 15 (DI1-DI8 Define) values is 48 (Fire Mode Fwd) or 49 (Fire Mode Rev) and the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

13.16 Diagnosis Function Group (DIAG)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[96]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		35	-	O	4.3.3	2500h	a500h
01	MainCap Diag En	0	No	0	-	O	9.3.1	2501h	a502h
		1	Yes						
02	MainCap Diag Mode	0	None	0	-	△	9.3.1	2502h	a504h
		1	Diagnosed Capacity						
03	MainCap Diag Sts	0	None	-	-	X	9.3.1	2503h	a506h
		1	Need To Check						
		2	Need To Exchange						
		3	Power Off Please						
		4	Diagnostic Cap						
04	MainCap MeasuredLv	0.0-100.0		0.0	%	X	9.3.1	2504h	a508h
								0.01	0.01
05	MainCap Diag Time	-		-	Time[97]	X	9.3.1	2505h	a50ah
								1	1
06	MainCap Warn Level	50.0-90.0		70.0	%	O	9.3.1	2506h	a50ch
								0.01	0.01
07	Cap Check Alarm En	0	No	0	-	O	9.3.2	2507h	a50eh
		1	Yes						
08	Cap Chk AlarmCycle	2000-50000		18000	hour	O	9.3.2	2508h	a510h
								1	1
11	MainCap Repl En	0	No	0	-	O	9.3.3	250bh	a516h
		1	Yes						

[96] O: Writable during operation, △: Writable when stopped, X: Not writable
[97] The information is displayed in the form of “day, hour, minute (0 days 00:00).”

Code	LCD Display	Setting Range		Initial Value	Unit	Property[96]	Ref.	Communication address/scale	
								16-Bit	32-Bit
12	MainCap Repl Level	10.0-100.0		90.0	%	O	9.3.3	250ch 0.01	a518h 0.01
13	MainCap Used Level	0.0-100.0		-	%	X	9.3.3	250dh 0.01	a51ah 0.01
40	PreCharger Warn Sel	0	No	0	-	O	9.3.6	2528h	a550h
		1	Yes						
41	PreCharger Repl Lvl	10.00-100.00		90.00	%	O	9.3.6	2529h 0.01	a552h 0.01
42	PreCharger Used Lv	0.00-100.00		-	%	X	9.3.6	252ah 0.01	a554h 0.01
52	MainFan Repl En	0	No	0	-	O	9.3.4	2534h	a568h
		1	Yes						
53	MainFan Repl Level	10.00-100.00		90.00	%	O	9.3.4	2535h 0.01	a56ah 0.01
54	MainFan Used Level	0.00-100.00		0.00	%	X	9.3.4	2536h 0.01	a56ch 0.01
62 [98]	AuxFan Repl En	0	No	0	-	O	9.3.4	253eh	a57ch
		1	Yes						
63 [98]	AuxFan Repl Level	10.00-100.00		90.00	%	O	9.3.4	253fh 0.01	a57eh 0.01
64 [98]	AuxFan Used Level	0.00-100.00		0.00	%	X	9.3.4	2540h 0.01	a580h 0.01
90	MainFan Time	-		-	Time[97]	X	9.3.7	255ah 1	a5b4h 1
91	MainFan Time Reset	0	No	0	-	△	9.3.7	255bh	a5b6h
		1	Yes						
95 [98]	AuxFan Time	-		-	Time[97]	X	9.3.7	255fh 1	a5beh 1

[98] Activated when an inverter is equipped with an auxiliary fan (Aux Fan).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[96]	Ref.	Communication address/scale	
								16-Bit	32-Bit
96 [98]	AuxFan Time Reset	0	No	0	-	△	9.3.7	2560h	a5c0h
98	Drive On Time	-		-	-	X	9.3.7	2562h	a5c4h
								1	1
99	Drive Run Time	-		-	-	X	9.3.7	2563h	a5c6h
								1	1

13.17 Internal Communication Group (INTC)

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[99]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		30	-	O	4.3.3	2700h	a700h
01	Station ID	**Modbus RTU**	1-250 [100]	1	-	O	10.2.2	2701h	a702h
		LS Inv 485	1-31 [101]						
		RTU Master	1-250 [100]					1	1
02	Protocol	0	Modbus RTU	0	-	O	10.2.2	2702h	a704h
		1	LS Inv 485						
		2	Modbus RTU Master						
03	Baud Rate	0	1200bps	3	-	O	10.2.2	2703h	a706h
		1	2400bps						
		2	4800bps						
		3	9600bps						
		4	19200bps						
		5	38400bps						
		6	56000bps						
		7	115kbps						
04	RS485 Mode	0	D8/PN/S1	0	-	O	10.2.2	2704h	a708h
		1	D8/PN/S2						
		2	D8/PE/S1						
		3	D8/PO/S1						
05	Response Delay	0-1000		5	msec	O	10.2.2	2705h	a70ah
								1	1

[99] O: Writable during operation, △: Writable when stopped, X: Not writable
[100] Shown when the communication protocol (INTC-02 Protocol) is 0 (Modbus RTU).
[101] Shown when the communication protocol (INTC-02 Protocol) is other than 0 (Modbus RTU).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[99]	Ref.	Communication address/scale	
								16-Bit	32-Bit
06	Modbus Addr Mode	0	No	1	-	O	10.2.2	2706h	a70ch
		1	Yes						
07	Termi Resistor En	0	Off	0	-	O	10.2.2	2707h	a70eh
		1	On						
11	Para Status-1	0000-FFFF		000Ah	Hex	O	10.3.6	270bh	a716h
								1	1
12	Para Status-2	0000-FFFF		000Eh	Hex	O	10.3.6	270ch	a718h
								1	1
13	Para Status-3	0000-FFFF		000Fh	Hex	O	10.3.6	270dh	a71ah
								1	1
14	Para Status-4	0000-FFFF		0000	Hex	O	10.3.6	270eh	a71ch
								1	1
15	Para Status-5	0000-FFFF		0000	Hex	O	10.3.6	270fh	a71eh
								1	1
16	Para Status-6	0000-FFFF		0000	Hex	O	10.3.6	2710h	a720h
								1	1
17	Para Status-7	0000-FFFF		0000	Hex	O	10.3.6	2711h	a722h
								1	1
18	Para Status-8	0000-FFFF		0000	Hex	O	10.3.6	2712h	a724h
								1	1
19	Para Status-9	0000-FFFF		0000	Hex	O	10.3.6	2713h	a726h
								1	1
20	Para Status-10	0000-FFFF		0000	Hex	O	10.3.6	2714h	a728h
								1	1
21	Para Status-11	0000-FFFF		0000	Hex	O	10.3.6	2715h	a72ah
								1	1
22	Para Status-12	0000-FFFF		0000	Hex	O	10.3.6	2716h	a72ch
								1	1
23	Para Status-13	0000-FFFF		0000	Hex	O	10.3.6	2717h	a72eh
								1	1

Code	LCD Display	Setting Range	Initial Value	Unit	Property[99]	Ref.	Communication address/scale	
							16-Bit	32-Bit
24	Para Status-14	0000-FFFF	0000	Hex	O	10.3.6	2718h	a730h
							1	1
25	Para Status-15	0000-FFFF	0000	Hex	O	10.3.6	2719h	a732h
							1	1
26	Para Status-16	0000-FFFF	0000	Hex	O	10.3.6	271ah	a734h
							1	1
31	Para Control-1	0000-FFFF	0005	Hex	O	10.3.6	271fh	a73eh
							1	1
32	Para Control-2	0000-FFFF	0006	Hex	O	10.3.6	2720h	a740h
							1	1
33	Para Control-3	0000-FFFF	0000	Hex	O	10.3.6	2721h	a742h
							1	1
34	Para Control-4	0000-FFFF	0000	Hex	O	10.3.6	2722h	a744h
							1	1
35	Para Control-5	0000-FFFF	0000	Hex	O	10.3.6	2723h	a746h
							1	1
36	Para Control-6	0000-FFFF	0000	Hex	O	10.3.6	2724h	a748h
							1	1
37	Para Control-7	0000-FFFF	0000	Hex	O	10.3.6	2725h	a74ah
							1	1
38	Para Control-8	0000-FFFF	0000	Hex	O	10.3.6	2726h	a74ch
							1	1
39	Para Control-9	0000-FFFF	0000	Hex	O	10.3.6	2727h	a74eh
							1	1
40	Para Control-10	0000-FFFF	0000	Hex	O	10.3.6	2728h	a750h
							1	1
41	Para Control-11	0000-FFFF	0000	Hex	O	10.3.6	2729h	a752h
							1	1
42	Para Control-12	0000-FFFF	0000	Hex	O	10.3.6	272ah	a754h
							1	1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[99]	Ref.	Communication address/scale	
								16-Bit	32-Bit
43	Para Control-13	0000-FFFF		0000	Hex	O	10.3.6	272bh	a756h
								1	1
44	Para Control-14	0000-FFFF		0000	Hex	O	10.3.6	272ch	a758h
								1	1
45	Para Control-15	0000-FFFF		0000	Hex	O	10.3.6	272dh	a75ah
								1	1
46	Para Control-16	0000-FFFF		0000	Hex	O	10.3.6	272eh	a75ch
								1	1
98	Error Count	-		-	-	X	10.2.2	2762h	a7c4h
								1	1
99	Error Count Reset	0	No	-	-	O	10.2.2	2763h	a7c6h
		1	Yes						

13.18 Modbus Master Group (INTM)

This group is only activated when the INTC-02 (Protocol) value is 2 (Modbus RTU Master).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		30	-	O	4.3.3	2800h	a800h
1	Comm Enable Mode	0	None	0	-	O	7.27.6.2	2801h	a802h
		1	Always Enable						
		2	DI Dependent						
2	P01 - Slave RW Mode	0	Not Used	0	-	O	7.27.6.2	2802h	a804h
		1	Read Mode						
		2	Write Mode						
		3	Broadcast Write						
3	P01 - Slave StationID	1-64		1	-	O	7.27.6.2	2803h	a806h
								1	1
4	P01 - Data Count	1-4		1	-	O	7.27.6.2	2804h	a808h
								1	1
5	P01 - Slave DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2805h	a80ah
								1	1
6	P01 - Master DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2806h	a80ch
								1	1
7	P01 - Time Period	0.10-1.00		0.10	sec	O	7.27.6.2	2807h	a80eh
								0.01	0.01

[102] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
8	P01 - Comm Diagnostic	0	Not Used	0	-	X	-	2808h	a810h
		1	IDLE						
		2	ILLEGAL FUNC						
		3	ILLEGAL ADDR						
		4	ILLEGAL DATA						
		5	WRITE PERMISSION						
		6	UNDEF CONDITION						
		7	DISCONNECT						
9	P02-Slave RW Mode	0	Not Used	0	-	O	7.27.6.2	2809h	a812h
		1	Read Mode						
		2	Write Mode						
		3	Broadcast Write						
10	P02 - Slave StationID	1-64		1	-	O	7.27.6.2	280ah	a814h
								1	1
11	P02 - Data Count	1-4		1	-	O	7.27.6.2	280bh	a816h
								1	1
12	P02 - Slave DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	280ch	a818h
								1	1
13	P02 - Master DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	280dh	a81ah
								1	1
14	P02-Time Period	0.10-1.00		0.10	sec	O	7.27.6.2	280eh	a81ch
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
15	P02 - Comm Diagnostic	0	Not Used	0	-	X	-	280fh	a81eh
		1	IDLE						
		2	ILLEGAL FUNC						
		3	ILLEGAL ADDR						
		4	ILLEGAL DATA						
		5	WRITE PERMISSION						
		6	UNDEF CONDITION						
		7	DISCONNECT						
16	P03-Slave RW Mode	0	Not Used	0	-	O	7.27.6.2	2810h	a820h
		1	Read Mode						
		2	Write Mode						
		3	Broadcast Write						
17	P03 - Slave StationID	1-64		1	-	O	7.27.6.2	2811h	a822h
								1	1
18	P03 - Data Count	1-4		1	-	O	7.27.6.2	2812h	a824h
								1	1
19	P03 - Slave DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2813h	a826h
								1	1
20	P03 - Master DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2814h	a828h
								1	1
21	P03-Time Period	0.10-1.00		0.10	sec	O	7.27.6.2	2815h	a82ah
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
22	P03-Comm Diagnostic	0	Not Used	0	-	X	-	2816h	a82ch
		1	IDLE						
		2	ILLEGAL FUNC						
		3	ILLEGAL ADDR						
		4	ILLEGAL DATA						
		5	WRITE PERMISSION						
		6	UNDEF CONDITION						
		7	DISCONNECT						
23	P04-Slave RW Mode	0	Not Used	0	-	O	7.27.6.2	2817h	a82eh
		1	Read Mode						
		2	Write Mode						
		3	Broadcast Write						
24	P04 - Slave StationID	1-64		1	-	O	7.27.6.2	2818h	a830h
								1	1
25	P04 - Data Count	1-4		1	-	O	7.27.6.2	2819h	a832h
								1	1
26	P04 - Slave DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	281ah	a834h
								1	1
27	P04 - Master DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	281bh	a836h
								1	1
28	P04-Time Period	0.10-1.00		0.10	sec	O	7.27.6.2	281ch	a838h
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
29	P04-Comm Diagnostic	0	Not Used	0	-	X	-	281dh	a83ah
		1	IDLE						
		2	ILLEGAL FUNC						
		3	ILLEGAL ADDR						
		4	ILLEGAL DATA						
		5	WRITE PERMISSION						
		6	UNDEF CONDITION						
		7	DISCONNECT						
30	P05-Slave RW Mode	0	Not Used	0	-	O	7.27.6.2	281eh	a83ch
		1	Read Mode						
		2	Write Mode						
		3	Broadcast Write						
31	P05 - Slave StationID	1-64		1	-	O	7.27.6.2	281fh	a83eh
								1	1
32	P05 - Data Count	1-4		1	-	O	7.27.6.2	2820h	a840h
								1	1
33	P05 - Slave DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2821h	a842h
								1	1
34	P05 - Master DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2822h	a844h
								1	1
35	P05-Time Period	0.10-1.00		0.10	sec	O	7.27.6.2	2823h	a846h
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
36	P05-Comm Diagnostic	0	Not Used	0	-	X	-	2824h	a848h
		1	IDLE						
		2	ILLEGAL FUNC						
		3	ILLEGAL ADDR						
		4	ILLEGAL DATA						
		5	WRITE PERMISSION						
		6	UNDEF CONDITION						
		7	DISCONNECT						
37	P06-Slave RW Mode	0	Not Used	0	-	O	7.27.6.2	2825h	a84ah
		1	Read Mode						
		2	Write Mode						
		3	Broadcast Write						
38	P06 - Slave StationID	1-64		1	-	O	7.27.6.2	2826h	a84ch
								1	1
39	P06 - Data Count	1-4		1	-	O	7.27.6.2	2827h	a84eh
								1	1
40	P06 - Slave DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2828h	a850h
								1	1
41	P06 - Master DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2829h	a852h
								1	1
42	P06-Time Period	0.10-1.00		0.10	sec	O	7.27.6.2	282ah	a854h
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
43	P06-Comm Diagnostic	0	Not Used	0	-	X	-	282bh	a856h
		1	IDLE						
		2	ILLEGAL FUNC						
		3	ILLEGAL ADDR						
		4	ILLEGAL DATA						
		5	WRITE PERMISSION						
		6	UNDEF CONDITION						
		7	DISCONNECT						
44	P07-Slave RW Mode	0	Not Used	0	-	O	7.27.6.2	282ch	a858h
		1	Read Mode						
		2	Write Mode						
		3	Broadcast Write						
45	P07 - Slave StationID	1-64		1	-	O	7.27.6.2	282dh	a85ah
								1	1
46	P07 - Data Count	1-4		1	-	O	7.27.6.2	282eh	a85ch
								1	1
47	P07 - Slave DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	282fh	a85eh
								1	1
48	P07 - Master DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2830h	a860h
								1	1
49	P07-Time Period	0.10-1.00		0.10	sec	O	7.27.6.2	2831h	a862h
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
50	P07-Comm Diagnostic	0	Not Used	0	-	X	-	2832h	a864h
		1	IDLE						
		2	ILLEGAL FUNC						
		3	ILLEGAL ADDR						
		4	ILLEGAL DATA						
		5	WRITE PERMISSION						
		6	UNDEF CONDITION						
		7	DISCONNECT						
51	P08-Slave RW Mode	0	Not Used	0	-	O	7.27.6.2	2833h	a866h
		1	Read Mode						
		2	Write Mode						
		3	Broadcast Write						
52	P08 - Slave StationID	1-64		1	-	O	7.27.6.2	2834h	a868h
								1	1
53	P08 - Data Count	1-4		1	-	O	7.27.6.2	2835h	a86ah
								1	1
54	P08 - Slave DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2836h	a86ch
								1	1
55	P08 - Master DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2837h	a86eh
								1	1
56	P08-Time Period	0.10-1.00		0.10	sec	O	7.27.6.2	2838h	a870h
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
57	P08-Comm Diagnostic	0	Not Used	0	-	X	-	2839h	a872h
		1	IDLE						
		2	ILLEGAL FUNC						
		3	ILLEGAL ADDR						
		4	ILLEGAL DATA						
		5	WRITE PERMISSION						
		6	UNDEF CONDITION						
		7	DISCONNECT						
58	P09-Slave RW Mode	0	Not Used	0	-	O	7.27.6.2	283ah	a874h
		1	Read Mode						
		2	Write Mode						
		3	Broadcast Write						
59	P09 - Slave StationID	1-64		1	-	O	7.27.6.2	283bh	a876h
								1	1
60	P09 - Data Count	1-4		1	-	O	7.27.6.2	283ch	a878h
								1	1
61	P09 - Slave DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	283dh	a87ah
								1	1
62	P09 - Master DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	283eh	a87ch
								1	1
63	P09-Time Period	0.10-1.00		0.10	sec	O	7.27.6.2	283fh	a87eh
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
64	P09-Comm Diagnostic	0	Not Used	0	-	X	-	2840h	a880h
		1	IDLE						
		2	ILLEGAL FUNC						
		3	ILLEGAL ADDR						
		4	ILLEGAL DATA						
		5	WRITE PERMISSION						
		6	UNDEF CONDITION						
		7	DISCONNECT						
65	P10-Slave RW Mode	0	Not Used	0	-	O	7.27.6.2	2841h	a882h
		1	Read Mode						
		2	Write Mode						
		3	Broadcast Write						
66	P10 - Slave StationID	1-64		1	-	O	7.27.6.2	2842h	a884h
								1	1
67	P10 - Data Count	1-4		1	-	O	7.27.6.2	2843h	a886h
								1	1
68	P10 - Slave DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2844h	a888h
								1	1
69	P10 - Master DataAddr	0000-FFFF		0000	Hex	O	7.27.6.2	2845h	a88ah
								1	1
70	P10-Time Period	0.10-1.00		0.10	sec	O	7.27.6.2	2846h	a88ch
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[102]	Ref.	Communication address/scale	
								16-Bit	32-Bit
71	P10-Comm Diagnostic	0	Not Used	0	-	X	-	2847h	a88eh
		1	IDLE						
		2	ILLEGAL FUNC						
		3	ILLEGAL ADDR						
		4	ILLEGAL DATA						
		5	WRITE PERMISSION						
		6	UNDEF CONDITION						
		7	DISCONNECT						

13.19 USB Communication Group (USBC)

Code	LCD Display	Setting Range		Initial Value	Unit	Property[103]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		30	-	O	4.3.3	2a00h	aa00h
05	Response Delay	0-1000		5	msec	O	10.2.2	2a05h	aa0ah
								1	1
06	Modbus Addr Mode	0	No	1	-	△	10.2.2	2a06h	aa0ch
		1	Yes						
11	Para Status-1	0000-FFFF		000A	Hex	△	10.3.5	2a0bh	aa16h
								1	1
12	Para Status-2	0000-FFFF		000E	Hex	△	10.3.5	2a0ch	aa18h
								1	1
13	Para Status-3	0000-FFFF		000F	Hex	△	10.3.5	2a0dh	aa1ah
								1	1
14	Para Status-4	0000-FFFF		0000	Hex	△	10.3.5	2a0eh	aa1ch
								1	1
15	Para Status-5	0000-FFFF		0000	Hex	△	10.3.5	2a0fh	aa1eh
								1	1
16	Para Status-6	0000-FFFF		0000	Hex	△	10.3.5	2a10h	aa20h
								1	1
17	Para Status-7	0000-FFFF		0000	Hex	△	10.3.5	2a11h	aa22h
								1	1
18	Para Status-8	0000-FFFF		0000	Hex	△	10.3.5	2a12h	aa24h
								1	1
19	Para Status-9	0000-FFFF		0000	Hex	△	10.3.5	2a13h	aa26h
								1	1
20	Para Status-10	0000-FFFF		0000	Hex	△	10.3.5	2a14h	aa28h
								1	1
21	Para Status-11	0000-FFFF		0000	Hex	△	10.3.5	2a15h	aa2ah
								1	1

[103] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range	Initial Value	Unit	Property[103]	Ref.	Communication address/scale	
							16-Bit	32-Bit
22	Para Status-12	0000-FFFF	0000	Hex	△	10.3.5	2a16h	aa2ch
							1	1
23	Para Status-13	0000-FFFF	0000	Hex	△	10.3.5	2a17h	aa2eh
							1	1
24	Para Status-14	0000-FFFF	0000	Hex	△	10.3.5	2a18h	aa30h
							1	1
25	Para Status-15	0000-FFFF	0000	Hex	△	10.3.5	2a19h	aa32h
							1	1
26	Para Status-16	0000-FFFF	0000	Hex	△	10.3.5	2a1ah	aa34h
							1	1
31	Para Control-1	0000-FFFF	0005	Hex	△	10.3.5	2a1fh	aa3eh
							1	1
32	Para Control-2	0000-FFFF	0006	Hex	△	10.3.5	2a20h	aa40h
							1	1
33	Para Control-3	0000-FFFF	0000	Hex	△	10.3.5	2a21h	aa42h
							1	1
34	Para Control-4	0000-FFFF	0000	Hex	△	10.3.5	2a22h	aa44h
							1	1
35	Para Control-5	0000-FFFF	0000	Hex	△	10.3.5	2a23h	aa46h
							1	1
36	Para Control-6	0000-FFFF	0000	Hex	△	10.3.5	2a24h	aa48h
							1	1
37	Para Control-7	0000-FFFF	0000	Hex	△	10.3.5	2a25h	aa4ah
							1	1
38	Para Control-8	0000-FFFF	0000	Hex	△	10.3.5	2a26h	aa4ch
							1	1
39	Para Control-9	0000-FFFF	0000	Hex	△	10.3.5	2a27h	aa4eh
							1	1
40	Para Control-10	0000-FFFF	0000	Hex	△	10.3.5	2a28h	aa50h
							1	1

Code	LCD Display	Setting Range	Initial Value	Unit	Property[103]	Ref.	Communication address/scale	
							16-Bit	32-Bit
41	Para Control-11	0000-FFFF	0000	Hex	△	10.3.5	2a29h 1	aa52h 1
42	Para Control-12	0000-FFFF	0000	Hex	△	10.3.5	2a2ah 1	aa54h 1
43	Para Control-13	0000-FFFF	0000	Hex	△	10.3.5	2a2bh 1	aa56h 1
44	Para Control-14	0000-FFFF	0000	Hex	△	10.3.5	2a2ch 1	aa58h 1
45	Para Control-15	0000-FFFF	0000	Hex	△	10.3.5	2a2dh 1	aa5ah 1
46	Para Control-16	0000-FFFF	0000	Hex	△	10.3.5	2a2eh 1	aa5ch 1
50	S.Scope Enable	0 No 1 Yes	0	-	O	-	2a32h	aa64h
51	S.Scope SamplingT	1-1000	5	-	O	-	2a33h 1	aa66h 1
52	S.Scope Para Count	1-8	4	-	O	-	2a34h 1	aa68h 1
53	S.Scope ParaAddr 1	0000-FFFF	0000	Hex	O	-	2a35h 1	aa6ah 1
54	S.Scope ParaAddr 2	0000-FFFF	0000	Hex	O	-	2a36h 1	aa6ch 1
55	S.Scope ParaAddr 3	0000-FFFF	0000	Hex	O	-	2a37h 1	aa6eh 1
56	S.Scope ParaAddr 4	0000-FFFF	0000	Hex	O	-	2a38h 1	aa70h 1
57	S.Scope ParaAddr 5	0000-FFFF	0000	Hex	O	-	2a39h 1	aa72h 1
58	S.Scope ParaAddr 6	0000-FFFF	0000	Hex	O	-	2a3ah 1	aa74h 1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[103]	Ref.	Communication address/scale	
								16-Bit	32-Bit
59	S.Scope ParaAddr 7	0000-FFFF		0000	Hex	O	-	2a3bh	aa76h
								1	1
60	S.Scope ParaAddr 8	0000-FFFF		0000	Hex	O	-	2a3ch	aa78h
								1	1
98	Error Count	-		-	-	X	-	2a62h	aac4h
								1	1
99	Error Count Reset	0	No	0	-	O	-	2a63h	aac6h
		1	Yes						

13.20 Virtual Terminal Block Group (VIRT)

Code	LCD Display	Setting Range		Initial Value	Unit	Property[104]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		33	-	O	4.3.3	2c00h	ac00h
01	Virtual DI01Define	0	User Defined Func	0	-	△	10.3.3	2c01h	ac02h
		1	FX						
		2	RX						
		3	RST						
		4	BX						
		5	External Trip-1						
		6	External Trip-2						
		7	External Trip-3						
		8	External Trip-4						
		9	JOG						
		10	SPEED_L						
		11	SPEED_M						
		12	SPEED_H						
		13	SPEED_X						
		14	XCEL_L						
		15	XCEL_M						
		16	XCEL_H						
		17	XCEL Stop						
		18	RUN Enable						
		19	3-Wire						
		20	2nd Source						
		21	Exchange						
		22	Up						

[104] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[104]	Ref.	Communication address/scale	
								16-Bit	32-Bit
01	Virtual DI01Define	23	Down	0	-	△	10.3.3	2c01h	ac02h
		24	Up/Down Clear						
		25	Up/Down Save						
		26	Cmd Frequency Hold						
		27	2nd Motor						
		28	Dc Injection						
		29	Spd/Trq Change						
		30	Reserved						
		31	Reserved						
		32	Timer Input						
		33	Reserved						
		34	Disable Aux Ref						
		35	Forward JOG						
		36	Reverse JOG						
		37	PPID Run Enable						
		38	PPID Open Loop						
		39	PPID Ref Change						
		40	PPID Gain Change						
		41	PPID I-Term Clear						
		42	PPID Output Hold						
		43	PPID Sleep ON						
		44	PPID Sleep Change						
		45	PPID Step Ref-L						
		46	PPID Step Ref-M						
		47	PPID Step Ref-H						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[104]	Ref.	Communication address/scale	
								16-Bit	32-Bit
01	Virtual DI01Define	48	Fire Mode Fwd	0	-	△	10.3.3	2c01h	ac02h
		49	Fire Mode Rev						
		50	Pre Heat						
		51	EPID1 Run						
		52	EPID1 I-Term Clear						
		53	EPID2 Run						
		54	EPID2 I-Term Clear						
		55	Brake Monitor Sel						
		56	POS Home						
		57	POS POS Run Home						
		58	POS HW Lmt L						
		59	POS HW Lmt H						
		60	POS Pattern-L						
		61	POS Pattern-M						
		62	POS Pattern-H						
		63	POS Pattern-X						
		64	POS Run						
		65	POS Run Pre-Posi						
		66	POS Run Relative						
		67	Modbus Master En						
		68	UserSeqCtrl OnOff						
02	Virtual DI1Status	0	Off	0	-	X	10.3.3	2c02h	ac04h
		1	On						
03	Virtual DI1 Const	0	Off	0	-	O	10.3.3	2c03h	ac06h
		1	On						

Code	LCD Display	Setting Range	Initial Value	Unit	Property[104]	Ref.	Communication address/scale	
							16-Bit	32-Bit
4	Virtual DI2 Define	Same as Virtual DI1 Define, Virtual DI1 Status, and Virtual DI1 Const					2c04h	ac08h
5	Virtual DI2 Status						2c05h	ac0ah
6	Virtual DI2 Const						2c06h	ac0ch
7	Virtual DI3 Define						2c07h	ac0eh
8	Virtual DI3 Status						2c08h	ac10h
9	Virtual DI3 Const						2c09h	ac12h
10	Virtual DI4 Define						2c0ah	ac14h
11	Virtual DI4 Status						2c0bh	ac16h
12	Virtual DI4 Const						2c0ch	ac18h
13	Virtual DI5 Define						2c0dh	ac1ah
14	Virtual DI5 Status						2c0eh	ac1ch
15	Virtual DI5 Const						2c0fh	ac1eh
16	Virtual DI6 Define						2c10h	ac20h
17	Virtual DI6 Status						2c11h	ac22h
18	Virtual DI6 Const						2c12h	ac24h

Code	LCD Display	Setting Range	Initial Value	Unit	Property[104]	Ref.	Communication address/scale	
							16-Bit	32-Bit
19	Virtual DI7 Define	Same as Virtual DI1 Define, Virtual DI1 Status, and Virtual DI1 Const					2c13h	ac26h
20	Virtual DI7 Status						2c14h	ac28h
21	Virtual DI7 Const						2c15h	ac2ah
22	Virtual DI8 Define						2c16h	ac2ch
23	Virtual DI8 Status						2c17h	ac2eh
24	Virtual DI8 Const						2c18h	ac30h
25	Virtual DI9 Define						2c19h	ac32h
26	Virtual DI9 Status						2c1ah	ac34h
27	Virtual DI9 Const						2c1bh	ac36h
28	Virtual DI10 Define						2c1ch	ac38h
29	Virtual DI10 Status						2c1dh	ac3ah
30	Virtual DI10 Const						2c1eh	ac3ch
31	Virtual DI11 Define						2c1fh	ac3eh
32	Virtual DI11 Status						2c20h	ac40h
33	Virtual DI11 Const						2c21h	ac42h
34	Virtual DI12 Define						2c22h	ac44h

Code	LCD Display	Setting Range	Initial Value	Unit	Property[104]	Ref.	Communication address/scale	
							16-Bit	32-Bit
35	Virtual DI12 Status	Same as Virtual DI1 Define, Virtual DI1 Status, and Virtual DI1 Const					2c23h	ac46h
36	Virtual DI12 Const						2c24	ac48h
37	Virtual DI13 Define						2c25h	ac4ah
38	Virtual DI13 Status						2c26h	ac4ch
39	Virtual DI13 Const						2c27h	ac4eh
40	Virtual DI14 Define						2c28h	ac50h
41	Virtual DI14 Status						2c29h	ac52h
42	Virtual DI14 Const						2c2ah	ac54h
43	Virtual DI15 Define						2c2bh	ac56h
44	Virtual DI15 Status						2c2ch	ac58h
45	Virtual DI15 Const						2c2dh	ac5ah
46	Virtual DI16 Define						2c2eh	ac5ch
47	Virtual DI16 Status						2c2fh	ac5eh
48	Virtual DI16 Const						2c30h	ac60h

Code	LCD Display	Setting Range		Initial Value	Unit	Property[104]	Ref.	Communication address/scale	
								16-Bit	32-Bit
50	Virtual DO1 Define	0	User Defined Func	0	-	O	10.3.4	2c32h	ac64h
		1	FDT-1						
		2	FDT-2						
		3	FDT-3						
		4	FDT-4						
		5	Over Load Warn						
		6	Drv Over Load Warn						
		7	Under Load Warn						
		8	MainFan Warn						
		9	Stall						
		10	Over Voltage Trip						
		11	Low Voltage						
		12	Drv Over Heat Trip						
		13	Lost Int Comm Warn						
		14	Run						
		15	Stop						
		16	Steady						
		17	Drive Output Line						
		18	Supply Power Line						
		19	Speed Search						
		20	Ready						
		21	Zero speed Detect						
		22	Torque Detect						
		23	Timer Output						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[104]	Ref.	Communication address/scale	
								16-Bit	32-Bit
50	Virtual DO1 Define	24	Trip	0	-	O	10.3.4	2c32h	ac64h
		25	Lost Keypad Warn						
		26	DB Warn %ED						
		27	Encoder Tune Warn						
		28	Encoder Dir Warn						
		29	On/Off Control						
		30	Brake Control						
		31	Run with Zero Spd						
		32	STO Monitor						
		33	Rst Restart F Trip						
		34	Lost USB Warn						
		35	KEB Operating						
		36	Lost AI-1 Warn						
		37	Lost AI-2 Warn						
		38	Lost AI-3 Warn						
		39	E24V Monitor						
		40	Main Cap Repl Warn						
		41	MainFan Repl Warn						
		42	AuxFan Repl Warn						
		43	MainCap Diag Alarm						
		44	Pos Tar Bound Err						
		45	Pos Max Track Err						
		46	OCS Run						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[104]	Ref.	Communication address/scale	
								16-Bit	32-Bit
50	Virtual DO1 Define	47	FWD Run	0	-	O	10.3.4	2c32h	ac64h
		48	REV Run						
		49	Fire Mode						
		50	WebBreak Warn						
		51	Lost OptComm Warn						
		52	Ana In Lvl Detect						
		53	SPD Sync Complete						
		54	POS Sync Complete						
51	Virtual DO1 Status	0	Off	0	-	X	10.3.4	2c33h	ac66h
		1	On						
52	Virtual DO2 Define	Same as Virtual DO1 Define and Virtual DO1 Status						2c34h	ac68h
53	Virtual DO2 Status							2c35h	ac6ah
54	Virtual DO3 Define							2c36h	ac6ch
55	Virtual DO3 Status							2c37h	ac6eh
56	Virtual DO4 Define							2c38h	ac70h
57	Virtual DO4 Status							2c39h	ac72h
58	Virtual DO1 Const	0	Off	0	-	O	10.3.4	2c3ah	ac74h
		1	On						
59	Virtual DO2 Const	0	Off	0	-	O	10.3.4	2c3bh	ac76h
		1	On						
60	Virtual DO3 Const	0	Off	0	-	O	10.3.4	2c3ch	ac78h
		1	On						
61	Virtual DO4 Const	0	Off	0	-	O	10.3.4	2c3dh	ac7ah
		1	On						

13.21 Encoder Group (ENC)

This group is only activated when the encoder card (optional) is installed.

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[105]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		33	-	O	4.3.3	2d00h	ad00h
02	Enc Monitor[Hz]	-600.00-600.00		0.00	Hz	X	3.3	2d02h	ad04h
								0.01	0.01
03	Enc Monitor[rpm]	-60000-60000		0 [106]	rpm	X	3.3	2d03h	ad06h
								1	1
10	Auto Flying Start	0	No	1	-	X	3.3	2d0ah	ad14h
		1	Yes						
11	Enc Output Phase	0	(A+B)	0	-	△	3.3	2d0bh	ad16h
		1	- (A + B)						
12	Pulse/ Revolution	10-4096		1024	-	△	3.3	2d0ch	ad18h
								1	1
13	Enc LPF Gain	0-10000		3	msec	O	3.3	2d0dh	ad1ah
								1	1
16 [107]	Wire Check Trip En	0	No	0	-	O	3.3	2d10h	ad20h
		1	Yes						
17 [107]	Wire Check Time	0.1-10.0		1.0	sec	O	3.3	2d11h	ad22h
								0.1	0.1
18	Enc Pulse Chk Time	500-5000		1000	msec	O	3.3	2d12h	ad24h
								1	1

[105] O: Writable during operation, △: Writable when stopped, X: Not writable
[106] The rpm value varies according to the motor rating pole number (MOT1, 2-25).
[107] Only activated when a line driver encoder card is installed.

13.22 External PID 1 Group (EPI1)

This group is only activated when the APP-02 (ExternalPID Enable) value is 1 (Yes).

The values below have the following meanings:

- Unit Max: Unit at 100% (EPI1-93)
- Unit Min: 2 * Unit at 0% (EPI1-92) - Unit at 100% (EPI1-93)
- PID Unit: Unit Select (EPI1-90)

Code	LCD Display	Setting Range		Initial Value	Unit	Property[108]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		1	-	O	4.3.3	2e00h	ae00h
01	Control State	0	Idle	0	-	X	7.8	2e01h	ae02h
		1	Pre-PID						
		2	RUN						
		3	Sleep Boost						
		4	Sleep						
02	Output Value	-100.00-100.00		-	%	X	7.8	2e02h	ae04h
								0.01	0.01
03	Reference Value	Unit Min - Unit Max		-	PID Unit	X	7.8	2e03h	ae06h
								PID Unit	PID Unit
04	Feedback Value	Unit Min - Unit Max		-	PID Unit	X	7.8	2e04h	ae08h
								PID Unit	PID Unit
05	Error Value	Unit Min - Unit Max		-	PID Unit	X	7.8	2e05h	ae0ah
								PID Unit	PID Unit
06	Mode	0	None	0	-	O	7.8	2e06h	ae0ch
		1	Always Enable						
		2	Run In Drv Run						
		3	DI Dependent						

[108] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[108]	Ref.	Communication address/scale	
								16-Bit	32-Bit
10	Reference Source	0	Keypad	0	-	O	7.8	2e0ah	ae14h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Up Down Drive						
		6	Internal Comm.						
		7	USB Comm.						
		8	Option Comm.						
		9	UserSequence						
		10	X-Analog Input 1						
		11	X-Analog Input 2						
		12	X-Analog Input 3						
11	Ref Keypad Set	- Unit at 100% - Unit at 100%		0	PID Unit	O	7.8	2e0bh PID Unit	ae16h PID Unit
25	Feedback Source	0	Analog Input 1	0	-	O	7.8	2e19h	ae32h
		1	Analog Input 2						
		2	Analog Input 3						
		3	Pulse Input						
		4	Internal Comm.						
		5	USB Comm.						
		6	Option Comm.						
		7	UserSequence						
		8	Ext PID-1 Output						
		9	X-Analog Input 1						
		10	X-Analog Input 2						
		11	X-Analog Input 3						
35	Proportional Gain	0.0-1000.0		50.0	%	O	7.8	2e23h 0.1	ae46h 0.1

Code	LCD Display	Setting Range	Initial Value	Unit	Property[108]	Ref.	Communication address/scale	
							16-Bit	32-Bit
36	Integral Time	0.0-200.0	10.0	sec	O	7.8	2e24h	ae48h
							0.1	0.1
37	Derivative Time	0-1000	0	msec	O	7.8	2e25h	ae4ah
							1	1
38	FeedForward Gain	0-1000.0	0.0	%	O	7.8	2e26h	ae4ch
							0.1	0.1
46	Output Limit Low	-100.00 - Output Limit High	0.00	%	O	7.8	2e2eh	ae5ch
							0.01	0.01
47	Output Limit High	Output Limit Low - 100.00	100.00	%	O	7.8	2e2fh	ae5eh
							0.01	0.01
49	Output LPF Gain	0-10000	0	msec	O	7.8	2e31h	ae62h
							1	1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[108]	Ref.	Communication address/scale	
								16-Bit	32-Bit
90	Unit Select	0	CUST	1	-	O	7.8	2e5ah	aeb4h
		1	%						
		2	PSI						
		3	°F						
		4	°C						
		5	inWC						
		6	inM						
		7	Bar						
		8	mBar						
		9	Pa						
		10	kPa						
		11	Hz						
		12	rpm						
		13	V						
		14	A						
		15	kW						
		16	HP						
		17	mpm						
		18	Ft						
		19	m/s						
		20	m^3/s						
		21	m^3/m						
		22	m^3/h						
		23	l/s						
		24	l/m						
		25	l/h						
		26	kg/s						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[108]	Ref.	Communication address/scale	
								16-Bit	32-Bit
90	Unit Select	27	kg/m	1	-	O	7.8	2e5ah	aeb4h
		28	kg/h						
		29	gl/s						
		30	gl/m						
		31	gl/h						
		32	ft/s						
		33	f³/s						
		34	f³/m						
		35	f³/h						
		36	lb/s						
		37	lb/m						
		38	lb/h						
		39	ppm						
		40	pps						
91	Unit Scale	0	X100	2	-	O	7.8	2e5bh	aeb6h
		1	X10						
		2	X1						
		3	X0.1						
		4	X0.01						
92	Unit at 0%	0.00 - Unit at 100%		0.00	PID Unit	O	7.8	2e5ch	aeb8h
93	Unit at 100%	Unit at 0%-300.00		100.00	PID Unit	O	7.8	2e5dh	Aebah

13.23 External PID 2 Group (EPI2)

This group is only activated when the APP-02 (ExternalPID Enable) value is 1 (Yes).

The values below have the following meanings:

- Unit Max: Unit at 100% (EPI2-93)
- Unit Min: 2 x Unit at 0% (EPI2-92) - Unit at 100% (EPI2-93)
- PID Unit: Unit Select (EPI2-90)

Code	LCD Display	Setting Range		Initial Value	Unit	Property[109]	Ref.	Communication address/scale	
								16-Bit	32-Bit
00	Jump Code	1-99		60	-	O	4.3.3	2f00h	af00h
01	Control State	0	Idle	0	-	X	7.8	2f01h	af02h
		1	Pre-PID						
		2	RUN						
		3	Sleep Boost						
		4	Sleep						
02	Output Value	-100.00-100.00		-	%	X	7.8	2f02h	af04h
03	Reference Value	Unit Min - Unit Max		-	PID Unit	X	7.8	2f03h	af06h
								PID Unit	PID Unit
04	Feedback Value	Unit Min - Unit Max		-	PID Unit	X	7.8	2f04h	af08h
								PID Unit	PID Unit
05	Error Value	Unit Min - Unit Max		-	PID Unit	X	7.8	2f05h	af0ah
								PID Unit	PID Unit
06	Mode	0	None	0	-	O	7.8	2f06h	af0ch
		1	Always Enable						
		2	Run In Drv Run						
		3	DI Dependent						

[109] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[109]	Ref.	Communication address/scale	
								16-Bit	32-Bit
10	Reference Source	0	Keypad	0	-	O	7.8	2f0ah	af14h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Up Down Drive						
		6	Internal Comm.						
		7	USB Comm.						
		8	Option Comm.						
		9	UserSequence						
		10	X-Analog Input 1						
		11	X-Analog Input 2						
		12	X-Analog Input 3						
11	Ref Keypad Set	- Unit at 100% - Unit at 100%		0	PID Unit	O	7.8	2f0bh	af16h
								PID Unit	PID Unit
25	Feedback Source	0	Analog Input 1	0	-	O	7.8	2f19h	af32h
		1	Analog Input 2						
		2	Analog Input 3						
		3	Pulse Input						
		4	Internal Comm.						
		5	USB Comm.						
		6	Option Comm.						
		7	UserSequence						
		8	Ext PID-1 Output						
		9	X-Analog Input 1						
		10	X-Analog Input 2						
		11	X-Analog Input 3						
35	Proportional Gain1	0.0-1000.0		50.0	%	O	7.8	2f23h	af46h
								0.1	0.1

Code	LCD Display	Setting Range	Initial Value	Unit	Property[109]	Ref.	Communication address/scale	
							16-Bit	32-Bit
36	Integral Time1	0.0-200.0	10.0	sec	O	7.8	2f24h	af48h
							0.1	0.1
37	Derivative Time1	0-1000	0	msec	O	7.8	2f25h	af4ah
							1	1
38	FeedForward Gain	0.0-1000.0	0.0	%	O	7.8	2f26h	af4ch
							0.1	0.1
46	Output Limit Low	-100.00 - Output Limit High	0.00	%	O	7.8	2f2fh	af5ch
							0.01	0.01
47	Output Limit High	Output Limit Low - 100.00	100.00	%	O	7.8	2f2fh	af5eh
							0.01	0.01
49	Output LPF Gain	0-10000	0	msec	O	7.8	2f 31h	af62h
							1	1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[109]	Ref.	Communication address/scale	
								16-Bit	32-Bit
90	Unit Select	0	CUST	1	-	O	7.8	2f5a	afb4
		1	%						
		2	PSI						
		3	°F						
		4	°C						
		5	inWC						
		6	inM						
		7	Bar						
		8	mBar						
		9	Pa						
		10	kPa						
		11	Hz						
		12	rpm						
		13	V						
		14	A						
		15	kW						
		16	HP						
		17	mpm						
		18	ft						
		19	m/s						
		20	m^3/s						
		21	m^3/m						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[109]	Ref.	Communication address/scale	
								16-Bit	32-Bit
90	Unit Select	22	m³/h	1	-	O	7.8	2f5ah	afb4h
		23	l/s						
		24	l/m						
		25	l/h						
		26	kg/s						
		27	kg/m						
		28	kg/h						
		29	gl/s						
		30	gl/m						
		31	gl/h						
		32	ft/s						
		33	f³/s						
		34	f³/m						
		35	f³/h						
		36	lb/s						
		37	lb/m						
		38	lb/h						
		39	ppm						
		40	pps						
91	Unit Scale	0	X100	2	-	O	7.8	2f5bh	afb6h
		1	X10						
		2	X1						
		3	X0.1						
		4	X0.01						
92	Unit at 0%	0.00 - Unit at 100%		0.00	PID Unit	O	7.8	2f5ch	afb8h
93	Unit at 100%	Unit at 0%-300.00		100.00	PID Unit	O	7.8	2f5dh	afbah

13.24 Position Control Group 1 (POS1)

This group is only activated when the APP-44 (Pos Ctrl Enable) value is 1 (Yes).

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range		Initial Value	Unit	Property[110]	Ref.	Communication address/scale	
								16-Bit	32-Bit
0	Jump Code	1-99		33	-	O	4.3.3	3000h	b000h
1	Pos Ctrl State	0	Stop	-	-	X	7.26	3001h	b002h
		1	POS Run						
		2	POS Run Pre-Posi						
		3	POS Run Relative						
		4	Trip						
		5	POS Run Home						
		6	POS Home						
2	Pos Ctrl Mode	0	Pos Single	0	-	△	7.26	3002h	b004h
		1	Multi Sync Pos						
3	Tar Position	-		-	UC	X	7.26	3003h	b006h
								1	1
4	Cur Position	-		-	UC	X	7.26	3004h	b008h
								1	1
5	Pre Position	0-65000		0	UC	△	7.26	3005h	b00ah
								1	1
6	Error Value	0-65000		-	Puls	X	7.26	3006h	b00ch
								1	1
7	Reference Value	-		-	Puls	X	7.26	3007h	b00eh
								1	1

[110] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[110]	Ref.	Communication address/scale	
								16-Bit	32-Bit
8	Feedback Value	-		-	Puls	X	7.26	3008h	b010h
								1	1
9	Total Move Time	0.00-650.00		-	sec	X	7.26	3009h	b012h
								0.01	0.01
10	Cmd Source	0	DI Dependent	0	-	△	7.26	300ah	b014h
		1	Keypad						
		2	Internal Comm.						
		3	USB Comm.						
		4	Option Comm.						
		5	UserSequence						
11	Cmd Keypad Set	0	Stop	0	-	O	7.26	300bh	b016h
		1	POS Run						
		2	POS Run Pre-Posi						
		3	POS Run Relative						
12	Multi Sync Time	0.00-650.00		0.00	sec	X	7.26	300ch	b018h
								0.01	0.01
15	Stop Homing	0	No	0	-	O	7.26	300fh	b01eh
		1	Yes						
20	Proportional Gain	0.0-1000.0		50.0	%	O	7.26	3014h	b028h
								0.1	0.1
21	FeedForward Gain	0.0-1000.0		100.0	%	O	7.26	3015h	b02ah
								0.1	0.1
22	Output LPF Gain	0-10000		0	msec	O	7.26	3016h	b02ch
								1	1
30	SW Limit Prot Mode	0	Trip	0	-	O	7.26	301eh	b03ch
		1	Warning						
31	SW Limit Hi Enable	0	No	0	-	O	7.26	301fh	b03eh
		1	Yes						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[110]	Ref.	Communication address/scale	
								16-Bit	32-Bit
32	SW Limit Lo Enable	0	No	0	-	O	7.26	3020h	b040h
		1	Yes						
33	Pos SW Limit High	Pos SW Limit Low - 65000		60000	UC	O	7.26	3021h	b042h
								1	1
34	Pos SW Limit Low	0-Pos SW Limit High		5000	UC	O	7.26	3022h	b044h
								1	1
35	HW Limit Prot Mode	0	Trip	0	-	O	7.26	3023h	b046h
		1	Warning						
36	Max Track Pulse	0-65000		30000	Puls	O	7.26	3024h	b048h
								1	1
37	Tar Bound Pulse	0-65000		200	Puls	O	7.26	3025h	b04ah
								1	1
40	Error Stop Mode	0	CoastStop (FreeRun)	0	-	△	7.26	3028h	b050h
		1	Trip Dec Stop						
50	Homing Type	0	Inverse + index	0	-	△	7.26	3032h	b064h
		1	Inverse + No Index						
		2	Index						
		3	No index						
51	Homing Dir	0	FWD	0	-	△	7.26	3033h	b066h
		1	REV						
52	Homing Freq	0.00-Max Frequency		2.00	Hz	△	7.26	3034h	b068h
								0.01	0.01
53[111]	Homing Speed	0-Maximum Speed		60[112]	rpm	△	7.26	3035h	b06ah
								1	1
54	Homing Ramp Time	0.00-6000.00		10.00	sec	△	7.26	3036h	b06ch
								0.1	0.01

[111] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[112] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[110]	Ref.	Communication address/scale	
								16-Bit	32-Bit
55	Run Relative Dir	0	FWD	0	-	△	7.26	3037h	b06eh
		1	REV						
60	UC Numerator	1-65000		1	-	△	7.26	303ch	b078h
								1	1
61	UC Denominator	1-65000		1	-	△	7.26	303dh	b07ah
								1	1

13.25 Position Control Group 2 (POS2)

This group is only activated when the APP-44 (Pos Ctrl Enable) value is 1 (Yes).

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Max Frequency and Maximum Speed refer to the setting values at DRV-20 (Max Frequency) and DRV-21 (Maximum Speed) respectively.

Code	LCD Display	Setting Range	Initial Value	Unit	Property[113]	Ref.	Communication address/scale	
							16-Bit	32-Bit
00	Jump Code	1-99	33	-	O	4.3.3	3100h	b100h
01	TRJ Tar Pos-01	0-65000	30000	UC	O	7.26	3101h	b102h
							1	1
02	TRJ Tar Freq-01	0.00-Max Frequency	60.00	Hz	O	7.26	3102h	b104h
							0.01	0.01
03 [114]	TRJ Tar Spd-01	0-Maximum Speed	1800 [115]	rpm	O	7.26	3103h	b106h
							1	1
04	TRJ Acc Time-01	0.00-6000.00	10.00	sec	O	7.26	3104h	b108h
							0.1	0.01
05	TRJ Dec Time-01	0.00-6000.00	10.00	sec	O	7.26	3105h	b10ah
							0.1	0.01
07	TRJ Tar Pos-02	0-65000	30000	UC	O	7.26	3107h	b10eh
							1	1
08	TRJ Tar Freq-02	0.00-Max Frequency	60.00	Hz	O	7.26	3108h	b110h
							0.01	0.01
09 [114]	TRJ Tar Spd-02	0-Maximum Speed	1800	rpm	O	7.26	3109h	b112h
							1	1
10	TRJ Acc Time-02	0.00-6000.00	10.00	sec	O	7.26	310ah	b114h
							0.1	0.01

[113] O: Writable during operation, △: Writable when stopped, X: Not writable

[114] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[115] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[113]	Ref.	Communication address/scale	
							16-Bit	32-Bit
11	TRJ Dec Time-02	0.00-6000.00	10.00	sec	O	7.26	310bh	b116h
							0.1	0.01
13	TRJ Tar Pos-03	0-65000	30000	UC	O	7.26	310dh	b11ah
							1	1
14	TRJ Tar Freq-03	0.00-Max Frequency	60.00	Hz	O	7.26	310eh	b11ch
							0.01	0.01
15 [114]	TRJ Tar Spd-03	0-Maximum Speed	1800	rpm	O	7.26	310fh	b11eh
							1	1
16	TRJ Acc Time-03	0.00-6000.00	10.00	sec	O	7.26	3110h	b120h
							0.1	0.01
17	TRJ Dec Time-03	0.00-6000.00	10.00	sec	O	7.26	3111h	b122h
							0.1	0.01
19	TRJ Tar Pos-04	0-65000	30000	UC	O	7.26	3113h	b126h
							1	1
20	TRJ Tar Freq-04	0.00-Max Frequency	60.00	Hz	O	7.26	3114h	b128h
							0.01	0.01
21 [114]	TRJ Tar Spd-04	0-Maximum Speed	1800	rpm	O	7.26	3115h	b12ah
							1	1
22	TRJ Acc Time-04	0.00-6000.00	10.00	sec	O	7.26	3116h	b12ch
							0.1	0.01
23	TRJ Dec Time-04	0.00-6000.00	10.00	sec	O	7.26	3117h	b12eh
							0.1	0.01
25	TRJ Tar Pos-05	0-65000	30000	UC	O	7.26	3119h	b132h
							1	1
26	TRJ Tar Freq-05	0.00-Max Frequency	60.00	Hz	O	7.26	311ah	b134h
							0.01	0.01
27 [114]	TRJ Tar Spd-05	0-Maximum Speed	1800	rpm	O	7.26	311bh	b136h
							1	1
28	TRJ Acc Time-05	0.00-6000.00	10.00	sec	O	7.26	311ch	b138h
							0.1	0.01

Code	LCD Display	Setting Range	Initial Value	Unit	Property[113]	Ref.	Communication address/scale	
							16-Bit	32-Bit
29	TRJ Dec Time-05	0.00-6000.00	10.00	sec	O	7.26	311dh	b13ah
							0.1	0.01
31	TRJ Tar Pos-06	0-65000	30000	UC	O	7.26	311fh	b13eh
							1	1
32	TRJ Tar Freq-06	0.00-Max Frequency	60.00	Hz	O	7.26	3120h	b140h
							0.01	0.01
33[114]	TRJ Tar Spd-06	0-Maximum Speed	1800	rpm	O	7.26	3121h	b142h
							1	1
34	TRJ Acc Time-06	0.00-6000.00	10.00	sec	O	7.26	3122h	b144h
							0.1	0.01
35	TRJ Dec Time-06	0.00-6000.00	10.00	sec	O	7.26	3123h	b146h
							0.1	0.01
37	TRJ Tar Pos-07	0-65000	30000	UC	O	7.26	3125h	b14ah
							1	1
38	TRJ Tar Freq-07	0.00-Max Frequency	60.00	Hz	O	7.26	3126h	b14ch
							0.01	0.01
39[114]	TRJ Tar Spd-07	0-Maximum Speed	1800	rpm	O	7.26	3127h	b14eh
							1	1
40	TRJ Acc Time-07	0.00-6000.00	10.00	sec	O	7.26	3128h	b150h
							0.1	0.01
41	TRJ Dec Time-07	0.00-6000.00	10.00	sec	O	7.26	3129h	b152h
							0.1	0.01
43	TRJ Tar Pos-08	0-65000	30000	UC	O	7.26	312bh	b156h
							1	1
44	TRJ Tar Freq-08	0.00-Max Frequency	60.00	Hz	O	7.26	312ch	b158h
							0.01	0.01
45[114]	TRJ Tar Spd-08	0-Maximum Speed	1800	rpm	O	7.26	312dh	b15ah
							1	1
46	TRJ Acc Time-08	0.00-6000.00	10.00	sec	O	7.26	312eh	b15ch
							0.1	0.01

Code	LCD Display	Setting Range	Initial Value	Unit	Property[113]	Ref.	Communication address/scale	
							16-Bit	32-Bit
47	TRJ Dec Time-08	0.00-6000.00	10.00	sec	O	7.26	312fh	b15eh
							0.1	0.01
49	TRJ Tar Pos-09	0-65000	30000	UC	O	7.26	3131h	b162h
							1	1
50	TRJ Tar Freq-09	0.00-Max Frequency	60.00	Hz	O	7.26	3132h	b164h
							0.01	0.01
51 [114]	TRJ Tar Spd-09	0-Maximum Speed	1800	rpm	O	7.26	3133h	b166h
							1	1
52	TRJ Acc Time-09	0.00-6000.00	10.00	sec	O	7.26	3134h	b168h
							0.1	0.01
53	TRJ Dec Time-09	0.00-6000.00	10.00	sec	O	7.26	3135h	b16ah
							0.1	0.01
55	TRJ Tar Pos-10	0-65000	30000	UC	O	7.26	3137h	b16eh
							1	1
56	TRJ Tar Freq-10	0.00-Max Frequency	60.00	Hz	O	7.26	3138h	b170h
							0.01	0.01
57 [114]	TRJ Tar Spd-10	0-Maximum Speed	1800	rpm	O	7.26	3139h	b172h
							1	1
58	TRJ Acc Time-10	0.00-6000.00	10.00	sec	O	7.26	313ah	b174h
							0.1	0.01
59	TRJ Dec Time-10	0.00-6000.00	10.00	sec	O	7.26	313bh	b176h
							0.1	0.01
61	TRJ Tar Pos-11	0-65000	30000	UC	O	7.26	313dh	b17ah
							1	1
62	TRJ Tar Freq-11	0.00-Max Frequency	60.00	Hz	O	7.26	313eh	b17ch
							0.01	0.01
63 [114]	TRJ Tar Spd-11	0-Maximum Speed	1800	rpm	O	7.26	313fh	b17eh
							1	1
64	TRJ Acc Time-11	0.00-6000.00	10.00	sec	O	7.26	3140h	b180h
							0.1	0.01

Code	LCD Display	Setting Range	Initial Value	Unit	Property[113]	Ref.	Communication address/scale	
							16-Bit	32-Bit
65	TRJ Dec Time-11	0.00-6000.00	10.00	sec	O	7.26	3141h	b182h
							0.1	0.01
67	TRJ Tar Pos-12	0-65000	30000	UC	O	7.26	3143h	b186h
							1	1
68	TRJ Tar Freq-12	0.00-Max Frequency	60.00	Hz	O	7.26	3144h	b188h
							0.01	0.01
69 [114]	TRJ Tar Spd-12	0-Maximum Speed	1800	rpm	O	7.26	3145h	b18ah
							1	1
70	TRJ Acc Time-12	0.00-6000.00	10.00	sec	O	7.26	3146h	b18ch
							0.1	0.01
71	TRJ Dec Time-12	0.00-6000.00	10.00	sec	O	7.26	3147h	b18eh
							0.1	0.01
72	TRJ Tar Pos-13	0-65000	30000	UC	O	7.26	3148h	b190h
							1	1
73	TRJ Tar Freq-13	0.00-Max Frequency	60.00	Hz	O	7.26	3149h	b192h
							0.01	0.01
74 [114]	TRJ Tar Spd-13	0-Maximum Speed	1800	rpm	O	7.26	314ah	b194h
							1	1
75	TRJ Acc Time-13	0.00-6000.00	10.00	sec	O	7.26	314bh	b196h
							0.1	0.01
76	TRJ Dec Time-13	0.00-6000.00	10.00	sec	O	7.26	314ch	b198h
							0.1	0.01
78	TRJ Tar Pos-14	0-65000	30000	UC	O	7.26	314eh	b19ch
							1	1
79	TRJ Tar Freq-14	0.00-Max Frequency	60.00	Hz	O	7.26	314fh	b19eh
							0.01	0.01
80 [114]	TRJ Tar Spd-14	0-Maximum Speed	1800	rpm	O	7.26	3150h	b1a0h
							1	1
81	TRJ Acc Time-14	0.00-6000.00	10.00	sec	O	7.26	3151h	b1a2h
							0.1	0.01

Code	LCD Display	Setting Range	Initial Value	Unit	Property[113]	Ref.	Communication address/scale	
							16-Bit	32-Bit
82	TRJ Dec Time-14	0.00-6000.00	10.00	sec	O	7.26	3152h	b1a4h
							0.1	0.01
84	TRJ Tar Pos-15	0-65000	30000	UC	O	7.26	3154h	b1a8h
							1	1
85	TRJ Tar Freq-15	0.00-Max Frequency	60.00	Hz	O	7.26	3155h	b1aah
							0.01	0.01
86 [114]	TRJ Tar Spd-15	0-Maximum Speed	1800	rpm	O	7.26	3156h	b1ach
							1	1
87	TRJ Acc Time-15	0.00-6000.00	10.00	sec	O	7.26	3157h	b1aeh
							0.1	0.01
88	TRJ Dec Time-15	0.00-6000.00	10.00	sec	O	7.26	3158h	b1b0h
							0.1	0.01
90	TRJ Tar Pos-16	0-65000	30000	UC	O	7.26	315ah	b1b4h
91	TRJ Tar Freq-16	0.00-Max Frequency	60.00	Hz	O	7.26	315bh	b1b6h
							0.01	0.01
92 [114]	TRJ Tar Spd-16	0-Maximum Speed	1800	rpm	O	7.26	315ch	b1b8h
							1	1
93	TRJ Acc Time-16	0.00-6000.00	10.00	sec	O	7.26	315dh	b1bah
							0.1	0.01
94	TRJ Dec Time-16	0.00-6000.00	10.00	sec	O	7.26	315eh	b1bch
							0.1	0.01

13.26 WEB1 Group (WEB1)

This group is only activated when the APP-45 (Tension Ctrl Enable) value is 1 (Yes).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[116]	Ref.	Communication address/scale	
							16-Bit	32-Bit
0	Jump Code	1-99	1	-	O	4.3.3	3200h	b200h
2	Output Value	-	-	%	X	7.28.5.1	3202h	b204h
							0.01	0.01
3	Reference Value	-	-	%	X	7.28.5.1	3203h	b206h
							0.01	0.01
4	Feedback Value	-	-	%	X	7.28.5.1	3204h	b208h
							0.01	0.01
5	Error Value	-	-	%	X	7.28.5.1	3205h	b20ah
							0.01	0.01
10	Main Spd Monitor	-	-	%	X	7.28.2.1	320ah	b214h
							0.01	0.01

[116] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[116]	Ref.	Communication address/scale	
								16-Bit	32-Bit
11	Main Spd Source	0	Keypad	0	-	O	7.28.2.1	320bh	b216h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Internal comm.						
		6	USB Comm.						
		7	Option Comm.						
		8	User Sequence						
		9	X-Analog Input 1						
		10	X-Analog Input 2						
		11	X-Analog Input 3						
12	Main Spd Kpd Set	0.0-100.0		0	%	O	7.28.2.1	320ch	b218h
								0.01	0.01
13	Main XcelTime En	0	No	0	-	O	7.28.2.1	320dh	b21ah
		1	Yes						
14	Main Spd AccTime	0.00-300.00		10.00	sec	O	7.28.2.1	320eh	b21ch
								0.1	0.01
15	Main Spd DecTime	0.00-300.00		20.00	sec	O	7.28.2.1	320fh	b21eh
								0.1	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[116]	Ref.	Communication address/scale	
								16-Bit	32-Bit
20	Reference Source	0	Keypad	0	-	O	7.28.4	3214h	b228h
		1	Analog Input 1						
		2	Analog Input 2						
		3	Analog Input 3						
		4	Pulse Input						
		5	Internal comm.						
		6	USB Comm.						
		7	Option Comm.						
		8	User Sequence						
		9	X-Analog Input 1						
		10	X-Analog Input 2						
		11	X-Analog Input 3						
21	Ref Keypad Set	-100.00-100.00		20.00	%	O	7.28.4	3215h	b22ah
								0.01	0.01
22	PID Ref Ramp Time	0.00-300.00		50.0	sec	O	7.28.4.3	3216h	b22ch
								0.01	0.01
23	Taper Selection	0	None	0	-	O	-	3217h	b22eh
		1	Linear						
		2	Hyperbolic						
24	Taper Set	-100.00-100.00		0	%	O	7.28.4.1	3218h	b230h
								0.01	0.01
25	Tension Up Type	0	Fixed	0	-	O	7.28.4.2	3219h	b232h
		1	Proportional						
26	Tension Up In	0.00-50.00		0	%	O	7.28.4.2	321ah	b234h
								0.01	0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[116]	Ref.	Communication address/scale	
								16-Bit	32-Bit
27	Tension Down Type	0	Fixed	0	-	O	7.28.4.2	321bh	b236h
		1	Proportional						
28	Tension Down In	0.00-50.00		0	%	O	7.28.4.2	321ch	b238h
								0.01	0.01
30	Web PID Enable	0	No	0	-	△	7.28.5.1	321eh	b23ch
		1	Yes						
31	Feedback Source	0	Analog Input 1	0	-	O	7.28.5.1	321eh	b23eh
		1	Analog Input 2						
		2	Analog Input 3						
		3	Pulse Input						
		4	Internal Comm.						
		5	USB Comm.						
		6	Option Comm.						
		7	UserSequence						
		8-	X-Analog Input 1						
			X-Analog Input 2						
		10	X-Analog Input 3						
32	Proportional Gain1	0.00-100.00		50.0	%	O	7.28.5.2	3220h	b240h
								0.01	0.01
33	Integral Time1	0.00-200.00		10.00	sec	O	7.28.5.2	3221h	b242h
								0.01	0.01
34	Proportional Gain2	0.00-100.00		100.0	%	O	7.28.5.2	3222h	b244h
								0.01	0.01
35	Integral Time2	0.00-200.00		20.00	sec	O	7.28.5.2	3223h	b246h
								0.01	0.01
36	Derivative Time	0-1000		0	msec	O	7.28.5.2	3224h	b248h
								1	1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[116]	Ref.	Communication address/scale	
								16-Bit	32-Bit
37	Out Limit Lo	-100.00-100.00		100.00	%	O	7.28.5.1	321eh 0.01	b24ah 0.01
38	Out Limit Hi	-100.00-100.00		100.00	%	O	7.28.5.1	321eh 0.01	b24ch 0.01
39	Output Scale	0.00-100.00		100.0	%	O	7.28.5.1	321eh 0.01	b24eh 0.01
40	Output LPF Gain	0-10000		0	msec	O	7.28.5.1	321eh 1	b250h 1
41	Output Inverse	0	500.00	0	-	O	7.28.5.1	321eh	b252h
		1	Yes						
42	PID Start Ramp	0.00-300.00		0.00	sec	O	7.28.5.1	321eh 0.01	b254h 0.01
43	PI Gain Chg Mode	0	Ramp	0	-	O	7.28.5.2	322bh	b256h
		1	MainSpeed						
44	PI Change Speed1	0.00-100.00		20.00	%	O	7.28.5.2	322ch 0.01	b258h 0.01
45	PI Change Speed2	0.00-100.00		80.00	%	O	7.28.5.2	322dh 0.01	b25ah 0.01
46	PI Gain Ramp Time	0.00-300.00		0.00	sec	O	7.28.5.2	322eh 0.01	b25ch 0.01
47	Profile P Mode	0	None	0	-	O	7.28.5.2	322fh	b25eh
		1	Linear						
		2	Square						
48	Profile P Gain	0.01-10.00		1.00	%	O	7.28.5.2	3230h 0.01	b260h 0.01
50	Curr Diameter	0.00-100.00		-	%	X	7.28.6.2	3232h 0.01	b264h 0.01
51	Curr Bobbin	1-4		-	-	X	7.28.6.1	3233h1	b266h1

Code	LCD Display	Setting Range		Initial Value	Unit	Property[116]	Ref.	Communication address/scale	
								16-Bit	32-Bit
52	Bobbin1 Diameter	0.00-100.00		10.00	%	△	7.28.6.1	3234h 0.01	b268h 0.01
53	Bobbin2 Diameter	0.00-100.00		15.00	%	△	7.28.6.1	3235h 0.01	b26ah 0.01
54	Bobbin3 Diameter	0.00-100.00		20.00	%	△	7.28.6.1	3236h 0.01	b26ch 0.01
55	Bobbin4 Diameter	0.00-100.00		25.00	%	△	7.28.6.1	3237h 0.01	b26eh 0.01
56	Diameter Calc Mode	0	No	1	-	O	7.28.6.4	3238h	b270h
		1	Yes						
57	Diameter LPF	0.00-300.00		30.00	sec	O	7.28.6.2	3239h 0.1	b272h 0.01
58	Dia Calc Hold Freq	0.00-30.00		5.00	Hz	△	7.28.6.3	323ah 0.01	b274h 0.01
59	Max Main Freq	0.00-60.00		60.00	Hz	△	7.28.6.2	323bh 0.01	b276h 0.01
60	Min Main Speed	0.00-100.00		1.00	%	△	7.28.6.3	323ch 0.01	b278h 0.01
61	Min Diameter	5.00-100.00		10.00	%	△	7.28.6.2	323dh 0.01	b27ah 0.01
70	Fixed WPID Enable	0	No	1	-	△	7.28.7.1	3246h	b28ch
		1	Yes						
71	Fixed WPID Min Spd	0.00-50.00		10.00	%	△	7.28.7.1	3247h 0.01	b28eh 0.01
72	Rev Tension Enable	0	No	1	-	O	7.28.7.3	3248h	b290h
		1	Yes						
73	Splice Level	0.00-100.00		0	%	O	7.28.7.4	3249h 0.01	b292h 0.01

Code	LCD Display	Setting Range		Initial Value	Unit	Property[116]	Ref.	Communication address/scale	
								16-Bit	32-Bit
74	Web Bias Freq	0.00-60.00		0	Hz	O	7.28.7.5	324ah	b294h
								0.01	0.01
80	WebBreak Enable	0	None	2	-	O	7.28.9	3250h	b2a0h
		1	Trip						
		2	Warning						
81	WebBreak Level Lo	0.00-100.00		20.00	%	O	7.28.9	3251h	b2a2h
								0.01	0.01
82	WebBreak Level Hi	0.00-100.00		80.00	%	O	7.28.9	3252h	b2a4h
								0.01	0.01
83	WebBreak Delay	0.00-300.00		5.00	sec	O	7.28.9	3253h	b2a6h
								0.01	0.01
84	WebBreak Start Dly	0.00-300.00		10.00	sec	O	7.28.9	3254h	b2a8h
								0.01	0.01
90	Web PID FF Gain	0.0-1000.0		100.0	%	O	7.28.9	325ah	b2b4h
								0.01	0.01
95	TrqLimit BoostTime	0.10-60.00		1.00	sec	O	7.28.10.3	325fh	b2beh
								0.01	0.01
96	TrqLimit Boost	100.00-500.00		150.00	%	O	7.28.10.3	3260h	b2c0h
								0.01	0.01

13.27 WEB2 Group (WEB2)

This group is only activated when the APP-45 (Tension Ctrl Enable) value is 1 (Yes).

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[117]	Ref.	Communication address/scale	
							16-Bit	32-Bit
0	Jump Code	1-99	1	-	O	-	3300h	b300h
1	Friction Auto Tuning	0 No 1 Yes	0	-	△	7.28.10.2	3301h	b302h
2	Fric Comp Freq 1	1.00-Fric Comp Freq 2	6.00	Hz	△	7.28.10.2	3302h 0.01	b304h 0.01
3 [118]	Fric Comp Spd 1	30-Fric Comp Spd 2	180 [119]	rpm	△	7.28.10.2	3303h 1	b306h 1
4	Fric Comp Trq 1	0.00-100.00	0.00	%	△	7.28.10.2	3304h 0.01	b308h 0.01
5	Fric Comp Freq 2	Fric Comp Freq 1-Fric Comp Freq 3	12.00	Hz	△	7.28.10.2	3305h 0.01	b30ah 0.01
6	Fric Comp Spd 2	Fric Comp Spd 1-Fric Comp Spd 3	360 [119]	rpm	△	7.28.10.2	3306h 1	b30ch 1
7	Fric Comp Trq 2	0.00-100.00	0.00	%	△	7.28.10.2	3307h 0.01	b30eh 0.01
8	Fric Comp Freq 3	Fric Comp Freq 2-Fric Comp Freq 4	18.00	Hz	△	7.28.10.2	3308h 0.01	b310h 0.01
9 [118]	Fric Comp Spd 3	Fric Comp Spd 2-Fric Comp Spd 4	540 [119]	rpm	△	7.28.10.2	3309h 1	b312h 1
10	Fric Comp Trq 3	0.00-100.00	0.00	%	△	7.28.10.2	330ah 0.01	b314h 0.01

[117] O: Writable during operation, △: Writable when stopped, X: Not writable

[118] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[119] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range	Initial Value	Unit	Property[117]	Ref.	Communication address/scale	
							16-Bit	32-Bit
11	Fric Comp Freq 4	Fric Comp Freq 3-Fric Comp Freq 5	24.00	Hz	△	7.28.10.2	330bh	b316h
							0.01	0.01
12 [118]	Fric Comp Spd 4	Fric Comp Spd 3-Fric Comp Spd 5	720 [119]	rpm	△	7.28.10.2	330ch	b318h
							1	1
13	Fric Comp Trq 4	0.00-100.00	0.00	%	△	7.28.10.2	330dh	b31ah
							0.01	0.01
14	Fric Comp Freq 5	Fric Comp Freq 4-Fric Comp Freq 6	30.00	Hz	△	7.28.10.2	330eh	b31ch
							0.01	0.01
15 [118]	Fric Comp Spd 5	Fric Comp Spd 4-Fric Comp Spd 6	900 [119]	rpm	△	7.28.10.2	330fh	b31eh
							1	1
16	Fric Comp Trq 5	0.00-100.00	0.00	%	△	7.28.10.2	3310h	b320h
							0.01	0.01
17	Fric Comp Freq 6	Fric Comp Freq 5-Fric Comp Freq 7	36.00	Hz	△	7.28.10.2	3311h	b322h
							0.01	0.01
18 [118]	Fric Comp Spd 6	Fric Comp Spd 5-Fric Comp Spd 7	1080 [119]	rpm	△	7.28.10.2	3312h	b324h
							1	1
19	Fric Comp Trq 6	0.00-100.00	0.00	%	△	7.28.10.2	3313h	b326h
							0.01	0.01
20	Fric Comp Freq 7	Fric Comp Freq 6-Fric Comp Freq 8	42.00	Hz	△	7.28.10.2	3314h	b328h
							0.01	0.01
21 [118]	Fric Comp Spd 7	Fric Comp Spd 6-Fric Comp Spd 8	1260 [119]	rpm	△	7.28.10.2	3315h	b32ah
							1	1
22	Fric Comp Trq 7	0.00-100.00	0.00	%	△	7.28.10.2	3316h	b32ch
							0.01	0.01
23	Fric Comp Freq 8	Fric Comp Freq 7-Fric Comp Freq 9	48.00	Hz	△	7.28.10.2	3317h	b32eh
							0.01	0.01
24 [118]	Fric Comp Spd 8	Fric Comp Spd 7-Fric Comp Spd 9	1440 [119]	rpm	△	7.28.10.2	3318h	b330h
							1	1
25	Fric Comp Trq 8	0.00-100.00	0.00	%	△	7.28.10.2	3319h	b332h
							0.01	0.01

Code	LCD Display	Setting Range	Initial Value	Unit	Property[117]	Ref.	Communication address/scale	
							16-Bit	32-Bit
26	Fric Comp Freq 9	Fric Comp Freq 8- Fric Comp Freq 10	54.00	Hz	△	7.28.10.2	331ah 0.01	b334h 0.01
27 [118]	Fric Comp Spd 9	Fric Comp Spd 8- Fric Comp Spd 10	1620 [119]	rpm	△	7.28.10.2	331bh 1	b336h 1
28	Fric Comp Trq 9	0.00-100.00	0.00	%	△	7.28.10.2	331ch 0.01	b338h 0.01
29	Fric Comp Freq 10	Fric Comp Freq 9- Max Frequency	60.00	Hz	△	7.28.10.2	331dh 0.01	b33ah 0.01
30 [118]	Fric Comp Spd 10	Fric Comp Spd 9- Maximum Speed	1800 [119]	rpm	△	7.28.10.2	331eh 1	b33ch 1
31	Fric Comp Trq 10	0.00-100.00	0.00	%	△	7.28.10.2	331fh 0.01	b33eh 0.01

13.28 Communication Option 1 Group (OPC1)

This group is displayed only when a communication option is installed. For details, refer to the user manual for the communication option.

Code	LCD Display	Setting Range	Initial Value	Unit	Property[120]	Ref.	Communication address/scale	
							16-Bit	32-Bit
0	Jump Code	1-99	1	-	O	-	3400h	B400h
1	FBus Option Type	Refer to the user manual for the communication option					3401h	B402h
2	FBus S/W Ver						3402h	b404h
3	FBus H/W Ver						3403h	b406h
4	FBus Led						3404h	b408h
5	FBus BaudRate						3405h	b40ah
6	FBus ID						3406h	b40ch
7	FBus IP Addr1						3407h	b40eh
8	FBus IP Addr2						3408h	b410h
9	FBus IP Addr3						3409h	b412h
10	FBus IP Addr4						340ah	b414h
11	FBus Subnet Mask1						340bh	b416h
12	FBus Subnet Mask2						340ch	b418h
13	FBus Subnet Mask3						340dh	b41ah
14	FBus Subnet Mask4						340eh	b41ch
15	FBus GateWay Addr1						340fh	b41eh
16	FBus GateWay Addr2						3410h	b420h
17	FBus GateWay Addr3						3411h	b422h

[120] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range	Initial Value	Unit	Property[120]	Ref.	Communication address/scale	
							16-Bit	32-Bit
18	FBus GateWay Addr4	Refer to the user manual for the communication option					3412h	b424h
19	DHCP						3413h	b426h
20	Profile						3414h	b428h
21	Profile CSM						3415h	b42ah
22	Telegram						3416h	b42ch
23	Network ID						3417h	b42eh
24	BAC Dev Inst1						3418h	b430h
25	BAC Dev Inst2						3419h	b432h
26	Password						341ah	b434h
27	SSQ Push						341bh	b436h
28	SSQ Control						341ch	b438h
29	Web Server						341dh	b43ah
30	MB Timeout						341eh	b43ch
31	MB Session Time						341fh	b43eh
51	OptParameter01						3433h	b466h
52	OptParameter02						3434h	b468h
53	OptParameter03						3435h	b46ah
54	OptParameter04						3436h	b46ch
55	OptParameter05						3437h	b46eh
56	OptParameter06						3438h	b470h
57	OptParameter07						3439h	b472h
58	OptParameter08						343ah	b474h
59	OptParameter09						343bh	b476h
60	OptParameter10						343ch	b478h
61	OptParameter11						343dh	b47ah
62	OptParameter12						343eh	b47ch

Code	LCD Display	Setting Range	Initial Value	Unit	Property[120]	Ref.	Communication address/scale	
							16-Bit	32-Bit
63	OptParameter13	Refer to the user manual for the communication option					343fh	b47eh
64	OptParameter14						3440h	b480h
65	OptParameter15						3441h	b482h
66	OptParameter16						3442h	b484h
98	Para Settings						3462h	b4c4h
99	Comm Update						3463h	b4c6h

13.29 Communication Option 2 Group (OPC2)

This group is displayed only when a communication option is installed. For details, refer to the user manual for the communication option.

Code	LCD Display	Setting Range	Initial Value	Unit	Property[121]	Ref.	Communication address/scale	
							16-Bit	32-Bit
0	Jump Code	1-99	1	-	O	-	3500h	b500h
1	Para Status Num	0-32	3	-	O	Refer to the user manual for the communication option	3501h	b502h
2	Para Status-01	0000-FFFF	000A	Hex	O		3502h	b504h
3	Para Status-02	0000-FFFF	000E	Hex	O		3503h	b506h
4	Para Status-03	0000-FFFF	000F	Hex	O		3504h	b508h
5	Para Status-04	0000-FFFF	0000	Hex	O		3505h	b50ah
6	Para Status-05	0000-FFFF	0000	Hex	O		3506h	b50ch
7	Para Status-06	0000-FFFF	0000	Hex	O		3507h	b50eh
8	Para Status-07	0000-FFFF	0000	Hex	O		3508h	b510h
9	Para Status-08	0000-FFFF	0000	Hex	O		3509h	b512h
10	Para Status-09	0000-FFFF	0000	Hex	O		350ah	b514h
11	Para Status-10	0000-FFFF	0000	Hex	O		350bh	b516h
12	Para Status-11	0000-FFFF	0000	Hex	O		350ch	b518h
13	Para Status-12	0000-FFFF	0000	Hex	O		350dh	b51ah
14	Para Status-13	0000-FFFF	0000	Hex	O		350eh	b51ch
15	Para Status-14	0000-FFFF	0000	Hex	O		350fh	b51eh
16	Para Status-15	0000-FFFF	0000	Hex	O		3510h	b520h
17	Para Status-16	0000-FFFF	0000	Hex	O		3511h	b522h
18	Para Status-17	0000-FFFF	0000	Hex	O		3512h	b524h
19	Para Status-18	0000-FFFF	0000	Hex	O		3513h	b526h
20	Para Status-19	0000-FFFF	0000	Hex	O		3514h	b528h
21	Para Status-20	0000-FFFF	0000	Hex	O		3515h	b52ah
22	Para Status-21	0000-FFFF	0000	Hex	O		3516h	b52ch

[121] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range	Initial Value	Unit	Property[121]	Ref.	Communication address/scale	
							16-Bit	32-Bit
23	Para Status-22	0000-FFFF	0000	Hex	O	Refer to the user manual for the communication option	3517h	b52eh
24	Para Status-23	0000-FFFF	0000	Hex	O		3518h	b530h
25	Para Status-24	0000-FFFF	0000	Hex	O		3519h	b532h
26	Para Status-25	0000-FFFF	0000	Hex	O		351ah	b534h
27	Para Status-26	0000-FFFF	0000	Hex	O		351bh	b536h
28	Para Status-27	0000-FFFF	0000	Hex	O		351ch	b538h
29	Para Status-28	0000-FFFF	0000	Hex	O		351dh	b53ah
30	Para Status-29	0000-FFFF	0000	Hex	O		351eh	b53ch
31	Para Status-30	0000-FFFF	0000	Hex	O		351fh	b53eh
32	Para Status-31	0000-FFFF	0000	Hex	O		3520h	b540h
33	Para Status-32	0000-FFFF	0000	Hex	O		3521h	b542h
51	Para Control Num	0-32	3		O		3533h	b566h
52	Para Control-01	0000-FFFF	0000	Hex	O		3534h	b568h
53	Para Control-02	0000-FFFF	0000	Hex	O		3535h	b56ah
54	Para Control-03	0000-FFFF	0000	Hex	O		3536h	b56ch
55	Para Control-04	0000-FFFF	0000	Hex	O		3537h	b56eh
56	Para Control-05	0000-FFFF	0000	Hex	O		3538h	b570h
57	Para Control-06	0000-FFFF	0000	Hex	O		3539h	b572h
58	Para Control-07	0000-FFFF	0000	Hex	O		353ah	b574h
59	Para Control-08	0000-FFFF	0000	Hex	O		353bh	b576h
60	Para Control-09	0000-FFFF	0000	Hex	O		353ch	b578h
61	Para Control-10	0000-FFFF	0000	Hex	O		353dh	b57ah
62	Para Control-11	0000-FFFF	0000	Hex	O		353eh	b57ch
63	Para Control-12	0000-FFFF	0000	Hex	O		353fh	b57eh
64	Para Control-13	0000-FFFF	0000	Hex	O		3540h	b580h
65	Para Control-14	0000-FFFF	0000	Hex	O		3541h	b582h
66	Para Control-15	0000-FFFF	0000	Hex	O		3542h	b584h

Code	LCD Display	Setting Range	Initial Value	Unit	Property[121]	Ref.	Communication address/scale	
							16-Bit	32-Bit
67	Para Control-16	0000-FFFF	0000	Hex	O	Refer to the user manual for the communication option	3543h	b586h
68	Para Control-17	0000-FFFF	0000	Hex	O		3544h	b588h
69	Para Control-18	0000-FFFF	0000	Hex	O		3545h	b58ah
70	Para Control-19	0000-FFFF	0000	Hex	O		3546h	b58ch
71	Para Control-20	0000-FFFF	0000	Hex	O		3547h	b58eh
72	Para Control-21	0000-FFFF	0000	Hex	O		3548h	b590h
73	Para Control-22	0000-FFFF	0000	Hex	O		3549h	b592h
74	Para Control-23	0000-FFFF	0000	Hex	O		354ah	b594h
75	Para Control-24	0000-FFFF	0000	Hex	O		354bh	b596h
76	Para Control-25	0000-FFFF	0000	Hex	O		354ch	b598h
77	Para Control-26	0000-FFFF	0000	Hex	O		354dh	b59ah
78	Para Control-27	0000-FFFF	0000	Hex	O		354eh	b59ch
79	Para Control-28	0000-FFFF	0000	Hex	O		354fh	b59eh
80	Para Control-29	0000-FFFF	0000	Hex	O		3550h	b5a0h
81	Para Control-30	0000-FFFF	0000	Hex	O		3551h	b5a2h
82	Para Control-31	0000-FFFF	0000	Hex	O		3552h	b5a4h
83	Para Control-32	0000-FFFF	0000	Hex	O		3553h	b5a6h

13.30 User Sequence Group (US)

This group is only activated when the APP-03 (User Seq Enable) value is 1 (Yes).

The codes in the gray shaded area are hidden when shipped from the factory and shown only when setting the parameter (refer to the footnote).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[122]	Ref.	Communication address/scale	
								16-Bit	32-Bit
0	Jump Code	1-99		33	-	O	4.3.3	3400h	b400h
1	UserSeq Control	0	Off	0	-	O	7.27.1	3401h	b402h
		1	On						
2	UserSeq Loop Time	10-1000		10	msec	O	7.27.1	3402h	b404h
								1	1
3	All Blk Exec Time	-		-	usec	X	7.27.1	3403h	b406h
								1	1
4	Status	0	Standby	0	-	X	7.27.1	3404h	b408h
		1	Starting						
		2	Init						
		3	Running						
		4	Waiting						
		5	Stopping						
		6	Error						
5	Last Error	-		-	-	X	7.27.1	3405h	b40ah
								1	1
6	BlockID of LastErr	-		-	-	X	7.27.1	3406h	b40ch
								1	1
7	LastError Reset	0	No	0	-	O	7.27.1	3407h	b40eh
		1	Yes						
8	Check Validation	0	Off	0	-	O	7.27.1	3408h	b410h
		1	On						
10	Run Forward	0	Off	0	-	O	7.27.1	340ah	b414h
		1	On						

[122] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[122]	Ref.	Communication address/scale	
								16-Bit	32-Bit
11	Run Reverse	0	Off	0	-	O	7.27.1	340bh	b416h
		1	On						
15	Command Frequency	0.00-Max Frequency		0.00	Hz	O	7.27.1	340fh	b41eh
16 [123]	Command Speed	0-Maximum Speed		0 [124]	rpm	O	7.27.1	3410h	b420h
								1	1
17	Command Torque	-180.0-180.0		0.0	%	O	7.27.1	3411h	b422h
								0.1	0.1
18	Acc Time	0.00-6000.00		20.00	sec	O	7.27.1	3412h	b424h
								0.1	0.01
19	Dec Time	0.00-6000.00		30.00	sec	O	7.27.1	3413h	b426h
								0.1	0.01
20	Output Current	-		-	-	X	7.27.1	3414h	b428h
								0.1	0.1
21	Output Frequency	-		-	-	X	7.27.1	3415h	b42ah
								0.01	0.01
22	Output RPM	-		-	-	X	7.27.1	3416h	b42ch
								1	1
23	Output Voltage	-		-	-	X	7.27.1	3417h	b42eh
								1	1
24	DC Link Voltage	-		-	-	X	7.27.1	3418h	b430h
								1	1
25	Output Power	-		-	-	X	7.27.1	3419h	b432h
								0.1	0.1
26	Output Torque	-		-	-	X	7.27.1	341ah	b434h
								0.1	0.1

[123] Activated when the DRV-32 (Hz/rpm Select) value is 1 (rpm Display). (The unit of rpm is based on 4 poles)

[124] The rpm value varies according to the motor rating pole number (MOT1, 2-25).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[122]	Ref.	Communication address/scale	
								16-Bit	32-Bit
40	Speed Searching	0	Off	-	-	X	7.27.1	3428h	b450h
		1	On						
41	Acceleration	0	Off	-	-	X	7.27.1	3429h	b452h
		1	On						
42	ConstRate Operating	0	Off	-	-	X	7.27.1	342ah	b454h
		1	On						
43	Deceleration	0	Off	-	-	X	7.27.1	342bh	b456h
		1	On						
44	Dec to stop	0	Off	-	-	X	7.27.1	342ch	b458h
		1	On						
45	H/W OCS	0	Off	-	-	X	7.27.1	342dh	b45ah
		1	On						
46	S/W OCS	0	Off	-	-	X	7.27.1	342eh	b45ch
		1	On						
47	Dwell Operating	0	Off	-	-	X	7.27.1	342fh	b45eh
		1	On						
48	Stopped	0	Off	-	-	X	7.27.1	3430h	b460h
		1	On						
49	Forward Direction	0	Off	-	-	X	7.27.1	3431h	b462h
		1	On						
50	Reverse Direction	0	Off	-	-	X	7.27.1	3432h	b464h
		1	On						
51	DC Operating	0	Off	-	-	X	7.27.1	3433h	b466h
		1	On						
52	Warned	0	Off	-	-	X	7.27.1	3434h	b468h
		1	On						
53	Tripped	0	Off	-	-	X	7.27.1	3435h	b46ah
		1	On						

13.31 User Sequence Logical Operation Group (USL)

This group is only activated when the APP-03 (User Seq Enable) value is 1 (Yes).

Code	LCD Display	Setting Range		Initial Value	Property[125]	Ref.	Communication address/scale	
							16-Bit	32-Bit
0	Jump Code	1-99		33	O	4.3.3	3500h	b500h
5	Logic01 Type	0	NOT(A)	0	O	7.27.2	3505h	b50ah
		1	AND(A,B,C)					
		2	NAND(A,B,C)					
		3	OR(A,B,C)					
		4	NOR(A,B,C)					
		5	XOR(A,B)					
		6	(A AND B) OR C					
		7	AND(A,B,!C)					
		8	OR(A,B,!C)					
		9	R-EDGE-DETECT(A)					
		10	F-EDGE-DETECT(A)					
6	Logic01 InputA	0-1		0	O	7.27.2	3506h	b50ch
7	Logic01 InputB	0-1		0	O	7.27.2	3507h	b50eh
8	Logic01 InputC	0-1		0	O	7.27.2	3508h	b510h
9	Logic01 Output	0-1		0	O	7.27.2	3509h	b512h
10	Logic02 Type	Same as Logic01 Type		0	O	7.27.2	350ah	b514h
11	Logic02 InputA	0-1		0	O	7.27.2	350bh	b516h
12	Logic02 InputB	0-1		0	O	7.27.2	350ch	b518h
13	Logic02 InputC	0-1		0	O	7.27.2	350dh	b51ah
14	Logic02 Output	0-1		0	O	7.27.2	350eh	b51ch
15	Logic03 Type	Same as Logic01 Type		0	O	7.27.2	350fh	b51eh

[125] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range	Initial Value	Property[125]	Ref.	Communication address/scale	
						16-Bit	32-Bit
16	Logic03 InputA	0-1	0	O	7.27.2	3510h	b520h
17	Logic03 InputB	0-1	0	O	7.27.2	3511h	b522h
18	Logic03 InputC	0-1	0	O	7.27.2	3512h	b524h
19	Logic03 Output	0-1	0	O	7.27.2	3513h	b526h
20	Logic04 Type	Same as Logic01 Type	0	O	7.27.2	3514h	b528h
21	Logic04 InputA	0-1	0	O	7.27.2	3515h	b52ah
22	Logic04 InputB	0-1	0	O	7.27.2	3516h	b52ch
23	Logic04 InputC	0-1	0	O	7.27.2	3517h	b52eh
24	Logic04 Output	0-1	0	O	7.27.2	3518h	b530h
25	Logic05 Type	Same as Logic01 Type	0	O	7.27.2	3519h	b532h
26	Logic05 InputA	0-1	0	O	7.27.2	351ah	b534h
27	Logic05 InputB	0-1	0	O	7.27.2	351bh	b536h
28	Logic05 InputC	0-1	0	O	7.27.2	351ch	b538h
29	Logic05 Output	0-1	0	O	7.27.2	351dh	b53ah
30	Logic06 Type	Same as Logic01 Type	0	O	7.27.2	351eh	b53ch
31	Logic06 InputA	0-1	0	O	7.27.2	351fh	b53eh
32	Logic06 InputB	0-1	0	O	7.27.2	3520h	b540h
33	Logic06 InputC	0-1	0	O	7.27.2	3521h	b542h
34	Logic06 Output	0-1	0	O	7.27.2	3522h	b544h
35	Logic07 Type	Same as Logic01 Type	0	O	7.27.2	3523h	b546h
36	Logic07 InputA	0-1	0	O	7.27.2	3524h	b548h
37	Logic07 InputB	0-1	0	O	7.27.2	3525h	b54ah
38	Logic07 InputC	0-1	0	O	7.27.2	3526h	b54ch
39	Logic07 Output	0-1	0	O	7.27.2	3527h	b54eh
40	Logic08 Type	Same as Logic01 Type	0	O	7.27.2	3528h	b550h
41	Logic08 InputA	0-1	0	O	7.27.2	3529h	b552h

Code	LCD Display	Setting Range	Initial Value	Property[125]	Ref.	Communication address/scale	
						16-Bit	32-Bit
42	Logic08 InputB	0-1	0	O	7.27.2	352ah	b554h
43	Logic08 InputC	0-1	0	O	7.27.2	352bh	b556h
44	Logic08 Output	0-1	0	O	7.27.2	352ch	b558h
45	Logic09 Type	Same as Logic01 Type	0	O	7.27.2	352dh	b55ah
46	Logic09 InputA	0-1	0	O	7.27.2	352eh	b55ch
47	Logic09 InputB	0-1	0	O	7.27.2	352fh	b55eh
48	Logic09 InputC	0-1	0	O	7.27.2	3530h	b560h
49	Logic09 Output	0-1	0	O	7.27.2	3531h	b562h
50	Logic10 Type	Same as Logic01 Type	0	O	7.27.2	3532h	b564h
51	Logic10 InputA	0-1	0	O	7.27.2	3533h	b566h
52	Logic10 InputB	0-1	0	O	7.27.2	3534h	b568h
53	Logic10 InputC	0-1	0	O	7.27.2	3535h	b56ah
54	Logic10 Output	0-1	0	O	7.27.2	3536h	b56ch
55	Logic11 Type	Same as Logic01 Type	0	O	7.27.2	3537h	b56eh
56	Logic11 InputA	0-1	0	O	7.27.2	3538h	b570h
57	Logic11 InputB	0-1	0	O	7.27.2	3539h	b572h
58	Logic11 InputC	0-1	0	O	7.27.2	353ah	b574h
59	Logic11 Output	0-1	0	O	7.27.2	353bh	b576h
60	Logic12 Type	Same as Logic01 Type	0	O	7.27.2	353ch	b578h
61	Logic12 InputA	0-1	0	O	7.27.2	353dh	b57ah
62	Logic12 InputB	0-1	0	O	7.27.2	353eh	b57ch
63	Logic12 InputC	0-1	0	O	7.27.2	353fh	b57eh
64	Logic12 Output	0-1	0	O	7.27.2	3540h	b580h
65	Logic13 Type	Same as Logic01 Type	0	O	7.27.2	3541h	b582h
66	Logic13 InputA	0-1	0	O	7.27.2	3542h	b584h
67	Logic13 InputB	0-1	0	O	7.27.2	3543h	b586h

Code	LCD Display	Setting Range	Initial Value	Property[125]	Ref.	Communication address/scale	
						16-Bit	32-Bit
68	Logic13 InputC	0-1	0	O	7.27.2	3544h	b588h
69	Logic13 Output	0-1	0	O	7.27.2	3545h	b58ah
70	Logic14 Type	Same as Logic01 Type	0	O	7.27.2	3546h	b58ch
71	Logic14 InputA	0-1	0	O	7.27.2	3547h	b58eh
72	Logic14 InputB	0-1	0	O	7.27.2	3548h	b590h
73	Logic14 InputC	0-1	0	O	7.27.2	3549h	b592h
74	Logic14 Output	0-1	0	O	7.27.2	354ah	b594h
75	Logic15 Type	Same as Logic01 Type	0	O	7.27.2	354bh	b596h
76	Logic15 InputA	0-1	0	O	7.27.2	354ch	b598h
77	Logic15 InputB	0-1	0	O	7.27.2	354dh	b59ah
78	Logic15 InputC	0-1	0	O	7.27.2	354eh	b59ch
79	Logic15 Output	0-1	0	O	7.27.2	354fh	b59eh

13.32 User Sequence Arithmetic Operation Group (USV)

This group is only activated when the APP-03 (User Seq Enable) value is 1 (Yes).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[126]	Ref.	Communication address/scale	
								16-Bit	32-Bit
0	Jump Code	1-99		33	-	O	4.3.3	3600h	b600h
5	Value01 Type	0	A+B+C	0	-	O	7.27.3	3605h	b60ah
		1	A-B-C						
		2	A+B-C						
		3	ABS(A,B,C)						
		4	A mod B						
		5	(A*B)/C						
		6	MIN(A,B,C)						
		7	MAX(A,B,C)						
		8	SWITCH(A) B/C						
		9	BitTest(A,B)						
		10	BitSet(A,B)						
		11	BitClear(A,B)						
		12	Up Counter						
		13	Down Counter						
		14	BINARY DECODE						
		15	A>B+/-C						
		16	A>=B						
		17	A<=B						
		18	A(1+B)						
		19	((A * B) / 100) + C						
		20	ABS(A) > ABS(B) +/- C						
		21	ABS(A) >= ABS(B)						
		22	IF(C)-A						

[126] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[126]	Ref.	Communication address/scale	
								16-Bit	32-Bit
5	Value01 Type	23	IF(A==B)	0	-	O	7.27.3	3605h	b60ah
		24	IF(A!=B)						
		25	IF(C) HOLD(A)						
		26	ON DELAY						
		27	OFF DELAY						
		28	Timer						
		29	Window						
		30	Window C <= A <= B						
		31	Lowpass Filter						
		32	LimitA UprB LwrC						
		33	ExtractBits						
6	Value01 InputA	-99999999-99999999		0	-	O	7.27.3	3606h	b60ch
7	Value01 InputB	-99999999-99999999		0	-	O	7.27.3	3607h	b60eh
8	Value01 InputC	-99999999-99999999		0	-	O	7.27.3	3608h	b610h
9	Value01 Output	-99999999-99999999		0	-	O	7.27.3	3609h	b612h
10	Value02 Type	Same as Value01 Type		0	-	O	7.27.3	360ah	b614h
11	Value02 InputA	-99999999-99999999		0	-	O	7.27.3	360bh	b616h
12	Value02 InputB	-99999999-99999999		0	-	O	7.27.3	360ch	b618h
13	Value02 InputC	-99999999-99999999		0	-	O	7.27.3	360dh	b61ah
14	Value02 Output	-99999999-99999999		0	-	O	7.27.3	360eh	b61ch
15	Value03 Type	Same as Value01 Type		0	-	O	7.27.3	360fh	b61eh

Code	LCD Display	Setting Range	Initial Value	Unit	Property[126]	Ref.	Communication address/scale	
							16-Bit	32-Bit
16	Value03 InputA	-99999999-99999999	0	-	O	7.27.3	3610h	b620h
17	Value03 InputB	-99999999-99999999	0	-	O	7.27.3	3611h	b622h
18	Value03 InputC	-99999999-99999999	0	-	O	7.27.3	3612h	b624h
19	Value03 Output	-99999999-99999999	0	-	O	7.27.3	3613h	b626h
20	Value04 Type	Same as Value01 Type	0	-	O	7.27.3	3614h	b628h
21	Value04 InputA	-99999999-99999999	0	-	O	7.27.3	3615h	b62ah
22	Value04 InputB	-99999999-99999999	0	-	O	7.27.3	3616h	b62ch
23	Value04 InputC	-99999999-99999999	0	-	O	7.27.3	3617h	b62eh
24	Value04 Output	-99999999-99999999	0	-	O	7.27.3	3618h	b630h
25	Value05 Type	Same as Value01 Type	0	-	O	7.27.3	3619h	b632h
26	Value05 InputA	-99999999-99999999	0	-	O	7.27.3	361ah	b634h
27	Value05 InputB	-99999999-99999999	0	-	O	7.27.3	361bh	b636h
28	Value05 InputC	-99999999-99999999	0	-	O	7.27.3	361ch	b638h
29	Value05 Output	-99999999-99999999	0	-	O	7.27.3	361dh	b63ah
30	Value06 Type	Same as Value01 Type	0	-	O	7.27.3	361eh	b63ch
31	Value06 InputA	-99999999-99999999	0	-	O	7.27.3	361fh	b63eh
32	Value06 InputB	-99999999-99999999	0	-	O	7.27.3	3620h	b640h

Code	LCD Display	Setting Range	Initial Value	Unit	Property[126]	Ref.	Communication address/scale	
							16-Bit	32-Bit
33	Value06 InputC	-99999999-99999999	0	-	O	7.27.3	3621h	b642h
34	Value06 Output	-99999999-99999999	0	-	O	7.27.3	3622h	b644h
35	Value07 Type	Same as Value01 Type	0	-	O	7.27.3	3623h	b646h
36	Value07 InputA	-99999999-99999999	0	-	O	7.27.3	3624h	b648h
37	Value07 InputB	-99999999-99999999	0	-	O	7.27.3	3625h	b64ah
38	Value07 InputC	-99999999-99999999	0	-	O	7.27.3	3626h	b64ch
39	Value07 Output	-99999999-99999999	0	-	O	7.27.3	3627h	b64eh
40	Value08 Type	Same as Value01 Type	0	-	O	7.27.3	3628h	b650h
41	Value08 InputA	-99999999-99999999	0	-	O	7.27.3	3629h	b652h
42	Value08 InputB	-99999999-99999999	0	-	O	7.27.3	362ah	b654h
43	Value08 InputC	-99999999-99999999	0	-	O	7.27.3	362bh	b656h
44	Value08 Output	-99999999-99999999	0	-	O	7.27.3	362ch	b658h
45	Value09 Type	Same as Value01 Type	0	-	O	7.27.3	362dh	b65ah
46	Value09 InputA	-99999999-99999999	0	-	O	7.27.3	362eh	b65ch
47	Value09 InputB	-99999999-99999999	0	-	O	7.27.3	362fh	b65eh
48	Value09 InputC	-99999999-99999999	0	-	O	7.27.3	3630h	b660h
49	Value09 Output	-99999999-99999999	0	-	O	7.27.3	3631h	b662h

Code	LCD Display	Setting Range	Initial Value	Unit	Property[126]	Ref.	Communication address/scale	
							16-Bit	32-Bit
50	Value10 Type	Same as Value01 Type	0	-	O	7.27.3	3632h	b664h
51	Value10 InputA	-99999999-99999999	0	-	O	7.27.3	3633h	b666h
52	Value10 InputB	-99999999-99999999	0	-	O	7.27.3	3634h	b668h
53	Value10 InputC	-99999999-99999999	0	-	O	7.27.3	3635h	b66ah
54	Value10 Output	-99999999-99999999	0	-	O	7.27.3	3636h	b66ch
55	Value11 Type	Same as Value01 Type	0	-	O	7.27.3	3637h	b66eh
56	Value11 InputA	-99999999-99999999	0	-	O	7.27.3	3638h	b670h
57	Value11 InputB	-99999999-99999999	0	-	O	7.27.3	3639h	b672h
58	Value11 InputC	-99999999-99999999	0	-	O	7.27.3	363ah	b674h
59	Value11 Output	-99999999-99999999	0	-	O	7.27.3	363bh	b676h
60	Value12 Type	Same as Value01 Type	0	-	O	7.27.3	363ch	b678h
61	Value12 InputA	-99999999-99999999	0	-	O	7.27.3	363dh	b67ah
62	Value12 InputB	-99999999-99999999	0	-	O	7.27.3	363eh	b67ch
63	Value12 InputC	-99999999-99999999	0	-	O	7.27.3	363fh	b67eh
64	Value12 Output	-99999999-99999999	0	-	O	7.27.3	3640h	b680h
65	Value13 Type	Same as Value01 Type	0	-	O	7.27.3	3641h	b682h
66	Value13 InputA	-99999999-99999999	0	-	O	7.27.3	3642h	b684h

Code	LCD Display	Setting Range	Initial Value	Unit	Property[126]	Ref.	Communication address/scale	
							16-Bit	32-Bit
67	Value13 InputB	-99999999-99999999	0	-	O	7.27.3	3643h	b686h
68	Value13 InputC	-99999999-99999999	0	-	O	7.27.3	3644h	b688h
69	Value13 Output	-99999999-99999999	0	-	O	7.27.3	3645h	b68ah
70	Value14 Type	Same as Value01 Type	0	-	O	7.27.3	3646h	b68ch
71	Value14 InputA	-99999999-99999999	0	-	O	7.27.3	3647h	b68eh
72	Value14 InputB	-99999999-99999999	0	-	O	7.27.3	3648h	b690h
73	Value14 InputC	-99999999-99999999	0	-	O	7.27.3	3649h	b692h
74	Value14 Output	-99999999-99999999	0	-	O	7.27.3	364ah	b694h
75	Value15 Type	Same as Value01 Type	0	-	O	7.27.3	364bh	b696h
76	Value15 InputA	-99999999-99999999	0	-	O	7.27.3	364ch	b698h
77	Value15 InputB	-99999999-99999999	0	-	O	7.27.3	364dh	b69ah
78	Value15 InputC	-99999999-99999999	0	-	O	7.27.3	364eh	b69ch
79	Value15 Output	-99999999-99999999	0	-	O	7.27.3	364fh	b69eh

13.33 User Sequence Parameter Operation Group (USP)

This group is only activated when the APP-03 (User Seq Enable) value is 1 (Yes).

Note

Please only use a 32-bit address for USP-61-90 (Var 01-30).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[127]	Ref.	Communication address/scale	
								16-Bit	32-Bit
0	Jump Code	1-99		33	-	O	4.3.3	3700h	b700h
1	Paraset01 In	0-1		0	-	O	7.27.4	3701h	b702h
2	Paraset01 Type	0	0-1 EDGE	0	-	O	7.27.4	3702h	b704h
		1	1-0 EDGE						
3	Paraset 01 Result	-		0	-	O	7.27.4	3703h	b706h
4	Paraset02 In	0-1		0	-	O	7.27.4	3704h	b708h
5	Paraset02 Type	0	0-1 EDGE	0	-	O	7.27.4	3705h	b70ah
		1	1-0 EDGE						
6	Paraset 02 Result	-		0	-	O	7.27.4	3706h	b70ch
7	Paraset03 In	0-1		0	-	O	7.27.4	3707h	b70eh
8	Paraset03 Type	0	0-1 EDGE	0	-	O	7.27.4	3708h	b710h
		1	1-0 EDGE						
9	Paraset 03 Result	-		0	-	O	7.27.4	3709h	b712h
10	Paraset04 In	0-1		0	-	O	7.27.4	370ah	b714h
11	Paraset04 Type	0	0-1 EDGE	0	-	O	7.27.4	370bh	b716h
		1	1-0 EDGE						
12	Paraset 04 Result	-		0	-	O	7.27.4	370ch	b718h
13	Paraset05 In	0-1		0	-	O	7.27.4	370dh	b71ah

[127] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[127]	Ref.	Communication address/scale	
								16-Bit	32-Bit
14	Paraset05 Type	0	0-1 EDGE	0	-	O	7.27.4	370eh	b71ch
		1	1-0 EDGE						
15	Paraset 05 Result	-		0	-	O	7.27.4	370fh	b71eh
16	Paraset06 In	0-1		0	-	O	7.27.4	3710h	b720h
17	Paraset06 Type	0	0-1 EDGE	0	-	O	7.27.4	3711h	b722h
		1	1-0 EDGE						
18	Paraset 06 Result	-		0	-	O	7.27.4	3712h	b724h
19	Paraset07 In	0-1		0	-	O	7.27.4	3713h	b726h
20	Paraset07 Type	0	0-1 EDGE	0	-	O	7.27.4	3714h	b728h
		1	1-0 EDGE						
21	Paraset 07 Result	-		0	-	O	7.27.4	3715h	b72ah
22	Paraset08 In	0-1		0	-	O	7.27.4	3716h	b72ch
23	Paraset08 Type	0	0-1 EDGE	0	-	O	7.27.4	3717h	b72eh
		1	1-0 EDGE						
24	Paraset 08 Result	-		0	-	O	7.27.4	3718h	b730h
25	Paraset09 In	0	0-1 EDGE	0	-	O	7.27.4	3719h	b732h
		1	1-0 EDGE						
26	Paraset09 Type	-		0	-	O	7.27.4	371ah	b734h
27	Paraset 09 Result	0-1		0	-	O	7.27.4	371bh	b736h
28	Paraset10 In	0	0-1 EDGE	0	-	O	7.27.4	371ch	b738h
		1	1-0 EDGE						
29	Paraset10 Type	-		0	-	O	7.27.4	371dh	b73ah
30	Paraset 10 Result	0-1		0	-	O	7.27.4	371eh	b73ch

Code	LCD Display	Setting Range		Initial Value	Unit	Property[127]	Ref.	Communication address/scale	
								16-Bit	32-Bit
31	Paraset11 In	0	0-1 EDGE	0	-	O	7.27.4	371fh	b73eh
		1	1-0 EDGE						
32	Paraset11 Type	-		0	-	O	7.27.4	3720h	b740h
33	Paraset 11 Result	0-1		0	-	O	7.27.4	3721h	b742h
34	Paraset12 In	0	0-1 EDGE	0	-	O	7.27.4	3722h	b744h
		1	1-0 EDGE						
35	Paraset12 Type	-		0	-	O	7.27.4	3723h	b746h
36	Paraset 12 Result	0-1		0	-	O	7.27.4	3724h	b748h
37	Paraset13 In	0	0-1 EDGE	0	-	O	7.27.4	3725h	b74ah
		1	1-0 EDGE						
38	Paraset13 Type	-		0	-	O	7.27.4	3726h	b74ch
39	Paraset 13 Result	0-1		0	-	O	7.27.4	3727h	b74eh
40	Paraset14 In	0	0-1 EDGE	0	-	O	7.27.4	3728h	b750h
		1	1-0 EDGE						
41	Paraset14 Type	-		0	-	O	7.27.4	3729h	b752h
42	Paraset 14 Result	0-1		0	-	O	7.27.4	372ah	b754h
43	Paraset15 In	0	0-1 EDGE	0	-	O	7.27.4	372bh	b756h
		1	1-0 EDGE						
44	Paraset15 Type	-		0	-	O	7.27.4	372ch	b758h
45	Paraset 15 Result	0-1		0	-	O	7.27.4	372dh	b75ah
46	Paraset16 In	0	0-1 EDGE	0	-	O	7.27.4	372eh	b75ch
		1	1-0 EDGE						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[127]	Ref.	Communication address/scale	
								16-Bit	32-Bit
47	Paraset16 Type	-		0	-	O	7.27.4	372fh	b75eh
48	Paraset 16 Result	0-1		0	-	O	7.27.4	3730h	b760h
49	Paraset17 In	0	0-1 EDGE	0	-	O	7.27.4	3731h	b762h
		1	1-0 EDGE						
50	Paraset17 Type	-		0	-	O	7.27.4	3732h	b764h
51	Paraset 17 Result	0-1		0	-	O	7.27.4	3733h	b766h
52	Paraset18 In	0	0-1 EDGE	0	-	O	7.27.4	3734h	b768h
		1	1-0 EDGE						
53	Paraset18 Type	-		0	-	O	7.27.4	3735h	b76ah
54	Paraset 18 Result	0-1		0	-	O	7.27.4	3736h	b76ch
55	Paraset19 In	0	0-1 EDGE	0	-	O	7.27.4	3737h	b76eh
		1	1-0 EDGE						
56	Paraset19 Type	-		0	-	O	7.27.4	3738h	b770h
57	Paraset 19 Result	0-1		0	-	O	7.27.4	3739h	b772h
58	Paraset20 In	0	0-1 EDGE	0	-	O	7.27.4	373ah	b774h
		1	1-0 EDGE						
59	Paraset20 Type	-		0	-	O	7.27.4	373bh	b776h
60	Paraset 20 Result	0-1		0	-	O	7.27.4	373ch	b778h
61	Var 01	-99999999-99999999		0	-	O	7.27.4	373dh	b77ah
62	Var 02	-99999999-99999999		0	-	O	7.27.4	373eh	b77ch
63	Var 03	-99999999-99999999		0	-	O	7.27.4	373fh	b77eh

Code	LCD Display	Setting Range	Initial Value	Unit	Property[127]	Ref.	Communication address/scale	
							16-Bit	32-Bit
64	Var 04	-99999999-99999999	0	-	O	7.27.4	3740h	b780h
65	Var 05	-99999999-99999999	0	-	O	7.27.4	3741h	b782h
66	Var 06	-99999999-99999999	0	-	O	7.27.4	3742h	b784h
67	Var 07	-99999999-99999999	0	-	O	7.27.4	3743h	b786h
68	Var 08	-99999999-99999999	0	-	O	7.27.4	3744h	b788h
69	Var 09	-99999999-99999999	0	-	O	7.27.4	3745h	b78ah
70	Var 10	-99999999-99999999	0	-	O	7.27.4	3746h	b78ch
71	Var 11	-99999999-99999999	0	-	O	7.27.4	3747h	b78eh
72	Var 12	-99999999-99999999	0	-	O	7.27.4	3748h	b790h
73	Var 13	-99999999-99999999	0	-	O	7.27.4	3749h	b792h
74	Var 14	-99999999-99999999	0	-	O	7.27.4	374ah	b794h
75	Var 15	-99999999-99999999	0	-	O	7.27.4	374bh	b796h
76	Var 16	-99999999-99999999	0	-	O	7.27.4	374ch	b798h
77	Var 17	-99999999-99999999	0	-	O	7.27.4	374dh	b79ah
78	Var 18	-99999999-99999999	0	-	O	7.27.4	374eh	b79ch
79	Var 19	-99999999-99999999	0	-	O	7.27.4	374fh	b79eh
80	Var 20	-99999999-99999999	0	-	O	7.27.4	3750h	b7a0h

Code	LCD Display	Setting Range	Initial Value	Unit	Property[127]	Ref.	Communication address/scale	
							16-Bit	32-Bit
81	Var 21	-99999999-99999999	0	-	O	7.27.4	3751h	b7a2h
82	Var 22	-99999999-99999999	0	-	O	7.27.4	3752h	b7a4h
83	Var 23	-99999999-99999999	0	-	O	7.27.4	3753h	b7a6h
84	Var 24	-99999999-99999999	0	-	O	7.27.4	3754h	b7a8h
85	Var 25	-99999999-99999999	0	-	O	7.27.4	3755h	b7aah
86	Var 26	-99999999-99999999	0	-	O	7.27.4	3756h	b7ach
87	Var 27	-99999999-99999999	0	-	O	7.27.4	3757h	b7aeh
88	Var 28	-99999999-99999999	0	-	O	7.27.4	3758h	b7b0h
89	Var 29	-99999999-99999999	0	-	O	7.27.4	3759h	b7b2h
90	Var 30	-99999999-99999999	0	-	O	7.27.4	375ah	b7b4h

13.34 User Sequence Special Function Group (USM)

This group is only activated when the APP-03 (User Seq Enable) value is 1 (Yes).

Code	LCD Display	Setting Range		Initial Value	Unit	Property[128]	Ref.	Communication address/scale	
								16-Bit	32-Bit
0	Jump Code	1-99		33	-	O	4.3.3	3800h	b800h
1	Mux1 Input01	0	Off	0	-	O	7.27.5	3801h	b802h
		1	On						
2	Mux1 Input02	0	Off	0	-	O	7.27.5	3802h	b804h
		1	On						
3	Mux1 Input03	0	Off	0	-	O	7.27.5	3803h	b806h
		1	On						
4	Mux1 Input04	0	Off	0	-	O	7.27.5	3804h	b808h
		1	On						
5	Mux1 Input05	0	Off	0	-	O	7.27.5	3805h	b80ah
		1	On						
6	Mux1 Input06	0	Off	0	-	O	7.27.5	3806h	b80ch
		1	On						
7	Mux1 Input07	0	Off	0	-	O	7.27.5	3807h	b80eh
		1	On						
8	Mux1 Input08	0	Off	0	-	O	7.27.5	3808h	b810h
		1	On						
9	Mux1 Input09	0	Off	0	-	O	7.27.5	3809h	b812h
		1	On						
10	Mux1 Input10	0	Off	0	-	O	7.27.5	380ah	b814h
		1	On						
11	Mux1 Input11	0	Off	0	-	O	7.27.5	380bh	b816h
		1	On						

[128] O: Writable during operation, △: Writable when stopped, X: Not writable

Code	LCD Display	Setting Range		Initial Value	Unit	Property[128]	Ref.	Communication address/scale	
								16-Bit	32-Bit
12	Mux1 Input12	0	Off	0	-	O	7.27.5	380ch	b818h
		1	On						
13	Mux1 Input13	0	Off	0	-	O	7.27.5	380dh	b81ah
		1	On						
14	Mux1 Input14	0	Off	0	-	O	7.27.5	380eh	b81ch
		1	On						
15	Mux1 Input15	0	Off	0	-	O	7.27.5	380fh	b81eh
		1	On						
16	Mux1 Input16	0	Off	0	-	O	7.27.5	3810h	b820h
		1	On						
17	Mux1 Output	0000-FFFF		0000	Hex	O	7.27.5	3811h	b822h
18	Demux1 Input	0000-FFFF		0000	Hex	O	7.27.5	3812h	b824h
19	Demux1 Out01	0	Off	0	-	O	7.27.5	3813h	b826h
		1	On						
20	Demux1 Out02	0	Off	0	-	O	7.27.5	3814h	b828h
		1	On						
21	Demux1 Out03	0	Off	0	-	O	7.27.5	3815h	b82ah
		1	On						
22	Demux1 Out04	0	Off	0	-	O	7.27.5	3816h	b82ch
		1	On						
23	Demux1 Out05	0	Off	0	-	O	7.27.5	3817h	b82eh
		1	On						
24	Demux1 Out06	0	Off	0	-	O	7.27.5	3818h	b830h
		1	On						
25	Demux1 Out07	0	Off	0	-	O	7.27.5	3819h	b832h
		1	On						
26	Demux1 Out08	0	Off	0	-	O	7.27.5	381ah	b834h
		1	On						

Code	LCD Display	Setting Range		Initial Value	Unit	Property[128]	Ref.	Communication address/scale	
								16-Bit	32-Bit
27	Demux1 Out09	0	Off	0	-	O	7.27.5	381bh	b836h
		1	On						
28	Demux1 Out10	0	Off	0	-	O	7.27.5	381ch	b838h
		1	On						
29	Demux1 Out11	0	Off	0	-	O	7.27.5	381dh	b83ah
		1	On						
30	Demux1 Out12	0	Off	0	-	O	7.27.5	381eh	b83ch
		1	On						
31	Demux1 Out13	0	Off	0	-	O	7.27.5	381fh	b83eh
		1	On						
32	Demux1 Out14	0	Off	0	-	O	7.27.5	3820h	b840h
		1	On						
33	Demux1 Out15	0	Off	0	-	O	7.27.5	3821h	b842h
		1	On						
34	Demux1 Out16	0	Off	0	-	O	7.27.5	3822h	b844h
		1	On						
35	PI Run Enable	0	Off	0		O	7.27.5	3823h	b846h
		1	On						
36	Reference Value	-300.00-300.00		0.00	%	O	7.27.5	3824h	b848h
								0.01	0.01
37	Feedback Value	-300.00-300.00		0.00	%	O	7.27.5	3825h	b84ah
								0.01	0.01
38	Proportional Gain	0.0-1000.0		50.0	%	O	7.27.5	3826h	b84ch
								0.1	0.1
39	Integral Time	0.00-200.00		10.00	sec	O	7.27.5	3827h	b84eh
								0.1	0.1
46	Output Limit Low	-100.00-100.00		0.00	%	O	7.27.5	382eh	b85ch
								0.01	0.01

Code	LCD Display	Setting Range	Initial Value	Unit	Property[128]	Ref.	Communication address/scale	
							16-Bit	32-Bit
47	Output Limit High	-100.00-100.00	100.00	%	O	7.27.5	382fh	b85eh
							0.01	0.01
49	Output Scale	0.1-1000.0	100.0	%	O	7.27.5	3831h	b862h
							0.1	0.1
50	I-Term Clear	0 Off 1 On	0	-	O	7.27.5	3832h	b864h
51	Output Value	-100.00-100.00	-	%	X	7.27.5	3833h	b866h
							0.01	0.01
52	Error Value	-300.00-300.00	-	%	X	7.27.5	3834h	b868h
							0.01	0.01
55	Block Input 01	0-65535	0	-	O	7.27.5	3837h	b86eh
56	Block Input 02	0-65535	0	-	O	7.27.5	3838h	b870h
57	Block Input 03	0-65535	0	-	O	7.27.5	3839h	b872h
58	Block Input 04	0-65535	0	-	O	7.27.5	383ah	b874h
59	Block Input 05	0-65535	0	-	O	7.27.5	383bh	b876h
60	Block Input 06	0-65535	0	-	O	7.27.5	383ch	b878h
61	Block Input 07	0-65535	0	-	O	7.27.5	383dh	b87ah
62	Block Input 08	0-65535	0	-	O	7.27.5	383eh	b87ch
63	Block Input 09	0-65535	0	-	O	7.27.5	383fh	b87eh
64	Block Input 10	0-65535	0	-	O	7.27.5	3840h	b880h
65	Block Output 01	0-65535	0	-	O	7.27.5	3841h	b882h

Code	LCD Display	Setting Range	Initial Value	Unit	Property[128]	Ref.	Communication address/scale	
							16-Bit	32-Bit
66	Block Output 02	0-65535	0	-	O	7.27.5	3842h	b884h
67	Block Output 03	0-65535	0	-	O	7.27.5	3843h	b886h
68	Block Output 04	0-65535	0	-	O	7.27.5	3844h	b888h
69	Block Output 05	0-65535	0	-	O	7.27.5	3845h	b88ah
70	Block Output 06	0-65535	0	-	O	7.27.5	3846h	b88ch
71	Block Output 07	0-65535	0	-	O	7.27.5	3847h	b88eh
72	Block Output 08	0-65535	0	-	O	7.27.5	3848h	b890h
73	Block Output 09	0-65535	0	-	O	7.27.5	3849h	b892h
74	Block Output 10	0-65535	0	-	O	7.27.5	384ah	b894h
80	Block Input 01	0-65535	0	-	O	7.27.5	3850h	b8a0h
81	Block Output 01	0-65535	0	-	O	7.27.5	3851h	b8a2h

14 Troubleshooting

14.1 Trip and Warning

When the inverter detects an abnormal condition, it will stop (trip) the operation or display a warning to protect the internal circuit. When a trip or warning occurs, detailed trip information and warning information will be displayed on the Smart Operator. When two or more trips occur, the trip information with the highest priority will be displayed first in the Smart Operator,
and the information for the next trip can be accessed by pressing the  key.
Refer to **12.3 Trip Status Monitoring** for details about the trip screen.

The trip conditions can be categorized as follows:

- Level: When the trip is corrected, the trip or warning signal will automatically disappear. The trip will not be saved in the trip history.
- Latch: When the trip is corrected and a reset input signal is provided, the trip or warning signal will disappear. In the event that the trip continues, contact the retailer or our customer service center.

14.1.1 Fault Trips

14.1.1.1 Protection Functions for Output Current and Input Voltage

Table 1. Current/voltage-related trip

LCD Display	Trip condition	Details
Over Load	Latch	Displayed when the motor load is greater than the set overload warning level (PRT-36 OL Warn Level) after selecting the motor overload trip. Operates when the PRT-38 (OL Trip Select) code is set to a value other than 0.
Under Load	Latch	Displayed when the motor load is less than the set under load level after selecting the motor underload protection function. Operates when the PRT-47 (UL Trip Select) code is set to a value other than 0.
Over Current	Latch	Displayed when the inverter output current exceeds 240% of the rated current.
Over Voltage	Latch	Displayed when the internal DC circuit voltage is greater than the specified value.

LCD Display	Trip condition	Details
Low Voltage	Latch/ Level	Displayed when internal DC circuit voltage is less than the specified value during operation. It is possible to set the trip type (Latch/Level) in the PRT-02 (LV Trip Mode) code.
Ground Fault Trip	Latch	Displayed when a ground fault trip occurs on the output side of the inverter and causes the current to exceed the specified value. The specified value varies depending on inverter capacity.
E-Thermal	Latch	Occurs according to the inverse time characteristic in order to prevent overheating caused by overloads during motor operation. Operates when the MOT1, MOT2-75 (ETH Enable) code is set to a value other than 0.
OutputPhase U Open OutputPhase V Open OutputPhase W Open	Latch	Displayed when a 3-phase inverter output has one or more phases in an open circuit condition. Operates when PRT-12 (Out Phase Open Chk) code is set to 1 (Yes).
No Motor Trip	Latch	Displayed when a 3-phase inverter output has two or more phases in an open circuit condition.
Input Phase Open	Latch	Displayed when a 3-phase inverter input has one or more phases in an open circuit condition while operating with a load of 50% or more of the inverter's rated current. Operates when PRT-10 (In Phase Open Chk) code is set to 1 (Yes).
Drive Over Load	Latch	This is an inverse time characteristic protection function that protects an inverter from overloading. Displayed when a current of 150% or more of the inverter’s rated current flows for 1 minute.
Over Speed	Latch	Displayed when the motor speed exceeds the maximum speed.
Speed Deviation	Latch	Displayed when the difference between the motor speed and the current command speed exceeds the set value of PRT-67 (Speed Dev BandFreq) or PRT-68 (Speed Dev BandSpd) and is maintained above the set value of PRT-69 (Speed Dev Time).
Line To Line Short	Latch	Displayed when the inverter output terminal short-circuits.
HW OCS Fail	Latch	Displayed when there is an error with H/W overcurrent suppression.

14.1.1.2 Protection Functions Using Abnormal Internal Circuit Conditions and External Signals

Table 2. Trip related to internal circuit/external signal

LCD Display	Trip condition	Details
Data Storage Error	Fatal	Displayed when there is an error in reading/writing parameters due to damage to the inverter's internal storage device.
Main System Error Watch Dog	Fatal	Displayed when there is an error with S/W operation.
Drive Over Heat	Latch	Displayed when the temperature of the inverter heat sink exceeds the specified value.
Arm Short	Latch	Displayed when the DC circuit in the inverter detects the size of the short-circuited current.
Fuse Open	Latch	Displayed when there is an error in the fuse in the power unit of the inverter.
ADC OffSet	Latch	Displayed when there is an error in the current sensing circuit (U/V/W terminal, current sensor, etc.).
NTC Open	Latch	Displayed when a temperature sensor error has been detected in the Insulated Gate Bipolar Transistor (IGBT) or when there is a problem with the internal sensor connection connector.
NTC Short	Latch	Displayed when an error is detected in the temperature sensor of the Insulated Gate Bipolar Transistor (IGBT).
IO Board Trip	Latch	Displayed when the I/O board or external communication card is not connected to the inverter or there is a bad connection.
Main Fan Fault	Latch	Displayed when an error is detected in the cooling fan. Operates when the PRT-75 (MainFan Trip mode) code is set to 0 (Trip).
AuxiliaryFan Fault	Latch	Displayed when an error is detected in the auxiliary cooling fan.
Control Fan Fault	Latch	Displayed when an error is detected in the internal circulation fan.
MC Fault	Latch	Displayed when there is an error in the magnetic contactor (MC) or relay used in the pre-charge circuit.
Gate Power Loss	Latch	Displayed when there is an error in the power circuit of the power unit in the inverter.

LCD Display	Trip condition	Details
Power Index Error	Level	Displayed when there is an error in the capacity recognition circuit of the power unit in the inverter.
STO P24 Fault	Latch	Displayed when there is an error in the safety circuit (24V power).
STO P05 Fault	Latch	Displayed when there is an error in the safety circuit (5V power).
Option Trip-1, 2, 3	Latch	Displayed when an option installed in the inverter is not recognized.
CAN Bus Error	Latch	Displayed when there is an error with the communication interface with the option installed on the inverter.

14.1.1.3 External Interface Fault

Table 3. Trip related to external interface

LCD Display	Trip condition	Details
External Trip-1, 2, 3, 4	Latch/ Level	Displayed when an external trip signal is provided by the multifunction terminal. Operates when DIN-01, 03, 05, 07, 09, 11, 13, 15 (DI1-DI8 Define) codes are set to 5-8 (External Trip-1 to External Trip-4).
BX	Level	Displayed when the inverter output is blocked according to the function setting of the multifunction terminal. Operates when DIN-01, 03, 05, 07, 09, 11, 13, 15(DI1-DI8 Define) codes are set to 4 (BX).
Lost Analog-1, 2, 3	Level	Displayed if a trip signal is provided when the analog input is not connected. Operates when PRT-25, 28, 31 (Lost AI1-AI3 Mode) codes are set to a value other than 0.
Lost Keypad	Level	Displayed if a trip signal is provided when the Smart Operator is not connected. Operates when PRT-16 (Lost Keypad Mode) is set to a value other than 0.
Lost Internal Comm	Level	Displayed if a trip signal is provided when communication is not performed through internal communication. Operates when PRT-17 (Lost IntComm Mode) is set to a value other than 0.

LCD Display	Trip condition	Details
Lost USB	Level	Displayed if a trip signal is provided when communication is not performed through the USB connector. Operates when PRT-19 (Lost USB Mode) is set to a value other than 0.
Lost Ext Ana In-1, 2, 3, 4	Level	Displayed if a trip signal is provided when the analog input in the extended IO is not connected.
Lost Option Comm	Level	Displayed if a trip signal is provided when there is an error in the communication of the option card.
STO Feedback A/B	Latch/ Level	Displayed when SA or SB input is not in the STO terminal block. Depending on the settings of PRT-82 (Safety Trip Mode), latch/level operation is determined.
Motor Over Heat	Latch	Displayed if the motor overheats when the motor temperature is detected through the PTC.
Encoder Error	Latch	Displayed when the polarity of each signal of line drive type encoder is incorrectly connected.
Lost External 24V	Level	Displayed if there is no external 24V power input when the PRT-89 (Ext 24V Pwr Lost) setting value is 1 (Yes). If PRT-89 (Ext 24V Pwr Lost) is set to 0 (No), 24V power input is not checked.
Encoder No Connect	Latch	Displayed if there is no encoder when using a function that requires an encoder.
Encoder Tuning Err	Latch	Displayed when the Z pulse does not come in abnormally when tuning the encoder.
Pole Pos Detect F	Latch	Displayed when there is an error in the PM motor stimulus estimation.

14.1.1.4 Advanced Functions

Table 4. Trip related to application functions

LCD Display	Trip condition	Details
Mechanical Brake	Latch	Displayed when there is an error with the mechanical brake sequence.
Reset Restart Fail	Latch	Displayed when the restart function is activated after more than the set number of resets has been performed.
Pre-PID Fail	Latch	Displayed when Pre-PID fails.
KEB Safety Stop	Latch	Displayed when there is an error with KEB operation.
Br Release Invalid	Latch	Displayed when the brake is not released because the load required to release the brake is not reached for a certain period of time.
Br Releasing Fail	Latch	Displayed when a request to release the brake is issued and the actual brake is not released after a certain period of time. Operates when the DIN-01, 03, 05, 07, 09, 11, 13, 15 (DI1-DI8 Define) codes are set to 55 (Brake Monitor Sel).
Br Engaging Fail	Latch	Displayed when a request to fix the brake is issued and the actual brake is not fixed after a certain period of time. Operates when the DIN-01, 03, 05, 07, 09, 11, 13, 15 (DI1-DI8 Define) codes are set to 55 (Brake Monitor Sel).
POS Max Track Err	Latch	Occurs when the difference between the reference pulse and position feedback pulse is bigger than the setting value of POS1-36 (Max Track Pulse).
Pos Tar Bound Err	Latch	Displayed when the difference between the target position and the actual position after conducting position control is greater than the set value of POS1-37 (Tar Bound Pulse).
Pos SW Limit High	Latch	Displayed if the current position (POS1-4 Cur Position) is greater than the set value of SW Hight Limit (POS1-33 Pos SW Limit High) when POS1-30 (SW Limit Prot Mode) is set to 1 (Trip) and POS1-31 (SW Limit Hi Enable) is set to 1 (Yes) in position control mode.
Pos SW Limit Low	Latch	Displayed if the current position (POS1-4 Cur Position) exceeds the set value of SW Low Limit (POS1-34 Pos SW Limit Low) when POS1-30 (SW Limit Prot Mode) is set to 1 (Trip) and POS1-32 (SW Limit Lo Enable) is set to 1 (Yes) in position control mode.

LCD Display	Trip condition	Details
Pos HW Limit High	Latch	Displayed when an input signal is input into the multifunction terminal whose DI1-DI8 Define code is set to 59 (POS HW Lmt H).
Pos HW Limit Low	Latch	Displayed when an input signal is input into the multifunction terminal whose DI1-DI8 Define code is set to 58 (POS HW Lmt L).
Pos Multi Sync F	Latch	Displayed when there is an error with the multiposition sync.
Cur Pos Overf Err	Latch	Displayed when there is an error in the firmware internal operation during position control.

14.1.1.5 Diagnostic Functions

Table 5. Trip related to diagnostic functions

LCD Display	Trip condition	Details
Main Cap Diag Fail	Latch	Displayed when the current input voltage falls below the applicable voltage during the main capacitor diagnostic function, or when the power is not turned off for longer than 10 seconds.

14.1.1.6 Miscellaneous

Table 6. Miscellaneous trip

LCD Display	Trip condition	Details
ParaWrite Trip	Latch	Displayed when communication is not achieved while writing parameters due to a wire error or poor contact in the Smart Operator. Displayed when using the Smart Operator.
System Error-1	Latch	Displayed when there is an error inside the firmware.
Lost Power MCU	Latch	Displayed when there is an error in the power unit inside the inverter.
Option Trip-1, 2, 3	Latch	Displayed when an option installed in the inverter is not recognized.

14.1.2 Warning Messages

14.1.2.1 Fault status

Table 7. Fault status warning

LCD Display	Details
Over Load Warn	Displayed when the motor becomes overloaded. Operates when PRT-35 (OL Warn Select) code is set to 1 (Yes). To receive a warning output signal, set the OUT-50, 52, 54 (DO1-DO3 Status) codes to 5 (Over Load Warn).
Under Load Warn	Displayed when the motor becomes underloaded. Operates when PRT-45 (UL Warn Select) code is set to 1 (Yes). To receive a warning output signal, set OUT-50, 52, 54 (DO1-DO3 Status) codes to 7 (Under Load Warn).
Drv Over Load Warn	Displayed when a time equivalent to 60% of the operating time of the inverter overload protection (IOLT) function is accumulated. To receive a warning output signal, set OUT-50, 52, 54 (DO1-DO3 Status) codes to 6 (Drv Over Load Warn).
Lost Keypad Warn	Displayed when the Smart Operator (Keypad) connection is lost. Operates when PRT-16 (Lost Keypad Mode) is set to 3 (Warning). To receive a warning output signal, set the OUT-50, 52, 54 (DO1-DO3 Status) codes to 25 (lost Keypad Warn).
Lost Int Comm Warn	Displayed when internal communication is lost. Operates when PRT-17 (Lost IntComm Mode) is set to 3 (Warning). To receive a warning output signal, set the OUT-50, 52, 54 (DO1-DO3 Status) codes to 13 (Lost Int Comm Warn).
Lost USB Warn	Displayed when the USB connection on the main body is lost. Operates when PRT-19 (Lost USB Mode) is set to 3 (Warning). To receive a warning output signal, set the OUT-50, 52, 54 (DO1-DO3 Status) codes to 34 (Lost USB Warn).
Lost Analog Inl-1~3	Displayed when analog input terminal connection is lost. To receive a warning output signal, set OUT-50, 52, 54 (DO1-DO3 Status) codes to 36, 37, 38 (Lost AI-1 - 3 Warn).
Main Fan Warning	Displayed when an error is detected in the cooling fan. Operates when PRT-75 (MainFan Trip Mode) code is set to 1 (Warn). To receive a warning output signal, set the OUT-50, 52, 54 (DO1-DO3 Status) codes to 8 (MainFan Warn).

LCD Display	Details
DB Warn %ED	Displayed when the DB resistor warning level is greater than the APP-37 (DB Warn %ED) set value. Operates when the APP-36 (DB Warn %ED Enable) code is set to 1 (Yes). To receive a warning output signal, set the OUT-50, 52, 54 (DO1-DO3 Status) codes to 26 (DB Warn %ED).
PreChargerRepWarn	Displayed when the number of pre-charger operations (DIAG-42 PreCharger Used Lv) is greater than the pre-charger replacement level (DIAG-41 PreCharger Repl Lv). Operates when the DIAG-40 (PreCharger Warn Sel) code is set to 1 (Yes).
Main Cap Repl Warn	Displayed when the cumulative usage time of the main capacitor is greater than DIAG-12 (MainCap Repl Level). To receive a warning output signal, set the OUT-50, 52, 54 (DO1-DO3 Status) codes to 40 (Main Cap Repl Warn).
Low Capacity Warn	Displayed when the capacitor capacity is low after performing main capacitor diagnostics.
MainCap Diag Alarm	It is a function that alerts with a warning so that periodic testing of the main capacitor can be performed. To receive a warning output signal, set the OUT-50, 52, 54 (DO1-DO3 Status) codes to 43 (Main Cap Diag Alarm).
Pos SW Limit High	Displayed when the current position (POS1-04 Cur Position) is greater than the set value of SW Hight Limit (POS1-33 Pos SW Limit High) in position control mode. Operates when POS1-30 (SW Limit Prot Mode) is set to 1 (Warning) and POS1-31 (SW Limit Hi Enable) is set to 1 (Yes) in position control mode.
Pos SW Limit Low	Displayed when the current position (POS1-4 Cur Position) is greater than the set value of SW Low Limit (POS1-34 Pos SW Limit Low) in position control mode. Operates when POS1-30 (SW Limit Prot Mode) is set to 1 (Warning) and POS1-32 (SW Limit Lo Enable) is set to 1 (Yes) in position control mode.
Pos HW Limit High	Occurs when there is an input signal at the multifunction terminal to which 59 (POS HW Lmt H) is set for the Define code of DI1-DI8 of the terminal input group (DIN).
Pos HW Limit Low	Occurs when there is an input signal at the multifunction terminal where 58 (POS HW Lmt L) is set for the Define item of DI1-DI8 of the terminal input group (DIN).
Motor Over Heat	Displayed when electronic thermal of the motor is detected by the temperature sensor attached to the motor.
AC Input Over Volt	Displayed when the input voltage of the inverter is greater than the allowable range during a stop.
AC Input Low Volt	Displayed when the input voltage of the inverter is less than the allowable range during a stop.

14.1.2.2 Status display according to advanced tasks

Table 8. Status display warning according to advanced tasks

LCD Display	Details
Torque->Speed	Displayed when converting to speed control mode during a torque control mode operation in torque control mode.
Speed->Torque	Displayed when converting to torque control mode during a speed control mode operation in torque control mode.
Running Auto Tune	Displayed to indicate that autotuning is currently in progress.
Fire Mode	Displayed to indicate that a fire mode operation is currently in progress.

14.1.2.3 Miscellaneous

Table 9. Miscellaneous warnings

LCD Display	Details
Power Off Please	Displayed if power off is required according to the sequence when performing the main capacitor diagnostic function.
ParameterReset Warn	Displayed when all parameters stored inside the inverter are abnormally initialized.

14.2 Troubleshooting Fault Trips

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

Table 10. Troubleshooting Fault Trips

Items	Cause	Remedy
Over Load	The load is greater than the rated motor capacity.	Replace the motor and inverter with models that have a larger capacity.
	The set value for the overload trip level (PRT-39 OL Trip Level) is too low.	Increase the set value for the overload trip level.
Under Load	There is a motor-load connection problem.	Replace the motor and inverter with models that have smaller capacities.
	The set value for underload level is greater than the system's minimum load.	Lower the set value of the underload level (PRT-49 UL LF Level, PRT-50 UL BF Level).
Over Current	The acceleration/deceleration time is too short for the load inertia (GD2).	Set the acceleration/ deceleration time (DRV-05 Acc Time, DRV-06 Dec Time) to a longer value.
	The inverter load is greater than the rated capacity.	Replace the inverter with a model that has increased capacity.
	Inverter output was applied during a motor free run.	Operate the inverter after the motor has stopped or use the speed search function (APP-05 SpeedSearch Mode).
	The mechanical brake of the motor is operating too fast.	Check the mechanical brake.

Items	Cause	Remedy
Over Voltage	Deceleration time is too short for the load inertia (GD2).	Set the deceleration time (PRT-01 Trip Dec Time) to a longer value.
	A generative load occurs at the inverter output.	Use the braking unit. Refer to **16.6 Braking Unit and Braking Resistor Specifications** for more information on the types and specifications of brake units that can be used.
	The input voltage is too high.	Determine if the input voltage is above the specified value.
Low Voltage	The input voltage during operation is low.	Determine if the input voltage is below the specified value.
	A load greater than the power capacity is connected to the system (e.g., a welder, direct motor connection, etc.).	Increase the power capacity.
	The magnetic contactor (MC) connected to the power source has a faulty connection.	Replace the magnetic contactor.
	An input open-phase has occurred when input voltage is low.	Check the input wiring.
Ground Trip	A ground fault has occurred in the inverter output wiring.	Check the output wiring.
	The motor insulation is damaged.	Replace the motor.
E-Thermal	The motor is overheated.	Reduce the load or operation frequency.
	The inverter load is greater than the rated capacity.	Replace the inverter with a model that has increased capacity.
	The set value for electronic thermal protection (ETH) is too low.	Set the electronic thermal protection level (MOT1, MOT2-77 ETH Cont Current, MOT1, MOT2-78 ETH 1min Current) appropriately.
	The inverter has been operated at low speed for an extended duration.	Replace the motor with a model that supplies extra power to the motor cooling fan.

Items	Cause	Remedy
Out Phase Open	The magnetic contactor (MC) on the output side has a connection fault.	Check the magnetic contactor on the output side.
	The output wiring is faulty.	Check the output wiring.
In Phase Open	The magnetic contactor (MC) on the input side has a connection fault.	Check the magnetic contactor on the input side.
	The input wiring is faulty.	Check the input wiring.
	The DC link capacitor needs to be replaced.	Replace the DC link capacitor. Contact the retailer or our customer service center.
Inverter OLT	The load is greater than the rated motor capacity.	Replace the motor and inverter with models that have a larger capacity.
	The torque boost level is too high.	Reduce the torque boost level.
Over Heat	There is a problem with the cooling system.	Determine if a foreign object is obstructing the air inlet, outlet, or vent.
	The inverter cooling fan has been operated for an extended period.	Replace the cooling fan.
	The ambient temperature is too high.	Keep the ambient temperature below 50℃.
Arm Short	Output wiring is short-circuited.	Check the output wiring.
	There is a fault with the electronic semiconductor (IGBT).	Do not operate the inverter. Contact the retailer or our customer service center.
NTC Open	The ambient temperature is too low.	Keep the ambient temperature above -10℃.
	There is a fault with the internal temperature sensor.	Contact the retailer or our customer service center.
Main Fan Fault	A foreign object is obstructing the fan's air vent.	Remove the foreign object from the air inlet or outlet.
	The cooling fan needs to be replaced.	Replace the cooling fan.

14.3 Actions on Other Faults

When a fault other than those identified as fault trips or warnings occurs, refer to the following table for possible causes and remedies.

Table 11. Actions on Other Faults

Items	Cause	Remedy
Parameters cannot be set.	The inverter is in operation (driving mode).	Stop the inverter to change to program mode and set the parameter. Refer to **13 Table of Functions** for a list of parameters that cannot be changed during operation.
	The parameter access is incorrect.	Check the correct parameter access level and set the parameter.
	The password is incorrect.	Check the password, disable the parameter lock and set the parameter.
	Low voltage is detected.	Check the power input to resolve the low voltage and set the parameter.
The motor does not rotate.	The frequency command source is set incorrectly.	Check the frequency command source setting. Refer to **5.1 Frequency Settings** for details.
	The operation command source is set incorrectly.	Check the operation command source setting. Refer to **5.2 Operation Command Settings** for details.
	Power is not supplied to the terminal R/S/T.	Check the terminal connections R/S/T and U/V/W. Refer to **2.2.3 Step 3 Power Terminal Wiring** for information about terminal wiring.
	The charge indicator is off.	Turn on the inverter.
	The operation command is off.	Turn on the operation command as directed in DRV-10 (1st Command Source).
	The motor is locked.	Unlock the motor or lower the load level.

Items	Cause	Remedy
The motor does not rotate.	The load is too high.	Operate the motor independently.
	An emergency stop signal is input.	Reset the emergency stop signal.
	The wiring for the control circuit terminal is incorrect.	Check the wiring for the control circuit terminal.
	The input voltage or current for the frequency command is incorrect.	Check the input voltage or current for the frequency command. Refer to **5.1.1.3 Setting Frequency via Terminal Analog Voltage Input (AI1-AI3)** for details.
	The PNP/NPN mode is selected incorrectly.	Check the PNP/NPN mode setting. Refer to **2.2.5 Step 5 PNP/ NPN Mode Selection** for details.
	The frequency command value is too low.	Check the frequency command and input a value above the minimum frequency. Refer to **5.1.1.2 Setting Operating Frequency in the Smart Operator-Direct Input** for details.
	The motor torque is too low.	Manually increase the amount of torque boost to operate. Refer to **7.6.1 Manual Torque Boost** for details. If the fault remains, replace the inverter with a model with increased capacity.
The motor rotates in the opposite direction to the command.	The wiring for the motor output cable is incorrect.	Make sure that the output wiring is properly connected to the motor's phase (U/V/W). Refer to **2.2.3 Step 3 Power Terminal Wiring** for information about terminal wiring.
	The signal connection between the control circuit terminal (forward/reverse rotation) of the inverter and the forward/reverse rotation signal on the control panel side is incorrect.	Check the forward/reverse rotation wiring.

Items	Cause	Remedy
The motor only rotates in one direction.	Reverse rotation prevention is selected.	Remove the reverse rotation prevention.
	The reverse rotation signal is not provided, even when a 3-wire sequence is selected.	Check the input signal associated with the 3-wire operation and adjust as necessary. Refer to **7.3 3-Wire Operation** for details.
The motor is overheating.	The load is too high.	Reduce the load. Set the acceleration/deceleration time (DRV-05 Acc Time, DRV-06 Dec Time) to a longer value.
		Check the motor-related parameters (MOT1, MOT2) and set the correct values.
		Replace the motor and the inverter with models with appropriate capacities for the load.
	The ambient temperature of the motor is too high.	Lower the ambient temperature of the motor.
	The motor's phase-to-phase voltage is insufficient.	Use a motor that can withstand phase-to-phase voltage surges greater than the maximum surge voltage.
		Only use motors suitable for applications with inverters.
		Connect the AC reactor to the output side. Refer to **16.4.2 AC Input Fuse and Reactor Specifications** for more information on the types and specifications of AC reactors that can be used.
	The motor fan has stopped or the fan is obstructed with debris.	Check the motor fan and remove any foreign objects.

Items	Cause	Remedy
The motor stops when accelerating.	The load is too high.	Reduce the load.
		Manually increase the amount of torque boost to operate. Refer to **7.6.1 Manual Torque Boost** for details.
		Replace the motor and the inverter with models with appropriate capacities for the load.
	The current is too high.	Manually reduce the amount of torque boost to operate if the load is light but the current is high. Refer to **7.6.1 Manual Torque Boost** for details.
The motor stops when the load is connected.	The load is too high.	Reduce the load.
		Replace the motor and the inverter with models with appropriate capacities for the load.
The motor does not accelerate. /The acceleration time of the motor is long.	The frequency command value is low.	Check the frequency command and enter the value in the DRV-01 (Command Frequency) code or DRV-02 (Command Speed) code.
	The load is too high.	Reduce the load or increase the acceleration time (DRV-05 Acc Time). Or check the mechanical brake status.
	The acceleration time is too long.	Check the acceleration time (DRV-05 Acc Time) and change it.
	The combined values of the motor properties and the inverter parameter are incorrect.	Check the motor-related parameter group (MOT1, MOT2) and change the code value.
	The stall prevention level during acceleration is low.	Check the stall prevention level (VF1, VF2-81, 84, 87, 90 Stall Level-1 to Stall level-4) and change it.
	The stall prevention level during operation is low.	Check the stall prevention level (VF1, VF2-81, 84, 87, 90 Stall Level-1 to Stall level-4) and change it.

Items	Cause	Remedy
Motor revolutions per minute varies during operation.	There is a high variance in load.	Replace the motor and inverter with models that have a larger capacity.
	The input voltage varies.	Stabilize the power supply voltage.
	Motor speed variations occur at a specific frequency.	Adjust the output frequency (DRV-01 Command Frequency) to avoid a resonance area.
The motor rotation is different from the setting.	The V/F pattern is set incorrectly.	Set the V/F pattern (VF1, VF2-01) in accordance with the motor specifications.
The motor deceleration time is too long even with Dynamic Braking (DB) resistor connected.	The deceleration time is set too long.	Check the deceleration time (DRV-06 Dec Time) and change the setting.
	Motor torque is insufficient.	Replace it with a motor of larger capacity if the motor-related parameters (MOT1, MOT2) are normal.
	There is a load applied to the inverter that exceeds its current limit.	Replace the inverter with a model that has increased capacity.
While the inverter is in operation, a control unit malfunctions or noise occurs.	Noise occurs due to switching inside the inverter.	Change the carrier frequency (DRV-27 Carrier Frequency) to the minimum value.
		Install a micro surge filter in the inverter output.
When the inverter is operating, the earth leakage breaker is activated.	An earth leakage breaker will interrupt the supply if current flows to ground during inverter operation.	Connect the inverter to a ground terminal.
		Check that the ground resistance is less than 100 Ω for 200 V inverters and less than 10 Ω for 400 V inverters.
		Check the capacity of the earth leakage breaker and make the appropriate connection, based on the rated current of the inverter.
		Set the carrier frequency (DRV-27 Carrier Frequency) to a low value.
		Make the cable length between the inverter and the motor as short as possible.

Items	Cause	Remedy
The motor vibrates severely and does not rotate normally.	The voltage between phases is badly balanced.	Check the input voltage and balance the voltage.
		Check and test the motor's insulation.
The motors makes humming, or loud noises.	Resonance occurs between the motor's natural frequency and the carrier frequency.	Increase or decrease the carrier frequency (DRV-27 Carrier Frequency) slightly.
	Resonance occurs between the motor's natural frequency and the inverter's output frequency.	Increase or decrease the operation frequency (DRV-01 Command Frequency) slightly.
		Use the frequency jump function to avoid the frequency band where resonance occurs. Refer to **Frequency Jump** for details.
The motor vibrates/ hunts.	The frequency input command is an external, analog command.	In situations of noise inflow on the analog input side that results in frequency command interference, change the set value of the input filter time constant (AIN-04, 19, 34 AI1, 2, 3 LPF Gain).
	The wiring length between the inverter and the motor is too long.	The total wiring length for the inverter and motor should not exceed 100m.
	There is a deviation in the rotor time constant value when operating in induction motor vector control mode using the position/speed sensor.	Increase the current controller bandwidth (MOT1, MOT2-51 ACR Bandwidth) or adjust the torque compensation value (VEC1, VEC2-34 IMSD Trq Comp).
The motor will not come to a complete stop when the inverter output stops.	It is difficult to decelerate sufficiently, because DC braking is not operating normally.	Adjust the DC braking parameter. Refer to **5.2.5.2 Stop after DC Braking** for details.
		Adjust the set value of DC braking current (BAS-07 DC Brake Level) to a larger value.
		Adjust the set value of DC braking time (BAS-06 DC Brake Timer) to a larger value.

Items	Cause	Remedy
The output frequency does not increase to the frequency reference.	The frequency reference is within the jump frequency range.	Set the frequency reference higher than the jump frequency range.
	The frequency reference is exceeding the upper limit of the frequency command.	Set the upper limit of the frequency command higher than the frequency reference.
	Because the load is too heavy, the stall prevention function is working.	Replace the inverter with a model that has increased capacity.
The cooling fan does not rotate.	The control parameter for the cooling fan is set incorrectly.	Check the set value of the cooling fan control parameter (DRV-50 Fan Control).

15 Maintenance

15.1 Regular Inspection Lists

15.1.1 Daily Inspections

Table 1. Regular Inspection List

Inspection Area	Inspection Item	Inspection Details	Inspection Method	Judgment Standard	Inspection Equipment
All	Environmental Factors	Is the ambient temperature and humidity within the design range, and is there any dust or foreign objects present?	Refer to **2.1 Mounting on the Wall or within the Panel**.	There must be no danger of freezing with ambient temperature of -10~50˚C and must be no condensation with ambient humidity of less than 90%.	Thermometer, hygrometer, recorder
	Inverter	Is there any abnormal vibration or noise?	Visual inspection	No abnormality	-
	Power voltage	Are the input and output voltages normal?	Measure voltages between R/S/T-phases in. the inverter terminal block.	Refer to **16.1 Input and Output Specifications**.	Digital multimeter/ tester
Input/ Output circuit	Smoothing capacitor	Is there any leakage from the inside?	Visual inspection	No abnormality	-
		Is the capacitor swollen?			

Inspection Area	Inspection Item	Inspection Details	Inspection Method	Judgment Standard	Inspection Equipment
Cooling system	Cooling Fan	Is there any abnormal vibration or noise?	Turn off the system and check operation by rotating the fan manually.	Fan rotates smoothly	-
Display	Measuring device	Is the display value normal?	Check the reading of displayed device on the panel.	Check and manage specified values.	Voltmeter, ammeter, etc.
Motor	All	Is there any abnormal vibration or noise?	Visual inspection	No abnormality	-
		Is there any abnormal smell?	Check for overheating or damage.		

15.1.2 annual Inspections

Table 2. Regular (Yearly) Inspection List

Inspection Area	Inspection Item	Inspection Details	Inspection Method	Judgment Standard	Inspection Equipment
Input/ Output circuit	All	Megger test (between input/output terminals and earth terminal)	Remove wiring from the inverter and short R/S/T/U/V/W terminals, and then measure from each terminal to the earth terminal using a megger (insulation-resistance tester).	Must be above 5 MΩ	DC 500 V class megger (insulation-resistance tester)
		Is there anything loose in the device?	Tighten up all screws.	No abnormality	
		Is there any evidence of parts overheating?	Visual inspection		
	Connecting conductor / wire	Are there any corroded cables?	Visual inspection	No abnormality	-
		Is there any damage to cable insulation?			
	Terminal block	Is there any damage?	Visual inspection	No abnormality	-
	Smoothing capacitor	Measure electrostatic capacity.	Measure with capacity meter.	Rated capacity over 85%	Capacity meter

Inspection Area	Inspection Item	Inspection Details	Inspection Method	Judgment Standard	Inspection Equipment
Input/ Output circuit	Relay	Is there any chattering noise during operation?	Visual inspection	No abnormality	-
		Is there any damage to the contacts?	Visual inspection		
	Braking resistor	Is there any damage from resistance?	Visual inspection	No abnormality	Digital multimeter / analog tester
		Check for disconnection.	Disconnect one side and measure with a tester.	Must be within ±10% of the rated value of the resistor.	
Control Circuit and Safety Circuit	Operation check	Check for output voltage imbalance while the inverter is in operation.	Measure voltage among the inverter output terminals, U/V/W.	Balance the voltage between phases: Within 4 V for 200 V class and within 8 V for 400 V class.	Digital multimeter or DC voltmeter
		Is there an error in the display circuit after the sequence protection test?	Test the inverter output protection in both short and open circuit conditions.	The circuit must work according to the sequence.	
Cooling system	Cooling Fan	Are any of the fan parts loose?	Check the connecting part of the connector and tighten up the screws.	No abnormality	-
Display	Display device	Is the display value normal?	Check the command value on the display device.	Specified and managed values must match.	Voltmeter, ammeter, etc.

15.1.3 bi-annual Inspections

Table 3. Regular (Biennial) Inspection List

Inspection Area	Inspection Item	Inspection Details	Inspection Method	Judgment Standard	Inspection Equipment
Motor	Insulation resistance	Megger test (between the output and earth terminals).	Remove the wires from terminals U/V/W before testing the wiring.	Must be above 5 MΩ	DC 500 V class megger (insulation-resistance tester)

⚠ Caution

Do not run a megger (insulation-resistance test) test on the control circuit. This may cause damage to the inverter.

15.2 Storage and Disposal

15.2.1 Proper Product Storage

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

- Store the product in the environmental suitable for operation (refer to **1.3 Installation Considerations**).
- When storing the product for a period longer than 3 months, store it between -10 ˚C and 30 ˚C, to prevent depletion of the electrolytic capacitor.
- Do not expose the inverter to snow, rain, fog, or dust.
- Package the inverter in a way that prevents contact with moisture. Keep the relative humidity below 70% in the package by including a desiccant, such as a silica gel packet.
- Do not leave the inverter in a humid or dusty environment (e.g. Used as a device or control panel at a construction site). Disassemble the product and store in a place that is suitable for operation.

15.2.2 Correct Disposal

When disposing of the product, categorize it as general industrial waste. The product contains materials that can be recycled. Please consider the environment, energy, and resources and recycle unused products. The packing materials and all metal parts can be recycled. Although plastic can also be recycled, it can be incinerated under controlled conditions in some regions.

⚠ Caution

If the product is left in a prolonged state without a flow of current, the condenser will deteriorate due to its characteristics. To prevent the deterioration of the electrolytic condenser, turn on the power of the inverter at least once a year for the current to flow for 30–60 minutes. Run the device under no-load conditions.

16 Technical Specifications

16.1 Input and Output Specifications

16.1.1 200 V Class 0.4-18.5 kW (LSLV0004 - 0185S300-2)

Table 1. Input/Output Specifications (200 V Class 0.4-18.5 kW)

Model: LSLV□□□□S300-2			0004	0008	0015	0022	0040	0055	0075	0110	0150	0185
Applied Motor [1]	Heavy Duty (HD)	[HP]	0.5	1	2	3	5	7.5	10	15	20	25
		[kW]	0.4	0.75	1.5	2.2	4	5.5	7.5	11	15	18.5
	Normal Duty (ND)	[HP]	1	2	3	5	7.5	10	15	20	25	30
		[kW]	0.75	1.5	2.2	4	5.5	7.5	11	15	18.5	22
Output Rating	Rated capacity	HD [kVA]	1.2	1.9	3.0	4.2	6.7	9.5	12.6	17.9	22.9	28.6
		ND [kVA]	1.9	3.0	4.6	6.1	8.4	11.4	16.0	21.3	26.7	31.2
	Rated current [2]	HD [A]	3.2	5	8	11	17.5	25	33	47	60	75
		ND [A]	5	8	12	16	22	30	42	56	70	82
	Output frequency	[Hz]	V/F, V/F-SC [3]: 0.01~590									
			V/F-PG [4]: 0~400									
			SLVC-IM [5], SLVC-PM [6], SVC-IM [7], SVC-PM [8]: 0~400									
	Output voltage	[V]	3-phase 200-240									

1 The motor capacity is based on a standard 4-pole motor.
2 The rated output current is limited based on the carrier frequency (DRV-27 Carrier Frequency) settings.
3 V/F slip compensation control mode
4 V/F sensored (encoder) control (Only available when the induction motor type is selected.)
5 Sensorless vector-induction motor control
6 Sensorless vector-permanent magnet motor control
7 Sensored vector-induction motor control
8 Sensored vector-permanent magnet motor control

Model: LSLV□□□□S300-2			0004	0008	0015	0022	0040	0055	0075	0110	0150	0185
Input Rating	Input Voltage	[V]	3-phase 200-240, -15% - +10%									
	Input frequency	[Hz]	50/60 ±5%									
	Rated Current	HD [A]	2.5	4.0	6.8	9.6	15.5	22.1	29.6	42.6	54.8	68.4
		ND [A]	4.0	6.8	10.5	14.1	19.5	26.9	38.1	51.1	63.9	75.8
Weight (lb /kg)			3.2	3.3	3.5	3.7	3.8	5.5	5.6	7.2	12.9	13.2

* For non-DCR products, performance is guaranteed only at the Heavy Duty (HD) rating.

16.1.2 200 V Class 22-75 kW (LSLV0220 - 0750S300-2)

Table 2. Input/Output Specifications (200 V Class 22-75 kW)

Model: LSLV□□□□S300-2			0220	0300	0370	0450	0550	0750
Applied Motor [9]	Heavy Duty (HD)	[HP]	30	40	50	60	75	100
		[kW]	22	30	37	45	55	75
	Normal Duty (ND)	[HP]	40	50	60	75	100	125
		[kW]	30	37	45	55	75	90
Output Rating	Rated capacity	HD [kVA]	33.5	43.8	55.3	68.6	83.8	109.7
		ND [kVA]	41.9	52.6	64.4	80.4	109.7	131.5
	Rated current [10]	HD [A]	88	115	145	180	220	288
		ND [A]	110	138	169	211	288	345

[9] The motor capacity is based on a standard 4-pole motor.
[10] The rated output current is limited based on the carrier frequency (DRV-27 Carrier Frequency) settings.

Model: LSLV□□□□S300-2			0220	0300	0370	0450	0550	0750
Output Rating	Output frequency	[Hz]	V/F, V/F-SC [11]			0.01~590		
			V/F-PG [12]			0~400		
			SLVC-IM [13], SLVC-PM [14], SVC-IM [15], SVC-PM [16]			0~400		
	Output voltage	[V]	3-phase 200-240					
Input Rating	Input Voltage	[V]	3-phase 200-240, -15% - +10%					
	Input frequency	[Hz]	50/60 ±5%					
	Rated Current	HD [A]	81.3	106.9	135.6	168.4	212.0	277.5
		ND [A]	102.3	129.1	158.1	198.5	277.5	332.5
Weight (lb /kg)			19.1	26.7	38.8	39.1	54	73

16.1.3 400 V Class 0.4-22 kW (LSLV0004 - 0220S300-4)

Table 3. Input/Output Specifications (400 V Class 0.4-22 kW)

Model: LSLV□□□□S300-4			0004	0008	0015	0022	0040	0055	0075	0110	0150	0185	0220
Applied Motor [17]	Heavy Duty (HD)	[HP]	0.5	1	2	3	5	7.5	10	15	20	25	30
		[kW]	0.4	0.75	1.5	2.2	4	5.5	7.5	11	15	18.5	22
	Normal Duty (ND)	[HP]	1	2	3	5	7.5	10	15	20	25	30	40
		[kW]	0.75	1.5	2.2	4	5.5	7.5	11	15	18.5	22	30

[11] V/F slip compensation control mode
[12] V/F sensored (encoder) control (Only available when the induction motor type is selected.)
[13] Sensorless vector-induction motor control
[14] Sensorless vector-permanent magnet motor control
[15] Sensored vector-induction motor control
[16] Sensored vector-permanent magnet motor control
[17] The motor capacity is based on a standard 4-pole motor.

Model: LSLV□□□□S300-4			0004	0008	0015	0022	0040	0055	0075	0110	0150	0185	0220
Output Rating	Rated capacity	HD [kVA]	1.4	2.6	3.7	4.2	7.0	11.3	12.6	18.3	23.6	29.7	34.3
		ND [kVA]	1.9	3.1	4.6	6.1	9.2	13.3	18.3	23.6	29.0	34.3	46.5
	Rated Current [18] (380 - 460 V)	HD [A]	1.8	3.4	4.8	5.5	9.2	14.8	16.5	24	31	39	45
		ND [A]	2.5	4.1	6	8	12.1	17.5	24	31	38	45	61
	Rated Current [18] (460-480 V)	HD [A]	1.7	3.1	4.4	5	8.3	13.4	14.9	21.6	27.9	35.1	40.5
		ND [A]	2.3	3.7	5.4	7.6	11	15.8	21.6	27.9	34.2	40.5	54.9
	Output frequency	[Hz]	V/F, V/F-SC [19]						0.01~590				
			V/F-PG [20]						0~400				
			SLVC-IM [21], SLVC-PM [22], SVC-IM [23], SVC-PM [24]						0~400				
	Output voltage	[V]	3-phase 380-480										
Input Rating	Input Voltage	[V]	3-phase 380-480, -15% - +10%										
	Input frequency	[Hz]	50/60 ±5%										
	Rated current	HD [A]	1.4	2.7	4.1	4.8	8.1	13.1	14.8	21.8	28.3	35.6	41.6
		ND [A]	2.0	3.5	5.2	7.1	10.7	15.7	21.8	28.3	34.7	41.6	56.7
Weight (lb /kg)			3.3	3.5	3.5	3.6	3.7	5.3	5.6	7.6	7.7	13.6	14

* For non-DCR products, performance is guaranteed only at the Heavy Duty (HD) rating.

[18] The rated output current is limited based on the carrier frequency (DRV-27 Carrier Frequency) settings.
[19] V/F slip compensation control mode
[20] V/F sensored (encoder) control (Only available when the induction motor type is selected.)
[21] Sensorless vector-induction motor control
[22] Sensorless vector-permanent magnet motor control
[23] Sensored vector-induction motor control
[24] Sensored vector-permanent magnet motor control

16.1.4 400 V Class 30-75 kW (LSLV0300 - 0750S300-4)

Table 4. Input/Output Specifications (400 V Class 30-75 kW)

Model: LSLV□□□□S300-4			0300	0370	0450	0550	0750
Applied Motor [25]	Heavy Duty (HD)	[HP]	40	50	60	75	100
		[kW]	30	37	45	55	75
	Normal Duty (ND)	[HP]	50	60	75	100	125
		[kW]	37	45	55	75	90
Output Rating	Rated capacity	HD [kVA]	46.5	57.2	69.4	83.8	115.8
		ND [kVA]	57.2	69.4	81.5	108.2	128.8
	Rated Current [26] (380 - 460 V)	HD [A]	61	75	91	110	152
		ND [A]	75	91	107	142	169
	Rated Current [26] (460-480 V)	HD [A]	54.9	67.5	81.9	99	136.8
		ND [A]	67.5	81.9	96.3	127.8	156
	Output frequency	[Hz]	V/F, V/F-SC [27]			0.01~590	
			V/F-PG [28]			0~400	
			SLVC-IM [29], SLVC-PM [30], SVC-IM [31], SVC-PM [32]			0~400	
	Output voltage	[V]	3-phase 380-480				

[25] The motor capacity is based on a standard 4-pole motor.
[26] The rated output current is limited based on the carrier frequency set at DRV-27 (Carrier Frequency).
[27] V/F slip compensation control mode
[28] V/F sensored (encoder) control (Only available when the induction motor type is selected.)
[29] Sensorless vector-induction motor control
[30] Sensorless vector-permanent magnet motor control
[31] Sensored vector-induction motor control
[32] Sensored vector-permanent magnet motor control

Model: LSLV□□□□S300-4			0300	0370	0450	0550	0750
Input Rating	Input Voltage	[V]	3-phase 380-480, -15% - +10%				
	Input frequency	[Hz]	50/60 ±5%				
	Rated current	HD [A]	56.7	70.1	85.1	103.5	146.5
		ND [A]	70.1	85.1	100.7	136.8	162.9
Weight (lb /kg)			18.6	18.7	28.3	41.2	41.9

16.1.5 400 V Class 90-220 kW (LSLV0900 - 2200S300-4)

Table 5. Input/Output Specifications (400 V Class 90-220 kW)

Model: LSLV□□□□S300-4			0900	1100	1320	1600	1850	2200
Applied Motor [33]	Heavy Duty (HD)	[HP]	125	150	200	250	300	350
		[kW]	90	110	132	160	185	220
	Normal Duty (ND)	[HP]	150	200	250	300	350	400
		[kW]	110	132	160	185	220	250

[33] The motor capacity is based on a standard 4-pole motor.

Model: LSLV□□□□S300-4			0900	1100	1320	1600	1850	2200
Output Rating	Rated capacity	HD [kVA]	139	170	201	248	282	324
		ND [kVA]	170	201	248	282	329	367
	Rated Current [34] (380 - 460 V)	HD [A]	183	223	264	325	370	425
		ND [A]	223	264	325	370	432	481
	Rated Current [34] (460-480 V)	HD [A]	164.7	200.7	237.6	292.5	333	382.5
		ND [A]	200.7	237.6	292.5	333	388.8	432.9
	Output frequency	[Hz]	V/F, V/F-SC [35]				0.01~590	
			V/F-PG [36]				0~400	
			SLVC-IM [37], SLVC-PM [38], SVC-IM [39], SVC-PM [40]				0~400	
	Output voltage	[V]	3-phase 380-480					
Input Rating	Input Voltage	[V]	3-phase 380-480, -15% - +10%					
	Input frequency	[Hz]	50/60 ±5%					
	Rated current	HD [A]	178.4	217.4	258.9	318.7	367.0	428.8
		ND [A]	217.4	257.4	318.7	362.8	428.5	485.3
Weight (lb /kg)			58	58	77	78	120.5	121.5

[34] The rated output current is limited based on the carrier frequency set at DRV-27 (Carrier Frequency).
[35] V/F slip compensation control mode
[36] V/F sensored (encoder) control (Only available when the induction motor type is selected.)
[37] Sensorless vector-induction motor control
[38] Sensorless vector-permanent magnet motor control
[39] Sensored vector-induction motor control
[40] Sensored vector-permanent magnet motor control

16.2 Product Specification Details

16.2.1 Product Specification Details

Table 6. Product Specifications

Items			Description	
Control	Control method		V/F control, slip compensation, V/F PG [41], sensorless vector, sensored vector	
	Frequency settings power resolution		Digital command	0.01Hz
			Analog command	0.06 Hz(60 Hz standard)
	Frequency accuracy		1% of maximum output frequency	
	V/F pattern		Linear, square reduction, user V/F	
	Overload capacity		Normal duty (ND): based on VT rated current [42]	
			Heavy duty (HD): 150%/minute compared to CT rated current	
	Torque Boost		Manual torque boost, automatic torque boost	
Run	Operation type		Select among Smart Operator, terminal block, and communication operation	
	Frequency Settings		Analog type: -10-10 V, 0-10 V, 0-20 mA Digital type: Smart Operator, pulse train input	
	Operation function		PID Control, Up-down operation, 3-Wire Operation, DC braking, Frequency (speed) limit, Frequency Jump, Second function, Slip compensation, Anti-forward and reverse direction rotation, Automatic restart, Commercial transition, Kinetic energy buffering operation, Speed search, Flux Braking, Power braking, Energy Saving Operation, Leakage reduction operation	
	Input	Multifunction Terminal (8ea) DI1-DI8	Select between PNP (Source) and NPN (Sink) modes Functions can be set according to parameter settings at DIN-01, 03, 05, 07, 09, 11, 13, and 15 as follows:	

[41] V/F sensored (encoder) control (Only available when the induction motor type is selected.)

[42] 200V: 45 kW or less 120%, 1 minute / 55 kW or more 110%, 1 minute
400V: 75 kW or less 120%, 1 minute / 90 kW or more 110%, 1 minute

Items			Description		
Run	Input	Multifunction Terminal (8ea) DI1-DI8	Forward operation, reverse operation		
			Reset		
			Emergency stop		
			External trip 1, 2, 3, 4		
			Jog operation		
			Multi-stage frequency: L/M/H/X		
			Multi-stage acceleration and deceleration: high/medium/low		
			Acceleration or deceleration stop		
			Safe operation (Run Enable)		
			3-wire		
			Second operation (2nd Source)		
			Switching to commercial power (Exchange)		
			Increase/reduce/delete/save up-down operation frequency		
			Fix command frequency		
			Second motor selection		
			DC braking during stop		
			Timer settings (Timer Input)		
			Deactivate auxiliary speed		
			FWD jog		
			REV jog		
			PID Enable, Open Loop		
			PID Ref, Gain Change		
			PID I-Term Clear		
			PID Output Hold		
			PID Sleep On/Change		
			PID Step Ref L/M/H		
		Pulse Train	0~32kHz	Low Level	0~0.8V
				High Level	3.5~12V

<table>
<tr><th colspan="3">Items</th><th colspan="3">Description</th></tr>
<tr><td rowspan="6">Run</td><td rowspan="6">Output</td><td>Multifunction Open Collector Terminal</td><td rowspan="5">Trip output and inverter operation status output</td><td colspan="2">Less than DC 26V, 50mA</td></tr>
<tr><td rowspan="2">Trip Relay Terminal</td><td>N.O.</td><td>Less than AC 250 V, 2 A,
less than DC 30 V, 3 A</td></tr>
<tr><td>N.C.</td><td>Less than AC 250 V, 1 A,
less than DC 30 V, 1 A</td></tr>
<tr><td rowspan="2">Multi function relay terminal</td><td colspan="2">Less than AC 250 V, 5 A</td></tr>
<tr><td colspan="2">Less than DC 30 V, 5A</td></tr>
<tr><td>Analog Output</td><td colspan="3">0 - 10 Vdc (0-20 mA): Frequency, output current, output voltage, DC voltage, and more are selectable</td></tr>
<tr><td>Pulse Train</td><td colspan="3">Maximum of 32 kHz, 0-10 V</td></tr>
<tr><td rowspan="3">Protection Functions</td><td colspan="2">Trip</td><td colspan="3">Overcurrent trip, Overvoltage trip, External signal trip,
Temperature sensor trip, ARM short current fault trip,
Inverter overheat trip, Over heat trip,
Out phase open trip, In phase open trip,
Inverter overload trip, Ground trip, Fan trip,
Motor overheat trip, Low voltage trip during operation,
I/O board link trip, Low voltage trip,
Parameter writing trip, Analog input error trip,
Emergency stop trip, Motor overload trip,
Command loss trip, Smart Operator command loss trip,
External memory error, Level detection trip,
CPU watchdog trip, Motor normal duty trip</td></tr>
<tr><td colspan="2">Alarm</td><td colspan="3">Warnings for command loss, overload, normal duty, inverter overload, fan operation, braking rate of braking resistance, and LDT</td></tr>
<tr><td colspan="2">Instantaneous power interruption</td><td colspan="3">Use KEB operation [43]</td></tr>
</table>

[43] Operates when 1 (KEB Ride-Through) is selected in APP-15 (KEB Mode).

16.2.2 Structure and Usage Environment

Table 7. Product Structure/Usage Environment

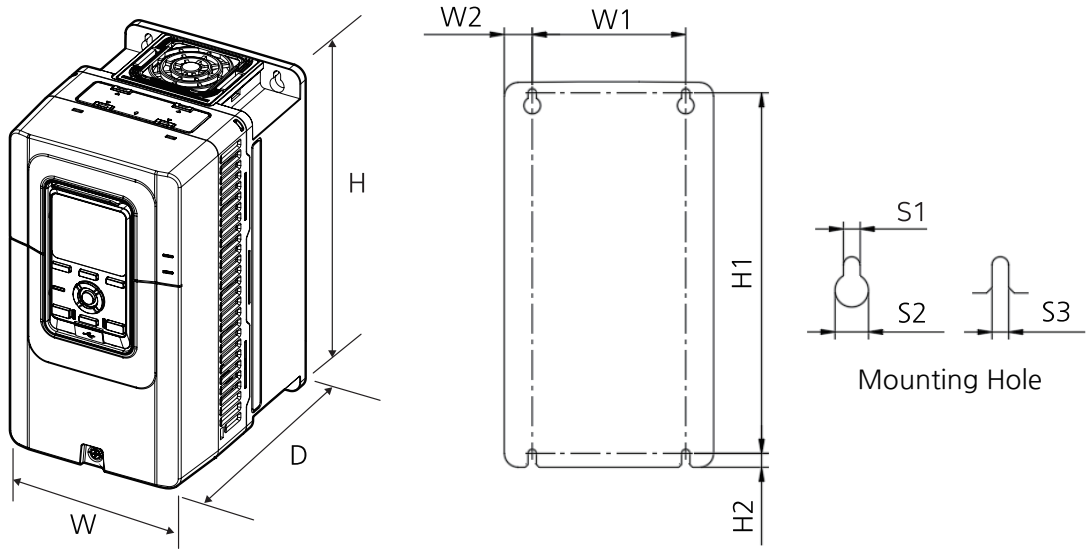
Items		Description
Structure/ Usage Environment	Cooling type	Forced fan cooling structure
	Protection structure	IP 20 (default), UL Open & Enclosed Type 1 (optional) Installing Conduit option fulfills UL Enclosed Type 1
	Ambient temperature	Where there is no ice or frost, • -10~50℃ on heavy duty • -10~40℃ on normal duty The conduit option requires 1.5%/℃ current derating when it is over 30℃ on normal duty and when it is over 40℃ on heavy duty.
	Ambient humidity	Relative humidity less than 95% RH (to avoid condensation forming)
	Storage temperature	-20~65°C
	Environmental Factors	No corrosive gas, inflammable gas, oil stains, dust, and other pollutants inside (Pollution Degree 2 Environment [44])
	Operation altitude/ oscillation	No higher than 3280 ft (1,000 m), less than 9.8 m^2/sec (1.0 G).
	Air Pressure	70~106kPa

[44] Pollution level of temporary conductivity from dew, though nonconductive pollution occurs.

16.3 External Dimensions (IP20 Type)

16.3.1 External Dimensions

200 V Class 0.4-4 kW / 400 V Class 0.4-4 kW



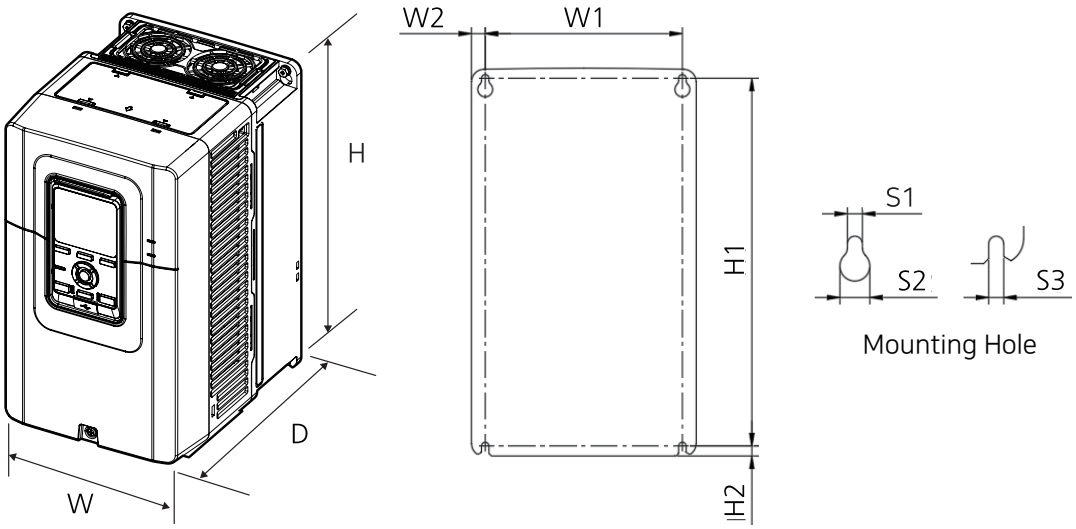
[Image 1. 200 V class 0.4-4 kW/400 V class 0.4-4 kW Exterior Diagram]

Table 8. External Dimensions (200 V Class 0.4-4 kW/400 V Class 0.4-4 kW)

Model LSLV□□□□	W	H	D	W1	W2	H1	H2	S1	S2	S3
LSLV0004S300-4 LSLV0008S300-4 LSLV0015S300-4 LSLV0022S300-4 LSLV0040S300-4 LSLV0004S300-2 LSLV0008S300-2 LSLV0015S300-2 LSLV0022S300-2 LSLV0040S300-2	150.0 (5.91)	276.0 (10.87)	192.0 (7.56)	110.0 (4.33)	20.0 (0.79)	258.0 (10.16)	10.0 (0.39)	6.0 (0.24)	12.0 (0.47)	6.0 (0.24)

Units: mm(in)

200 V Class 5.5-7.5 kW / 400 V Class 5.5-7.5 kW



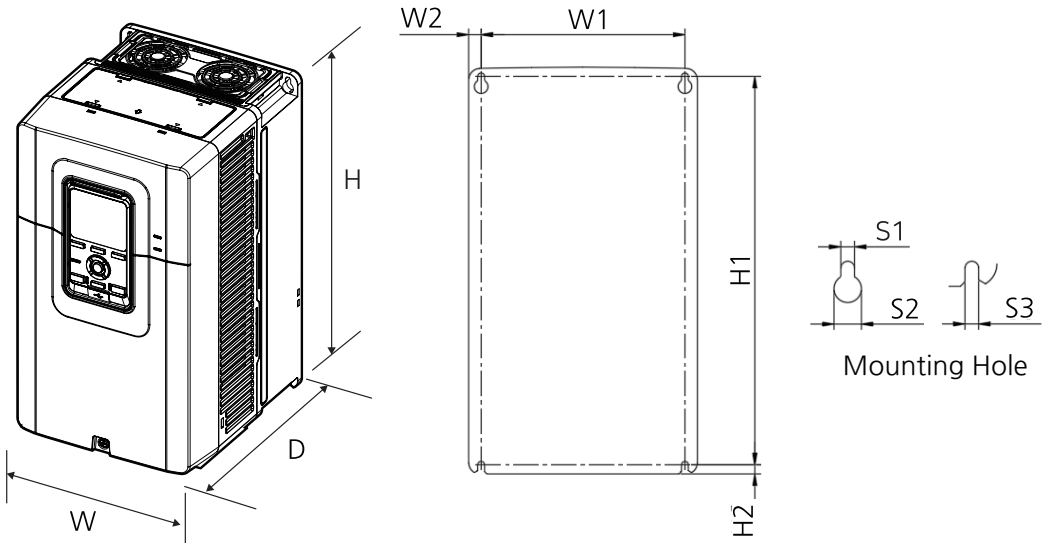
[Image 2. 200 V class 5.5-7.5 kW/400 V class 5.5-7.5 kW Exterior Diagram]

Table 9. External Dimensions (200 V Class 5.5-7.5 kW/400 V Class 5.5-7.5 kW)

Model LSLV□□□□	W	H	D	W1	W2	H1	H2	S1	S2	S3
LSLV0055S300-4 LSLV0075S300-4 LSLV0055S300-2 LSLV0075S300-2	180.0 (7.09)	310.0 (12.20)	225.0 (8.86)	158.0 (6.22)	11.0 (0.43)	294.0 (11.57)	8.0 (0.31)	6.0 (0.24)	12.0 (0.47)	6.0 (0.24)

Units: mm(in)

200 V Class 11 kW / 400 V Class 11-15 kW



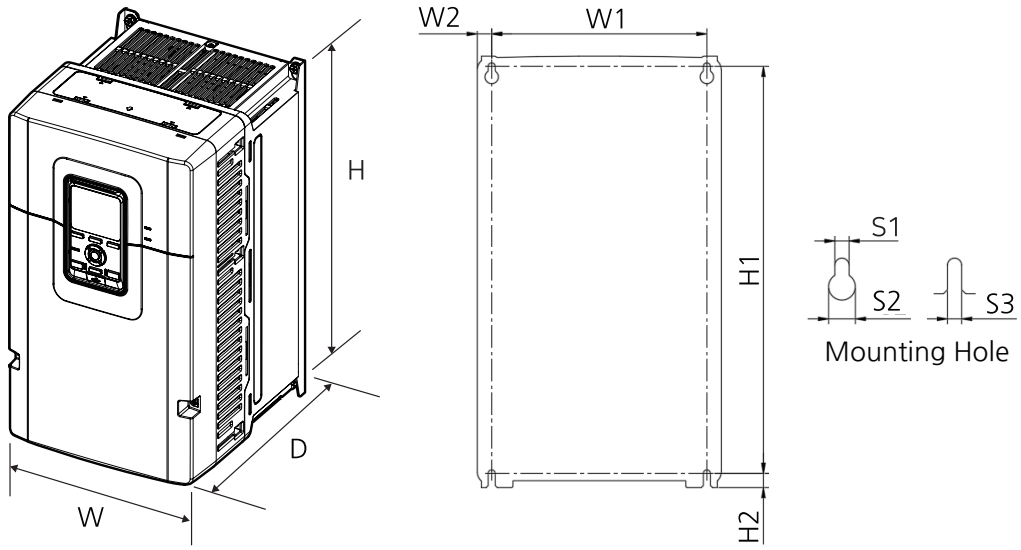
[Image 3. 200 V Class 11 kW/400 V Class 11-15 kW Exterior Diagram]

Table 10. External Dimensions (200 V Class 11 kW/400 V Class 11-15 kW)

Model LSLV□□□□	W	H	D	W1	W2	H1	H2	S1	S2	S3
LSLV0110S300-4 LSLV0150S300-4 LSLV0110S300-2	200.0 (7.87)	355.0 (13.98)	225.0 (8.86)	178.0 (7.01)	11.0 (0.43)	339.0 (13.35)	8.0 (0.31)	6.0 (0.24)	12.0 (0.47)	6.0 (0.24)

Units: mm(in)

200 V Class 15-18.5 kW / 400 V Class 18.5-22 kW



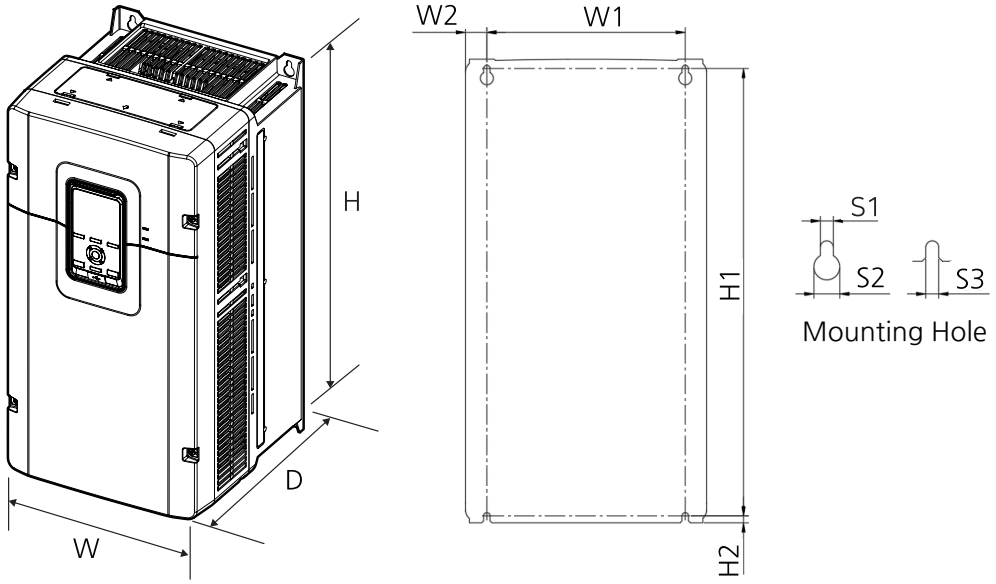
[Image 4. 200 V class 15-18 kW/400 V class 18.5-22 kW Exterior Diagram]

Table 11. External Dimensions (200 V Class 15-18.5 kW/400 V Class 18.5-22 kW)

Model LSLV□□□□	W	H	D	W1	W2	H1	H2	S1	S2	S3
LSLV0185S300-4 LSLV0220S300-4 LSLV0150S300-2 LSLV0185S300-2	240.0 (9.45)	424.0 (16.69)	265.0 (10.43)	211.6 (8.33)	14.2 (0.56)	400.0 (15.75)	14.0 (0.55)	7.0 (0.28)	13.2 (0.52)	7.0 (0.28)

Units: mm(in)

200 V Class 22 kW / 400 V Class 30-37 kW



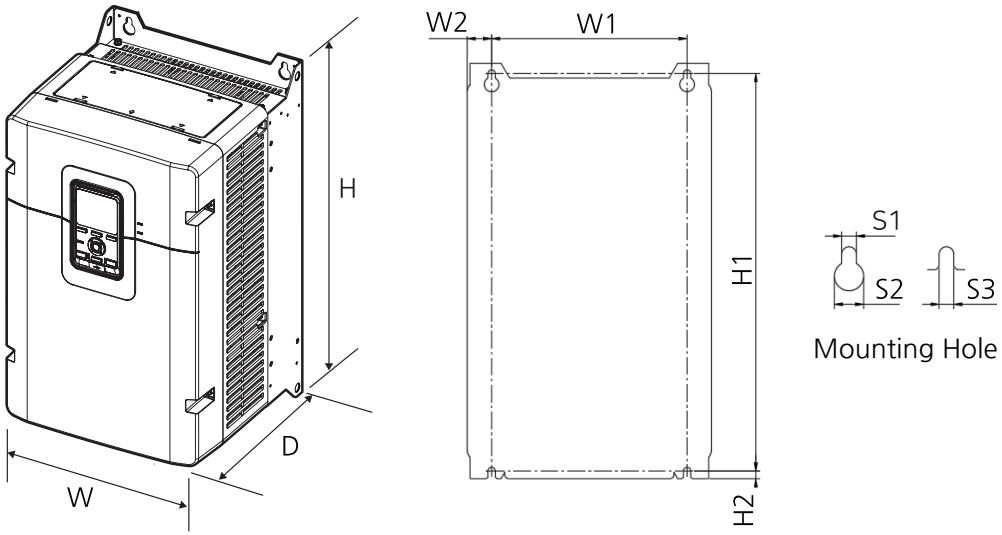
[Image 5. 200 V Class 22 kW/400 V Class 30-37 kW Exterior Diagram]

Table 12. External Dimensions (200 V Class 22 kW/400 V Class 30-37 kW)

Model LSLV□□□□	W	H	D	W1	W2	H1	H2	S1	S2	S3
LSLV0300S300-4 LSLV0370S300-4 LSLV0220S300-2	260.0 (10.24)	500.0 (19.69)	271.0 (10.67)	214.0 (8.43)	23.0 (0.91)	482.5 (19.00)	7.5 (0.30)	7.0 (0.28)	14.0 (0.55)	7.0 (0.28)

Units: mm(in)

200 V Class 30 kW / 400 V Class 45 kW



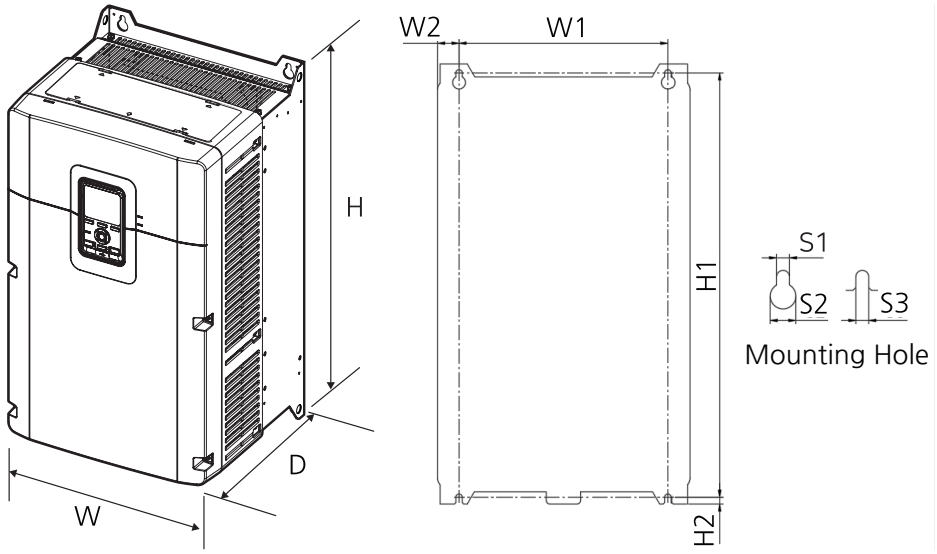
[Image 6. 200 V Class 30 kW/400 V Class 45 kW Exterior Diagram]

Table 13. External Dimensions (200 V Class 30 kW/400 V Class 45 kW)

Model LSLV□□□□	W	H	D	W1	W2	H1	H2	S1	S2	S3
LSLV0450S300-4 LSLV0300S300-2	300.0 (11.81)	510.0 (20.08)	298.2 (11.74)	240.0 (9.45)	30.0 (1.18)	488.0 (19.21)	9.5 (0.37)	9.0 (0.35)	18.0 (0.71)	9.0 (0.35)

Units: mm(in)

200 V Class 37-45 kW / 400 V Class 55-75 kW



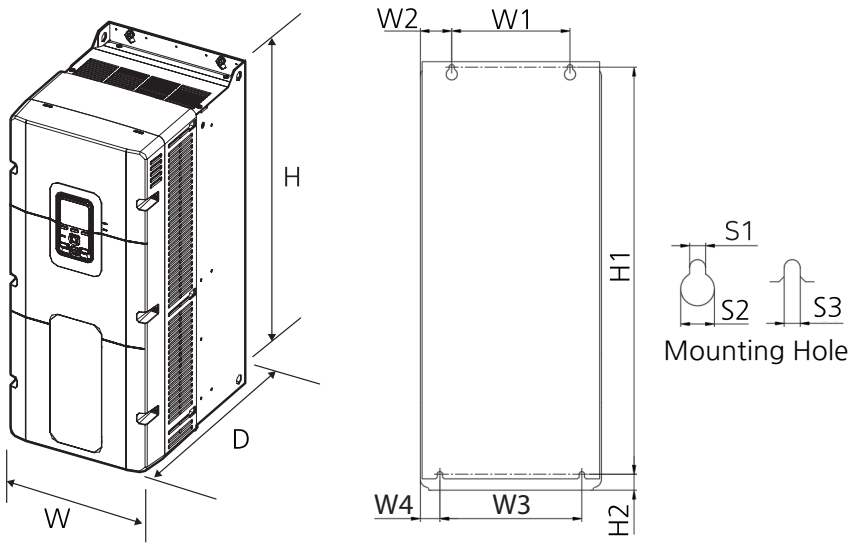
[Image 7. 200 V class 37-45 kW/400 V class 55-75 kW Exterior Diagram]

Table 14. External Dimensions (200 V Class 37-45 kW/400 V Class 55-75 kW)

Model LSLV□□□□	W	H	D	W1	W2	H1	H2	S1	S2	S3
LSLV0550S300-4 LSLV0750S300-4 LSLV0370S300-2 LSLV0450S300-2	350.0 (13.78)	615.0 (24.21)	318.3 (12.53)	290.0 (11.42)	30.0 (1.18)	593.0 (23.35)	9.5 (0.37)	9.0 (0.35)	18.0 (0.71)	9.0 (0.35)

Units: mm(in)

400 V Class 90-110 kW



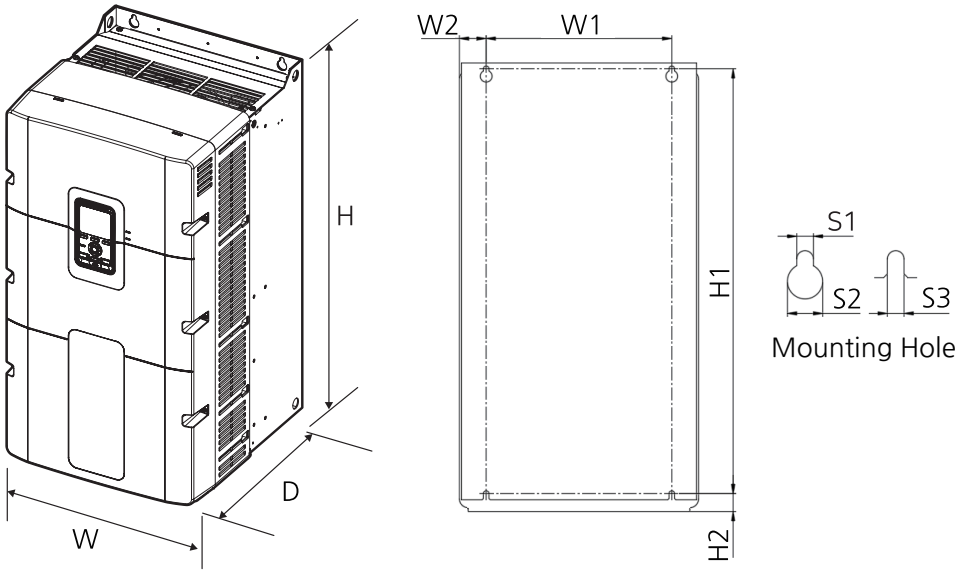
[Image 8. 400 V Class 90-110 kW Exterior diagram]

Table 15. External Dimensions (400 V Class 90-110 kW)

Model LSLV□□□□	W	H	D	W1	W2	W3	W4	H1	H2	S1	S2	S3
LSLV0900S300-4 LSLV1100S300-4	306.4 (12.06)	725.0 (28.54)	391.0 (15.39)	200.0 (7.87)	53.2 (2.09)	240.0 (9.45)	33.2 (1.31)	688.5 (27.11)	27.0 (1.06)	9.0 (0.35)	19.0 (0.75)	9.0 (0.35)

Units: mm(in)

200 V Class 55-75 kW / 400 V Class 132-160 kW



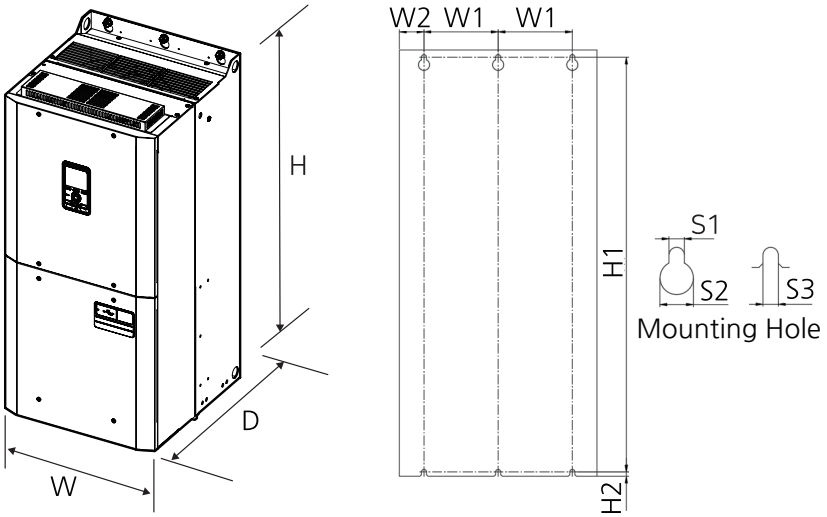
[Image 9. 200 V class 55-75 kW/400 V class 132-160 kW Exterior Diagram]

Table 16. External Dimensions (200 V Class 55-75 kW/400 V Class 132-160 kW)

Model LSLV□□□□	W	H	D	W1	W2	H1	H2	S1	S2	S3
LSLV1320S300-4 LSLV1600S300-4 LSLV0550S300-2 LSLV0750S300-2	386.4 (15.21)	724.0 (28.50)	401.0 (15.79)	300.0 (11.81)	43.2 (1.70)	685.5 (26.99)	29.0 (1.14)	9.0 (0.35)	19.0 (0.75)	9.0 (0.35)

Units: mm(in)

400 V Class 185-220 kW



[Image 10. 400 V Class 185-220 kW Exterior diagram]

Table 17. External Dimensions (400 V Class 185-220 kW)

Model LSLV□□□□	W	H	D	W1	W2	H1	H2	S1	S2	S3
LSLV1850S300-4 LSLV2200S300-4	426.0 (16.77)	920.0 (36.22)	440.9 (17.36)	160.0 (6.30)	53.0 (2.09)	895.5 (35.26)	9.0 (0.35)	11.0 (0.43)	24.0 (0.94)	11.0 (0.43)

Units: mm(in)

16.4 Peripheral Devices

16.4.1 Standards of Molded Case Circuit Breaker (MCCB), Earth Leakage Circuit Breaker (ELCB), and Magnetic Contactor (MC)

You may use molded case circuit breakers (MCCB), earth leakage circuit breakers (ELCB), and magnetic contactors (MC) in the following table:

Table 18. Compatible Molded Case Circuit Breaker, Earth Leakage Circuit Breaker, and Magnetic Contactor Standards

Model LSLV□□□□	Molded Case Circuit Breaker (MCCB)		Earth Leakage Circuit Breaker (ELCB)	Magnetic Contactor (MC)		
	Model	Rating [A]	Model	Rating [A]	Model	Rating [A]
0004S300-2	UTE100·H·FTU·15·3P·UL	15	EBS33c	10	MC-6a	9
0008S300-2	UTE100·H·FTU·15·3P·UL	15	EBS33c	10	MC-9a	11
0015S300-2	UTE100·H·FTU·15·3P·UL	15	EBS33c	15	MC-12a	13
0022S300-2	UTE100·H·FTU·20·3P·UL	20	EBS33c	20	MC-18a	18
0040S300-2	UTE100·H·FTU·30·3P·UL	30	EBS33c	30	MC-32a	32
0055S300-2	UTS150·H·FTU·40·3P·UL	40	EBS53c	40	MC-40a	40
0075S300-2	UTS150·H·FTU·60·3P·UL	60	EBS63c	60	MC-55a	55
0110S300-2	UTS150·H·FTU·80·3P·UL	80	EBS103c	75	MC-75a	75
0150S300-2	UTS150·H·FTU·100·3P·UL	100	EBS103c	100	MC-100a	100
0185S300-2	UTS150·H·FTU·125·3P·UL	125	EBS103c	125	MC-130a	130
0220S300-2	UTS150·H·FTU·150·3P·UL	150	EBS203c	150	MC-150a	150
0300S300-2	UTS250·H·FTU·200·3P·UL	200	EBS203c	175	MC-185a	185
0370S300-2	UTS250·H·FTU·225·3P·UL	225	EBS403c	225	MC-225a	225
0450S300-2	UTS400·H·FTU·300·3P·UL	300	EBS403c	300	MC-265a	265
0550S300-2	UTS400·H·FTU·400·3P·UL	400	EBS403c	400	MC-400a	400
0750S300-2	UTS600·H·FTU·500·3P·UL	500	EBS603c	500	MC-500a	500
0004S300-4	UTS150·L·MCP·3.2·3P·UL	3.2	EBS33c	5	MC-6a	7
0008S300-4	UTS150·L·MCP·6.3·3P·UL	6.3	EBS33c	5	MC-6a	7
0015S300-4	UTS150·L·MCP·12·3P·UL	12	EBS33c	10	MC-9a	9

Model LSLV□□□□	Molded Case Circuit Breaker (MCCB)		Earth Leakage Circuit Breaker (ELCB)	Magnetic Contactor (MC)		
	Model	Rating [A]	Model	Rating [A]	Model	Rating [A]
0022S300-4	UTS150·L·MCP·12·3P·UL	12	EBS33c	10	MC-12a	12
0040S300-4	UTS150·L·MCP·20·3P·UL	20	EBS33c	15	MC-18a	18
0055S300-4	UTS150·L·MCP·32·3P·UL	32	EBS33c	25	MC-32a	32
0075S300-4	UTS150·L·MCP·32·3P·UL	32	EBS33c	30	MC-32a	32
0110S300-4	UTS150·L·FTU·40·3P·UL	40	EBS53c	50	MC-50a	43
0150S300-4	UTS150·L·FTU·50·3P·UL	50	EBS53c	50	MC-65a	65
0185S300-4	UTS150·L·FTU·60·3P·UL	60	EBS63c	60	MC-65a	65
0220S300-4	UTS150·L·FTU·80·3P·UL	80	EBS103c	100	MC-100a	100
0300S300-4	UTS150·L·FTU·100·3P·UL	100	EBS103c	100	MC-100a	100
0370S300-4	UTS150·L·FTU·125·3P·UL	125	EBS103c	125	MC-130a	130
0450S300-4	UTS150·L·FTU·150·3P·UL	150	EBS203c	150	MC-150a	150
0550S300-4	UTS250·L·FTU·175·3P·UL	175	EBS203c	200	MC-185a	185
0750S300-4	UTS250·L·FTU·225·3P·UL	225	EBS203c	225	MC-225a	225
0900S300-4	UTS400·LT·FTU·300·3P·UL	300	EBS403c	300	MC-330a	330
1100S300-4	UTS400·LT·FTU·400·3P·UL	400	EBS403c	350	MC-400a	400
1320S300-4	UTS600·LT·FTU·500·3P·UL	500	EBS603c	500	MC-500a	500
1600S300-4	UTS600·LT·FTU·600·3P·UL	600	EBS603c	500	MC-500a	500
1850S300-4	UTS600·LT·FTU·600·3P·UL	600	EBS603c	600	MC-630a	630
2200S300-4	UTS800·LT·NGO·800·3P·UL	800	EBS803c	800	MC-800a	800

16.4.2 AC Input Fuse and Reactor Specifications

This product has a built-in DC reactor. To additionally install an AC reactor, contact our customer service center.

Table 19. Input Fuse and Reactor Specifications

Model LSLV□□□□	AC Input Fuse		AC Reactor*	
	Voltage [V]	Current [A]	Inductance [mH]	Current [A]
0004S300-2	600	10	2.02	5
0008S300-2	600	15	1.12	9
0015S300-2	600	15	0.92	11
0022S300-2	600	25	0.59	17
0040S300-2	600	35	0.42	24
0055S300-2	600	50	0.30	34
0075S300-2	600	70	0.22	46
0110S300-2	600	80	0.16	64
0150S300-2	600	100	0.12	83
0185S300-2	600	125	0.10	103
0220S300-2	600	150	0.08	123
0300S300-2	600	200	0.06	161
0370S300-2	600	250	0.05	204
0450S300-2	600	300	0.04	253
0550S300-2	600	400	0.03	334
0750S300-2	600	500	0.02	417
0004S300-4	600	6	6.74	3
0008S300-4	600	6	4.04	5
0015S300-4	600	10	2.89	7
0022S300-4	600	15	2.25	9
0040S300-4	600	20	1.56	13
0055S300-4	600	25	1.01	20
0075S300-4	600	35	0.75	27

Model LSLV□□□□	AC Input Fuse		AC Reactor*	
	Voltage [V]	Current [A]	Inductance [mH]	Current [A]
0110S300-4	600	50	0.59	34
0150S300-4	600	60	0.47	43
0185S300-4	600	80	0.37	54
0220S300-4	600	100	0.29	69
0300S300-4	600	100	0.24	86
0370S300-4	600	125	0.19	106
0450S300-4	600	150	0.16	128
0550S300-4	600	200	0.12	165
0750S300-4	600	250	0.09	220
0900S300-4	600	400	0.08	261
1100S300-4	600	400	0.07	309
1320S300-4	600	500	0.05	383
1600S300-4	600	600	0.05	446
1850S300-4	600	600	0.04	515
2200S300-4	600	800	0.03	583

ⓘ Caution

Use Class CC, G, J, L, R or T 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.

ⓘ Attention

Utiliser UNIQUEMENT des fusibles d'entrée homologués de Classe CC, G, J, L, R ou T UL et des disjoncteurs UL. Se reporter au tableau ci-dessus pour la tension et le courant nominal des fusibless et des disjoncteurs.

16.5 Terminal Screw Specifications

16.5.1 Input/output Terminal Screw Specification

Table 20. Input/output Terminal Screw Specification

Model LSLV□□□□	Terminal Block Screw Size	Screw Torque [Kgf·cm (N·m)]
0004S300-2	M4	12.2~14.3(1.2~1.4)
0008S300-2	M4	12.2~14.3(1.2~1.4)
0015S300-2	M4	12.2~14.3(1.2~1.4)
0022S300-2	M4	12.2~14.3(1.2~1.4)
0040S300-2	M4	12.2~14.3(1.2~1.4)
0055S300-2	M4	12.2~14.3(1.2~1.4)
0075S300-2	M4	12.2~14.3(1.2~1.4)
0110S300-2	M5	20.4~24.5(2.0~2.4)
0150S300-2	M5	20.4~24.5(2.0~2.4)
0185S300-2	M5	20.4~24.5(2.0~2.4)
0220S300-2	M6	30.6~38.2(3~3.74)
0300S300-2	M8	61.2~91.8(6~9)
0370S300-2	M8	61.2~91.8(6~9)
0450S300-2	M8	61.2~91.8(6~9)
0550S300-2	M12	182.4~215.0(18~21.2)
0750S300-2	M12	182.4~215.0(18~21.2)
0004S300-4	M4	12.2~14.3(1.2~1.4)
0008S300-4	M4	12.2~14.3(1.2~1.4)
0015S300-4	M4	12.2~14.3(1.2~1.4)
0022S300-4	M4	12.2~14.3(1.2~1.4)
0040S300-4	M4	12.2~14.3(1.2~1.4)
0055S300-4	M4	12.2~14.3(1.2~1.4)
0075S300-4	M4	12.2~14.3(1.2~1.4)

Model LSLV□□□□	Terminal Block Screw Size	Screw Torque [Kgf·cm (N·m)]
0110S300-4	M5	12.2~14.3(1.2~1.4)
0150S300-4	M5	12.2~14.3(1.2~1.4)
0185S300-4	M5	20.4~24.5(2.0~2.4)
0220S300-4	M5	20.4~24.5(2.0~2.4)
0300S300-4	M5 / M6	24.5~31.8(2.4~3.1)/30.6~38.2(3~3.74)
0370S300-4	M5 / M6	24.5~31.8(2.4~3.1)/30.6~38.2(3~3.74)
0450S300-4	M8	61.2~91.8(6~9)
0550S300-4	M8	61.2~91.8(6~9)
0750S300-4	M8	61.2~91.8(6~9)
0900S300-4	M8	61.2~91.8(6~9)
1100S300-4	M8	61.2~91.8(6~9)
1320S300-4	M12	182.4~215.0(18~21.2)
1600S300-4	M12	182.4~215.0(18~21.2)
1850S300-4	M12	182.4~215.0(18~21.2)
2200S300-4	M12	182.4~215.0(18~21.2)

16.5.2 Control Circuit Terminal Screw Specifications

Table 21. Control Circuit Terminal Screw Specifications

Terminals	Terminal Block Screw Size	Screw Torque [Kgf·cm (N·m)]
VR+, VR-, AI1, AI2, AI3, TI, TO, AO1, AO2, EPI, S+, S-, 5G, DI1~DI8, CM, DP, DG, A1/B1/C1, A2/C2, Q3, EG	M2.5	24.0 (0.4)

ⓘ Caution

Apply rated torques to the terminal screws. Loose screws may cause short circuits and malfunctions. Tightening the screw too much may damage the terminals and cause short circuits and malfunctions. Use copper wires only with 600V, 90℃ rating for the power terminal wiring, and 300V, 75℃ rating for the control terminal wiring.

ⓘ Attention

Appliquer des couples de marche aux vis des bornes. Des vis desserrées peuvent provoquer des courts-circuits et des dysfonctionnements. Ne pas trop serrer la vis, car cela risque d'endommager les bornes et de provoquer des courts-circuits et des dysfonctionnements. Utiliser uniquement des fils de cuivre avec une valeur nominale de 600 V, 90 ℃ pour le câblage de la borne d'alimentation, et une valeur nominale de 300 V, 75 ℃ pour le câblage de la borne de commande.

16.6 Braking Unit and Braking Resistor Specifications

16.6.1 Type of Braking Units

Table 22. Type of Braking Units

UL Type	Type	Voltage	Product Capacity	Brake unit	Exterior and Terminal Arrangement
UL type	Type A (Refer to the table **16.6.5 Braking Resistor Specifications** for resistance values of the braking resistor.)	200 V class	22kW	SV220DBU-2U	Refer to **Group 1**
			37kW	SV370DBU-2U	
			55kW	SV550DBU-2U	
		400 V class	55kW	SV550DBU-4U	
			75kW	SV750DBU-4U	
Non-UL Type	Type B (Refer to the user manual of each braking unit for resistance values of the braking resistor.)	400 V class	75kW	SV750DB-4	Refer to **Group 2**
			220kW	SV2200DB-4	Refer to **Group 3**
	Type C (Refer to the user manual of each braking unit for resistance values of the braking resistor.)	200 V class	22kW	LSLV0220DBU-2LN	Refer to **Group 4**
			37kW	LSLV0370DBU-2LN	
				LSLV0370DBU-2HN	Refer to **Group 5**
			75kW	LSLV0750DBU-2LN	Refer to **Group 4**
				LSLV0750DBU-2HN	Refer to **Group 5**
		400 V class	75kW	LSLV0750DBU-4LN	Refer to **Group 4**
				LSLV0750DBU-4HN	Refer to **Group 5**

Note

- Make sure to check the changes in the user manual of the relevant braking unit before use.
- Refer to **16.6.5 Braking Resistor Specifications**, or check the user manual of each braking unit for the resistance values of Type A.
- Check the user manual of each braking unit for resistance values of Type B and C.

16.6.2 Terminal Arrangement in the Braking Unit

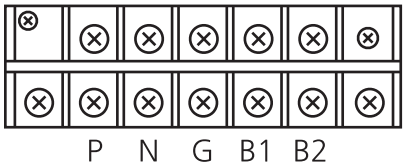
The following table describes the terminals in the braking unit.

Table 23. Terminal Arrangement in the Braking Unit

Terminal Name	Functionality
P	Terminal that connects to inverter terminal P
P(+)	
N	Terminal that connects to inverter terminal N
N(-)	
G	Ground Terminal
E	
B1	Terminal that connects to B1 in the braking resistor
B2	Terminal that connects to B2 in the braking resistor
N.C	Terminal not used
P/B1	Terminal that connects to inverter terminal P2 or P/ terminal that connects to B1 in the braking resistor

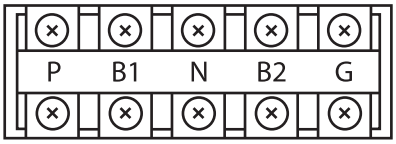
The terminal arrangement of the braking unit is as the following groups:

Group 1



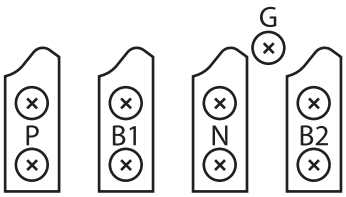
[Image 11. Terminal Arrangement in the Braking Unit - Group 1]

Group 2



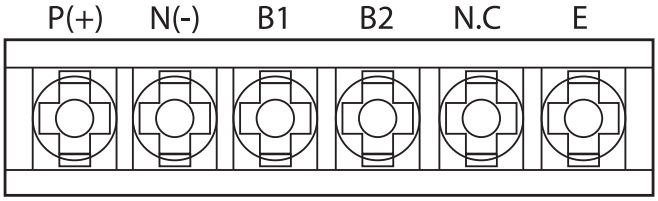
[Image 12. Terminal Arrangement in the Braking Unit - Group 2]

Group 3



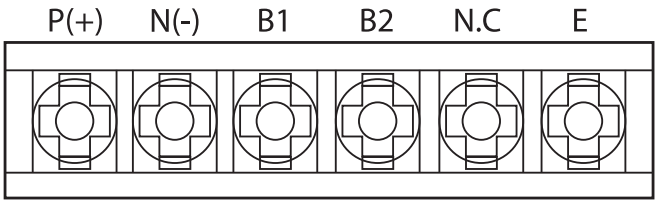
[Image 13. Terminal Arrangement in the Braking Unit - Group 3]

Group 4

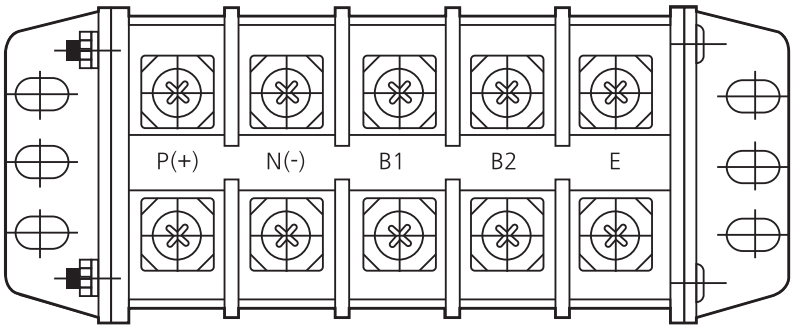


[Image 14. Terminal Arrangement in the Braking Unit - Group 4]

Group 5



[Image 15. Terminal Arrangement in the Braking Unit - Group 5: A Frame (200 V Class 37 kW, 400 V Class 37 kW/75 kW)



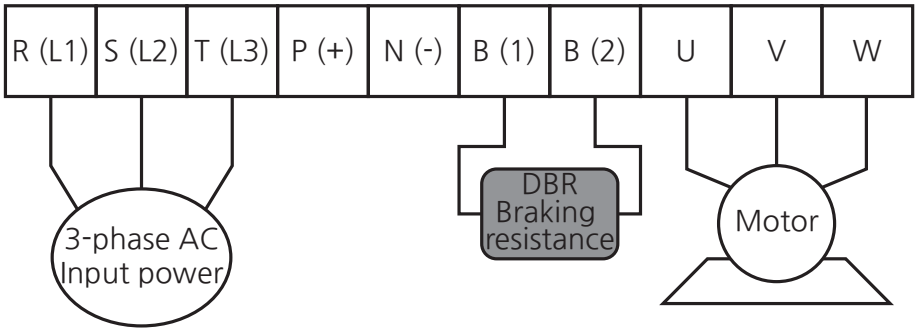
[Image 16. Terminal Arrangement in the Braking Unit - Group 5: B/C Frame (200 V Class 75 kW)]

16.6.3 Braking unit and braking resistor wiring diagram by capacity

200 V class 0.4-22 kW / 400 V class 0.4-37 kW

When using the built-in braking unit

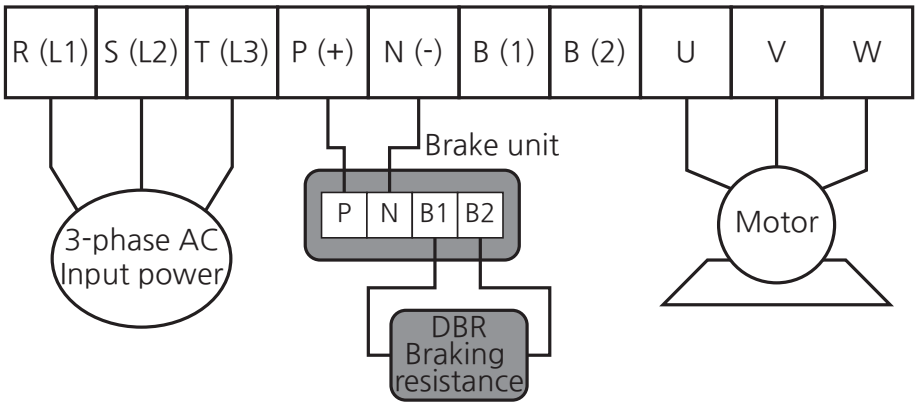
Connect the braking resistor to B (1) and B (2) terminals when using the built-in braking unit.



[Image 17. Braking resistor wiring – built-in braking unit (200 V class 0.4-18.5 kW, 400 V class 0.4-37 kW)]

When using the separate braking unit

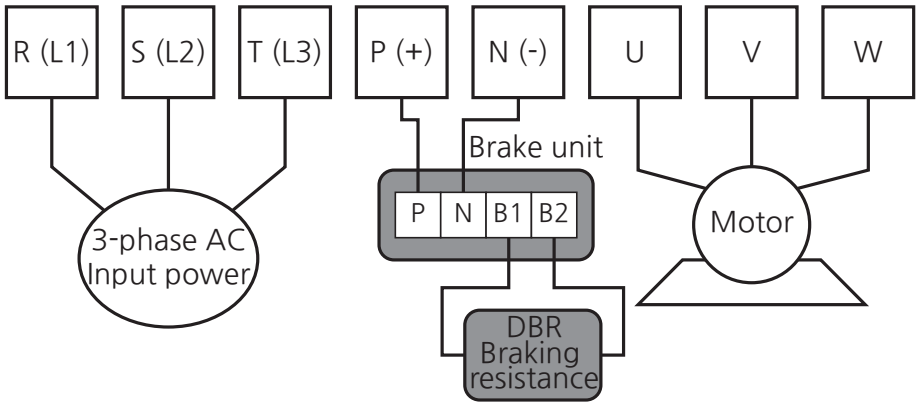
Connect the braking unit to P (+) and N (-) terminals when using the separate braking unit.



[Image 18. Braking resistor wiring – separate braking unit (200 V class 0.4-22 kW, 400 V class 0.4-37 kW)]

200 V class 30-45 kW / 400 V class 45-75kW

Connect the braking unit to P (+) and N (-) terminals when using the separate braking unit.

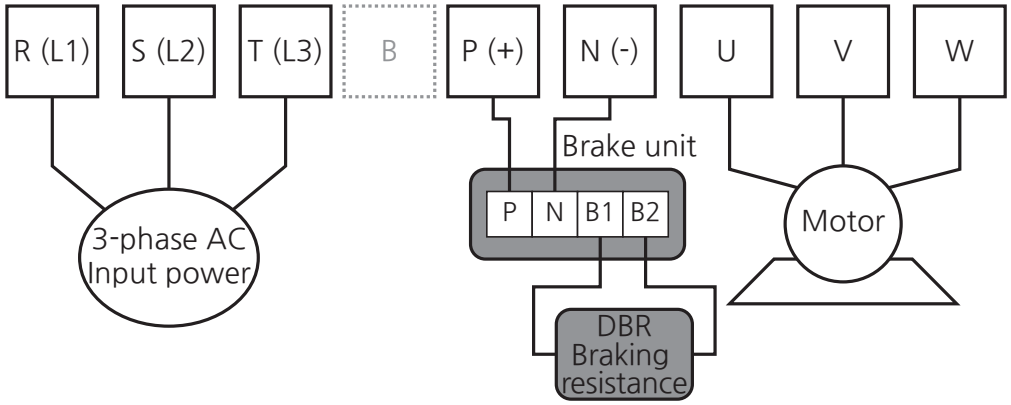


[Image 19. Braking resistor wiring – separate braking unit (200 V class 30-45 kW, 400 V class 45-75 kW)]

200 V class 55-75 kW / 400 V class 90-220 kW

Connect the braking unit to P (+) and N (-) terminals when using the separate braking unit.

Do not use a B terminal.



[Image 20. Braking resistor wiring – separate braking unit (200 V class 55-75 kW, 400 V class 90-220 kW)]

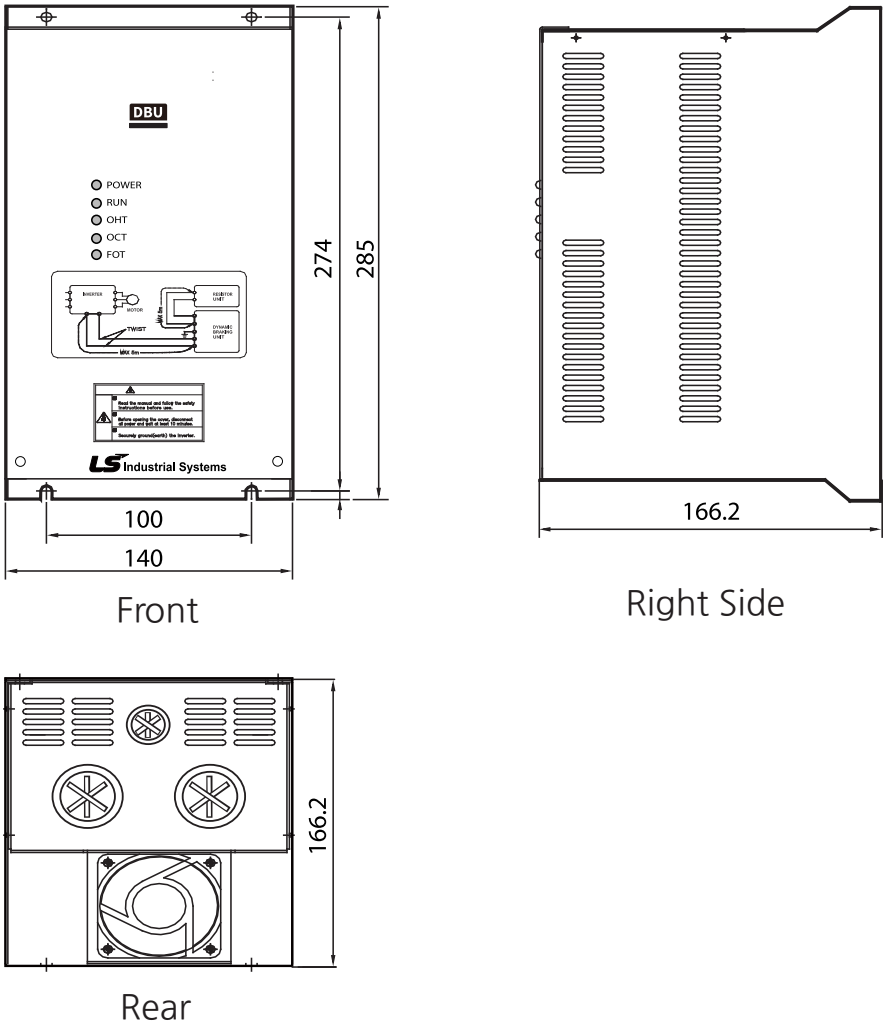
Table 24. Braking Resistor Terminal

Braking Resistor Terminal	Terminal Description
B1, B2	Wire correctly referring to the wiring diagram. Wire braking (DB) resistor to B1 and B2 terminals in the braking unit.
B	Do not use it.

16.6.4 Exterior Diagram of Braking Unit

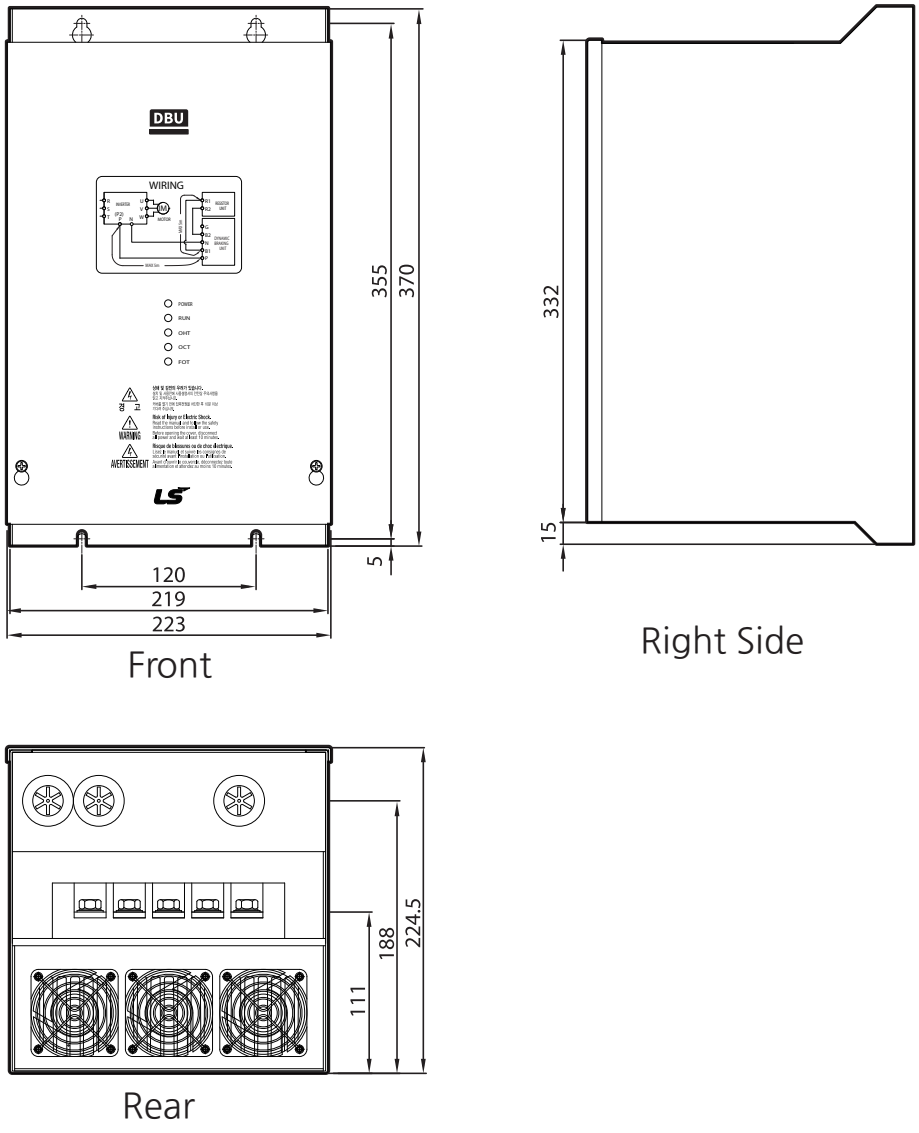
It shows the exterior diagram of the braking unit and product size.

Group 1



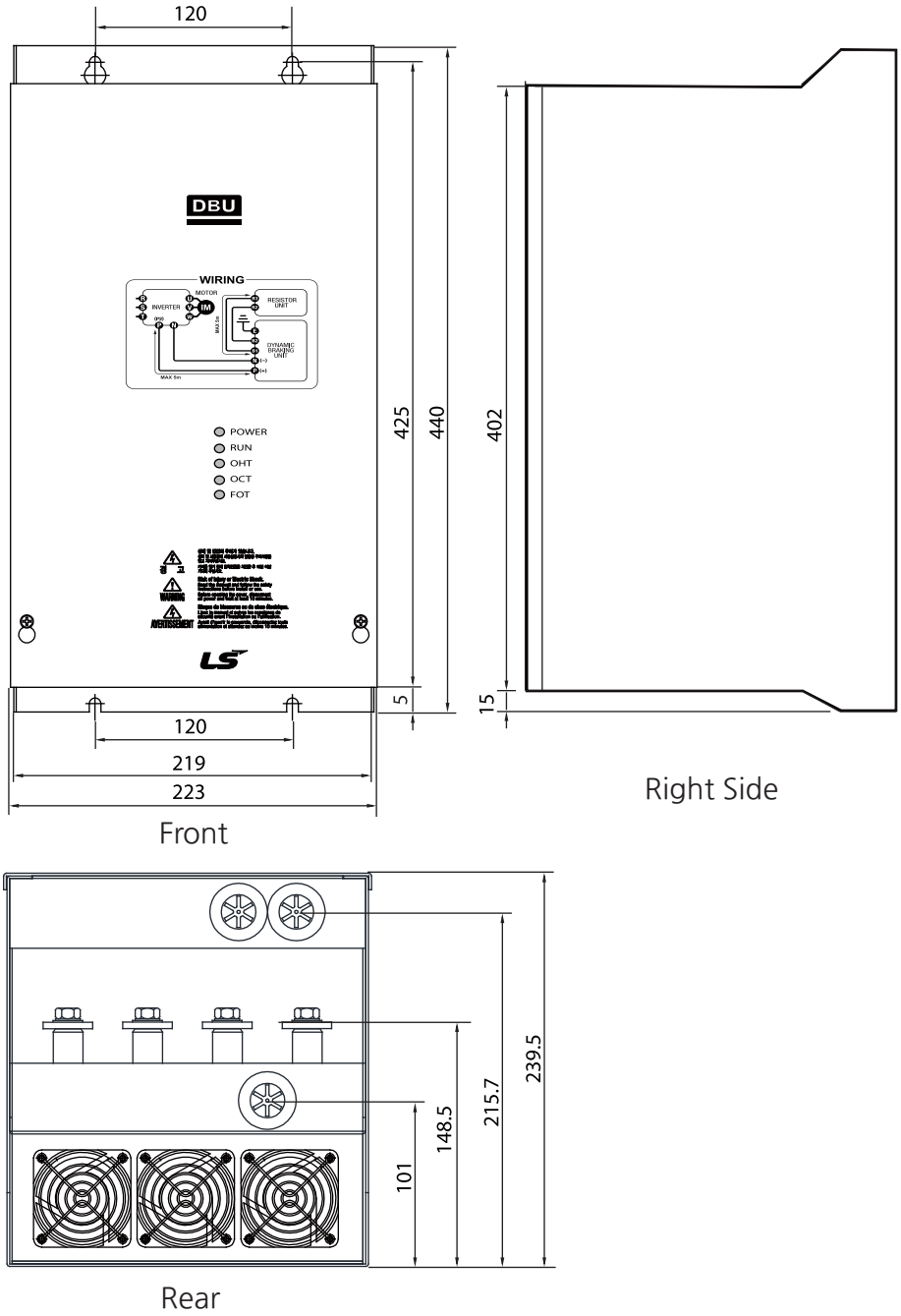
[Image 21. Exterior Diagram of Braking Unit - Group 1]

Group 2



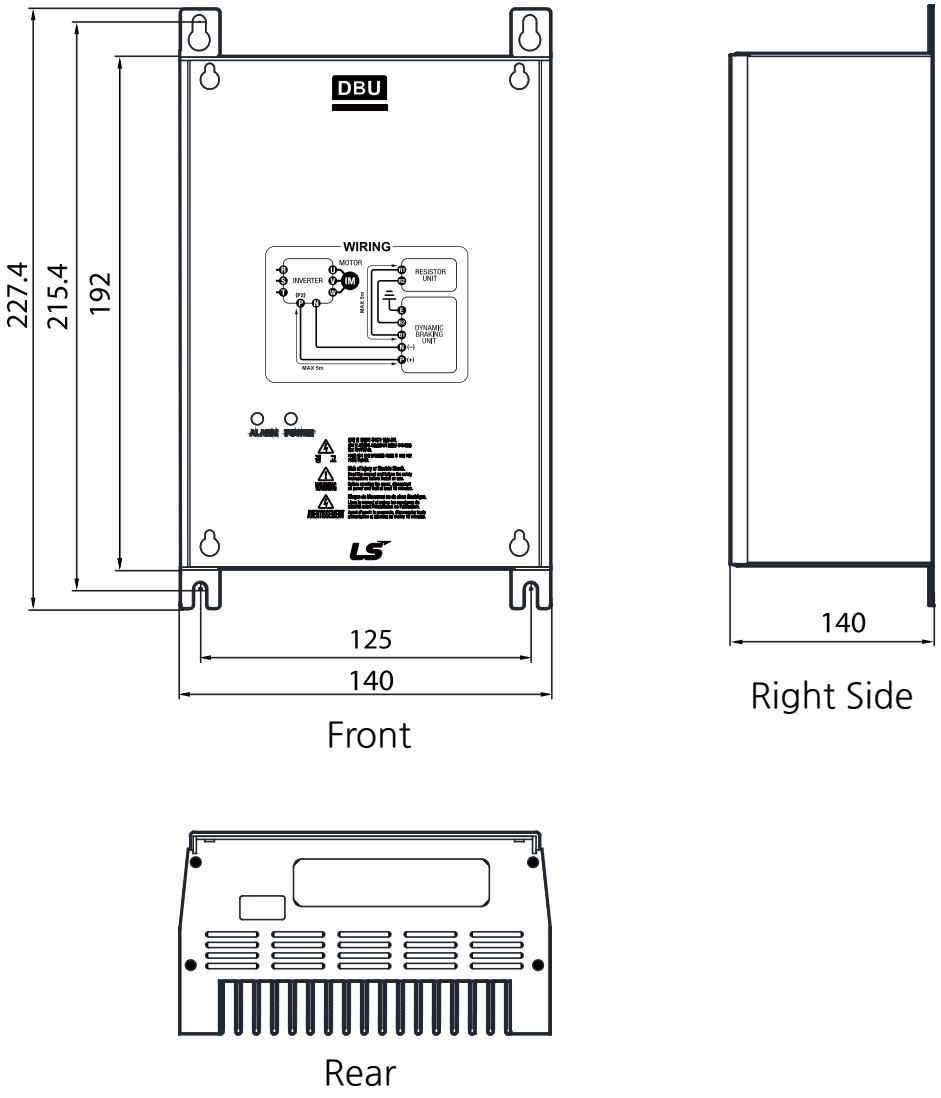
[Image 22. Exterior Diagram of Braking Unit - Group 2]

Group 3



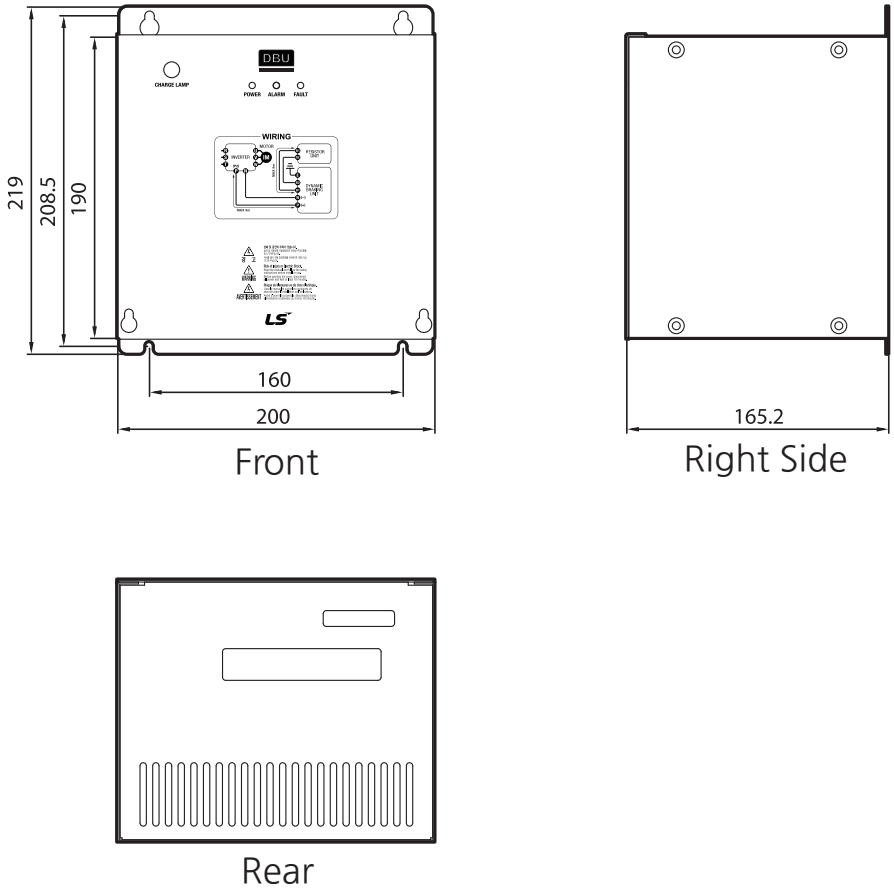
[Image 23. Exterior Diagram of Braking Unit - Group 3]

Group 4

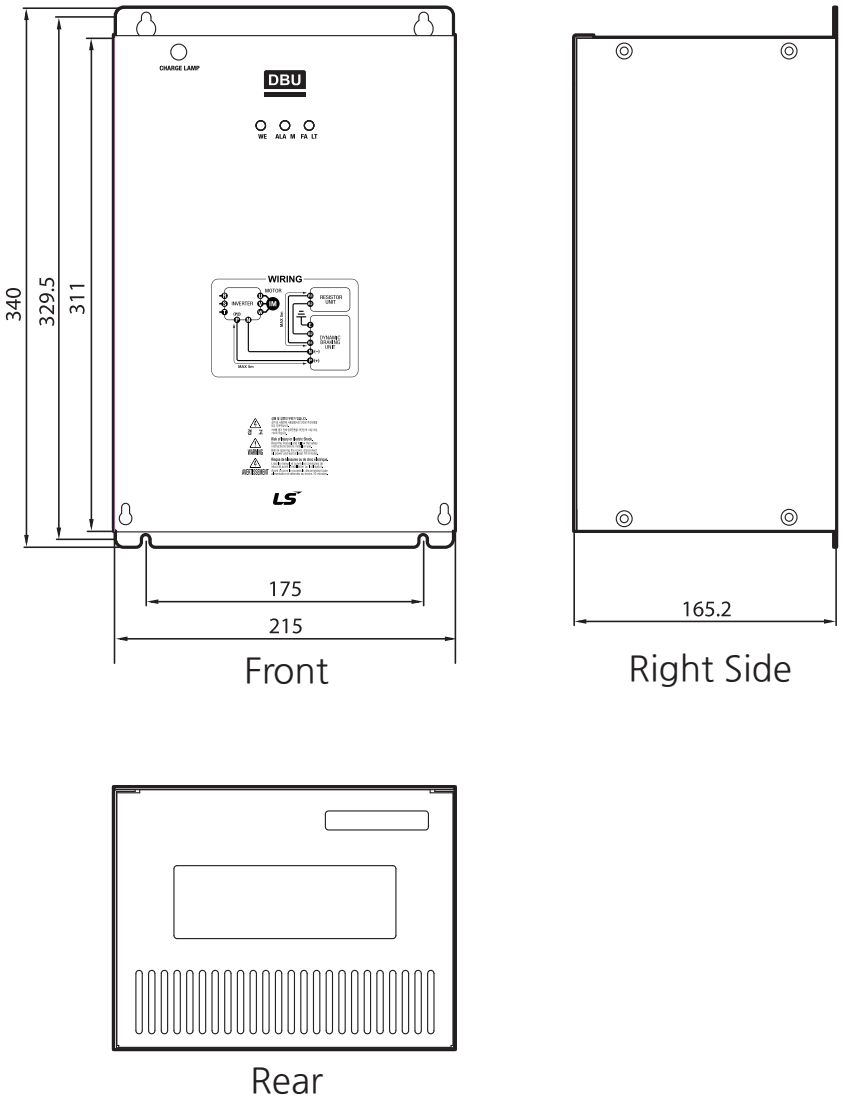


[Image 24. Exterior Diagram of Braking Unit - Group 4]

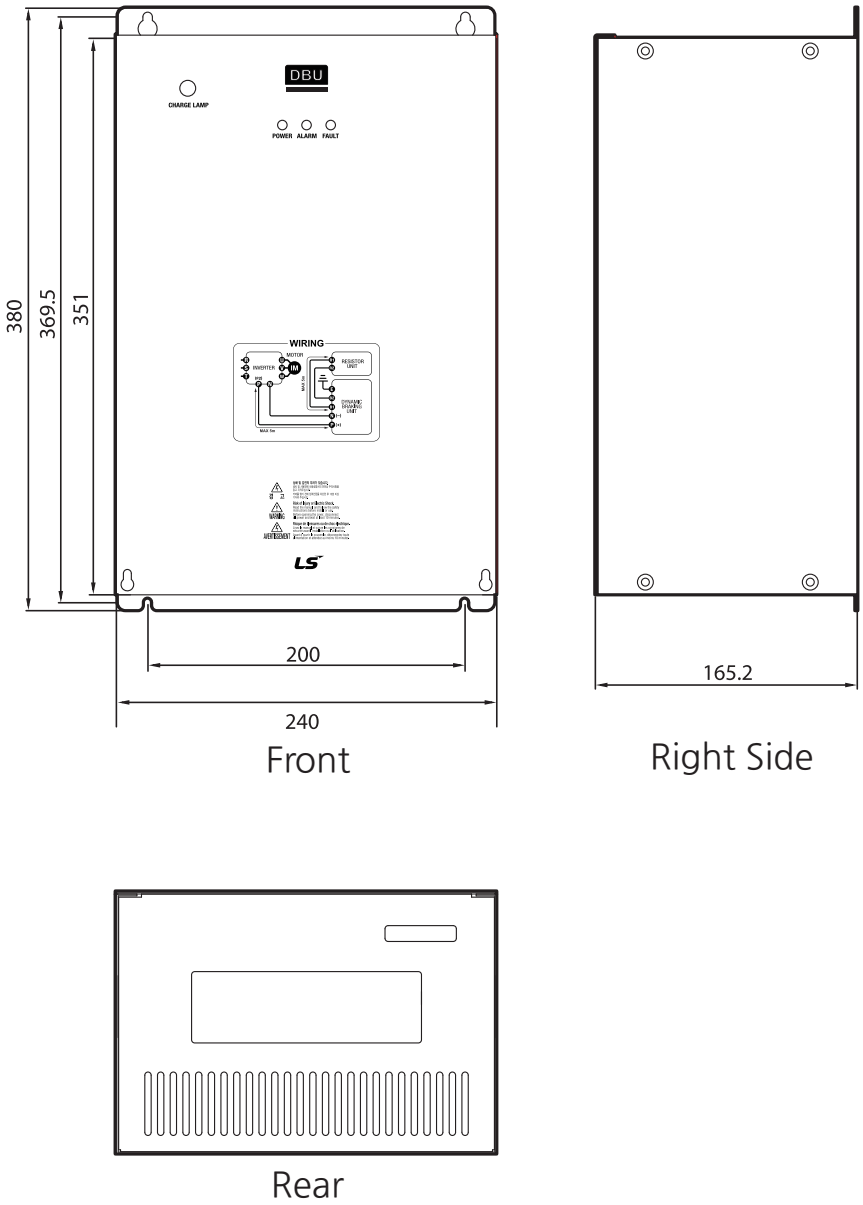
Group 5



[Image 25. Exterior Diagram of Braking Unit - Group 5: A Frame]



[Image 26. Exterior Diagram of Braking Unit - Group 5: B Frame]



[Image 27. Exterior Diagram of Braking Unit - Group 5: C Frame]

Table 25. Exterior Dimensions of Braking Unit (Group 5)

Frame	Voltage Used (V)	Capacity (kW)	Duty Cycle	Product Size (mm)				Installation Location (mm)		Weight	Hole Size for Installation
			(%ED)	W	H	H2	D	W1	H1	(Kg)	(f)
A Frame	220	37	50	200	219	190	165.2	160	208.5	3.77	M6
	440	37	50							3.84	
		75	50	3.98							
B Frame	220	75	50	215	340	311	8.48	175	329.5	8.26	
		90	50								
	440	90	50				8.30				
		132	50	8.40							
C Frame	440	160	50	240	380	351		200	369.5	9.40	
		220	50				9.70				

16.6.5 Braking Resistor Specifications

Table 26. Braking Resistor Specifications

Model LSLV□□□□	Reference Braking Unit	Braking resistance					
		100% Torque			150% Torque		
		Resistance (Ω)	Capacity (kW)		Resistance (Ω)	Capacity (kW)	
			ED 5%	ED 10%		ED 5%	ED 10%
0004S300-2	-	400	0.05	0.1	300	0.1	0.2
0008S300-2	-	200	0.1	0.2	150	0.15	0.3
0015S300-2	-	100	0.2	0.4	60	0.3	0.6
0022S300-2	-	60	0.3	0.6	50	0.4	0.8
0040S300-2	-	40	0.5	1	33	0.5	1
0055S300-2	-	30	0.6	1.2	20	0.8	1.6
0075S300-2	-	20	0.8	1.6	15	1.2	2.4
0110S300-2	-	15	1.2	2.4	10	2	4
0150S300-2	-	10	2	4	8	2	4

Model LSLV□□□□	Reference Braking Unit	Braking resistance					
		100% Torque			150% Torque		
		Resistance (Ω)	Capacity (kW)		Resistance (Ω)	Capacity (kW)	
			ED 5%	ED 10%		ED 5%	ED 10%
0185S300-2	-	10	2	4	5	3.6	7.2
0220S300-2	LSLV0220DBU-2LN	8.4	2	4	5.0	3.6	7.2
0300S300-2	LSLV0370DBU-2HN	6.0	3	6	4.0	4	8
0370S300-2	LSLV0370DBU-2HN	5.0	3.6	7.2	3.4	5	10
0450S300-2	LSLV0750DBU-2HN	4.0	4	8	2.8	6	12
0550S300-2	LSLV0750DBU-2HN	3.4	5	10	2.0	8	16
0750S300-2	LSLV0750DBU-2HN	2.4	6.4	12.8	1.6	9.6	19.2
0004S300-4	-	1800	0.05	0.1	1200	0.1	0.2
0008S300-4	-	900	0.1	0.2	600	0.15	0.3
0015S300-4	-	450	0.2	0.4	300	0.3	0.6
0022S300-4	-	300	0.3	0.6	200	0.4	0.8
0040S300-4	-	200	0.4	0.8	130	0.6	1.2
0055S300-4	-	120	0.6	1.2	85	1	2
0075S300-4	-	90	0.8	1.6	60	1.2	2.4
0110S300-4	-	60	1.2	2.4	40	2	4
0150S300-4	-	45	2	4	30	2.4	4.8
0185S300-4	-	35	2	4	20	3.6	7.2
0220S300-4	-	30	2.4	4.8	20	3.6	7.2
0300S300-4	-	20	3.6	7.2	16	5	10
0370S300-4	-	20	3.6	7.2	12	6.4	12.8
0450S300-4	LSLV0750DBU-4HN	16	4	8	10	6.4	12.8
0550S300-4	LSLV0750DBU-4HN	13.0	5	10	9.0	7.2	14.4
0750S300-4	LSLV0750DBU-4HN	10.0	6	12	6.8	9.6	19.2
0900S300-4	LSLV0900DBU-4HN	8.4	8	16	5.6	12	24
1100S300-4	LSLV1320DBU-4HN	6.4	9.6	19.2	4.6	15	30

Model LSLV□□□□	Reference Braking Unit	Braking resistance					
		100% Torque			150% Torque		
		Resistance (Ω)	Capacity (kW)		Resistance (Ω)	Capacity (kW)	
			ED 5%	ED 10%		ED 5%	ED 10%
1320S300-4	LSLV1320DBU-4HN	5.5	12	24	3.8	18	36
1600S300-4	LSLV1600DBU-4HN	4.8	15	30	3.2	20	40
1850S300-4	LSLV2200DBU-4HN	4.1	15	30	2.7	26	52
2200S300-4	LSLV2200DBU-4HN	3.4	20	40	2.3	30	60

Note

- Products that are less than 18.5 kW-200 V or 37 kW-400 V have a built-in braking unit by default and do not require separate installation.
- Refer to the user manual of each braking unit for more details on the specifications of the braking resistor applicable for the use of braking unit. Make sure you use the braking resistance value, watt, braking torque, and duty cycle described in the user manual of the braking unit.
- If you double the duty cycle (%ED) from the standard, you also need to double the rated watts of the separately installed resistor.
- Braking resistor is an object that heats during braking. Make sure there is enough distance from the inverter when you install it.

16.7 Derating

16.7.1 Continuous Rated Current Derating

The continuous rated current of the inverter is limited based on the carrier frequency. Refer to the following table:

Table 27. Inverter Rated Current Based on the Carrier Frequency (200 V Class)

Capacity (kW)	Rated Current (A)						
	Heavy Duty, Low Leakage PWM						
	1kHz	3kHz	5kHz	8kHz	10kHz	12kHz	15kHz
0.4	3.2	3.2	3.2	3.2	3.1	3	2.9
0.75	5	5	5	5	4.8	4.7	4.4
1.5	8	8	8	8	7.8	7.5	7.2
2.2	11	11	11	11	10.8	10.5	10.2
4	17.5	17.5	17.5	17.5	17.1	16.8	16.2
5.5	25	25	25	25	24.3	23.6	22.5
7.5	33	33	33	33	32.1	31.1	29.7
11	47	47	47	47	45.3	43.6	41
15	60	60	60	60	58.1	56.3	53.4
18.5	75	75	75	75	72.7	70.3	66.8
22	88	88	88	88	80.6	73.1	62
30	115	115	115	99.4	89	-	-
37	145	145	145	125.2	112	-	-
45	180	180	180	155.7	139.5	-	-
	1kHz	2kHz	3kHz	4kHz	5kHz	6kHz	7kHz
55	220	220	220	220	213.8	207.5	201.3
75	288	288	288	288	279.8	271.7	263.5

Capacity (kW)	Rated Current (A)				
	Heavy Duty, Normal PWM				
	1kHz	3kHz	5kHz	8kHz	10kHz
0.4	3.2	3.2	3.2	3.1	3
0.75	5	5	5	4.8	4.6
1.5	8	8	8	7.6	7.4
2.2	11	11	11	10.4	9.9
4	17.5	17.5	17.5	16.5	15.8
5.5	25	25	25	23.7	22.8
7.5	33	33	33	31.3	30.1
11	47	47	47	43.6	42
15	60	60	60	57.4	55.6
18.5	75	75	75	71.7	69.5
22	88	88	88	72.4	62
30	115	115	100.4	78.6	-
37	145	145	126.5	98.8	-
45	180	180	157.3	123.3	-
	1kHz	4kHz	-	-	-
55	220	220	-	-	-
75	288	288	-	-	-

Capacity (kW)	Rated Current (A)						
	Normal Duty, Low Leakage PWM						
	1kHz	3kHz	5kHz	8kHz	10kHz	12kHz	15kHz
0.4	5	5	4.9	4.7	4.6	4.5	4.3
0.75	8	8	7.8	7.6	7.4	7.2	6.9
1.5	12	12	11.7	11.3	11.1	10.8	10.4
2.2	16	16	15.7	15.2	14.9	14.6	14.1
4	22	22	21.6	20.9	20.5	20.1	19.4
5.5	30	30	29.3	28.2	27.5	26.8	25.7
7.5	42	42	41	39.5	38.5	37.5	36
11	56	56	54.4	52	50.5	48.9	46.5
15	70	70	68.1	65.2	63.3	61.4	58.5
18.5	82	82	79.8	76.4	74.1	71.9	68.5
22	110	110	102.7	91.7	84.3	77	66
30	138	138	125.1	105.9	93	-	-
37	169	169	153.6	130.4	115	-	-
45	211	211	191.9	163.1	144	-	-
	1kHz	2kHz	3kHz	4kHz	5kHz	6kHz	7kHz
55	288	288	280.6	273.1	265.5	258	250.5
75	345	345	336.8	328.6	320.4	312.1	303.9

Capacity (kW)	Rated Current (A)				
	Normal Duty, Normal PWM				
	1kHz	2kHz	5kHz	8kHz	10kHz
0.4	5	5	4.8	4.6	4.5
0.75	8	8	7.7	7.4	7.2
1.5	12	12	11.6	11.1	10.8
2.2	16	16	15.3	14.6	14.2
4	22	22	21.1	20.1	19.5
5.5	30	30	28.7	27.3	26.4
7.5	42	42	40.1	38.3	37
11	56	56	52.7	49.5	47.3
15	70	70	65.8	61.7	58.9
18.5	82	82	77.1	72.3	69
22	110	110	93.5	77	66
30	138	138	109.1	80.1	-
37	169	169	134.3	99.6	-
45	211	211	168	124.9	-
	1kHz	2kHz	3kHz	4kHz	-
55	288	288	281.1	274.3	-
75	345	345	336.8	328.6	-

Table 28. Inverter Rated Current Based on Carrier Frequency (400 V-460 V Class)

Capacity (kW)	Rated Current (A)						
	Heavy Duty, Low Leakage PWM						
	1kHz	3kHz	5kHz	8kHz	10kHz	12kHz	15kHz
0.4	1.8	1.8	1.8	1.8	1.7	1.5	1.4
0.75	3.4	3.4	3.4	3.4	3.2	2.9	2.6
1.5	4.8	4.8	4.8	4.8	4.5	4.1	3.6
2.2	5.5	5.5	5.5	5.5	5.2	4.8	4.3
4	9.2	9.2	9.2	9.2	8.6	8.1	7.2
5.5	14.8	14.8	14.8	14.8	13.7	12.6	11
7.5	16.5	16.5	16.5	16.5	15.3	14.1	12.3
11	24	24	24	24	21.9	19.8	16.6
15	31	31	31	31	28.3	25.6	21.5
18.5	39	39	39	39	36.5	33.9	30.2
22	45	45	45	45	42.1	39.2	34.8
30	61	61	61	54.6	50.4	-	-
37	75	75	75	60.5	50.8	-	-
45	91	91	91	75.4	65	-	-
55	110	110	110	88.4	74	-	-
75	152	152	152	122	102	-	-
	1kHz	2kHz	3kHz	4kHz	5kHz	6kHz	-
90	183	183	183	180	177	174	-
110	223	223	223	219.3	215.7	212	-
132	264	264	264	250.6	237.2	-	-
160	325	325	325	308.5	292	-	-
185	370	370	370	-	-	-	-
220	425	425	425	-	-	-	-

Capacity (kW)	Rated Current (A)				
	Heavy Duty, Normal PWM				
	1kHz	3kHz	5kHz	8kHz	10kHz
0.4	1.8	1.8	1.8	1.6	1.5
0.75	3.4	3.4	3.4	3.1	2.8
1.5	4.8	4.8	4.8	4.3	4
2.2	5.5	5.5	5.5	4.9	4.6
4	9.2	9.2	9.2	7.9	7.3
5.5	14.8	14.8	14.8	13.5	12.6
7.5	16.5	16.5	16.5	15	14
11	24	24	24	21.2	19.4
15	31	31	31	27.4	25
18.5	39	39	39	35.7	33.5
22	45	45	45	41.2	38.6
30	61	61	54.8	45.4	-
37	75	75	61.5	41.2	-
45	91	91	76.4	54.6	-
55	110	110	89.8	59.6	-
75	152	152	124	82	-
	2kHz	3kHz	4kHz	5kHz	6kHz
90	183	175.4	167.8	-	-
110	223	213.8	204.5	-	-
132	264	249.1	-	-	-
160	325	306.7	-	-	-
185	370	-	-	-	-
220	425	-	-	-	-

Capacity (kW)	Rated Current (A)						
	Normal Duty, Low Leakage PWM						
	1kHz	3kHz	5kHz	8kHz	10kHz	12kHz	15kHz
0.4	2.5	2.5	2.3	2.1	1.9	1.8	1.5
0.75	4.1	4.1	3.8	3.4	3.1	2.9	2.5
1.5	6	6	5.6	5	4.6	4.2	3.6
2.2	8	8	7.5	6.7	6.2	5.7	5
4	12.1	12.1	11.3	10.2	9.4	8.7	7.5
5.5	17.5	17.5	16.8	15.6	14.9	14.2	13.1
7.5	24	24	23	21.5	20.4	19.4	17.9
11	31	31	29.1	26.3	24.5	22.6	19.8
15	38	38	35.7	32.3	30	27.7	24.3
18.5	45	45	42.4	38.4	35.7	33.1	29.1
22	61	61	57.4	52	48.5	44.9	39.5
30	75	75	67.9	57.3	50.2	-	-
37	91	91	80.9	65.8	55.8	45.7	30.6
45	107	107	96.2	80.1	69.3	-	-
55	142	142	122.9	94.1	75	-	-
75	169	169	150.5	122.8	104.4	-	-
	1kHz	2kHz	3kHz	4kHz	5kHz	6kHz	-
90	223	223	213.9	204.8	195.8	186.7	-
110	264	264	253.3	242.5	231.8	221	-
132	325	325	311.2	297.5	283.7	-	-
160	370	370	354.3	338.7	323	-	-
185	432	432	388	-	-	-	-
220	481	481	432	-	-	-	-

Capacity (kW)	Rated Current (A)				
	Normal Duty, Normal PWM				
	2kHz	4kHz	6kHz	8kHz	10kHz
0.4	2.5	2.3	2.1	1.9	1.8
0.75	4.1	3.8	3.5	3.2	2.9
1.5	6	5.6	5.1	4.7	4.2
2.2	8	7.3	6.7	6	5.4
4	12.1	11.1	10.1	9.1	8.1
5.5	17.5	16.4	15.3	14.2	13.1
7.5	24	22.5	21	19.4	17.9
11	31	28.7	26.3	24	21.6
15	38	35.1	32.3	29.4	26.5
18.5	45	42	39	35.9	32.9
22	61	56.9	52.8	48.7	44.6
30	75	65.3	55.5	45.8	-
37	91	75.9	60.8	45.7	-
45	107	90.8	74.7	58.5	-
55	142	113.3	84.6	55.9	-
75	169	140.4	111.9	83.3	-
	2kHz	3kHz	4kHz	-	-
90	223	212.9	202.7	-	-
110	264	252	240	-	-
132	325	308	-	-	-
160	370	350.7	-	-	-
185	432	-	-	-	-
220	481	-	-	-	-

Table 29. Inverter Rated Current Based on the Carrier Frequency (Over 460 V Class)

Capacity (kW)	Rated Current (A)						
	Heavy Duty, Low Leakage PWM						
	1kHz	3kHz	5kHz	8kHz	10kHz	12kHz	15kHz
0.4	1.7	1.7	1.7	1.7	1.6	1.5	1.3
0.8	3.1	3.1	3.1	3.1	2.9	2.7	2.3
1.5	4.4	4.4	4.4	4.4	4.1	3.8	3.3
2.2	5.0	5.0	5.0	5.0	4.7	4.4	3.9
4	8.3	8.3	8.3	8.3	7.8	7.3	6.5
5.5	13.4	13.4	13.4	13.4	12.4	11.5	10.0
7.5	14.9	14.9	14.9	14.9	13.8	12.7	11.1
11	21.6	21.6	21.6	21.6	19.7	17.8	15.0
15	27.9	27.9	27.9	27.9	25.5	23.0	19.4
18.5	35.1	35.1	35.1	35.1	32.8	30.6	27.1
22	40.5	40.5	40.5	40.5	37.9	35.3	31.3
30	54.9	54.9	54.9	49.2	45.4	-	-
37	67.5	67.5	67.5	54.5	45.8	-	-
45	81.9	81.9	81.9	67.9	58.5	-	-
55	99.0	99.0	99.0	79.6	66.6	-	-
75	136.8	136.8	136.8	109.8	91.8	-	-
	1kHz	2kHz	3kHz	4kHz	5kHz	6kHz	-
90	164.7	164.7	164.7	162.0	159.3	156.6	-
110	200.7	200.7	200.7	197.4	194.1	190.8	-
132	237.6	237.6	237.6	225.5	213.5	-	-
160	292.5	292.5	292.5	277.7	262.8	-	-
185	333.0	333.0	333.0	-	-	-	-
220	382.5	382.5	382.5	-	-	-	-

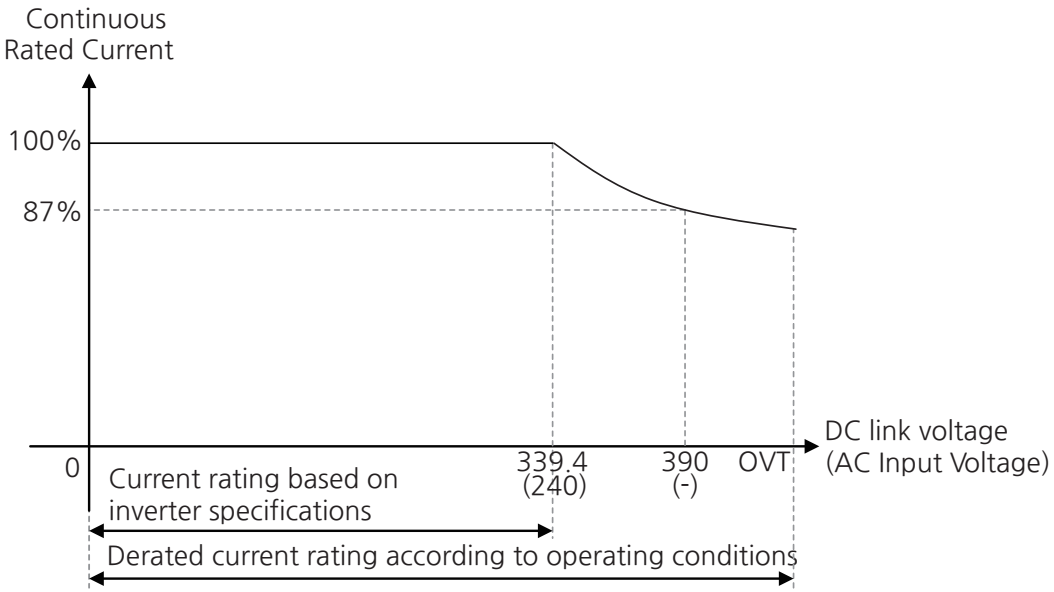
Capacity (kW)	Rated Current (A)				
	Heavy Duty, Normal PWM				
	1kHz	3kHz	5kHz	8kHz	10kHz
0.4	1.7	1.7	1.7	1.5	1.4
0.8	3.1	3.1	3.1	2.8	2.6
1.5	4.4	4.4	4.4	4.0	3.7
2.2	5.0	5.0	5.0	4.5	4.1
4	8.3	8.3	8.3	7.1	6.6
5.5	13.4	13.4	13.4	12.2	11.4
7.5	14.9	14.9	14.9	13.5	12.6
11	21.6	21.6	21.6	19.1	17.4
15	27.9	27.9	27.9	24.7	22.5
18.5	35.1	35.1	35.1	32.1	30.1
22	40.5	40.5	40.5	37.0	34.7
30	54.9	54.9	49.3	40.9	-
37	67.5	67.5	55.3	37.1	-
45	81.9	81.9	68.8	49.1	-
55	99.0	99.0	80.9	53.6	-
75	136.8	136.8	111.6	73.8	-
	2kHz	3kHz	4kHz	-	-
90	164.7	157.9	151.0	-	-
110	200.7	192.4	184.1	-	-
132	237.6	224.2	-	-	-
160	292.5	276.0	-	-	-
185	333.0	-	-	-	-
220	382.5	-	-	-	-

Capacity (kW)	Rated Current (A)						
	Normal Duty, Low Leakage PWM						
	1kHz	3kHz	5kHz	8kHz	10kHz	12kHz	15kHz
0.4	2.3	2.3	2.1	1.9	1.8	1.6	1.4
0.8	3.7	3.7	3.5	3.1	2.8	2.6	2.2
1.5	5.4	5.4	5.0	4.5	4.1	3.8	3.2
2.2	7.6	7.6	7.1	6.4	5.9	5.4	4.7
4	11.0	11.0	10.3	9.3	8.6	7.9	6.8
5.5	15.8	15.8	15.1	14.1	13.5	12.8	11.8
7.5	21.6	21.6	20.7	19.3	18.4	17.5	16.1
11	27.9	27.9	26.2	23.7	22.0	20.4	17.8
15	34.2	34.2	32.1	29.1	27.0	25.0	21.9
18.5	40.5	40.5	38.1	34.6	32.2	29.8	26.2
22	54.9	54.9	51.7	46.8	43.6	40.4	35.6
30	67.5	67.5	61.1	51.6	45.2	-	-
37	81.9	81.9	72.8	59.3	50.2	-	-
45	96.3	96.3	86.6	72.1	62.4	-	-
55	127.8	127.8	110.6	84.7	67.5	-	-
75	156.0	156.0	139.0	113.4	96.3	-	-
	1kHz	2kHz	3kHz	4kHz	5kHz	6kHz	-
90	200.7	200.7	192.5	184.4	176.2	168.0	-
110	237.6	237.6	227.9	218.3	208.6	198.9	-
132	292.5	292.5	280.1	267.7	255.3	-	-
160	333.0	333.0	318.9	304.8	290.7	-	-
185	388.8	388.8	349.2	-	-	-	-
220	432.9	432.9	388.8	-	-	-	-

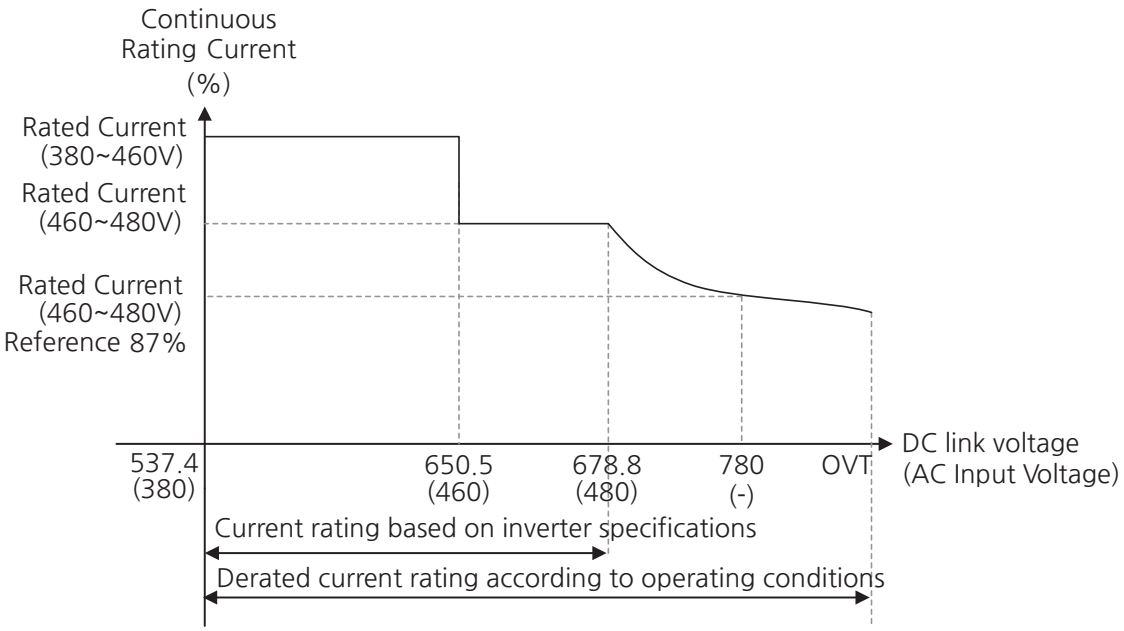
Capacity (kW)	Rated Current (A)				
	Normal Duty, Normal PWM				
	2kHz	4kHz	6kHz	8kHz	10kHz
0.4	2.3	2.1	2.0	1.8	1.6
0.8	3.7	3.4	3.1	2.9	2.6
1.5	5.4	5.0	4.6	4.2	3.8
2.2	7.6	7.0	6.3	5.7	5.1
4	11.0	10.1	9.2	8.3	7.4
5.5	15.8	14.8	13.8	12.8	11.8
7.5	21.6	20.2	18.9	17.5	16.1
11	27.9	25.8	23.7	21.6	19.5
15	34.2	31.6	29.0	26.4	23.9
18.5	40.5	37.8	35.1	32.3	29.6
22	54.9	51.2	47.5	43.8	40.1
30	67.5	58.7	50.0	41.2	-
37	81.9	68.3	54.7	41.1	-
45	96.3	81.8	67.2	52.7	-
55	127.8	102.0	76.1	50.3	-
75	156.0	129.6	103.3	76.9	-
	2kHz	3kHz	4kHz	-	-
90	200.7	191.6	182.5	-	-
110	237.6	226.8	216.0	-	-
132	292.5	277.2	-	-	-
160	333.0	315.6	-	-	-
185	388.8	-	-	-	-
220	432.9	-	-	-	-

16.7.1.1 The Continuous Rated Current Derating Based on Input Voltage

The continuous rated current of the inverter is limited based on the input voltage. Refer to the following graph.



[Image 28. The Continuous Rated Current Derating Ratio Based on Input Voltage (200 V Class)]



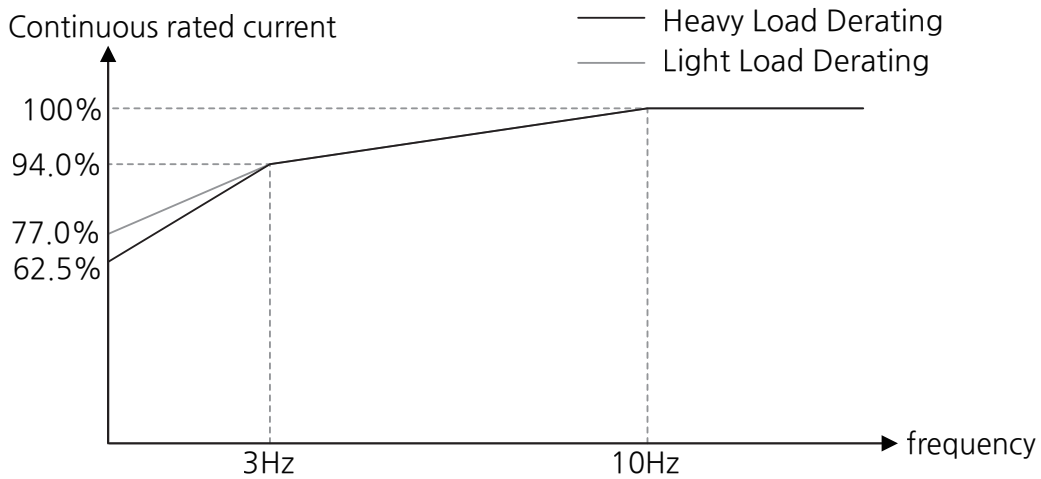
[Image 29. The Continuous Rated Current Derating Ratio Based on Input Voltage (400 V Class)]

16.7.1.2 The Continuous Rated Current Derating Based on Operating Frequency

The following table shows the maximum value of the carrier frequency that guarantees 100% of the rated current. The continuous rated current of the inverter is limited based on the operating frequency if it is operated with the carrier frequency that exceeds this value. Refer to the following graph.

Table 30. Maximum value of the carrier frequency (Guarantees 100% of the rated current)

	Inverter Capacity (kW)	Normal Duty (kHz) Low Leakage / Normal	Heavy Duty (kHz) Low Leakage / Normal
200 V Type	0.4~22	3/2	8/5
	30~45	3/2	5/3
	55~75	2	4
400 V Type	0.4~30	3/2	8/5
	37~75	3/2	5/3
	90~220	2	3/2

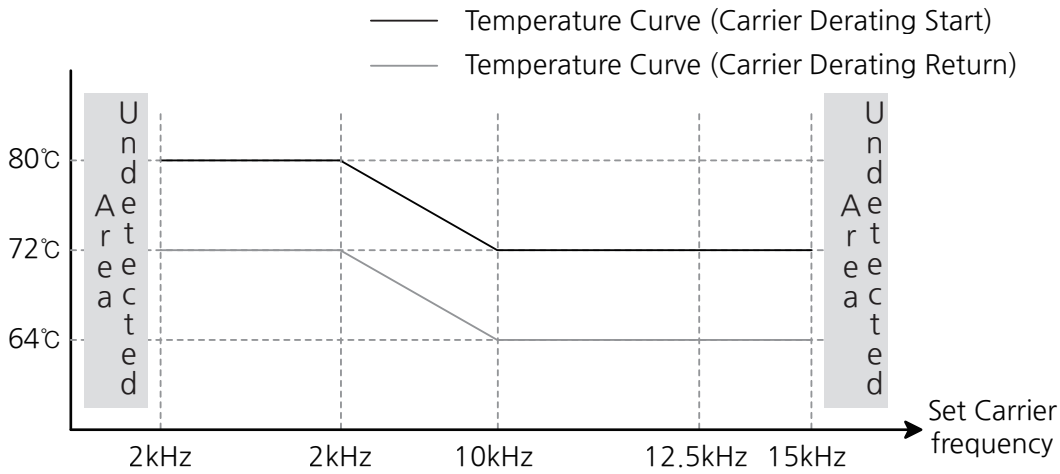


[Image 30. The Derating Ratio of Continuous Rated Current Based on the Operating Frequency]

16.7.2 Carrier Frequency Derating

16.7.2.1 Carrier Frequency Derating Based on the Power Unit Temperature

The carrier frequency may change according to the power unit temperature. This is to prevent burning the inverter from the temperature increase in the power unit. It reduces the switching loss and suppresses temperature increase. The example of operation conditions is as follows:

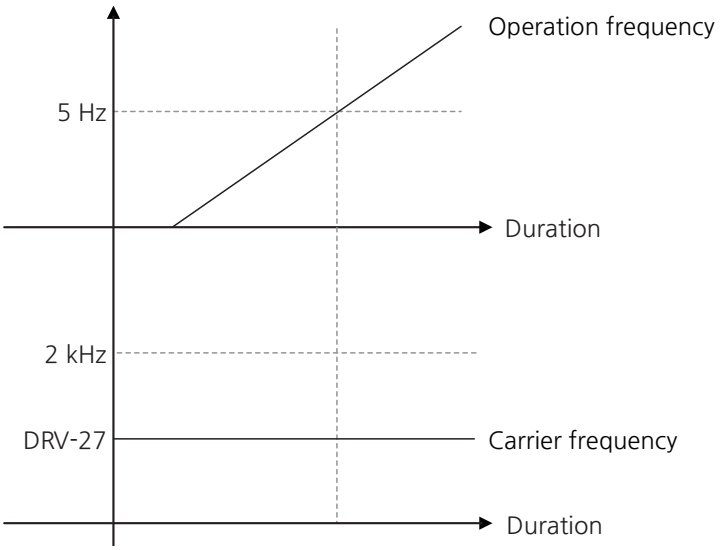


[Image 31. Carrier Frequency Derating Ratio Based on the Power Unit Temperature]

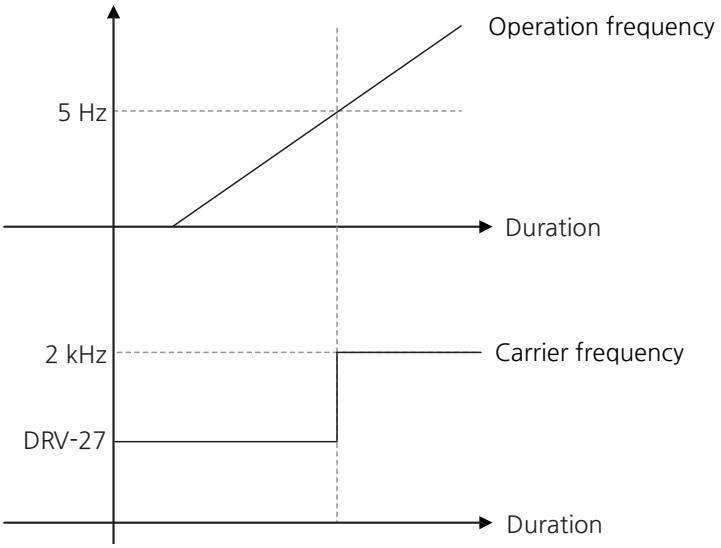
When the power unit temperature in the inverter goes above the reference temperature curve of the start of carrier derating during inverter operation, the carrier frequency will be changed to 2 kHz regardless of inverter capacity or control mode. If the power unite temperature in the inverter goes below the reference temperature for the carrier derating return while keeping operating in the changed carrier frequency, the carrier frequency will increase or decrease according to the power unit temperature. The carrier frequency cannot be lower than 2 kHz, and the carrier frequency derating will end when it reaches the setting value at DRV-27 (Carrier Frequency). Afterwards, if the power unit temperature in the inverter goes above the reference temperature curve of the carrier derating again, the former process will be iterated.

16.7.2.2 Carrier Frequency Derating Based on Operating Frequency

The carrier frequency may change according to the operating frequency. When the operating frequency is under 5 Hz, the carrier frequency will be changed to 2 kHz (derating carrier frequency), and when the operating frequency is 5 Hz or higher, the carrier frequency will be changed to the setting value at DRV-27 (Carrier Frequency). However, when the setting value at DRV-27 (Carrier Frequency) is lower than 2 kHz, the carrier frequency will not be changed.



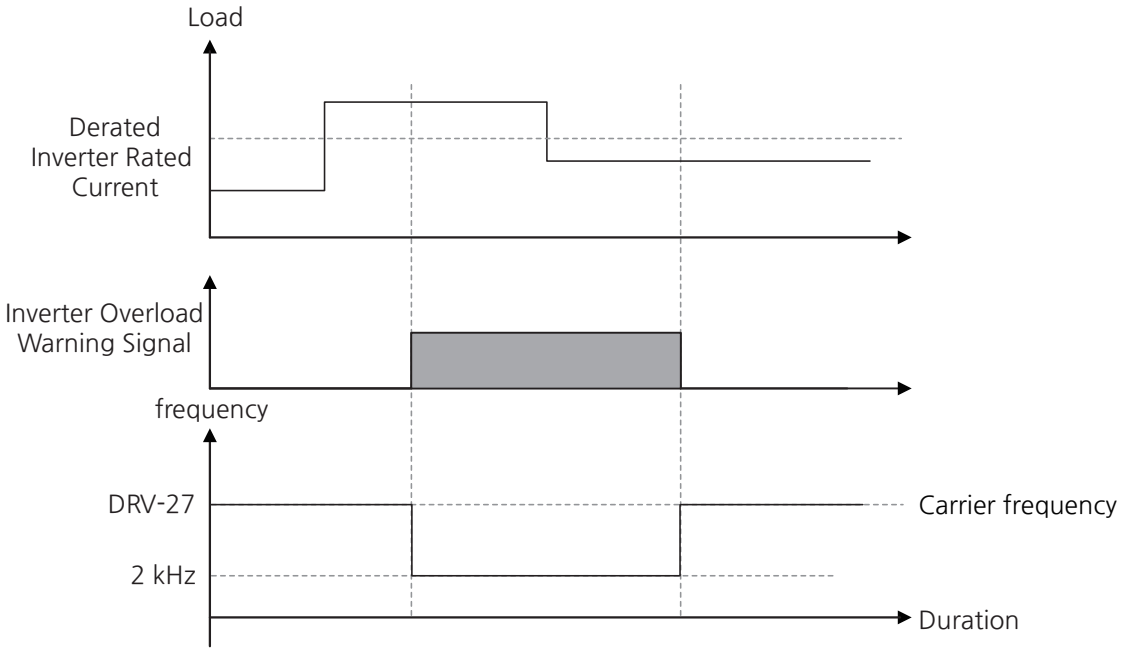
[Image 32. Carrier Frequency Derating Based on the Operating Frequency (Lower than 2 kHz)]



[Image 33. Carrier Frequency Derating Based on the Operating Frequency (Higher than 2 kHz)]

16.7.2.3 Carrier Frequency Derating Based on the Inverter Load

The carrier frequency may change according to the inverter load. When the inverter load is too high and causes a overload warning, the carrier frequency will be changed to 2 kHz (derating carrier frequency), and when the overload warning is lifted, the carrier frequency will be changed to the setting value at DRV-27 (Carrier Frequency). However, when the setting value at DRV-27 (Carrier Frequency) is lower than 2 kHz, the carrier frequency will not be changed.



[Image 34. Carrier Frequency Derating Based on the Load Volume]

16.8 Parameter Default Values Based on the Motor Capacity

16.8.1 200 V Class Motor

Table 31. Parameter Default Values Based on the Motor Capacity (200 V class)

Motor Output (kW)	Efficiency (%)	Rated Current (A)	No-Load Current (A)	Rated Speed (rpm)	Rs (mΩ)	Lsigma (uH)	Ls (uH)	Tr (ms)	Acceleration Time (sec)	Deceleration Time (sec)	Torque Boost (%)
0.2	64	1.1	0.8	1700	14000.0	40400	385000	93	20	30	20
0.4	70	2.4	1.4	1700	6700.0	26900	206000	116	20	30	20
0.7	74	3.4	1.7	1710	2600.0	17940	174400	145	20	30	20
1.5	80	6.4	2.6	1720	1170.0	9290	115800	162	20	30	20
2.2	82	8.6	3.3	1730	840.0	6630	90700	183	20	30	20
3.7	84	13.8	5.0	1730	500.0	4480	59700	211	20	30	20
5.5	85	21.0	7.1	1755	314.0	3190	41500	250	20	30	20
7.5	87	28.2	9.3	1760	169.0	2844	31860	271	20	30	20
11	88	40.0	12.4	1770	120.0	1488	23910	310	20	30	20
15	89	53.6	15.5	1770	84.0	1118	19070	350	20	30	20
18.5	89	65.6	19.0	1770	67.6	819	15590	390	20	30	20
22	90	76.8	21.5	1770	56.0	948	13790	435	20	30	20
30	90	104.6	29.3	1770	42.2	711	10120	530	20	30	20
37	91	128.6	34.7	1770	33.8	568	8540	600	20	30	20
45	91	156.0	42.1	1770	28.1	474	7040	630	20	30	20
55	92	184.1	49.7	1770	23.1	389	5960	670	20	30	20
75	92	244.5	61.1	1770	16.9	284	4850	800	20	30	20
90	93	289.5	72.3	1770	14.0	250	4090	900	60	90	10
110	93	351.5	84.3	1770	13.8	232	3510	1000	60	90	10
132	93	418.5	100.4	1770	11.5	193	2950	1100	60	90	10
160	93	501.8	120.4	1770	9.5	159	2460	1200	60	90	10
185	93	578.0	132.9	1770	9.0	150	2230	1250	60	90	10
220	93	690.0	158.7	1770	6.9	116	1860	1350	60	90	10
280	93	878.4	193.2	1770	5.4	91	1530	1400	60	90	10
315	93	988.3	217.4	1770	4.8	81	1360	1430	60	90	10
375	93	1176.7	247.1	1770	4.0	68	1190	1470	60	90	10
450	93	1412.2	296.5	1770	3.3	57	990	1520	60	90	10

16.8.2 400V Class Motor

Table 32. Parameter Default Values Based on the Motor Capacity (400 V class)

Motor Output (kW)	Efficiency (%)	Rated Current (A)	No-Load Current (A)	Rated Speed (rpm)	Rs (mΩ)	Lsigma (uH)	Ls (uH)	Tr (ms)	Acceleration Time (sec)	Deceleration Time (sec)	Torque Boost (%)
0.2	64	0.7	0.5	1700	28000.0	121200	1045000	93	20	30	20
0.4	70	1.4	0.8	1700	14000.0	80800	610000	116	20	30	20
0.75	74	2.0	1.0	1710	7810.0	53900	512000	145	20	30	20
1.5	80	3.7	1.5	1720	3520.0	27900	346000	162	20	30	20
2.2	82	5.0	1.9	1730	2520.0	19950	269500	183	20	30	20
3.7	84	8.0	2.9	1730	1500.0	13450	177800	211	20	30	20
5.5	85	12.1	4.1	1755	940.0	9620	124500	250	20	30	20
7.5	87	16.3	5.4	1760	520.0	8530	95200	271	20	30	20
11	88	23.2	7.2	1770	360.0	4480	71200	310	20	30	20
15	89	31.0	9.0	1770	250.0	3380	57000	350	20	30	20
18.5	89	38.0	11.0	1770	168.0	2457	46470	390	20	30	20
22	90	44.5	12.5	1770	168.0	2844	41100	435	20	30	20
30	90	60.5	16.9	1770	126.6	2133	30230	530	20	30	20
37	91	74.4	20.1	1770	101.4	1704	25490	600	20	30	20
45	91	90.3	24.4	1770	84.3	1422	21010	630	20	30	20
55	92	106.6	28.8	1770	69.3	1167	17790	670	20	30	20
75	92	141.6	35.4	1770	50.7	852	14460	800	20	30	20
90	93	167.6	41.9	1770	39.9	715	12220	900	60	90	10
110	93	203.5	48.8	1770	32.6	585	10480	1000	60	90	10
132	93	242.3	58.1	1770	27.2	488	8800	1100	60	90	10
160	93	290.5	69.7	1770	22.4	403	7340	1200	60	90	10
185	93	335.0	77.0	1770	21.0	380	6640	1250	60	90	10
220	93	405.0	93.1	1770	16.3	293	5497	1350	60	90	10
280	93	530.7	116.7	1770	12.8	230	4386	1400	60	90	10
315	93	604.0	132.8	1770	11.4	204	3854	1430	60	90	10
375	93	729.7	153.2	1770	9.6	171	3342	1470	60	90	10
450	93	886.8	177.2	1770	8.0	143	2749	1520	60	90	10

16.9 Safe Torque Off (STO) Function

S300 series inverter offers a safety torque off (STO) function. In case of emergency, the inverter output can be immediately cut off to protect the users and prevent potential hazards. This manual provides only a basic overview of the safety functions. For more information, refer to the safety manual on the website (https://www.ls-electric.com).

16.9.1 Safety Standards

The safety torque off function of the S300 series complies with the following European directives and standards.

- European Machinery Directive 2006/42/EC
- EN 61800-5-2:2017 SIL2
- EN ISO 13849-1:2023 Category 3, PL d
- EN 61508:2010 SIL2

⚠ Caution

Use caution when utilizing safety functions, verify that the system's risk factors are identified and safety requirements are satisfied.

Note

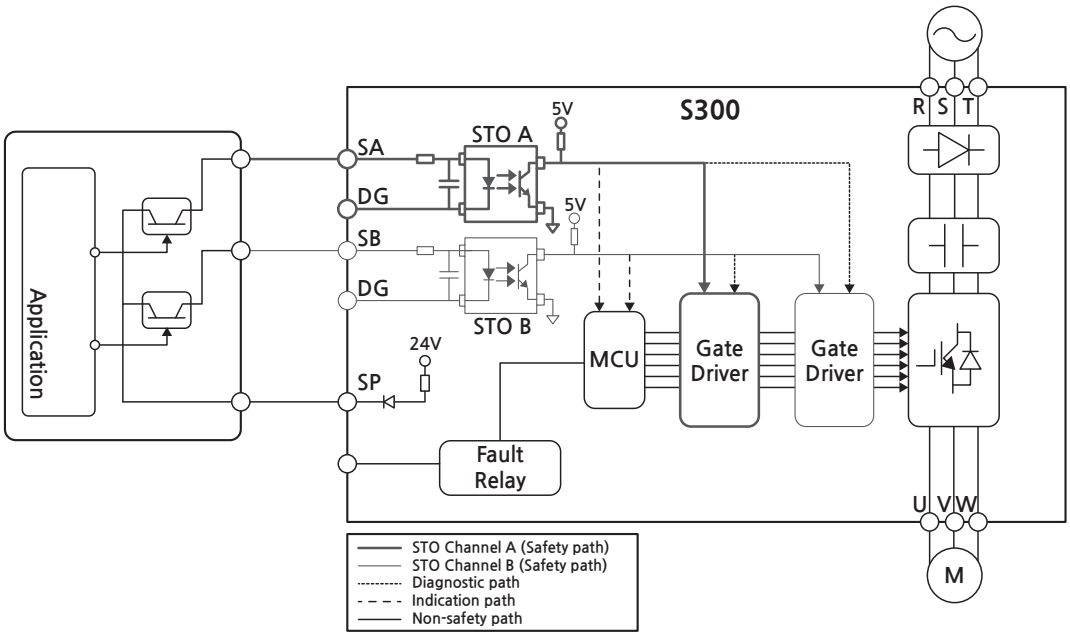
- When wiring or performing maintenance on the inverter, ensure that the power to the inverter is turned off.
- Safety functions are not designed to electrically isolate the inverter.

16.9.2 Safety Functions Description

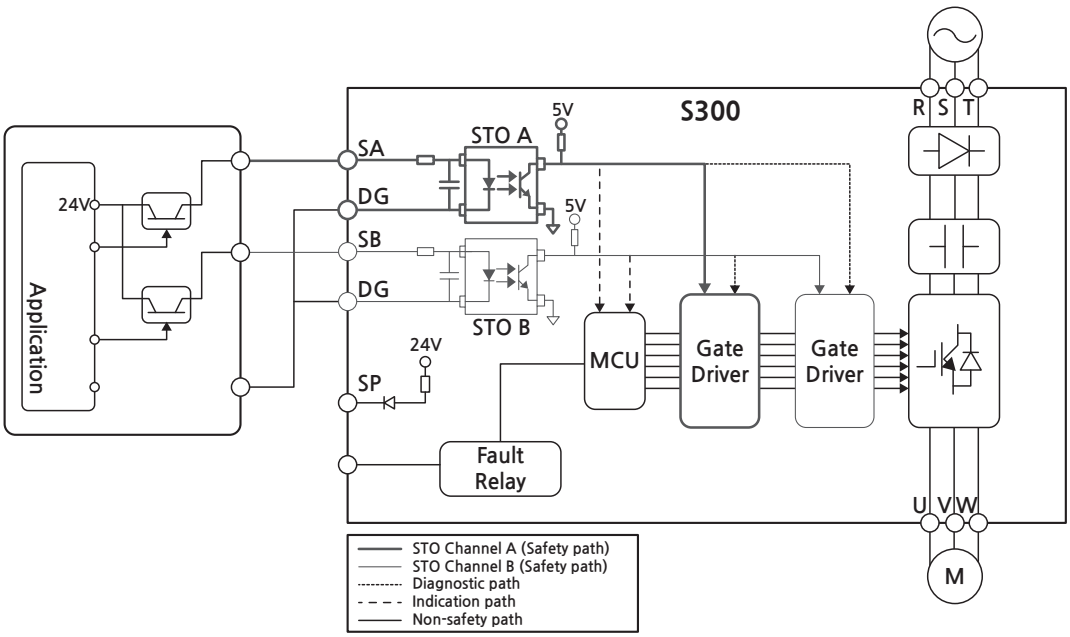
The STO function offered by the S300 inverter consists of two independent channels (SA, SB). If either channel is activated during operation, it interrupts the motor drive gate signals, cutting off power to the motor. When motor power is interrupted, torque output ceases, and the motor transitions to a free-run state. Depending on the active channel, the keypad will display either the **STO Feedback A** or **STO Feedback B** trip message.

The STO function can be activated by removing the safety connector from the SA, SB, and SP terminals on the control board. The inverter operates normally when SA and SB are connected to SP, and disconnecting the SA and SB from SP activates the STO function. To deactivate the safety function after activation, reconnect SA and SB to the SP using the safety connector and press the STOP/RESET key.

16.9.3 Safety Operation Diagram



[Image 35. Safety Operation Diagram (When using internal DC 24 V power)]



[Image 36. Safety Operation Diagram (When using external DC 24 V power)]

Product Warranty

Warranty Period

The warranty period for the purchased product is 24 months from the date of manufacture.

Warranty Coverage

1. The initial fault diagnosis should be conducted by the customer as a general principle. However, upon request, we or our service network can carry out this task for a fee. If the fault is found to be our responsibility, the service will be free of charge.
2. The warranty applies only when our products are used under normal conditions as specified in the handling instructions, user manual, catalog, and caution labels.
3. Even within the warranty period, the following cases will be subject to chargeable repairs:
   1) Replacement of consumables or lifespan parts (relays, fuses, electrolytic capacitors, batteries, fans, etc.)
   2) Failures or damage due to improper storage, handling, negligence, or accidents by the customer
   3) Failures due to the hardware or software design of the customer
   4) Failures due to modifications of the product without our consent (repairs or modifications recognized as done by others will also be refused, even if paid)
   5) Failures that could have been avoided if the customer's device, which incorporates our product, had been equipped with safety devices required by legal regulations or common industry practices.
   6) Failures that could have been prevented through proper maintenance and regular replacement of consumable parts as per the handling instructions and user manual
   7) Failures and damage caused by the use of inappropriate consumables or connected equipment
   8) Failures due to external factors, such as fire, abnormal voltage, and natural disasters like earthquakes, lightning, salt damage, and typhoons
   9) Failures due to reasons that could not have been foreseen with the scientific and technological standards at the time of our product shipment
   10) Other cases where the responsibility for failure, damage, or defect is acknowledged to lie with the customer

EC DECLARATION OF CONFORMITY

We, the undersigned,

Representative:	**LS ELECTRIC Co., Ltd.**
Address:	**LS Tower, 127, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea**
Manufacturer:	**LS ELECTRIC Co., Ltd.**
Address:	**56, Samseong 4-gil, Mokcheon-eup, Dongnam-gu, Cheonan-si, Chungcheongnam-do, Korea**

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

Type of Equipment:	**Inverter (Power Conversion Equipment)**
Model Name:	**LSLV-S300 series**
Trade Mark:	**LS ELECTRIC Co.,Ltd.**

This declaration of conformity is under the sole responsibility of the manufacturer.

Conforms to the essential requirements of the directives:

2014/30/EU Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to electromagnetic compatibility.

2014/35/EU Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.

2011/65/EU Directive on the restriction of the use certain of certain Hazardous Substances in electrical and electronic equipment –RoHs.-

Based on the following specifications applied:

EN IEC 61800-3:2018
EN 61800-5-1:2007+A1:2017+ A11:2021
EN IEC 63000:2018

and therefore, complies with the essential requirements and provisions of the 2014/30/EU, 2014/35/EU and 2011/65/EU Directives.

Place: **Cheonan, Chungnam,**
Korea

박 창 근 2024. 5. 13 (Signature, Date)

Mr. PARK CHANGKEUN / Manager

UL mark



The UL mark applies to products in the United States and Canada. This mark indicates that UL has tested and evaluated the products and determined that the products satisfy the UL standards for product safety. If a product received UL certification, this means that all components inside the product had been certified for UL standards as well.

Suitable for Installation in a compartment Handing Conditioned Air

CE mark



The CE mark indicates that the products carrying this mark comply with European safety and environmental regulations. European standards include the Machinery Directive for machine manufacturers, the Low Voltage Directive for electronics manufacturers and the EMC guidelines for safe noise control.

Low Voltage Directive

We have confirmed that our products comply with the Low Voltage Directive (EN 61800-5-1).

EMC Directive

The Directive defines the requirements for immunity and emissions of electrical equipment used within the European Union. The EMC product standard (EN 61800-3) covers requirements stated for drives.

EAC mark



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

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

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

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

Manual Revision History

Revision History

No.	Date	Version	Changes
1	2023/07/07	1.0	First Issue
2	2024/07/04	1.1	Macro Setting/Winder Operation added
3	2024/07/25	1.2	Input Rating Updated
4	2024/09/20	1.3	Output Rating and Current Derating Updated
5	2025/01/23	1.4	STO Function Added
6	2025/10/16	1.5	Fan Trip Mode Initial Value Updated
7	2026/01/20	1.6	Anti-sway Function Added
8	2026/08/06	1.7	Non-DCR Information Added
9	2026/09/03	1.8	400 V Class 30kW Current Derating Updated

FUTURING SMART ENERGY

We open up a brighter future through
efficient and convenient energy solutions.

Safety Instructions

- For your safety, please read user's manual thoroughly before operating.
- Contact the nearest authorized service facility for examination, repair, or adjustment.
- Please contact qualified service technician when you need maintenance.
  Do not disassemble or repair by yourself!
- Any maintenance and inspection shall be performed by the personnel having expertise concerned.

- According to The WEEE Directive, please do not discard the device with your household waste.

LS ELECTRIC

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10310001873

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2026. 09 | Specifications in this catalog are subject to change without notice due to continuous product development and improvement.

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