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# **AC Variable Speed Drive**

SV-iS7 series

**User's Manual** 

0.75-75kW[200V] 0.75-375kW[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,



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- SV-iS7 is the official name for the iS7 series inverters.
- This operation manual is intended for users with basic knowledge of electricity and electric devices.
- Keep this manual near the product for future reference whenever setting change, maintenance or service is required.
- Ensure that the field operators and service engineers can easily access this manual.
- For detailed information about the optional extension boards, including the specifications and the requirements for installation and operation, refer to the instruction manuals that are supplied with the products.

## **Safety Information**

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

### Safety symbols in this manual

## **▲** Danger

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

## **⚠** Warning

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

### ① Caution

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

## Safety information

## **▲** Danger

- Do not open the cover of the equipment while it is on or operating. Likewise, do not operate the
  inverter while the cover is open. Exposure of the high voltage terminals or the charging area to
  the external environment may result in an electric shock. Do not remove any covers or touch
  the internal circuit boards (PCBs) or electrical contacts on the product when the power is on or
  during operation. Doing so may result in serious injury, death, or serious property damage.
- Do not open the cover of the equipment, even when the power supply to the inverter has been turned off, unless it is necessary for maintenance or regular inspection. Opening the cover may result in an electric shock even when the power supply is off.
- The equipment may hold a charge long after the power supply has been turned off. Use a multi-meter to make sure that the remaining voltage is below 30 VDC before working on the inverter, motor, or motor cable.

## 

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

### ① Caution

- Do not modify the interior workings of the inverter. Doing so will void the warranty.
- Do not use cables with damages or cracks on the protective insulation when wiring the inverter. Damaged insulation may cause misoperation, an electric shock or a fire.
- Do not place heavy objects on top of electric cables. Doing so may damage the cable and result in an electric shock.

### Note

#### [English]

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

#### [French]

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. L'entraînement convient pour une utilisation dans un circuit capable de délivrer pas plus de 100 kA RMS à la tension nominale maximale de l'entraînement. 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		65/10	0/150kA	
480V(50/60Hz)	) 25/35kA 35/65/100kA 35/65/100kA		35/65	/100kA			
Working Voltage	ABS33c	ABS53c	ABS63c	ABS1	103c	ABS203c	ABS403c
240V(50/60Hz)	30kA	35kA	35kA	85kA		85kA	75kA
480V(50/60Hz)	7.5kA	10kA	10kA	26kA	`	26kA	35kA

## **About This Manual**

This operation manual describes the specifications of the SV-iS7 series inverters and provides detailed information required for the installation, operation, and maintenance of the products.

This operation manual is intended for users with a basic knowledge of electricity and electric devices. Read this manual carefully to install, operate, and maintain the products safely and properly.

The following table lists the chapters in this manual, and brief descriptions of the information provided:

Chapter	Chapter name	Information provided
1	About the Product	Basic information about the product that is required for safe installation and operation
2	Technical Specifications	Product ratings and I/O types
3	Installing the Inverter	Information required for the installation of the product, including considerations for installation locations and operation environment
4	Connecting the Cables	Information required for connecting power supply and signal cables
5	Peripheral Devices	Information about the peripheral devices that can be connected to the input and output terminals of the product
6	Using the Keypad	Information about the keypad display and the operation keys on the keypad
7	Basic Functions	Information about configuring the inverter to run the basic functions
8	Learning Advanced Features	Information about configuring the inverter for advanced system application
9	Using Monitor Functions	Information about monitoring the inverter for operation statuses and trip conditions
10	Using Protection Features	Information about the functions to protect the motor and the inverter
11	Communication Function	Specifications for the RS-485 network communication between inverters and other devices
12	Troubleshooting and Maintenance	Information about identifying the failures and anomalies during operation and resolving them
13	Table of Functions	Table of all functions with brief descriptions
14	Functional Safety	Information about the products compliant with the safety standards, and the safety functions
15	Classified Product	Information about the products approved for marine application
16	Using a Single Phase Power Source	Considerations for operating the inverter with a single phase power source

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## 1 About the Product

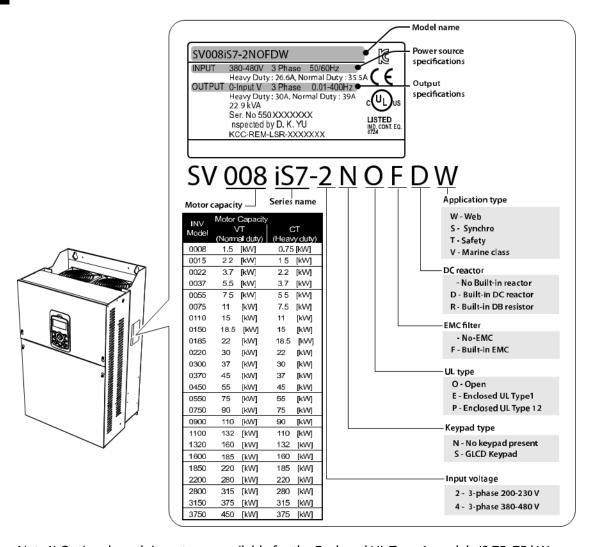
This chapter provides details on product identification and part names. To install the inverter correctly and safely, carefully read and follow the instructions.

## 1.1 Preparing for Installation and Operation

## 1.1.1 Identifying the Product

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

The iS7 inverter is manufactured in a range of product groups based on drive capacity and power source specifications. The product name and specifications are detailed on the rating plate. Check the rating plate before installing the product and make sure that the product meets your requirements.



Note1) Optional conduit parts are available for the Enclosed UL Type 1 models (0.75–75 kW products).

Note2) Optional built-in DCR is available for the Web application models (0.75-375 kW / type 2/4 products).

Note3) To use safety function, please buy 0.75-160kW product including safety option. However 185-375kW product users have to buy safety option and apply to standard products because safety option is not included.

#### Note

The iS7 75/90 kW, 400 V inverters satisfy the EMC standard EN61800-3 without the installation of optional EMC filters.

## 1.1.2 Checking the Product for Defects or Damage

If you suspect that the product has been mishandled or damaged in any way, contact the LS ELECTRIC Customer Support center with the phone numbers listed on the back cover of this manual.

## 1.1.3 Preparing the Product for Installation and Operation

Preparation steps for installation and operation may slightly vary by product type and application. Refer to the manual and prepare the product accordingly.

## 1.1.4 Installing the Product

Refer to the installation section of this manual and install the product correctly considering the installation and operating conditions at the installation location, such as installation clearances, to prevent premature deterioration or performance loss.

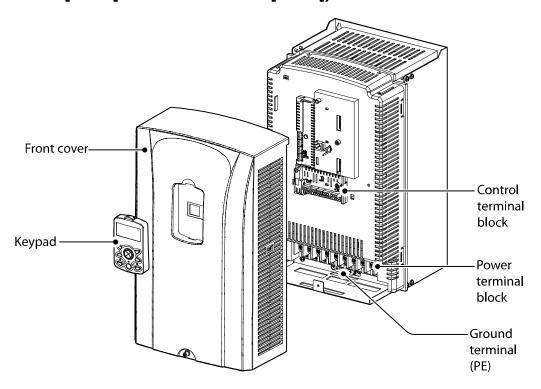
## 1.1.5 Connecting the Cables

Connect the power input/output and signal cables to the terminal block according to the instructions provided in this manual. Ensure that all the cables are connected correctly before supplying power to the product. Incorrect cable connections may damage the product.

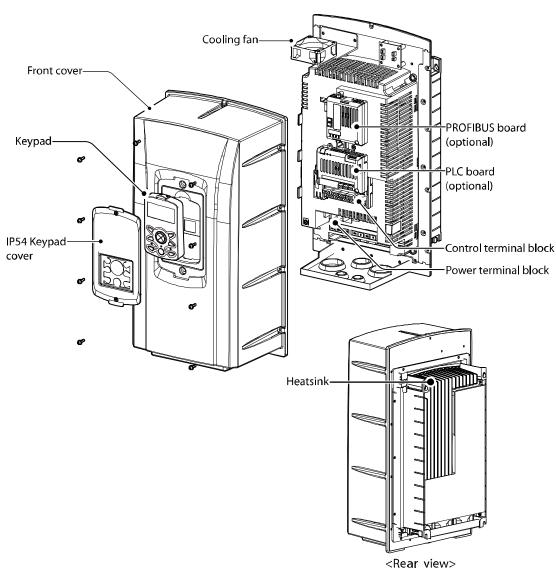
## 1.2 Part Names

The illustration below displays part names. Details may vary between product groups.

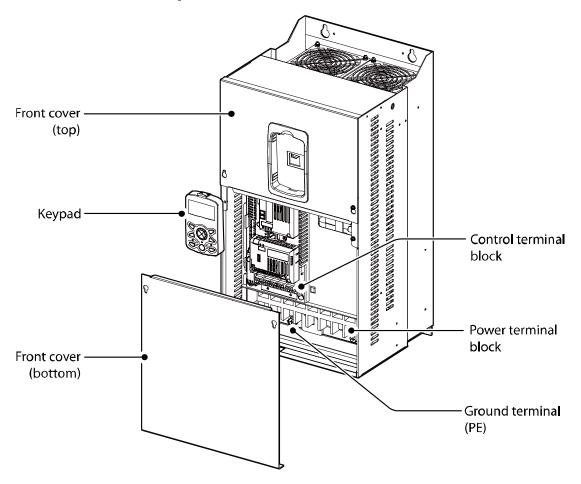
# 1.2.1 Interior and Exterior View (IP 21 Model Types Less than 22 kW [200 V] / Less than 75 kW [400 V])



## 1.2.2 Interior and Exterior View (IP 54 Model Types Less than 22 kW [200/400 V])



# 1.2.3 Interior and Exterior View (Model Types 30 kW and up [200 V] / 90 kW and up [400 V])



### Note

Refer to the installation manual provided with the optional module products before installing communication modules in the inverter.

# **2 Technical Specifications**

### 2.1 Input and Output Specifications 200 V Class (0.75– 22 kW)

Model SV	xxx iS7-2x		0008	0015	0022	0037	0055	0075	0110	0150	0185	0220	
	Normallas	HP	2	3	5	7.5	10	15	20	25	30	40	
Applied	Applied Normal load	kW	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	
Motor	Homedone	HP	1	2	3	5	7.5	10	15	20	25	30	
	Heavy load	kW	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	
	Rated Capa	acity (kVA)	1.9	3.0	4.5	6.1	9.1	12.2	17.5	22.9	28.2	33.5	
	Rated Normal load		8	12	16	24	32	46	60	74	88	124	
(A)	Heavy load	5	8	12	16	24	32	46	60	74	88		
	Output Fre	quency	0–400 Hz)	0–400 Hz (Sensorless-1: 0–300 Hz, Sensorless-2, Vector: 0.1–120 Hz)									
	Output Vol	tage (V)	3-Phase 200–230 V										
	Working Vo	oltage (V)	3-Pha	se 200	-230 V	AC (-15	%-+10 <sup>9</sup>	%)					
	Input Freq	uency	50-60	Hz (±5	5%)								
Rated input Rated Currer (A)		Normal load	6.8	10.6	14.9	21.3	28.6	41.2	54.7	69.7	82.9	116.1	
		Heavy load	4.3	6.9	11.2	14.9	22.1	28.6	44.3	55.9	70.8	85.3	

- Only the heavy duty ratings apply to model types without a built-in DC resistor (NON-DCR).
- The standard used for 200 V inverters is based on a 220 V supply voltage.
- The rated output current is limited based on the carrier frequency set at CON-04.
- The output frequency is limited to 0-300 Hz if DRV-09 (control mode) is set to "3 (Sensorless-1)," and to 0-120 Hz if DRV-09 (control mode) is set to "4 (Sensorless-3)."
- The maximum output voltage cannot exceed the input voltage of the power source.

# 2.2 Input and Output Specifications 200 V Class (30–75 kW)

Model SV	Model SV xxx iS7-2x		0300	0370	0450	0550	0750					
	Normalloa	d HP	50	60	75	100	125					
Applied	Normal load	kW	37	45	55	75	90					
Motor	Heavy load	HP	40	50	60	75	100					
	пеачу юай	kW	30	37	45	55	75					
	Rated Capa	city (kVA)	46	57	69	84	116					
	Rated Current	Normal load	146	180	220	288	345					
Rated output	(A)	Heavy load	116	146	180	220	288					
	Output Fre	quency	0-400 Hz)	0–400 Hz (Sensorless-1: 0–300 Hz, Sensorless-2, Vector: 0.1–120 Hz)								20
	Output Vol	tage (V)	3-Pha	3-Phase 200–230 V								
	Working Vo	oltage (V)	3-Pha	se 200-:	230 VA	C (-15%–	+10%)					
	Input Frequ	uency	50-60	Hz (±5%	%)							
Rated input	Rated	Normal load	152	190	231	302	362					
	Current (A)	Heavy load	121	154	191	233	305					

- The standard motor capacity is based on a standard 4-pole motor.
- The standard used for 200 V inverters is based on a 200 V supply voltage.
- The rated output current is limited based on the carrier frequency set at CON-04.
- The output frequency is limited to 0-300 Hz if DRV-09 (control mode) is set to "3 (Sensorless-1)," and to 0-120 Hz if DRV-09 (control mode) is set to "4 (Sensorless-3)."
- The maximum output voltage cannot exceed the input voltage of the power source.

# 2.3 Input and Output Specifications 400 V Class (0.75–22 kW)

Model SV xxx iS7-2x		8000	0015	0022	0037	0055	0075	0110	0150	0185	0220		
	Normallo	H	Р	2	3	5	7.5	10	15	20	25	30	40
Applied	Normal load kW		Ν	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30
Motor	Howarload	, Н	Р	1	2	3	5	7.5	10	15	20	25	30
	Heavy load	kV	Ν	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
	Rated Capa (kVA)	acity		1.9	3.0	4.5	6.1	9.1	12.2	18.3	22.9	29.7	34.3
Rated	Rated load	Norn load	mal	4	6	8	12	16	24	30	39	45	61
output		Heav load	/y	2.5	4	6	8	12	16	24	30	39	45
	Output Fre	quenc	Су	0–400 Hz (Sensorless-1: 0–300Hz, Sensorless-2, Vector: 0.1–120Hz)									
	Output Vol	tage (\	V)	3-Phase 380–480 V									
	Working V	oltage	(V)	3-Pha	se 380	-480 V	AC (-15	%-+109	%)				
	Input Freq	uency		50-60	Hz (±5	5%)							
Rated input Rated Current (A)	Norn load	nal	3.7	5.7	7.7	11.1	14.7	21.9	26.4	35.5	41.1	55.7	
	Heav load	/y	2.2	3.6	5.5	7.5	11.0	14.4	22.0	26.6	35.6	41.6	

- Only the heavy duty ratings apply to model types without a built-in DC resistor (NON- DCR).
- The standard motor capacity is based on a standard 4-pole motor.
- The standard used for 400 V inverters is based on a 440 V supply voltage.
- The rated output current is limited based on the carrier frequency set at CON-04.
- The output frequency is limited to 0-300 Hz if DRV-09 (control mode) is set to "3 (Sensorless-1)," and to 0-120 Hz if DRV-09 (control mode) is set to "4 (Sensorless-3)."
- The maximum output voltage cannot exceed the input voltage of the power source.

# 2.4 Input and Output Specifications 400 V Class (30–160 kW)

Model SV	xxx iS7-2x		0300	0370	0450	0550	0750	0900	1100	1320	1600	
	Normal loa	HP	50	60	75	100	125	150	200	250	300	
Applied		kW	37	45	55	75	90	110	132	160	185	
Motor	Hazarlaza	НР	40	50	60	75	100	125	150	200	250	
	Heavy load	kW	30	37	45	55	75	90	110	132	160	
	Rated Capacity (kVA)		46	57	69	84	116	139	170	201	248	
Datad	Rated	Norma load	75	91	110	152	183	223	264	325	370	
Rated output	(A)	Heavy load	61	75	91	110	152	183	223	264	325	
	Output Fre	quency	0-400 Hz)	0–400 Hz (Sensorless-1: 0–300 Hz, Sensorless-2, Vector: 0.1–120 Hz)								
	Output Vol	tage (V)	3-Pha	3-Phase 380–480 V								
	Working Vo	oltage (V	3-Pha	se 380	-480 V	AC (-15	%-+10 <sup>9</sup>	%)				
	Input Freq	uency	50-60	) Hz (±5	5%)							
input Rated Current	Norma load	67.5	81.7	101.8	143.6	173.4	2129	254.2	315.3	359.3		
	Heavy load	55.5	67.9	82.4	1026	143.4	174,7	213.5	255.6	316.3		

- The standard used for 400 V inverters is based on a 440 V supply voltage.
- The rated output current is limited based on the carrier frequency set at CON-04.
- The output frequency is limited to 0-300 Hz if DRV-09 (control mode) is set to "3 (Sensorless-1)," and to 0-120 Hz if DRV-09 (control mode) is set to "4 (Sensorless-3)."
- The maximum output voltage cannot exceed the input voltage of the power source.

### 2.5 Input and Output Specifications 400 V Class (185-375 kW)

Model SV	Model SV xxx iS7-2x		1850	2200	2800	3150	3750					
	Normallo	HP	350	400	500	-	-					
Applied	Normal load	kW	220	280	315	375	450					
Motor	Howarloss	HP	300	350	400	500	-					
	Heavy load	kW	185	220	280	315	375					
	Rated Cap	acity (kVA	286	329	416	467	557					
D ( )	Rated Current	Normal load	432	547	613	731	877					
Rated output	(A)	Heavy load	370	432	547	613	731					
	Output Fre	equency	0-400	) Hz (Sen	sorless	:-1: 0-3	00 Hz, :	Senso	orless-2	, Vecto	r: 0–120	Hz)
	Output Vo	ltage (V)	3-Pha	3-Phase 380–480 V								
	Working V	oltage (V)	3-Pha	ıse 380–	480 VA	C (-15%	-+10%	)				
	Input Freq	uency	50-60	) Hz (±5%	6)	_	_					
Rated input	Rated	Normal load	463	590	673	796	948					
	Current (A)	Heavy load	404	466	605	674	798					

- The standard motor capacity is based on a standard 4-pole motor.
- The standard used for 400 V inverters is based on a 440 V supply voltage.
- The rated output current is limited based on the carrier frequency set at CON-04.
- The output frequency is limited to 0-300 Hz if DRV-09 (control mode) is set to "3 (Sensorless-1)," and to 0-120 Hz if DRV-09 (control mode) is set to "4 (Sensorless-3)."
- The maximum output voltage cannot exceed the input voltage of the power source.

#### Note

#### [English]

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

### [French]

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. L'entraînement convient pour une utilisation dans un circuit capable de délivrer pas plus de 100 kA RMS à la tension nominale maximale de l'entraînement. 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)		UTS40 (N/H/		
240V(50/60Hz)	50/65kA	65/100/150kA	65/100/15	0kA	65/10	0/150kA	
480V(50/60Hz)	25/35kA	35/65/100kA	35/65/100	kA	35/65	/100kA	
Working Voltage	ABS33c	ABS53c	ABS63c	ABS1	103c	ABS203c	ABS403c
240V(50/60Hz)	30kA	35kA	35kA	85kA	١	85kA	75kA
480V(50/60Hz)	7.5kA	10kA	10kA	26kA	\	26kA	35kA

# 2.6 Product Specification Details

## 2.6.1 Control

Items		Description
	Control modes	V/F control, V/F PG, slip compensation, sensorless vector-1, sensorless vector-2, vector control
	Frequency settings resolution	Digital command: 0.01 Hz Analog command: 0.06 Hz (maximum frequency: 60 Hz)
Control	Frequency accuracy	Digital command: 0.01% of maximum output frequency Analog command: 0.1% of maximum output frequency
	V/F pattern	Linear, square reduction, user V/F
	Overload capacity	Rated current for heavy duty operation: 150% for 1 min Rated current for normal duty operation: 110% for 1 min
	Torque boost	Manual torque boost, automatic torque boost

Only the heavy load ratings apply to 0.75-22 kW model types without a built-in DC resistor (NON-DCR).

## 2.6.2 Operation

Items		Description	Description						
	Operation types	Select from keypad, terminal strip, operation.	select from keypad, terminal strip, or network communication operation.						
	Frequency settings	Analog type: -10–10 V, 0–10 V, 0–20 Digital type: keypad	mA						
Operation	Operation function	<ul> <li>PID control</li> <li>3-wire operation</li> <li>Frequency limit</li> <li>Second function</li> <li>Reverse rotation prevention</li> <li>Inverter bypass</li> <li>Flying start</li> <li>Power braking</li> </ul>	•	Up-down operation DC braking Frequency jump Slip compensation Automatic restart Automatic tuning Energy buffering Flux braking					

Items			Description	
			<ul><li>Leakage reduction</li><li>Easy start</li></ul>	• MMC
	Input	Multi- function terminal (8 EA) P1–P8*	<ul> <li>Select NPN (Sink) or PNP (Source) mo</li> <li>Forward direction operation</li> <li>Reset</li> <li>Emergency stop</li> <li>Multi-step speed frequency-high/med/low</li> <li>DC braking during stop</li> <li>Frequency increase</li> <li>3-wire operation</li> </ul>	<ul> <li>Reverse direction operation</li> <li>External trip</li> <li>Jog operation</li> <li>Multi-step acc/dechigh/med/low</li> <li>Second motor selection</li> </ul>
			<ul> <li>Acceleration/deceleration/stop</li> <li>Operation by keypad input during an operation by network communication</li> </ul>	<ul> <li>Frequency reduction</li> <li>Transition from PID to general operation</li> <li>Analog command frequency fix</li> </ul>
		Multi- function open collector terminal	Fault output and inverter operation	Less than DC 26 V, 100 mA
	Output	Multi- function relay terminal	status output	N.O.: Less than AC 250 V 1A, DC 30 V, 3A N.C.: Less than AC 250 V 1A, DC 30 V 1A
		Analog output	DC 0–10 V, 0–20 mA: Select output type voltage, or DC voltage.	pe from frequency, current,

<sup>\*</sup> Set the Input Group codes IN-65 through IN-72 to configure the multi-function terminal functions.

## 2.6.3 Protection Function

Items		Description
Protection function	Trips	<ul> <li>Over voltage</li> <li>Low voltage</li> <li>Over current</li> <li>Earth current detection</li> <li>Inverter overheat</li> <li>Motor overheat</li> <li>Output imaging</li> <li>Overload protection</li> <li>Network</li> <li>Lost command</li> <li>Hardware failure</li> <li>Cooling fan failure</li> <li>Pre-PID failure</li> <li>No motor trip</li> <li>External trip</li> <li>Other safety functions</li> </ul>
	Alarms	<ul> <li>Stall prevention</li> <li>Overload</li> <li>Light load</li> <li>Encoder error</li> <li>Fan failure</li> <li>Keypad command loss</li> <li>Speed command loss</li> </ul>
	Instantaneous blackout	Less than 15 ms (CT) [Less than 8 ms (VT)]: Continue operation (must be within the rated input voltage and rated output range).  Over 15 ms (CT) [Over 8 ms (VT)]: Automatically restart

## 2.6.4 Structure and Operating Environment Control

Items		Description
	Cooling type	Forced cooling: 0.75–15 kW (200/400 V class), 22 kW (400 V class) Inhalation cooling: 22–75 kW (200 V class), 30–375 kW (400 V class)
Structure/ operating environment	Protection structure	- 0.75–22 kW (200V), 0.75–75 kW (400 V): Open type IP 21 (default), UL enclosed type 1 (optional)* - 30–75 kW (200 V), 90–375 kW (400 V): Open type IP 00 - 0.75–22 kW, frame types 2, 4 and others.: Enclosed IP54 type, UL enclosed type 12
	Ambient temperature	CT load (heavy duty): -10–50℃  VT load (normal duty): -10–40℃

Items		Description
		<ul> <li>No ice or frost should be present.</li> <li>Working under normal load at 50°C (122°F), it is recommended that less than 80% load is applied.</li> <li>IP54 product: -10–40°C</li> <li>No ice or frost should be present.</li> </ul>
	Storage temperature.	-20°C-65°C (-4-149°F)
	Ambient humidity	Relative humidity less than 95% RH (to prevent condensation from forming)
	Operation altitude	Maximum 1000m above sea level for standard operation. From 1000 to 4000m, the rated input voltage and rated output current of the drive must be derated by 1% for every 100m.
	Oscillation	Less than 5.9 m/sec <sup>2</sup> (0.6 G).
	Surrounding environment	Prevent contact with corrosive gases, inflammable gases, oil stains, dust, and other pollutants (Pollution Degree 2 Environment).

<sup>\*</sup> UL Enclosed type 1 when an optional conduit box is installed. The 30–75 kW (200 V class) product is regarded as UL Open type IP 20 when an optional conduit box is installed.

# **Installing the Inverter**

#### **Installation Considerations** 3.1

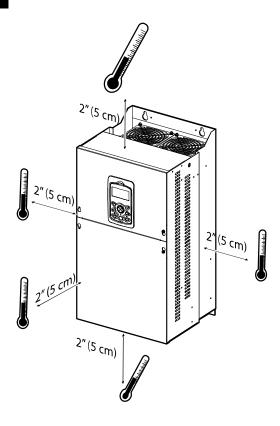
Inverters are composed of various precision electronic devices, and therefore the installation environment can significantly impact the lifespan and reliability of the product. The table below details the ideal operation and installation conditions for the inverter.

Items	Description
	CT load (heavy duty): -10℃-50℃
Ambient Temperature*	VT load (normal duty): -10℃–40℃
	IP54 model types: -10℃-40℃
Ambient Humidity	90% relative humidity (no condensation)
Storage Temperature	- 4–149°F (-20–65℃)
Environmental Factors	An environment free from corrosive or flammable gases, oil residue, or dust (pollution degree 2)
Altitude/Vibration	Lower than 3,280 ft (1,000 m) above sea level/less than 0.6 G (5.9 m/sec2)
Air Pressure	70–106 kPa

<sup>\*</sup>The ambient temperature is the temperature measured at a point 2" (5 cm) from the surface of the inverter. No ice or frost should be present.

## ① Caution

- Do not transport the inverter by lifting with the inverter's covers or plastic surfaces. The inverter may tip over if covers break, causing injuries or damage to the product. Always support the inverter using the metal frames when moving it.
- Hi-capacity inverters are very heavy and bulky. Use an appropriate transport method that is suitable for the weight. Do not place heavy objects on top of electric cables. Doing so may damage the cable and result in an electric shock.
- 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.



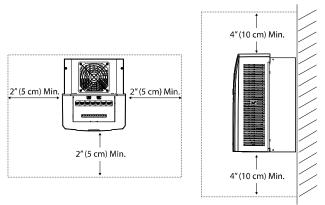
## ① Caution

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

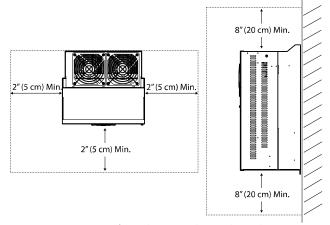
## 3.2 Selecting and Preparing a Site for Installation

When selecting an installation location, consider the following requirements:

- The inverter must be installed on a wall that can support the inverter's weight.
- The location must be free from vibration. Vibrations can adversely affect the operation of the inverter.
- The inverter can become very hot during operation. Install the inverter on a surface that is
  fire resistant or flame retardant with sufficient clearance around the inverter to allow for air
  circulation. The illustrations below detail the required installation clearances.



<Clearance requirements for model types with less than 30 kW capacity'>



<Clearance requirements for model types with more than 30 kW capacity>

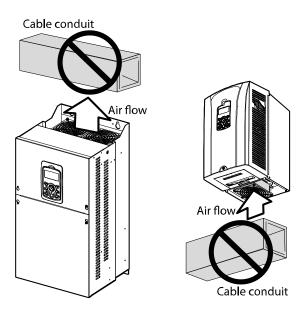
## ① Caution

Install the inverter on a non-flammable surface, and do not place flammable material near the inverter. Otherwise, a fire may result.

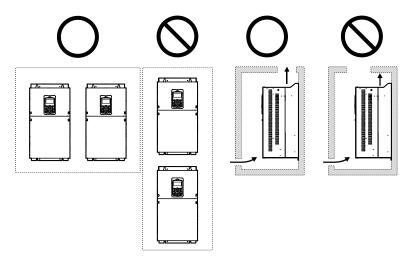
### Note

Model types with capacities of 30 kW or more require a minimum of 8" clearance above and below the unit.

Ensure that the cable conduits do not obstruct the air flow to and from the cooling fan.



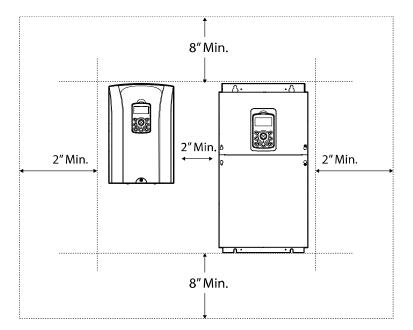
Ensure sufficient air circulation is provided around the inverter when it is installed. If the
inverter is to be installed inside a panel, enclosure, or cabinet rack, carefully consider the
position of the inverter's cooling fan and vents. The cooling fan must be positioned to
efficiently dissipate the heat generated by the operation of the inverter.



#### Note

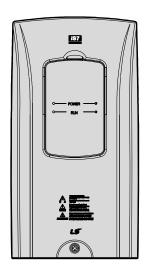
In order to meet EMC standards, 200 V, 30–75 kW model types and model types with capacities of 90 kW or more should be installed inside a metal cabinet.

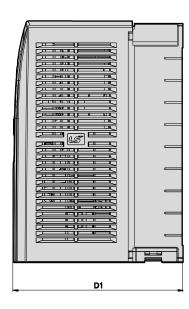
If you are installing multiple inverters of different ratings, provide sufficient clearance to meet the clearance specifications of the larger inverter. The iS7 inverters rated for up to 30 kW may be installed side by side.

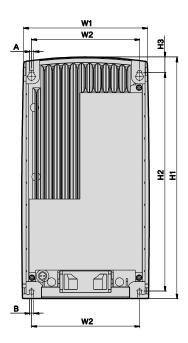


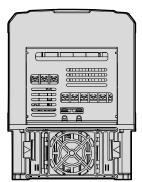
# 3.3 Exterior and Dimensions (UL Enclosed Type 1, IP21 Type)

#### SV0008-0037iS7 (200 V/400 V)





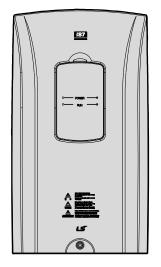


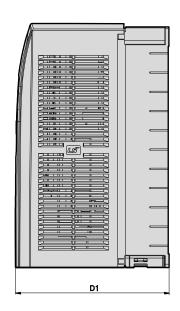


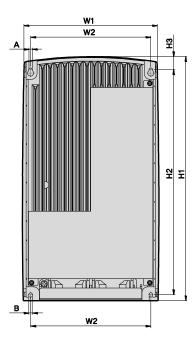
Units: mm (inch)

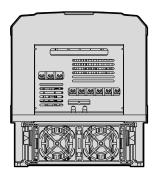
Inverter Capacity	W1	W2	H1	H2	НЗ	D1	Α	В
SV0008-0037 iS7 - 2/4	150	127	284	257	18	200	5	5
	(5.90)	(5.00)	(11.18)	(10.11)	(0.70)	(7.87)	(0.19)	(0.19)

## SV0055-0075iS7 (200 V/400 V)





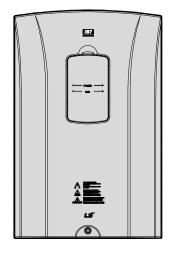


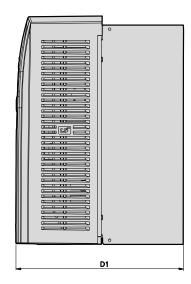


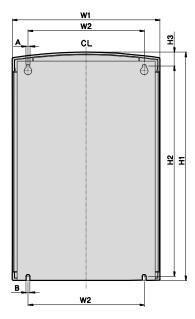
Units: mm (inch)

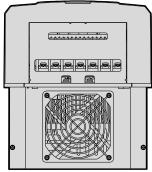
Inverter Capacity W1	W2	H1	H2	Н3	D1	Α	В
SV0055-0075 iS7 - 2/4 200	176	355 (13.97)	327	19	225	5	5

## SV0110-0150iS7 (200 V/400 V)





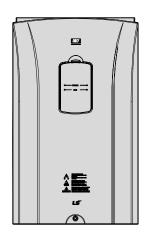


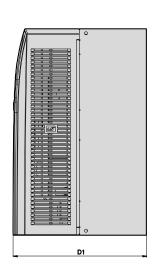


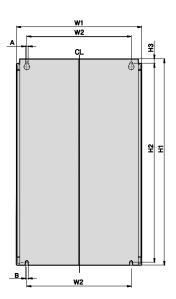
Units: mm (inch)

Inverter Capacity	W1	W2	H1	H2	НЗ	D1	Α	В
SV0110-0150 iS7- 2/4		214.6 (8.44)	385 (15.15)	355 (13.97)	23.6 (0.92)			6.5 (0.25)

## SV0185-0220iS7 (200 V/400 V)



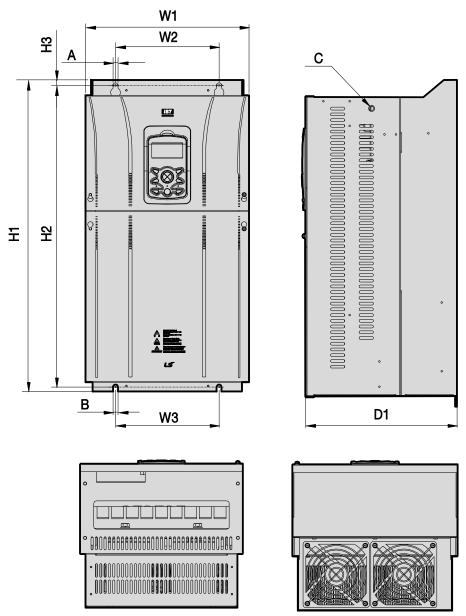






Inverter Capacity	W1	W2	H1	H2	НЗ	D1	A	В
SV0185-0220iS7-2/4	280			445	10.1	298	6.5	6.5
	(11.02)	(9.58)	(18.17)	(17.51)	(0.39)	(11.73)	(0.25)	(0.25)

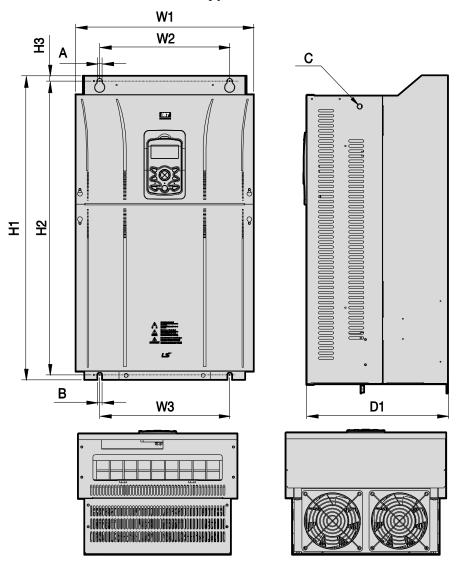
## SV0300-iS7 (200 V, IP00 Type)



Units: mm (inch)

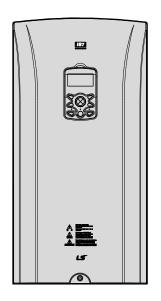
Inverter Capacity	W1	W2	W3	H1	H2	НЗ	D1	А	В	С
SV0300 iS7-2	300 (11.81)	190 (7.48)	190 (7.48)	570 (22.44)	552 (21.73)	10 (0.39)	265.2 (10.44)	10 (0.39)	10 (0.39)	M8

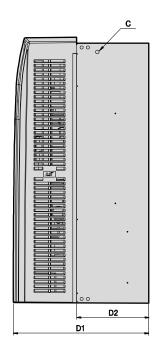
## SV0370-0450iS7 (200 V, IP00 Type)

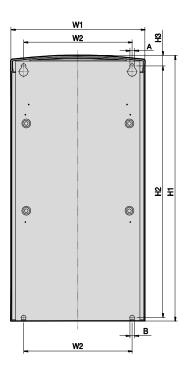


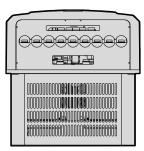
Inverter Capacity	W1	W2	W3	H1	H2	НЗ	D1	Α	В	С
SV0370-0450	370	270	270	630	609	11	281.2	10	10	M10
iS7-2	(14.56)	(10.63)	(10.63)	(24.8)	(23.97)	(0.43)	(11.07)	(0.39)	(0.39)	

## SV0300-0450iS7 (400 V)





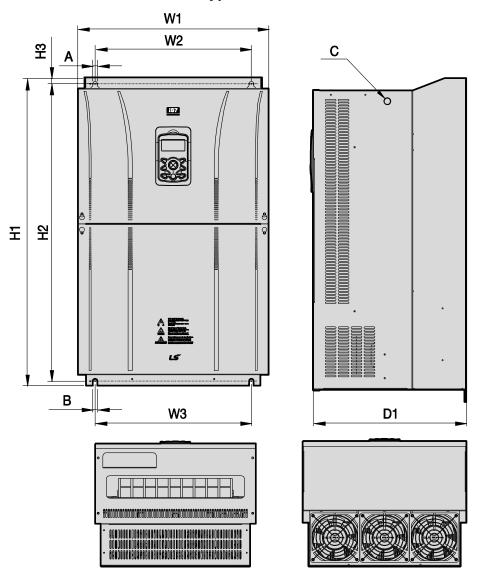




Units: mm (inch)

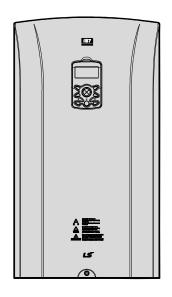
Inverter Capacity	W1	W2	H1	H2	Н3	D1	D2	A	В	С
	i\$7-4				DCR typ	e				
		594.1	562	24.1 (0.94)	303.2 (11.93)	161 (6.33)	10	10	MO	
157-4		(23.38)	(22.12)		Non-DCR type		(0.39)	(0.39)	M8	
					271.2 (10.67)	129 (5.78)				

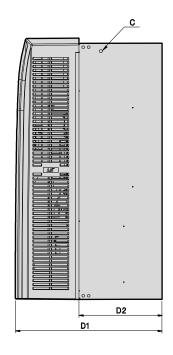
## SV0550-0750iS7 (200 V, IP00 Type)

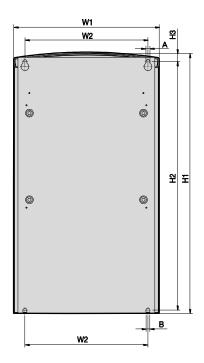


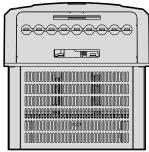
Inverter Capacity	W1	W2	W3	H1	H2	Н3	D1	А	В	С
SV0550-0750 iS7-2	465 (18.3)	381 (15.0)	381 (15.0)	750 (29.52)	723.5 (28.48)	15.5 (0.61)	355.6 (14.0)		11 (0.43)	M16

#### SV0550-0750iS7 (400 V)





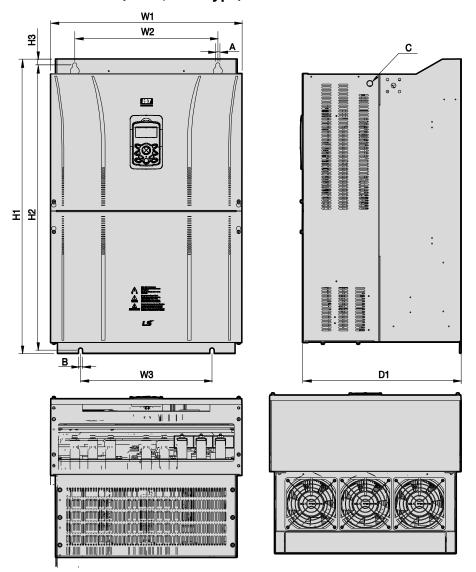




Units: mm (inch)

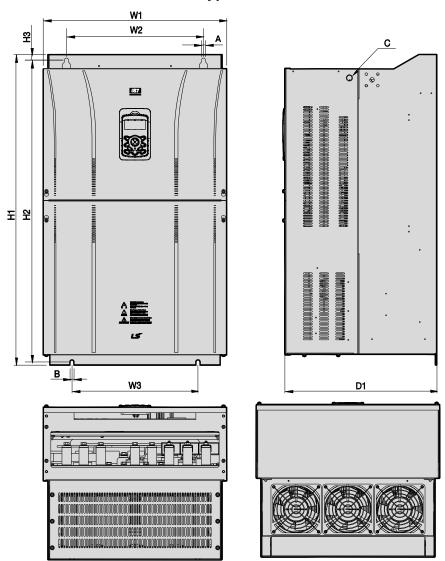
Inverter	W1	W2	H1	H2	Н3	D1	D2	Α	В	С
	S7-4   370.1   312.8   663.5				DCR type					
SV0550-0750		663.5	631.4	24.1 (0.94)	373.3 (14.69)	211.5 (8.32)	10	10	MO	
157-4		(26.12)	(24.85)		Non-DCR type		(0.39)	(0.39)	M8	
					312.4 (12.29)	150.6 (5.92)				

#### SV0900-1100iS7 (400 V, IP00 Type)



Inverter Capacity	W1	W2	W3	H1	H2	НЗ	D1	Α	В	С
SV0900-1100	510	381	350	783.5	759	15.5	422.6	11	11	M16
iS7-4	(20.07)	(15.0)	(13.77)	(30.84)	(29.88)	(0.61)	(16.63)	(0.43)	(0.43)	

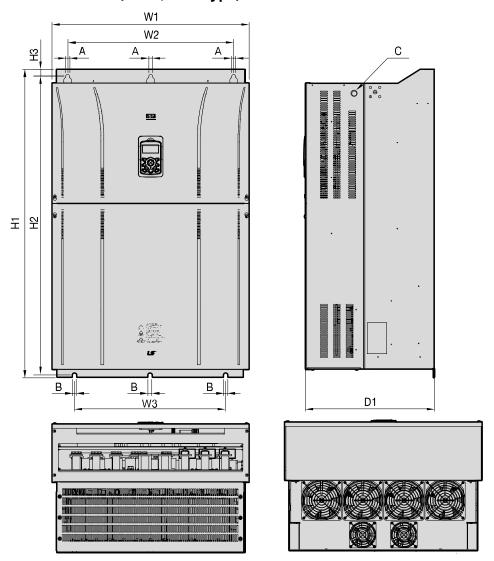
## SV1320-1600iS7 (400 V, IP00 Type)



Units: mm (inch)

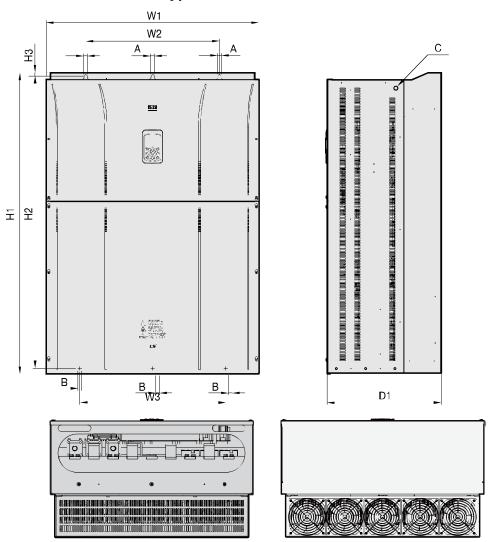
Inverter Capacity	W1	W2	W3	H1	H2	НЗ	D1	Α	В	С
SV1320-1600 iS7-4	510 (20.07)	381 (15.0)	350 (13.77)	861 (33.89)	836.5 (32.93)		422.6 (16.63)	11 (0.43)	11 (0.43)	M16

## SV1850-2200iS7 (400 V, IP00 Type)



Inverter Capacity	W1	W2	W3	H1	H2	НЗ	D1	Α	В	С
SV1850/ 2200iS7-4	690 (27.16)	581 (22.87)	528 (20.79)	1078 (42.44)	1043.5 (41.08)		450 (17.72)	14 (0.55)	15 (0.59)	M20

### SV2800iS7 (400 V, IP00 Type)

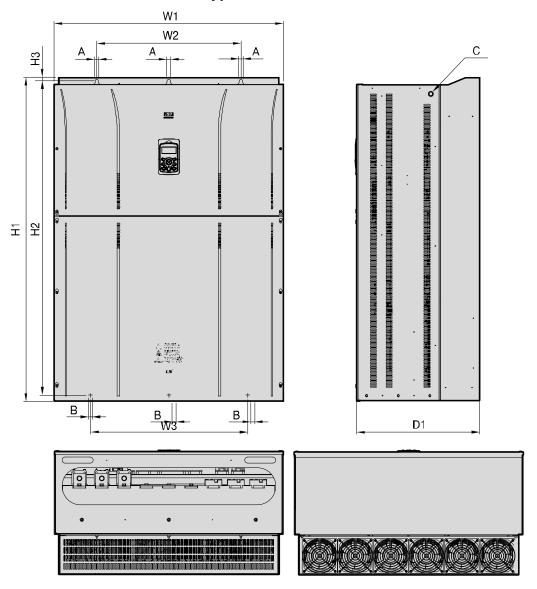


Units: mm (inch)

Inverter Capacity	W1	W2	W3	H1	H2	НЗ	D1	A	В	С
SV2800iS7-4	771 (30.35)	500 (19.69)	500 (19.69)	1138 (44.80)	1110 (43.70)	15 (0.59)	440 (17.32)	13 (0.51)	13 (0.51)	M16

For 280 kW model types, I volts are supplied with the product.

#### SV3150-3750iS7 (400 V, IP00 Type)

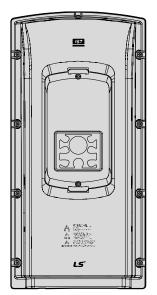


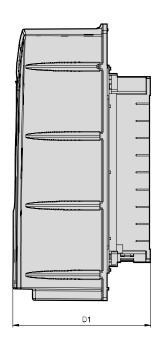
Inverter Capacity	W1	W2	W3	H1	H2	НЗ	D1	A	В	С
SV3150/	922	580	580	1302.5	1271.5	15	495	14	14	M16
3750iS7-4	(36.30)	(22.83)	(22.83)	(51.28)	(50.06)	(0.59)	(19.49)	(0.55)	(0.55)	IVITO

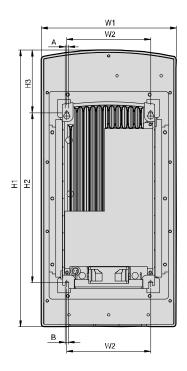
For 315-375 kW model types, I volts are supplied with the product.

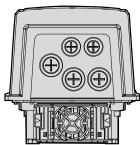
# 3.4 Exterior and Dimensions (UL Enclosed Type 12, IP54 Type)

## SV0008-0037iS7 (200 V/400 V)



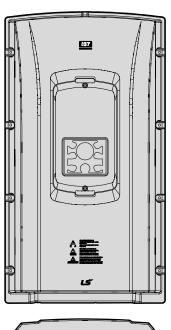


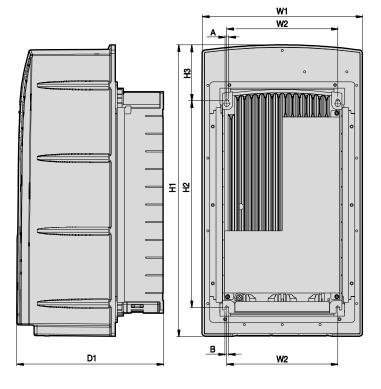


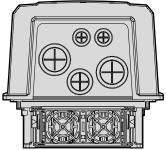


Inverter Capacity	W1	W2	H1	H2	Н3	D1	Α	В
SV0008-0037 iS7-2/4	204.2	127	419	257	95.1	208	5	5
	(8.03)	(5.0)	(16.49)	(10.11)	(3.74)	(8.18)	(0.19)	(0.19)

## SV0055-0075iS7 (200 V/400 V)



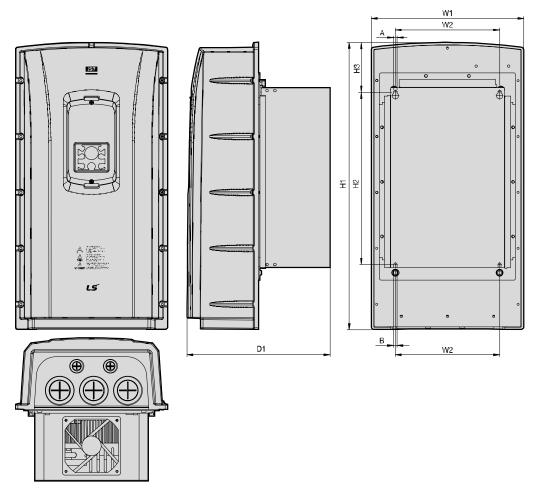




Units: mm (inch)

Inverter Capacity	W1	W2	H1	H2	Н3	D1	Α	В
SV0055-0075 iS7-2/4	254	176	460.6	327	88.1	232.3	5	5
	(10.0)	(6.92)	(18.13)	(12.87)	(3.46)	(9.14)	(0.19)	(0.19)

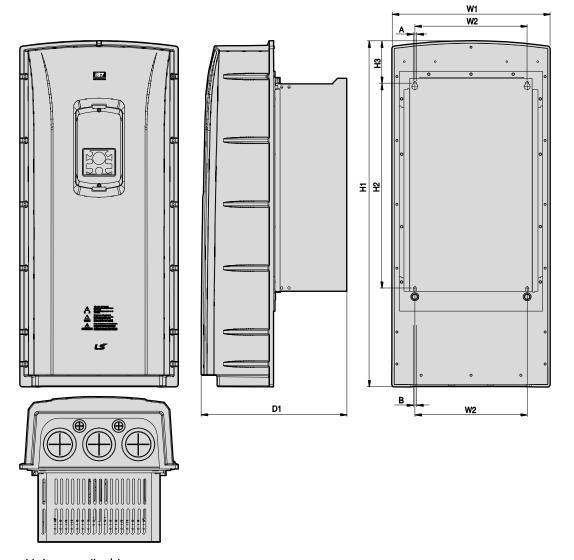
## SV0110-0150iS7 (200 V/400 V)



Units: mm (inch)

Inverter Capacity	W1	W2	H1	H2	Н3	D1	A	В
SV0110-0150 iS7-2/4	313.1 (12.32)			355 (13.97)	101.7 (4.0)		6.5 (0.25)	6.5 (0.25)

## SV0185-0220iS7 (200 V/400 V)



Inverter Capacity	W1	W2	H1	H2	Н3	D1	A	В
SV0185-0220 iS7-2/4	343.2 (13.51)	243.5 (9.58)	750.8 (29.55)	445 (17.51)			6.5 (0.25)	6.5 (0.25)

## 3.5 Frame Dimensions and Weight (UL Enclosed Type 1, IP 21 Type)

Inverter Capacity	W[mm]	H[mm]	D[mm]	Weight[Kg] w/ built-in EMC and DCR	Weight[Kg] w/ built-in EMC	Weight[Kg] w/ built-in DCR	Weight[Kg] non-DCR types
SV0008iS7-2/4	150	284	200	5.5	4.5	5.0	4.5
SV0015iS7-2/4	150	284	200	5.5	4.5	5.0	4.5
SV0022iS7-2/4	150	284	200	5.5	4.5	5.0	4.5
SV0037iS7-2/4	150	284	200	5.5	4.5	5.0	4.5
SV0055iS7-2/4	200	355	225	10	8.4	9.3	7.7
SV0075iS7-2/4	200	355	225	10	8.4	9.3	7.7
SV0110iS7-2/4	250	385	284	20	17.2	16.8	14
SV0150iS7-2/4	250	385	284	20	17.2	16.8	14
SV0185iS7-2	280	461.6	298	30	27	25.9	22.9
SV0220iS7-2	280	461.6	298	30	25.8	25.9	22.9
SV0185iS7-4	280	461.6	298	27.4	23.5	23.3	19.7
SV0220iS7-4	280	461.6	298	27.4	23.5	23.5	20.1
SV0300iS7-2	300	570	265.2	-	-	-	29.5
SV0370iS7-2	370	630	281.2	-	-	-	44
SV0450iS7-2	370	630	281.2	-	-	-	44
SV0550iS7-2	465	750	355.6	-	-	-	72.5
SV0750iS7-2	465	750	355.6	-	-	-	72.5

#### Note

- The weight specified in the table indicates the total weight of the product without packaging, which includes the built-in parts, such as the EMC filter and DCR.
- The built-in EMC filter and DCR are not available for 30–75 kW (200 V) products.

Inverter Capacity	W[mm]	H[mm]	D[mm]	Weight[Kg] w/ built-in EMC and DCR	Weight[Kg] w/ built-in EMC	Weight[Kg] w/ built-in DCR	Weight[Kg] non-DCR types
SV0300iS7-4	300	594	300.4	-	-	41	28
SV0370iS7-4	300	594	300.4	-	-	41	28
SV0450iS7-4	300	594	300.4	-	-	41	28
SV0550iS7-4	370	663.4	371	-	-	63	45
SV0750iS7-4	370	663.4	371	-	-	63	45
SV0900iS7-4	510	784	423	-	-	101	-
SV1100iS7-4	510	784	423	-	-	101	-
SV1320iS7-4	510	861	423	-	-	114	-
SV1600iS7-4	510	861	423	-	-	114	-
SV1850iS7-4	690	1078	450	-	-	200	-
SV2200iS7-4	690	1078	450	-	-	200	-
SV2800iS7-4	771	1138	440	-	-	-	252
SV3150iS7-4	922	1302.5	495	-	-	-	352
SV3750iS7-4	922	1302.5	495	-	-	-	352

#### Note

- The weight specified in the table indicates the total weight of the product without packaging, which includes built-in parts, such as the EMC filter and DCR.
- 300-220 kW (400 V) products have built-in DCR only.
- 280-375 kW (400 V) products are provided without a built-in EMC filter and DCR.

## 3.6 Frame Dimensions and Weight (UL Enclosed Type 12, IP54 Type)

Inverter Capacity	W[mm]	H[mm]	D[mm]	Weight[Kg] w/ built-in EMC and DCR	Weight[Kg] w/ built-in EMC	Weight[Kg] w/ built-in DCR	Weight[Kg] non-DCR types
SV0008iS7-2/4	204	419	208	8.2	7.2	7.7	6.7
SV0015iS7-2/4	204	419	208	8.2	7.2	7.7	6.7
SV0022iS7-2/4	204	419	208	8.2	7.2	7.7	6.7
SV0037iS7-2/4	204	419	208	8.2	7.2	7.7	6.7
SV0055iS7-2/4	254	461	232	12.8	10.2	12.1	9.5
SV0075iS7-2/4	254	461	232	12.9	10.3	12.2	9.6
SV0110iS7-2/4	313	591	294	25.6	22.8	22.4	19.6
SV0150iS7-2/4	313	591	294	25.9	23.1	22.7	19.9
SV0185iS7-2	343	751	316	38.3	34.2	34.1	29.9
SV0220iS7-2	34	751	316	38.3	34.2	34.1	29.9
SV0185iS7-4	343	751	316	34.9	31	31	27.1
SV0220iS7-4	343	751	316	34.9	31	31	27.1

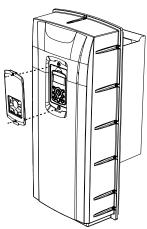
#### Note

- The weight specified in the table indicates the total weight of the product without packaging, which includes the built-in parts, such as the EMC filter and DCR.
- Only 0.75-22 kW products are available in IP 54 Type specifications.

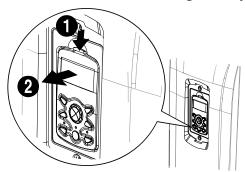
## 3.7 **Installation Procedures for UL Enclosed Type12** and IP54 Type Products

#### 3.7.1 **Disassembling the Keypad Cover and Keypad**

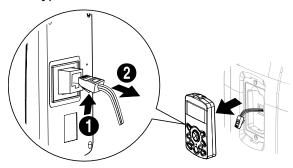
Loosen the screws that secure the keypad cover and remove the keypad cover.



Depress the tab at the top of the keypad and gently lift the keypad from the inverter to remove it. Be careful not to damage the keypad cable.

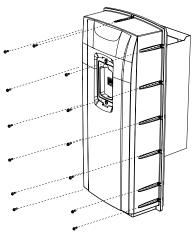


3 Depress the tab on the keypad cable connector and disconnect the cable from the back of the keypad.

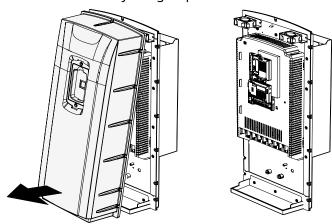


## 3.7.2 Disassembling the IP54 Front Cover

1 Loosen the screws that secure the front cover to the chassis. There are 9-13 screws on the cover depending on the model type.

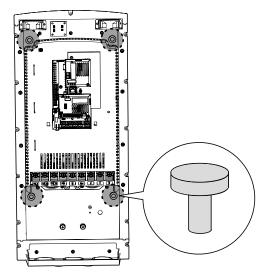


2 Remove the cover by lifting it upwards from the bottom.

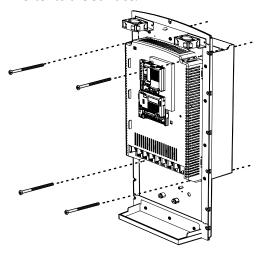


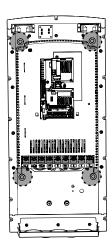
#### **Mounting the Inverter** 3.7.3

Remove the 4 rubber feet from the corners.



2 Place the inverter on a flat wall or in a cabinet, and use 4 screws or bolts to securely fix the inverter to the surface.

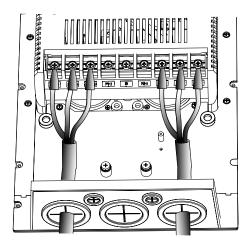




## 3.7.4 Connecting the Power Cables

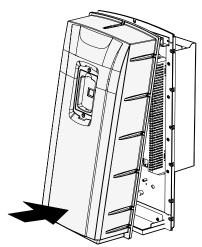
Connect the power cables to the input (R, S, T) and output (U, V, W) terminals. Then, tighten the terminal screws.

Refer to <u>4 Connecting the Cables</u> on page <u>49</u> for detailed information.

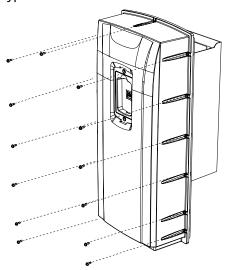


## Reassembling the IP54 Front Cover and the Keypad

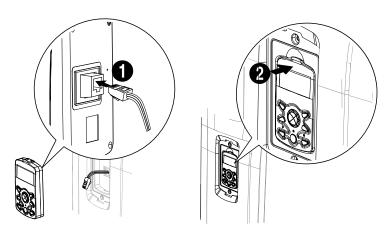
Place the front cover on the chassis and align the screw holes on each side. 1



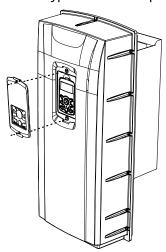
Insert and tighten the screws. There are 9-13 screws on the cover depending on the model type.



3 Connect the signal cable to the keypad, align the lower part of the keypad to the bottom of the keypad receptacle, and then push the top part of the keypad into the chassis until the keypad snaps into place.



4 Place the keypad cover on top of the keypad, and secure it using 2 screws.



## 4 Connecting the Cables

Connect cables to the power and signal terminal blocks of the inverter.

#### ① Caution

ESD (Electrostatic discharge) from the human body may damage sensitive electronic components on the PCB. Therefore, be extremely careful not to touch the PCB or the components on the PCB with bare hands while you work on the I/O PCB.

To prevent damage to the PCB from ESD, touch a metal object with your hands to discharge any electricity before working on the PCB, or wear an anti-static wrist strap and ground it on a metal object.

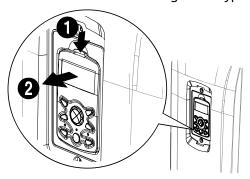
## 4.1 Removing the Front Cover for Cable Connection

## **▲** Danger

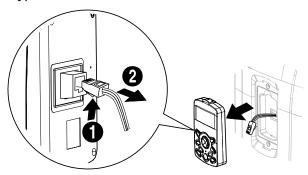
Wait at least 10 minutes before opening the covers and exposing the terminal connections. Before working on the inverter, test the connections to ensure the DC voltage has been fully discharged. Personal injury or death by electric shock may result if the DC voltage has not been discharged.

## 4.1.1 IP 21 Type Products

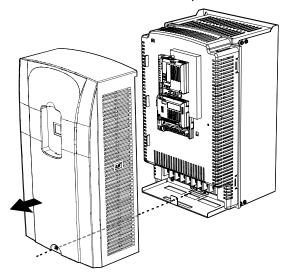
1 Depress the tab at the top of the keypad and gently lift the keypad from the inverter to remove it. Be careful not to damage the keypad cable.



**2** Depress the tab on the keypad cable connector and disconnect the cable from the back of the keypad.

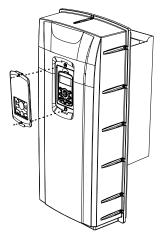


3 Loosen the screw from the bottom part of the front cover, and then remove the front cover.

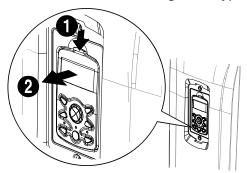


## 4.1.2 IP 54 Type Products

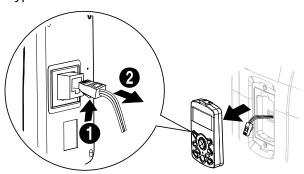
Loosen the two screws securing the keypad cover, and then remove the keypad cover. 1



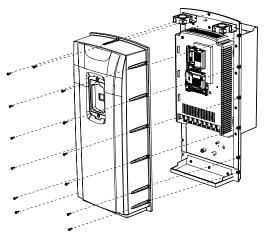
Depress the tab at the top of the keypad and gently lift the keypad from the inverter to 2 remove it. Be careful not to damage the keypad cable.



Depress the tab on the keypad cable connector and disconnect the cable from the back of 3 the keypad.

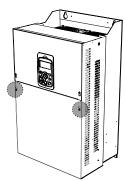


Remove the screws from each side of the front cover, and then remove the front cover.

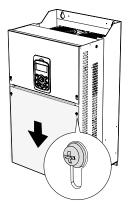


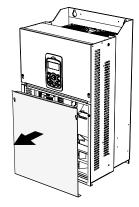
## 90-375 kW, 400 V and 30-75 kW, 200 V Products

Loosen the two screws on the front cover.



2 Slide the cover downwards and remove it from the inverter.





## 4.2 Activating and Deactivating the Built-in EMC Filter

Some iS-7 inverter models have built-in EMC filters to reduce conductive and radiational noise at the inverter input. Refer to <u>1.1.1 Identifying the Product</u> on page <u>1</u> and check your inverter's model type and specifications to see if it has a built-in EMC filter.

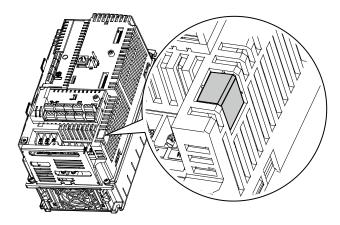
If your inverter has a built-in EMC filter, refer to the following instructions to activate or deactivate it.



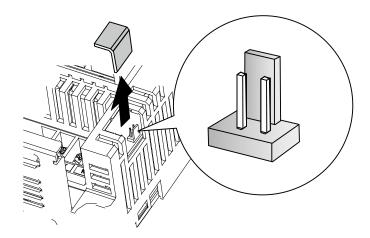
Do not activate the EMC filter if the inverter uses a power source with an asymmetrical grounding structure, for example a grounded delta connection. Personal injury or death by electric shock may result if the power source is not grounded properly.

## 4.2.1 Up to 7.5 kW Inverters

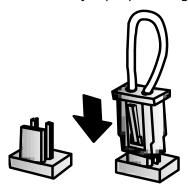
1 Locate the plastic knockout cap that covers the EMC filter switch (jumper SW1).



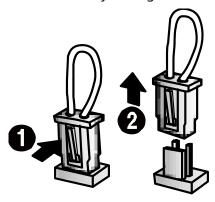
2 Remove the knockout cap and locate the jumper switch. The EMC filter will be deactivated if the two jumper pins are not connected.



3 Connect the two jumper pins using a short circuit connector to activate the EMC filter.

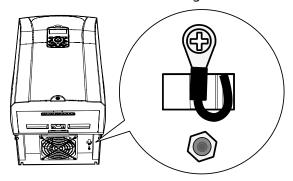


4 To remove the short circuit connector and deactivate the EMC filter, pull the connector while pressing the latch on the side of the connector. Use pliers or tweezers if you cannot reach the latch with your fingers.



#### 4.2.2 11-22 kW Inverters

1 Locate the EMC filter cable and the ground terminal at the bottom of the inverter.



The EMC filter is deactivated if the EMC filter cable is connected to the insulated stud.



<EMC filter is turned OFF>

2 Remove the EMC filter cable from the insulated stud and connect it to the ground terminal (metal) to activate the EMC filter.



<EMC filter is turned ON>

An EMC filter prevents electromagnetic interference by reducing radio emissions from the inverter. Using an EMC filter is not always recommended, as it increases current leakage. If an inverter uses a power source with an asymmetrical grounding connection, the EMC filter must be turned off.

Before using the inverter, confirm the power supply's grounding system. Disable the EMC filter if the power source has an asymmetrical grounding connection.

Asymmetrical Grounding Connection				
One phase of a delta connection is grounded	S(L	Intermediat grounding point on one phase of a delta (L3) connection		
The end of a single phase is grounded	L	A 3-phase connection without grounding	R(L1) ————————————————————————————————————	

# 4.3 Precautions for Wiring the Inverter

# 

- Do not connect power to the inverter until installation has been fully completed and the inverter is ready to be operated. Doing so may result in electric shock.
- Wiring and inspection of wiring must be performed by an authorized engineer.

### ① Caution

- Install the inverter before connecting the cables.
- Ensure that no metal debris, such as wire clippings, remain inside the inverter. Metal debris in the inverter can cause inverter failure.
- Power supply cables must be connected to the R, S, and T terminals. Connecting power cables to other terminals will damage the inverter.
- Use insulated ring lugs when connecting cables to 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.
- To avoid circuit interruption or damaging connected equipment, do not install phase-advanced condensers, surge protection, or electronic noise filters on the output side of the inverter.
- To avoid circuit interruption or damaging connected equipment, do not install magnetic contactors on the output side of the inverter.
- Make sure that the total cable length does not exceed 495 ft (150 m). For inverters < = 3.7 kW capacity, ensure that the total cable length does not exceed 165 ft (50 m). Long cable runs can cause reduced motor torque in low frequency applications due to voltage drop. Long cable runs also increase a circuit's susceptibility to stray capacitance and may trigger over-current protection devices or result in the malfunction of equipment connected to the inverter.
- Route the signal cables away from the power cables. Otherwise, signal errors may occur due to electric interference.
- Tighten terminal screws to their specified torques. Loose terminal block screws may allow the cables to disconnect and cause a short circuit or inverter failure. Refer to <u>4.7 Specifications of the Power Terminal Block and Exterior Fuse</u> on page 6666 for torque specifications.
- Do not place heavy objects on top of electric cables. Heavy objects may damage the cable and result in electric shock.
- Use cables with the largest cross-sectional area, appropriate for power terminal wiring, to ensure that voltage drops do not exceed 2%.
- Use copper cables rated at  $600 \, \text{V}$ ,  $75 \, ^{\circ}\text{C}$  for power terminal wiring.
- Use copper cables rated at 300 V, 75 °C for control terminal wiring.
- If you need to rewire the terminals due to wiring-related faults, ensure that the inverter keypad display is turned off and the charge lamp under the terminal cover is off before working on wiring connections. The inverter may hold a high-voltage electric charge long after the power supply has been turned off.

### 4.4 Ground Connection

# **⚠** Warning

Install ground connections for the inverter and the motor by following the correct specifications to ensure safe and accurate operation. Using the inverter and the motor without the specified grounding connections may result in electric shock.

### ① Caution

- Do not use the ground terminal as the signal (control) ground.
- Do not share the ground connection with other machines that consume a large amount of power, such as a welding machine.
- Connect the ground cable to the nearest earth contact and keep the cable length as short as possible.

Because the inverter is a high-frequency switching device, leakage current may occur during operation. To avoid the danger of electrocution due to current leakage, the inverter must be properly grounded. Ground connection must be made to the specified ground terminal on the inverter. Do not connect ground cables to chassis screws.

#### Note

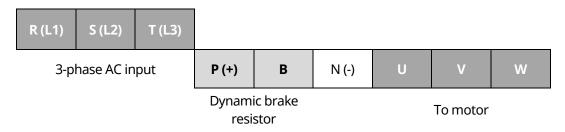
- 200 V products require Class 3 grounding. Resistance to ground must be ≤ 100  $\Omega$ .
- 400 V products require Special Class 3 grounding. Resistance to ground must be  $\leq$  10  $\Omega$ .

The following table lists the minimum ground cable specifications that must be met to properly ground the inverters.

Inverter Capacity	Grounding wire size ( mm²)				
inverter capacity	200 V class	400 V class			
0.75-3.7kW	4	2.5			
5.5–7.5 kW	6	4			
11–15 kW	16	10			
18.5–22 kW	25	16			
30-45 kW	25	16			
55–75 kW	35	35			
90–110 kW	-	60			
132-220 kW	-	100			
280-315 kW	-	185			
375 kW	-	240			

# 4.5 Terminal Wiring Diagram

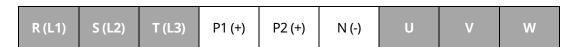
#### 4.5.1 Up to 7.5 kW Inverters



### 4.5.2 11-22 kW Inverters

R (L1) S (L2) T (L3) P (+) B N (-) U V W
--

# 4.5.3 30-75 kW Inverters



# 4.5.4 90-160 kW Inverters

ı								
	R (L1)	S (L2)	T (L3)	P2 (+)	N (-)	U	V	W

### 4.5.5 185-220 kW Inverters

R (L1)	S (L2)	T (L3)	P2 (+)	N (-)	U	V	W
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### 4.5.6 280–375 kW Inverters

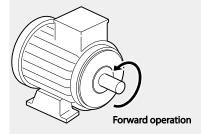
R (L1)	S (L2)	T (L3)	P1 (+)	P2 (+)	N (-)	U	V	W	
--------	--------	--------	--------	--------	-------	---	---	---	--

### Note

- Inverters with a rated capacity of 11 kW or more are equipped with linearly arranged terminal blocks.
- 0.75–22 kW inverters have built-in DC reactors. The installation of an external DC reactor is not necessary for these inverters.
- The inverter must be properly grounded using the ground terminal.

#### Note

If the forward command (Fx) is turned 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.

#### 4.6 Connecting Cables to the Power Terminal Block

### ① Caution

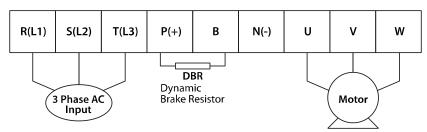
Power supply cables must be connected to the R, S, and T terminals. Connecting power cables to other terminals will damage the inverter.

#### Note

The motor will rotate in the opposite direction if the U, V, and W terminals are connected in a wrong phase order.

# 4.6.1 0.75-22 kW (200 V/400 V)

### Cable connection for utilizing the built-in dynamic braking unit

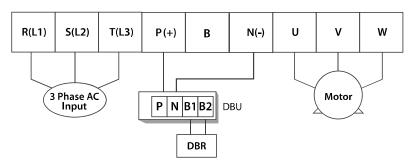


Connect the cables from the dynamic braking unit to the P (+) and B terminals to utilize the built-in dynamic braking unit.

Terminal Symbol	Terminal Name	Description
R (L1), S (L2), T (L3)	AC power supply input terminals	AC input terminals
P (+)	(+) DC voltage terminal	(+) DC link voltage terminal
N (-)	(-) DC voltage terminal	(-) DC link voltage terminal.
P (+), B	Dynamic brake resistor terminals	Dynamic brake resistor terminals
U, V, W	Inverter output terminals	Output terminals to a 3-phase induction motor

# Cable connection for utilizing the optional dynamic braking unit

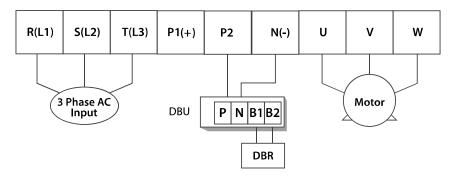
Connect the cables from dynamic braking unit to P (+) and N (-) terminals to utilize the optional dynamic braking unit. Do not connect cables to B terminal.



Terminal Symbol	Terminal Name	Description
R (L1), S (L2), T (L3)	AC power supply input terminals	AC input terminals
P (+)	(+) DC voltage terminal	(+) DC link voltage terminal
N (-)	(-) DC voltage terminal	(-) DC link voltage terminal.
P (+), B	Dynamic brake resistor terminals	Dynamic brake resistor terminals
U, V, W	Inverter output terminals	Output terminals to a 3-phase induction motor

# 4.6.2 30-75 kW (200 V/400 V)

Connect the cables from the dynamic braking unit to the P (+) and B terminals to utilize the built-in dynamic braking unit.



In 30-75 kW 200 V model types, the P1 and P2 terminals are connected with a jumper pin.

Terminal Symbol	Terminal Name	Description
62   LSELECT	TRIC	

Terminal Symbol	Terminal Name	Description
R (L1), S (L2), T (L3)	AC power supply input terminals	AC input terminals
P1 (+)	(+) DC voltage terminal	(+) DC link voltage terminal
P2, N (-)	Dynamic brake resistor terminal / DC common*	Dynamic brake resistor terminals
N (-)	(-) DC voltage terminal	(-) DC link voltage terminal
U, V, W	Inverter output terminals	Output terminals to a 3-phase induction motor

<sup>\*</sup>Contact LS ELECTRIC Customer Support before configuring the P2 (+) and N (-) terminals as the DC common source. There are a few factors that require special attention for this application.

### Note

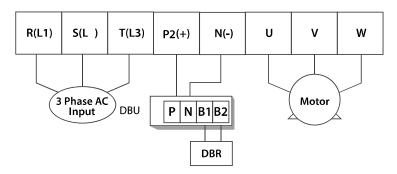
External DC reactors cannot be used with 30–75 kW inverters. To use a DC reactor with these inverters, purchase a 30–75 kW inverter that has a built-in DC reactor.

### ① Caution

- When a built-in DCR unit is present, the P1 (+) and P (-) terminals are connected to the reactor's input and output terminals respectively.
- If your product does not have a built-in DCR unit, the P2 (+) and N (-) terminals may be used as the common DC source. Do not use the P1 (+) terminal as the common DC source, as this may result in product damage.
- Use the P2 (+) and N (-) terminals to connect a dynamic braking resistor to the inverter. Do not connect the dynamic braking unit to the P1 (+) terminal, as this may result in product damage.
- Contact LS ELECTRIC Customer Support before configuring the N (-) terminal as the DC common source. There are a few factors that require special attention for this application.

# 4.6.3 90-160 kW (400 V)

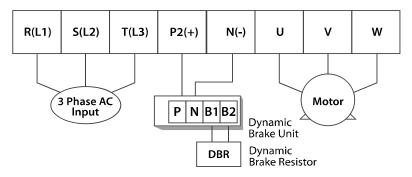
Connect the cables from the dynamic braking unit to the P2 (+) and N (-) terminals to utilize an external dynamic braking unit.



Terminal Symbol	Terminal Name	Description
R (L1), S (L2), T (L3)	AC power supply input terminals	AC input terminals
N (-)	(-) DC voltage terminal	(-) DC link voltage terminal
P2 (+), N (-)	Dynamic brake resistor terminal	Dynamic brake resistor terminals
U, V, W	Inverter output terminals	Output terminals to a 3-phase induction motor

# 4.6.4 185-220 kW (400 V)

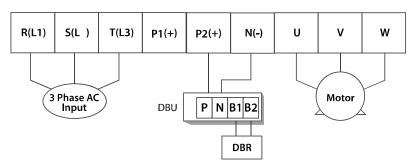
Connect the cables from the dynamic braking unit to the P2 (+) and N (-) terminals to utilize an external dynamic braking unit.



Terminal Symbol	Terminal Name	Description
R (L1), S (L2), T (L3)	AC power supply input terminals	AC input terminals
N (-)	(-) DC voltage terminal	(-) DC link voltage terminal
P2 (+), N (-)	Dynamic brake resistor terminal	Dynamic brake resistor terminals
U, V, W	Inverter output terminals	Output terminals to a 3-phase induction motor

# 4.6.5 280-375 kW (200 V/400 V)

Connect the cables from the dynamic braking unit to the P2 (+) and N (-) terminals to utilize the built-in dynamic braking unit.



Terminal Symbol	Terminal Name	Description	
R (L1), S (L2), T (L3)  AC power supply input terminals		AC input terminals	
P1 (+) C voltage terminal		(+) DC link voltage terminal	
P2/N (-)	Dynamic brake resistor terminal / DC common*	Dynamic brake resistor terminals	
N (-)	(-) DC voltage terminal	(-) DC link voltage terminal	
U, V, W	Inverter output terminals	Output terminals to a 3-phase induction motor	

<sup>\*</sup>Contact LS ELECTRIC Customer Support before configuring the P2 (+) and N (-) terminals as the DC common source. There are a few factors that require special attention for this application.

# ① Caution

- Apply rated torques to the terminal screws. Loose screws may cause the terminals to short circuit and malfunction. Tightening the screws too much may damage the terminals and cause them to short circuit and malfunction.
- Only use copper wires with a 600 V, 75 ℃ rating for the power terminal wiring, and a 300 V, 75 ℃ rating for the control terminal wiring.
- Power supply wiring must be connected to the R, S, and T terminals. Connecting them to the U,
   V, W terminals causes internal damage to the inverter. The motor should be connected to the U,
   V, and W terminals. Arrangement of the phase sequence is not necessary.

# **Specifications of the Power Terminal Block and Exterior Fuse**

				Cable <sup>2)</sup>					
Inverte	capacity	Terminal	Screw torque <sup>1)</sup>	mm²		AWG or	kcmil	Exterior f	use
		screw size	(Kgf·cm)	R,S,T	U,V,W	R,S,T	U,V,W	Current	Voltage
	0.75 kW	M4	7.1–12	2.5	2.5	14	14	10 A	500 V
	1.5 kW	M4	7.1–12	2.5	2.5	14	14	15 A	500 V
	2.2 kW	M4	7.1–12	2.5	2.5	14	14	20 A	500 V
	3.7 kW	M4	7.1–12	4	4	12	12	32 A	500 V
	5.5 kW	M4	7.1–12	6	6	10	10	50 A	500 V
	7.5 kW	M4	7.1–12	10	10	8	8	63 A	500 V
	11 kW	M6	30.6-38.2	16	16	6	6	80 A	500 V
200V	15 kW	M6	30.6-38.2	25	25	4	4	100 A	500 V
	18.5 kW	M8	61.2–91.8	35	35	2	2	125 A	500 V
	22 kW	M8	61.2–91.8	50	50	1	1	160 A	500 V
	30 kW	M8	61.2 – 91.8	70	70	1/0	1/0	200 A	500 V
	37 kW	M8	61.2 – 91.8	95	95	2/0	2/0	250 A	500 V
	45 kW	M8	61.2 – 91.8	95	95	2/0	2/0	350 A	500 V
	55 kW	M10	89.7 - 122.0	120	120	3/0	3/0	400 A	500 V
	75 kW	M10	89.7 - 122.0	150	150	4/0	4/0	450 A	500 V
	0.75– 1.5kW	M4	7.1–12	2.5	2.5	14	14	10 A	500 V
	2.2 kW	M4	7.1–12	2.5	2.5	14	14	15 A	500 V
	3.7 kW	M4	7.1–12	2.5	2.5	14	14	20 A	500 V
	5.5 kW	M4	7.1–12	4	2.5	12	14	32 A	500 V
	7.5 kW	M4	7.1–12	4	4	12	12	35 A	500 V
	11 kW	M5	24.5-31.8	6	6	10	10	50 A	500 V
	15 kW	M5	24.5-31.8	10	10	8	8	63 A	500 V
	18.5 kW	M6	30.6-38.2	16	10	6	8	70 A	500 V
400) (	22 kW	M6	30.6-38.2	25	16	4	6	100 A	500 V
400V	30 kW	M8	61.2-91.8	25	25	4	4	125 A	500 V
	37 kW	M8	61.2-91.8	25	35	4	2	125 A	500 V
	45 kW	M8	61.2-91.8	50	50	1	1	160 A	500 V
	55 kW	M8	61.2-91.8	70	70	1/0	1/0	200 A	500 V
	75 kW	M8	61.2-91.8	95	95	2/0	2/0	250 A	500 V
	90 kW	M12	182.4-215.0	100	100	4/0	4/0	350 A	500 V
	110 kW	M12	182.4-215.0	100	100	4/0	4/0	400 A	500 V
	132 kW	M12	182.4–215.0	150	150	300	300	450 A	500 V
	160 kW	M12	182.4-215.0	200	200	400	400	450 A	500 V
	185 kW	M12	182.4-215.0	200	200	400	400	620 A	500 V

Inverter capacity		Terminal	Scrow torque1)	Cable <sup>2)</sup>		Exterior fuse			
			Screw torque <sup>1)</sup> (Kgf·cm)	mm²				AWG or kcmil	
	screw size			R,S,T	U,V,W	R,S,T	U,V,W	Current	Voltage
	220 kW	M12	182.4-215.0	250	250	500	500	800 A	500 V
	280 kW	M12	182.4-215.0	325	325	650	650	1000 A	500 V
	315 kW	M12	182.4-215.0	2x200	2x200	2x400	2x400	1200 A	500 V
	375 kW	M12	182.4-215.0	2x250	2x250	2x500	2x500	1400 A	500 V

<sup>1)</sup> Apply rated torques to the terminal screws. Loose screws may cause the terminals to short circuit and malfunction.

#### 4.7.1 Cable Length between the Inverter and the Motor

The maximum cable lengths of the inverter and the motor are listed in <Table 1) Maximum cable length by inverter capacity>.

Make sure that the total cable length does not exceed 495 ft (150 m). For inverters with a capacity of less than 3.7 kW, ensure that the total cable length does not exceed 165 ft (50 m). Long cable runs can cause reduced motor torque in low frequency applications due to voltage drop. Long cable runs also increase a circuit's susceptibility to stray capacitance and may trigger over-current protection devices, or result in the malfunction of equipment connected to the inverter.

<Table 1) Maximum Cable Length by Inverter Capacity>

Inverter capacity	Up to 3.7 kW	5.5 kW or more
Maximum cable length	< 164 ft (50 m)	< 492 ft (150 m)

The following table lists maximum carrier frequencies available for model types with a rated capacity of 5.5 kW or more.

<Table 2) Maximum Carrier Frequency according to Cable Length>

Distance	< 165 ft (50 m)	< 330 ft (100 m)	> 330 ft (100 m)
Allowed Carrier Frequency	<15 kHz	<5 kHz	<2.5 kHz

Depending on the system layout and operating conditions at the installation site, high peak output voltage may result.

<sup>2)</sup> Only use copper wires with a 600 V, 75°C rating for the power terminal wiring.

a) If the output peak voltage is too high even when the motor cable length is shorter than the maximum recommended cable length for the inverter capacity:

- use a motor with a high insulation rating.
- install an output circuit filter (micro surge filter).
- install a dv/dt filter, or a sine wave filter.

### b) If the cable length is too long:

- use thicker cables to prevent voltage drop. [Voltage Drop (V) = [ $\sqrt{3}$  X cable resistance (m $\Omega$ /m) X cable length (m) X current (A)] / 1000]
- do not use 3-core cables.
- use a lower carrier frequency.

### 4.7.2 Protective Measures for the Inverter and the Motor

The inverter output voltage pulse, regardless of the actual output frequency, is identical to the DC link voltage pulse, which has a very short rising time. When the power is transmitted through the output cables, the output peak voltage can rise up to twice the total DC link voltage (2.8 times the main power voltage).

If a switching device (a magnetic contactor or relay) is connected to the output side of the inverter, high-voltage surges may result whenever a switch is made, regardless of the length of the motor cable.

Such high-voltage surges can damage the inverter's output components (such as the current sensor), motor cables, and the motor itself. To protect the inverter and the motor from such damage caused by a high-voltage surge, do not install switching devices in the output side of the inverter. You can install an output reactor, dv/dt filter, or sine wave filter to protect the inverter and motor from a surge voltage.

An output surge with a high switching frequency and fast rising time causes a motor shaft current that runs through the motor bearing. It slowly corrodes the surface of the motor bearing, eventually seizing up the motor.

To decrease the motor shaft current and protect the motor insulation, refer to <Table 1) Maximum cable length by inverter capacity>. Install a dv/dt filter or sine wave filter if possible, regardless of the length of the motor cable.

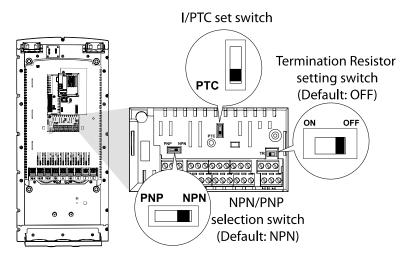
### ① Caution

Only use Class H or RK5 UL listed input fuses and UL listed breakers. See the table above for the voltage and current ratings for the fuses and breakers.

Utiliser UNIQUEMENT des fusibles d'entrée homologués de Classe H ou RK5 UL et des disjoncteurs UL. Se reporter au tableau ci-dessus pour la tension et le courant nominal des fusibless et des disjoncteurs.

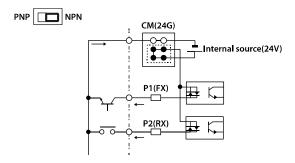
# 4.8 Control Terminal Wiring for iS7 Inverters Rated for Up To 22 kW

The iS7 inverter supports both PNP (Source) and NPN (Sink) modes for sequence inputs at the terminal. Select an appropriate mode to suit your requirements using the PNP/NPN selection switch above the control terminal block. Refer to the following information for detailed applications.



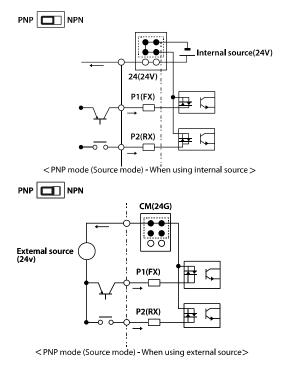
## 4.8.1 NPN Mode (Sink)

Select NPN using the PNP/NPN selection switch. The factory default setting is NPN mode. CM (24V GND) is the common ground terminal for all terminal inputs.



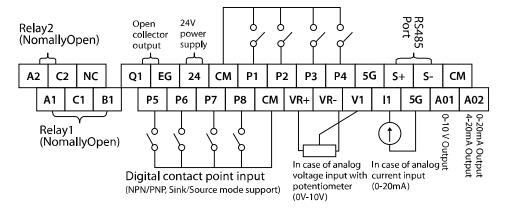
# 4.8.2 PNP Mode (Source)

Select PNP using the PNP/NPN selection switch. The factory default setting is NPN mode. CM (24 V GND) is the common ground terminal for all terminal inputs, and 24 is the 24 V internal source. If you are using an external 24 V source, select PNP (sink) mode and build a circuit that connects the external source (-) and the CM terminal.



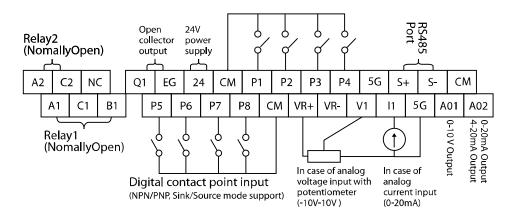
#### 4.8.3 0.75-22 kW (Basic I/O)

### Wiring Examples



Default Functions Assigned for the Multi-Function Terminals

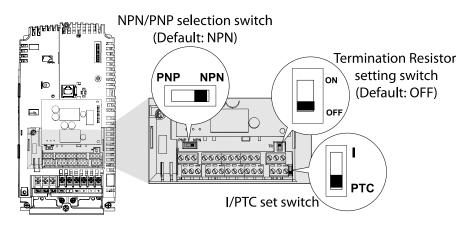
P1	P2	Р3	P4	P5	P6	P7	P8
FX	RX	BX	RST	Sp-L	Sp-M	Sp-H	JOG



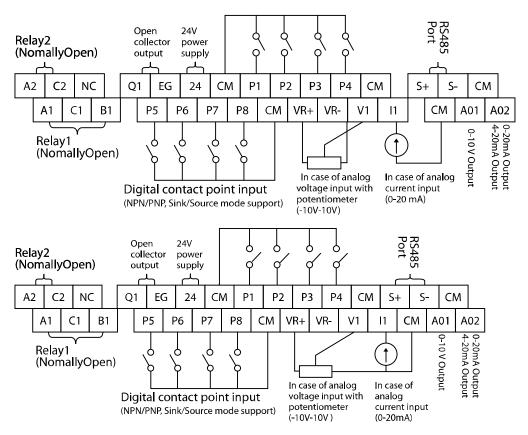
### Note

- The TR (termination resistor) switch is used to terminate the RS485 network connection (120  $\,\Omega$ ).
- For analog voltage input, use a potentiometer rated at 0.5W, 1kOhm.
- Refer to 13 Table of Functions on page 399 for the multi-function terminal configurations.

# 4.9 Control Terminal Wiring for iS7 Inverters Rated for 30 kW or More



# 30-375 kW (control terminal block)



### Note

- The TR (termination resistor) switch is used to terminate the RS485 network connection (120 Ω).
- Use a potentiometer rated for 0.5 W, 1 k $\Omega$ .

If the analog voltage (V) or current (I) input is used to set the frequency reference, the analog input is reflected when the input is actually received. For instance, the voltage input 0 V at V1 does not indicate that no input is received at V1, but it means that 0 V input is actually received at V1.

### Note

When you use the analog voltage input, the bipolar input range (-10 - +10V), in comparison to the unipolar input range (0-10V), allows for more accurate input control with smaller increments.

### ① Caution

If the analog input is interrupted when setting a frequency reference using the analog voltage (V) input and no voltage input is received at the terminal, an offset voltage may be applied to keep the frequency reference at approximately 4–5 Hz.

# **4.10 Terminal Inputs for Inverter Operation**

Input	Туре	Symbol	Name	Description
			Multi-function	Configurable for multi-function input terminals.
	Terminal	P1-P8	input1-8	Refer to <u>13 Table of Functions</u> on page <u>399</u> for the
			IIIput I-o	multi-function terminal configurations.
<del></del>	input	CM	Common sequence	Common terminal for terminal inputs (5G common
signal		Civi		terminal is used for analog frequency inputs only).
It Si		VR(+)	Potentiometer	Used to setup or modify a frequency reference via
Input			frequency reference	the analog voltage or current input.
Ξ	Analog		(+)	Maximum output is +12 V, 100 mA.
	input		Potentiometer	Used to setup or modify a frequency reference via
		VR(-)	frequency reference	the analog voltage or current input.
			(-)	Maximum output is -12 V, 100 mA.

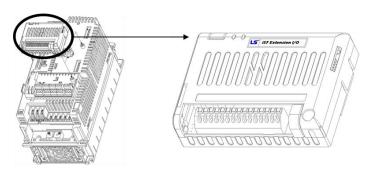
Input	t Type	Symbol	Name	Description
		V1	Voltage input for frequency reference	Used to setup or modify a frequency reference via the analog voltage input terminal. Unipolar: 0–10 V Bipolar: -10–10 V Input resistance 20 k $\Omega$
		I1	Current input for frequency reference	Used to setup or modify a frequency reference via the current input terminals. Input current: DC 0–20 mA Input resistance 249 $\Omega$
		5G	Frequency setting common terminal	Common terminal for analog voltage and current terminals (CM common terminal is used for terminal inputs only).
	Analog	AO1	Multi-function analog voltage output terminal	Used to send inverter output information to external devices. Output voltage: 0-10 V Maximum output voltage: 10 V Maximum output current: 10 mA
	output	AO2	Multi-function analog current output terminal	Used to send inverter output information to external devices. Output current: 4-20 mA (0-20 mA) Maximum output current: 20 mA
		Q1	Multi-function terminal (open collector)	DC 26 V, below 100 mA
gnal		EG	Common terminal for open collector	Common ground contact for an open collector (with external power source).
Output Signa		24	External 24 V power source	Maximum output current: 150 mA
Oni		CM	External 24 V common	Common ground contact for the external 24 V power source.
	Terminal output	A1, B1,C1	Fault signal output	Sends out alarm signals when the inverter's safety features are activated (below AC 250 V 5 A, DC 30 V 5 A). 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)
		A2, C2	Multi-function relay2 output A contact	Outputs the signal while running. User defined multi-function output terminal. (< AC 250 V, 5 A / < DC 30 V, 5 A)
		S+,S-,CM	RS-485 signal line	Used to send or receive RS-485 signals. Refer to <u>11</u> <u>Communication Function</u> on page <u>351</u> .

# **4.11 Cable Specifications for Control Block Wiring**

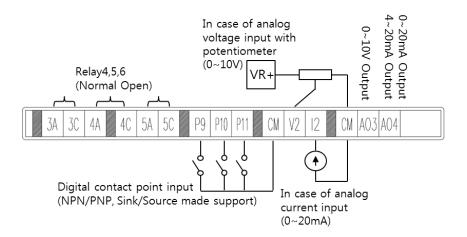
Terminal Name		Cable size <sup>1)</sup> mm <sup>2</sup> AWG		Specifications
				Specifications .
P1-P8	Multi-function input terminal			-
СМ	Common terminal input (5G common is used for analog frequency inputs only).			Common earth for multi-function input terminal
VR+	Analog frequency setting (+) power	0.33-	16–22	Output voltage: +12 V Maximum output voltage: 100 mA
VR-	Analog frequency setting (-) power	1.25	10-22	Output voltage: -12 V Maximum output voltage: 100 mA
V1	Multi-function analog voltage input terminal			Input voltage: 0–10 V or -10–10 V
I1	Multi-function analog current input terminal			0–20 mA input Internal resistance: 249 $\Omega$
AO1	Multi-function analog voltage output terminal			Maximum output voltage: 10 V Maximum output current: 10 mA
AO2	Multi-function analog current output terminal		14-22	Maximum output current: 20 mA
5G	Frequency setting common terminal (CM common terminal is used for terminal inputs only).	0.33- 2.0		Common terminal of analog frequency setting signal and analog current and voltage terminals
Q1	Multi-function terminal (open collector)			DC 26 V, below 100 mA
EG	Ground terminal for external power			Common terminal for an open collector external power source
24	External 24 V power supply	0.33-		Maximum output current: 150 mA
CM	24 V common	1.25	16–22	Common terminal for external 24 V power source
A1	Multi-function relay 1 output A			Below AC 250 V/5 A, Below DC 30 V/5 A
B1	Multi-function relay 1 output B			Below AC 250 V/5 A, Below DC 30 V/5 A
C1	Multi-function relay 1 common terminal	0.33-	14-22	Below AC 250 V/5 A, Below DC 30 V/5 A
A2	Multi-function relay 2 output A	2.0		Below AC 250 V/5 A, Below DC 30 V/5 A
C2	Multi-function relay 2 common terminal			Below AC 250 V/5 A, Below DC 30 V/5 A
S+,S-	RS485 signal input terminal			RS485 signal line
CM	RS485 common terminal	0.75	18	For multi-connections, RS485 power ground (shield) connection terminal

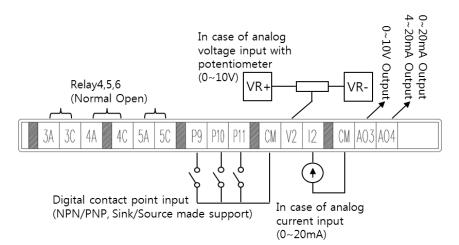
<sup>1)</sup> Use shielded, twisted-pair cables.

# 4.12 Control Terminal Wiring for iS7 Extension I/O (Optional)



### Extension I/O (control terminal block)





# **4.13 Terminal Inputs for Inverter Operation**

Innus	t Type	Symbol	Name	Description
Inpu	гуре	Symbol	Name	•
	Terminal	P9-P11	Multi-function	Configurable for multi-function input terminals.  Refer to <u>13 Table of Functions</u> on page <u>399</u> for the
	input	F 9-F 1 1	input9-11	multi-function terminal configurations.
	прис	CM	Common sequence	Common terminal for terminal inputs
_		Civi	commonsequence	Used to setup or modify a frequency reference via
Input signal				the analog voltage input terminal.
t sić		V2	Voltage input for	Unipolar: 0–10 V
ndı	A1		frequency reference	Bipolar: -10–10 V
Ä	Analog			Input resistance 20 kΩ
	input			Used to setup or modify a frequency reference via
		I2	Current input for	the current input terminals.
		12	frequency reference	Input current: DC 0-20 mA
				Input resistance 249 Ω
				Used to send inverter output information to
		AO3	Multi-function O3 analog voltage output terminal	external devices.
				Output voltage: -10-10 V
	Analog			Maximum output voltage: 10 V
	output			Maximum output current: 10 mA
	σατρατ		Multi-function	Used to send inverter output information to
		AO4	analog current	external devices.
<del>a</del>		A04	output terminal	Output current: 4-20 mA (0-20 mA)
Output Signal			·	Maximum output current: 20 mA
ıt S			Multi-function	
ıtbı		3A, 3C	relay3 output A	
ŏ			contact	
			Multi-function	Outputs the signal while running. User defined
	Terminal	4A, 4C	relay4 output A	multi-function output terminal.
	output		contact	(< AC 250 V, 5 A / < DC 30 V, 5 A)
	'		Multi-function	
		5A, 5C	relay5 output A	
			contact	
		CM	External 24 V	Common ground contact for the external 24V
			common	power source.

# **4.14 Cable Specifications for Control Block Wiring**

Terminal Name			size <sup>1)</sup>	Considerations
Termin	ai Name	mm <sup>2</sup>	AWG	Specifications
P9- P11	Multi-function input terminal			-
СМ	Common terminal input (5G common is used for analog frequency inputs only).			Common earth for multi-function input terminal
V2	Multi-function analog voltage input terminal			Input voltage: 0-10 V or -10-10 V
I2	Multi-function analog current input terminal			0–20 mA input Internal resistance: 249 $\Omega$
AO3	Multi-function analog voltage output terminal			Maximum output voltage: 10 V Maximum output current: 10 mA
AO4	Multi-function analog current output terminal	0.33– 1.25	16–22	Maximum output current: 20 mA
CM	24 V common			Common terminal for external 24 V power source
3A	Multi-function relay 3 output A			Below AC 250 V/5 A, Below DC 30 V/5 A
3C	Multi-function relay 3 common terminal			Below AC 250 V/5 A, Below DC 30 V/5 A
4A	Multi-function relay 4 output A			Below AC 250 V/5 A, Below DC 30 V/5 A
4C	Multi-function relay 4 common terminal			Below AC 250 V/5 A, Below DC 30 V/5 A
5A	Multi-function relay 5 output A			Below AC 250 V/5 A, Below DC 30 V/5 A
5C	Multi-function relay 5 common terminal			Below AC 250 V/5 A, Below DC 30 V/5 A

<sup>2)</sup> Use shielded, twisted-pair cables.

# 4.15 Setting the Built-in Surge Filter

The iS7 series inverters have a built-in surge filter between the input phases and the ground connection to absorb and mitigate surge current. This filter consists of a Y-CAP and multiple varistors.

However, in a non-grounded power system where specific ground faults occur frequently, adequate measures are required to avoid inverter damage.

Refer to the following table for details on how to prevent damage to specific power systems.

Power supply system and ground type	Varistors and Y-CAP connection	Effect
Directly grounded system	2-pin connector (on)	Reduced voltage stress and
Directly grounded system	2-piii connector (on)	noise
Non-grounded or impedance		Reduced risk of inverter
ground system	2-pin connector (off)	damage if ground fault
ground system		occurs

#### Note

The 0.75–22 KW (400 V) and 0.75-75 KW (200 V) products do not support this function.

### ① Caution

- You can deactivate the built-in surge filter if there is no risk of surge voltage occurring in the system.
- In order to prevent accidents, remove the jumper switch after the internal voltage of the inverter is completely discharged.

# 4.16 Activating or Deactivating the Surge Filter

### 4.16.1 iS7 30-75KW (400 V) Inverters

Contact LS ELECTRIC Customer Support and ask for assistance to deactivate the built-in surge filter for the 30–75 KW (400 V) inverters.

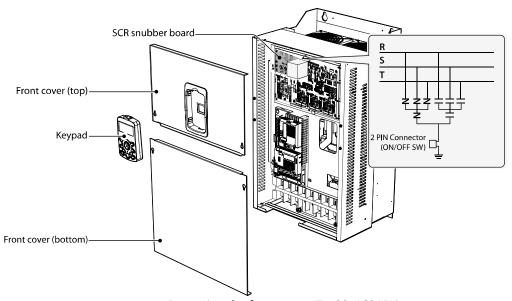
### 4.16.2 iS7 90-375 kW (400V) Inverters

Remove the keypad and the screws from the front cover, and then remove the front cover.

### ① Caution

Be careful not to open the front cover with the keypad attached, as this can damage the keypad cable.

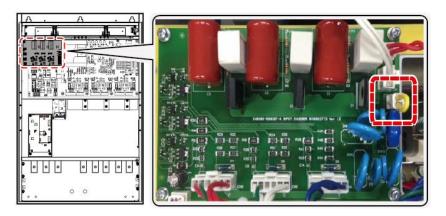
Refer to the figure below and locate the SCR snubber board. On the circuit board, activate or deactivate the surge filter by connecting the two jumper pins or breaking the connection between the two pins using a jumper plug. The filter is turned on when the jumper plug is installed, and it is turned off when the jumper plug is removed.



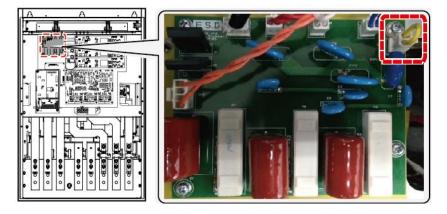
<Removing the front cover (Ex: 90–160 KW)>

Refer to the following figures to locate the jumper switch on the SCR snubber board and install or remove the jumper cap to activate or deactivate the built-in surge filter.

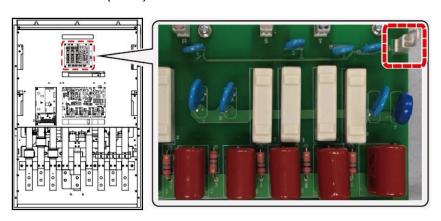
### SV900-1600iS7 (400 V)



### SV1850-2200iS7 (400 V)



### SV2800-3750iS7 (400 V)



# 4.17 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.

Items	Check Point	Result
	Is the installation location appropriate?	
Installation	Does the environment meet the inverter's operating conditions?	
Location/Power	Does the power source match the inverter's rated input?	
I/O Verification	Is the inverter's rated output sufficient to supply the equipment? (Certain circumstances will result in degraded performance.	
	Is a circuit breaker installed on the input side of the inverter?	
	Is the circuit breaker correctly rated?	
	Are the power source cables correctly connected to the R/S/T terminals of the inverter? (Caution: connecting the power source to the U/V/W terminals may damage the inverter.)	
	Are the motor output cables connected in the correct phase rotation (U/V/W)? (Caution: motors will rotate in the reverse direction if three-phase cables are not wired in the correct phase rotation.)	
Power Terminal Wiring	Are the cables used in the power terminal connections correctly rated?	
wiinig	Is the inverter grounded correctly?	
	Are the power terminal screws and the ground terminal screws tightened to their specified torques?	
	Are the overload protection circuits installed correctly on the motors (if multiple motors are run using one inverter)?	
	Is the inverter separated from the power source by a magnetic contactor (if a braking resistor is in use)?	
	Are advanced-phase capacitors, surge protection, and electromagnetic interference filters installed correctly? (These devices MUST not be installed on the output side of the inverter.)	
	Are STP (shielded twisted pair) cables used for control terminal wiring?	
Control Terminal Wiring	Is the shielding of the STP wiring properly grounded?	
Terrimar vvii irig	If 3-wire operation is required, are the multi-function input terminals	

Items	Check Point	Result
	defined prior to the installation of the control wiring connections?	
	Are the control cables properly wired?	
	Are the control terminal screws tightened to their specified torques?	
	Is the total cable length of all control wiring < 328 ft (100 m) for model types rated at 3.7 kW and below, and 984 ft (300 m) for model types rated at more than 3.7 kW?	
	Is the total length of safety wiring < 100 ft (30 m)?	
	Are optional modules connected correctly?	
	Is there any debris left inside the inverter?	
Miscellaneous	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 > 2 years?	
	Has a fuse been installed for the power source?	
	Are the connections to the motor separated from other connections?	

### Note

STP (Shielded Twisted Pair) cables have a highly conductive, shielded screen around twisted-pair cables. STP cables protect conductors from electromagnetic interference.

# 4.18 Test Run

When you turn on the iS7 inverter for the first time, it starts in Easy Start mode to help you configure the basic parameters required for inverter operation.

# 4.18.1 Entering Easy Start Mode

The inverter starts in Easy Start mode when you turn on the inverter for the first time, or when the inverter is turned on following a parameter initialization.

#### Note

- Before setting the parameter values for a user application, initialize the parameter settings to make sure that the default setting is applied to all parameters.
- If you initialized all parameters after an inverter trip occurred, the inverter starts in Easy Start mode after it is reset, regardless of the pending trip condition.
- Easy Start mode is not available while the inverter is already running.

# 4.18.2 Setting the Basic Parameters in Easy Start Mode

Refer to the following sequence table to understand the Easy Start sequence and configure the basic parameters according to the instructions.

Sequence	Instruction
Start Easy Set	Select "Yes" to start the inverter in Easy Start mode (select "No" to start the inverter in Monitor mode).
CNF-01 Language Sel	Select the keypad display language (only English is available at the moment).
DRV-14 Motor Capacity	Set the motor capacity. (Ex: 0.75 kW, 1.5 kW)
BAS-11 Pole Number	Set the number of poles in the motor.
BAS-15 Rated Volt	Set the rated motor voltage. Set this value to "0 V" if the rated motor voltage is identical to the input voltage.
BAS-10 60/50 Hz Sel	Set the rated motor frequency.
BAS19 AC Input Volt	Set the inverter input voltage.
DRV-06 Cmd Source	Set the source of the frequency reference. (Ex: KEYPAD, FX/RX-1, FX/RX-2, etc.)
DRV-01 Cmd Frequency	Set the frequency reference. (Ex: 50 Hz, 60 Hz, etc.)

### Note

While you are in Easy Start mode, you can press the [ESC] key on the keypad to cancel Easy Start mode and enter Monitor mode.

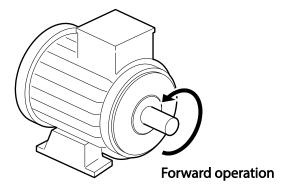
# 4.18.3 Checking the Inverter Operation

### Caution

Using an inverter, you can easily operate a motor at a high speed. Before operating a motor using an inverter, ensure that the set speed is within the motor's rated speed.

Follow the instructions to ensure that the motor operates correctly according to the inverter settings, and adjust the settings if required.

- 1 Set DRV-06 (CMD source) to "0 (KEYPAD)."
- 2 Set DRV-07 (Freq Ref Src) to "0 (Keypad-1)."
- 3 Set DRV-01 (CMD Frequency) to a temporary speed (Ex: 60 Hz).
- 4 Press the FWD key on the keypad, and ensure that the motor is rotating in the correct direction. When 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.



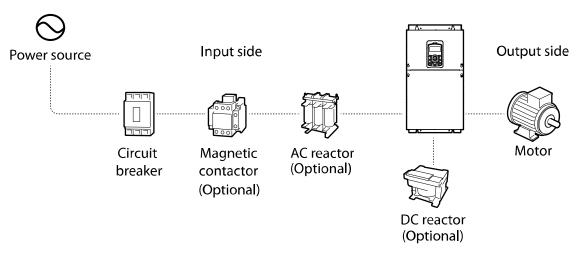
# ① Caution

Ensure that the input power is within the inverter's rated input voltage range during operation.

# **5 Peripheral Devices**

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

Prior to installing the inverter, ensure that the product is suitable for the application (power rating, capacity, etc.). Also, ensure that all of the required peripherals and optional devices (resistor brakes, contactors, noise filters, etc.) are available.



### ① Caution

- Figures in this manual are shown with covers or circuit breakers removed to show a more
  detailed view of the installation arrangements. Install covers and circuit breakers before
  operating the inverter. Operate the product according to the instructions in this manual.
- Supply input power within the voltage range approved for the inverter's rating.
- Do not start or stop the inverter using a magnetic contactor installed in the input power supply.
- If the inverter is damaged and loses control, the machine may cause a dangerous situation. Install an additional safety device, such as an emergency brake, to prevent these situations.
- High levels of current draw during power-on can affect the system. Ensure that correctly rated circuit breakers are installed to operate safely during power-on situations.
- Reactors can be installed to improve the power factor. Note that reactors may be installed within 32.8 ft (10 m) of the power source if the input power exceeds 1000 kVA.
- 400 V class inverters require a motor with reinforced insulation. Micro surge voltages generated at the motor terminals may deteriorate the motor insulation.

# 5.1 Wiring Switch, Electronic Contactor, and Reactor **Specifications**

# 5.1.1 Wiring Switch, Short Circuit Switch, and Electronic Contactor

	Wiring Swi	tch			Short Circuit Switch		Electronic Contactor	
Inverter	METASOL		SUSOL		Short Circuit	SWITCH	Electronic C	ontactor
Capacity	Model	Rated current[A]	Model	Rated current[A]	Model	Rated current[A]	Model	Rated current[A]
0008iS7-2	ABS33c	15	UTE100	15	EBS33c	15	MC-9b	11
0015iS7-2	ABS33c	15	UTE100	15	EBS33c	15	MC-12b	13
0022iS7-2	ABS33c	30	UTE100	30	EBS33c	30	MC-18b	18
0037iS7-2	ABS33c	30	UTE100	30	EBS33c	30	MC-32a	32
0055iS7-2	ABS53c	50	UTS150	50	EBS53c	50	MC-40a	40
0075iS7-2	ABS63c	60	UTS150	60	EBS63c	60	MC-50a	55
0110iS7-2	ABS103c	100	UTS150	100	EBS103c	100	MC-65a	65
0150iS7-2	ABS103c	125	UTS150	125	EBS203c	125	MC-100a	105
0185iS7-2	ABS203c	150	UTS150	150	EBS203c	150	MC-130a	130
0220iS7-2	ABS203c	175	UTS250	175	EBS203c	175	MC-150a	150
0300iS7-2	ABS203c	225	UTS250	225	EBS203c	225	MC-150a	150
0370iS7-2	ABS403c	300	UTS400	300	EBS403c	300	MC-225a	225
0450iS7-2	ABS403c	350	UTS400	350	EBS403c	350	MC-330a	330
0550iS7-2	ABS603c	500	UTS600	500	EBS603c	500	MC-400a	400
0750iS7-2	ABS603c	630	UTS600	600	EBS603c	630	MC-630a	630
0008iS7-4	ABS33c	15	UTE100	15	EBS33c	15	MC-9b	9
0015iS7-4	ABS33c	15	UTE100	15	EBS33c	15	MC-9b	9
0022iS7-4	ABS33c	15	UTE100	15	EBS33c	15	MC-12b	12
0037iS7-4	ABS33c	15	UTE100	15	EBS33c	15	MC-18b	18
0055iS7-4	ABS33c	30	UTE100	30	EBS33c	30	MC-22b	22
0075iS7-4	ABS33c	30	UTE100	30	EBS33c	30	MC-32a	32
0110iS7-4	ABS53c	50	UTS150	50	EBS53c	50	MC-40a	40
0150iS7-4	ABS63c	60	UTS150	60	EBS63c	60	MC-50a	50
0185iS7-4	ABS103c	80	UTS150	80	EBS103c	75	MC-65a	65
0220iS7-4	ABS103c	100	UTS150	100	EBS103c	100	MC-65a	65
0300iS7-4	ABS103c	125	UTS150	125	EBS203c	125	MC-100a	105
0370iS7-4	ABS203c	150	UTS150	150	EBS203c	150	MC-130a	130
0450iS7-4	ABS203c	175	UTS250	175	EBS203c	175	MC-150a	150
0550iS7-4	ABS203c	225	UTS250	225	EBS203c	225	MC-185a	185
0750iS7-4	ABS403c	300	UTS400	300	EBS403c	300	MC-225a	225

	Wiring Switch			Short Circuit Switch		Electronic Contactor		
Inverter	METASOL		SUSOL		Short Circuit Switch		Electronic Contactor	
Capacity	Model	Rated current[A]	Model	Rated current[A]	Model	Rated current[A]	Model	Rated current[A]
0900iS7-4	ABS403c	400	UTS400	400	EBS403c	400	MC-330a	330
1100iS7-4	ABS603c	500	UTS600	500	EBS603c	500	MC-400a	400
1320iS7-4	ABS603c	630	UTS600	600	EBS603c	630	MC-400a	400
1600iS7-4	ABS603c	630	UTS600	600	EBS603c	630	MC-630a	630
1850iS7-4	ABS803c	800	UTS800	800	EBS803c	800	MC-630a	630
2200iS7-4	ABS803c	800	UTS800	800	EBS803c	800	MC-800a	800
2800iS7-4	ABS1003b	1000	UTS1200	1000	EBS1003c	1000	1000A	1000
3150iS7-4	ABS1203b	1200	UTS1200	1200	EBS1203c	1200	1200A	1200
3750iS7-4	1400A	1400	1400A	1400	1400A	1400	1400A	1400

### ① Caution

Only use Class H or RK5 UL listed input fuses and UL listed breakers. See the table above for the voltage and current ratings for the fuses and breakers.

Utiliser UNIQUEMENT des fusibles d'entrée homologués de Classe H ou RK5 UL et des disjoncteurs UL. Se reporter au tableau ci-dessus pour la tension et le courant nominal des fusibless et des disjoncteurs.

#### Note

- If you install the recommended reactors, you can maintain the power factor above 85%, and keep the THD below 40% for operations at the rated load. Improvements are reduced at lighter loads.
- Cable impedance affects the input power factor and occurrence of harmonic waves. The input power factor and THD improvement of the reactors may be lower depending on the transformer capacity, the transformer impedance, and the cable length.
- Refer to the specifications table and install recommended reactors. Although a higher inductance value (L) of the reactor results in an improvement in the power factor and better suppression of harmonic effects, power loss increases at the same time due to voltage drop.
- The capacity of built-in DC reactors in some iS7 inverter models is based on the normal duty load factor. Therefore, improvements may be reduced during a heavy duty operation.

### 5.1.2 Reactors

### **DC Reactor Specifications**

The iS7 200 V/ 400 V 30-75 kW, 400 V/280-375 kW models are not supplied with a built-in DC reactor. Refer to the following specifications tables for different models to choose an appropriate DC reactor for your application.

### <200V/30-75kW>

Investor conscitu	DC reactor specifications				
Inverter capacity	mH	A			
0300iS7-2	0.24	200			
0370iS7-2	0.2	240			
0450iS7-2	0.17	280			
0550iS7-2	0.12	360			
0750iS7-2	0.1	500			

### <400V/30-75kW>

(For Non-DCR products, remove the P1 and P2 shorting pins to install the DC reactor.)

Invertor capacity	DC reactor specifications			
Inverter capacity	mH	A		
0300iS7-4	0.98	75		
0370iS7-4	0.87	90		
0450iS7-4	0.55	110		
0550iS7-4	0.47	150		
0750iS7-4	0.48	180		

### <400V/280-375 kW>

Travertor consists	DC reactor specifications				
Inverter capacity	mH	A			
2800iS7-4	0.09	836			
3150iS7-4	0.076	996			
3750iS7-4	0.064	1195			

### Note

All iS7 models, other than the 200 V/30-75 kW and 400 V/280-375 kW models, may be provided with an optional built-in DC reactor.

### **AC Reactor Specifications**

You can install an AC reactor to prevent the capacitors and generators from overheating or being damaged when the power source voltage is unbalanced.

When you install an AC reactor, connect the AC reactor cables to the R, S, and T terminals on the inverter. Installation of an AC reactor is not necessary if a DC reactor is already installed in the inverter.

To avoid power loss resulting from the incorrect installation of an AC reactor, contact LS ELECTRIC Customer Support to ensure that your model type and application requires the installation of an AC reactor.

Refer to the following specifications tables to choose an appropriate AC reactor for your application.

	AC reactor specifications				
Inverter capacity	Heavy duty		Normal duty		
	mH	A	mH	Α	
0008iS7-2	2.13	5.7	1.20	10	
0015iS7-2	1.20	10	0.88	14	
0022iS7-2	0.88	14	0.56	20	
0037iS7-2	0.56	20	0.39	30	
0055iS7-2	0.39	30	0.28	40	
0075iS7-2	0.28	40	0.20	59	
0110iS7-2	0.20	59	0.15	75	
0150iS7-2	0.15	75	0.12	96	
0185iS7-2	0.12	96	0.10	112	
0220iS7-2	0.10	112	0.07	160	
0300iS7-2	0.07	160	0.05	200	
0370iS7-2	0.05	200	0.044	240	
0450iS7-2	0.044	240	0.038	280	
0550iS7-2	0.038	280	0.026	360	
0750iS7-2	0.026	360	0.02	500	
0008iS7-4	8.63	2.8	4.81	4.8	

	AC reactor specifications					
Inverter capacity	Heavy duty		Normal duty			
	mH	A	mH	A		
0015iS7-4	4.81	4.8	3.23	7.5		
0022iS7-4	3.23	7.5	2.34	10		
0037iS7-4	2.34	10	1.22	15		
0055iS7-4	1.22	15	1.14	20		
0075iS7-4	1.14	20	0.81	30		
0110iS7-4	0.81	30	0.61	38		
0150iS7-4	0.61	38	0.45	50		
0185iS7-4	0.45	50	0.39	58		
0220iS7-4	0.39	58	0.287	80		
0300iS7-4	0.287	80	0.232	98		
0370iS7-4	0.232	98	0.195	118		
0450iS7-4	0.195	118	0.157	142		
0550iS7-4	0.157	142	0.122	196		
0750iS7-4	0.122	196	0.096	237		
0900iS7-4	0.096	237	0.081	289		
1100iS7-4	0.081	289	0.069	341		
1320iS7-4	0.069	341	0.057	420		
1600iS7-4	0.057	420	0.042	558		
1850iS7-4	0.042	558	0.042	558		
2200iS7-4	0.042	558	0.029	799		
2800iS7-4	0.029	799	0.029	799		
3150iS7-4	0.029	799	0.024	952		
3750iS7-4	0.024	952	0.024	952		

# 5.1.3 Dynamic Braking Unit (DBU) and Resistor

## **Dynamic Braking Unit Specifications**

UL form	Туре	Voltage	Capacity of Braking unit		Reference- Terminal arrangement & dimensions	
			30-37 kW	SV370DBU-2U		
		200 V	45-55 kW	SV550DBU-2U		
	Type A		75 kW	SV370DBU-2U, 2Set		
	(For resistance of		30-37 kW			
UL type	DB resistors,		210.02.00		Group 1	
	refer to <u>5.1.6 DB</u> <u>Resistors</u> on page	400.14	75 kW	SV750DBU-4U		
	102.)	400 V	90 kW	SV550DBU-4U, 2Set		
			110-132 kW	SV750DBU-4U, 2Set		
			160 kW	SV750DBU-4U, 3Set		
	Type B  (For resistance of DB resistors, refer to the DB Unit manual)	200 V	30-37 kW	SV037DBH-2		
			30-37 kW	SV037DBH-4	Group 2	
		400 V	45-55 kW,	SV075DBH-4		
			75 kW	SV075DB-4	Group 3	
			185-220 kW SV2200DB-4 Note 1)		Croup 4	
	,		280-375 Kw	SV2200DB-4, 2Set	Group 4	
Non UL			20 27 144	LSLV0370DBU-2LN	Group 5	
type		2001/	30-37 kW	LSLV0370DBU-2HN	Group 6	
	Type C	200 V	45-55 kW,	LSLV0750DBU-2LN	Group 5	
	(For registers of		75 kW	LSLV0750DBU-2HN	Group 6	
	(For resistance of DB resistors,		20 27 144	LSLV0370DBU-4LN	Group 5	
	refer to the DB		30-37 kW	LSLV0370DBU-4HN	Group 6	
	Unit manual)	400 V	45–55 kW, 75 kW	LSLV0750DBU-4LN	Group 5	
			90 kW	LSLV0900DBU-4HN	Group 6	

UL form	Туре	Voltage	Capacity of applied motor	Braking unit	Reference- Terminal arrangement & dimensions
			110-132 kW	LSLV1320DBU-4HN	
			160 kW	LSLV1600DBU-4HN	
			185-220 kW	LSLV2200DBU-4HN	
			280-375 kW	LSLV2200DBU-4HN, 2Set	

Note 1) For model types with a rated capacity of 180 kW and above, contact LS ELECTRIC Customer Support for detailed information.

### Note

- The 0.75–22kW (200 V/400 V) models are provided with a built-in dynamic braking unit. Installation of additional dynamic braking units is not necessary for these models.
- Refer to the instruction manual provided by the manufacturer before installing a dynamic braking unit. There may be specification changes that are not reflected in the table provided with this manual.
- For detailed specifications of type A DB units, such as resistance/wattage/braking torque/%ED, refer to the table in <u>5.1.6 DB Resistors</u> on page <u>102</u>. For type B and type C DB units, refer to the instruction manual provided by the manufacturer.

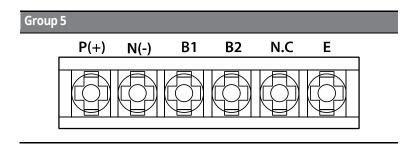
## **DBU Terminal Arrangement**

Group 1	Group 1					
P N G	B1 B2		G	N	B2	P/B1

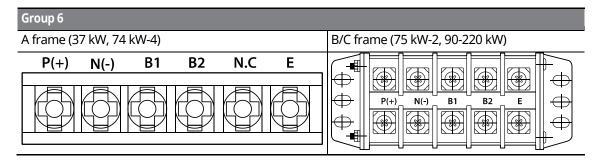
Terminal	Description
G	Ground Terminal
B2	Connect to the B2 terminal of a braking resistor.
B1	Connect to the B1 terminal of a braking resistor.
N	Connect to the N terminal of an inverter.
P	Connect to the P1 terminal of an inverter.

Group 3 (75 kW DB unit)	Group 4 (220 kW DB unit)
P B1 N B2 G  ⊗ ⊗ ⊗ ⊗ ⊗	$ \begin{array}{c c} & & & & G \\ & \otimes & & & \\ \hline \otimes & & \otimes & & \\ \hline \otimes & & \otimes & & \\ P & \otimes & & \otimes & \\ \hline \otimes & & & \otimes & \\ \hline & & & & & \\ \hline & & & & & \\ \hline & & & &$

Terminal	Description
G	Ground Terminal
B2	Connect to the B2 terminal of a braking resistor.
B1	Connect to the B1 terminal of a braking resistor.
N	Connect to the N terminal of an inverter.
P	Connect to the P terminal of an inverter.



Terminal	Description
P (+)	Connect to the P terminal of an inverter.
N(-)	Connect to the N terminal of an inverter.
B1	Connect to the B1 terminal of a braking resistor.
B2	Connect to the B2 terminal of a braking resistor.
N.C	Not used
Е	Ground terminal

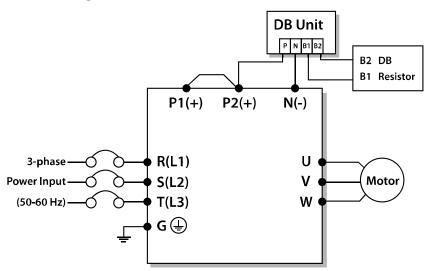


Terminal	Description
P (+)	Connect to the P terminal of an inverter (DC bus).
N(-)	Connect to the N terminal of an inverter (DC bus).
B1	Connect to the B1 terminal of an external braking resistor.
B2	Connect to the B2 terminal of an external braking resistor.
N.C	Not used
E	Ground terminal

### Note

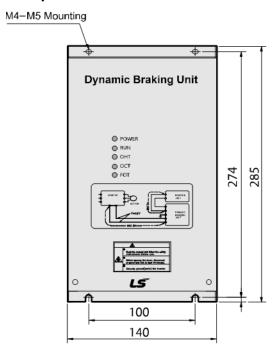
Refer to the instruction manual that is supplied with the DB unit to choose appropriate DB resistors for installation.

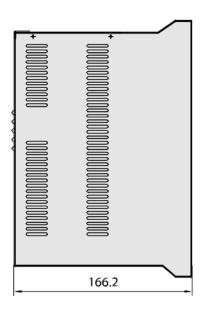
## Basic Wiring Connection for the DB Unit and DB Resistor

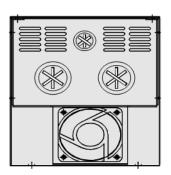


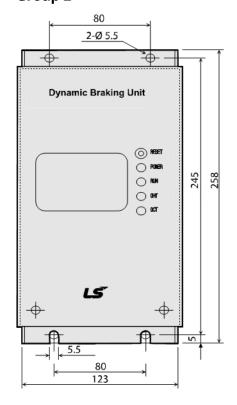
DB Unit Terminal	Description
B1	Connect to the B1 terminal of a DB resistor.
B2	Connect to the B2 terminal of a DB resistor.

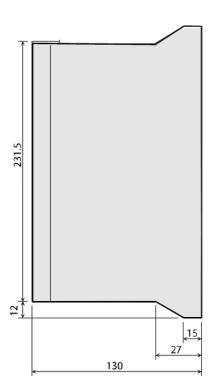
## 5.1.4 DB Unit Dimensions

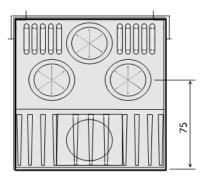


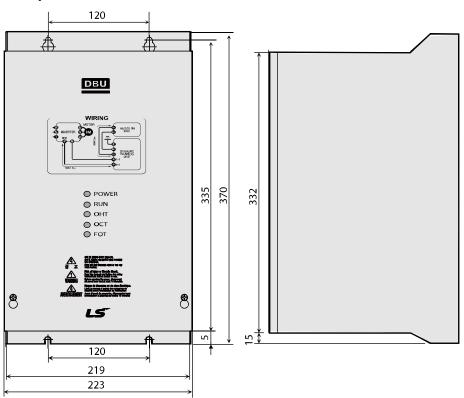


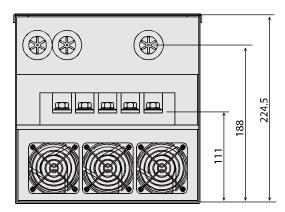


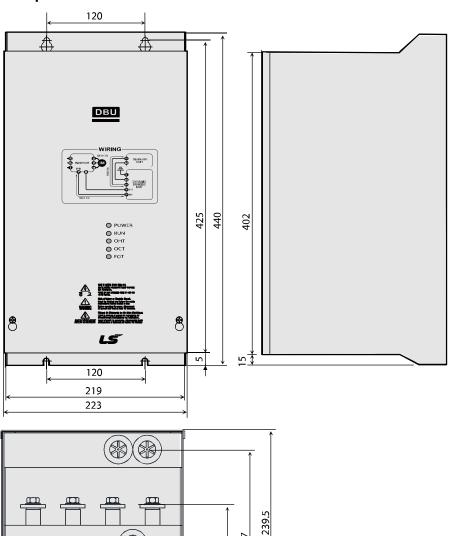










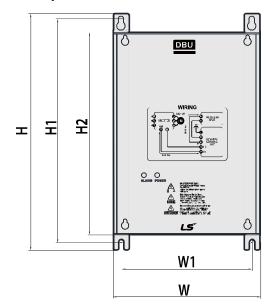


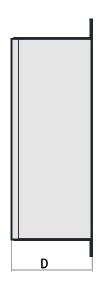
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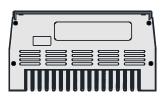
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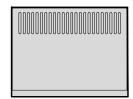


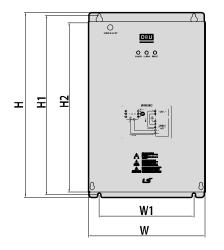


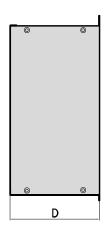


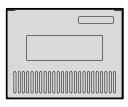


Voltage	Motor capacity	Dimensio	ns (mm)			Hole position		Weight	Hole size
[V]	[kW]	W	Н	H2	D	W1	H1	[kg]	(ф)
	15				76.4	125	215.4	1.50	- M4
220	22		227.4	192				1.55	
220	37	140						1.57	
	75							1.84	
	15	140	227.4				213.4	1.53	
440	22							1.55	
	37							1.56	
	75							1.85	









Frame	Voltage	Motor capacity	%ED	Dimens	Dimensions (mm)				Hole position		Hole size
	[V]	[kW]		W	Н	H2	D	W1	H1	[kg]	( <b>( )</b>
•	220	37	50							3.77	
Α	440	37	50	200	219	190		160	208.5	3.84	-
440	75	50							3.98		
	220	75	50	- - 215 -	340	340 311	165.2		208.5 329.5	8.26	
D	В	90	50					175		8.48	М6
Б		90	50					1/5		8.30	1
440	440	132	50							8.40	1
C 440	160	50	2.40	200	254		200	260.5	9.40	1	
	440	220	50	240	380	80   351		200	309.3	9.70	

#### Indicators on the DB unit 5.1.5

On a DB unit, there are three LED indicators (one red and two green indicators) that indicate the operating condition of the DB unit.

Indicator name	Color	Location	Description
Power indicator	Red	Middle	Turns on when the main power is supplied to the unit (if a DB unit is connected to an inverter, the power indicator is turned on when the main power is supplied to the inverter).
RUN indicator	Green	Right	Turns on when the DB unit is regenerating.
OHT indicator	Green	Left	Turns on when the overheating protection function is enabled.  If the DB unit temperature exceeds the maximum allowed operating temperature, the overheating protection function is activated to cut off the input to the DB unit (the power indicator on the DB unit is turned off).

#### 5.1.6 **DB Resistors**

The following table lists type A DB unit specifications for your reference. For type B and type C DB unit specifications, refer to the instruction manuals that are supplied with the DB units.

Before installing a DB resistor, refer to the instruction manuals provided by the manufacturer to choose an appropriate type of DB resistor.

### Note

When you double the duty cycle (%ED) of a DB unit, the wattage ratings of the optional DB resistor must be doubled accordingly.

	Inverter capacity (kW)	Resistance [ohm]	Wattage [W]	Туре	Reference	Wiring [mm²]	Model Type
	0.75	150	150	-		1.25	-
	1.5	60	300	-		1.25	-
	2.2	50	400	TYPE 1		2.5	MCRF400W50
2	3.7	33	600	TYPE 2	150%	2.5	MCRF600W33
0	5.5	20	800	TYPE 3	braking	2.5	MCRF800W20
0	7.5	15	1200	TYPE 5	torque,	4	MCRF1200W15
V	11	10	2400	TYPE 6	5%ED	4	MCRF-ST2400W10
C	15	8	2400	TYPE 6		10	MCRF-ST2400W8
1	18.5	5	3600	TYPE 7		20	MCRF-ST3600W5
a	22	5	3600	TYPE 7		20	MCRF-ST3600W5
S	30	5	5000	-		-	-
S	37	4.5	7000	-	100%	-	-
	45	3.5	10000	-	braking torque, 10%ED	-	-
	55	3.0	15000	-		-	-
	75	2.5	20000	-		-	-
	0.75	600	150	-	150%	1.25	-
	1.5	300	300	-		2	-
	2.2	200	400	TYPE 1		2.5	MCRF400W200
	3.7	130	600	TYPE 2		2.5	MCRF600W130
	5.5	85	1000	TYPE 4	braking	2.5	MCRF1000W85
4	7.5	60	1200	TYPE 5	torque,	2.5	MCRF1200W60
0	11	40	2000	TYPE 6	5%ED	2.5	MCRF-ST2000W40
۷	15	30	2400	TYPE 6		4	MCRF-ST2400W30
	18.5	20	3600	TYPE 7		6	MCRF-ST3600W20
C	22	20	3600	TYPE 7		6	MCRF-ST3600W20
ı a	30	16.9	6,400	-		-	-
S	37	16.9	6,400	-		-	-
S	45	11.4	9,600	-	100%	-	-
	55	11.4	9,600	-	braking	-	-
	75	8.4	12,800	-	torque,	-	-
	90	4.5	15,000	-	10%ED	-	-
	110	3.5	17,000	-		-	-
	132	3,0	20,000	-		-	-

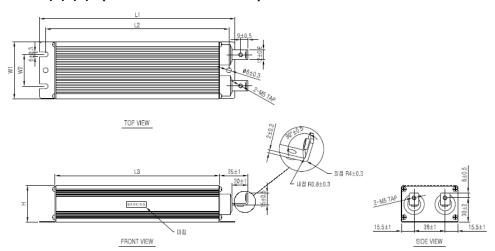
Inverter capacity (kW)		Wattage [W]	Туре	Reference	Wiring [mm²]	Model Type
160	2.5	25,000	-		-	-
185	2	30,000	-		-	-
220	2	30,000	-		-	-
280	1.5	40,000	-		-	-
315	1	60,000	-		-	-
375	1	60,000	-		-	-

## ① Caution

- If you install multiple DB units in parallel, the combined resistance value must match the resistance value in the table above.
- If an appropriate braking resistor type is not listed in the table, find a braking resistor with equivalent resistance and wattage values that are suggested in the table above.

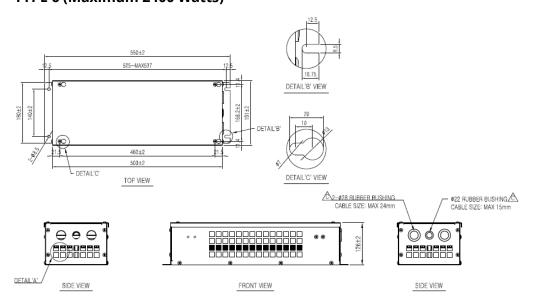
## 5.1.7 DB Resistor Dimensions

## **TYPE 1,2,3,4,5 (Maximum 1200 Watts)**

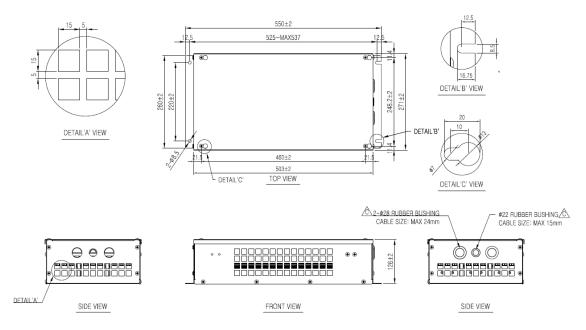


TVDF	Size [mm]						
ТҮРЕ	W	Н	D	А	В	С	
1	220	175	152	70	39	45	
2	260	245	222	70	39	45	
3	300	285	262	70	39	45	
4	340	325	302	70	39	45	
5	400	385	362	70	39	45	

## TYPE 6 (Maximum 2400 Watts)

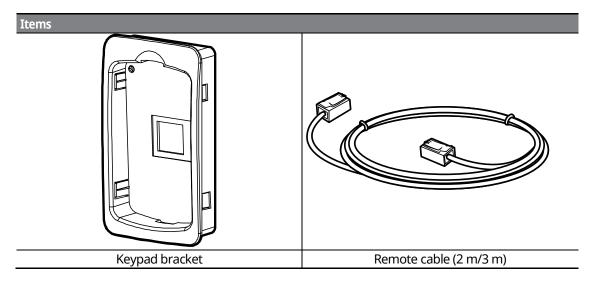


## **TYPE 7 (Maximum 3600 Watts)**

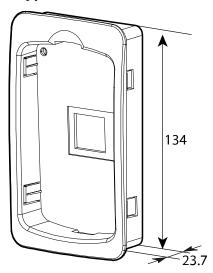


## 5.1.8 Keypad Extension Cable for Remote Control (Optional)

## **Included items**



## **Keypad Bracket Dimensions**

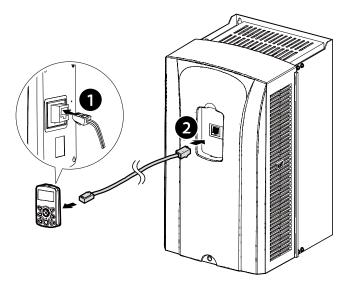


## **Remote Cable Specifications**

Model type	Part name
64110009	INV, iS7 REMOTE CABLE (2 M)
64110010	INV, iS7 REMOTE CABLE (3 M)

## **Installing the Remote Cable**

Refer to the following figure to install the remote cable to extend the keypad cable length.



If a "Line Check" message is displayed on the keypad display and the keypad is not operating correctly after installing the remote cable, check the cable connection on both sides.

## ① Caution

Do not extend the keypad cable using a third-party extension cable. The keypad may not operate correctly due to voltage drop and electromagnetic interference.

### Note

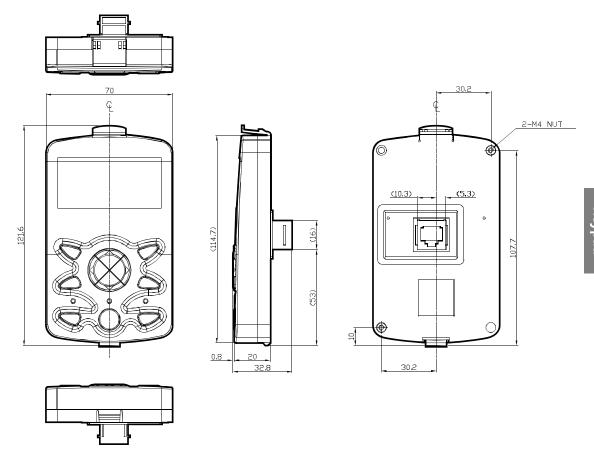
- Ensure that the cable length between the keypad and the inverter does not exceed 10 ft (3.04 m). Cable connections longer than 10 ft (3.04 m) may cause signal errors.
- Install a ferrite clamp to protect signal cables from electromagnetic interference (Ex. Wurth Electronics ferrite clamp PN742732).

# 6 Using the Keypad

# 6.1 About the Keypad

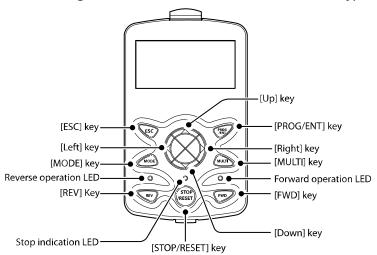
A keypad is used to set inverter parameters, monitor the inverter's status, and operate the inverter.

## 6.1.1 Dimensions



# 6.1.2 Key Functions

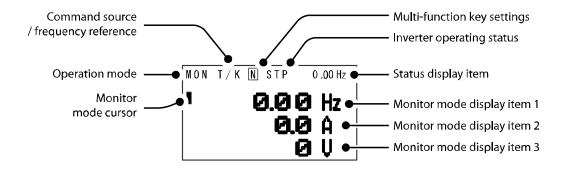
The following table lists the names and functions of the keypad's operation keys.



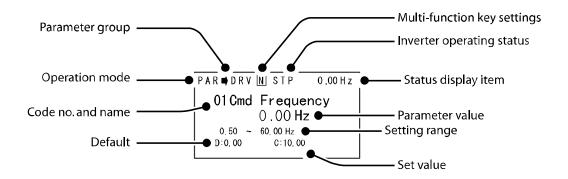
Section	Buttons Key Name		Function Description		
	MODE	[MODE] key	Used to switch between modes.		
	PROF	[PROG/ENT] key	If this button is pressed once, the parameter can be edited at the status of the editable parameter code. If this button is pressed after modification, it will save the modified data.		
		[Up] key	Switch between codes, or increase or decrease		
		[Down] key	parameter values.		
		[Left] key	Switch between groups or move the cursor during parameter setup or modification.		
		[Right] key			
	MULTI	[MULTI] key	Used to register jog or user codes.		
KEY	ESC	[ESC] key	If you press this key before pressing the [PROG / ENT] key, it will revert the parameter value to the previous value.  If you press this key while editing the codes in any function group, the keypad will display the first code of the function group.  If you press this key while moving through the modes, the keypad will display Monitor mode.		
	FWD	[FWD] key	Used to operate the motor in the forward direction.		
	REV	[REV] key	Used to operate the motor in the reverse direction.		
	STOP	[STOP/RESET] key	Used to stop the operation and release a fault.		

## 6.1.3 Display Items

### **Monitor Mode**



### **Parameter Mode**



# 6.1.4 Display Item List

The following table lists the items in the display.

Item	Description
Mode display items	Displays the current mode's display items. For more details, refer
wiode display items	to <u>6.3 Navigating Modes</u> on page <u>117</u> .

Item	Description	
Parameter group items	Displays the current parameter group's items. For more details, refer to <u>6.4 Navigating Modes and Parameters</u> on page <u>120</u> .	
Command source /	Displays the types of sequences and the number of steps during an	
frequency reference items	auto sequence operation.	
Status display items	Displays the output frequency, output voltage, and current. For	
Status display items	more details, refer to <u>6.1.3 Display Items</u> on pages <u>111</u> .	
Monitor mode display items	Displays the current operation status. For more details, refer to <u>6.1.3</u>	
Worldor Friode display items	<u>Display Items</u> on pages <u>111</u> .	

# **Monitor display items**

The following table lists display icons and their names and functions.

No	Function	Display	Description
		MON	Monitor mode
		PAR	Parameter mode
1	Operation mode	U&M	User-defined and Macro mode
	mode	TRP	Trip mode
		CNF	Configuration mode
		K	Keypad operation command
	C	0	FieldBus communication option operation command
2	Command	A	Application option operation command
	Source	R	Built-in 485 operation command
		Т	Terminal block operation command
		K	Keypad frequency command
		V	V1 input frequency command
		I	I1 input frequency command
		Р	Pulse input frequency command
	Fraguency	U	Frequency command during UP operation
3	Frequency reference		(Up-Down operation)  Frequency command during DOWN operation
		D	(Up-Down operation)
		S	Frequency command during STOP operation
			(Up-Down operation)
		0	FBus Option frequency command
		Х	V2 and I2 frequency commands for sub-terminal block

No	Function	Display	Description
		J	Jog frequency command
		R	Internal 485 frequency command
		1-9 A-F	Multi-step frequency command
		JOG key	Used to switch to Keypad JOG mode
	Multi-function	Local/Remote	Used to select local or remote operation
4	key settings	User Group Select key	Used to register parameters as a user group in Parameter mode or delete parameters in the user group.
		STP	Motor stopped
		FWD	Operating in the forward direction
		REV	Operating in the reverse direction
		DC	DC output
5	Inverter	WAN	Warning
3	operating status	STL	Stalling
		SPS	Speed Search
		OSS	Software over current controlled
		OSH	Hardware over current controlled
		TUN	Auto tuning

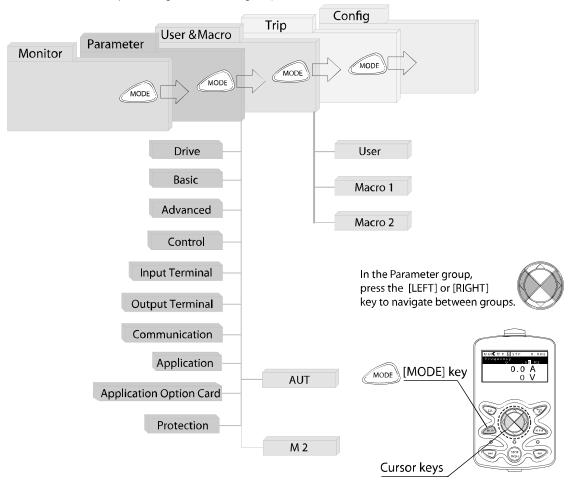
\*OSS / OSH may cause overcurrent when the load is too large or when the acceleration/deceleration time is short. The inverter monitors the output current so that an overcurrent trip does not occur and also performs overcurrent suppression.

At this time, the output frequency is automatically changed to reduce the output current or the inverter output is temporarily cut off to prevent overcurrent.

## 6.2 Menu Items

The SV-iS7 series inverter uses 5 modes to monitor or configure different functions. Each mode has its own function items suitable for the desired properties. The parameters in Parameter mode and User & Macro mode are divided into smaller groups of relevant functions.

Press the [MODE] key to navigate between groups.



Mode	Display	Description
Monitor mode	MON	Displays the inverter's operation status information. You can monitor the frequency setting, operating frequency display, output current, voltage, etc.
Parameter mode	PAR	Used to configure the functions required to operate the inverter. These functions are divided into 12 groups based on purpose and complexity.
User & Macro mode	U&M	Used to define User and Macro groups. These user-definable groups allow specific functions of the inverter to be grouped and managed in separate groups.  This mode will not be displayed when navigating through modes if no User groups or Macro groups have been defined.
Trip mode	TRP	Used to monitor the inverter's fault trip information, including the previous fault trip history.  When a fault trip occurs during inverter operation, the operation frequency, output current, and output voltage of the inverter at the time of the fault can be monitored.  This mode will not be displayed if the inverter is not at fault and a fault trip history does not exist.
Configuration mode	CNF	Used to configure the inverter features that are not directly related to the operation of the inverter. The settings you can configure in Configuration mode include keypad display language options, monitor mode environment settings, communication module display settings, and parameter duplication and initialization.

## 6.2.1 Parameter Mode

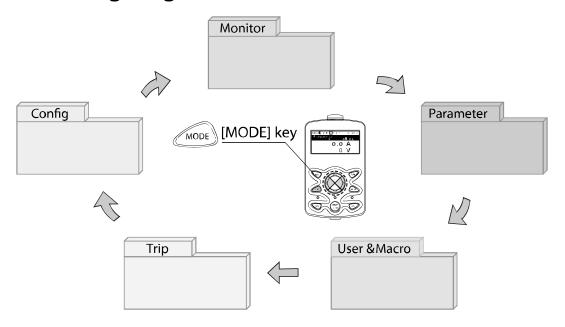
Mode	Display	Description
Drive group	DRV	Includes frequency/acceleration/deceleration time setting, operation command selection, etc.
Basic group	BAS	Configures basic operation parameters. These parameters include motor parameters and multi-step frequency parameters.
Advanced function group	ADV	Configures acceleration or deceleration, patterns, and frequency limits.
Control function group	CON	Configures functions related to sensorless and vector control.
Input terminal function group	IN	Configures input terminal–related features, including digital multi–functional inputs and analog inputs.

Mode	Display	Description
Output terminal function group	OUT	Configures the inverter output terminal block-related features, including the relay and analog outputs.
Communication function group	СОМ	Configures the communication features for the RS-485, if one is installed.
Application function group	APP	Configures the features related to PID control and auto sequence operation.
Auto Sequence run group	AUT	Configures the necessary features for auto sequence operation. This group will be displayed if the auto sequence operation in the APP group is selected.
Application option group	APO	Configures the encoder and PLC option module-related features if they are installed.
Protection group	PRT	Configures motor and inverter protection features.
Motor 2 function group (Motor 2)	M2	Configures the secondary motor-related features. This group will be displayed when Motor #2 is selected from the multi-function input terminal functions.

## 6.2.2 User & Macro Mode

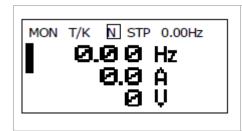
Group	Display	Description
User group	USR	Used to group frequently accessed function parameters. User parameter groups can be configured using the multi-function key on the keypad.
Macro group	MCx	This provides different factory preset groups of functions based on the type of load. Group MC1, MC2, or MC3 will be displayed when the user selects the desired load type. Macro groups can be selected in CNF mode. For more details, refer to

### 6.3 **Navigating Modes**

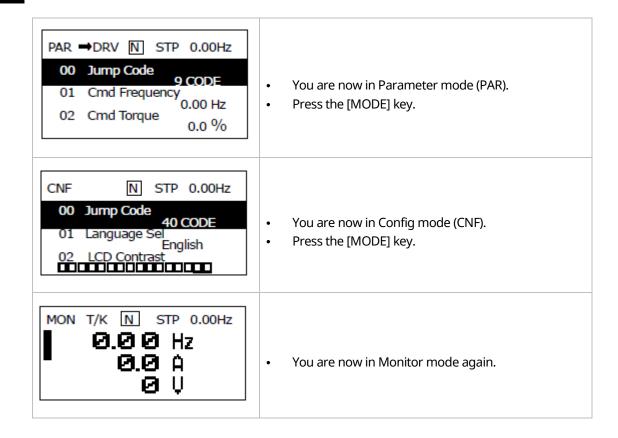


#### **Mode Navigation at the Factory Default** 6.3.1

You can change the display to navigate modes by using the [MODE] key. The User & Macro Mode and Trip Mode are not displayed when the inverter is set to the factory default settings. For more details, refer to 11.12 Parameter Group for Transmission of Macro Group and User Group at U&M Mode on page 361.

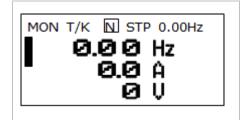


- Displays when the inverter is powered on. This is the display of Monitor mode (MON).
- Press the [MODE] key.

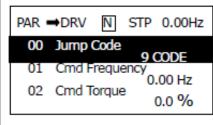


## 6.3.2 Mode Navigation with User/Macro Mode and Trip Mode

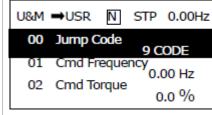
If you register a user code or set the macro function using the [MULTI] key, the User & Macro mode will be displayed, unlike the factory default settings during mode navigation. In addition, when a trip occurs during operation, Trip mode will be displayed. The trip information will also be saved in the trip mode history if you release the trip using the RESET function. The two modes for mode navigation are as follows.



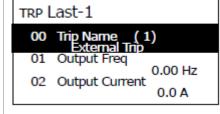
- Displays when the inverter is powered on. This is the display of Monitor mode (MON).
- Press the [MODE] key.



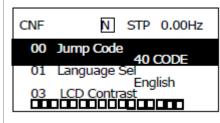
- You are now in Parameter mode (PAR).
- Press the [MODE] key.



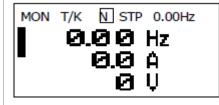
- You are now in User & Macro mode (U&M).
- Press the [MODE] key.



- You are now in Trip mode (TRP).
- Press the [MODE] key.



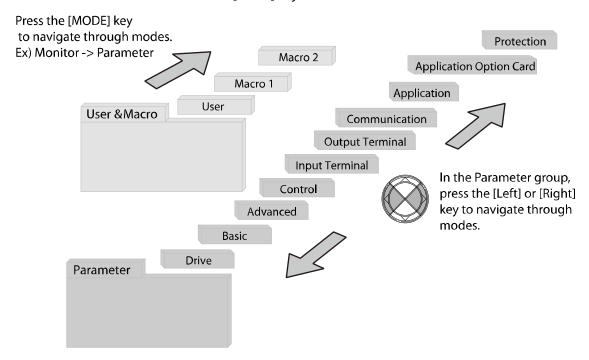
- You are now in Config mode (CNF).
- Press the [MODE] key.



You are now in Monitor mode again.

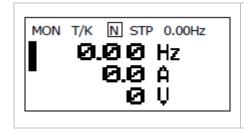
# 6.4 Navigating Modes and Parameters

You can navigate modes by using the [Left] or [Right] keys after navigating to the Parameter Mode or User & Macro Mode via the [Mode] key.



## 6.4.1 Group Navigation in Parameter mode

If you press the [Right] key in Parameter mode, the display will change as shown below. If you press the [Left] key, the display order will be reversed.



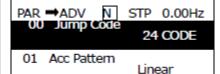
- Displays when the inverter is powered on. This is the display of Monitor mode (MON).
- Press the [MODE] key.

## PAR →DRV N STP 0.00Hz 00 Jump Code 9 CODE 01 Cmd Frequency

- 0.00 Hz 02 Cmd Torque 0.0 %
- You are now in Parameter mode (PAR).
- The Drive Group (DRV) of Parameter mode is displayed.
- Press the [Right] key.

### STP 0.00Hz PAR →BAS N 00 Jump Code 20 CODE

- 01 Aux Ref Src None 02 Cmd 2nd Src Fx/Rx-1
- You are now in the Basic Function Group (BAS).
- Press the [Right] key.



Linear

02 Dec Pattern

- You are now in the Advanced Function Group (ADV).
- Press the [Right] key 7 times.

PAR →PRT N STP 0.00Hz 00 Jump Code 40 CODE Load Phase Loss

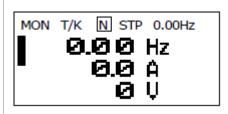
- The group sequence will change and the Protection Function Group (PRT) will be displayed.
- Press the [Right] key.

STP 0.00Hz PAR ⇒DRV N 00 Jump Code 9 CODE 01 Cmd Frequency 0.00 Hz 02 Cmd Torque 0.0%

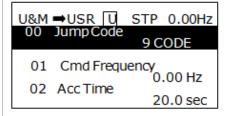
You are now in the Drive group (DRV) of the Parameter group again.

#### 6.4.2 **Group Shift in User & Macro Mode**

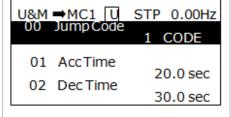
To navigate to User & Macro Mode, the user code should be registered or the macro function should be selected. For more details on how to register the user code and macro group, refer to 11.12 Parameter Group for Transmission of Macro Group and User Group at U&M Mode on page <u>361</u>. If the user code is registered and the macro function is selected, you can navigate to the group as shown below.



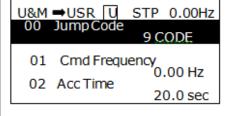
- Displays when the inverter is powered on. This is the display of Monitor mode (MON).
- Press the [MODE] key twice.



- You are now in the User & Macro mode (U&M).
- The User Group (USR) is displayed.
- Press the [Right] key.



- You are now in the Macro group (MC1).
- Press the [Right] key.

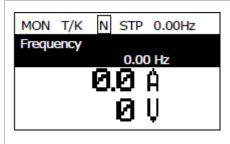


You are now in the User Group (USR) again.

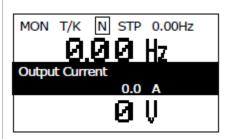
## 6.5 Navigating through Codes (Function Items)

#### **Code Navigation in Monitor Mode** 6.5.1

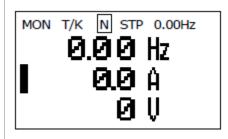
To display the frequency, output current, and output voltage, press the [Up] or [Down] keys to scroll through the items.



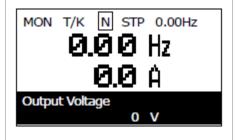
- Displays when the inverter is powered on. This display is in Monitor mode.
- The cursor is located at the frequency item.
  - Press the [Down] key.



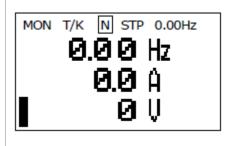
- The second display item displays the output current.
- Do not press any key for approximately 2 seconds after navigation.



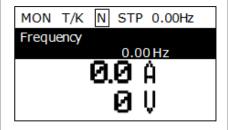
- The output current text has disappeared and the cursor has moved to the second display item.
- Press the [Down] key.



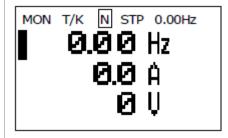
- The third display item displays the output voltage.
- Do not press any key for approximately 2 seconds after navigation.



- The output voltage text has disappeared and the cursor has moved to the third display item.
- Press the [Up] key twice.



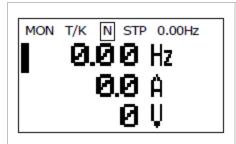
The first item displays the frequency.



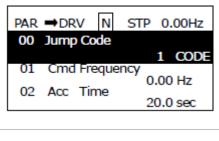
The frequency text has disappeared and the cursor has moved to the first display item.

## 6.5.2 Code Navigation (function items) in Other Modes and Groups

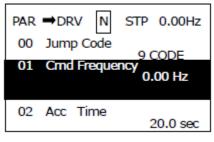
Using the [Up] and [Down] keys: The following example demonstrates how to navigate through the codes in the Drive (DRV) group and the Basic [BAS] group of Parameter mode. Code navigation in other modes is the same as follows.



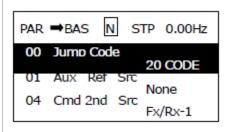
- Displays when the inverter is powered on. This display is in Monitor mode.
- Press the [Down] key.



Displays the Drive (DRV) group of Parameter mode. If the DRV group is not displayed, press the [MODE] key until the DRV group appears, or press the [ESC] kev.



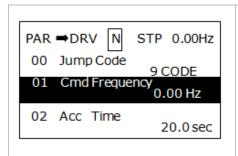
- If you press the [Down] key, you will navigate to code No. 01 in the DRV group of Parameter mode.
- Press the [Right] key.



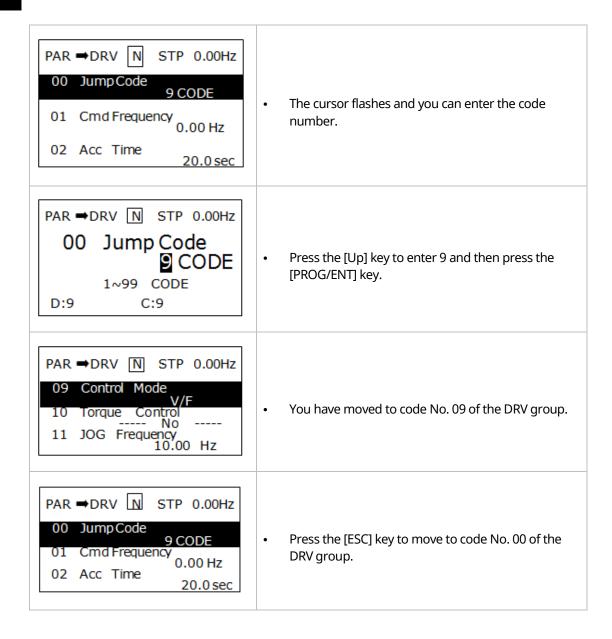
- You have moved to the Basic (BAS) group of Parameter mode.
- You can navigate through the codes using the [Up] or [Down] keys.

### **Code Navigation Using Jump Code** 6.5.3

In the Parameter mode and User/Macro mode groups, you can use the Jump Code Entry item to move to a desired code. It is quicker to move to a large code number using the Jump Code Entry item rather than the [Up] and [Down] keys. The following example demonstrates how to move to code No. 09 of the Drive (DRV) group.



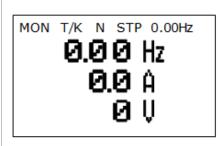
- Ensure that code No. 00 is displayed in the initial display of the Drive (DRV) group of Parameter mode.
- Press the [PROG/ENT] key.



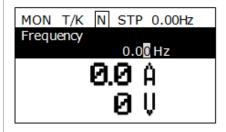
## 6.6 Setting Parameters

#### **Parameter Settings in Monitor Mode** 6.6.1

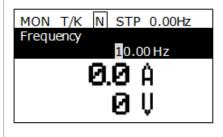
You can set some parameters, such as the frequency, in Monitor mode. The following example demonstrates how to set the frequency.



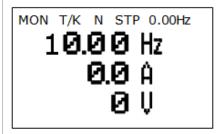
- Ensure that the cursor is at the frequency item. Also, ensure that the frequency can be set to 09 in the Drive (DRV) group using the keypad.
- Press the [PROG/ENT] key.



- Detailed information of the item is displayed and the cursor flashes.
- Press the [Left] or [Right] keys to move the cursor to the desired location to set the frequency.



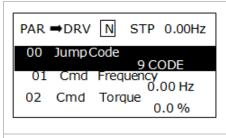
- Press the [Up] key to set the frequency to 10 Hz.
- Press the [PROG/ENT] key.



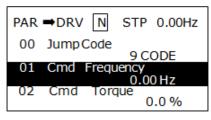
The frequency reference is set to 10 Hz.

## 6.6.2 Parameter Settings in Other Modes and Groups

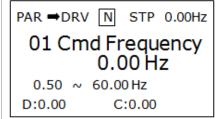
The following example demonstrates how to change the frequency of the Drive (DRV) group in Parameter mode. The frequency in the other modes or groups can be set as follows.



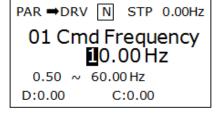
- This is the initial display in Parameter mode.
- Press the [Down] key.



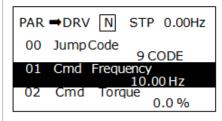
- You have moved to the 01 frequency setting code.
- Press the [PROG/ENT] key.



- The cursor flashes and you can enter the desired frequency.
- If the frequency reference is set to 10 Hz, press the [Left] or [Right] keys to move the cursor to the desired place.



 Press the [Up] key to enter 10 Hz and then press the [PROG/ENT] key.



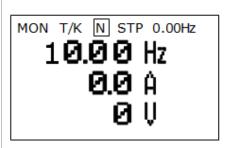
The frequency reference is set to 10 Hz.

128

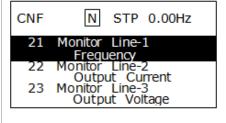
# 6.7 Monitoring Operating Status

#### **Using Monitor Mode** 6.7.1

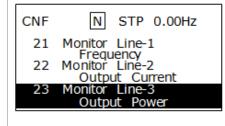
Three items can be displayed in Monitor mode at a time. Also, some items, such as the frequency item, can be edited. You can select the displayed items in Configuration (CNF) mode.



- This is the initial display in Monitor mode.
- The frequency, current, and voltage are set as the default monitor items.
- The frequency reference is displayed when the inverter operation has stopped, and the operating frequency is displayed when the inverter is operating.



- You can set the items to display in Monitor mode in sequence from 21 to 23 in Configuration (CNF) mode.
- Press the [Down] key to move to code No. 23



Change the code No. 23 item in Monitor mode to the output power.



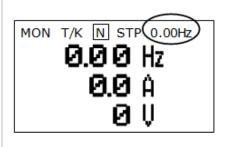
Ensure that the third displayed item in Monitor mode is changed to the output power.

# 6.7.2 Monitoring Items

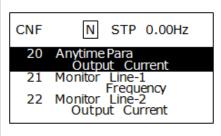
Mode	Code	Function Display	Setting	Range	Initial Value
	20	Anytime Para	0	Frequency	0: Frequency
	21	Monitor Line-1 1		Speed	0: Frequency
	22	Monitor Line-2	2	Output Current	2:Output Current
			3	Output Voltage	
			4	Output Power	
			5	WHour Counter	
			6	DCLink Voltage	
			7	DI Status	
			8	DO Status	
			9	V1 Monitor [V]	
			10	V1 Monitor [%]	
			11	I1 Monitor [mA]	
CNF			12	I1 Monitor [%]	
CIVI			13	V2 Monitor [V]	
	23	Monitor Line-3	14	V2 Monitor [%]	3:Output Voltage
			15	I2 Monitor [mA]	
			16	I2 Monitor [%]	
			17	PID Output	
			18	PID Ref Value	
			19	PID Fdb Value	
			20	Torque	
			21	Torque Limit	
			22	Trq Bias Ref	
			23	Speed Limit	
			24	Load Speed	
			25	Temperature	

#### **Using the Status Display** 6.7.3

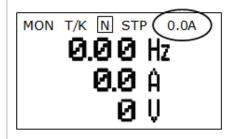
The items displayed on the right-top of the display are shown in other modes, including Monitor mode. If you register a desired variable in the display, you can monitor it at any time regardless of the mode navigation or change.



- This is the initial display of Monitor mode.
- When the inverter settings are set to the factory default, the status item displays the frequency.



- Select the item to display in the status display in code 20 of Configuration (CNF) mode.
  - Press the [PROG/ENT] key to change the item to the output current.
- The unit at the top of the display is changed from hertz (frequency) to amps (current).



Ensure that the unit in the status display is changed to amps (current) in Monitor mode.

# 6.8 Monitoring Faults

#### **Faults during Inverter Operation** 6.8.1

TRP current

# Over Voltage (01)

01 Output Freq 48.30 Hz 02 Output Current 33.3 A

If a fault trip occurs during inverter operation, the inverter enters Trip mode automatically and displays the type of fault trip that has occurred.

TRP Last-1

01 Output Freq

48.30 Hz

02 Output Current

33.3 A

03 Inverter State Stop Press the [Down] key to view the information on the inverter at the time of the fault, including the output frequency, current, and operating status.

MON T/K N STP 0.0A 0.00 Hz

When the inverter is reset and the fault trip is released, the keypad display returns to the screen that was displayed before the fault trip occurred.

#### **Multiple Faults at a Time during Inverter Operation** 6.8.2

## TRP current Over Voltage (02)

01 Output Freq 48.30 Hz 02 Output Current 33.3 A

- If multiple fault trips occur at the same time, the number of fault trips that occurred is displayed next to the fault trip type.
- Press the [PROG/ENT] key.

# TRP current Name (2)

- 0 Over Voltage Externa Trip 1
- The types of all the fault trips are displayed.
- Press the [PROG/ENT] key.

### TRP current Over Voltage (02)

01 Output Freq 48.30 Hz 02 Output Current 33.3 A

The display mode that was shown before you checked the fault information is displayed.

#### Saving and Monitoring the Fault Trip History 6.8.3

Previous fault trips can be saved in Trip mode. You can save up to 5 previous fault trips. Fault trips caused by resetting the inverter, as well as low voltage faults caused by the inverter being switched off, are also saved.

If there are more than 5 fault trips, the oldest 5 fault trips are automatically deleted.

### TRP current

## Over Voltage (02)

01 Output Freq

48.30 Hz

02 Output Current 33.3 A If a fault trip occurs during inverter operation, the inverter enters Trip mode and displays the type of fault trip that has occurred.

MON T/K N STP 0.0A

0.00 Hz

- If you press the [STOP/RESET] key or an input is entered on the terminal, the fault trip is automatically saved and the display status that was displayed before the fault trip occurred is displayed.
- Press the [MODE] key to move to Trip mode.

## TRP current

## 00 Trip Name (2)

## Over Voltage

01 Output Freq

48.30 Hz 02 Output Current

33.3 A

- The most recent fault trip is saved in the Last-1 code.
- Press the [Right] key.

### TRP current

## 00 Trip Name (1) External Trip

01 Output Freq

48.30 Hz

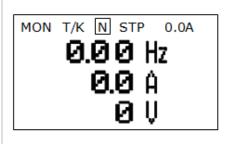
02 Output Current

33.3 A

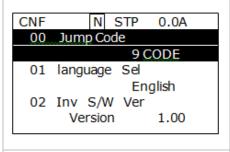
- The previous fault trips are saved in the Last-2 code.
- If another fault trip occurs, the previous fault trips saved in the Last-2 code move to the Last-3 code.

#### 6.9 **Initializing Parameters**

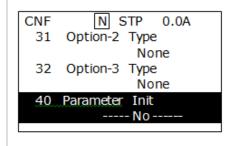
You can initialize the changed parameters. In addition to initializing the entire parameter, you can also select the individual parameter mode to be initialized.



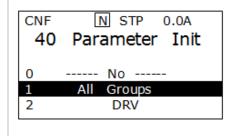
Monitor mode is displayed.



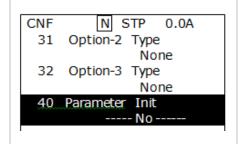
Press the [MODE] key to move to Configuration (CNF) mode.



- Press the [Down] key to move to code No. 40.
- Press the [PROG/ENT] key.



Of the parameter items to initialize, select All Groups and then press the [PROG/ENT] key.



The Parameter Initialization option is displayed again when the initialization is complete.

# **Basic Functions**

### **Setting Frequency References** 7.1

The iS7 inverter provides several methods to set up and modify a frequency reference for an operation. The keypad, analog inputs [for example voltage (V1) and current (I1) signals], or RS-485 (digital signals from higher-level controllers, such as PCs or PLCs) can be used.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
				0	KeyPad-1		
				1	KeyPad-2	0-9	
				2	V1		
	07	Frequency reference source	5 D (C	3	I1		
DRV				4	V2		
DKV	07		Freq Ref Src	5	I2		-
				6	Int 485		
				7	Encoder		
				8	Field Bus		
				9	Pulse		

## 7.1.1 Keypad as the Source (KeyPad-1 setting)

You can modify the frequency reference using the keypad and apply changes by pressing the [ENT/PROG] key. To use the keypad as a frequency reference input source, go to DRV-07 (Frequency reference source) and change the parameter value to "0 (Keypad-1)". Input the frequency reference for an operation at DRV-01 (Frequency reference).

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	01	Frequency reference	Cmd Frequency	0.00		0.00-max. frequency*	Hz
DRV	07	Frequency reference source	Freq Ref Src	0	KeyPad-1	0-9	-

<sup>\*</sup> You cannot set a frequency reference that exceeds the max. frequency, as configured with DRV-20.

## 7.1.2 Keypad as the Source (KeyPad-2 setting)

You can use the [UP] and [DOWN] cursor keys to modify a frequency reference. To use this as a second option, set the keypad as the source of the frequency reference by going to DRV-07 (Frequency reference source) and changing the parameter value to "1 (Keypad-2)". This allows frequency reference values to be increased or decreased by pressing the [UP] and [DOWN] cursor keys.

Group	Code	Name	LCD Display	Pa	rameter Setting	Setting Range	Unit
DRV	01	Frequency reference	Cmd Frequency	0.0	00	0.00–max. frequency *	Hz
	07	Frequency reference source	Freq Ref Src	1	KeyPad-2	0-9	-

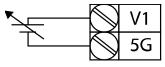
<sup>\*</sup> You cannot set a frequency reference that exceeds the max. frequency, as configured with DRV-20.

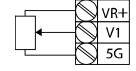
## 7.1.3 V1 Terminal as the Source

You can set and modify a frequency reference by setting voltage inputs when using the V1 terminal. Use voltage inputs ranging from 0– $10\,V$  (unipolar) for forward-only operations. Use voltage inputs ranging from -10 to +10 V (bipolar) for both directions, with negative voltage inputs used for reverse operations.

# 7.1.3.1 Setting a Frequency Reference for 0–10 V Input

Set IN-06 (V1 Polarity) to "0 (unipolar)". Use a voltage output from an external source or use the voltage output from the VR terminal to provide inputs to V1. Refer to the diagrams below for the wiring required for each application.





[External source application]

[Internal source (VR) application]

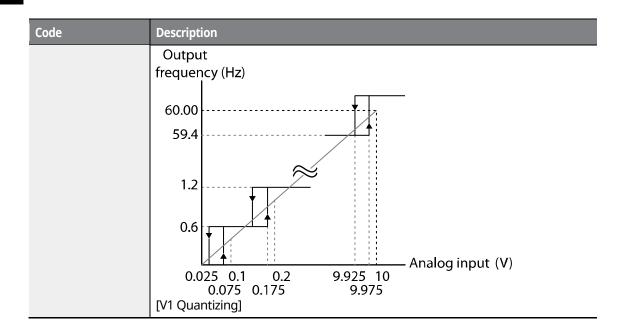
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	2	V1	0–9	-
	01	Frequency at maximum analog input	Freq at 100%	Maxim freque	_	0.00– max. frequency	Hz
	05	V1 input monitor	V1 Monitor[V]	0.00		0.00-10.00	V
	06	V1 polarity options	V1 Polarity	0	Unipolar	0–1	-
	07	V1 input filter time constant	V1 Filter	10		0–10000	ms
	08	V1 minimum input voltage	V1 volt x1	0.00		0.00-10.00	V
IN	09	V1 output at minimum voltage (%)	V1 Perc y1	0.00		0.00–100.00	%
	10	V1 maximum input voltage	V1 Volt x2	10.00		0 .00– 10.00	V
	11	V1 output at maximum voltage (%)	V1 Perc y2	100.00	1	0–100	%
	16	Rotation direction options	V1 Inverting	0	No	0–1	-
	17	V1 quantizing level	V1 Quantizing	0.04		0.00*, 0.04– 10.00	%

<sup>\*</sup>Quantizing is disabled if "0" is selected.

# 0–10 V Input Voltage Setting Details

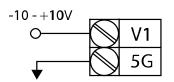
Code	Description
IN-01 Freq at 100%	<ul> <li>Configures the frequency reference at the maximum input voltage when a potentiometer is connected to the control terminal block. A frequency set with code IN-01 becomes the maximum frequency only if the value set in code IN-11 (or IN-15) is 100%.</li> <li>Set code IN-01 to 40.00 and use default values for codes IN-02-IN-16. The motor will run at 40.00 Hz when a 10 V input is provided at V1.</li> <li>Set code IN-11 to 50.00 and use default values for codes IN-01-IN-16. The motor will run at 30.00 Hz (50% of the default maximum frequency-60 Hz) when a 10 V input is provided at V1.</li> </ul>
IN-05 V1 Monitor[V]	Configures the inverter to monitor the input voltage at V1.
IN-07 V1 Filter	The V1 filter may be used when there are large variations between reference frequencies. Variations can be mitigated by increasing the time constant, but this requires an increased response time.  The value t (time) indicates the time required for the frequency to reach 63% of the reference, when external input voltages are provided in multiple steps.  V1 input from external source  Frequency 100% 63%  V1 Filter(t)  [V1 Filter]
IN-08 V1 volt x1- IN-11 V1 Perc y2	These parameters are used to configure the gradient level and offset values of the output frequency, based on the input voltage.

Code	Description
	Frequency reference
	In.11 V1 input
IN-16 V1 Inverting	In.08 In.10  Inverts the direction of rotation. Set this code to "1 (Yes)" if you need the motor to run in the opposite direction from the current rotation.
IN-17 V1 Quantizing	Quantizing may be used when the noise level is high in the analog input (V1 terminal) signal.  Quantizing is useful when you are operating a noise-sensitive system, because it suppresses any signal noise. However, quantizing will diminish system sensitivity (resultant power of the output frequency will decrease based on the analog input).  You can also turn on the low-pass filter using code IN-07 to reduce the noise, but increasing the value will reduce responsiveness and may cause pulsations (ripples) in the output frequency.  Parameter values for quantizing refer to a percentage based on the maximum input. Therefore, if the value is set to 1% of the maximum analog input (60 Hz), the output frequency will increase or decrease by 0.6 Hz for every 0.1 V change in voltage.  When the analog input is increased, an increase in the input equal to 75% of the set value will change the output frequency, and then the frequency will increase according to the set value. Likewise, when the analog input decreases, a decrease in the input equal to 75% of the set value will make an initial change to the output frequency.  As a result, the output frequency will be different at acceleration and deceleration, mitigating the effect of analog input changes over the output frequency (ripples).



# 7.1.3.2 Setting a Frequency Reference for -10-+10 V Input

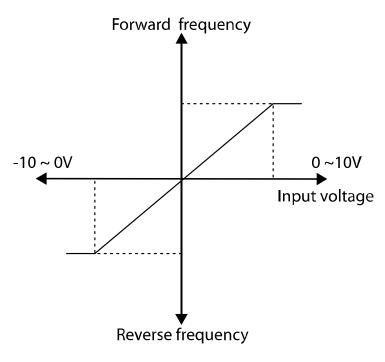
Set DRV-07 (Frequency reference source) to "2 (V1)", and then set IN-06 (V1 Polarity) to "1 (bipolar)". Use the output voltage from an external source to provide an input to V1.



VR+ V1 VR-

[External source application] [V1 terminal wiring]

[Internal source (VR) application]



[Bipolar input voltage and output frequency]

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	2	V1	0-9	-
IN	01	Frequency at maximum analog input	Freq at 100%	60.00		0–max. frequency	Hz

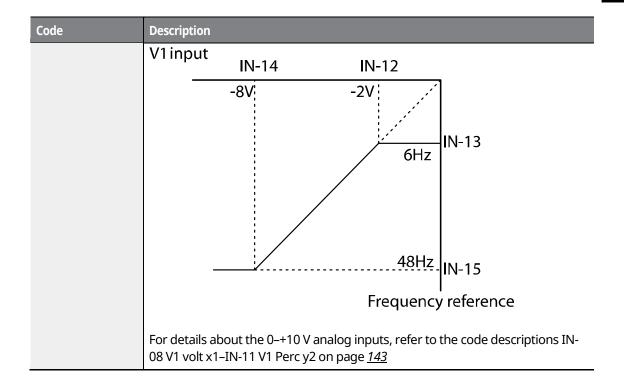
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	05	V1 input monitor	V1 Monitor	0.00		0.00-10.00 V	٧
	06	V1 polarity options	V1 Polarity	1	Bipolar	0–1	-
	12	V1 minimum input voltage	V1- volt x1	0.00		0.00-10.00 V	V
	13	V1 output at minimum voltage (%)	V1- Perc y1			-100.00-0.00%	%
	14	V1 maximum input voltage	V1- Volt x2			-10.00-0.00 V	V
	15	V1 output at maximum voltage (%)	V1- Perc y2	-100.	00	-100.00-0.00%	%

# **Rotational Directions for Different Voltage Inputs**

Command /	Input voltage					
Voltage Input	0-10 V	-10-0 V				
FWD	Forward	Reverse				
REV	Reverse	Forward				

## 10–10 V Voltage Input Setting Details

Code	Description
IN-12 V1- volt x1– IN-15 V1- Perc y2	Sets the gradient level and offset value of the output frequency in relation to the input voltage. These codes are displayed only when IN-06 is set to "1 (bipolar)".  As an example, if the minimum input voltage (at V1) is set to "-2 (V)" with 10% output ratio, and the maximum voltage is set to "-8 (V)" with an 80% output ratio, the output frequency will vary within the range of 6–48 Hz.



## 7.1.3.3 Setting a Reference Frequency using Input Current (I1)

You can set and modify a frequency reference using input current at the I1 terminal. Set DRV-07 (Frequency reference source) to "3 (I1)" and apply an input current of 0–20 mA to I1.

Group	Code	Name	LCD Display	Paramet	ter Setting	Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	3	I1	0-9	-
	01	Frequency at maximum analog input	Freq at 100%	60.00		0–max. frequency	Hz
	20	I1 input monitor	I1 Monitor	0.00		0.00-20.00	mA
	22	I1 input filter time constant	I1 Filter	10		0–10000	ms
	23	I1 minimum input current	I1 Curr x1	4.00		0.00-20.00	mA
IN	24	I1 output at minimum current (%)	I1 Perc y1	0.00		0–100	%
	25	I1 maximum input current	I1 Curr x2	20.00		4.00-20.00	mA
	26	I1 output at maximum current (%)	I1 Perc y2	100.00		0.00-100.00	%
	31	I1 rotation direction options	I1 Inverting	0	No	0-1	-
	32	I1 quantizing level	I1 Quantizing	0.04		0.00*, 0.04– 10.00	%

<sup>\*</sup>Quantizing is disabled if "0" is selected.

# Input Current (I1) Setting Details

Code	Description
IN-01 Freq at 100%	<ul> <li>Configures the frequency reference for operation at the maximum current (when IN-26 is set to 100%).</li> <li>If IN-01 is set to 40.00, and default settings are used for IN-23–26, an input current of 20 mA (max) to I1 will produce a frequency reference of 40.00 Hz.</li> <li>If IN-26 is set to 50.00, and default settings are used for IN-01 (60 Hz) and IN-23–26, an input current of 20 mA (max) to I1 will produce a frequency reference of 30.00 Hz (50% of 60 Hz).</li> </ul>
IN-20 I1 Monitor	Used to monitor the input current at I1.
IN-22 I1 Filter	Configures the time for the operation frequency to reach 63% of the target frequency based on the input current at I1.
IN-23 I1 Curr x1- IN-26 I1 Perc y2	Configures the gradient level and offset value of the output frequency.  Frequency reference  IN-26  IN-23  IN-25  [Gradient and offset configuration based on output frequency]
IN-32 I1 Quantizing	Same as V1 Quantizing. For more details, refer to <u>7.1.3.1 Setting a Frequency</u> <u>Reference for 0–10 V Input</u> on page <u>139</u> .

# 7.1.4 Setting a Frequency Reference Using an I/O Expansion Module (Terminal V2/I2)

After installing an optional I/O I/O expansion moduleto the iS7 inverter, you can set and modify a frequency reference using the input voltage or current at the V2/I2 terminal.

## 7.1.4.1 Setting a Reference Frequency using Input Voltage at V2 Terminal

Set the DRV-07 (Frequency reference source) to "4 (V2)" and apply an input voltage of -10-+12 V to the V2 terminal.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	4	V2	0–9	-
	35	V2 input display	V2 Monitor	0.00		-10.00- +10.00	V
	37	V2 input filter time constant	V2 Filter	10		0–10000	ms
	38	Minimum V2 input voltage	V2 Volt x1	0.00		0.00–10.00	V
	39	Output% at minimum V2 voltage	V2 Perc y1	0.00		0.00-100.00	%
IN	40	Maximum V2 input voltage	V2 Volt x2	10.00		0.00–10.00	V
IIN	41	Output% at maximum V2 voltage	V2 Perc y2	100.00		0.00-100.00	%
	42	Minimum V2 input voltage'	V2 -Volt x1'	0.00		0–10	V
	43	Output% at minimum V2 voltage'	V2 -Perc y1'	0.00		0–100	%
	44	Maximum V2 input voltage'	V2 -Volt x2'	-10.00		-10.00 0–10	
	45	Output% at	V2 -Perc y2'	-100.00		-100–0	%

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
		maximum V2' voltage				
	46 Invert V2 rotational direction V2 Invertire		V2 Inverting	No	No/Yes	-
	47	V2 quantizing level	V2 Quantizing	0.04	0.00*, 0.04- 10.00	%

<sup>\*</sup>Quantizing is disabled if "0" is selected.

# 7.1.4.2 Setting a Reference Frequency using Input Current at I2 Terminal

Set the DRV-07 (Frequency reference source) to "5 (I2)" and apply an input voltage of 0-20 mA to the I2 terminal.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	5	12	0-9	-
	50	I2 input monitor	I2 Monitor	0.00		0.00-20.00	mA
	52	I2 input filter time constant	I2 Filter	10		0–10000	ms
	53	I2 minimum input current	I2 Curr x1	4.00		0.00-20.00	
	54	I2 output at minimum current (%)	I2 Perc y1	0.00		0–100	%
	55	I2 maximum input current	I2 Curr x2	20.00		4.00-20.00	mA
	56	I2 output at maximum current (%)	I2 Perc y2	100.00		0.00-100.00	%
	61	I2 rotation direction options	I2 Inverting	0 No		0–1	-
	62	I2 quantizing level	I2 Quantizing	0.04		0.00*, 0.04– 10.00	%

<sup>\*</sup>Quantizing is disabled if "0" is selected.

# 7.1.5 Setting a Frequency with Pulse Input (with an optional encoder module)

After installing an optional encoder module, you can set a frequency reference by setting DRV-07 (Frequency reference source) to "9 (Pulse)" and providing a pulse frequency of  $0-32.00 \, \text{kHz}$  to the pulse input terminal.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	7	Encoder	0–9	-
IN	01	Frequency at maximum analog input	Freq at 100%	60.00		0.00–max. frequency	Hz
	01	Encoder option mode	Enc Opt Mode	2 Reference		0-2	-
	04	Encoder type selection	Enc Type Sel	0	-	0-2	-
	05	Encoder pulse selection	Enc Pulse Sel	2	А	0-2	-
	06	Encoder pulse number	Enc Pulse Num	-		10-5000	-
APO	09	Pulse input display	Pulse Monitor	-		-	kHz
	10	Encoder filter time constant	Enc Filter	10		0-10000	ms
	93	Minimum pulse input	Enc Pulse x1	0.0		0-100	kHz
	94	Minimum pulse Output%	Enc Perc Y1	0.00		0-100	%
	95	Maximum pulse input	Enc Pulse x2	100.0		0-200	kHz
	96	Maximum pulse Output%	Enc Perc y2	100.00		0-100	%

<sup>\*</sup> Quantizing is disabled if "0" is selected.

# **Pulse Input Setting Details**

Code	Description					
APO-01 Enc Opt Mode	Sets the encoder option mode. Set APO-01 to "2 (Reference)" to receive a pulse input for the frequency reference.					
APO-04 Enc Type Sel	Sets the output type.					
APO-05 Enc Pulse Sel	Selects the encoder pulse to use.					
APO-06 Enc Pulse Num	Sets the number of pulses that is appropriate for the encoder specification.					
APO-09 Pulse Monitor	Displays the pulse frequency supplied at the encoder option module when APO-1 is set to "2 (Reference)".					
APO-10 Enc Filter	Sets the time for the pulse input to reach 63% of its nominal frequency (when the pulse frequency is supplied in multiple steps).					
APO-11 Enc Pulse x1-IN-96 Enc Perc y2	Configures the gradient level and offset values for the output frequency.  Frequency reference  IN-26  IN-24  IN-23  IN-25  I1Input					

#### **Setting a Frequency Reference via RS-485 Communication** 7.1.6

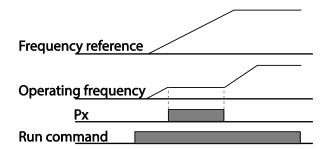
Control the inverter with upper-level controllers, such as PCs or PLCs, via RS-485 communication. Set DRV-07 (Frequency reference source) to "6 (Int 485)" and use the RS-485 signal input terminals (S+/S-/SG) for communication. For more details, refer to 11 Communication Function on page 351.

Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	6	Int 485	0-9	-
0	01	Integrated RS-485 communication inverter ID	Int485 St ID	-	1	1–250	-
	02	Integrated communication protocol	Int485 Proto	0	ModBus RTU	0–2	
				1	ModBus ASCII		-
СОМ		p. 606.60.		2	LS Inv 485		
	04	Integrated communication speed	Int485 BaudR	3	9600 bps	1200-38400	bps
				0	D8/PN/S1		
	04	Integrated communication frame configuration	Int485 Mode	1	D8/PN/S2	0-3	
	04			2	D8/PE/S1		-
				3	D8/PO/S1		

# 7.2 Frequency Hold by Analog Input

If you set a frequency reference via the analog input at the control terminal block, you can hold the operation frequency of the inverter by assigning a multi-function input as the analog frequency hold terminal. The operation frequency will be linked to the analog input signal.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
			Freq Ref Src	0	Keypad-1		
				1	Keypad-2		
				2	V1	0–9	
				3	I1		
DRV	07	Frequency reference source		4	V2		
DKV	07			5	I2		_
				6	Int 485		
				7	Encoder		
				8	Field Bus		
				9	PLC		
IN	65– 75	Px terminal configuration	Px Define(Px: P1–P8 [optional: P9– P11]) [Optional P9-11]	21	Analog Hold	65-75	-



# 7.3 Changing the Displayed Units (Hz↔Rpm)

You can change the units used to display the operational speed of the inverter by setting DRV-21 (Speed unit selection) to "0 (Hz Display)" or "1 (Rpm Display)".

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DDV	DRV 21 Speed unit selection	Speed unit	/D C .l	0	Hz Display	0 1	-
DKV		selection Hz/Rpm Sel	пикріп зеі	1	Rpm Display	0–1	

# 7.4 Setting Multi-Step Frequency

Multi-step operations can be carried out by assigning different speeds (or frequencies) to the Px terminals. Step 0 uses the frequency reference source set at DRV-07. Px terminal parameter values 7 (Speed-L), 8 (Speed-M), 9 (Speed-H), and 10 (Speed-X) are recognized as binary commands and work in combination with Fx or Rx run commands. The inverter operates according to the frequencies set at BAS-50–64 (multi-step frequency 1–15) and the binary command combinations.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit		
DRV	07	Frequency reference source	Freq Ref Src	-		-		-	-
BAS	50-64	Multi-step frequency 1–15	Step Freq - x	-		-	Hz		
		65–75 Px terminal configuration	Px Define (Px: P1– P8 [optional: P9–	7	Speed-L		-		
	65 75			8	Speed-M	0–51	-		
	05-75		P11]) [Optional	9	Speed-H				
IN			P9-P11]	10	Speed-X		-		
	89	Multi-step command delay time	InCheck Time	1		1–5000	ms		

# **Multi-step Frequency Setting Details**

Code	Description				
BAS Group 50-64	Configure multi-	step frequency 1	I <b>-</b> 15.		
IN-65–75 Px Define	Choose the term codes (IN-65-75 Provided that te	ninals to set up a ) to 7 (Speed-L), 8 rminals P6, P7, a tively, the followi	s multi-step in 3 (Speed-M), 9 ( nd P8 have being multi-step of	outs, and then se (Speed-H), or 10 en set to Speed-l operation will be	(Speed-X). _, Speed-M and
	Speed	Fx/Rx	P8	P7	P6
	0	✓	-	-	-
	1	✓	-	-	✓
	2	✓	-	✓	-
	3	✓	-	✓	✓
	4	✓	✓	-	-
	5	✓	✓	-	✓
	6	✓	✓	✓	-
	7	✓	✓	✓	✓
	By setting the Sp	peed-X, you can o	configure up to	16 multi-step sp	peeds, where

Code	Description					
	the highest b	it is Speed-X.				
	Speed	Fx/Rx	P8	P7	P6	P5
	0	✓	-	-	-	-
	1	✓	-	-	-	✓
	2	✓	-	-	✓	-
	3	✓	-	-	✓	✓
	4	✓	-	✓	-	-
	5	✓	-	✓	-	✓
	6	✓	-	✓	✓	-
	7	✓	-	✓	✓	✓
	8	✓	✓	-	-	-
	9	✓	✓	-	-	✓
	10	✓	✓	-	✓	-
	11	✓	✓	-	✓	✓
	12	✓	✓	✓	-	-
	13	✓	✓	✓	-	✓
	14	✓	✓	✓	✓	-
	15	✓	✓	✓	✓	✓
IN-89 InCheck Time	Set a time intrafter receiving After IN-89 is will search for accelerate or	g an input sig set to 100 m r inputs at otl	gnal. s and an inpu her terminals	t signal is rec for 100 ms, b	eived at P6, tl	he inverter

# **Command Source Configuration**

Various devices can be selected as command input devices for the iS7 inverter. Input devices available include the keypad, multi-function input terminal, RS-485 communication, and field bus adapter.

Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Unit	
			Cmd Source			Keypad		
				1	Fx/Rx-1			
	06	Command Source		2	Fx/Rx-2	0.5		
DRV	06			3	Int 485	0–5	-	
				4 F		Field Bus		
				5	PLC			

#### The Keypad as a Command Input Device 7.5.1

Set DRV-06 to "0 (Keypad)" to select the keypad as the command source.

Since the keypad is now the command source, forward or reverse operation starts when the [FWD] or [REV] key is pressed, and it stops when the [STOP/RESET] key is pressed.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	06	Command source	Cmd Source	0	KeyPad	0–5	-

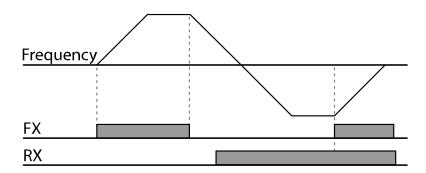
# 7.5.2 The Terminal Block as a Command Input Device (Fwd/Rev run commands)

Multi-function terminals can be selected as a command input device. This is configured by setting DRV-06 (command source) to "1 (Fx/Rx-1)". Select two terminals for the forward and reverse operations, and then set the relevant codes (2 of the 11 multi-function terminal codes, IN-65–75 for P1–P8 [optional: P9-P11]) to "1 (Fx)" and "2 (Rx)" respectively. This application enables both terminals to be turned on or off at the same time, constituting a stop command that will cause the inverter to stop operating.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	06	Command source	Cmd Source	1	Fx/Rx-1	0–5	-
		Px terminal	Px Define(Px:	1	Fx		
IN	65–75	configuration	P1– P8 [optional: P9-P11])	2	Rx	0–51	-
	88	Delay time setting	Run On Delay	-	1.00	0.00-100.00	Sec

## Fwd/Rev Command by Multi-function Terminal - Setting Details

Code	Description
DRV-06 Cmd Source	Set to "1 (Fx/Rx-1)".
IN-65–75 Px Define	Assign a terminal for forward (Fx) operation. Assign a terminal for reverse (Rx) operation.
IN-88 Run On Delay	Set the delay time if the inverter operation needs to be synchronized with other sequences. When the run command input (Fx/Rx) is given, the operation begins after the set time has elapsed.



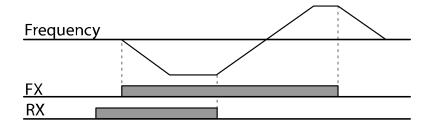
# 7.5.3 The Terminal Block as a Command Input Device (Run and Rotation Direction Commands)

Multi-function terminals can be selected as a command input device. This is configured by setting DRV-06 (command source) to "2 (Fx/Rx-2)". Select two terminals for run and rotation direction commands, and then set the relevant codes (2 of the 11 multi-function terminal codes, IN-65–75 for P1–P11 [optional: P9-P11]) to "1 (Fx)" and "2 (Rx)" respectively. This application uses an Fx input as a run command, and an Rx input to change a motor's rotation direction (On: Rx, Off: Fx).

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	06	Command source	Cmd Source	2	Fx/Rx-2	0–5	-
			Px Define (Px:	1	Fx		
IN	65-75	Px terminal configuration	P1–P8 [optional: P9– P11])	2	Rx	-	-
	88	Delay time setting	Run On Delay	-	1.00	0.00-100.00	Sec

# Run Command and Fwd/Rev Change Command Using Multi-function Terminal – Setting Details

Code	Description
DRV-06 Cmd Source	Set to "2 (Fx/Rx-2)".
IN-65-75 Px Define	Assign a terminal for the run command (Fx). Assign a terminal for changing the rotation direction (Rx).
IN-88 Run On Delay	Set the delay time if the inverter operation needs to be synchronized with other sequences. When the run command input (Fx/Rx) is given, the operation begins after the set time has elapsed.



## 7.5.4 RS-485 Communication as a Command Input Device

Internal RS-485 communication can be selected as a command input device by setting DRV-06 (command source) in the Drive group to "3 (Int 485)". This configuration uses upper level controllers, such as PCs or PLCs, to control the inverter by transmitting and receiving signals via the S+, S-, and RS-485 signal input terminals at the terminal block. For more details, refer to <u>11 Communication Function</u> on page <u>351</u>.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	06	Command source	Cmd Source	3	Int 485	0–5	-
COM	04	Integrated communication inverter ID	Int485 St ID	1		1–250	-
	05	Integrated communication protocol	Int485 Proto	0	ModBus RTU	-	-
	06	Integrated communication speed	Int485 BaudR	3	9600 bps	1200-38400	bps
	Integrated	D8 / PN / S1	-	-			

# 7.6 Local/Remote Mode Switching

Local/remote mode switching is useful for checking the inverter's operation, or to perform an inspection while retaining all parameter values. Also, in an emergency, it can also be used to override controls and operate the system manually using the keypad.

The [MULTI] key is a programmable key that can be configured to carry out multiple functions.

## ① Caution

Use local/remote operation mode switching only when it is necessary. Improper mode switching may interrupt the inverter's operation.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
CNF	42	[MULTI] key functions	Multi-Key Sel	2	Local/Remote	-	-
DRV	06	Command source	Cmd Source	1	Fx/Rx-1	0–5	-

## **Local/Remote Mode Switching Setting Details**

Code	Description
	Set CNF-42 to "2(Local/Remote)" to perform local/remote mode switching using the [MULTI] key.
	Once the parameter is set, "R" (remote) is displayed on the keypad, and the inverter will automatically begin operating in remote mode. Changing from local to remote operation will not alter any previously configured parameter values and the operation of the inverter will not change.
CNF-42 [MULTI] key functions	Press the [MULTI] key to switch the operation mode to "local." "L" (local) is displayed on the keypad, and the command source and frequency source indication on the keypad (in MON mode) changes to "K/K." The inverter stops operating if it was previously running in remote mode, and you can operate the inverter using the keypad.
	Press the [MULTI] key again to switch the operation mode back to "remote." "R" (remote) is displayed again on the keypad, and the command source and frequency source indication on the keypad (in MON mode) changes according to the previous parameter settings.  The inverter is now ready to operate in remote mode, and the inverter operation may vary depending on the type of input source.

### **Note**

## **Local/Remote Operation**

- Full control of the inverter is available with the keypad during local operation.
- During local operation, jog commands will only work if one of the multi-function terminals (Px: P1-P11, codes IN-65-75) is set to "13 (RUN Enable)" and the relevant terminal is turned on.
- During remote operation, the inverter will operate according to the previously set frequency reference source and the command received from the input device.
- If ADV-10 (power-on run) is set to "0 (No)", the inverter will not operate on power-on even when the following terminals are turned on:
  - Fwd/Rev run (Fx/Rx) terminal
  - Fwd/Rev jog terminal (Fwd jog/Rev Jog)



- Pre-excitation terminal
- To operate the inverter manually with the keypad, switch to local mode. Use caution when switching back to remote operation mode as the inverter will stop operating. If ADV-10 (poweron run) is set to "0 (No)", a command through the input terminals will work only after all the terminals listed above have been turned off and then turned on again.
- If the inverter has been reset to clear a fault trip during an operation, the inverter will switch to local operation mode at power-on, and full control of the inverter will be with the keypad. The inverter will stop operating when operation mode is switched from "local" to "remote". In this case, a run command through an input terminal will work only after all the input terminals have been turned off.

### **Inverter Operation During Local/Remote Switching**

Switching operation mode from "remote" to "local" while the inverter is running will cause the inverter to stop operating. Switching operation mode from "local" to "remote", however, will cause the inverter to operate based on the command source:

- Analog commands via terminal input: The inverter will continue to run without interruption based on the command at the terminal block. If a reverse operation (Rx) signal is ON at the terminal block at startup, the inverter will operate in the reverse direction even if it was running in the forward direction in local operation mode before the reset.
- Digital source commands: All command sources, except terminal block command sources (which are analog sources), are digital command sources that include the keypad, LCD keypad, and communication sources. The inverter stops operating when switching to remote operation mode, and then starts operating when the next command is given.

## **Forward or Reverse Run Prevention**

The rotation direction of motors can be configured to prevent motors from running in a forward or reverse direction. When reverse direction prevention is configured, pressing the [REV] key on the keypad will cause the motor to decelerate to 0 Hz and stop.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
ADV			Run Prevent	0	None		
	09	Run prevention options		1	Forward Prev	0–2	-
				2	Reverse Prev		

## **Forward/Reverse Run Prevention Setting Details**

Code	Descrip	Description							
	Choos	e a direction to prevent.							
	Settir	ng	Description						
ADV-09 Run Prevent	0	None	Do not set run prevention.						
Prevent	1 Forward		Set forward run prevention.						
	2	Reverse Prev	Set reverse run prevention.						

#### 7.8 Power-on Run

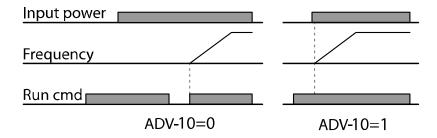
The Power-on Run feature can be set up to start an inverter operation after powering up based on the run commands by terminal inputs (if they are configured).

## ① Caution

Use caution when operating the inverter with Power-on Run enabled as the motor will begin rotating when the inverter starts up.

To enable Power-on Run, set DRV-06 (command source) to "1 (Fx/Rx-1)" or "2 (Fx/Rx-2)" and ADV-10 to "1". If a run command via a terminal input is on, the inverter starts operating according to the terminal input settings as soon as it is turned on.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	06	Command source	Cmd Source	1, 2	Fx/Rx-1 or Fx/Rx-2	0–5	-
ADV	10	Power-on run	Power-on Run	1	Yes	0–1	-



#### Note

- To prevent a repeat fault trip from occurring when a load, such as a fan, is free-running on a Power-on Run, set CON-71 (speed search options) bit 4 to "1". The inverter will perform a speed search at the beginning of the operation. If the speed search is not enabled, the inverter will start its operation in a normal V/F pattern and accelerate the motor.
- If the inverter has been turned on without Power-on Run enabled, the terminal block command must be first turned off, and then turned on again to begin the inverter's operation.

#### **Reset and Restart** 7.9

The reset and restart operations can be set up for inverter operation following a fault trip, based on the terminal block operation command (if it is configured).

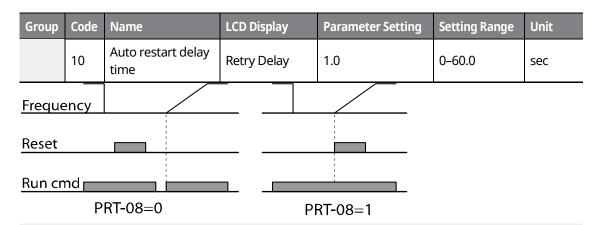
#### ① Caution

- Use caution when operating the inverter with reset and restart enabled as the motor will begin rotating when the inverter starts up.
- Stop the frequency reference signal if you do not want the inverter to run again after a reset.

Set PRT-08 (RST Restart) to "1 (yes)" to allow the inverter to start operating after it is reset if a fault trip occurs. PRT-10 (Retry Delay) sets the delay time for a restart (the time the inverter will wait before it restarts).

The number of auto-restarts (PRT-09) refers to the number of times the inverter will try restarting its operation. If fault trips occur again after a restart, the retry number counts down each time the inverter restarts until the number becomes "0". Once the inverter restarts successfully after the initial fault trip, the inverter does not restart until the next fault trip occurs. The number of auto-restarts set at PRT-09 that decreased after a restart reverts to the original setting value if successful operation continues for a certain period of time.

Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Unit
DRV	06		Cmd Source	1	Fx/Rx-1	4.2	
DRV U6	Command source	Cma source	2	Fx/Rx-2	1-2	-	
PRT	08	Reset restart setup	RST Restart	1	Yes	No(0) [default] / Yes(1)	-
	09	No. of auto restart	Retry Number	1		0–10	-



#### Note

- To prevent a repeat fault trip from occurring, set the CON-71 (Speed search options) bit 2 to "1".
   The inverter will perform a speed search at the beginning of the operation. If the speed search is not enabled, the inverter will start its operation in a normal V/F pattern and accelerate the motor.
- If the inverter has been turned on without "reset and restart" enabled, the terminal block command must first be turned off and then turned on again to begin inverter operation.

# 7.10 Setting Acceleration and Deceleration Times

# 7.10.1 Acc/Dec Time Based on Maximum Frequency

Regardless of the operating frequency, acc/dec time values can be set based on the maximum frequency. To set acc/dec time values based on the maximum frequency, set BAS-08 (Acc/Dec reference) to "0 (Max Freq)".

The acceleration time set at DRV-03 (Acceleration time) refers to the time required for the inverter to reach the maximum frequency from a stopped state (0 Hz). Likewise, the value set at DRV-04 (Deceleration time) refers to the time required to return to a stopped state (0 Hz) from the maximum frequency.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
02	Acceleration	Acc Time	75 kW and less	20.0	0.0 600.0		
	03	time	Acc Time	90 kW and up	60.0	0.0–600.0	sec
DRV	DRV 04	Deceleration	Dec Time	75 kW and less	30.0	0.0-600.0	sec
		time	Dec Time	90 kW and up	90.0	0.0-600.0	
	20	20 Maximum Max Freq		60.00		0.00-400.00	Hz

Group	Code	Name	LCD Display	LCD Display Parameter Setting		Setting Range	Unit
		frequency					
BAS	08	Acc/Dec reference	Ramp T Mode	0	Max Freq	Max Freq/Delta Freq	-
	09	Time scale	Time scale	1	0.1	0-2 (0.01/0.1/1)	sec

## Acc/Dec Time Based on Maximum Frequency - Setting Details

Code	Description
	Set BAS-08 to "0 (Max Freq)" to setup acc/dec time based on maximum frequency.
	Configuration Description
	0 Max Freq Set the acc/dec time based on the maximum frequency.
	1 Delta Freq Set the acc/dec time based on the operating frequency.
BAS-08 Ramp T Mode	If, for example, the maximum frequency is 60.00 Hz, the acc/dec times are set to 5 seconds, and the frequency reference for operation is set at 30 Hz (half of 60 Hz). Therefore, the time required to reach 30 Hz is 2.5 seconds (half of 5 seconds).  Max. Freq.  Frequency Run cmd  Dec. time
	Use the time scale for all time-related values. It is particularly useful when more accurate acc/dec times are required, due to load characteristics, or
DAC OO Time a seele	when the maximum time range needs to be extended.  Configuration  Description
BAS-09 Time scale	0 0.01 sec Sets 0.01 second as the minimum unit.
	1 0.1 sec Sets 0.1 second as the minimum unit.
	2 1 sec Sets 1 second as the minimum unit.

# ① Caution

Note that the range of maximum time values may change automatically when the units are changed. If for example, the acceleration time is set to 6000 seconds, a time scale change from 1 second to 0.01 second will result in a modified acceleration time of 60.00 seconds.

# 7.10.2 Acc/Dec Time Based on Operation Frequency

Acc/Dec times can be set based on the time required to reach the next frequency from the existing operation frequency. To set the acc/dec time values based on the existing operation frequency, set BAS-08 (Acc/Dec reference) to "1 (Delta Freq)".

Group	Code	Name	LCD Display Settings		tings	Setting Range	Unit
DDV	03	Acceleration time	Acc Time	20.	0	0.0 - 600.0	sec
DRV 04	04	Deceleration time	Dec Time	30.	0	0.0 - 600.0	sec
BAS	08	Acc/Dec reference	Ramp T Mode	1	Delta Freq	Max Freq/Delta Freq	-

#### Acc/Dec Time Based on Operation Frequency- Setting Details

Code	Description			
	frequ	iency.	Delta Freq)" to set acc/dec times based on operation	
	Con	figuration	Description	
	0	Max Freq	Set the acc/dec time based on the maximum frequency.	
	1	Delta Freq	Set the acc/dec time based on the operating frequency.	
BAS-08 Ramp T Mode	are u	sed in the op	es are set to 5 seconds, and multiple frequency references eration in 2 steps, at 10 Hz and 30 Hz, each acceleration econds (refer to the graph below).	
	Freq	uency <sub> </sub>	30Hz	
	Run	cmd 5 se	10Hz 5 7 12 time	

# 7.10.3 Multi-Step Acc/Dec Time Configuration

The acc/dec times can be configured via a multi-function terminal by setting the ACC (acceleration time) and DEC (deceleration time) codes in the DRV group.

Group	Code	Name	LCD Display	Parame	ter Settir	ng	Setting Range	Unit
	03	Acceleration time	Acc Time	75 kW a	and less	20.0	0.0.000	sec
DRV	03	Acceleration time	ACC TIME	90 kW a	and up	60.0	0.0–600.0	sec
DKV	04	Deceleration time	Dec Time	75 kW a	and less	30.0	0.0-600.0	sec
	04	Deceieration time	Dec Time	90 kW a	and up	90.0	0.0-000.0	sec
BAS	70, 72, 74 Multi-step acceleration time1–3 Acc Time–x		x.xx			0.0-600.0	sec	
DAS	71, 73, 75	Multi-step deceleration time1–3	Dec Time-x	x.xx		0.0-600.0	sec	
			Px Define	11	XCEL-L			
	65- 75	Px terminal configuration	(Px: P1-P8 [optional:	12	XCEL-N	1	-	-
IN	/ 3	comgaration	P9-P11])	49	XCEL-H			
	89	Multi-step command delay time	In Check Time	1			1-5000	ms

#### Acc/Dec Time Setup via Multi-function Terminals - Setting Details

Code	Descripti	Description				
BAS-70, 72, 74 Acc Time 1–3	Set mult	Set multi-step acceleration time 1–3.				
BAS-71, 73, 75 Dec Time 1–3	Set mult	Set multi-step deceleration time 1–3.				
	Choose a inputs.	and configur	e the terminals to use for multi-step acc/dec time			
IN-65-75	Configu	uration	Description			
Px Define (P1–P8	11	XCEL-L	Acc/Dec command-L			
[optional P9–P11])	D9_PTT]) 12		Acc/Dec command-M			
	49	XCEL-H	Acc/Dec command-H			

Code	Description					
	acc/dec commands are recognized as binary code inputs and will control acceleration and deceleration based on parameter values set at BAS-70					
	·	d P8 terminals are set as X0 g operation will be available				
	Acc2 Dec1 Acc2 Dec2 Acc1 Dec3 P7 P8					
	Acc/Dec time	P8	P7			
	0	-	-			
	1 2	- ✓	✓			
	3					
	[Multi-function terminal F	7, P8 configuration]	1			
IN-89 In Check Time	Set the time for the inverter to check for other terminal block inputs. If IN-89 is set to 100 ms and a signal is supplied to the P6 terminal, the inverter searches for other inputs over the next 100 ms. When the time expires, the acc/dec time will be set based on the input received at P6.					

# 7.10.4 Configuring Acc/Dec Time Switch Frequency

By configuring the switch frequency, you can switch between two different sets of acc/dec times (acc/dec gradients) without configuring the multi-function terminals.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
DDV	03	Acceleration time	Acc Time	10.0	0.0-600.0	sec
DRV (	04	Deceleration time	Dec Time	10.0	0.0-600.0	sec
BAS	70	Multi-step acceleration time1	Acc Time-1	20.0	0.0-600.0	sec

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	71	Multi-step deceleration time1	Dec Time-1	20.0	0.0-600.0	sec
ADV	60	Acc/dec time switch frequency	Xcel Change Fr	30.00	0–Maximum frequency	Hz/RPM

# **Acc/Dec Time Switch Frequency Setting Details**

Code	Description
ADV-60 Xcel Change Fr	After the acc/dec switch frequency has been set, the acc/dec gradients configured at BAS-70 and 71 will be used when the inverter's operation frequency is at or below the switch frequency. If the operation frequency exceeds the switch frequency, the gradient level configured for the acceleration and deceleration times (set at DRV-03 and DRV-04) will be used. If you configure the P1–P8 [optional: P9–P11]) multi-function input terminals for multi-step acc/dec gradients (XCEL-L, XCEL-M, XCEL-H), the inverter will operate based on the acc/dec inputs at the terminals regardless of the acc/dec switch frequency configurations.  DRV-03  DRV-04  BAS-70  Frequency  Run cmd

# 7.11 Acc/Dec Pattern Configuration

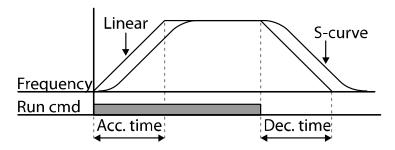
The acc/dec gradient level patterns can be configured to enhance and smooth out the inverter's acceleration and deceleration curves. A linear pattern features a linear increase or decrease to the output frequency, at a fixed rate. An S-curve pattern offers a smoother and more gradual increase or decrease of output frequency, ideal for lift-type loads or elevator doors, etc. The S-curve gradient level can be adjusted using codes ADV-03–06 in the advanced group.

Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Unit
BAS	08	Acc/dec reference	Ramp T mode	0	Max Freq	0–1	-
	01	Acceleration pattern	Acc Pattern	0	Linear	0–1	
	01	Acceleration pattern	ACC Pattern	1	S-curve	0-1	-
	02	Deceleration pattern	Dec Pattern	0	Linear	0–1	_
	02 Deceleration pattern	Decrattern	1	S-curve	0-1		
ADV	03	S-curve acc start gradient	Acc S Start	40		1–100	%
	04	S-curve acc end gradient	Acc S End	40		1–100	%
0	05	S-curve dec start gradient	Dec S Start	40		1–100	%
	06	S-curve dec end gradient	Dec S End	40		1–100	%

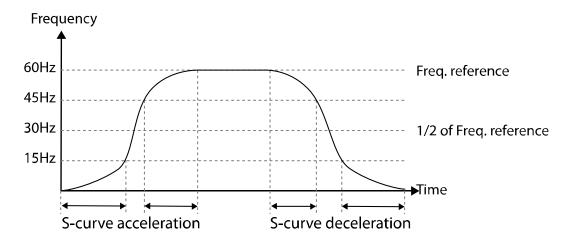
#### **Acc/Dec Pattern Setting Details**

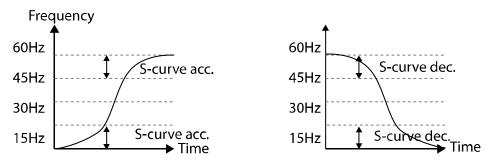
Code	Description
ADV-03 Acc S Start	Sets the gradient level as acceleration starts when using an S-curve, acc/dec pattern. ADV-03 defines the S-curve gradient level as a percentage up to half of the total acceleration.  If the frequency reference and maximum frequency are set at 60 Hz and ADV-03 is set to 50%, ADV-03 configures the acceleration up to 30 Hz (half of 60 Hz). The inverter will perform S-curve acceleration in the 0-15 Hz frequency range (50% of 30 Hz). Linear acceleration will be applied to the remaining acceleration within the 15–30 Hz frequency range.
ADV-04 Acc S End	Sets the gradient level as acceleration ends when using an S-curve acc/dec

Code	Description
	pattern. ADV-03 defines S-curve gradient level as a percentage, above half of the total acceleration.  If the frequency reference and the maximum frequency are set at 60 Hz and ADV-04 is set to 50%, setting ADV-04 configures acceleration to increase from 30 Hz (half of 60 Hz) to 60 Hz (end of acceleration). Linear acceleration will be applied within the 30-45 Hz frequency range. The inverter will perform an S-curve acceleration for the remaining acceleration in the 45–60 Hz frequency range.
ADV-05 Dec S Start – ADV-06 Dec S End	Sets the rate of S-curve deceleration. Configuration for codes ADV-05 and ADV-06 may be performed the same way as configuring codes ADV-03 and ADV-04.



[Acceleration / deceleration pattern configuration]





[Acceleration / deceleration S-curve pattern configuration]

#### Note

#### The actual acc/dec time during an S-curve application

The 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.

The 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.

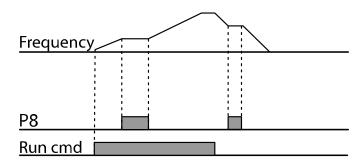
## ① Caution

Note that actual acc/dec times become greater than the user-defined acc/dec times when S-curve acc/dec patterns are in use.

# **7.12 Stopping the Acc/Dec Operation**

Configure the multi-function input terminals to stop acceleration or deceleration and operate the inverter at a fixed frequency.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
IN	65–75	Px terminal configuration	Px Define (Px: P1–P8 [optional: P9–P11])	25	XCEL Stop	0-51	-



# 7.13 V/F (Voltage/Frequency) Control

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

# 7.13.1 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. A linear V/F pattern is particularly useful when a constant torque load is applied.

Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Unit
09 Control mode Control		Control Mode	0	V/F	-	-	
DRV	18	Base frequency	Base Freq	60.00		30.00-400.00	Hz
	19	Start frequency	Start Freq	0.50	)	0.01–10.00	Hz
BAS	07	V/F pattern	V/F Pattern	0	Linear	1	-

#### **Linear V/F Pattern Setting Details**

Code	Description			
DRV-18 Base Freq	Sets the 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.			
	Sets the start frequency. A start frequency is a frequency at which the inverter starts voltage output. The inverter does not produce an output voltage while the frequency reference is lower than the set frequency. However, if a deceleration stop is made while operating above the start frequency, the output voltage will continue until the operation frequency reaches a full stop (0 Hz).			
DRV-19 Start Freq	Base Freq.  Frequency Start Freq.  Inverter's rated voltage Voltage			
	Run cmd			

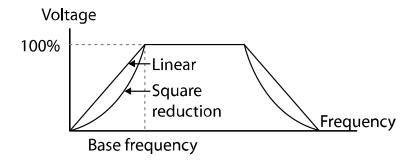
# 7.13.2 Square Reduction V/F Pattern Operation

Square reduction V/F pattern is ideal for loads such as fans and pumps. It provides non-linear acceleration and deceleration patterns to sustain torque throughout the entire frequency range.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DAC	07	V/F nattorn	V/F Dattorn	1	Square	0.2	
BAS	07	V/F pattern	V/F Pattern	3 Square2	0–3	-	

#### Square Reduction V/F pattern Operation - Setting Details

Code	Description				
	Sets the parameter value to "1 (Square)" or "2 (Square2)" depending on load's start characteristics.				
	Set	ting	Function		
BAS-07 V/F Pattern	1	Square	The inverter produces an output voltage proportionate to 1.5 square of the operation frequency.		
	3 Square2	The inverter produces an output voltage proportionate to 2 square of the operation frequency. This setup is ideal for variable torque loads, such as fans or pumps.			



# 7.13.3 User V/F Pattern Operation

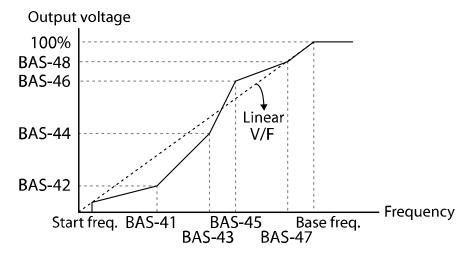
The iS7 inverter allows the configuration of user-defined V/F patterns to suit the load characteristics of a specific motor.

Group	Code	Name	LCD Display	Par	ameter Setting	Setting Range	Unit
	07	V/F pattern	V/F Pattern	2	User V/F	0–2	-
	41	User frequency 1	User Freq 1	15.0	00	0–Maximum frequency	Hz
	42	User voltage 1	User Volt 1	25		0–100%	%
	43	User frequency 2	ser frequency 2 User Freq 2 30.00		00	0–Maximum frequency	Hz
BAS	44	User voltage 2	User Volt 2	50		0–100%	%
	45	User frequency 3	r frequency 3 User Freq 3 45.00	00	0–Maximum frequency	Hz	
	46	User voltage 3	User Volt 3	75		0–100%	%
	47	User frequency 4	User Freq 4	60		0–Maximum frequency	Hz
	48	User voltage 4	User Volt 4	100	1	0–100%	%

## **User V/F pattern Setting Details**

Code	Description
BAS-41 User Freq 1 -BAS-48 User Volt 4	Sets the parameter values to assign user-defined frequencies (User Freq x) for the start and maximum frequencies. Voltages can also be set to correspond with each frequency, and for each user voltage (User Volt x).

The 100% output voltage in the figure below is based on the parameter settings of BAS-15 (motor rated voltage). If BAS-15 is set to "0," it will be based on the input voltage.



## ① Caution

- When a normal induction motor is in use, care must be taken not to change the output pattern from a linear V/F pattern. Non-linear V/F patterns may cause insufficient motor torque or motor overheating due to over-excitation.
- When a user V/F pattern is in use, the forward torque boost (DRV-16) and reverse torque boost (DRV-17) will not operate.

# 7.14 Torque Boost

## 7.14.1 Manual Torque Boost

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

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	15	Torque boost options	Torque Boost	0	Manual	0–1	-
DRV	16	Forward torque boost	Fwd Boost*	2.0		0.0-15.0	%
	17	Reverse torque boost	Rev Boost*	2.0		0.0-15.0	%

<sup>\*</sup> For 90 kW-160 kW model types, the default setting value is 1.0 [%].

#### **Manual Torque Boost Setting Details**

FX RX

Code	Description				
DRV-16 Fwd Boost	Sets the torque boost for forward operation.				
DRV-17 Rev Boost	Sets the torque boost for reverse operation.				

Output Voltage = Output voltage affected by DRV-16,17 Manual torque boost parameter = V/F voltage + Boosted voltage $= \left( Maximum \text{ voltage} - Boosted \text{ voltage} \right) \times \frac{Current \text{ frequency}}{Base \text{ frequency}} + Boosted \text{ voltage}$  Voltage 100% Fwd torque boost Fwd Time

Rev torque boost



#### ① Caution

Excessive torque boost will result in over-excitation and motor overheating.

## 7.14.2 Auto Torque Boost

Set DRV-15 to "1 (Auto)" to enable auto torque boost. While manual torque boost adjusts the inverter output based on the setting values, regardless of the type of load used during the operation, auto torque boost enables the inverter to automatically calculate the amount of output voltage required for the torque boost based on the entered motor parameters.

Because auto torque boost requires motor-related parameters, such as stator resistance, inductance, and no-load current, auto tuning (BAS-20) has to be performed before the auto torque boost can be configured. Similarly to manual torque boost, configure auto torque boost while running a load that requires high starting torque, such as lift-type loads. Refer to <u>8.9 Auto Tuning</u> on page <u>224</u>.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	15	Torque boost mode	Torque Boost	1	Auto	0–2	-
BAS	20	Auto tuning	Auto Tuning	2	Rs+Lsigma	0-3	-

## 7.14.3 Advanced Auto Torque Boost

Manual Torque Boost, regardless of load characteristics, outputs the inverter voltage according to the torque boost amount set by the user. Auto Torque Boost automatically calculates the boost amount, but auto tuning the motor is required. For Advanced Auto Torque Boost, the inverter outputs the inverter voltage by adjusting the boost amount according to the load itself without auto tuning the motor.

Advanced Automatic Torque Boost is adjusted according to the load determined by the Adv ATB M Gain, Adv ATB G Gain of DRV-27 and 28 values and it can be used when starting torque is insufficient or when excessive current flows...

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	15	Torque boost mode	Torque Boost	2	Advanced Auto	0–2	-
	16	Fwd Boost Note1)	Fwd Boost	2.0		0-15	%

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	17	Rev Boost Note2)	Rev Boost	2.0	0-15	%
	26	Adv ATB Filter	Adv ATB Filter	100	1-1000	msec
	27	Adv ATB M Gain	Adv ATB M Gain	50.0	0-300.0	%
	28	Adv ATB G Gain	Adv ATB G Gain	50.0	0-300.0	%

<sup>\*</sup> Note 1, Note 2) For 90 kW – 160 kW products, the factory shipment value is 1.0 [%].

#### **Advanced Auto Torque Boost Setting Details**

Code	Description
DRV-16 Fwd Boost	Adjusts the torque boost amount for forward rotation
DRV-17 Rev Boost	Adjusts the torque boost amount for reverse rotation.
DRV-26 Adv ATB Filter	Filter gain for calculating the Auto Torque Boost value.
DRV-27 Adv ATB M Gain	Gain for calculating the reverse Auto Torque Boost value.
DRV-28 Adv ATB G Gain	Gain for calculating the regeneration Auto Torque Boost value.

If there is no load, the additional voltage amount due to Auto Torque Boost is 0, which gives the same result as the normal manual boost.

When the load is applied, the amount of compensation voltage varies depending on the operation and reverse directions.

If you set the DRV-16 and DRV-17 values differently when using Advanced Auto Torque Boost at no load, a current hunting operation may occur.

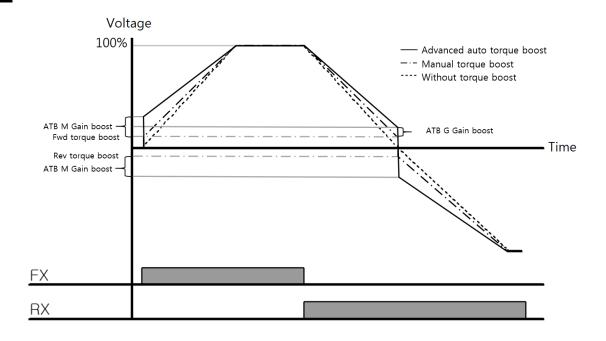
#### Output voltage = Primary output voltage + Secondary output voltage

#### · Primary output voltage

- = Output voltage affected by DRV-16,17 Manual torque boost parameter
- =  $(Maximum\ voltage Boosted\ voltage) \times \frac{Current\ frequency}{Base\ frequency} + Boosted\ voltage$

#### · Secondary output voltage

- = Output voltage affected by DRV-27,28 ATB M/G Gain parameter and motor load
- = Motor rated slip frequency  $\times \frac{\text{Motor max phase voltage}}{\text{Base frequency}} \times ATB M/G Gain \times \frac{\text{Current output current}}{\text{Motor rated current}}$



#### ① Caution

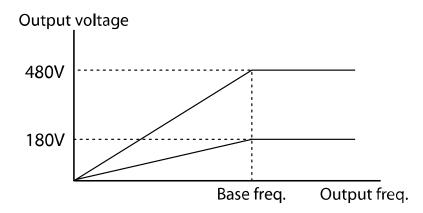
If the torque boost amount is set too large, overheating of the motor due to over-excitation will occur.

# 7.15 Output Voltage Setting

Output voltage settings are required when a motor's rated voltage differs from the input voltage to the inverter. Set BAS-15 to configure the motor's rated operating voltage. The set voltage becomes the output voltage of the inverter's base frequency. When the inverter operates above the base frequency, and when the motor's voltage rating is lower than the input voltage at the inverter, the inverter adjusts the voltage and supplies the motor with the voltage set at BAS-15 (motor-rated voltage). If the motor's rated voltage is higher than the input voltage at the inverter, the inverter will supply the inverter input voltage to the motor.

If BAS-15 (motor-rated voltage) is set to "0," the inverter corrects the output voltage based on the input voltage in the stopped condition. If the frequency is higher than the base frequency andwhen the input voltage is lower than the parameter setting, the input voltage will be the inverter output voltage.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
BAS	15	Motor rated voltage	Rated Volt	220	0, 180–480	٧



# 7.16 Start Mode Setting

Select the start mode to use when the operation command is input with the motor in the stopped condition.

#### 7.16.1 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.

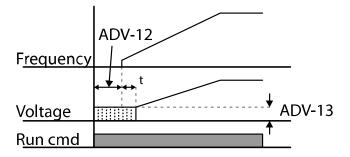
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
ADV	07	Start mode	Start mode	0	Acc	-	-

## 7.16.2 Start After DC Braking

This start mode supplies a DC voltage for a set amount of time to provide DC braking before an inverter starts to accelerate a motor. If the motor continues to rotate due to inertia, DC braking will stop the motor, allowing the motor to accelerate from a stop. DC braking can also be used with a mechanical brake connected to a motor shaft when a constant torque load is applied, if a constant torque is required after the mechanical brake is released.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
ADV	07	Start mode	Start Mode	1	DC-Start	-	-

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	12	Start DC braking time	DC-Start Time	0.00	0.00-60.00	sec
	13	DC Injection Level	DC Inj Level	50	0–200	%



## ① Caution

The amount of DC braking required is based on the motor's rated current. Do not use DC braking resistance values that can cause current draw to exceed the rated current of the inverter. If the DC braking resistance is too high or brake time is too long, the motor may overheat or be damaged.

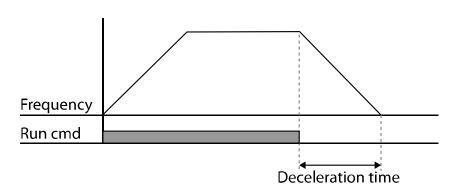
# 7.17 Stop Mode Setting

Select Stop mode to stop the inverter operation.

# 7.17.1 Deceleration Stop

Deceleration stop is a general stop mode. If there are no extra settings applied, the motor decelerates to 0 Hz and stops, as shown in the figure below.

Group	Code	Name	LCD Display	Paramete	er Setting	Setting Range	Unit
ADV	08	Stop mode	Stop Mode	0	Dec	-	-



## 7.17.2 Stop after DC Braking

When the operation frequency reaches the set value during deceleration (DC braking frequency) the inverter stops the motor by supplying DC power to the motor. With a stop command input, the inverter begins decelerating the motor. When the frequency reaches the DC braking frequency set at ADV-17, the inverter supplies DC voltage to the motor and stops it.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	08	Stop mode	Stop Mode	0	Dec	0–4	-
	14	Output block time before braking	DC-Block Time	0.10		0.00-60.00	sec
ADV	15	DC braking time	DC-Brake Time	1.00		0–60	sec
	16	DC braking amount	DC-Brake Level	50		0-200	%
	17	DC braking frequency	DC-Brake Freq	5.00		0.00-60.00	Hz

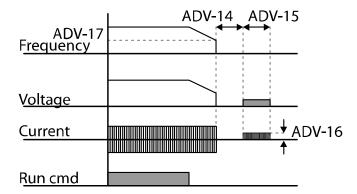
#### Note

DC braking does not produce stop torque. Install appropriate peripheral devices if stop torque is required in your application.

#### **DC Braking After Stop Setting Details**

Code	Description
ADV-14 DC-Block Time	Sets the time to block the inverter output before DC braking. If the inertia of the load is great, or if the DC braking frequency (ADV-17) is set too high, a fault trip may occur due to overcurrent conditions when the inverter supplies DC voltage

Code	Description
	to the motor. Prevent overcurrent fault trips by adjusting the output block time before DC braking.
ADV-15 DC- Brake Time	Sets the time duration for the DC voltage supply to the motor.
ADV-16 DC- Brake Level	Sets the amount of DC braking to apply. The parameter setting is based on the rated current of the motor.
ADV-17 DC- Brake Freq	Sets the frequency to start DC braking. When the frequency is reached, the inverter starts deceleration. If the dwell frequency is set lower than the DC braking frequency, the dwell operation will not work and DC braking will start instead.



## ① Caution

- The motor can overheat or be damaged if an excessive amount of DC braking is applied to the motor or if the DC braking time is set to a high value.
- DC braking is configured based on the motor's rated current. To prevent overheating or damaging motors, do not set the current value higher than the inverter's rated current.

## 7.17.3 Free Run Stop

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

Group	Code	Name	LCD Display	Paran	neter Setting	Setting Range	Unit
ADV	08	Stop mode	Stop Mode	2	Free-Run	0–4	-
Freque voltage							
Run cmd							

## ① Caution

When there is high inertia on the output side and the motor is operating at high speed, the load's inertia will cause the motor to continue rotating even after the inverter output is blocked.

# 7.17.4 Power Braking

When the inverter's DC voltage rises above a specified level due to motor-regenerated energy, a control is made to either adjust the deceleration gradient level or reaccelerate the motor in order to reduce the regenerated 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	Name	LCD Display	Param	neter Setting	Setting Range	Unit
ADV	08	Stop mode	Stop Mode	4	Power Braking	-	-

## ① Caution

- To prevent overheating or damaging the motor, do not apply power braking to loads that require frequent deceleration.
- Stall prevention and power braking only operate during deceleration, and power braking takes priority over stall prevention. In other words, when both bit 3 of PRT-50 (stall prevention and flux braking) and ADV-08 (braking options) are set, power braking will take precedence.
- Note that if the deceleration time is too short or the 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 may be longer than the preset deceleration time.

# 7.18 Frequency Limit

The operation frequency can be limited by setting a maximum frequency, start frequency, upper limit frequency, and lower limit frequency.

# 7.18.1 Frequency Limit Using Maximum Frequency and Start **Frequency**

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
DDV/	19	Start frequency	Start Freq	0.50	0.01-10.00	Hz
DRV	20	Maximum frequency	Max Freq	60.00	40.00-400.00	Hz

#### Frequency Limit Using Maximum Frequency and Start Frequency - Setting Details

Code	Description
DRV-19 Start Freq	Sets the lower limit value for all speed unit parameters that are expressed in Hz or rpm. Any operation frequency input that is lower than the start frequency is treated as a 0 Hz input.
DRV-20 Max Freq	Sets an upper limit frequency to all speed unit parameters that are expressed in Hz or rpm, except for the base frequency (DRV-18). An operation frequency cannot be set higher than the maximum frequency.

# 7.18.2 Frequency Limit Using Upper and Lower Limit Frequency **Values**

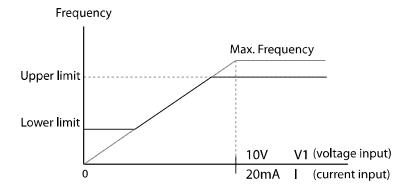
Group	Code	Name	LCD Display	Param	neter Setting	Setting Range	Unit
ADV	24	Frequency limit	Freq Limit	0	No	No/Yes	-

Group	Code	Name	LCD Display	Param	neter Setting	Setting Range	Unit
	25	Frequency lower limit value	Freq Limit Lo	0.50		0.0–maximum frequency	Hz
	26	Frequency upper limit value	Freq Limit Hi	60.00		0.5–maximum frequency	Hz
	34	Jog Freqency Limit	Jog Freq Limit	1	Yes	No/Yes	-

#### Frequency Limit Using Upper and Lower Limit Frequencies - Setting Details

Code	Description
ADV-24 Freq Limit	The initial setting is "0 (No)." Changing the setting to "1 (Yes)" allows you to set the lower limit frequency (ADV-25) and the upper limit frequency (ADV-26). When the setting is "0 (No)", codes ADV-25 and ADV-26 are not visible.
ADV-25 Freq Limit Lo ADV-26 Freq Limit Hi	Sets upper and lower frequency limits. All frequency selections are restricted to frequencies from within the upper and lower limits. This restriction also applies when you in input a frequency reference using the keypad.
ADV-34 Jog Freq Limit	This code allows you to select whether to use the frequency limit function with frequency upper/lower limits for jog operations.  When ADV-34 is set to "Yes", the frequency limit is applied if the frequency limit function using the frequency upper/lower limits is set the same as a normal operation for jog operations.  When ADV-34 is set to "No", the frequency limit value is not applied even if the frequency limit function using the frequency upper/lower limits is set for jog operations. However, the frequency limit for the maximum frequency and the start frequency applies.

#### — without upper / lower limits



## ① Caution

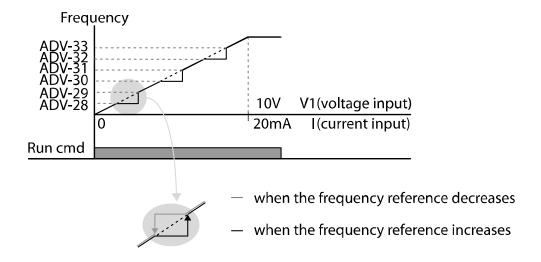
- When ADV-24 (Freq Limit) is set to "Yes," the frequency set at ADV-25 (Freq Limit Lo) is the minimum frequency (Low Freq). If ADV-24 (Freq Limit) is set to "No," the frequency set at DRV-19 (Start Freq) becomes the minimum frequency.
- When ADV-24 (Freq Limit) is set to "Yes," the frequency set at ADV-26 (Freq Limit Hi) is the maximum frequency (High Freq). If ADV-24 (Freq Limit) is set to "No," the frequency set at DRV-20 (Max Freq) becomes the maximum frequency.

# 7.18.3 Frequency Jump

Use frequency jump to avoid mechanical resonance frequencies. The inverter will avoid specific frequency ranges during acceleration and deceleration. Operation frequencies cannot be set within the preset frequency jump band.

When the operation frequency is increased while the frequency parameter setting value (voltage, current, RS-485 communication, keypad setting, etc.) is within a jump frequency band, the frequency will be maintained at the lower limit value of the frequency band. Then, the frequency will increase when the frequency parameter setting exceeds the range of frequencies used by the frequency jump band.

Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Unit
	27	Frequency jump	Jump Freq	0	No	No/Yes	-
	Jump freque lower limit1		Jump Lo 1	10.0	00	0.00–Jump frequency upper limit 1	Hz
	29	Jump frequency upper limit1	Jump Hi 1	15.0	00	Jump frequency lower limit 1–Maximum frequency	Hz
ADV	30	Jump frequency lower limit 2	Jump Lo 2	20.00		0.00–Jump frequency upper limit 2	Hz
	Jump frequency upper limit 2	Jump frequency upper limit 2	Jump Hi 2	25.0	00	Jump frequency lower limit 2–Maximum frequency	Hz
	32	Jump frequency lower limit 3	Jump Lo 3	30.0	00	0.00–Jump frequency upper limit 3	Hz
	33	Jump frequency upper limit 3	Jump Hi 3	35.0	00	Jump frequency lower limit 3–Maximum frequency	Hz



# 7.19 2<sup>nd</sup> Operation Mode Setting

Apply two types of operation modes and switch between them as required. For both the first and second command source, set the frequency after shifting operation commands to the multi-function input terminal. Mode switching can be used to stop remote control during an operation using the communication option and to switch the operation mode to operate via the local panel, or to operate the inverter from another remote control location.

Select one of the multi-function terminals from codes IN-65–75 and set the parameter value to "15 (2nd Source)".

Group	Code	Name	LCD Display	Para	meter Setting	Unit
	06	Command source	Cmd Source	1	Fx/Rx-1	-
DRV	07	Frequency reference source	Freq Ref Src	2	V1	-
	08	Torque reference source	Trq Ref Src	0	Keypad-1	
	04	2nd command source	Cmd 2nd Src	0	Keypad	-
BAS	05	2nd frequency reference source	Freq 2nd Src	0	KeyPad-1	-
	06	2nd torque reference source	Trq 2 <sup>nd</sup> Src	0	Keypad-1	
IN	65–75	Px terminal configuration	Px Define (Px: P1–P8 [optional: P9–P11])	15	2nd Source	-

#### **2nd Operation Mode Setting Details**

Code	Description
BAS-04 Cmd 2nd Src BAS-05 Freq 2nd Src	If signals are provided to the multi-function terminal set as the 2nd command source (2nd Source), the operation can be performed using the values set at BAS-04-05 instead of the values set at DRV-06 and DRV-07. The 2nd command source settings cannot be changed while operating with the 1st command source (Main Source).
BAS-06 Trq 2nd Src	If signals are provided to the multi-function terminal set as the 2nd command source (2nd Source), the operation can be performed using the torque reference set at BAS-06 instead of the value set at DRV-08. Codes DRV-08 and BAS-06 are visible only when DRV-09 (Control mode) is set to "sensorless" or "vector" control mode, and DRV-10 (Torque control) is set to "Yes."

## ① Caution

- When you set the multi-function terminal to the 2nd command source (2nd Source) and input the signal, the inverter's operation state changes according to the operation frequency and the operation command configured for the 2nd command. Before shifting the input to the multifunction terminal, ensure that the 2nd command is correctly set. An overvoltage fault trip may occur if the deceleration time is too short or the inertia of the load is too high.
- Depending on the parameter settings, the inverter may stop operating when you switch command modes.

# 7.20 Multi-function Input Terminal Control

Filter time constants and the type of multi-function input terminals can be configured to improve the response of the input terminals.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	85	Multi-function input terminal On filter	DI On Delay	0	0–10000	ms
TNI	86 Multi-function input terminal Off filter DI C	DI Off Delay	0	0–10000	ms	
IN	87	Multi-function input terminal selection	DI NC/NO Sel	0000 0000*	-	-
	90	Multi-function input terminal status	DI Status	0000 0000*	-	-

<sup>\*</sup> From the last bit to the first, the bits are for multi-purpose inputs P1-P8 (the last bit is for input 1, and the first bit is for input 8).

#### **Multi-function Input Terminal Control Setting Details**

Code	Description	Description				
IN-85 DI On Delay, IN-86 DI Off Delay		e terminal receives an On or Off inpugnal after the set delay time has elap				
IN-87 DI NC/ NO Sel	correspo bottom s terminal the term	Selects terminal contact types for each input terminal. The position of the docorresponds to the segment that is on as shown in the table below. With the pottom segment on, it indicates that the terminal is configured as an A serminal (Normally Open) contact. With the top segment on, it indicates that the terminal is configured as a B terminal (Normally Closed) contact. Terminal ere numbered P1–P8, from right to left.				
	Type	B terminal status (Normally Closed)	A terminal status (Normally Open)			
	Keypad					
IN-90 DI Status	Displays the configuration of each contact. When a segment is configured an A terminal at DRV-87, the On condition is indicated by the top segment turning on. The Off condition is indicated when the bottom segment is turn on. When contacts are configured as B terminals, the segment dots behave conversely. Terminals are numbered P1–P8, from right to left.					
	Type	A terminal setting (On)	A terminal setting (Off)			
	Keypad					

# 7.21 Expanded I/O Control with an Optional I/O Expansion Module

You can install an I/O expansion module to add 3 digital input and 3 digital output (relay output) multi-function terminals to the iS7 inverter. The following table lists the function codes to control the expanded I/O functions.

Group	Code	Name	LCD Display	Parameter Setting		Unit
IN	73	Px terminal configuration (P9 terminal function)	P9 Define	0	None	-
	74	Px terminal configuration (P10 terminal function)	P10 Define	0	None	-
	75	Px terminal configuration (P11 terminal function)	P11 Define	0	None	-
	34	Multi-function relay-3	Relay 3	2	FDT-2	-
OUT	35	Multi-function relay-4	Relay 4	3	FDT-3	-
	36	Multi-function relay-5	Relay 5	4	FDT-4	-

# 8 Learning Advanced Features

This chapter describes the advanced features of the iS7 inverter.

# 8.1 Operating with Auxiliary References

Frequency references can be configured with various calculated conditions that use the main and auxiliary frequency references simultaneously. The main frequency reference is used as the operating frequency, while auxiliary references are used to modify and fine-tune the main reference.

Group	Code	Name	LCD Display	Parar	meter Setting	Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	0	Keypad-1	0–9	-
BAS	01	Auxiliary frequency reference source	Aux Ref Src	1	V1	0–5	-
	02	Auxiliary frequency reference calculation type	Aux Calc Type	0	M+(G*A)	0–7	-
	03	Auxiliary frequency reference gain	Aux Ref Gain	-	0.00	-200.0–200.0	%
IN	65-75	Px terminal configuration	Px Define	36	dis Aux Ref	0-48	-

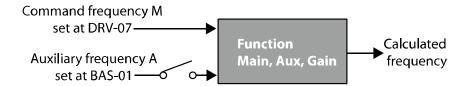
<sup>\*</sup> Codes IN-01-16 must be set to the default values, and IN-06 (V1 Polarity), set to "1 (Bipolar)".

The table above lists the available calculated conditions for the main and auxiliary frequency references. Refer to the table to see how the calculations apply to an example where the DRV-07 Frq Src code has been set to "0 (Keypad-1)", and the inverter is operating at a main reference frequency of  $30.00 \, \text{Hz}$ . Signals at -10 to +10 V are received at terminal V1, with the reference gain set at 5%. In this example, the resulting frequency reference is fine-tuned within the range of  $27.00-33.00 \, \text{Hz}^*$  (+/- 5% of  $60 \, \text{Hz}$ ).

#### **Auxiliary Reference Setting Details**

Description				
Sets the input type to be used for the auxiliary frequency reference.				
Configuration   Description				
0 None		Auxiliary frequency reference is disabled.		
S	Sets the inpu	Sets the input ty Configuration		

Code	Description					
	Sets the V1 (voltage) terminal at the control terminal block					
	2	I1	Sets 1	e source of the auxiliary frequency reference. the I1 (current) terminal at the control terminal block		
	3	as the source of the auxiliary frequency reference.  Sets the V2 (voltage) terminal at the optional I/O expandable as the source of the auxiliary frequency reference.				
	4	I2	Sets the I2 (current) terminal at the optional I/O expansion module as the source of the auxiliary frequency reference.			
	5	Pulse	Sets the pulse input terminal at the optional encoder			
BAS-02 Aux Calc Type	auxil where either where Corror or 1 2 3 4 5 6 7 M: M G: Au A: Au Not Where occur	iary reference calculating replus (+) or a unipolar a infiguration M+(G*A) M*(G*A) M+{M*(G*A) M+{G*2*(A-50)} M/{G*2*(A-50)} In the maximar due to an incomplete calculation of	Sets the pulse input terminal at the optional encoder module as the source of the auxiliary frequency reference.  Ty reference gain with BAS-03 (Aux Ref Gain) to configure the nee and set BAS-02 to decide the percentage to be reflected g the main reference. Note that items 4–7 below may result in r minus (-) references (forward or reverse operation) even analog inputs are used.*  Formula for frequency reference  Main reference + (BAS-03 x BAS-01 x IN-01)  Main reference x (BAS-03 x BAS-01)  Main reference + (Main reference x [BAS-03 x BAS-01])  A-50)  Main reference + BAS-03 x 2 x (BAS-01-50) x IN-01  (A-50)  Main reference / (BAS-03 x 2 x [BAS-01-50])			
BAS-03 Aux Ref Gain	Adjusts the size of the input (BAS-01 Aux Ref Src) configured for the auxiliary frequency.					
IN-65–75 Px Define	Set one of the multi-function input terminals to "40 (dis Aux Ref)" and turn it on to disable the auxiliary frequency reference. The inverter will operate using the main frequency reference only.					



The auxiliary command frequency is turned off when the terminal input (Px) set to "40 (dis Aux Ref)" is on.

#### **Auxiliary Reference Operation Ex #1**

#### Keypad Frequency Setting is Main Frequency, and V1 Analog Voltage is Auxiliary Frequency

- Main frequency (DRV-07): Keypad (operation frequency 30 Hz)
- Maximum frequency setting (DRV-20): 400 Hz
- Auxiliary frequency setting (BAS-01): V1 [Display by percentage (%) or auxiliary frequency (Hz) depending on the operation setting condition]
- Auxiliary reference gain setting (BAS-03): 50%
- IN-01-32: Factory default

Example: An input voltage of 6 V is supplied to V1, and the frequency corresponding to 10 V is 60 Hz. The table below shows the auxiliary frequency A as 36 Hz [= $60 \text{ Hz} \times (6 \text{ V}/10 \text{ V})$ ] or 60% [=  $100\% \times (6 \text{ V}/10 \text{ V})$ ].

Set	ting *	Calculating final command frequency**	
0	M[Hz]+(G[%]*A[Hz])	30 Hz(M)+(50%(G)x36 Hz(A))=48 Hz	
1	M[Hz]*(G[%]*A[%])	30 Hz(M)x(50%(G)x60%(A))=9 Hz	
2	M[Hz]/(G[%]*A[%])	30 Hz(M)/(50%(G)x60%(A))=100 Hz	
3	$M[Hz]+{M[Hz]*(G[\%]*A[\%])}$	30 Hz(M)+{30[Hz]x(50%(G)x60%(A))}=39 Hz	
4	M[Hz]+G[%]*2*(A[%]-50[%])[Hz]	30 Hz(M)+50%(G)x2x(60%(A)-50%)x60 Hz=36 Hz	
5	M[HZ]*{G[%]*2*(A[%]-50[%])}	30 Hz(M)x{50%(G)x2x(60%(A)-50%)}=3 Hz	
6	M[HZ]/{G[%]*2*(A[%]-50[%])}	30 Hz(M)/{50%(G)x2x(60%-50%)}=300 Hz	
7	M[HZ]+M[HZ]*G[%]*2*(A[%]-50[%])	30 Hz(M)+30 Hz(M)x50%(G)x2x(60%(A)–50%)=33 Hz	

<sup>\*</sup> M: Main frequency reference (Hz or rpm)/G: Auxiliary reference gain (%)/A: Auxiliary frequency reference (Hz or rpm) or gain (%).

<sup>\*\*</sup> If the frequency setting is changed to rpm, it is converted to rpm instead of Hz.

#### **Auxiliary Reference Operation Ex #2**

# The Keypad Frequency Setting is the Main Frequency, and I2 Analog Voltage is the Auxiliary Frequency

- Main frequency (DRV-07): Keypad (Operation frequency 30 Hz)
- Maximum frequency setting (BAS-20): 400 Hz
- Auxiliary frequency setting (BAS-01): I1 [Display by percentage (%) or auxiliary frequency (Hz) depending on the operation setting condition]
- Auxiliary reference gain setting (BAS-03): 50%
- IN-01-32: Factory default

Example: An input current of 10.4 mA is applied to I1, with the frequency corresponding to 20 mA of 60 Hz. The table below shows auxiliary frequency A as 24 Hz [= $60[Hz] X \{(10.4[mA]-4[mA])/(20[mA]-4[mA])\}$ ] or 40% [= $100[\%] X \{(10.4[mA]-4[mA])/(20[mA]-4[mA])\}$ ].

Setting*		Calculating final command frequency**		
0	M[Hz]+(G[%]*A[Hz])	30 Hz(M)+(50%(G)x24 Hz(A))=42 Hz		
1	M[Hz]*(G[%]*A[%])	30 Hz(M)x(50%(G)x40%(A))=6 Hz		
2	M[Hz]/(G[%]*A[%])	30 Hz(M)/(50%(G)x40%(A))=150 Hz		
3	M[Hz]+{M[Hz]*(G[%]*A[%])}	30 Hz(M)+{30[Hz]x(50%(G)x40%(A))}=36 Hz		
4	M[Hz]+G[%]*2*(A[%]-50[%])[Hz]	30 Hz(M)+50%(G)x2x(40%(A)-50%)x60 Hz=24 Hz		
5	M[HZ]*{G[%]*2*(A[%]-50[%])	30 Hz(M)x{50%(G)x2x(40%(A)–50%)}=-3 Hz (Reverse )		
6	M[HZ]/{G[%]*2*(A[%]-50[%])}	30 Hz(M)/{50%(G)x2x(60%–40%)}=-300 Hz (Reverse )		
7	M[HZ]+M[HZ]*G[%]*2*(A[%]-	30 Hz(M)+30 Hz(M)x50%(G)x2x (40%(A)–50%)=27 Hz		
	50[%])			

<sup>\*</sup> M: Main frequency reference (Hz or rpm)/G: Auxiliary reference gain (%)/A: Auxiliary frequency reference Hz or rpm) or gain (%).

<sup>\*\*</sup> If the frequency setting is changed to rpm, it is converted to rpm instead of Hz.

#### **Auxiliary Reference Operation Ex #3**

#### V1 is the Main Frequency, and I1 is the Auxiliary Frequency

- Main frequency (DRV-07): V1 (frequency command setting to 5 V and is set to 30 Hz)
- Maximum frequency setting (DRV-20): 400 Hz
- Auxiliary frequency (BAS-01): I1 [Display by percentage (%) or auxiliary frequency (Hz) depending on the operation setting condition]
- Auxiliary reference gain (BAS-03): 50%
- IN-01-32: Factory default

Example: An input current of 10.4 mA is applied to I1, with the frequency corresponding to 20 mA of 60 Hz. The table below shows auxiliary frequency A as 24 Hz [=60[Hz]x{(10.4[mA]-4[mA])/(20[mA]-4[mA])}] or 40% [=100[%] x {(10.4[mA] - 4[mA]) /(20 [mA] - 4[mA])}].

Set	ting*	Calculating final command frequency**				
0	M[Hz]+(G[%]*A[Hz])	30 Hz(M)+(50%(G)x24 Hz(A))=42 Hz				
1	M[Hz]*(G[%]*A[%])	30 Hz(M)x(50%(G)x40%(A))=6 Hz				
2	M[Hz]/(G[%]*A[%])	30 Hz(M)/(50%(G)x40%(A))=150 Hz				
3	M[Hz]+{M[Hz]*(G[%]*A[%])}	30 Hz(M)+{30[Hz]x(50%(G)x40%(A))}=36 Hz				
4	M[Hz]+G[%]*2*(A[%]-50[%])[Hz]	30 Hz(M)+50%(G)x2x(40%(A)-50%)x60 Hz=24 Hz				
5	M[HZ]*{G[%]*2*(A[%]-50[%])}	30 Hz(M)x{50%(G)x2x(40%(A)–50%)}=-3 Hz (Reverse)				
6	M[HZ]/{G[%]*2*(A[%]-50[%])}	30 Hz(M)/{50%(G)x2x(60%-40%)}=-300 Hz(Reverse)				
7	M[HZ]+M[HZ]*G[%]*2*(A[%]-50[%])	30 Hz(M)+30 Hz(M)x50%(G)x2x(40%(A)-50%)=27 Hz				

<sup>\*</sup> M: Main frequency reference (Hz or rpm)/G: Auxiliary reference gain (%)/A: Auxiliary frequency reference (Hz or rpm) or gain (%).

#### Note

When the maximum frequency value is high, output frequency deviation may occur due to analog input variation and deviations in the calculations.

<sup>\*\*</sup>If the frequency setting is changed to rpm, it is converted to rpm instead of Hz.

# 8.2 Jog Operation

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

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

# 8.2.1 Jog Operation 1-Forward Jog via Multi-function Terminal

The jog operation is available using the multi-function terminal input. To start a forward jog operation, an Fx operation command must be entered. The table below lists parameter settings for a forward jog operation using the multi-function terminal input.

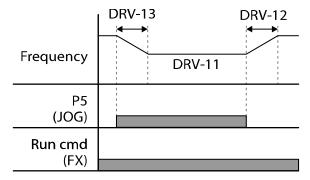
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	11	Jog frequency	JOG Frequency 10.00		0.5– Max Freq	Hz	
	12	Jog operation acceleration time	JOG Acc Time	20.00		0.00-600.00	sec
	13	Jog operation deceleration time	JOG Dec Time	30.00		0.00-600.00	sec
IN	65-75	Px terminal configuration	Px Define(Px: P1–P8 [optional: P9–P11])	6	JOG	-	-

#### **Forward Jog Details**

Code	Description
IN-65–75 Px Define	Select an input terminal from IN-65-75 (P1-P8 [optional: P9-P11]) and set it to "6 (Jog)".  P1 FX P5 JOG  [Terminal settings for jog operation using the P5 terminal]
DRV-11 JOG Frequency	Sets the operation frequency.

Code	Description
DRV-12 JOG Acc Time	Sets the acceleration speed for a jog operation.
DRV-13 JOG Dec Time	Sets the deceleration speed 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.

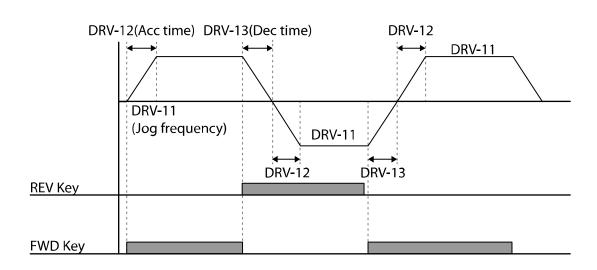


# 8.2.2 Jog Operation 2-Forward/Reverse Jog via Multi-function Terminal

For jog operation 1, an operation command must be entered to start an operation, but while using jog operation 2, a terminal that is set for a forward or reverse jog also starts an operation.

The priorities for the frequency, acc/dec time and terminal block input during operation in relation to other operating modes (Dwell, 3-wire, up/down, etc.) are identical to jog operation 1. If a different operation command is entered during a jog operation, it is ignored and the operation maintains the jog frequency.

Group	Code	Name	LCD Display	Parameter setting		Setting Range	Unit
DRV	11	Jog frequency	JOG Frequency 10.00		0	0.5–Max Freq	Hz
	12	Jog operation acceleration time	JOG Acc Time	20.0	0	0.00-600.00	sec
	13	Operation deceleration time	JOG Dec Time	30.0	0	0.00-600.00	sec
		Px terminal	Px Define	46	FWD JOG		
IN	65–75 configuration		(Px: P1–P8 [optional: P9–P11])	47	REV JOG	-	-



# 8.2.3 Jog Operation via Keypad Input

The jog operation is available using the keypad input as well.

The priorities for the frequency, acc/dec time, and terminal block input during an operation in relation to other operating modes (Dwell, 3-wire, up/down, etc.) are identical to jog operations using the terminal input.

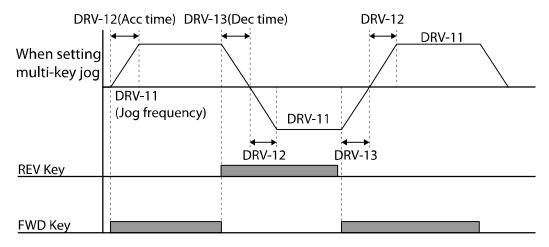
Group	Code	Name	LCD Display	Parameter setting	Setting Range	Unit
DRV	11	Jog frequency	JOG Frequency	10.00	0.5–Max Freq	Hz
	12	Jog operation acceleration time	JOG Acc Time	20.00	0.00-600.00	sec
	13	Operation deceleration time	JOG Dec Time	30.00	0.00-600.00	sec

The table below lists parameter settings for a forward jog operation using the keypad input.

MODE	Group	Code	LCD Display	Parameter Setting		Setting Range	Unit
CNF	-	42	Multi-Key Sel	1	JOG Key	-	-
PAR	DRV	06	Cmd Source	0	Keypad	0–5	sec

After setting CNF-42 to "1 (JOG Key)" and DRV-06 (in PAR mode) to "0 (Keypad)", you can start the jog operation using the keypad by pressing the [MULTI] key on the keypad.

When you press the [MULTI] key, "J" is displayed on the keypad indicating that a jog operation via the keypad is available. Press and hold the [FWD] or [REV] key to perform forward or reverse jog operations. Jog operations stop when you lift your finger from the [FWD] or [REV] key on the keypad.



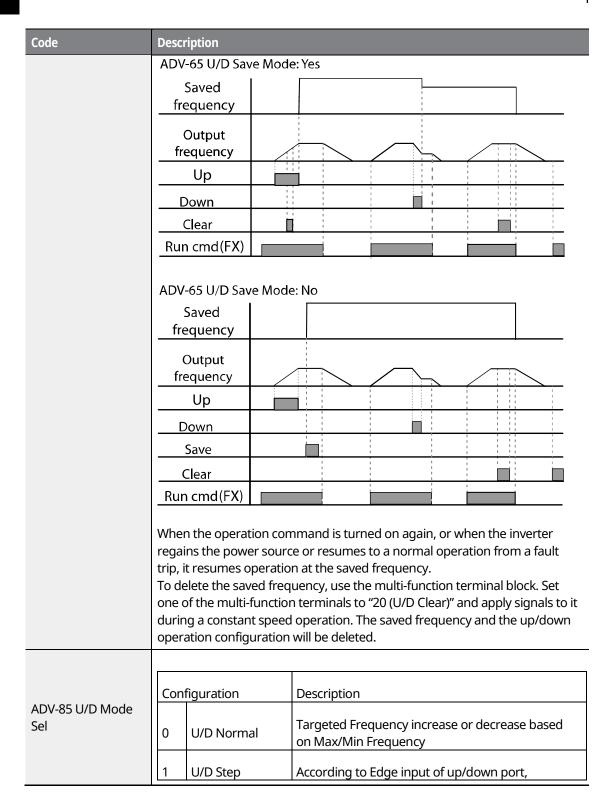
#### **Up/down Operation** 8.3

The acc/dec time can be controlled via the input at the multi-function terminal block. The updown operation can be applied easily to a system that uses the upper-lower limit switch signals (such as those of a flow meter) for acc/dec commands.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
ADV	65	Up/down operation frequency save	U/D Save Mode	1	Yes	0–1	-
	85	Up/down mode Sel	U/D Mode Sel	0	U/D Normal	0:U/D Normal 1:U/D Step 2:U/D Step+Norm	-
	86	Up/down Step freqency	U/D Step Freq	-	0	0-maximum frequency	Hz
		configuration	Px Define (Px: P1–P8	17	Up		
IN	65 75			18	Down	- 0-51 -	
IIN	05-75		[optional:	19	U/D Save		-
			P9-P11])	20	U/D Clear		

# **Up/down Operation Setting Details**

Code	Description		
IN-65–75 Px Define	"20 (Down)", respectively begins when the Up terr speed operation begins During operation, deceled Deceleration stops and a	up/down operation and set them which was the operation command in a signal is on. Acceleration stownen the signal is off.  Peration begins when the Down signal constant speed operation beging entered at the same time.	nput, acceleration ops and constant gnal is on.
IN 03 731 X Delinic	Frequency P7(UP) P8(Down) Run cmd (FX)		
ADV-65 U/D Save Mode	automatically under the or Rx) is off, a fault trip o  You can also save the up operated at a constant s (IN-65–75) to "19 (U/D Sa If the up/down frequence	operation, the operating freque following conditions: The operatic ccurs, or the power is off.  I/down operation frequency while peed by setting one of the multive)", or by setting ADV-65 to "1 (Y y saving function is enabled for the frequency will be saved as of	e the inverter is function terminals 'es)". he terminal and
	Save by keypad input (ADV-65) set to "1 (Yes)"	Save by keypad input (IN-65–75) set to "19 (U/D Save)"	U/D Save Result
	X	Х	Х
	0	X	0
	X	0	0
	0	0	0



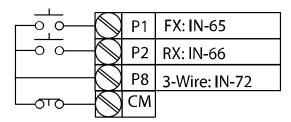
ode	Description	
		Frequency will be increase or decrease as much as ADV-86 setting date.
	2 U/D Step+Norm	Frequency that will be set by Edge input.
	1 : U/D STEP Output	
	Frequency	3sec
	Down	
	FX FX	
	2 : U/D STEP+Norm	
	Output Frequency	
	Up 🔳	3sec   3sec
	Down	
	FX FX	

# **3-Wire Operation**

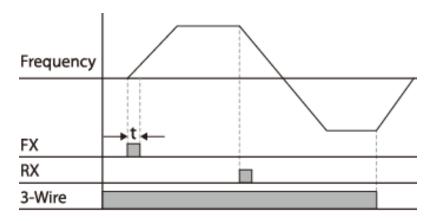
The 3-wire operation latches the signal input (the signal stays on after the button is released), and is used when operating the inverter with a push button.

Group	Code	Name	LCD Display	Par	ameter Setting	Setting Range	Unit
DRV	06	Command source	Cmd Source	1	Fx/Rx - 1	0–5	-
IN	65–75	Px terminal configuration	Px Define(Px: P1–P8 [optional: P9–P11])	14	3-Wire	0-51	-

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



[Terminal connections for 3-wire operation]



[3-wire operation]

#### **Safe Operation Mode** 8.5

When the multi-function terminals are configured to operate in Safe mode, operation commands can be entered in Safe mode only. Safe mode is used to safely control the inverter through the multi-function terminals.

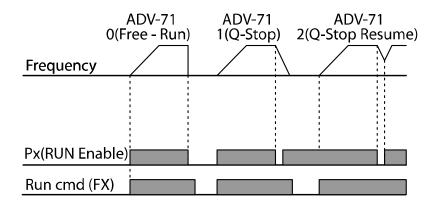
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
ADV	70	Safe operation selection	Run En Mode	1	DI Dependent	Always Enable / DI Dependent	-
	71	Safe operation stop mode	Run Dis Stop	0	Free-Run	0–2	-
	72	Safe operation deceleration time	Q-Stop Time	5.0		0.0-600.0	sec
IN	65-75	Px terminal configuration	Px Define(Px: P1–P8 [optional: P9–P11])	13	RUN Enable	0–51	-

### **Safe Operation Mode Setting Details**

Code	Desc	Description			
IN-65-75 Px Define		From the multi-function terminals, select a terminal to operate in Safe mode and set it to "13 (RUN Enable)".			
	Set	tting	Function		
ADV-70 Run En	0	Always Enable	Safe operation mode is deactivated.		
Mode	1	DI Dependent	Recognizes the operation command from a multi- function input terminal.		
	conf Whe	figured for Safe men the Safe mode ings at the Q-Stop	he inverter when the multi-function input terminal node is off. signal is given, the inverter decelerates according to the time. The inverter decelerates and stops according to (Dec Time) settings if the run command is off.		
ADV-71 Run Dis	Se	etting	Function		
Stop	1	Free-Run	Blocks the inverter output when the multi-function terminal is off.		
	2	Q-Stop	The deceleration time (Q-Stop Time) used in Safe mode. It stops after deceleration and then the operation can resume only when the operation		

command is entered again. The operation will not

Code	Description		
		begin if only the multi-function terminal is on.	
	3 Q-Stop Resume	The inverter decelerates to the deceleration time (Q-Stop Time) in Safe operation mode. It stops after deceleration. Then, if the multi-function terminal is on, the operation resumes as soon as the operation command is entered.	
ADV-72 Q-Stop Time	Set the deceleration time when ADV-71 (Run Dis Stop) is set to "1 (Q-Stop)" or "2 (Q-Stop Resume)".		

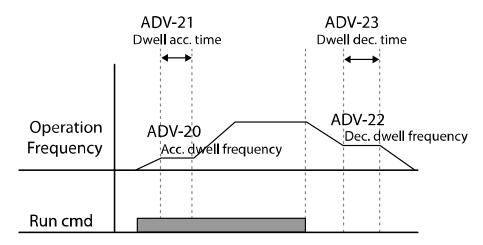


# 8.6 Dwell Operation

When DRV-09 (Control mode) is set to "0 (V/F mode)", a dwell operation may be used to maintain torque during inverter application, such as when enough torque is required before releasing mechanical brakes on lift-type loads. A dwell operation is based on the acc/dec dwell frequency and the dwell time set by the user. The following conditions also affect dwell operations.

- Acceleration Dwell Operation: When an operation command is given, acceleration
  continues until the acceleration dwell frequency and constant speed is reached within the
  acceleration dwell operation time (Acc Dwell Time). After the Acc Dwell Time has passed,
  acceleration is carried out based on the set acceleration time and operation speed.
- Deceleration Dwell Operation: When a stop command is given, deceleration continues
  until the deceleration dwell frequency and constant speed are reached within the
  deceleration dwell operation time (Dec Dwell Freq). After the set time has passed,
  deceleration is carried out based on the set deceleration time, and then the operation
  stops.

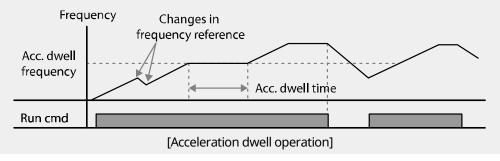
Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
2	20	Dwell frequency during acceleration	Acc Dwell Freq	5.00	Start frequency - Maximum frequency	Hz
ADV	21	Operation time during acceleration	Acc Dwell Time	0.0	0.0-60.0	sec
ADV	22	Dwell frequency during deceleration	Dec Dwell Freq	5.00	Start frequency - Maximum frequency	Hz
	23	Operation time during deceleration	Dec Dwell Time	0.0	0 .0- 60.0	sec



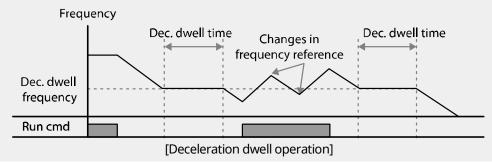
#### **Note**

#### Dwell operations are not performed when:

- The dwell operation time is set to 0 sec or the dwell frequency is set to 0 Hz.
- Re-acceleration is attempted from a stop or during deceleration, since only the first acceleration dwell operation command is valid.



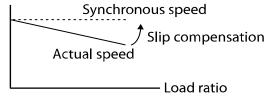
Although a deceleration dwell operation is carried out whenever stop commands are entered
and the deceleration dwell frequency is passed through, it does not work during a deceleration
operation by a simple frequency change (which is not deceleration due to a stop operation), or
during external brake control applications.



# 8.7 Slip Compensation Operation

Slip refers to the variation between the setting frequency (synchronous speed) and motor rotation speed. As the load increases, there can be variations between the setting frequency and motor rotation speed. Slip compensation is used for loads that require compensation of these speed variations.\*

#### **Motor Rotation**



\*If DRV-09 is set to Sensorless, Vector, or V/F PG, the variation (slip) is automatically compensated.

Group	Code	Name	LCD Display Parameter Setting		rameter Setting	Setting Range	Unit
	09	Control mode	Control Mode	2	Slip Compen	0-5	-
DRV	14	Motor Capacity	Motor Capacity	2	0.75 kW (0.75 kW based)	0.2-450	kW
	11	Number of motor poles	Pole Number			2-48	-
BAS	12	Rated slip speed	Rated Slip	90	(0.75 kW based)	0-3000	rpm
	13	Rated motor	Rated Curr	3.	6 (0.75 kW based)	1–10000	Α

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
		current				
	14	Motor no-load current	Noload Curr	1.6 (0.75 kW based)	0.5–1000	A
	16	Motor efficiency	Efficiency	72 (0.75 kW based)	70–100	%
	17	Load Inertia ratio	Inertia Rate	0 (0.75 kW based)	0–8	-
	92	SlipGain Mot-H	SlipGain Mot-H	50	0-200	%
	93	SlipGain Gen-H	SlipGain Gen-H	50	0-200	%
	94	SlipGain Mot-L	SlipGain Mot-L	50	0-200	%
ADV	95	SlipGain Gen-L	SlipGain Gen-L	50	0-200	%
	96	Slip Filter	Slip Filter	300	0-10000	msec
	97	Slip Comp Freq	Slip Comp Freq	5.00	0-60.00	Hz
	98	Slip Gain Freq	Slip Gain Freq	9.00	0-20.00	Hz

# **Slip Compensation Operation-Setting Details**

Code	Description
DRV-09 Control Mode	Sets DRV-09 to "2 (Slip Compen)" to carry out the slip compensation operation.
DRV-14 Motor Capacity	Sets the capacity of the motor connected to the inverter.
BAS-11 Pole Number	Enters the number of poles from the motor rating plate.
BAS-12 Rated Slip	Enters the number of rated rotations from the motor rating plate.
BAS-13 Rated Curr	Enters the rated current from the motor rating plate.
BAS-14 Noload Curr	Enters the measured current when the load on the motor axis is removed and when the motor is operated at the rated frequency. If the no-load current is difficult to measure, enter a current equivalent to 30-50% of the rated motor current.
BAS-16 Efficiency	Enters the efficiency from the motor rating place.
BAS-17 Inertia Rate	If inertia rate < 10 x motor inertia, set BAS-16 to "0".  If inertia rate = 10 x motor inertia, set BAS-16 to "1".  If inertia rate > 10 x motor inertia, set BAS-16 to "2–8".
ADV-92 Slip Gain Mot-H ADV-93 Slip Gain Gen-H	This is the slip compensation gain used in the region where the output frequency is higher than the slip compensation gain switching frequency (ADV-98). You can set the gain values differently for the

Code	Description
	reverse/regeneration operations.
ADV-94 Slip Gain Mot-L ADV-95 Slip Gain Gen-L	This is the slip compensation gain used in the region where the output frequency is lower than the slip compensation gain switching frequency (ADV-98). You can set the gain values differently for the reverse/regeneration operations.
ADV-96 Slip Filter	The filter time constant used when calculating the current required for slip compensation.
ADV-97 Slip Comp Freq	You can set the frequency at which slip compensation starts. It is used when load compensation is not performed properly due to a low load compensation amount when stopped. At a constant speed, when it is above this frequency setting value, it calculates the real time slip to compensate the load. If it is below, it compensates the load by using the previously calculated slip. When accelerating, the load is compensated by carrying out the sleep operation regardless of this frequency value. When decelerated, the load is compensated by using the previous calculated slip regardless of this frequency. When this value is set to 0, the slip operation is compensated in real time at all frequencies regardless of acceleration/deceleration and constant speed
ADV-98 Slip Gain Freq	Input using the rated speed of the motor nameplate

#### Note

The following is a formula for calculating the rated slip:

$$f_s = \frac{f_r \times 120}{P} - Rpm$$

 $f_s$  = Rated slip frequency,  $f_r$  = Rated frequency

Rpm= Number of rated motor rotations, P= Number of motor poles

Ex.) If the rated frequency is 60 Hz, the rated revolution is 1740 rpm, and the pole number is 4:

$$f_s = \frac{60 \times 120}{4} - 1740 = 60rpm$$

# 8.8 PID Control

PID control is one of the most common auto-control methods. It uses a combination of proportional, integral, and differential (PID) controls that provide more effective control for automated systems. The functions of PID control that can be applied to the inverter operation are as follows:

Purpose	Function
Speed Control	Controls the speed by monitoring the current speed levels of the equipment or machinery being controlled. This control maintains a consistent speed or operates at the target speed.
Pressure Control	Controls the pressure by monitoring the current pressure levels of the equipment or machinery being controlled. This control maintains a consistent pressure or operates at the target pressure.
Flow Control	Controls the flow by monitoring the current amount of flow in the equipment or machinery being controlled. This control maintains a consistent flow or operates at a target flow.
Temperature Control	Controls the temperature by monitoring the current temperature levels of the equipment or machinery being controlled. This control maintains a consistent temperature or operates at the target temperature.

# 8.8.1 PID Basic Operation

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

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	01	Application mode	App Mode	2	Proc PID	0-4	-
	16	PID output monitor	PID Output	-		-	-
APP	17	PID reference monitor	PID Ref Value	-		-	-
	18	PID Feedback Value	PID Fdb Value	-		-	-
	19	PID reference setting	PID Ref Set	50	.00	-100–100	%

Group	Code	Name	LCD Display	Par	amet	er Setting	Setting Range	Unit
	20	PID reference source	PID Ref Source	0	Key	/pad	0–10	-
	21	PID feedback source	PID F/B source	0	V1		0–9	-
	22	PID proportional gain	PID P-Gain	-	50.	0	0–1000	%
	23	PID integral time	PID I-Time	-	10.	0	0-200.0	sec
	24	PID differential time	PID D-Time	-	0		0–1000	ms
	25	PID feed forward gain	PID F-Gain	-	0.0		0–1000	%
	26	PID proportional gain scale	P Gain Scale	-	100	0.0	0–100	%
	27	PID output filter	PID Out LPF	-	0		0–10000	ms
	28	PID mode options	PID Mode	0	0	Process PID	0-1	-
	29	PID output upper limit	PID Limit Hi	-	60.	00	APP-30 setting value-300	Hz
	30	PID output lower limit	PID Limit Lo	-	-60	.00	-300–APP-029 setting value	Hz
	31	PID output inversion	PID Out Inv	-	0	No	0–1	-
	32	PID output scale	PID Out Scale	-	100	0.0	0.1–1000	%
	34	Pre-PID start frequency	Pre-PID Freq	-	0.0	0	0-Max. Freq	Hz
	35	Feedback value to end Pre-PID operation	Pre-PID Exit	-	0.0		0–100	%
	36	Pre-PID delay time	Pre-PID Delay	-	600	)	0-9999	sec
	37	PID sleep delay time	PID Sleep DT	-	60.	0	0-999.9	sec
	38	PID sleep frequency	PID Sleep Freq	-	0.0	0	0-Max. Freq.	Hz
	39	PID wakeup level	PID WakeUp	-	35		0–100	%

Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Unit
			Lev				
	40	PID wakeup mode option	PID WakeUp Mod	0	Below Level	0-2	-
	41	PID Rev Run Enable	PID Rev Run En	0	No	0-1	-
	42	PID unit option	PID Unit Sel	0	Hz	0–12	-
	43	PID gain unit	PID Unit Gain	-	100.0	0-300	%
	44	PID scale unit	PID Unit Scale	2	X 1	0–2	-
	45	PID proportional gain 2	PID P2-Gain	-	100.0	0–1000	%
			Px Define	22	I-Term Clear		
IN 65-75	Px circuit function setting	(Px: P1–P8 [optional:	23	PID Openloop	0–51	-	
			P9-P11])	24	P Gain2		

#### Note

- Normal PID output (PID OUT) is bipolar and is limited by APP-29 (PID Limit Hi) and APP-30 (PID Limit Lo) settings.
- If a PID change operation (changes from PID operation to normal operation) comes into multifunction inputs (P1-P11), the value of [%] is converted to [Hz] and is output.
- DRV-20 (MaxFreq) value equals 100% of PID output.

### **PID Basic Operation Setting Details**

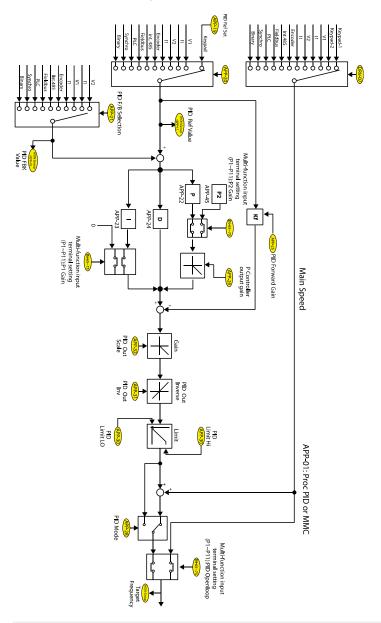
Code	Description
APP-01 App Mode	Sets the code to "2 (Proc PID)" to enable process PID.
APP-16 PID Output	Displays the existing output value of the PID controller. The unit, gain, and scale set at APP-42, APP-43, and APP-44 are applied on the display.
APP-17 PID Ref Value	Displays the existing reference value set for the PID controller. The unit, gain, and scale set at APP-42, APP-43, and APP-44 are applied on the display.
APP-18 PID Fdb Value	Displays the latest feedback value of the PID controller. The unit, gain, and scale set at APP-42, APP-43, and APP-44 are applied on the display.
APP-19 PID Ref Set	Sets the reference value when APP-20 (PID Ref Source) is set to "0 (Keypad)". If the reference source is set to any input other than the

Code	Description						
	keyp	keypad, this value will be ignored.					
	Set the reference input source for the PID control. If the V1 terminal is set as the PID feedback source at APP-21 (PID F/B Source), it cannot be set as the PID reference source. To set V1 as a reference source, change the feedback source settings first.						
		ting	Function	PID F/B Source			
	0	Keypad	Keypad	X			
	1	V1	Terminal input for -10–10 V input voltage	0			
	2	I1	Terminal input 0-20 mA input current	0			
	3	V2	[W/ optional I/O expansion module] Terminal input for -10–10 V input voltage	0			
APP-20 PID Ref Source	4	I2	[W/ optional I/O expansion module] Terminal input 0-20 mA input current	0			
All 2011D Net Source	5	Int. 485	RS-485 input terminal	0			
	6	Encoder	[W/ optional encoder module] Pulse input terminal	0			
	7	FieldBus	[W/ optional communication module] Fieldbus Communication input	0			
	8	PLC	[W/ optional PLC module] Input from a PLC	0			
	9	Synchro	[W/ optional synchronization module] Command via synchronization operation	0			
	10	Binary Type	[W/ optional BCD module] Command via BCD option module	Х			
	The PID reference source setting can be monitored at APP-17 (PID Ref Value) according to the information types for monitoring set at CNF-06–08.						
APP-21 PID F/B Source	Sets a feedback input source for the PID control. Keypad input (keypad-1, keypad-2) cannot be selected as the source of FB input. Also, the input type selected as the PID input source at APP-19 (PID Ref Set) cannot be set as the PID feedback input source.  For example, if the V1 terminal is set as the PID reference source at APP-20, you must select input types other than the V1 terminal as the PID feedback source.  You can set codes 06–08 in the CNF group to "18 (PID Fdb Value)" to monitor the feedback values.						
APP-22 PID P-Gain, APP-26 P Gain Scale	Sets the output ratio for differences (errors) between the reference and feedback. If the P-gain is set to 50%, then 50% of the difference (error) is output.  The setting range of P-gain is 0.0–1000.0%. You can set APP-26 (P-Gain Scale) to adjust the input scale if a more accurate control is required.						

Code	Descriptio	n			
APP-23 PID I-Time	Sets the time to output accumulated errors. When the error is 100%, the time taken for 100% output is set. When the integral time (PID I-Time) is set to 1 second, 100% output occurs after 1 second of the error and remains at 100%. Differences in a normal state can be reduced by PID I Time. When the multi-function terminal block is set to "21 (I-Term Clear)" and is turned on, all of the accumulated errors are deleted.				
APP-24 PID D-Time	time (PID	D-Time)		e of change in errors. If the differential ad the rate of change in errors per sec is ms.	
APP-25 PID F-Gain	Sets the releads to a		_	to the PID output. Adjusting this value	
APP-27 PID Out LPF	system is (default va higher va	unstable alue is 0 lue incre	e, due to severe o ) is used to speed eases stability. Th	out changes too quickly or the entire oscillation. In general, a lower value d up response time, but in some cases a se higher the value, the more stable the ower the response time.	
APP-28 PID Mode	output to	produce 8 to "1 (	e the final output Normal PID)" to (	add certain target values to the PID t. use the PID output without additional	
APP-29 PID Limit Hi, APP-30 PID Limit Lo	Sets the v	alues to	limit the output	of the PID controller.	
APP-32 PID Out Scale	Sets APP-	32 to ad	just the scale of t	he controller output.	
PID Rev Run En	set to 0 H does not	z when t reverse.	the frequency is of the frequency is of the frequency is the frequency is the frequency in the frequency is	"No", the lower limit frequency limit is decreased via PID control, so that it ", when the frequency decreases by PID erates in the reverse direction.	
	Set APP-4	2 to sele	ect the unit for th	e PID control.	
	Setting	Unit	Application	Description	
	0	%	-	Displays certain values into as a percentage.	
	1	Bar			
APP-42 PID Unit Sel	2	mBar	Pressure	Units for expressing different types	
	3	Pa	_	of pressure.	
	5	kPa Hz		Units for inverter output frequency	
	6	rpm	Speed	Units for inverter output frequency or motor revolution.	
	7	V	Voltage	Units for electric voltage, current,	
	8	I	Current	electrical consumption, or	

Code	Description					
	9	kW	Electric power	consumed power.		
	10	HP	Horse power			
	11	°F	Tomporaturo	Units for everyssing temperature		
	12	°C	Temperature	Units for expressing temperature.		
APP-43 PID Unit Gain, APP-44 PID Unit Scale	Adjust the unit value and scale to fit the unit selected at APP-42 (PID Unit Sel).					
APP-45 PID P2-Gain	Set APP-45 (PID P2-Gain) for an alternative PID controller gain and use the alternative gain via a terminal input.  Set IN-65–75 to "23 (P Gain2)". When the selected terminal is on, the gain set at APP-45 is used instead of the gain set at APP-22 and APP-23.					

#### **PID Control Block Diagram**



#### Note

- If the PID switching operation (switching from PID operation to normal operation) is performed at the multi-function inputs (P1-P11), % values are converted into Hz values.
- The polarity of the Normal PID output PID OUT is unipolar, and is limited by APP-29 (PID Limit Hi) and APP-30 (PID Limit Lo).
- 100% is based on the setting at DRV-20 (maxFreq).

# 8.8.2 Pre-PID Operation

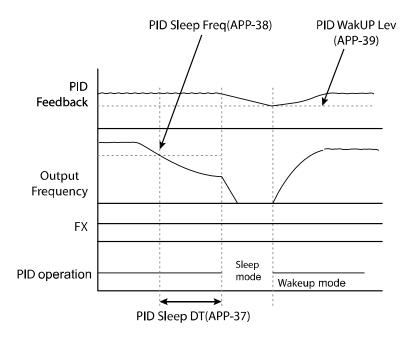
Pre-PID operation refers to a section of a PID operation where the inverter runs without PID control. The inverter accelerates to a set frequency and runs without PID control, and then the PID control begins after the PID output exceeds the set value at APP-35 (Pre-PID Exit).

Code	Description						
APP-34 Pre-PID Frq	Sets the target frequency to operate without PID control. The inverter continues running at the set frequency until the PID feedback exceeds the feedback value (%) set at APP-35.						
	Sets the feedback value of the PID control (PID reference) to stop pre-PID operation and start PID control.  PID Reference						
APP-35 Pre-PID Exit	PID Reference  Feedback — APP-35 Pre-PID Exit						
	Output Frequency APP-34 Pre-PID freq						
	FX						
	PID operation ← Area1 ← Area2 ← Area2						
APP-36 Pre-PID Delay	Sets the time until a pre-PID fault trip occurs. If a feedback smaller than the PID reference set at APP-35 is maintained for the set time, a pre-PID fail trip occurs and inverter output is stopped.						

# 8.8.3 PID Sleep Mode

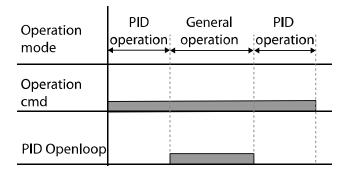
If an operation continues at a frequency lower than the PID operation conditions at APP-38 (Sleep Freq) for a set duration at APP-37 (PID Sleep DT), the inverter enters PID sleep mode. In PID sleep mode, the inverter resumes PID operation when the PID Wakeup level conditions set at APP-39 (PID WakeUp Lev) are met.

Code	Description
APP-37 PID Sleep DT, APP-38 PID Sleep Freq	Sets the PID sleep frequency and delay time. The inverter stops operation and enters sleep mode if an operation is maintained at a frequency lower than the sleep frequency set at APP-38 for the time set at APP-37.
	Sets the reference for PID wakeup at APP-39. If APP-40 is set to "0 (Below Level)", PID operation is resumed when the feedback volume is lower than the reference.
APP-39 PID WakeUp Lev, APP-40 PID WakeUp Mod	If APP-40 is set to "0 (Below level)", PID operation will resume when the feedback volume is lower than the reference.  If APP-40 is set to "1 (Above Level)", PID operation will resume when the feedback volume is higher than the reference.  If APP-40 is set to "2 (Beyond level)", PID operation will resume when the difference between the speed reference and the feedback is larger than the wakeup reference set at APP-39.



# 8.8.4 PID Switching (PID Openloop)

When one of the multi-function terminals (IN-65–75) is set to "22 (PID Openloop)" and is turned on, the PID operation stops and is switched to general operation. When the terminal turns off, the PID operation starts again.



# 8.9 Auto Tuning

The motor parameters can be measured automatically and can be used for an auto torque boost or sensorless vector control.

Example - Auto Tuning Based on 0.75 kW, 220 V Motor

Group	Code	Name	LCD Display	Parameter Setting		Unit
DRV	14	Motor capacity	Motor Capacity	2 0.75 k	W	kW
	11	Motor pole number	Pole Number	4		-
	12	Rated slip speed	Rated Slip	40		Rpm
	13	Rated motor current	Rated Curr	3.6		Α
	14	Motor no-load current	Noload curr	1.6		Α
	15	Motor rated voltage	Rated Volt	220		V
BAS	16	Motor efficiency	Efficiency	72		%
	20	Auto tuning	Auto Tuning	0	None	-
	21	Stator resistance	Rs	2.600		Ω
	22	Leakage inductance	Lsigma	17.94		mH
	23	Stator inductance	Ls	15.44		mH
	24	Rotor time constant Tr		145	·	ms
APO	01	Encoder option mode	Enc Opt Mode	0	None	

# **Auto Tuning Default Parameter Setting**

Motor Capacity (kW)		Rated Current (A)	No-load Current (A)	Rated Slip Frequency (Hz)	Stator Resistance (Ω)	Leakage Inductance (mH)	Stator Inductance [mH]	Rotator Time constant [ms]
	0.2	1.1	0.8	3.33	14.0	40.4	385	93
	0.4	2.4	1.4	3.33	6.70	26.9	206	116
	0.75	3.4	1.7	3.00	2.600	17.94	174.4	145
	1.5	6.4	2.6	2.67	1.170	9.29	115.8	162
	2.2	8.6	3.3	2.33	0.840	6.63	90.7	183
	3.7	13.8	5.0	2.33	0.500	4.48	59.7	211
	5.5	21.0	7.1	1.50	0.314	3.19	41.5	250
	7.5	28.2	9.3	1.33	0.169	2.844	31.86	271
200 V	11	40.0	12.4	1.00	0.120	1.488	23.91	310
200 V	15	53.6	15.5	1.00	0.084	1.118	19.07	350
	18.5	65.6	19.0	1.00	0.068	0.819	15.59	390
	22	76.8	21.5	1.00	0.056	0.948	13.79	435
	30	104.6	29.3	1.00	0.042	0.711	10.12	530
	37	128.6	34.7	1.00	0.033	0.568	8.54	600
	45	156.0	42.1	1.00	0.028	0.474	7.04	630
	55	184.1	49.7	1.00	0.023	0.389	5.96	670
	75	244.5	61.1	1.00	0.016	0.284	4.85	800
	90	289.5	72.3	1.00	0.014	0.250	4.09	900
	0.2	0.7	0.5	3.33	28.00	121.2	1045	93
	0.4	1.4	0.8	3.33	14.0	80.8	610	116
	0.75	2.0	1.0	3.00	7.81	53.9	512	145
	1.5	3.7	1.5	2.67	3.52	27.9	346	162
400 V	2.2	5.0	1.9	2.33	2.520	19.95	269.5	183
<del>-100 V</del>	3.7	8.0	2.9	2.33	1.500	13.45	177.8	211
	5.5	12.1	4.1	1.50	0.940	9.62	124.5	250
	7.5	16.3	5.4	1.33	0.520	8.53	95.2	271
	11	23.2	7.2	1.00	0.360	4.48	71.2	310
	15	31.0	9.0	1.00	0.250	3.38	57	350

Motor Capacit	y (kW)	Rated Current (A)	No-load Current (A)	Rated Slip Frequency (Hz)	Stator Resistance (Ω)	Leakage Inductance (mH)	Stator Inductance [mH]	Rotator Time constant [ms]
	18.5	38.0	11.0	1.00	0.168	2.457	46.47	390
	22	44.5	12.5	1.00	0.168	2.844	41.1	435
	30	60.5	16.9	1.00	0.126	2.133	30.23	530
	37	74.4	20.1	1.00	0.101	1.704	25.49	600
	45	90.3	24.4	1.00	0.084	1.422	21.01	630
	55	106.6	28.8	1.00	0.069	1.167	17.79	670
	75	141.6	35.4	1.00	0.050	0.852	14.46	800
	90	167.6	41.9	1.00	0.039	0.715	12.22	900
	110	203.5	48.8	1.00	0.032	0.585	10.48	1000
	132	242.3	58.1	1.00	0.027	0.488	8.8	1100
	160	290.5	69.7	1.00	0.022	0.403	7.34	1200
	185	335.0	77.0	1.00	0.021	0.380	6.64	1250
	220	405	93.1	30	0.0163	0.293	5.467	1350
	280	530.7	116.7	30	0.0128	0.23	4.386	1400
	315	604	132.8	30	0.0114	0.204	3.854	1430
	375	729.7	153.2	30	0.0096	0.171	3.342	1470

### **Auto Tuning Parameter Setting Details**

Code	Description	Description					
DRV-14 Motor Capacity	Set the motor capacity.	Set the motor capacity. The maximum motor capacity is limited by the inverter's capacity.					
	[PROG/ENT] ke	tuning type and run it. Select one of the options and then press the y to run auto tuning.  Function					
	Setting	The auto tuning function is disabled. Also, if you select one of the					
BAS-20 Auto Tuning	0 None	auto tuning options and run it, the parameter value will revert back to 0 when auto tuning is complete.					
Turning	1 All	Measures all motor parameters while the motor is rotating, including stator resistance (Rs), stator inductance (Lsigma), noload current (Noload Curr), rotor time constant (Tr), etc. If an optional encoder module is installed, the inverter state is also measured (requires appropriate settings for encoder-related					

Code	De	Description				
			functions). Use this setting when DRV-09 (Control mode) is set to "5 (Vector)". Since the motor is rotating while the parameters are being measured, if the load is connected to the motor spindle, the parameters may not be measured accurately. For accurate measurements, remove the load attached to the motor spindle. If DRV-09 (Control mode) is set to "4 (Sensorless-2)", the rotor time constant (Tr) must be measured in a stopped position.			
	2	All (static type)	Measures all parameters while the motor is in the stopped position, including stator resistance (Rs), stator inductance (Lsigma), no-load current (Noload Curr), rotor time constant (Tr), etc.  Use this setting when DRV-09 (Control mode) is set to "4 (Sensorless-2)".  Since the motor is not rotating while the parameters are measured, the measurements are not affected when the load is connected to the motor spindle.			
	3	Rs+Lsigma	Measures the stator resistance (Rs) and stator inductance (Lsigma) while the motor is not rotating. The measured values are used for auto torque boost and sensorless vector control. Since the motor is not rotating while the parameters are measured, the measurements are not affected when the load is connected to the motor spindle.			
	4	Enc. Test	Runs auto tuning after installing the optional encoder to the inverter and connecting the encoder cables to the motor. Auto tuning checks the cable connection. Ensure that the encoder related parameters are correctly set before auto tuning.			
	5	Tr	Uses this setting to measure the rotor time constant (Tr) when DRV-09 (Control mode) is set to "5 (Vector)". The motor rotates during auto tuning.			
	6	Tr (Stdstl)	Uses this setting to measure the rotor time constant (Tr) when DRV-09 (Control mode) is set to "4 (Sensorless-2)". The motor does not rotate during auto tuning.			
BAS-14 Noload Curr, BAS-21 Rs-BAS-24 Tr	l		parameters measured by auto tuning. For parameters that are not auto tuning measurement list, the default setting will be displayed.			

# ① Caution

- Perform auto tuning ONLY after the motor has completely stopped running.
- Before you run auto tuning, check the motor pole number, rated slip, rated current, rated voltage, and efficiency on the motor's rating plate and enter the data. The default parameter setting is used for values that are not entered.

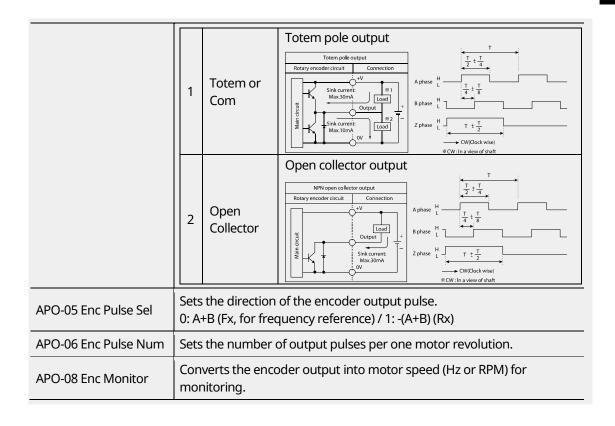
#### Note

Before checking the encoder status using auto tuning, ensure that the following parameters are correctly set.

Group	Code	Name	LCD Display	Par	ameter Setting	Unit
BAS	20	Auto tuning	Auto Tuning	3	Enc Test	0–6
	01	Encoder option mode	Enc Opt Mode	1	Feedback	0–2
	04	Encoder type selection	Enc Type Sel	0	Line Driver	0–2
APO	05	Encoder pulse direction	Enc Pulse Sel	0	(A+B)	0–2
	06	Encoder pulse number	Enc Pulse Num	-	1024	10-5000
	08	Encoder feedback monitor	Enc Monitor	-	0	-

#### **Encoder status checking details**

Code	Description				
BAS-20 Auto Tuning	Sets the auto tuning type to "3 (Enc Test)" to check the encoder connection.  The inverter operates in the Fx direction and accelerates to +20 Hz until it decelerates to 0 Hz and continues operating in the Rx direction, accelerating to -20 Hz.  BAS-20 parameter value is automatically changed to "None" if a connection error is not detected.  The "Enc reverse" message is displayed if the encoder connection is not correct. If this happens, you can change the APO-05 (ENC Pulse Sel) parameter setting to match the actual direction, or swap the two encoder cables that are connected to the motor.				
APO-01 ENC Opt Mode	Sets the encoder option mode to "1 (Feed-back)".				
	Select an encoder type.				
	Setting Output details				
APO-04 Enc Type Sel	Line driver output    Description   Connection   Connecti				



# 8.10 V/F Operation Using Speed Sensor

You can install an optional encoder module to the inverter to enhance the accuracy of V/F control. Before operating the inverter, check the encoder connection by running an auto tuning operation.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	09	Control mode	Control Mode	1	V/F PG	0–5	-
4!	45	PG operation proportional gain	PG P-Gain	-	3000	0-9999	-
CON	46	PG operation integral gain	PG I-Gain	-	50	0-9999	-
	47	PG operation maximum slip	PG Slip Max %	-	100	0–200	%
APO	01	Encoder option mode	Enc Opt Mode	1	Feed-back	0-2	-

### **V/F Operation Using Speed Sensor-Details**

Code	Description
DRV-09 Control Mode	Sets the control mode to "1 (V/F PG)". This mode adds a speed controller to a regular V/F mode. The command frequency becomes the speed reference of the speed controller, and the feedback is used as the encoder input.
CON-45 PG P-Gain, CON-46 PG I-Gain	Sets the proportional and integral gain (P-Gain/I-gain) of the speed controller. Higher P-gain results in a faster response. However, excessively high P-gain may lead to unstable operation. Lower I-gain results in a faster response. However, excessively low P-gain may lead to unstable operation.
CON-47 PG Slip Max %	Sets the maximum slip for the speed controller as a percentage (%) based on the rated slip set at BAS-12 (Rated Slip). For example, if CON-47 is set to 90% when the rated slip set at BAS-12 is 30 rpm, the maximum slip for the speed controller becomes 27 rpm, (90% of 30 rpm,).

# 8.11 Sensorless-1 Vector Control

Sensorless-1 vector control mode provides high performance operation without requiring a speed sensor. Motor parameter information is required for sensorless-1 vector control mode. Before operating the inverter in sensorless-1 mode, run auto tuning first.

Group	Code	Name	LCD Display	Para	meter Setting	Unit
	09	Control mode	Control Mode	3	Sensorless-1	-
DRV	10	Torque control option	Torque Control	0	No	-
	14	Motor-rated capacity	Motor Capacity	х	X.XX	kW
	11	Motor pole number	Pole Number	-	4	-
	12	Motor-rated slip	Rated Slip	-	2.00	Hz
BAS	13	Motor-rated current	Rated Curr	-	3.6	Α
DAS	14	Motor No-load current	Noload curr	-	0.7	Α
	15	Motor-rated voltage	Rated Volt	-	220	V
	16	Motor efficiency	Efficiency	-	83	%

Group	Code	Name	LCD Display	Para	meter Setting	Unit
	20	Auto tuning options	Auto Tuning	2	Rs+Lsigma	-
CON	21	Sensorless speed controller proportional gain 1	ASR-SL P Gain1	-	100.0	%
CON	22	Sensorless speed controller integral gain 1	ASR-SL I Gain1	-	150	ms

### ① Caution

- For sensorless-1 mode operation, the motor's rated capacity must match the inverter's rated capacity. If the inverter capacity is too large for the installed motor, run the motor in V/F mode.
- Sensorless-1 mode operation does not support multiple motor control (MMC) features. Do not connect multiple motors to one inverter that is operating in sensorless-1 mode.

#### Sensorless-1 Vector Control-Details

Code	Description
DRV-14 Motor Capacity, BAS-11 Pole Number, BAS-12 Rated Slip, BAS-13 Rated Curr, BAS-15 Rated Volt, BAS-16 Efficiency	Motor parameter information is required for sensorless-1 vector control mode.  Check the motor's rating plate for the motor capacity and other performance-related information, set the relevant parameters, and then run auto tuning at BAS-20.
	After setting all the parameter values (DRV-14 Motor Capacity, BAS-11 Pole Number, BAS-12 Rated Slip, BAS-13 Rated Curr, BAS-15 Rated Volt, and BAS-16 Efficiency), perform auto tuning.
BAS-20 Auto Tuning	<b>To perform astatic auto tuning</b> when the motor does not rotate, set BAS-20 to 2 (Rs+Lsigma). The default motor no-load current is used, and the motor stator resistance (Rs) and leakage inductance (Lsigma) values are saved at BAS-21 and BAS-22.
	<b>To perform rotating auto tuning</b> , separate the load from the motor axis, if possible, and set BAS-20 to "1 (ALL)". The motor no-load current, motor stator resistance (Rs), and motor leakage inductance (Lsigma) values are saved at BAS-14, BAS-21, and BAS-22 respectively.
CON-21 ASR-SL P Gain1, CON-22 ASR-SL I Gain1	Set the speed controller proportionately and integral gains for sensorless-1 vector control according to the default motor parameters and acc/dec time.

Code	Description
	① Caution
	Appropriate controller gain values must be set based on the load characteristics. Motor overheating or an unstable system may result if the gain values are not properly set.
	Selects the speed control and torque control modes. If you set DRV-10 (Torque control) to "1 (Yes)", the operation switches into torque control mode. Refer to <u>8.14 Torque Control</u> on page <u>242</u> for details.
	① Caution
DRV-10 Torque Control	Torque control is not available during low-speed regeneration and low-speed operation under a light load. Select vector control mode instead.
·	When the inverter is operated in torque control mode, do not switch between forward and reverse rotations. Overcurrent or Rx deceleration fault trips may result.
	When the inverter is operated in sensorless vector control mode, enable accelerating speed search by setting the CON-71 (Speed search) bits to "0001" if the inverter is expected to start or restart while the motor is free-running.

# 8.12 Sensorless-2 Vector Control

Similar to sensorless-1 vector control mode, sensorless-2 vector control mode provides high-performance inverter operation without requiring a speed sensor. It utilizes various gain values for more precise vector control.

Motor parameter information is required for sensorless-2 vector control mode. Before operating the inverter in sensorless-2 mode, run auto tuning first.

Group	Code	Name	LCD Display	Pa	arameter Setting	Unit
	09	Control mode	Control Mode	4	Sensorless-2	-
DRV	10	Torque control option	Torque Control	0	No	-
Ditt	14	Motor-rated capacity	Motor Capacity	х	Varies depending on motor capacity.	kW
BAS	11	Motor pole number	Pole Number	-	4	-

Group	Code	Name	LCD Display	P	arameter Setting	Unit
	12	Motor-rated slip	Rated Slip	-	Varies depending on motor capacity.	Hz
	13	Motor-rated current	Rated Curr	-	Varies depending on motor capacity.	А
	14	Motor No-load current	Noload curr	-	Varies depending on motor capacity.	А
	15	Motor-rated voltage	Rated Volt	-	220/380/440/480	V
	16	Motor efficiency	Efficiency	-	Varies depending on motor capacity.	%
	20	Auto tuning options	Auto Tuning	1	All	-
	20	Sensorless 2nd gain display setting	SL2 G View Sel	1	Yes	-
	21	Sensorless speed controller proportional gain1	ASR-SL P Gain1	-	Varies depending on motor capacity.	%
	22	Sensorless speed controller integral gain 1	ASR-SL I Gain1	-	Varies depending on motor capacity.	ms
	23	Senseless speed controller proportional gain 2	ASR-SL P Gain2	-	Varies depending on motor capacity.	%
	24	Sensorless2 speed controller integral gain 2	ASR-SL I Gain2	-	Varies depending on motor capacity.	%
	26	Sensorless2 measurer gain 1	Observer Gain1	-	10500	-
CON	27	Sensorless2 measurer gain 2	Observer Gain2	-	100.0	%
	28	Sensorless2 measurer gain 3	Observer Gain3	-	13000	-
	29	Sensorless2 speed estimator proportional gain 1	S-Est P Gain 1	-	Varies depending on motor capacity.	-
	30	Sensorless2 speed estimator integral gain 1	S-Est I Gain 1	-	Varies depending on motor capacity.	-
	31	Sensorless2 speed estimator proportional gain 2	S-Est P Gain 2	-	Varies depending on motor capacity.	%
	32	Sensorless2 speed estimator integral gain 2	S-Est I Gain 2	-	Varies depending on motor capacity.	%
	48	Current controller P gain	ACR P-Gain	_	1200	-
	49	Current controller I gain	ACR I-Gain	_	120	_

### ① Caution

- For sensorless-2 mode operation, the motor-rated capacity must match the inverter's rated capacity. If the inverter capacity is too large for the installed motor, run the motor in V/F mode.
- Sensorless-2 mode does not support multiple motor control (MMC) features. Do not connect multiple motors to one inverter that is operating in sensorless-1 mode.

#### Sensorless-2 Vector Control-Details

Code	Description
DRV-14 Motor Capacity, BAS-11 Pole Number, BAS-12 Rated Slip, BAS-13 Rated Curr, BAS-15 Rated Volt, BAS-16 Efficiency	Motor parameter information is required for sensorless-2 vector control mode.  Check the motor's rating plate for the motor capacity and other performance related information, set the relevant parameters, and then run auto tuning at BAS-20.
	After setting all the parameter values (DRV-14 Motor Capacity, BAS-11 Pole Number, BAS-12 Rated Slip, BAS-13 Rated Curr, BAS-15 Rated Volt, and BAS-16 Efficiency), perform a rotating auto tuning.
BAS-20 Auto Tuning	<b>To perform rotating auto tuning</b> , separate the load from the motor axis, and set BAS-20 to "1 (ALL)". The motor stator resistance (Rs), leakage inductance (Lsigma), stator inductance (Ls), no-load current (Noload Curr), and rotor time constant (Tr) are saved in BAS-21, BAS-22, BAS-23, BAS-14, and BAS-24, respectively.
CON-20 SL2 G View Sel	Set CON-20 to "1 (Yes)" to view various medium speed* gains (CON-23 ASR-SL P Gain2, CON-24 ASR-SL I Gain2, CON-27 Observer Gain2, CON-28 Observer Gain3, CON-31 S-Est P Gain2, and CON-32 S-Est I Gain2) for user configuration. These parameters are not visible if CON-20 is set to "0 (No)".  *Medium speed: A speed range that is approximately 50% of the base frequency.
CON-21 ASR-SL P Gain1, CON-22 ASR-SL I Gain1	Sets the speed controller proportionately and integral gain values for sensorless-2 vector control.  The P-gain is proportionate to speed deviation. Increasing the P-gain increases torque output and immediately eliminates speed deviation.  The I-gain is an integral gain which represents the time (ms) until the torque output is made under a steady speed deviation. Decreasing the I-gain can eliminate the speed deviation faster.  After setting the speed controller gain values, observe the changes and fine-tune the values to improve the speed control waveforms. Note that vibration may result if the set P-gain value is too large or the set I-gain value is too small. If oscillation is observed in the waveform, first increase the I-gain, and then increase the P-gain to find the optimal

Code	Description
	values.
CON-23 ASR-SL P Gain2, CON-24 ASR-SL I Gain2	These codes are visible only when CON-20 is set to "1 (yes)". Set the speed controller proportionately and integral gain values for sensorless-2 vector control for operation speeds greater than 50% of the base frequency.  CON-23 (ASR-SL P Gain2) and CON-24 (ASR-SL I Gain2) are set as percentage values (%) based on the proportionately set speed controller and integral gain1 values set at CON-21 (ASR-SL P Gain1) and CON-22 (ASR-SL I Gain1).  Therefore, P-gain2 and I-gain2 values of less than 100% result in decreased responsiveness when the inverter is operating above medium speed.* For example, if both P-gain1 and P-gain2 are set to 50%, the actual P-gain2 value is 25% of the reference. Likewise, if I-gain1 is set to 100 ms and I-gain2 is set to 50%, the resulting I-gain 2 value becomes 200 ms. By default, the speed controller gain values are set according to the motor parameters and acceleration and deceleration times.  *Medium speed: A speed range that is approximately 50% of the base
	frequency.
CON-26 Observer Gain1, CON-27 Observer Gain2, CON-28 Observer Gain3	These codes are visible only when CON-20 is set to "1 (yes)". The observer gain values may be adjusted by system engineers only. Sensorless-2 vector control mode requires the observers to estimate the motor's stator current and rotor magnetic flux. While observer gain1 (CON-26) is applied when the inverter operates at low to medium speeds, observer gain2 (CON-27) is applied when the inverter operates at medium to high speeds. Observer gain3 (CON-28) is applied in torque control mode.
CON-29 S-Est P Gain1, CON-30 S-Est I Gain1	Sets the speed estimator gain values for sensorless-2 vector control mode. Increase or decrease the speed estimator P-gain or I-gain by small increments if the displayed speed does not match the speed reference.  You can also adjust the speed estimator gain values if the motor vibrates severely, or a high current ripple occurs at power on. Decrease the speed estimator P-gain or I-gain gradually to reduce the vibration or current ripple.  By default, the speed estimator gains are set according to the default motor parameters and acceleration and deceleration times.
	These codes are visible only when CON-20 is set to "1 (yes)".
CON-31 S-Est P Gain2, CON-32 S-Est I Gain2	You can set the speed estimator gains to a frequency higher than the medium speed* in sensorless-2 vector control mode.  CON-31 and CON-32 are set as percentage values of low-speed gain values set at CON-29 and CON-30. For example, if CON-29 S-Est P-Gain1

Code	Description
	is 300 and CON-31 S-Est P-Gain2 is 40.0%, the speed estimator P-gain at higher than the actual medium speed is 120.  By default, the speed estimator gains are set according to the default motor parameters and acceleration and deceleration times.  *Medium speed: A speed range that is approximately 50% of the base frequency.
CON-34 SL2 OVM Perc	When the output voltage/input voltage ratio is below 100% (when the output voltage is not over modulated), the output voltage bears linear characteristics to the input voltage. In sensorless-2 control mode, you can set CON-34 (SL2 OVM Perc) to define a voltage range to be limited in the over modulated zone. By default, CON-34 (SL2 OVM Perc) is set as 120%. However, for a high-impact load where the load often exceeds the torque limit, such as a press load, you can increase the limit value to avoid frequent over current fault trips.  Also, in areas where the power supply is unstable, the input voltage tends to be lower than the rated input voltage, which results in more frequent overcurrent (OC1) fault trips with aforementioned high-impact load applications. If this is the case, you can set CON-34 (SL2 OVM Perc) as 140–150% to avoid frequent fault trips.
CON-48 ACR P-Gain, CON-49 ACR I Gain	Sets the current PI controller P-gain and I-gain values.
DRV-10 Torque Control	<ul> <li>Selects the speed control and torque control modes. If you set DRV-10 (Torque control) to "1 (Yes)", the operation switches to torque control mode.</li> <li>Refer to 8.14 Torque Control on page 242 for details.</li> <li>① Caution</li> <li>Torque control is not available during low-speed regeneration and low-speed operation under a light load. Select vector control mode instead.</li> <li>When the inverter is operated in torque control mode, do not switch between forward and reverse rotations. Overcurrent or Rx deceleration fault trips may occur.</li> <li>When the inverter is operated in sensorless vector control mode, enable accelerating speed search by setting the CON-71 (Speed search) bits to "0001," if the inverter is expected to start or restart while the motor is free-running.</li> </ul>

## ① Caution

In sensorless-2 control mode, the motor may overheat or the system may become unstable if the gain values are not properly set.

#### Note

Sensorless-2 vector control mode is greatly affected by the motor and load characteristics. Therefore, it is sometimes necessary to adjust the controller gain values.

When a sensorless-2 vector control is operated in speed mode [DRV-10 (torque control) is set to "0 (No)". If the operation is unstable at extremely low speeds (below 2–3 Hz), or if the speed bounces during startup, increase the CON-22 (ASR-SL I Gain1) value to 200% of the default value. With a regenerative load, motor torque ripples may occur frequently. In this case, decrease the CON-21 (ASR-SL P Gain1) value to 50% of the default value. If this does not solve the problem, increase the CON-21 (ASR-SL P Gain1) value back to the default, and decrease the CON-30 (S-Est I Gain1) value to 50% of the default value.

# 8.13 Vector Control Mode Operation

With an optional encoder module installed to the inverter, vector control mode provides highly precise operation abilities.

Similar to sensorless-1 and sensorless-2 vector control modes, vector control mode requires motor parameter values for operation. Before operating the inverter in sensorless-2 mode, run auto tuning first.

Group	Code	Name LCD Display Parameter Setting				Unit
	09	Control mode	Control Mode	5	Vector	-
DRV 21		Speed unit selection	Hz / rpm Sel	1	Rpm Display	-
BAS	20	Auto tuning	Auto Tuning	1	All	-
	09	Initial excitation time	PreExTime	-	1.0	sec
	10	Initial excitation power supply	Flux Force	-	100.0	%
	11	Continued operation duration	Hold Time	-	1.0	sec
	12	Speed controller proportional gain 1	ASR P Gain 1	-	50.0	%
CON	13	Speed controller integral gain 1	ASR I Gain 1	-	300	ms
-	15	Speed controller proportional gain 2	ASR P Gain 2	-	50.0	%
	16	Speed controller integral gain 2	ASR I Gain 2	-	300	ms
	18	Gain exchange frequency	Gain Sw Freq	-	0.00	Hz
	19	Gain exchange time	Gain Sw Delay	-	0.10	sec

Group	Code	Name	LCD Display	Para	ameter Setting	Unit
	51	Speed controller reference filter	ASR Ref LPF	-	0	ms
	52	Torque controller output filter	Torque Out LPF	-	0	ms
	53	Torque limit setting options	Torque Lmt Src	0	Keypad-1	-
	54	Forward offsetting torque limit	FWD +Trq Lmt	-	180	%
	55	Forward regenerative torque limit	FWD -Trq Lmt	-	180	%
	56	Reverse offsetting torque limit	REV +Trq Lmt	-	180	%
	57	Reverse regenerative torque limit	REV -Trq Lmt	-	180	%
	58	Torque bias setting options	Trq Bias Src	0	Keypad-1	-
	59	Torque bias	Torque Bias	-	0.0	%
	60	Torque bias compensation	Trq BiasFF	-	0.0	%
IN	65–75	PX terminal function setting	Px Define	36	Asr Gain 2	-
IIN	65-75	PX terminal function setting	Px Define	37	ASR P/PI	-

## ① Caution

- For vector control mode operation, the motor-rated capacity must match the inverter's rated capacity. If the inverter capacity is too large for the installed motor, run the motor in V/F mode.
- Vector control mode does not support multiple motor control (MMC) features. Do not connect multiple motors to one inverter that is operating in vector control mode.

#### **Vector Control Mode-Details**

Code	Description
DRV-14 Motor Capacity, BAS-11 Pole Number, BAS-12 Rated Slip, BAS-13 Rated Curr,	Motor parameter information is required for vector control mode operation.  Check the motor's rating plate for the motor capacity and other performance-related information, set the relevant parameters, and

Code	Description					
BAS-15 Rated Volt, BAS-16 Efficiency	then run auto tuning at BAS-20.					
APO-01 Enc Opt Mode	Sets the encoder option mode to "1 (feedback)".					
APO-04 Enc Type Sel	Sets the encoder's signal delivery options. Refer to the instruction manual supplied with the encoder and select one of the following options: 0: Line Driver / 1: Totem or Com / 2: Open Collect					
APO-05 Enc Pulse Sel	Sets the encoder output pulse options.  Setting Description  0 (A+B) Fx operation  1 (A+B) Rx operation  2 A Frequency reference					
APO-06 Enc Pulse Num	Sets the number of pulses per rotation.					
APO-08 Enc Monitor	Converts the encoder output into motor rotation and displays in Hz or rpm units.					
BAS-20 Auto Tuning	To test the encoder:  Sets the auto tuning type to "3 (Enc Test)" to check the encoder connection.  The inverter operates in the Fx direction and accelerates to 20 Hz until it decelerates to 0 Hz and continues operating in the Rx direction, accelerating to 20 Hz.  The BAS-20 parameter value is automatically changed to "None" if a connection error is not detected.  The "Enc reverse" message is displayed if the encoder connection is not correct. If this happens, you can change the APO-05 (ENC Pulse Sel) parameter setting to match the actual direction, or swap the two encoder cables that are connected to the motor.  To perform rotating auto tuning, separate the load from the motor axis, and set BAS-20 to "1 (ALL)". The motor stator resistance (Rs), leakage inductance (Lsigma), stator inductance (Ls), no-load current (Noload Curr) and rotor time constant (Tr) are saved in BAS-21, BAS-22, BAS-23, BAS-14, and BAS-24 respectively.					
CON-09 PreExTime	Sets the initial excitation time. Operation begins after the motor is excited to the rated speed.					
CON-10 Flux Force	Flux force may be used to reduce the initial excitation time. The motor flux increases based on a time constant. To reduce the time to reach the rated flux, you can supply a flux larger than the rating at first, and					

Code	Descri	Description					
	then rated f		ount of flux when the motor is excited close to the				
		Motor flux					
	Exc	itation flux					
	F	Forced flux					
CON-12 ASR P Gain1, CON-13 ASR I Gain1	Sets the speed controller proportional and integral gain values. Increasing the P-gain increases responsiveness and torque output, while decreasing the I-gain increases responsiveness. However, note that excessively high P-gain or low I-gain settings may result in motor speed oscillation.						
CON-15 ASR P Gain2, CON-16 ASR I Gain2	These codes are used to configure the gains that are applied based on the load characteristics and motor speed. The switching of gain values is performed based on the switching frequency set at CON-18 and the switching time set at CON-19.						
CON-51 ASR Ref LPF		ne filter time c controller.	onstant that is used in vector speed mode for the				
CON-52 Torque Out LPF	torque	e mode. In ved	onstant that can be used in vector speed or vector ctor speed mode, it is applied to the speed torque mode, it is applied to the torque reference.				
CON-48 ACR P-Gain, CON-49 ACR I Gain	Sets the P-and I-gain values for the current PI controller. These gains are used in sensorless speed/torque modes and vector speed/torque modes.						
			ion terminals to control the gains and controllers.				
	Settin	g I	Description When the terminal is on, gain switching takes				
IN-65–75 Px Define	36	ASR Gain2	place after the time set at CON-19 has passed.				
	37	When the terminal is on, the integral controller stops operating.					

Code	Description				
		urce for the torque limit function. The torque limit o limit the output to adjust the torque reference.			
	Setting	Description			
	0 Keypad-1	Sets the torque limit using the keypad (up to			
CON-53 Torque Lmt Src	1 Keypad-2	200% of the motor rated torque).			
4	2 V1 3 I1	Sets the torque limit using the analog terminals.			
	6 Int 485	Sets the torque limit using the built-in 485 communication device.			
IN-02 Torque at 100%	If CON-53 is set to becomes 200% w (*Applies only if a When any device	mit values for the analog input. 5 "2 (V1)" and IN-02 is set to "200%", the torque limit then 10 V input is supplied to V1.* Il V1 function parameters use default setting values.) other than the keypad is selected as the torque limit CNF-21–23 to "21 (Torque Limit)".			
CON-33 FWD +Trg Lmt		of the torque limit when CON-53 is set to "0 (Keypad- 2)". The torque limit can be set up to 200% of the ue.			
CON-34 FWD –Trq Lmt	Setting	Description			
CON-35 REV +Trq Lmt	FWD +Trq Lmt	Sets the torque limit for FX motoring operation.			
CON-36 REV -Trq Lmt	FWD -Trq Lmt	Sets the torque limit for FX regenerating operation.			
	REV +Trq Lmt	Sets the torque limit for RX motoring operation.			
	REV -Trq Lmt	Sets the torque limit for RX regenerating operatior			
	Selects the input reference.	source for the offset setting to be added to the torque			
	Setting	Description			
CON-58 Trq Bias Src	0 Keypad-1 1 Keypad-2				
	2 V1	Sets the torque bias using the analog terminals.			
	3 I1	(-120% –+120%, set at CON-59). The setting can be viewed in monitor mode. Set CFG-06–08 to "21 (Torque bias)".			
CON-59 Torque Bias	Sets the torque b	ias value between -120%– +120%.			
IN-65–75 Px Define	Sets one of the multi-function terminals to "48 (Trq Bias)". Torque bia input via the keypad or analog input is applied only when this multi-function terminal is on.				
CON-60 Trq BiasFF	Sets the compensation volume to add to the bias to make up for the loss caused by motor rotation. Negative (-) values diminish the torque bias.				

Code	Description
CON-11 Hold Time	When a run command stops, the inverter holds the zero speed output for the set time before the motor decelerates to a complete stop.  Output Hold time Voltage  Frequency
	Run cmd

# **8.14 Torque Control**

You can use torque control to operate the inverter to produce a certain amount of torque as indicated by the torque reference. In torque control mode, the motor speed is decided by the amount of load because a motor can run at a constant speed when the output torque and torque load are equal. The motor speed increases when the output torque becomes greater than the torque load. You can set a speed limit to maintain the motor speed within a certain range. Note that torque control is not available during the speed control operations.

Group	Code	Name	LCD Display	Para	meter Setting	Unit
	02	Torque command	Cmd Torque	-	0.0	%
DRV	08	Torque reference source	Trq Ref Src	0	Keypad-1	-
DKV	09	Control mode	Control Mode	5	Vector	-
	10	Torque control	Torque Control	1	Yes	-
BAS	20	Auto tuning	Auto Tuning	1	Yes	-
35	35	SL2 L-ExcitLmt	SL2 L-ExcitLmt	-	10	%
	62	Speed limit setting options	Speed Lmt Src	0	Keypad-1	-
CON	63	Forward speed limit	FWD Speed Lmt	-	60.00	Hz
64 65	64	Reverse speed limit	REV Speed Lmt	-	60.00	Hz
	Speed limit operation gain	Speed Lmt Gain	-	500	%	
IN	65-75	PX terminal function setting	Px Define	35	Speed/Torque	-
	31–33	Multi-function relay, Multi-function output 1	Relay x or Q1	27	Torque Dect	-
OUT	59	Detected torque amount	TD Level	-	100	%
	60	Detected torque width	TD Band	-	5.0	%

#### Note

- Basic parameters for inverter operation must be correctly set before you can operate the inverter in torque control mode.
- Torque control is not available during low speed regeneration and light load operation. Operate the inverter in vector control mode instead.
- Do not switch between Fx and Rx operations while the inverter is operating in torque control mode. An overcurrent or reverse deceleration fault trip may occur as a result.

#### **Torque Control-Details**

Code	Descri	ption					
	Select	the input so	urce for the torque reference.				
	Setti		Description				
	0	Keypad-1	Sets the torque reference using the keypad (up to 180%				
	1	1 Keypad-2 of rated motor torque, set at CON-02).					
	2	V1	Sets the torque reference using the analog terminals.				
DRV-08 Trq Ref Src			The torque reference changes based on the set value at IN-02 (Torque at 100%).				
51.0	3	I1	For example, if IN-02 is set to 200%, the torque reference				
			becomes 200% when 20 mA current is supplied.				
			The setting can be viewed in monitor mode. Set CFG-06–08 to "19 (Torque Ref)".				
	6	Int485	Sets the torque reference using the built-in RS485				
		1110405	communication device.				
CON-02 CMD Torque	Sets th	Sets the torque reference for keypad input.					
IN-02 Torque at 100%	Sets th	Sets the torque reference for analog terminal input.					
CON-35 SL2 L- ExcitLmt	speed	l range by lov	improve the operating characteristics in the low torque/low wering the magnetic flux current. However, if the value is se sorless control may not be possible.				
	Select	the input so	urce for the speed limit.				
	Setti	ng	Description				
	0	Keypad-1	Sets the speed limit using the keypad (CON-63 FWD				
CON-62 Speed	1	Keypad-2	Speed Lmt / CON-64 REV Speed Lmt).				
Lmt Src	2	V1	Set the torque reference using the analog terminals, in				
	3	I1	the same manner as setting a frequency reference.				
	6	Int485	The setting can be viewed in monitor mode. Set CNF-21–23 to "23 (Speed Limit)"				

23 to "23 (Speed Limit)".

Code	Description
CON-65 Speed Lmt Gain	Set the torque reference decrement rate between 100%–5000% for when the speed limit is exceeded.
IN-65–75 Px Define	Sets one of the multi-function inputs to "35 (Speed/Torque)". Switching between torque control mode and speed (vector) control mode takes place when the terminal is on.

## 8.15 Droop Control

Droop control is used to balance the load when operating multiple motors for a single load, or to prevent speed controller saturation in vector control mode.

Group	Code	Name	LCD Display	Paran	neter Setting	Unit
CON 66 67	Droop operation amount	Droop Perc	-	0.0	%	
	67	Droop start torque	Droop St Torque	-	100.0	%

#### **Droop Control-Details**

Code	Description				
CON-66 Droop Perc	Sets the percentage rate for the droop operation based on the rated torque				
CON-67 Droop	Sets the torque to start droop operation. Based on the set value, the motor speed can be calculated as follows:				
start torque	Droop speed = Maximum frequency × DroopPerc × Torque reference - DroopStTorque 100% torque - DroopStTorque				

# 8.16 Speed / Torque Control Switching

Set one of the multi-function terminals to switch between speed and torque control modes. This function is only available in vector control mode.

Group	Code	Name	LCD Display Para		neter Setting	Unit
CON	68	Torque mode-speed mode switching	SPD/TRQAcc T	-	20.0	sec

Group	Code	Name	LCD Display	Paran	neter Setting	Unit
		acceleration time				
	69	Torque mode–speed mode switching deceleration time	SPD/TRQDec T	-	30.0	sec
IN	65– 75	PX terminal setting option	Px Define	35	Speed/Torque	-
	09	Control mode	Control Mode	5	Vector	-
DRV	10	0 Torque control	Torque Control	0	No	-
	Ü			1	Yes	-

Set a multi-function input Px to "35 (Speed/Torque)".

If the terminal is on during a vector torque operation, where DRV-09 (Control Mode) is set to "5 (Vector)" and DRV-10 (Torque Control) is set to "1 (Yes)", the operation switches from torque to speed mode based on the acceleration and deceleration times set at CON-68 (SPD/TRQAcc T) and CON-69 (SPD/TRQDec T).

If the terminal is on during a vector speed operation, where DRV-09 (Control Mode) is set to "5 (Vector)" and DRV-10 (Torque Control) is set to "0 (No)", the operation switches from speed to torque mode.

# 8.17 Kinetic Energy Buffering

When the input power supply is disconnected, the inverter's DC link voltage decreases, and a low voltage trip occurs, blocking the output. A kinetic energy buffering operation uses regenerative energy generated by the motor during the blackout to maintain the DC link voltage. This extends the time for a low voltage trip to occur after an instantaneous power interruption.

Group	Code	Name	LCD Display	Parameter Setting		Setting range	Unit
					None		
	selection	Kinetic energy buffering selection	J KER Select 1.1	1	KEB-1	0–2	-
CON		Sciection		2	KEB-2		
COIT	78	Kinetic energy buffering start level	KEB Start Lev	130		110-200	%
	79	Kinetic energy buffering	KEB Stop	135		130-210	%

Group	Code	Name	LCD Display	ay Parameter Setting		Setting range	Unit
		stop level	Lev				
	86	Kinetic energy buffering P-Gain	KEB P Gain	KEB P Gain 1500			%
	87	Kinetic energy buffering I gain	KEB I Gain	500		1–20000	%
	88	Kinetic energy buffering slip gain	KEB Slip Gain	30.0	)	0–2000.0	%
	89	Kinetic energy buffering acceleration time	KEB Acc Time	10.0		0.0-600.0	Sec
IN	65– 75	PX terminal setting option	Px Define	50	KEB-1 Select	0–51	

## **Kinetic Energy Buffering Operation Setting Details**

Code	Description								
		Select the kinetic energy buffering operation when the input power is disconnected.							
	Note  If a multi-function terminal is set to "50 (KEB-1 Select)", KEB operation is available via terminal input only. Set CON-77 to "0 (none)" in this case.								
CON-77	Setting 0 None	Function  General deceleration is carried out until a low voltage trip occurs.  If input power failure occurs, the inverter output frequency is							
KEB Select	1 KEB-1	If input power failure occurs, the inverter output frequency is controlled and the regeneration energy from the motor is charged by the inverter. Normal operation is resumed when the power is supplied again, using the acceleration time set at CON-89 (KEB Acc Time).  DC Link Voltage  CON-78  CON-79							
		Output frequency Starting freq.  KEB Control Operation return (CON-89)							

Code	Description						
	If input power failure occurs, the inverter output frequency is controlled and the regeneration energy from the motor is charged by the inverter. The motor decelerates and stops when the power is supplied again, using the deceleration time set at DRV-04 (Dec Time).  2 KEB-2  DC Link Voltage  Output frequency  MEB Control Dec stop(DRV-04)  PX(FX)						
CON-78 KEB Start Lev, CON-79 KEB Stop Lev	Sets the start and stop points of the kinetic energy buffering operation. The set values must be based on the low voltage trip level at 100%, and the stop level (CON-79) must be set higher than the start level (CON-78).						
CON-86 KEB P Gain	Used to maintain the voltage during the kinetic energy buffering operation. It operates the inverter by modifying the set value to prevent malfunctions caused by low voltage after power interruptions.						
CON-87 KEB I Gain	Used to maintain the voltage during the kinetic energy buffering operation. Sets the gain value to maintain the operation until the frequency stops during the kinetic energy buffering operation.						
CON-88 KEB Slip Gain	Used to prevent malfunctions caused by low voltage from initial kinetic energy buffering occurring due to power interruptions.						
CON-89 KEB Acc Time	Sets the acceleration time for the frequency reference when the inverter's operation becomes normal after the kinetic energy buffering operation.						
IN-65–75 Px Define	Sets a multi-function input Px to "50 (KEB-1 Select)".  If the terminal is on during an operation, the inverter operates in KEB-1 mode. The inverter output frequency is controlled to the output level set at CON-78 and the regeneration energy from the motor is charged by the inverter. Normal operation is resumed when the power is supplied again, using the acceleration time set at CON-89 (KEB Acc Time).  If the terminal is not on, KEB operation does not start when the input power failure occurs.  If a multi-function terminal is set to "50 (KEB-1 Select)", KEB operation is available via terminal input only. Set CON-77 to "0 (none)" in this case.						

Code	Description	Description						
	DC Link Voltage	CON-78						
	Output frequency		K - K ( Ontrol	Operation return				
	PX (KEB-1 Se <b>l</b> ect)							

#### ① Caution

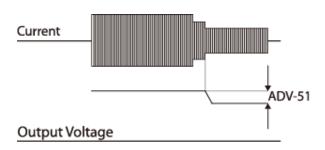
- Depending on the duration of instantaneous power interruptions and the amount of load inertia, a low voltage trip may occur even during a kinetic energy buffering operation.
- Motors may vibrate during kinetic energy buffering operation for some loads, except for variable torque loads (for example, fan or pump loads).

# 8.18 Energy Saving Operation

## 8.18.1 Manual Energy Saving Operation

If the inverter output current is lower than the current set at BAS-14 (Noload Curr), the output voltage must be reduced as low as the level set at ADV-51 (Energy Save). The voltage before the energy saving operation starts will become the base value of the percentage. The manual energy saving operation will not be carried out during acceleration and deceleration.

Group	Code	Name	LCD Display	Parameter Setting		Parameter Setting Setting Range		Unit
				0	None			
	50	Energy saving operation	E-Save Mode	1	Manual	1	Manual	-
ADV						2	Auto	
	51	Energy saving amount	Energy Save	30		0-3	0	%



## 8.18.2 Automatic Energy Saving Operation

The inverter automatically finds the optimal energy saving point based on the motor rated current (BAS-13) and the no-load current (BAS-14).

Group	Code	Name	LCD Display	Setting		Setting Range	Unit
ADV	50	Energy saving operation	E-Save Mode	2	Auto	0–2	-
DAC	13	Motor-rated current	Rated Curr	Depends on inverter capacity		1–1000	А
BAS	14	Motor no-load current	Noload Curr	Depends on inverter capacity		0.5–1000	A

## ① Caution

If the operation frequency is changed, or acceleration or deceleration is carried out during an energy saving operation, the actual acc/dec time may take longer than the set time due to the time required to return to general operations from the energy saving operation.

# 8.19 Speed Search Operation

Speed search operation is used to prevent fault trips that can occur when the inverter voltage output is disconnected and the motor is idling. Since this feature estimates the motor rotation speed based on the inverter output current, it does not give the exact speed.

Group	Code	Name	LCD Display	Parameter Setting			Setting Range	Unit
	70 Speed search mode selection SS Mode 0 Flyir		0 Flying Start-1		-	-		
	71	Speed search operation selection	Speed Search	000	0		-	bit
	72	Speed search	SS Sup-	Up	to 75 kW	150	80.200	%
CON	/2	reference current	Current	Ove	Over 75 kW 100		80–200	90
	73	Speed search proportional gain	SS P-Gain	100			0-9999	-
	74	Speed search integral gain	SS I-Gain	200			0-9999	-
	75	Output block time before speed search	SS Block Time	1.0		0-60	sec	
OUT	31-32	Multi-function relay 1–2	Relay 1–2	10	19 Speed Search			
OUT	33	Multi-function output 1	Q1 Define	19			9 Speed Search -	

#### **Speed Search Operation Setting Details**

Code	Description						
	Sel	ect a speed searc	h type.				
	Se	Setting Function					
CON-70 SS Mode	0	Flying Start-1	The speed search is carried out as it controls the inverter output current during idling below the CON-72 (SS Sup-Current) parameter setting. If the direction of the idling motor and the direction of the operation command at restart are the same, a stable speed search function can be performed at about 10				

Code	Desc	Description				
			mot at re prod	tor and the estart are o duce a sat	e direction of the different, the sp	direction of the idling e operation command beed search does not because the direction of
	1	Flying Start-	The which could have a set of the could have a set of	speed sea ch controls nter electr his mode of cor (forwar able regar cor and dir vever, becomerated by ng (the couportional to determine t from zero formed for	arch is carried of the ripple curromotive force of the direverse), the direction of the operate the counter electromotion the idle speed accurately are speed when the idling motiugh it depends	d), the idle frequency is nd re-acceleration may the speed search is or at a low speed (about
	disp				_	our options. If the top om segment is on, it is
	Iten	n	Bit Sett	ing On Sta	tus Bit	Setting Off Status
	Key			J		
CON-71 Speed		e and Funct	ions of S	peed Sear	ch Setting	
Search	Sett			-	Function	
	bit4	bit3	bit2	bit1		
				✓		h for general
		1			acceleration	
					T 1,1 11	
			✓			after a fault trip
		<b>√</b>	✓		Restart after	after a fault trip instantaneous power
		✓	<b>√</b>			after a fault trip instantaneous power

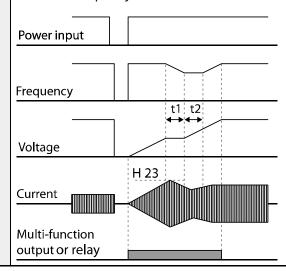
Code Description

> Speed search for general acceleration: If bit 1 is set to "1" and the inverter operation command runs, acceleration starts with the speed search operation. When the motor is rotating under load, a fault trip may occur if the operation command is run for the inverter to provide voltage output. The speed search function prevents such fault trips from occurring. **Initialization after a fault trip other than an LV trip:** If bit 2 is set to "1" and PRT-08 (RST Restart) is set to "1 (Yes)", the speed search operation automatically accelerates the motor to the operation frequency used before the fault trip when the [STOP/RESET] key is pressed (or the terminal block input is on) after a fault trip.

Automatic restart after an instantaneous power interruption: If bit 3 is set to "1", and if a low voltage trip occurs due to a power interruption but the power is restored before the internal power shuts down, the speed search operation accelerates the motor back to its frequency reference before the low voltage trip.

If an instantaneous power interruption occurs and the input power is disconnected, the inverter generates a low voltage trip and blocks the output. When the input power returns, the operation frequency before the low voltage trip and the voltage is increased by the inverter's inner PI controller.

If the current increases above the value set at CON-72, the voltage stops increasing and the frequency decreases (t1 zone). If the current decreases below the value set at CON-72, the voltage increases again and the frequency stops decelerating (t2 zone). When the normal frequency and voltage are resumed, the speed search operation accelerates the motor back to its frequency reference before the fault trip.



Code	Description
	<b>Starting with power-on:</b> Set bit 4 to "1" and ADV-10 (Power-on Run) to "1 (Yes)". If inverter input power is supplied while the inverter operation command is on, the speed search operation will accelerate the motor up to the frequency reference.
CON-72 SS Sup- Current	The amount of current flow is controlled during speed search operation based on the motor's rated current. If CON-70 (SS mode) is set to "1 (Flying Start-2)", this code is not visible.
CON-73 SS P-Gain, CON-74 SS I-Gain	The P/I gain of the speed search controller can be adjusted. If CON-70 (SS Mode) is set to "1"(Flying Start-2), different factory defaults based on motor capacity [at DRV-14 (Motor Capacity)] are used.
CON-75 SS Block Time	The block time parameter prevents overvoltage trips due to counter electromotive force by cutting off the inverter output for the set time before carrying out a speed search.

#### Note

- If operated within the rated output, the iS7 series inverter is designed to withstand instantaneous power interruptions of up to 15 ms and maintain normal operation [when 200-230 V AC input voltage is supplied to 200 V class model types, and 380-460 V AC input voltage is supplied to 400 V class model types, and when the inverter is operating with static load current (CT load)].
- The DC voltage inside the inverter changes depending on the load. Low voltage fault trips may result if the power interruption lasts longer than 15 ms, or the output voltage exceeds the rated input voltage.

# 8.20 Auto Restart Settings

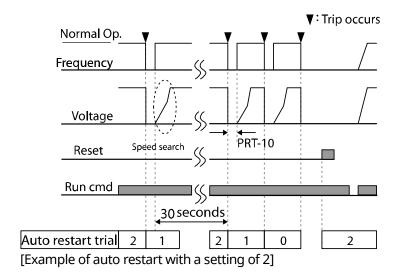
When inverter operation stops due to a fault and a fault trip is activated, the inverter automatically restarts based on the parameter settings.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Uni t
PRT 08	00		RST Restart	0	No		
	08	Select start at trip reset		1	Yes	-	_
	09	Auto restart count	Retry Number	6		0–10	-

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Uni t
	10	Auto restart delay time	Retry Delay	1.0		0.1-60.0	sec
	71	Select speed search operation	Speed Search -			0000-1111	bit
	72	Speed search startup	SS Sup-	Up to 75 kW 150		00, 200	%
	72 current		Current	Over 75 kW 100		80–200	70
CON	73	Speed search proportional gain	SS P-Gain	100		0-9999	
	74	Speed search integral gain	SS I-Gain	200		0-9999	
	75	Output block time before speed search	SS Block Time	1.0		0.0-60.0	sec

## **Auto Restart Setting Details**

Code	Description
PRT-08 RST Restart	Set PRT-08 to "1 (Yes)" to enable reset restart.
PRT-09 Retry Number, PRT-10 Retry Delay	The number of available auto restarts can be set at PRT-09. If a fault trip occurs during an operation, the inverter restarts after the time set at PRT-10 (Retry Delay). At each restart, the inverter counts the number of tries and subtracts it from the number set at PRT-09 until the retry number count reaches 0. After an auto restart, if a fault trip does not occur within 60 sec, it will increase the restart count number. The maximum count number is limited by the number set at PRT-09.  If the inverter stops due to low voltage, an emergency stop, an inverter overheating, or a hardware malfunction, auto restart is not activated.  At auto restart, the acceleration options are identical to those of the speed search operation. Codes CON-72–75 can be set based on the load. For the speed search function details, refer to <u>8.19 Speed Search Operation</u> on page <u>250</u> .



#### ① Caution

If the auto restart number is set, be careful when the inverter resets from a fault trip. The motor may automatically start to rotate.

# 8.21 Operational Noise Settings (Carrier Frequency Settings)

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
CON	04	Carrier Frequency	Carrier Freq	5.0		0.7–15.0	kHz
CON	05	Switching Mode	PWM* Mode	0	Normal PWM	Normal PWM / Low Leakage PWM	-

<sup>\*</sup>PWM: Pulse width modulation

#### **Operational Noise Setting Details**

Code	Description
CON-04 Carrier Freq	Adjusts motor operational noise by changing carrier frequency settings. Power transistors (IGBT) in the inverter generate and supply high frequency switching voltage to the motor. The carrier frequency refers to the switching speed in this process. If the carrier frequency is set high, it reduces operational noise from the motor. If the carrier frequency is set low, it increases operational

Code	Description	Description					
	noise from the motor.						
	The heat loss and leakage current from the inverter can be reduced by changing the load rate option at CON-05 (PWM Mode). Selecting "1 (LowLeakage PWM)" reduces heat loss and leakage current, compared to when "0 (Normal PWM)" is selected. However, it increases the motor noise. Low leakage PWM uses a two-phase PWM modulation mode, which helps minimize degradation and reduces switching loss by approximately 30%.						
		Carrier Frequency					
	Item	0.7 kHz	15 kHz				
CON-05 PWM		LowLeakage PWM	Normal PWM				
Mode	Motor noise	<u> </u>	$\downarrow$				
	Motor temperature	1	$\downarrow$				
	Inverter heat Loss	<b>1</b>	$\uparrow$				
	High frequency	<u> </u>	<u> </u>				
	Inverter output current wave form	Bad	Good				
	Inverter noise		<u> </u>				
	Inverter leakage current	<b>1</b>	<u> </u>				

## ① Caution

The factory default carrier frequency for 90–160 kW model types is 3 kHz. The figure in the red box (D: 5.0) is a factory default carrier frequency for models types up to 75 kW, provided for your reference only.



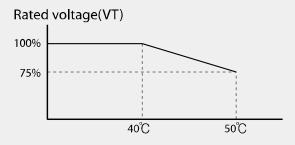
Since low carrier frequencies can transmit a much higher frequency than the capacity of the output current, an increase in motor loss will occur. Some motors may stall due to increased high frequency current and lack of torque may cause the inverter to stop.

#### Note

Factory default carrier frequency by model types

0.75-22 kW	30-45 kW	55-75 kW	90-110 kW	132-160 kW
5 kHz (15 kHz max.)	5 kHz (10 kHz max.)	5 kHz (7 kHz max.)	3 kHz (6 kHz max.)	3 kHz (5 kHz max.)

- **iS7 Series Inverter Derating Standard (Derating):** The overload rate represents an acceptable load amount that exceeds the rated load, and is expressed as a ratio based on the rated load and the duration. The overload capacity on the iS7 series inverter is 110%/1 min for normal loads.
- The current rating differs by load types, and it also has an ambient temperature limit.
- Current derating for ambient temperature at variable torque (VT) load operation:



Current derating table by ambient temperature and carrier frequency:

Inverter Capacity		0.75-7.5kW	11-22kW	30-75kW
	Normal Temp. (25°C)	10 kHz	10 kHz	5 kHz
CT Load	High Temp. (40°C)	7 kHz	7 kHz	4 kHz
	High Temp. (50°C)	5 kHz	5 kHz	4 kHz
V/T Lood	Normal Temp. (25℃)	7 kHz	7 kHz	3 kHz
VT Load	High Temp. (40°C)	2 kHz	2 kHz	2 kHz

# 8.22 2nd Motor Operation

The 2<sup>nd</sup> motor operation is used when a single inverter switch operates two motors. Using the 2<sup>nd</sup> motor operation, a parameter for the second motor is set. The second motor operates when a multi-function terminal input defined as a second motor function is turned on.

Group	Code	Name	LCD Display	Paran	neter Setting	Setting Range	Unit
IN	65–75	Px terminal configuration	Px Define(Px: P1–P8 [optional: P9–P11])	26	2nd Motor	-	-
M2	04	2nd motor acceleration time	M2-Acc Time	-	5.0	0–600	sec

#### **2<sup>nd</sup> Motor Operation Setting Details**

Code	Description
IN-65–75 Px Define	<ul> <li>Set one of the multi-function input terminals (P1–P11) to "26 (2nd Motor)" to display the M2 (2nd motor group) group. An input signal sent to a multifunction terminal set as the second motor will operate the motor according to the code settings listed below. However, if the inverter is in operation, input signals to the multi-function terminals will not read as a second motor parameter.</li> <li>You can set the 2nd motor control mode at M2-08 (M2-Ctrl Mode). V/F PG and Vector control modes are not supported with the 2nd motor operation.</li> <li>PRT-50 (Stall Prevent) must be set first, before M2-28 (M2-Stall Lev) settings can be used.</li> <li>PRT-40 (ETH Trip Sel) must be set first, before M2-29 (M2-ETH 1 min) and M2-30 (M2-ETH Cont) settings can be used.</li> </ul>

#### Parameter Setting at Multi-function Terminal Input on a Second Motor

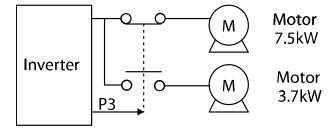
Code	Description	Code	Description
M2-04 Acc Time	Acceleration time	M2-15 M2-Efficiency	Motor efficiency
M2-05 M2-Dec Time	Deceleration time	M2-17 M2-Rs	Stator resistance
M2-06 M2-Capacity	Motor capacity	M2-18 M2-Lsigma	Leakage inductance
M2-07 M2-Base Freq	Motor base frequency	M2-25 M2-V/F Patt	V/F pattern
M2-08 M2-Ctrl Mode	Control mode	M2-26 M2-Fwd Boost	Forward torque boost

Code	Description	Code	Description
M2-10 M2-Pole Num	Pole number	M2-27 M2-Rev Boost	Reverse torque boost
M2-11 M2-Rate Slip	Rated slip	M2-28 M2-Stall Lev	Stall prevention level
M2-12 M2-Rated Curr	Rated current	M2-29 M2-ETH 1 min	Motor heat protection 1 min rating
M2-13 M2-Noload Curr	No-load current	M2-30 M2-ETH Cont	Motor heat protection continuous rating
M2-14 M2-Rated Volt	Motor-rated voltage		

#### **Example - 2nd Motor Operation**

Use the 2nd motor operation when switching operations between a 7.5 kW motor and a secondary 3.7 kW motor using terminal P3. Refer to the following settings.

Group	Code	Name	LCD Display	Para	meter Setting	Setting Range	Unit
IN	67	Terminal P3 configuration	P3 Define	26	2nd Motor	-	-
MA	06	Motor capacity	M2-Capacity	-	3.7 kW	-	-
M2	08	Control mode	M2-Ctrl Mode	0	V/F	-	=



# 8.23 Supply Power Transition

A supply power transition is used to switch the power source for the motor connected to the inverter from the inverter output power to the main supply power source (commercial power source), or vice versa.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
IN	65–75	Px terminal configuration	Px Define (Px: P1–P8 [optional: P9–P11])	16	Exchange	-	-
OUT	31-32	Multi-function relay 1–2	Relay1-2	17	Inverter Line	-	-
001	33	Multi-function output 1	Q1 Define	18	Comm Line	-	-

#### **Supply Power Transition Setting Details**

Code	Description							
IN-65–75 Px Define	When the motor power source changes from the inverter output to the main power supply, select a terminal to use and set the code value to "16 Exchange)". Power will be switched when the selected terminal is on. To reverse the transition, switch off the terminal.							
OUT-31 Relay 1, OUT-32 Relay 2, OUT-33 Q1 Define	Set the multi-function relay or multi-function output to "17 (Inverter Line)" or "18 (Comm Line)". The relay operation sequence is as follows.  Speed search  Output frequency  Px (Comm Line) Px (Inverter Line)  Inverter operation operation t: 500 msec							

# 8.24 Cooling Fan Control

This function turns the inverter's heatsink cooling fan on and off. It is used in situations where the load stops and starts frequently or when a noise-free environment is required. The correct use of cooling fan controls can extend the cooling fan's life.

Group	Code	Name	LCD Display	Para	meter Setting	Setting Range	Unit
		Cooling fan control	Fan Control	0	During Run		
ADV	64			1	Always On	0–2	-
				2	Temp Control		

#### **Cooling Fan Control Detail Settings**

Code	Description					
	Sett	ings	Description			
ADV-64 Fan Control	0	During Run	The 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 heat sink temperature is higher than its set value, the cooling fan operates automatically regardless of its operation status.			
	1	Always On	The cooling fan runs constantly if power is supplied to the inverter.			
	2 Temp Control	With 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

In 11–75 kW model types, if the heat sink temperature reaches a set level by input current harmonic waves or noise, the cooling fan may run to protect the inverter even when ADV-64 is set to "0 (During Run)".

# 8.25 Input Power Frequency Settings

Select the frequency for inverter input power. If the frequency changes from 60 Hz to 50 Hz, all other frequency (or RPM) settings, including the maximum frequency, base frequency, etc., will change to 50 Hz. Likewise, changing the input power frequency setting from 50 Hz to 60 Hz will change all related function item settings from 50 Hz to 60 Hz.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
BAS	10	Input power frequency	60/50 Hz Sel	0	60 Hz	0–1	-

# **8.26 Input Power Voltage Settings**

Set the inverter input power voltage. The low voltage fault trip level changes automatically according to the set voltage standard.

Group	Code	Name	LCD Display	Parameter	Setting	Setting Range	Unit
DAC	BAS 19 Input power v	Input nower veltage	AC Input	200 Type	220	170-230	.,
BAS		Triput power voitage	Volt	400 Type	380	380-480	V

## 8.27 Read, Write, and Save Parameters

Use read, write, and save parameter functions to copy parameters from the inverter to the keypad or from the keypad to the inverter.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	46	Parameter read	Parameter Read	1	Yes	-	-
CNF	47	Parameter write	Parameter Write	1	Yes	-	-
	48	Parameter save	Parameter Save	1	Yes	-	-

#### Read, Write, and Save Parameter Setting Details

Code	Description
CNF-46 Parameter Read	Copies saved parameters from the inverter to the keypad. Saved parameters on the keypad will be deleted and replaced with the copied parameters.
CNF-47 Parameter Write	Copies saved parameters from the keypad to the inverter. Saved parameters on the inverter will be deleted and replaced with the copied parameters. If an error occurs during parameter writing, the previously saved data will be used. If there is no saved data on the keypad, "EEP Rom Empty" will be displayed.
CNF-48 Parameter Save	As parameters set during communication transmission are saved in RAM, the setting values will be lost if the power turns off and on. When setting parameters during communication transmission, select "1 (Yes)" at CNF-48 to save the set parameters.

## Caution /

When utilizing the optional communication module, note the following information if you need to read or write the parameter values set at COM-10-25 (Opt Parameter).

- 1. Because the "Opt Parameter" (COM-10-25) values are stored in the optional add-on module, you must run "Comm Update" (COM-94) to apply the changes after making changes to the parameter settings.
- 2. You must save the parameter values set at COM-10-25 (Opt Parameter) by running "Parameter Save" before you can read or write the "Opt Parameter" parameters.

## 8.28 Parameter Initialization

User changes to parameters can be initialized (reset) to factory default settings on all or selected groups. Parameters cannot be reset during operation or a fault trip condition.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
CNF	40	Parameter initialization	Parameter Init	0	No	0–15	

#### **Parameter Initialization Setting Details**

Code	Description				
	Sett	ing	LCD Display	Function	
	0	No	No	-	
CNF-40 Parameter	1	Initialize all groups	All Grp	Initialize all data. Select "1 (All Grp)" and press the [PROG/ENT] key to start initialization. On completion, "0 (No)" will be displayed.	
Init	2	Initialize DRV group	DRV Grp		
	3	Initialize BAS group	BAS Grp	Initialize data by groups. Select	
	4	Initialize ADV group	ADV Grp	Initialize group and press the	
	5	Initialize CON group	CON Grp	[PROG/ENT] key to start initialization. On completion, "0	
	6	Initialize IN group	IN Grp	(No)" will be displayed.	
	7	Initialize OUT group	OUT Grp		

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Code	Desc	Description				
	8	Initialize COM group	COM Grp			
	9	Initialize APP group	APP Grp			
	10	Initialize AUT group	AUT Grp			
	11	Initialize APO group	APO Grp			
	12	Initialize PRT group	PRT Grp			
	13	Initialize M2 group	M2 Grp			

# **8.29 Parameter Viewing and Lock Options**

#### 8.29.1 Parameter View Lock

Use parameter view lock to hide parameter mode (PAR mode) after registering and entering a user password. Other modes (CNF, U&M, MAC and TRP modes) will still be visible when the parameter view lock is enabled.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	50	Parameter view lock	View Lock Set	Unlocked	0-9999	-
CNF	51	Parameter view lock password	View Lock Pw	Password	0–9999	-

#### **Parameter View Lock Setting Details**

Code	Desc	Description					
		Register a password to allow access to parameter view lock. Follow the steps below to register a password.					
	No	Procedure					
CNF-51 View Lock	1	Press the [PROG/ENT] key on code CNF-51 to show the previous password input window. If a password is being registered for the first time, enter "0". It is the factory default.					
Pw	2	If a password had been set, enter the saved password.					
	3	If the entered password matches the saved password, a new window prompting the user to enter a new password will be displayed (the process will not progress to the next stage until the user enters a valid password).					
	4	Register a new password.					
	5	After registration, code CNF-51 (View Lock PW) will be displayed.					
CNF-50 View Lock Set	To enable parameter view lock, enter a registered password. The [Locked] sign will be displayed on the screen to indicate that parameter view lock is enabled. To disable parameter view lock, re-enter the password. The [locked] sign will disappear, and PAR mode becomes visible again.						

## 8.29.2 Parameter Lock

Use parameter lock to prevent unauthorized modification of parameter settings. To enable parameter lock, register and enter a user password first.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
CNE	52	Parameter lock	Key Lock Set	Unlocked	0-9999	-
CNF	53	Parameter lock password	Key Lock Pw	Password	0-9999	-

#### **Parameter Lock Setting Details**

Code	Descri	Description						
	_	ter a password to prohibit parameter modifications. Follow the dures below to register a password.						
	No	Procedures						
CNF-53 Key Lock PW	1	Press the [PROG/ENT] key on code CNF-53 to display the saved password input window. If a password is being registered for the first time, enter "0". It is the factory default.						
	2	If a saved password has been set, enter the saved password.						
	3	If the entered password matches the saved password, then a new window to enter a new password will be displayed. (The process will not progress to the next stage until the user enters a valid password).						
	4	Register a new password.						
	5	After registration, code CNF-53 will be displayed.						
CNF-52 Key Lock Set	To enable parameter lock, enter the registered password. The [Locked] sign will be displayed on the screen to indicate that prohibition is enabled. Once enabled, pressing the [PROG/ENT] key will not allow the edit mode to run. To disable parameter lock, re-enter the password. The [Locked] sign will disappear.							

## ① Caution

If parameter view lock and parameter lock functions are enabled, no inverter operation related function changes can be made. It is very important that you memorize the password.

## 8.29.3 Changed Parameter Display

This feature displays all the parameters that are different from the factory defaults. Use this feature to track changed parameters.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
CNF	41	Changed parameter display	Changed Para	1	View Changed	-	-

#### **Changed Parameter Display Setting Details**

Code	Description				
CNF-41 Changed Para	Settir	ng	Function		
	0	View All	Display all parameters		
	1	View Changed	Display changed parameters only		

## 8.30 User Group

Create a user-defined group and register user-selected parameters from the existing function groups. The user group can carry up to a maximum of 64 parameter registrations.

Group	Code	Name	LCD Display		rameter Setting	Setting Range	Unit
CNIE	42	Multi-function key settings	Multi Key Sel	3	UserGrp SelKey	-	-
CNF	45	Delete all user registered codes	UserGrp AllDel	0	No	-	-

#### **User Group Setting Details**

Code	Description
CNF-42 Multi Key Sel	Selects "3 (UserGrp SelKey)" from the multi-function key setting options. If user group parameters are not registered, setting the multi-function key to the user group select key (UserGrp SelKey) will not display user group (USR Grp) items on the keypad.

Code	Desci	ription
	Follo	w the procedures below to register parameters to a user group.
	No	Procedure
	1	Set CNF- 42 to "3 (UserGrp SelKey)". The  icon will be displayed at the top of the LCD display.
	2	In the parameter mode (PAR Mode), move to the parameter you need to register and press the [MULTI] key. For example, if the [MULTI] key is pressed in the frequency reference in DRV-01 (Cmd Frequency), the screen below will be displayed.  USR → REG U STP 60.0Hz DRV01 Cmd Frequency 40 CODE  1 Group name and code number of the parameter. 2 Name of the parameter. 3 Code number to be used in the user group. Pressing the [PROG/ENT] key on the code number (40 Code) will register DRV-01 as code 40 in the user group. 4 Existing parameter registered as the user group code 40. 5 Setting range of the user group code. Entering "0" cancels the settings.
	3	3 Set a code number to use to register the parameter in the user group. Select the code number and press the [PROG/ENT] key.
	4	Changing the value in 3 will also change the value in 4. If no code is registered, "Empty Code" will be displayed. Entering "0" cancels the settings.
	5	The registered parameters are listed in the user group in U&M mode. You can register one parameter multiple times if necessary. For example, a parameter can be registered as code 2, code 11, etc. in the user group.
	Follo	w the procedures below to delete parameters in the user group.
	No.	Settings
	1	Set CNF- 42 to "3 (UserGrp SelKey)". The  icon will be displayed at the top of the LCD display.

Code	Description			
	2	In the USR group in U&M mode, move the cursor to the code that is to be deleted.		
	3	Press the [MULTI] key.		
	4	Select "YES" on the deletion confirmation screen, and press the [PROG/ENT] key.		
	5	The parameter is deleted.		
CNF-25 UserGrp AllDel	Set to	o "1 (Yes)" to delete all registered parameters in the user group.		

## 8.31 Macro Selection

The macro selection function is used to put various application functions together in a group. For applications with the iS7 series inverters, two basic macro configurations for "Draw"\* and "Traverse" applications (MC1 and MC2) are currently available in U&M mode. Macro functions cannot be added by the user, but the data can be modified.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
CNF 43	Macro selection	Macro Select	0	None	0–2	-	
			1	Draw			
				2	Traverse		

<sup>\*</sup>The draw application is an open loop tension control which maintains a stable tension load applied to the material by utilizing the difference between the main reference and the auxiliary reference (Refer to 8.1 Operating with Auxiliary References on page 196 for details).

#### **Macro Selection Details**

Code	Description
CNF-43 Macro Select	A list of macro settings is displayed for user selection. When a macro function is selected, all the related parameters are automatically changed based on the inverter's macro settings.

# 8.32 Easy Start

Run Easy Start to easily set up the basic motor parameters required to operate a motor in a batch. Set CNF-61 (Easy Start On) to "1 (Yes)" to activate the feature, initialize all parameters by setting CNF-40 (Parameter Init) to "1 (All Grp)", and restart the inverter to activate Easy Start.

Group	Code	Name	LCD Display	Pai	rameter Setting	Setting Range	Unit
CNF	61	Parameter easy start settings	Easy Start On	1	Yes	-	-

#### **Easy Start Setting Details**

Code	Description		
	Follow the procedures listed below to set the Easy Start parameters.		
	No Procedures		
	1 Set CNF-61 (Easy Start On) to "1 (Yes)".		
	2 Set CNF-40 (Parameter Init) to "1 (All Grp)" to initialize all parameters in the inverter.		
CNF-61 Easy Start On	Restarting the inverter will activate Easy Start. Set the values in the following screens on the keypad. To exit Easy Start, press the [ESC] key.  Start Easy Set: Select "Yes".  CNF-01 Language Sel: Select a language.  DRV-30 kW/HP Select: select the capacity of the unit.  DRV-14 Motor Capacity: Set motor capacity.  BAS-11 Pole Number: Set motor pole number.  BAS-15 Rated Volt: Set motor rated voltage.  BAS-10 60/50 Hz Sel: Set motor rated frequency.  BAS-19 AC Input Volt: Set input voltage.  DRV-06 Cmd Source: Set command source.  DRV-01 Cmd Frequency: Set frequency reference.  When the settings are complete, the minimum parameter settings on the motor have been made. The keypad will return to a monitoring display. Now the motor can be operated with the		
	command source set at DRV-06.		

# 8.33 Config (CNF) Mode

The config mode parameters are used to configure keypad-related features.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	2	LCD brightness/ contrast adjustment	LCD Contrast	-		-	
	10	Inverter S/W version	Inv S/W Ver	x.xx		-	
	11	Keypad S/W version	Keypad S/W Ver	x.xx		-	-
	12	Keypad title version	KPD Title Ver	x.xx		-	-
	30-32	Power slot type	Option-x Type	Non	е	-	-
	41	Display changed parameters	Changed Para	0	View All	0–1	-
CNF*	44	Erase trip history	Erase All Trip	No		-	-
	60	Add title update	Add Title Up	No		-	-
	62	Initialize accumulated electrical energy	WH Count Reset	No		-	-
	74	Accumulated cooling fan operation time	Fan Time	0000	DDAY 00:00		
	75	Accumulated cooling fan operation time initialization	Fan Time Rst	0	No		

#### **Config Mode Parameter Setting Details**

Code	Description			
CNF-2 LCD Contrast	Adjusts LCD brightness/contrast on the keypad.			
CNF-10 Inv S/W Ver, CNF-11 Keypad S/W Ver	Checks the OS version in the inverter and on the keypad.			
CNF-12 KPD Title Ver	Checks the title version on the keypad.			
CNF-30–32 Option-x Type	Checks the type of option board installed in the option slot.			
CNF-41 Changed Para	Displays all the parameters that are different from the factory defaults.			
CNF-44 Erase All Trip	Deletes the stored trip history.			

Code	Description
CNF-60 Add Title UP	When the inverter SW version is updated and more code is added, CNF-60 settings will add, display, and operate the added codes. Set CNF-60 to "1 (Yes)" and disconnect the keypad from the inverter. Reconnecting the keypad to the inverter updates titles.
CNF-62 WH Count Reset	Initialize the accumulated electrical energy consumption count.
CNF-74 Fan Time	Displays the accumulated cooling fan operation time.
CNF-75 Fan Time Rst	Initialize the accumulated cooling fan operation time at CNF-74.

# 8.34 Timer Settings

Set a multi-function input terminal to a timer and set the On/Off controls to the multi-function outputs and relays according to the timer settings.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
IN	65- 75	Px terminal Px Define (Px: P1-P8 [optional: P9-P11])		38	Timer In	-	-
OUT	31	Multi-function relay 1	Relay 1	20	Timer Out		505
	33	Multi-function output 1	Q1 Define	28	Timer Out	-	sec
	55	Timer on delay	TimerOn Delay	0.00	)	0.00-100.00	sec
	56	Timer off delay	TimerOff Delay	0.00	)	0.00-100.00	sec

#### **Timer Setting Details**

Code	Description
IN-65-75 Px Define	Selects one of the multi-function input terminals and change it to a timer terminal by setting it to "38 (Timer In)".
OUT-31 Relay 1, OUT-36 Q1 Define	Sets the multi-function output terminal or relay to be used as a timer to "28 (Timer out)".

Code	Description
OUT-55	Inputs a signal (On) to the timer terminal to operate a timer output
TimerOn Delay,	(Timer out) after the time set at OUT-55 has passed. When the multi-
OUT-56	function input terminal is off, the multi-function output or relay turns off
TimerOff Delay	after the time set at OUT-56.



# 8.35 Auto Sequence Operation

Create operation sequences that can be automatically run using terminal inputs. You can configure up to two sequences for automated inverter operation.

Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Unit
APP	01	Applied function selection	APP Mode	4	Auto Sequence	0–4	-
				41	SEQ-1		
			Px Define	42	SEQ-2		
IN	65–75	Px terminal configuration	(Px: P1–P8 [optional: P9–P11])	43	Manual	0–51	-
		comigaration.		44	Go Step		
				45	Hold Step		
OUT	31–32	Multi-function relay 1–2	Relay 1–2	20	Step Pulse	-	-
001	33	Multi-function output 1	Q1 Define	21	Seq Pulse	-	-
	01	Auto operation	Auto Mode	0	Auto-A		
AUT	01	type		1	Auto-B		-
	02	Auto operation terminal delay time	Auto Check	-	0.10	0.02-2.00	Sec

Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Unit
	04	Number of sequence 1 steps*	Step Number 1	-	2	1-8	-
	04	Number of sequence 2 steps*	Step Number 2	-	2	1-8	-
	10	1/1 step frequency*	Seq 1/1 Freq	-	11.00	0.01 - maximum frequency (Hz)	Hz
	11	1/1 Acc/Dec time*	Seq 1/1 XcelT	-	5.0	0.1-600.0 (sec)	Sec
	12	1/1 steady speed operation time*	Seq 1/1 StedT	-	5.0	0.1-600.0 (sec)	Sec
	13	1/1 operation	6 445	0	Reverse		
	13	direction*	Seq 1/1 Dir	1	Forward	-	-
	14	1/2 step frequency*	Seq 1/2 Freq	-	21.00	0.01 - maximum frequency (Hz)	Hz

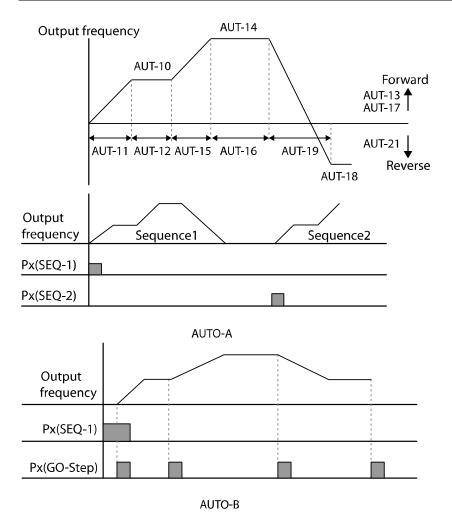
<sup>\*</sup>The same parameter setting is required for each step (eight steps max.) at AUT-10-AUT-74.

#### **Auto Sequence Operation Details**

Code	Description	Description				
	paramet	ers become visible. In an au equence operation, acc/dec	Auto sequence group (AUT group) to sequence group, you can set the times, and rotation direction for			
	Setting	Function mode				
APP-01 APP Mode	0	None				
	1	Traverse				
	2	Proc PID				
	3	Reserved				
	4	Auto Sequence				

Code	Description	n			
	Selects the functions.	e multi-functio	n input terminals to assign auto sequence		
	Setting	Functions	Description		
	41	SEQ-1	Runs sequence-1 operation.		
	42	SEQ-2	Runs sequence-2 operation.		
IN-65-75 Px Define	43 Manual		Operates the inverter with the command source and frequency reference source set at DRV-06 and DRV-07.		
IV 03 731 X Deline	44	Go Step	In sequence operation mode, if the auto sequence operation type at AUT-01 is set to "1 (Auto-B)" and the terminal is on while the motor is stopped, the next step is operated.		
	45 Hold Step		In sequence operation mode, if the auto sequence operation type at AUT-01 is set to "0 (Auto-A)" and the terminal is on, the current step operation is maintained.		
OUT-31 Relay 1–2	Set one of the multi-function output relays to "20 (Step Pulse)" to produce a pulse output (100 ms) at each step change.				
OUT-36 Q1 Define	Set the multi-function output terminal to "21 (Seq Pulse)" to produpulse output (100 ms) at the last step of a sequence.				
	Select the auto sequence operation type.				
	Setting	Functions	Description		
AUT 01 Auto Modo	0	Auto-A	Runs all the steps in a sequence automatically when a signal is received at a multi-function terminal set for SEQ-1 or SEQ-2.		
AUT-01 Auto Mode	1	Auto-B	While a signal is received at a multi-function terminal set for SEQ-1 or SEQ-2, the operation proceeds to the next step each time a terminal input is received at the multi-function terminal set to "44 (Go Step)".		
AUT-02 Auto Check	and SEQ-2	. The inputs a	erter to recognize simultaneous inputs for SEQ-1 re regarded to be simultaneous if the second the set time after the first signal is received.		
		, acc/dec time	s in a sequence. Parameters for setting step s, and rotational direction become visible per of steps.		
AUT-10 Seq 1/1 Freq	Sets the operation frequency for step 1. "1/1" indicates "sequence#/step#."				

Code	Description
	For example, sequence-2 begins operation with the set frequency at "Seq 2/1 Freq."
AUT-11 Seq 1/1 XcelT	Sets the acceleration or deceleration time for the step. Acceleration or deceleration times indicate the time it takes for the operation frequency to transit to the next step frequency.
AUT-12 Seq 1/1 StedT	Sets the time duration for the inverter to maintain the reference frequency set at AUT-10.
AUT-13 Seq 1/1 Dir	Sets the rotational direction for the step.



# **8.36 Traverse Operation**

The traverse operation is used to periodically change the motor rotation. In its application as a winder, the traverse operation ensures that the thread or wire is evenly wound on a spindle without tangles.

Group	Code	Name	LCD Display	Parai	meter Setting	Setting Range	Unit
	01	Applied function selection	App Mode	1	Traverse	0-4	-
	08	Traverse operating range	Trv Amplit %	-	0.0	0–20	%
	09	Traverse scramble magnitude	Trv Scramb %	-	0.0	0-50	%
APP	10	Traverse acceleration time	Trv Acc Time	-	2.0	0.1-600.0	Sec
	11	Traverse deceleration time	Trv Dec Time	-	3.0	0.1-600.0	Sec
	12	Traverse offset upper limit	Trv Offset Hi	-	0.0	0–20.0	%
	13	Traverse offset lower limit	Trv Offset Lo	-	0.0	0-20.0	%
IN	65–75	Px terminal	Px Define (Px: P1–P8	27	Trv Offset Lo	-	-
		configuration	[optional: P9–P11])	28	Trv Offset Hi	-	-

#### **Traverse Operation Details**

Code	Description			
	Set APP-0 become v		ers for the traverse operation	
	Setting	Function mode		
APP-01 APP Mode	0	None		
APP-01 APP Mode	1	Traverse		
	2	Proc PID		
	3	Reserved		
	4	Auto Sequence		
			<u> </u>	

Code	Description
APP-08 Trv Amplit %	Sets the operation frequency for the scramble operation as a percentage of the inverter's frequency reference.
APP-09 Trv Scramb %	Sets the scramble frequency (frequency jump volume at the beginning of a deceleration) for traverse operation as a percentage of the traverse operation frequency.
APP-10 Trv Acc Time, APP-11 Trv Dec Time	Sets the acceleration and deceleration time for the traverse operation.
APP-12 Trv Offset Hi	Sets the high offset amount for the traverse operation as a percentage of the inverter's frequency reference.  After setting one of the multi-function terminals to "28 (Trv Offset Hi)", the offset value is added to the traverse operation frequency when the terminal input is on.
APP-13 Trv Offset Lo	Sets the low offset amount for traverse operation as a percentage of the inverter's frequency reference.  After setting one of the multi-function terminals to "27 (Trv Offset Lo)", the offset value is deducted from the traverse operation frequency when the terminal input is on.

## 8.37 Brake Control

Brake control is used to control the On/Off operation of the electronic brake load system. Check the inverter's control mode set at DRV-09 before configuring the brake control sequence as the operation sequence varies by the control mode.

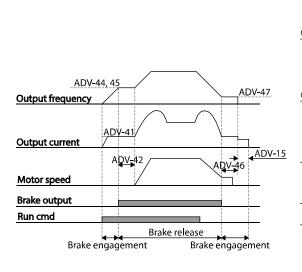
Group	Code	Name	LCD Display	Paran	neter Setting	Setting Range	Unit
DRV	09	Control mode	Control Mode	0	V/F	-	-
	41	Brake release current	BR Rls Curr	50.0		0.0-180.0%	%
	42	Brake release delay time	BR RIs Dly	1.00		0–10.00	sec
ADV	44	Brake release forward frequency	BR RIs Fwd Fr	1.00		0-400	Hz
	45	Brake release reverse frequency	BR Rls Rev Fr	1.00		0-400	Hz
	46	Brake engage delay	BR Eng Dly	1.00		0–10	sec

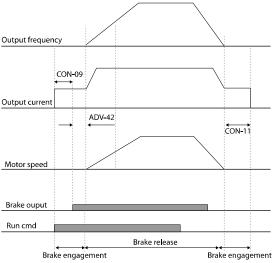
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
		time					
	47	Brake engage frequency	BR Eng Fr	2.00		0-400	Hz
OUT	31- 32	Multi-function relay1–2	Relay 1–2	25	BR Control:		
OUT	33	Multi-function output1 item	Q1 Define	35	BR Control:	-	-

#### **Brake Control Details**

Code	Description
	When the brake control is activated, DC braking (ADV-12) at inverter start and dwell operation (ADV-20–23) do not operate.
	Brake Operation Sequence in Control Modes Other than "Vector"
ADV-12 Dc-Start Time	<b>Prake release sequence&gt;</b> During the motor stop state, if an operation command is entered, the inverter accelerates up to the brake release frequency (ADV-44-
ADV-15 Dc Brake Time ADV-16 Dc Brake Level	45) in a forward or reverse direction.  After reaching the brake release frequency, if the motor current
ADV-20 Acc Dwell Freq, ADV-21 Acc Dwell Time,	reaches the brake release current (BR Rls Curr), the output relay or multi-function output terminal for brake control sends a release signal.
ADV-22 Dec Dwell Freq, ADV-23 Dec Dwell Time	Once the signal has been sent, acceleration will begin after maintaining the frequency for the brake release delay time (ADV-42
ADV-42 BR RIs Dly ADV-44 BR RIs Fwd Fr	BR RIs Dly).
ADV-45 BR RIs Rev Fr	<brake engage="" sequence=""></brake>
ADV-46 BR Eng Dly	If a stop command is sent during operation, the motor decelerates.
ADV-47 BR Eng Dly	Once the output frequency reaches the brake engage frequency (ADV-47 BR Eng Fr), the motor stops decelerating and sends out a brake engage signal to a preset output terminal.
	The frequency is maintained for the brake engage delay time (ADV-47 BR Eng Dly) and it becomes "0" afterwards. If the DC braking time (ADV-15) and DC braking resistance (ADV-16) are set, the inverter output is
	blocked after DC braking. For more details on DC braking, refer to 7.17.2 Stop after DC Braking on page 185.

Code	Description
	Brake Operation Sequence in "Vector" control Mode
	<b><brake release="" sequence=""></brake></b> When an operational command is entered, the output relay or multi-function output terminal for brake control sends a brake release signal after the pre-excitation time is passed. Once the signal has been sent, acceleration will begin after the brake release delay time (ADV-42 BR Rls Dly) has passed.
	<b><brake engage="" sequence=""></brake></b> If a stop command is sent during operation, the inverter decelerates to "0 Hz" and sends out a brake engage signal. Then, the output is cut off after the brake engage delay time (ADV-46 BR Eng Dly) has passed. The brake engage sequence does not operate in torque control mode.





# 8.38 Multi-function Output On/Off Control

Group	Code	Name	LCD Display	Param	eter Setting	Setting Range	Unit
	66	Output contact On/Off control options	On/Off Ctrl Src	1	V1	0-4	-
ADV	67	Output contact point On level	On-C Level	-	90.00	10–100	%
	68	Output contact point Off level	Off-C Level	-	10.00	0–Output contact on level	%
OUT	31- 33	Multi-function relay, Multi- function output 1	Relay x or Q1	34	On/Off Control	-	-

#### **Multi-function Output On/Off Control Details**

Code	Description
ADV-66 On/Off Ctrl Src ADV-67 On-C Level ADV-68 Off-C Level	If the analog input value exceeds the set value, the output relay or multi-function output terminal can be turned on or off.  Select the analog input to use for On/Off control at ADV-66 and set the levels at which the output terminal is on and off at ADV-67 and 68 respectively.
	If the analog input value exceeds the value set at ADV-67, the output terminal is on. If the analog input is below the value set at ADV-68, the output terminal is off.

#### 8.39 MMC function

The MMC (Multiple Motor Control) function is used to control multiple motors of a pump system. The main motor connected with the inverter output is controlled by the PID controller. The auxiliary motors are connected with the supply power and turned on and off by the relay within the inverter.

The relay for controlling auxiliary motors uses Relay 1 and 2 in the standard I/O module embedded in the inverter and multi-function output terminal Q1. If the I/O expansion option module is connected to the inverter option slot, up to 3 relay outputs can be used.

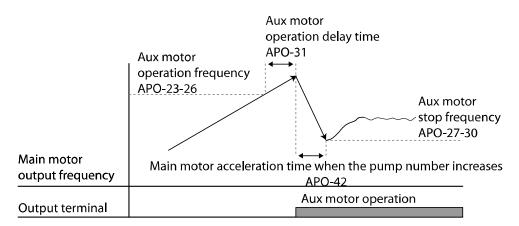
Group	Code	Name	LCD Display	Paran	neter Setting	Setting Range	Unit
APP	01	Application mode	App Mode	3	MMC	-	-
	20	Aux motor rotation number	Aux Motor Run	-	0	0-4	-
	21	Starting aux motor selection	Starting Aux	-	1	1-4	-
	22	Auto operation time	Auto Op Time	-	0:00	xx:xx	Min
	23	1st aux motor starting frequency	Start Freq 1	-	49.99	0-60	Hz
	24	2nd aux motor starting frequency	Start Freq 2	-	49.99	0-60	Hz
	25	3rd aux motor starting frequency	Start Freq 3	-	49.99	0-60	Hz
APO	26	4th aux motor starting frequency	Start Freq 4	-	49.99	0-60	Hz
	27	1st aux motor stop frequency	Stop Freq 1	-	15.00	0-60	Hz
	28	2nd aux motor stop frequency	Stop Freq 2	-	15.00	0-60	Hz
	29	3rd aux motor stop frequency	Stop Freq 3	-	15.00	0-60	Hz
	30	3th aux motor stop frequency	Stop Freq 4	-	15.00	0-60	Hz
	31	Aux motor starting delay time	Aux Start DT	-	60.0	0-3600.0	Sec
	32	Aux motor stop delay time	Aux Stop DT	-	60.0	0-3600.0	Sec
	33	Aux motor number selection	Num of Aux	-	4	0–4	-
	34	Bypass selection	Regul Bypass	0	No	0–1	-
APO	35	Auto change mode selection	Auto Ch Mode	0	Aux	None/Aux/Mai n	-
	36	Auto change time	Auto Ch Time	-	72:00	0-99:00	Min
	38	Interlock selection	Interlock	0	No	0–1	-

Group	Code	Name	LCD Display	Param	eter Setting	Setting Range	Unit
	39	Interlock movement delay time	Interlock DT	-	5.0	0.1–360.0	Sec
	40	Aux motor rotation pressure difference	Actual Pr Diff	-	2	0–100%	%
	41	Main motor acceleration time when the number of pumps decreases	Aux Acc Time	-	2.0	0.0-600.0	Sec
	42	Main motor deceleration time when the number of pumps increases	Aux Dec Time	-	2.0	0.0-600.0	Sec
OUT	31- 33	Multi-function relay, Multi-function output 1	Relay x or Q1	24	ММС	-	-
	34– 36	Qx terminal configuration	Qx Define	24	ММС	-	-

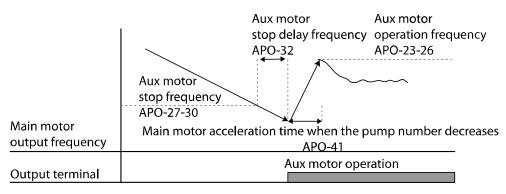
# 8.39.1 Basic MMC Operation

Code	Description
APP-01 APP Mode	If "3 (MMC)" is selected for the applied function, the items related to the MMC function are displayed in the option module function group (APO) and the functions related to the PID controller are displayed in APP.
APO-20, 21, 33	If the number of auxiliary motors is set at APO-33 and there is more than one auxiliary motor, the auxiliary motor number for the first operation should be APO-21. For example, if there are three auxiliary motors and each of them is controlled by Relay 1 and 2 and the Q1 terminal, the auxiliary motors operate in the sequence of Relay 2, Q1, and then Relay 1 when"2" is input at APO-21. The auxiliary motors stop in the sequence of Relay 1, Q1, and Relay 2. At APO-20, the number of currently operating auxiliary motors can be monitored.
APO-23–26 Start Freq 1–4	Sets the starting frequency for auxiliary motors. Since the main motor is operated by the PID controller, its operating frequency is increased by the load change and the operation for an auxiliary motor becomes necessary. The conditions of the inverter output terminal I (Relay or multi-function output [Qx]) that turns on for auxiliary motor operation is as follows. The auxiliary motor can operate when  • The speed of the main motor exceeds the starting frequency (APO-23–26) of the auxiliary motor.  • The starting delay time (APO-13) of the auxiliary motor passes.  • The difference between the reference and the feedback of the main motor PID controller becomes smaller than the pressure difference (APO-40) of the auxiliary motor motion.
APO-27–30 Stop Freq 1–4	Sets the stop frequency for auxiliary motors. If the operating frequency for the main motor decreases below a certain frequency while the auxiliary motor is running, the auxiliary motor should be stopped. The condition of the auxiliary motor to be stopped is as follows. The auxiliary motor can be stopped when  The speed of the main motor decreases below the stop frequency (APO-27–30) for the auxiliary motor.  The stop delay time (APO-32) for the auxiliary motor passes.  The difference between the reference and the feedback of the main motor PID controller becomes larger than the pressure difference (APO-40) of the auxiliary motor operation.

Code	Description
APO-41 Aux Acc Time, APO-42 Aux Dec Time	The main motor stops PID control and operates the normal acceleration and deceleration when the auxiliary motor runs or stops. When the auxiliary motor runs, the main motor decelerates to the decelerating frequency of the auxiliary motor for the decelerating time set at APO-42. Inversely, when the auxiliary motor stops, the main motor accelerates to the starting frequency for the accelerating time set at APO-41.



Auxiliary motor operation sequence by increased load

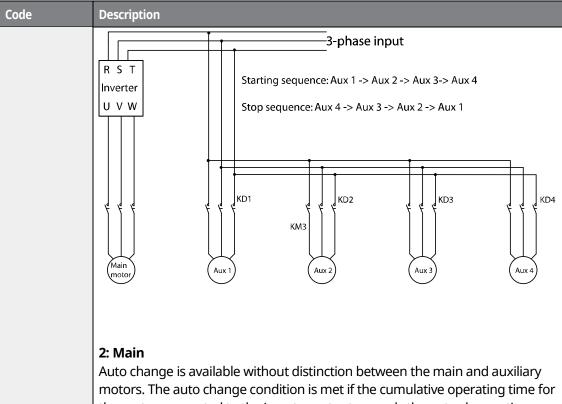


Auxiliary motor stop sequence by decreased load

#### 8.39.2 Auto Change Operation

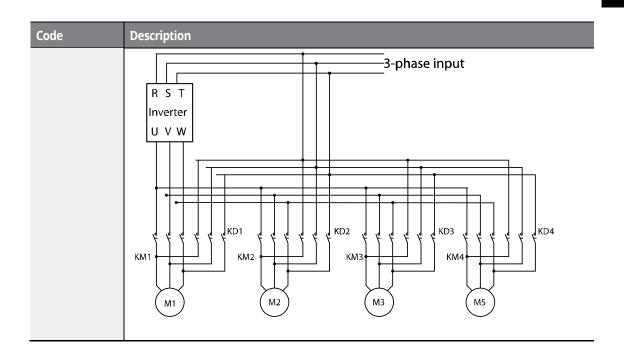
The auto change function enables the inverter to automatically switch operations between main and auxiliary motors. Prolonged continuous operation of a motor reduces motor performance. The auto change function switches the motors automatically when certain conditions are met to avoid biased use of certain motors and protect them from deterioration.

Code	Description
	Selects the motors to apply the auto change function.
	0: None
	The operation sequence of the auxiliary motor starts with the auxiliary motor selected at APO-21(starting auxiliary motor selection) and the automatic change function is not active.
	1: Aux
APO-35 Auto Ch Mode	The operation sequence of the auxiliary motor starts with the auxiliary motor selected in APO-21(starting auxiliary motor selection). When the cumulative operating time for a main and auxiliary motor exceeds the auto change time (APO-36), the auto change condition is met. If the main motor is stopped by a stop command or the sleep operation mode after the auto change condition, the start sequence of the auxiliary motor selected at APO-21 is changed. For example, if there are four auxiliary motors operating and motor 4 is selected in APO-21, the start sequence of the auxiliary motor automatically changes to motor 1. Therefore, the previous start sequence of the auxiliary motor of 4, 1, 2, and 3 changes to 1, 2, 3, and 4, and if the auto change condition is met, the sequence is changed to 2, 3, 4, and 1.



the motor connected to the inverter output exceeds the auto change time (APO-36).

If the inverter is stopped by a stop command or sleep operation mode, the operating sequence of the motor automatically changes. For example, if the starting auxiliary motor selection (APO-21) is set at "2", the inverter output is connected to motor 2. If there are four motors and the auxiliary motor operating condition is met, motors 3, 4, and 1 start operating one after another in sequence. If the inverter stops in the auto change condition, motor 3 is connected to the inverter output in the next restart and the auxiliary motors operate in the sequence of 4, 1, and 2.



## 8.39.3 Interlock Operation

When there is motor trouble, the interlock feature is used to stop the affected motor and replace it with another that is not currently operating (i.e. in the off state). To activate the interlock feature, connect the cables to send abnormal motor signals to the inverter input terminal and configure the terminals as interlock 1–4 inputs. Then, the inverter decides the motor's availability based on the signal inputs. The order in which the alternative motor is selected is decided based on the auto change mode selection options set at APO-35.

Code	Description
	The terminal to use as the interlock among IN 65–72 (up to 75 if there is an I/O expansion module) is selected and Interlock 1–4 are set depending on the motor sequence.
IN-65–75 Px Define	If the auto change mode selection (APO-35) is set to "0 (None)" or "1 (Aux)" and if auxiliary motors 1, 2, and 3 are connected to inverter output terminals Relay 1, 2, and Q1 when a total of four motors including the main motor is operating, the interlock numbers 1, 2, and 3 correspond to the motor connected to Relay 1, 2, and Q1.

Code	Description
	However, if the auto change mode selection (APO-35) is set to "2 (Main)" and the main and auxiliary motors are connected to inverter output terminals Relay1, 2, Q1, and Q2 (I/O expansion module used) respectively, Interlock 1, 2, 3 and 4 correspond to the motors connected to Relay 1, 2, Q1 and Q2.
	Select "1 (Yes)" to enable an interlock operation.
	1) If there are five motors and the auto change mode selection (APO-35) is set to" 0 (None)" or "1 (Aux)", the operation is as follows:
	If signals are sent to the terminal block set at Interlock 3 with a fault at motor 3 when it is static, the auxiliary motors operate in the sequence of 1, 2, and 4 (when the starting auxiliary motor selection APO-21 is "1"). If the terminal block signals are released, the operation sequence is 1, 2, 3, and 4.
APO-38 Interlock	If signals are sent to the terminal for Interlock 3, auxiliary motor 3 stops and auxiliary motor 4 operates. If the interlock signal is released, auxiliary motor 4 stops and auxiliary motor 3 operates again.
AFO-36 Interlock	2) If there are four motors and the auto change mode selection (APO-35) is set to "2 (Main)", the operation is as follows:
	If the starting auxiliary motor selection APO-21 is set to "1", motor 1 is operated by the inverter and the remaining motors (2, 3, and 4) are operated by the auxiliary motors and interlock signals are sent to the auxiliary motors, the operation sequence is the same as the procedure described in condition 1) above.
	However, if there is a problem with motor 1, which is connected to the inverter, the output is immediately blocked and motor 2 becomes connected to the inverter output and the operation sequence of the auxiliary motor is 3 and 4. If the interlock signal of motor 1 is released, the operation sequence of the auxiliary motor is 3, 4, and 1.

## 8.39.4 Bypass Operation (Regular Bypass)

This function controls the motor speed based on the feedback amount instead of using the PID controller. Auxiliary motors may be controlled with this feature based on the feedback amount.

# 8.40 Press Regeneration Prevention (To evade control operation in the status of regeneration during press)

Press regeneration prevention is used during press operations to prevent braking during the regeneration process. If motor regeneration occurs during a press operation, the motor operation speed automatically goes up to avoid the regeneration zone.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	73	Regeneration evasion mode	RegenAvd Mode	000-1	11	001	Bit
	74	Regeneration evasion function for press selection	RegenAvd Sel	0	No	0-1	-
		Press regeneration		350		200 V class: 300– 400	
75 ADV 76 77	75	prevention operation voltage level	n J	700		400 V class: 600– 800	V
	76	Press regeneration prevention compensation frequency limit	CompFreq Limit	1.00		0–10.00	Hz
	77	Press regeneration prevention P- Gain	RegenAvd Pgain	50.0		0–100.0	%
	78	Press regeneration prevention I gain	RegenAvd Igain	500		20-30,000	ms

#### **Press Regeneration Prevention Details**

Code	Description
ADV-73 RegenAvd Mode	Set the motor operation mode to decide when the regeneration evasion function is activated.
ADV-74 RegenAvd Sel (select regeneration evasion function for press)	Frequent regeneration voltage from a press load during a constant speed motor operation may put excessive stress on the brake unit, which may damage or shorten brake life. To prevent this, select ADV-74 (RegenAvd Sel) to control DC link voltage and disable the brake unit operation.
ADV-75 RegenAvd Level (set regeneration evasion level for press)	Set brake operation prevention level voltage when the DC link voltage goes up due to regeneration.
ADV-76 CompFreq Limit (limit regeneration evasion compensation frequency for press)	Set an alternative frequency width that can replace the actual operation frequency during regeneration prevention.
ADV-77 RegenAvd P gain	Set a P gain for regeneration evasion compensation function. To avoid the regeneration zone, set P-Gain in the DC link voltage suppress PI controller.
ADV-78 RegenAvd I gain	Set an I gain for regeneration evasion compensation function.  To avoid the regeneration zone, set I gain in the DC link voltage suppress PI controller.

## ① Caution

Press regeneration prevention does not operate during acceleration or deceleration; it only operates during constant speed motor operation. When regeneration prevention is activated, the output frequency may change within the range set at ADV-76 (CompFreq Limit).

# 8.41 Anti-Hunting Regulator

Group	Code	Name	LCD Display	Parame	eter Setting	Setting Range	Unit
CON	90	Function selection for preventing current	New AHR Sel.	1	Yes	-	-

Group	Code	Name	LCD Display	Parame	eter Setting	Setting Range	Unit
		hunting					
	91	Gain from current hunting prevention	AHR P-Gain	1000		0-32767	-

This function is used to prevent the hunting of a V/F controlled fan or motor caused by current distortion or oscillation due to mechanical resonance or other reasons. You can set the hunting prevention function (CON-90) to prevent current hunting.

**CON-91 AHR P-Gain**: Increasing AHR proportional gain improves the responsiveness of the anti-hunting regulation. However, current oscillation may result if AHR proportional gain is set too high.

## 8.42 Fire Mode

This function is used to allow the inverter to ignore minor faults during emergency situations, such as fire, and provides continuous operation to protect other systems, such as ventilation fans. When fire mode is activated, the inverter operates continuously based on the set frequency and direction.

Group	Code	Name	LCD Display	Parameter Setting		Setting range	Unit			
				0	None		-			
	80	Fire mode selection	Fire Mode Sel	1	Fire Mode	0-2				
		56.666.5.1		2	Fire Test		-			
	81	Fire mode frequency	Fire Mode Freq	60.0	00		Hz			
ADV			Fire mode			Fine Marda Dia	0	Forward	0.1	-
	82	operating direction	Fire Mode Dir	Fire Mode Dir			0-1	-		
				1	Reverse					
	83	Fire mode counter	Fire Mode Cnt	0		-	-			
IN	65– 75	Px terminal configuration	Px Define	Px Define 51		-	-			
OUT	31- 33	Relay1,2 and Q1	Relay1,2 / Q1 37		-	-				

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#### **Fire Mode Details**

Code	Description
ADV-80 Fire Mode Sel	When you select function 1-Fire Mode, ADV-81–83 is displayed. In the above settings, if "51 (Fire Mode)" in IN-65–75 is on, fire mode operates. During the fire mode operation status, a "fire mode" warning occurs. During fire mode operation, the inverter's frequency and operation direction is performed in the value set for fire mode with the previously set control mode.
ADV-81 Fire Mode Freq	Set the operation frequency for fire mode.
ADV-82 Fire Mode Dir	Set the run direction for fire mode operation.
ADV-80 Fire Mode Sel	If the mode is set to "2-Fire Test", related items for the fire function (ADV-81–83) are displayed. In the above settings, if "51 (Fire Mode)" in IN-65–75 is on, fire mode operates. The basic operation is the same as fire mode. However, ADV-83 is not counted in fire test mode. Also, all fault trips occur without ignoring them.

If a fault occurs during fire mode operation, the fault trip is ignored and the inverter continuously operates. However, if a critical fault occurs, the inverter performs the trip operation or auto restart operation. The auto restart is performed after PRT-10 Retry Delay is set.

If the inverter performs the fire mode operation when the inverter is in normal status after the auto restart, the inverter will operate via the speed search.

Fire mode cannot be set while in torque mode. Therefore, fire mode can only be set when the inverter is in speed or operation mode.

In fire mode, the operation for fault trips is listed in the following table.

Operation in the event of fault trips	Fault trips
Fault trips that are ignored	Low Voltage, Over Load, Under Load, Inverter OLT, E- Thermal, Out Phase Open, In Phase Open, Over Speed, Speed Dev Trip, NTC Open, Over Heat, Fuse Open, Thermal Trip, Fan Trip, BX, Lost Command, Lost Keypad, Low Voltage2, etc.

Operation in the event of fault trips	Fault trips
Auto restart after fault trips	Ground Trip, Over Current1, Over Voltage
Trip operation	H/W-Diag, Over Current2, Safety Opt Err

#### ① Caution

Fire mode operation voids the product warranty. To test fire mode not to increase the fire mode operation count at ADV-83, set ADV-80 to "2-Fire Test" and operate the inverter.

If the multi-function terminal input set to "51 (Fire Mode)" is on when ADV-83 is set to "1 (Fire Mode)", the count value set at ADV-83 is increased by 1.

# 8.43 Dynamic Braking (DB) Resistor Operation Reference Voltage

Depending on the capacity, the iS7 series is divided into models with a braking resistor circuit integrated inside the inverter, and models that require an external braking unit to be installed. The inverters rated between 0.75–22 kW have the built-in braking model (except for the brake resistor), and the inverters rated above 30 kW require an external braking unit. Therefore, the reference voltage setting function for the braking resistor is necessary for inverters rated below 22 kW.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
ADV	79	DB unit operating	DB Turn On Lev	390 V	200 V Type: 350-400 V	V
ADV /	, ,	voltage	•		400 V Type: 600-800 V	•

**ADV-79 DB Turn On Lev**: This is the operation reference voltage for the braking resistor. The braking resistor operates when the DC link voltage exceeds the reference value.

The initial value for 200 V-type inverters is 390 V, and the initial value for 400 V-type inverters is 780 V.

For 200 V-type inverters, the reference voltage that stops the braking resistor is 10 V lower than the operating voltage set at ADV-79. For 400 V-type inverters, the braking resistor stops if the

voltage is 20 V lower than the operating voltage set at ADV-79.

#### ① Caution

If the set value for ADV-79 is lower than the DC link voltage when the inverter is in normal operation, the DB resistor may overheat due to continuous DB resistor operation. Conversely, if the set value at ADV-79 is much higher than the DC link voltage range, an overvoltage trip may occur because the DB resistor does not operate when it is needed.

Example) If the input voltage is 440 V and the value at ADV-79 is set to 600 V, the DB resistor operates when the inverter is on because the DC link voltage is 622 V. Since the voltage level that stops the DB resistor is 590 V, the DB resistor may overheat due to continuous DB resistor operation.

#### 8.44 kW/HP Unit Selection

Select the units between kW and HP for the capacity of the inverter and motor.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV 30	30	kW/HP unit	KW/HP Select	0	kW	0-1	-
		selection		1	HP	- U-1	

# 8.45 Output Voltage Drop Prevention

This function is used to prevent voltage drop in the inverter output by decreasing the current output, thereby taking advantage of the expanded command zone of the output voltage, if the input voltage drops or overload conditions arise.

Group	Code	Name	LCD Display	Par	ameter Setting	Setting Range	Initi al
ADV	87	OVM Mode	OVM Mode Sel	0	No	0-1	0:No

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Initi al
		selection		1	Yes		

This function is used to prevent voltage drop in the inverter output by decreasing the current output, thereby taking advantage of the expanded command zone of the output voltage, if the input voltage drops or overload conditions arise. Set ADV-87 (OVM Mode Sel) to "0 (No)" to limit the voltage output command zone for linear voltage output. Set ADV-87 (OVM Mode Sel) to "1 (Yes)" to expand the voltage output command zone and ensure stable voltage output is made throughout the overmodulated zone.

#### Caution /



- When you enable the OVM Mode, the output wave may be distorted because it will not be maintained in a linear form.
- Also, a higher voltage than the motor's rated voltage may be output to the motor if the input voltage is higher than the motor's rated voltage.
- Although the current may appear to be rapidly oscillating during high-speed operation, the actual change in the output current is not severe.
- The output voltage will be compensated for to stay below the rated voltage of the motor according to the parameter setting.
- The OVM Mode will not be activated if the input voltage is higher than the output voltage.

# **9 Using Monitor Functions**

# 9.1 Monitoring the Operating Status via the Keypad

You can monitor the operating status using the keypad of the inverter. You can select the desired items to monitor in Config mode (CNF), view three items at a time in Monitor mode, and select an item on the status display.

#### 9.1.1 Selecting Monitor Mode Display

Mode	Group	Code	LCD Display	Parameter Setting		Unit
	-	21	Monitor Line-1	0	Frequency	Hz
CNIE	-	22	Monitor Line-2	2	Output Current	А
CNF	-	23	Monitor Line-3	3	Output Voltage	V
		24	Mon Mode Init	0	No	-

#### **Monitor Mode Display Selection Details**

Code	Description						
	the disp CNF	inverter is powered layed simultaneou -24 (Mon Mode Ini	nitor in Monitor mode. Monitor mode is displayed when don. Also, all three items in Monitor Line-1–3 can be sly. Select an item for the line to display. If "Yes" is set at t), CNF-21–23 will be initialized.				
	Set	ting	Function				
CNF-21-23	0	Frequency	Displays the set frequency while stopped. During operation, it displays the actual output frequency (Hz).				
Monitor Line-x	1	Speed	Displays the set speed (rpm) while stopped. During operation, it displays the actual operating speed (rpm).				
	2	Output Current	Displays the output current.				
	3	Output Voltage	Displays the output voltage.				
	4	Output Power	Displays the output power.				

Code	Desc	ription	
	5	WHour Counter	Displays the inverter's power consumption.
	6	DCLink Voltage	Displays the inverter's DC link voltage.
	7	DI Status	Displays the input terminal status of the terminal block. Starting from the right, it displays P1–P8.
	8	DO Status	Displays the output terminal status of the terminal block. Starting from the right, it displays Relay1, Relay2, and Q1.
	9	V1 Monitor[V]	Displays the input voltage value at terminal V1 (V).
	10	V1 Monitor[%]	Displays the input voltage terminal V1 value as a percentage. If -10V, 0V, and+10V is measured, -100%, 0%, and 100% will be displayed.
	11	I1 Monitor[mA]	Displays the magnitude of the current being input to the I1 terminal of the inverter terminal block.
	12	I1 Monitor[%]	Displays the above current as a percent. If the input current is 0–20[mA], it is shown as 0–100%.
	13	V2 Monitor[V]	Displays the voltage input of the I/O expansion module's V2 terminal when using the I/O expansion module.
	14	V2 Monitor[%]	Displays the V2 input voltage as a percent.
	15	I2 Monitor[mA]	Displays the current input for the I/O expansion module's I2 terminal when using the I/O expansion module.
	16	I2 Monitor[%]	Displays the I2 input current terminal value as a percentage.
	17	PID Output	Displays the PID controller's output.
	18	PID Ref Value	Displays the PID controller's reference value.
	19	PID Fdb Value	Displays the PID controller's feedback volume.
	20	Torque	Displays the torque reference value if torque reference command mode (DRV-08) is set to a value other than "Keypad" (0 or 1).
	21	Torque Limit	Displays the torque limit value if the torque limit setting method (CON-53) is set to a value other than "Keypad" (0 or 1).
	22	Trq Bias Ref	Displays the torque bias if the torque bias setting method (CON-58) is set to a value other than "Keypad" (0 or 1).
	23	Spd Limit	Displays the speed limit setting If the speed limiting (CON-62) in Torque Control mode is set to a value other than "Keypad" (0 or 1).

Code	Desc	ription	
	24	Load Speed	Displays the load speed in the desired scale and unit. Displays the load speed as values which are applied in the units of rpm or mpm set in ADV-63 (Load Spd Unit), ADV-61 (Load Spd Gain), and ADV-62 (Load Spd Scale).
	25	Temperature	Displays the inverter's internal temperature.

#### 9.1.2 Displaying Output Power

Mode	Group	Code	LCD Display	Parameter Setting		Unit
PAR	BAS	18	Trim Power %	-	100.0	%

When CNF-21–23 (Monitor Line-x Select) is set to "4 (Output Power)", increase the set value at BAS-18 (Trim Power) appropriately if the output power displayed on the keypad is lower than expected.

If the output power displayed on the keypad is higher than expected, decrease this set value accordingly. The output power display is calculated using voltage and current. However, an output power error may occur when the power factor is low.

#### Note

#### WHour Counter (Inverter power consumption)

Values are calculated using voltage and current. Electric power is calculated every second and the results are accumulated.

Power consumption is displayed as follows:

- Less than 1,000 kW: Units are in kW, displayed in a 999.9 kW format.
- 1–99 MW: Units are in MW, displayed in a 99.99 MWh format.
- 100–999 MW: Units are in MW, displayed in a 999.9 MWh format.
- More than 1,000 MW: Units are in MW, displayed in 9,999 MWh format and can be displayed up to 65,535 MW. (Values exceeding 65,535 MW will reset the value to 0 and units will return to kW. It will be displayed in a 999.9 kW format).
- If the WH CNF-62 (Count Reset) is set to "YES," you can clear the electricity consumption.

## 9.1.3 Selecting Load Speed Display

Mode	Group	Code	LCD Display Paran		er Setting	Unit
		61	Load Spd Gain	-	100.0	%
PAR	ADV	62	Load Spd Scale	0	X 1	-
		63	Load Spd Unit	0	rpm	-

#### **Load Speed Display Details**

Set CNF-21–23 (Monitor Line-x Select) to "24 (Load Speed)", and adjust the following codes to display load speed.

Code	Description
ADV-61 Load Spd Gain	Sets the gear ratio in a percentage for speed conversion. When the ratio is set, the actual number of rotations of the other axis or gear system that is connected to the motor is displayed accordingly.  For example, set ADV-61 (Load Spd Gain) to 30.0%, if the flux value is 300 [mpm] at 1000 [rpm].
ADV-62 Load Spd Scale	Selects to what decimal place to display at "24 (Load Speed)" among the monitor items (x1-x0.0001). If you want to display the value to one decimal place, set ADV-63 (Load Spd Scale) to X 0.1.
ADV-63 Load Spd Unit	Selects the unit of "24 (Load Speed)" from the monitor items. Also, select either RPM (Revolutions Per Minute) or MPM (Meters Per Minute).

## 9.1.4 Selecting Hz/Rpm Display

You can convert all the parameters with a Hz unit into RPM or vice versa. The pole number (BAS-11) must be entered for the conversion.

Mode	Group	Code	LCD Display	Parameter Setting		Unit
PAR	DRV	21	Hz/Rpm Sel	0	Hz	-
	BAS	11	Pole Number	-	4	-

## **⚠** Warning

If you change the default set value at DRV-21 (Hz/RPM Sel) from "Hz" to "RPM", all parameters except the ones set for the monitor mode will be changed to RPM. To change the speed unit from frequency to speed in Monitor mode, change the parameter value at CNF-21.

## 9.1.5 Selecting Status Display

Mode	Code	LCD Display	Parameter Setting		Unit
CNF	20	AnyTime Para	0	Frequency	-

#### **Status Display Selection Details**

Code	Description						
	Select the variables to be displayed at the top of Keypad display (LCD display).						
	Setting	Function	Setting	Function			
	0	Frequency	13	V2 Monitor[V]			
	1	Speed	14	V2 Monitor[%]			
	2	Output Current	15	I2 Monitor[mA]			
	3 4	Output Voltage	16	I2 Monitor[%]			
CNF-20 AnyTime		Output Power	17	PID Output			
Para	5	WHour Counter	18	PID Ref Value			
	6	DCLink Voltage	19	PID Fdb Value			
	7 8 9 10	-	20	Torque			
		-	21	Torque Limit			
		V1 Monitor[V]	22	Trq Bias Ref			
		V1 Monitor[%]	23	Speed Limit			
		I1 Monitor[mA]	24	Load Speed			
	12	I1 Monitor[%]					

## 9.1.6 Monitoring Output Frequency

Select DRV-25 to monitor output frequency. Output frequency is displayed in 0.01[Hz] increments. The output frequency is displayed as 0.00[Hz] when the inverter is not operating.

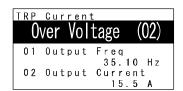
Group	Code	LCD Display	Parameter Setting		Unit
DRV	25	Output Freq	-	0.00	Hz

## 9.2 Monitoring Fault Status Using Keypad

Trip mode displays the fault status when a fault trip occurs during inverter operation. You can monitor the fault types, operating frequency, and output current at the time of fault trip. Up to the last 5 fault trips can be saved.

#### 9.2.1 Monitoring Current Fault Status

When a fault trip occurs, the fault type is displayed on the keypad's display.



For more details on types and descriptions of fault trips, refer to <u>12.2 Warning Messages</u> on page <u>391</u>. The following operating status can be monitored and recorded.

Displayed Information		Description			
1	1 Output Freq Displays the operating frequency at the time of the fault trip.				
2	2 Output Current Displays the output current at the time of the fault trip.				
3 Inverter State Displays accele state.		Displays acceleration, deceleration, constant speed operation, and stop state.			
4	4 DCLink Voltage Displays the inverter's DC power voltage.				
5 Temperature Displays the inverter's temperature.		Displays the inverter's temperature.			
6	Input State	Displays the input terminal's status.			
7	Output State	Displays the output terminal's status.			
8	Trip On Time	Displays the time from the power ON to the fault trip.			
9	9 Trip Run Time Displays the time from Run to the fault trip.				

If you press the [STOP/RESET] key on the keypad or input the reset terminal of the terminal block to release the fault trip, the information for the currently displayed fault trip is saved as part of the fault trip history. In this case, what was saved in the Fault Trip History 1 (Last-1) is moved to the Failure History 2 (Last-2).

The number next to the fault trip name represents the number of simultaneously occurring faults. If more than one fault occurred, you can press the [PROG/ENT] key to view the other faults.

## 9.2.2 Monitoring Fault Trip History

The types of up to five previous fault trips can be saved and monitored. The lower the number of Last X is, the more recent the fault it represents. If more than 5 faults occur, those occurring before the last 5 are automatically deleted.

The items displayed in the fault trip history are listed in the following table.

Displayed Information		Description		
0	0 Trip Names(1) Displays the fault types.			
1	1 Output Freq The operating frequency at the time of the fault occurrence.			
2	2 Output Current The output current at the time of the fault occurrence.			
3 Inverter State		Displays acceleration, deceleration, constant speed operation, and stop state.		
4	4 DCLink Voltage Displays the inverter's DC power voltage.			
5	5 Temperature Displays the inverter's temperature.			
6	6 Input State Displays the input terminal's status.			
7	Output State	Displays the output terminal's status.		
8	Trip On Time	Displays the time from the power ON to the fault occurrence.		
9	Trip Run Time	Displays the time from Run to the fault occurrence.		
10	Trip Delete ?	Displays whether the currently saved fault trip history is to be deleted.		

There are two ways to delete the fault trip history.

At each fault trip, To delete the individual fault trip, select "Yes" at TRP-10 (Trip Delete?). Also, to delete the entire fault trip history, select "Yes" at CNF-24 (Erase All Trip).

# 9.3 Analog output

#### 9.3.1 Voltage Output (0–10 V)

Select the items to be output from AO1 (Analog Output 1) terminal of the inverter terminal block and adjust the output sizes.

Group	Code	LCD Display	Parameter Setting		Unit
	01	AO1 Mode	0	Frequency	-
	02	AO1 Gain	-	100.0	%
OUT	03	AO1 Bias	-	0.0	%
OUT	04	AO1 Filter	-	5	ms
	05	AO1 Const %	-	0.0	%
	06	AO1 Monitor	-	0.0	%

## **Voltage Output Setting Details**

Code	Description					
	Sele	ect the output types.				
	Set	ting	Description			
			Outputs an operation frequency as the standard. A 10 V			
	0	Frequency	output is supplied based on the frequency set at DRV-20			
			(Max Freq).			
	1	Output	A 10 V output is supplied from 200% of the inverter-rated			
	ı	Current	current (based on CT: Constant Torque).			
			Sets the outputs based on the inverter output voltage. A 10			
OUT-01 AO1	3	Output	V output is supplied from the voltage set at BAS-15 (Rated V).			
Mode		Voltage	If 0 V is set at BAS-15, 200 V/400 V models output 10 V based			
			on the actual input voltage (220 V and 440 V respectively).			
		DC Link Volt	Outputs the inverter DC link voltage as the standard.			
			Outputs 10 V when the DC link voltage is 410 VDC for 200 V			
			models, and 820 VDC for 400 V models.			
	5	Torque	Outputs the generated torque as the standard. Outputs 10 V			
			at 250% of the motor-rated torque.			
		Output	Monitors the output wattage. 200% of the rated output is			
		Power	the maximum display voltage (10 V).			

Code	Description					
	6	Idse	Outputs the maximum voltage at 200% of the no load current.			
	7	Iqse	Outputs the maximum voltage at 250% of the rated torque current.			
			Rated torque current = $\sqrt{\text{rated current}^2 - \text{Non - load current}^2}$			
	8	Target Freq	Outputs the set frequency as the standard. Outputs 10 V at the maximum frequency (DRV-20).			
	9	Ramp Freq	Outputs frequency calculated with Acc/Dec function as a standard. This may vary depending on the actual output frequency. Outputs 10 V.			
	10	Speed Fdb	Displays the speed information of the input into the encoder extension module. It produces 10 V at the maximum frequency (DRV-20).			
	11	Speed Dev	Outputs the difference between the speed reference (command) and the motor's rotation speed that inputs into the encoder extension module. It outputs 10 V at twice the rated slip frequency. It is valid only in Vector Control mode.			
	12	PID Ref Value	Outputs command value of a PID controller as the standard. Outputs approximately 6.6 V at 100%.			
	13	PID Fdb Value	Outputs feedback volume of a PID controller as the standard. Outputs approximately 6.6 V at 100%.			
	14	PID Output	Outputs the output value of a PID controller as the standard. Outputs approximately 10 V at 100%.			
	15	Constant	Outputs the OUT-05 (AO1 Const %) value as a standard.			
	Adjusts output value and offset. If frequency is selected as an output item, it will operate as shown below. $AO1 = \frac{Frequency}{MaxFreq} \times AO1Gain + AO1Bias$					
OUT-02 AO1 Gain, OUT-03 AO1 Bias	The graph below illustrates how the analog voltage output (AO1) changes depending on OUT-02 (AO1 Gain) and OUT-3 (AO1 Bias) values. The Y-axis is analog output voltage (0–10 V), and the X-axis is a % value of the output item.					
	Example, if the maximum frequency set at DRV-20 (Max Freq) is 60 Hz and the present output frequency is 30 Hz, then the x-axis value on the next graph is 50%.					
	OU	T-02 AO1 Gai	in			
	OU.	T- 0.0%	100.0% (Factory Default) 80.0%			

Code	Description					
	03 (Factory Default) 10V 8V 5V 6.4V 4V 4V 2V 2V 0% 50% 80% 100% 0% 50% 80% 100%					
OUT-04 AO1 Filter	Sets the filter time constant of the analog output.					
OUT-04 AO1 Const %	Sets the analog output items to Constant (AO1 Mode: 15), and then the analog voltage is output at the value of the parameters set.					
OUT-06 AO1 Monitor	Monitors the analog output value, which is represented as a percentage based on the 10 V maximum output voltage.					

#### 9.3.2 Current Output (4-20 mA)

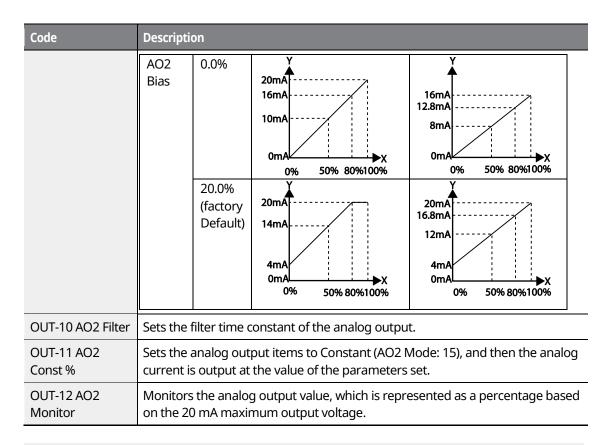
Select the items to be output from AO2 (Analog Output 2) terminal of the inverter terminal block and adjust the output sizes.

Group	Code	LCD Display	Paran	neter Setting	Unit
	07	AO2 Mode	0	Frequency	-
	08	AO2 Gain	-	80.0	%
OUT	09	AO2 Bias	-	20.0	%
OUT	10	AO2 Filter	-	5	ms
	11	AO2 Const %	-	0.0	%
	12	AO2 Monitor	-	0.0	%

#### **Current Output Setting Details**

Code	Description					
	Select the output types.					
	Set	ting	Description			
	0	Frequency	Outputs an operation frequency as the standard. A 10 V output is supplied based on the frequency set at DRV-20 (Max Freq).			
	1	Output Current	A 10 V output is supplied from 200% of the inverter-rated current (based on CT: Constant Torque).			
OUT-07 AO2 Mode	2	Output Voltage	Sets the outputs based on the inverter output voltage. A 10 V output is supplied from the voltage set at BAS-15 (Rated V).  If 0 V is set at BAS-15, 200 V/400 V models output 10 V based on the actual input voltage (220 V and 440 V respectively).			
	3	DC Link Volt	Outputs the inverter DC link voltage as the standard. Outputs 10 V when the DC link voltage is 410 VDC for 200 V models, and 820 VDC for 400 V models.			
	4	Torque	Outputs the generated torque as the standard. Outputs 10 V at 250% of the motor-rated torque.			
	5	Output Power	Monitors the output wattage. 200% of the rated output is the maximum display voltage (10 V).			
	6	Idse	Outputs the maximum voltage at 200% of the no load current.			

Code	Desc	ription		
	7	Iqse	Outputs the maximum voltage current.  Rated torque current = $\sqrt{\text{rated cu}}$	ge at 250% of the rated torque
	8 Target Freq		•	the standard. Outputs 10 V at
	9	Ramp Freq	Outputs frequency calculated standard. This may vary deperence frequency. Outputs 10 V.	
	10	Speed Fdb	Displays the speed information encoder extension module. I maximum frequency (DRV-20)	t produces 10 V at the
	11 Speed Dev		the encoder extension modu	een the speed reference rotation speed that inputs into ile. It outputs 10 V at twice the d only in Vector Control mode.
	12	PID Ref Value	Outputs command value of a standard. Outputs approxim	PID controller as the
	13	PID Fdb Value	Outputs feedback volume of standard. Outputs approxim	
	14 15	PID Output Constant	Outputs the output value of a standard. Outputs approxim Outputs the OUT-05 (AO1 Co	ately 10 V at 100%.
OUT-08 AO2 Gain, OUT-09 AO2 Bias	Adju will of AO. The depotence outperson outpe	asts output value operate as shear as s	ilue and offset. If frequency is sown below.  EXX × AO2Gain + AO2Bias  Illustrates how the analog curr  JT-02 (AO2 Gain) and OUT-3 (AI  t current (0–20 mA), and the X-  aximum frequency set at DRV- equency is 30 Hz, then the x-ax	rent output (AO2) changes O2 Bias) values. The Y-axis is axis is a percentage of the 20 (Max Freq) is 60 Hz and the kis value on the next graph is 80.0% (Factory
	09			Default)



When 4–20 mA is used as the output, tune OUT-08 AO2 Gain and OUT-09 AO2 Bias as follows.

- 1 Set OUT-07 AO2 Mode to Constant and OUT11 AO2 Const % to 0.0%.
- 2 After setting OUT-09 AO2 Bias to 20.0%, ensure that that the current is 4 mA. If the current is lower than 4 mA, gradually increase OUT-09 AO2 Bias until it measures 4 mA. If the current is higher than 4 mA, gradually decrease OUT-09 AO2 Bias until it measures 4 mA.
- **3** Set OUT11 AO2 Const % to 100.0%. After setting OUT-08 AO2 Gain to 80.0%, ensure that the current is 20 mA. If the current is lower than 20 mA, gradually increase OUT-08 AO2 Gain until it measures 20 mA. If the current is higher than 20 mA, gradually decrease OUT-08 AO2 Gain until it measures 20 mA.
- **4** When 0-20 mA is used as the output, set OUT-08 A02 Gain to 100% and OUT-09 A02 Bias to 0.0%.
- 5 The functions for each code are the same as the item of 0–10 V output. And, the output range is 0–20 mA.

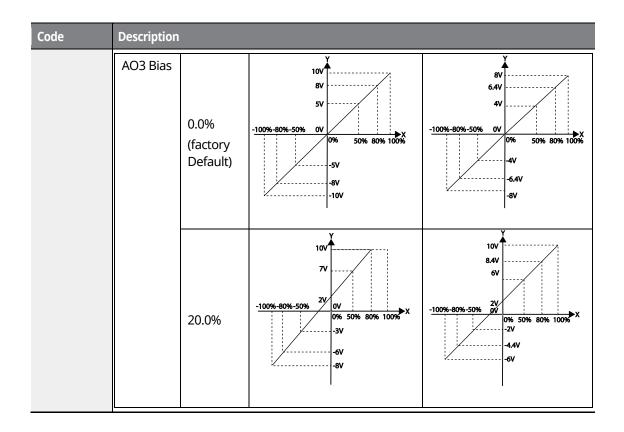
#### Voltage Output (-10-+10V) Using an I/O Expansion Module 9.3.3

If the optional I/O expansion module is installed, the operating status can be monitored using the bipolar voltage output of the I/O expansion module.

Group	Code	LCD Display	Paramet	er Setting	Unit
	14	AO3 Mode	0	Frequency	-
	15	AO3 Gain	-	100.0	%
OUT	16	AO3 Bias	-	0.0	%
OUT	17	AO3 Filter	-	5	Msec
	18	AO3 Const %	-	0.0	%
	19	AO3 Monitor	-	0.0	%

#### Voltage Output (-10-+10 V) Details

Code	Description						
	The output mode can be set identically to when the AO1 voltage output is used. However, because bipolar voltage output is possible for AO3, unipolar (0–+10V) or bipolar (-10–+10V) voltage can be produced according to the type of the output variable.						
OUT-14 AO3			tput voltages are a	s follows.		1	
Mode	Output Direction	R	elated Functions				
	Forward(+)	0:	: Frequency	9: Ramp Fre	eq	10: Speed Fdb	
	/Reverse(-)		2: PID Ref Value	13: PID Fdb	Value	14: PID Output	
	Reverse(-) /Regenerative(-)	4	: Torque	7: Iqss		-	
OUT-15 AO3 Gain, OUT-	depending on th The Y-axis is anal output. For exam	The graph below illustrates how the analog voltage output (AO3) changes depending on the OUT-15 (AO3 Gain) and OUT-16 (AO3 Bias) values.  The Y-axis is analog output voltage (-10–+10V), and the X-axis is a percentage of the output. For example, if the maximum frequency set at DRV-20 (Max Freq) is 60 Hz					
16 AO3 Bias	and the present output frequency is 30 Hz, then the x-axis value on the next graph is 50%.						
	OUT-08 AO3 Ga	n					
	OUT-16		100.0% (Factory	Default)	80.0%		



#### Current Output (4-20 mA/0-20 mA) Using an I/O Expansion 9.3.4 Module

If the optional I/O expansion module is installed, the current output (0–20 mA or 4–20 mA) can be produced via terminal AO4. The setting details are identical to those of AO1 analog output terminal.

Group	Code	LCD Display	Parameter Setting		Unit
	20	AO4 Mode	0	Frequency	-
	21	AO4 Gain	-	100.0	%
OUT	22	AO4 Bias	-	0.0	%
001	23	AO4 Filter	-	5	ms
	24	AO4 Const %	-	0.0	%
	25	AO4 Monitor	-	0.0	%

#### **Relay Output and Multi-function Output Terminal** 9.4 **Settings**

Group	Code	LCD Display	Paramete	er Setting	Unit
	30	Trip Out Mode	-	010	bit
	31	Relay 1	28	Trip	-
OUT	32	Relay 2	14	Run	-
OUT	33	Q1 Define	1	FDT-1	
	34-36	Relay 3–5	-	-	-
	41	DO Status	-	-	bit

#### **Relay Output and Multi-function Output Terminal Setting Details**

Code	Description					
OUT-30 Trip	Set OL Bit on			Mode) to enable or disable the fault relay.		
Out Mode	Settin	g option		Function		
	Bit3	Bit2	Bit1	The top-right corner of the display is 'Bit 1'.		
			✓	Operates when a low voltage fault trip occurs.		
		<b>√</b>		Operates when a fault trip other than low voltage occurs.		
	<b>✓</b>			Operates when auto restart fails (PRT-08-09).		
OUT 24	Set ou	tput opt	ions for	the relays and multi-function output terminal Q1.		
OUT-31	Settin	g		Function		
Relay1, OUT-32,	0	None		No output signal		
Relay2, OUT-33 Q1 Define, OUT-34–36 Relay 3–5	1 FDT-1			No output signal  Inspects whether the output frequency for the inverter reaches the frequency set by the user. The inverter begins to operate when the condition is met:  Absolute value (set frequency - output frequency) < detected frequency width/2.  When the detected frequency width is 10 Hz, the FDT-1		

Code	Descrip	otion						
			output is	as shov	vn in the graph b	elow.		
			Group	Code	LCD Display	1	meter	Unit
					. ,	setti	ng	
			OUT	58	FDT Band (Hz)	-	10.00	Hz
			Frequent reference Frequen	e	20Hz	40H	l <u>z</u> <u>0Hz</u> 35Hz	z
			Q1					
			Run cm	<del>d</del>			_	
			- Itali Cili	<u> </u>				
			frequence condition [Absolute detected met The dete	cy (FDT for at the evalue (doing) frequence to the control of the	when the set free requency) are equency – (set frequency – ency width /2]& quency width is 1 to 30 Hz, the FDT-	ual, ar  detec [ FDT  0 Hz.	nd fulfills the ted frequence of ted frequence of ted frequence of ted frequence of the ted frequence of ted frequen	ency) < ion is
			Group	Code	LCD Display		meter	Unit
	2	FDT-2	OUT	57	FDT	setti -	30.00	Hz
				3,	Frequency		30.00	112
				58	FDT Band (Hz)	-	10.00	Hz
			Frequer Frequer Q1 Run cm	ce 2 ncy	30Hz 5Hz	50H	<u>lz</u>	
	3	FDT-3	following <b>Absolute</b>	g conditi <b>e value</b>	when the operat on: (detected frequer ency width /2			

Code	Descri	peloli						
			Group	Code	LCD Display	Initi	ial Setting	Unit
			OUT	57	FDT Frequency	-	30.00	Hz
				58	FDT Band (Hz)	-	10.00	Hz
			Frequei Q1 Run cm	ncy /	Hz		35 25	
			<ul><li>and dece</li><li>In a freq</li><li>In d</li></ul>	eleratior ccelera uency lecelera	al can be separated n conditions. ation: Operation fr ation: Operation fr Detected frequen	eque	ncy≧ Dete	cted
	4	FDT-4		y is set telow.  Code  57 58	ncy width is 10 Hz. to 30 Hz, FDT-4 ou  LCD Display  FDT Frequency FDT Band (Hz)	tput i	s as shown	Unit Hz Hz
	4	FDT-4	frequence graph be Group OUT	cy is set felow.  Code  57 58  30H:	LCD Display  FDT Frequency FDT Band (Hz)	Par sett	ameter ting 30.00 10.00	Unit Hz Hz
			Group  OUT  Frequer Q1 Run cm	cy is set felow. Code 57 58 30H:	LCD Display  FDT Frequency FDT Band (Hz)	Par sett	ameter ting 30.00 10.00	Unit Hz Hz
	5	FDT-4  Over Load  IOL	Frequence Group  OUT  Frequence Q1  Run cm  Outputs Outputs the rated prevent of	sy is set felow.  Code  57 58  30H: a signal a signal d current damage	LCD Display  FDT Frequency FDT Band (Hz)  at motor overload when the inverter t and a protective to the inverter, bar	Par sett	s as shown  ameter ting  30.00  10.00  25H  at current exion is activation	Unit Hz Hz cxceeds
	5	Over Load	Frequence Group  OUT  Frequer Q1  Run cm  Outputs  Outputs the rated prevent of proportion	sy is set to be low.  Code  57 58  30H: a signal a signal d curren damage onal cha	LCD Display  FDT Frequency FDT Band (Hz)  at motor overload when the inverter t and a protective to the inverter, baracteristics.	Par sett	s as shown  ameter ting  30.00  10.00  25H  at current exion is activation	Unit Hz Hz cxceeds
	5	Over Load IOL	Frequence Group  OUT  Frequer Q1 Run cm  Outputs Outputs the rated proportion Outputs Outputs	sy is set felow.  Code  57 58  30H: a signal a signal d current damage on al character a signal a signal character a signal character a signal character a signal a signal character a s	LCD Display  FDT Frequency FDT Band (Hz)  at motor overload when the inverter t and a protective to the inverter, bar	Par sett	s as shown  ameter ting  30.00  10.00  25H  at current exion is activation	Unit Hz Hz cxceeds

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Code	Descr	iption						
	10	Over Voltage	•	_	when the inve		C link voltage i	rises
	11	Low Voltage	Outputs	a signal v	•	rter D	C link voltage	drops
	12	Over Heat			nen the inverte			
	13	Lost Command	Outputs a signal when there is a loss of analog input terminal and RS-485 communication command at the terminal block. Outputs a signal when communication power is present and an I/O expansion module is installed. It also outputs a signal when losing analog input and communication power commands.  Outputs a signal when an operation command is entered and the inverter outputs voltage. No signal output during DC braking.  Frequency  Q1  Run cmd					
	14	RUN						ntered
	15	Stop	-	_	at operation co er output volta		and off, and wh	nen
	16	Steady			n steady oper			
	17	Inverter Line	Outputs line.	a signal v	vhile the moto	or is d	riven by the in	verter
	18	Comm Line	(switchin Group IN OUT	g) is ente Code 65-72 32 33	Px Define Relay 2 Q1 Define	<b>Initi</b> 16 15 16	al Setting Exchange Inverter Line Comm Line	Unit - -
	19	Speed Search	Outputs a signal during inverter speed search operation. For details, refer to <u>8.19 Speed Search Operation</u> on page					
	20	Step Pulse		250.  Outputs a signal when a step is completed in an auto				to

Code	Descri	otion						
	21	Seq Pulse	Outputs sequence	_	when a sequendion.	ce is co	mpleted ir	n an auto
	22	Ready		_	when the inverteive external ope		_	
			-	_	when the invertuency during a t			n.
	23	Trv ACC	Group	Code	LCD Display	Para settii	meter ng	Unit
			APP	01	App Mode when the invert		Traverse	<u> </u>
			decelera	ting freq	uency during a	traver	se operatio	1
	24	Trv DEC	Group	Code	LCD Display	Para settii	meter ng	Unit
			APP	01	App Mode		Traverse	-
	25	MMC	relay out configuri	. By configi put to MM 3 (MMC), it nulti-motor	C and can			
			Group	Code	LCD Display	settir		Unit
			APP	01	App Mode		MMC	<u> </u>
					tor's rotation sp the control mod			
			Group	Code	LCD Display Parameter setting		ameter	Unit
			DRV	09	Control Mode	4	Vector	-
			CON	82	ZSD Frequency	-	2.00	Hz
				83	ZSD Band (Hz)	-	1.00	Hz
	26	Zspd Dect	(encoder	signal), on or off stant.	ation is depende a fault may occu due to the enco	ır whe	n turning t gnal noise	:he

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Code	Descri	ption								
				its a signal if the torque, with the control mode set isorless or vector, is below the following levels.						
						Parameter setting				
			DRV	09	Control	3–	Sensorless-1,	-		
	27	7 Torque Dect			Mode	4	Sensorless-2,			
							Vector			
			OUT	59	TD Level	-	100.0	%		
				60	TD Band	-	5.0	%		
			A timer f	unction	to operate ter	mina	l output after a	certain		
							al block input.			
			Group	Code	LCD Display	_	ameter setting	Unit		
		Timer Out	IN	65-	Px Define	38	Timer In	-		
	28		O. I.T.	72	<del>-</del>		0.00			
			OUT	55	Timer On	-	0.00	Sec		
				56	Delay Timer Off	_	0.00	Sec		
				30	Delay	_	0.00	Sec		
	-									
	32	ENC Tune		utputs a warning signal by releasing the contact point tput if autotuning is performed, if there is no encoder						
		LIVE TUTIE					not set to "Feed			
					-		motor rotation			
							roperly. The wa	rning		
	33	ENC Dir	signal is	generat	ed when then	enco	der wiring is no	t made		
			properly even if the encoder module has been installed							
			and APO-01 Enc Opt Mode is set to "Feedback".							
		KEB	Outputs a signal when the energy buffering operation is							
	36	Operating	performed (when an input power outage occurs and the							
		'			voltage of th			l :£		
	37	Fire Mode				ae is	in operation on	іу іт		
			ADV-80 is set to Fire mode.							
	38	Run2	It operates when the operation command is input or the inverter is outputting voltage. Unlike "14: Run", it operates even during DC braking							
OUT 44 DO	-	1	1	<u> </u>	<u> </u>					
OUT-41 DO State	Used t	o check On/Off	state of th	e DO (di	gital output) b	y ead	h bit.			

# 9.5 Fault trip output using multi-function output terminals and relays

The inverter can output a fault trip state using the multi-function output terminal (Q1) and relay (Relay1).

Group	Code	LCD Display	Paramet	er Setting	Unit
	30	Trip Out Mode	-	010	
	31	Relay 1	29	Trip	-
OUT	32	Relay 2	14	Run	-
OUT	33	Q1 Define	1	FDT-1	-
	53	Trip Out On Dly	-	0.00	Sec
	54	Trip Out Off Dly	-	0.00	Sec

<sup>\*</sup> The inverter can output a fault trip status using expansion digital output terminals (OUT 34–36) if the optional I/O expansion module is installed.

Code	Description						
OUT-30 Trip Out Mode	Bit on  Dependent configuration	Bit of	f he fault	trip type, the terminal and relay operation can be the table below.  Function The top-right corner of the display is 'Bit 1'. Operates when a low voltage fault trip occurs.			
		<b>√</b>		Operates when a fault trip other than low voltage occurs.			
	✓			Operates when auto restart fails (PRT-08-09).			
OUT-31-33	Select the terminal and relay to use for failure output and set OUT-31–33 to "28 (Trip mode)". When a fault trip occurs in the inverter, the relevant terminal and relay will operate.						
OUT-53 Trip Out On Dly,			If a fault trip occurs, trip relay or multi-function output operates after the time delay set in OUT-53. The terminal turns off with the input initialized after the time delay				

Code	Description
OUT-54 Trip Out Off Dly,	set in OUT-54.

## 9.6 Output Terminal Delay Time and Terminal Types

You can adjust the operating time of the output terminals and relays. The ON and OFF delay time can be set separately. You can choose between "form A" terminal (Normally Open) and "form B" terminal (Normally Closed).

#### 9.6.1 Output Terminal Delay Time

Group	Code	LCD Display	Parameter Setting		Unit
OUT	50	DO On Delay	-	0.00	Sec
	51	DO Off Delay	-	0.00	Sec

#### **Output Terminal Delay Time Setting Details**

Code	Description
OUT-50 DO On Delay	Set the delay time before the output signal is turned on.
OUT-51 DO Off Delay	Set the delay time before the output signal is turned off.

The delay time set at codes OUT-50 and OUT-51 apply to the multi-function output terminal (Q1) and relays (Relay 1 and 2), except when the multi-function output function is in fault trip mode.

#### 9.6.2 Setting the Output Terminal Type

Group	Code	LCD Display	Parameter Setting		Unit
OUT	52	DO NC/NO Sel	ı	000	bit

#### **Output Terminal Type Setting Details**

Code	Description
OUT-52 DO NC/NO Sel	Select the type for the relay and multi-function output terminal. An additional three terminal type selection bits at the terminal block will be added when an optional I/O expansion module is installed.  Set the relevant bit to "0" to operate it as a "form A" terminal (Normally Open), "1" to operated it as a "form B" terminal (Normally Closed). Relay 1 and Q1 settings start from the right bit (The top-right corner of the display is 'Bit 1'.).

## 9.7 Operation Time Monitor

Group	Code	LCD Display	Paran	neter Setting	Unit
	70	On-time	-	0000DAY 00hr:00mm	-
	71	Run-time	-	0000DAY 00hr:00mm	-
CNF	72	Time Reset	0	No	-
	74	Fan Time	-	0000DAY 00hr:00mm	-
	75	Fan Time Reset	0	No	-

## **Output Terminal Type Setting Details**

Code	Description				
CNF-70 On-time	Displays the accumulated power supply time. Information is displayed in [0000DAY 00hr:00mm] format.				
CNF-71 Run-time  Displays the accumulated time of voltage output by operation cominput. Information is displayed in [0000DAY 00hr:00mm] format.					
CNF-72 Time Reset	Setting "1 (Yes)" will delete the accumulated power supply time (On-time) and operation accumulated time (Run-time), and is displayed in 0000DAY 00hr:00mm format.				
CNF-74 Fan time	Displays the accumulated inverter cooling fan operation time. Information will be displayed in [0000DAY 00hr:00mm] format.				
CNF-75 Fan Time Reset	Setting "1 (Yes)" will delete the accumulated cooling fan operation time (on-time) and accumulated operation time (run-time), and will display it in				

Code	Description
	0000DAY 00hr:00mm format.

#### **Setting the Keypad Language** 9.8

Select the language to be displayed on the LCD keypad. Keypads using S/W Ver 1.04 and later provide a language selection. The Korean language setting supports Korean and English.

Group	Code	LCD Display	Initial Se	tting	Unit
			0	English	
			1	Russian	
CNF 01	01	Language Sel	2	Spanish	-
			3	Italian	
			4	Turkish	

## **10 Using Protection Features**

Protection features provided by the SV-iS7 series inverter are categorized into two types: Protection from damage due to an overheating motor and Protection against inverter malfunction.

#### **10.1 Motor Protection**

#### **10.1.1 Electrothermal Motor Overheating Prevention (ETH)**

ETH is a protective function that uses the output current of an inverter without a separate temperature sensor to predict increases in motor temperature and protect the motor, based on its heat characteristics.

Group	Code	LCD Display	Para	meter Setting	Setting Range	Unit
40	ETH Trip Sel	0	None	None/Free-Run/Dec	-	
	41	Motor Cooling	0	Self-cool	-	-
PRT	42	ETH 1min	-	150	120-200	%
-	43	ETH Cont	-	120	50–180	%

#### **Electronic Thermal (ETH) Prevention Function Setting Details**

Code	Description					
		ETH can be selected to provide motor thermal protection. The LCD screen displays "E-Thermal."				
	Set	ting	Function			
PRT-40 ETH Trip Sel	0	None	The ETH function is not activated.			
·	1	Free-Run	The inverter output is blocked. The motor coasts to a halt (free-run).			
	2	Dec	The inverter decelerates the motor to a stop.			
	Select the drive mode of the cooling fan, attached to the motor.					
PRT-41 Motor	Setting		Function			
Cooling	0	Self-cool	As the cooling fan is connected to the motor axis, the cooling effect varies based on motor speed. Most			

Code	Description				
			universal induction motors have this design.		
	1	Forced-cool	Additional power is supplied to operate the cooling fan. This provides expansion operation at low speeds. Motors designed for inverters typically have this design.		
		5	PRT-41=1 PRT-41=0		
	The	20			
PRT-42 ETH 1 min		•	ut current that can be continuously supplied to the motor on the motor-rated current (BAS-13).		
	belo		current with the ETH function activated. The range et values that can be used during continuous operation ion function.		
PRT-43 ETH Cont	PRT		60 ETH trip time (seconds)		

## 10.1.2 Overload Early Warning and Trip

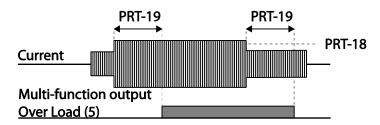
A warning or fault trip (cutoff) occurs when the motor reaches an overload state, based on the motor-rated current. The amount of current for warnings and trips can be set separately.

Group	Code	LCD Display	Para	ameter Setting	Setting Range	Unit
	04	Load Duty	1	Heavy Duty	-	-
	17	OL Warn Select	1	Yes	0–1	-
	18	OL Warn Level	-	150	30–180	%
PRT	19	OL Warn Time	-	10.0	0–30	sec
	20	OL Trip Select	1	Free-Run	-	-
	21	OL Trip Level	-	180	30–200	%
	22	OL Trip Time	-	60.0	0-60.0	sec
	31	Relay 1			-	
OUT	32	Relay 2	5	Over Load	-	] -
	33	Q1 Define			-	

#### **Overload Early Warning and Trip Setting Details**

Code	Description					
	Select the load lev	Select the load level.				
	Setting	Function				
	0 Normal	Use this setting for light loads, such as, fans and				
PRT-04 Load Duty	Duty	pumps (overload tolerance: 110% of rated underload current for 1 minute).				
	1 Heavy Duty	Use this setting for heavy loads, such as, cranes and parking elevators (overload tolerance: 150% of rated heavy load current for 1 minute).				
PRT-17 OL Warn Select	If the overload reaches the warning level, the terminal block multi-function output terminal and relay are used to output a warning signal. If "1 (Yes)" is selected, it will operate. If "0 (No)" is selected, it will not operate.					
PRT-18 OL Warn Level, PRT-19 OL Warn Time	When the input current to the motor is greater than the overload warning level (OL Warn Level) and continues at that level during the overload warning time (OL Warn Time), the multi-function output (Relay 1, Q1) sends a warning signal. When Over Load is selected at OUT-31 and OUT-33, the multi-function output terminal or relay outputs a signal. The signal output does not block the inverter output.					

Code	Description					
	Sele	Select the inverter protective action in the event of an overload fault trip.				
	Set	ting	Function			
PRT-20	0	None	No protective action is taken.			
OL Trip Select		Free-Run	In the event of an overload fault, inverter output is			
	'	riee-kuii	blocked and the motor will free-run due to inertia.			
	3	3 Dec If a fault trip occurs, the motor decelerates and stops				
PRT-21 OL Trip Level, PRT-22 OL Trip Time	When the current supplied to the motor is greater than the preset value of the overload trip level (OL Trip Level) and continues to be supplied during the overload trip time (OL Trip Time), the inverter output is either blocked according to the preset mode from PRT-17 or slows to a stop after deceleration.					



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 the overload trip time (OL Trip Time).

#### 10.1.3 Stall Prevention and Flux Braking

The stall prevention function is a protective function that prevents motors from stalling due to overloads. If a motor stall occurs due to an overload, the inverter operation frequency is adjusted automatically. When a stall is caused by overload, high currents induced in the motor may cause motor overheating or damage the motor and interrupt operation of the motordriven devices.

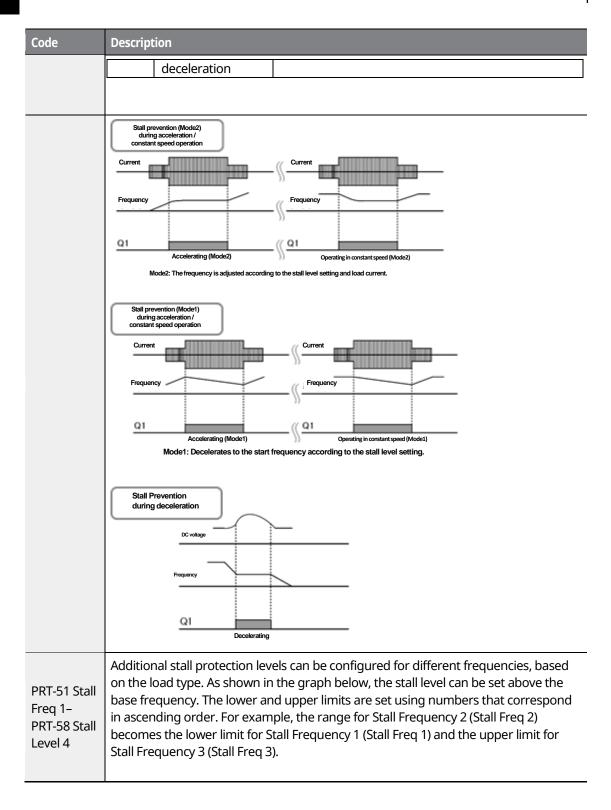
In this case, the motor decelerates with optimum deceleration without a braking resistor by using flux braking. If the deceleration time is too short, an over voltage fault trip may occur because of regenerative energy from the motor. The flux braking makes the motor use regenerate energy, therefore optimum deceleration is available without over voltage fault trip. To protect the motor from overload faults, the inverter output frequency is adjusted automatically, based on the size of load.

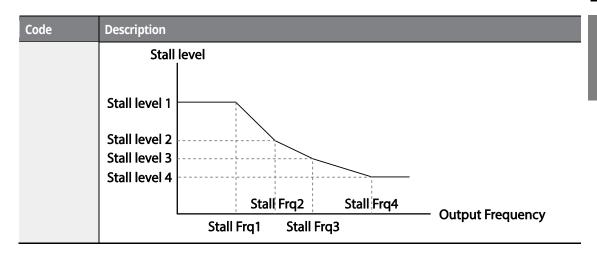
Group	Code	LCD Display	Param	neter Setting	Setting Range	Unit
	50	Stall Prevent & Flux Braking	-	0 0000	-	Bit
	51	Stall Freq 1	-	60.00	Starting Freq-Stall Freq 1	Hz
	52	Stall Level 1	-	180	30-250	%
	53	Stall Freq 2	-	60.00	Stall Freq 1–Stall Freq 3	Hz
PRT	54	Stall Level 2	-	180	30-250	%
	55	Stall Freq 3	-	60.00	Stall Freq 2–Stall Freq 4	Hz
	56	Stall Level 3	-	180	30-250	%
	57	Stall Freq 4	-	60.00	Stall Freq 3-Max. Freq	Hz
	58	Stall Level 4	-	180	30-250	%
OUT	31–33	Relay1,2, Q1	9	Stall	-	-

## **Stall Prevention Function and Flux Braking Setting Details**

Code	Descrip	Description								
		Stall prevention can be configured for acceleration, deceleration, or while operating a motor at constant speed. When the LCD segment is on, the corresponding bit is off.								
	Item		Bit Stat	us (On)	Bit Status (Off)					
	Keypad	d display								
PRT-50 Stall										
Prevent	Setting				Function					
	Bit5	Bit 4	Bit 3	Bit 2	Bit 1					
					✓	Stall protection during acceleration				
				✓		Stall protection while operating at a constant speed				
			✓			Stall protection during deceleration				
		✓				Flux braking during deceleration				
	<b>√</b>					Stall protection during acceleration & constant speed				

Code	Descript	ion	
	Setting		Function
	0 0001	Stall protection during acceleration	If the inverter output current exceeds the preset stall level (PRT-52, 54, 56, 58) during acceleration, the motor stops accelerating and starts decelerating. If current level stays above the stall level, the motor decelerates to the start frequency (DRV-19). If the current level causes deceleration below the preset level while operating the stall protection function, the motor resumes acceleration.
	1 0001	Stall prevention during acceleration (Mode2)	If the inverter's output current exceeds the preset stall level (PRT-52, 54) during acceleration, the inverter adjusts the output frequency to prevent stalling. The inverter performs a PI control on the current level to adjust the output frequency to be above the stall level. While the stall prevention feature is activated, the inverter starts accelerating again when the the current drops below the the set level.
	0 0010	Stall protection while operating at constant speed	Similar to stall protection function during acceleration, the output frequency automatically decelerates when the current level exceeds the preset stall level while operating at constant speed. When the load current decelerates below the preset level, it resumes acceleration.
	1 0010	Stall prevention while operating at a constant speed (Mode2)	Similar to the stall protection function during acceleration (Mode 2), if the inverter output current exceeds the preset stall level while operating at a constant speed, the inverter adjusts the output frequency according to the load current. When the load current drops below the preset level, the inverter resumes acceleration.
	1 or 0 0100	Stall protection during deceleration	The inverter decelerates and keeps the DC link voltage below a certain level to prevent an over voltage fault trip during deceleration. As a result, deceleration times can be longer than the set time depending on the load.
	1 or 0 1000	Flux braking during deceleration	When using flux braking, deceleration time may be reduced because regenerative energy is expended at the motor.
	1 or 0 1100	Stall protection and flux braking during	Stall protection and flux braking operate together during deceleration to achieve the shortest and most stable deceleration performance.





Stall protection and flux braking operate together only during deceleration. Turn on the third and fourth bits of PRT-50 (Stall Prevention) to achieve the shortest and most stable deceleration performance without triggering an over voltage fault trip for loads with high inertia and short deceleration times. Do not use this function when frequent deceleration of the load is required, as the motor can overheat and be easily damaged.

#### ① Caution

- Use caution when decelerating while using stall protection since the deceleration time can take longer than the time set, depending on the load. Acceleration stops when stall protection operates during acceleration. This may make the actual acceleration time longer than the preset acceleration time.
- When the motor is operating, Stall Level 1 applies and determines the operation of stall protection.

#### 10.1.4 Motor Overheat Sensor Input

To use the motor overheat protection, connect the overheat protection temperature sensor (PT 100, PTC) installed in the motor to the inverter's analog input terminal.

Group	Code	LCD Display	Parame	ter Setting	Setting Range	Unit
PRT	34	Thermal-T Sel	1	Free-Run	-	-
	35	Thermal In Src	1	V1	-	-
	36	Thermal-T Lev	-	50.0	0–100	%
	37	Thermal-T Area	0	Low	Low/High	-

Group	Code	LCD Display	Parame	ter Setting	Setting Range	Unit
OUT	07	AO2 Mode	14	Constant	-	=
OUT	08	AO2 Const	11	100%	0–100	%
TNI	65–75	Px Define	39	Thermal In	-	-
IN	87	DI NC/NO Sel	-	-	-	-

## **Motor Overheat Sensor Input Details**

Code	Description					
PRT-34 Thermal-T Sel	The inverter operating status is set when the motor overheats. If Free-Run (1) is set, the inverter output will be blocked. If decelerating stop (2) is set and the overheat sensor detects overheating, the inverter will decelerate and stop.					
	The terminal type is selected when the motor overheat sensor is connected to the voltage (V1) or current (I1) input terminals of the inverter terminal block in the inverter. The voltage (V2) or current (I2) terminals in the I/O expansion module are also available.					
	If you use the current input terminal I1 by supplying constant current to the temperature sensor with the analog current output (AO2) terminal, the switch in the I/O expansion module should be where the PTC is. Before use, check if the switch is at the PTC.					
PRT-35 Thermal In Src	AO2 V1 CM Switch					
	[With voltage (V1) input] [With current (I1) input terminal]  Temperature is measured by letting a certain amount of current flow chrough the A02 terminal and converting it into voltage depending on the resistance value change.					
IN-65–72 Px Define, IN-82 DI NC/NO Sel	You can set the overheat trip function input using the multi-function terminal block input when using a bimetal-type sensor relay. Connect PTC					

Code	Description
	between the terminal block to use and CM and select "39 (Thermal)" In among the function items. Select the type of contact point of the terminal used in IN-87 as "1 (NC)".
	I1 PX CM
	[Configuration using multi-function input terminals]
PRT-36 Thermal-T Lev	Sets the operation level for the motor overheat sensor. For the voltage input terminal (V1), the maximum input voltage is 10 V and for the current (I1), the maximum input voltage is 5 V. For example, if you use the current input terminal and set the failure level to 50%, the protection function is performed when the voltage supplied to the I1 terminal is below 2.5 V. To perform the protection function when the voltage supplied to the I1 terminal is above 2.5 V, refer to the PRT-37 Thermal-T Area.
PRT-37 Thermal-T Area	If Low (0) is set and the motor overheat sensor input is smaller than PRT-36, the protection function is performed. If High (1) is set and the motor overheat sensor input is bigger than PRT-36, the protection function is performed.

## **10.2 Inverter and Sequence Protection**

#### 10.2.1 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. Open-phase output protection is also available. An open phase at the connection between the motor and the inverter may cause the motor to stall, due to a lack of torque.

Group	Code	LCD Display	Parameter Setting		Setting Range	Unit
PRT	05	Phase Loss Chk	-	10	-	Bit
PRI	06	IPO V Band	-	40	1–100	٧

### **Input and Output Open-phase Protection Setting Details**

Code	Description						
	When open-phase protection is operating, input and output configurations are displayed differently. When the LCD segment is On, the corresponding bit is set to 'Off'.						
	Item		Bit statu	s (On)	Bit status (Off)		
	Keypa displa						
	Setting	1	Keypad	Function			
	Bit 2	Bit 1	display				
PRT-05 Phase Loss Chk		<b>√</b>		Output open-phase protection. If one or more than one phase from U, V, and W is open, the inverter output will be blocked and "Out Phase Open" will be displayed on the keypad.			
	<b>V</b>			Input open-phase protection. If one or more phases from R, S, and T are open, the inverter output will be blocked and "In Phase Open" will be displayed on the keypad. Protection against input phase open starts only when a certain amount of current (70–80% of the inverter-rated output current) flows through the motor.			
	✓	✓			ut open-phase protection		
PRT-06 IPO V Band	Sets the band of the allowed ripple voltage. If one or more phases from the inverter output are open, the ripple of the DC link voltage increases. If ripple voltage exceeds the set ripple voltage band, an input phase open trip occurs. The IPO V Band may be adjusted depending on the operating environment.  Sets the IPO V Band 1–10 volts higher if the output load is too large for the input capacity, and an open phase fault trip occurs during a normal operation.  Sets the IPO V Band 1–10 volts lower if the output load is too smaller for the input capacity.						

Ensure that the motor-rated current (BAS-13 Rated Curr) is correctly set. Phase open protection may not be operated properly if the motor's rated current is not correctly set at BAS-13.

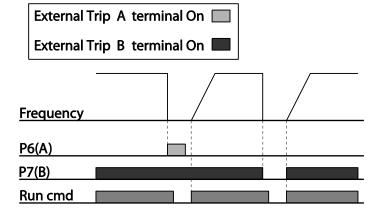
#### 10.2.2 External Trip Signal

Set one of the multi-function input terminals to "4 (External Trip)" to allow the inverter to stop operation when abnormal operating conditions arise.

Group	Code	LCD Display	Paran	neter Setting	Unit
	65–72	Px Define	4	External Trip	-
IN	87	DI NC/NO Sel	-	(000 0000000)	-

#### **External Trip Signal Setting Details**

Code	Description											
IN-87 DI NC/NO Sel	Select the toperates as operates as	s a for s a for	m A te m B te	rmina rmina	l (Norr l (Norr	nally C nally C	)pen). :losed)	If the r	mark is			
	Bit	11	10	9	8	7	6	5	4	3	2	1
	Terminal	-	-	-	P8	P7	P6	P5	P4	Р3	P2	P1



#### **10.2.3 Inverter Overload Protection (IOLT)**

If more current than the inverter-rated current flows, the protective function starts to protect the inverter depending on the inverse time characteristic.

Group	Code	LCD Display	Paramete	Unit	
OUT	31-33	Relay 1,2, Q1	6	IOL	-

A warning signal output can be provided in advance by the multi-function output terminal before the inverter overload protection function (IOLT) operates. When the overcurrent time reaches 60% of the allowed overcurrent (150%, 1 min), a warning signal output is provided (signal output at 150% for 36 sec).

#### 10.2.4 Keypad Command Loss

When setting operation speed using the keypad, speed command loss setting can be used to select the inverter operation for situations when the speed command from the keypad is lost due to the disconnection of signal cable.

Group	Code	LCD Display	Parameter Setting		Unit
PRT	11	Lost KPD Mode	2	Free-Run	-
OUT	31-33	Relay1,2, Q1	30	Lost Keypad	-
DRV	06	Cmd Source	0	Keypad	-
CNF	22	Multi Key Sel	0	JOG Key	-

#### **Speed Command Loss Setting Details**

Code	Description						
	I	Set the DRV-06 (command source) to "0 (keypad)", and select the inverter's operation for when there is a keypad connection problem.					
	Set	tting	Function				
	0	None	The speed command immediately becomes the operation frequency without any protection function.				
PRT-11 Lost KPD Mode	1	Warning	Set one of the output terminals to "29 (Lost keypad)" to output a relevant warning signal when abnormal operating conditions arise.				
	2	Free-Run	The inverter blocks output when the keypad connection is lost. The motor performs in free-run condition.				
	3	Dec	The motor decelerates and then stops at the time set at PRT-07 (Trip Dec Time) when the keypad connection is				

Code	Description					
	lost.					
	The protection function is also available for the keypad command loss during jog key operation when CNF-22 is set to "JOG Key."					

#### **10.2.5 Speed Command Loss**

When setting the operation speed using an analog input at the terminal block, communication options, or the keypad, the speed command loss setting can be used to select the inverter operation for situations when the speed command is lost due to the disconnection of signal cables.

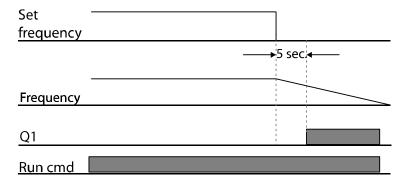
Group	Code	LCD Display	Parameter Setting		Setting Range	Unit
PRT	12	Lost Cmd Mode	1	Free-Run	-	-
	13	Lost Cmd Time	-	1.0	0.0–120	Sec
	14	Lost Preset F	-	0.00	Starting Freq-Max. Freq	Hz
	15	AI Lost Level	1	Half of X1	-	-
OUT	31-33	Relay1,2, Q1	13	Lost Command	-	-

#### **Speed Command Loss Setting Details**

Code	Description						
	In situations when speed commands are lost, the inverter can be configured to operate in a specific mode:						
	Set	ting	Function				
	0	None	The speed command immediately becomes the operation frequency without any protection function.				
	1	Free-Run	The inverter blocks output. The motor performs in free-run condition.				
PRT-12 Lost Cmd Mode	2	Dec	The motor decelerates and then stops at the time set at PRT-07 (Trip Dec Time).				
Wiode	3	Hold Input	The inverter calculates the average input value for 10 seconds before the loss of the speed command and uses it as the speed reference.				
	4	Hold Output	The inverter calculates the average output value for 10 seconds before the loss of the speed command and uses it as the speed reference.				
	5	Lost Preset	The inverter operates at the frequency set at PRT-14 (Lost Preset F).				
PRT-15 AI Lost Level,	Configure the voltage and decision time for speed command loss when using analog input.						
PRT-13 Lost Cmd Time	Set	ting	Function				
TITLE	0	Half of x1	Based on the values set at IN-08 and IN-12, a				

Code	Description	Description					
	1 Below of x1	protective operation starts when the input signal is reduced to half of the initial value of the analog input set using the speed command (DRV-01) and it continues for the time (speed loss decision time) set at PRT-13 (Lost Cmd Time). For example, set the speed command to "2 (V1)" at DRV-07, and set IN-06 (V1 Polarity) to "0 (Unipolar)". When the voltage input drops to less than half of the value set at IN-08 (V1 Volt x 1), the protective function is activated.  The protective operation starts when the signal becomes smaller than the initial value of the analog input set by the speed command and it continues for the speed loss decision time set at PRT-13 (Lost Cmd Time). Codes IN-08 and IN-12 are used to set the standard values.					
PRT-14 Lost Preset F	In situations where speed commands are lost, set the operation mode (PRT-12 Lost Cmd Mode) to "5 (Lost Preset)". This operates the protection function and sets the frequency so that the operation can continue.						

Set IN-06 (V1 Polarity) to "Unipolar" and IN-08 to "5 (V)". Set PRT-15 (AI Lost Level) to "1 (Below x1)" and PRT-12 (Lost Cmd Mode) to "2 (Dec)" and then set PRT-13 (Lost Cmd Time) to 5 seconds. Then the inverter operates as follows:



#### Note

If speed command is lost while using communication options or the integrated RS-485 communication, the protection function operates after the command loss decision time set at PRT-13 (Lost Cmd Time) is elapsed.

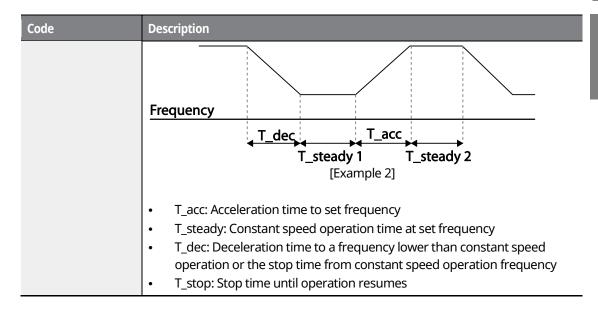
#### 10.2.6 Dynamic Braking (DB) Resistor Configuration

The iS7 series is divided into a model which features a built-in braking circuit and the other in which a separate external braking unit should be installed. 0.75–22 kW model types belong to the former (braking resistor unit is excluded) and for those model types above 30 kW, you should install a braking unit on the exterior of the inverter. Therefore the function of limiting the braking resistance use rate (%ED) is necessary for only models below 22 kW.

Group	Code	LCD Display	Parameter Setting		Setting Range	Unit
PRT	66	DB Warn %ED	-	10	0–30%	-
OUT	31-33	Relay1,2, Q1	31	DB Warn%ED	-	-

#### **Dynamic Breaking Resistor Setting Details**

Code	Description				
PRT-66 DB Warn %ED	Sets braking resistor configuration (%ED: Duty cycle). 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 is not output from the inverter after the 15 sec period has expired. An example of braking resistor set up is as follows: $\%ED = \frac{T\_dec}{T\_acc + T\_steady + T\_dec + T\_stop} \times 100\%$				
	T_acc T_steady 1 T_dec T_stop  [Example 1]				
	$\%ED = \frac{T\_dec}{T\_dec + T\_steady1 + T\_acc + T\_steady2} \times 100\%$				



#### ① 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 multi-function input.

#### 10.2.7 Underload Warning and Failure

The following table lists the under load fault trip and warning features of the iS7 series inverter.

Group	Code	LCD Display	Parameter Setting		Setting Range	Unit
PRT	04	Load Duty	0	Normal Duty	-	-
	25	UL Warn Sel	1	Yes	0–1	
	26	UL Warn Time	-	10.0	0-600.0	sec
	27	UL Trip Sel	1	Free-Run	-	-
	28	UL Trip Time	-	30.0	0-600.0	sec
	29	UL LF Level	-	30	10–30	%
	30	UL BF Level	-	30	10–100	%

## **Under Load Trip and Warning Setting Details**

Code	Description				
PRT-27 UL Trip Sel	Sets the inverter operation mode for situations when an under load trip occurs. If "1 (Free-Run)" is set, the output is blocked in an under load fault trip situation. If "2 (Dec)" is set, the motor decelerates and stops when an under load trip occurs.				
PRT-25 UL Warn Sel	Select the under load warning options. Set the multi-function output terminals (at OUT-30–32) to "6 (Underload)." The warning signals are output when an under load condition arises.				
PRT-29 UL LF Level, PRT-30 UL BF Level	Sets the range necessary for underload detection based on the underload type.  Set the underload rate at an operating frequency for the motor-rated slip speed (2x operation), (BAS-12 Rated Slip) at PRT-29.  At PRT-30, the under load rate is decided based on the base frequency set at DRV-18 (Base Freq). When variable torque is required (for example, for fans or pumps), set PRT-04 (Load Duty) to "0 (Normal Duty)." For loads operated at constant torques, like elevators and conveyors, set PRT-04 to "1 (Heavy Duty)."  Output current  PRT-30  Output  Frequency  Set to normal load (Normal duty: VT)  Output current  PRT-30  Rated slipX2  Output frequency  Set to heavy load (Heayvy duty: CT)				
PRT-26 UL Warn Time, PRT-28 UL Trip Time	The protection function operates when the under load level condition explained above is maintained for the set warning time or fault trip time. This function does not operate if the energy-saving operation is activated at ADV-50 (E-SaveMode)				

#### 10.2.8 Overspeed Fault

This function is performed when the control mode (DRV-09 Control Mode) is set to "Vector". If the motor rotates faster than the overspeed level (Over SPD Level) during the overspeed detection time (Over SPD Time), the inverter blocks output.

Group	Code	LCD Display	Parameter Setting		Unit
PRT	70	Over SPD Level	-	120.0	Hz
	72	Over SPD Time	-	0.01	Sec

#### **10.2.9 Speed Deviation Fault**

This function is performed when the control mode (DRV-09 Control Mode) is set to "Vector". If the motor rotates faster than the speed deviation limit (Speed Dev Band) for the set detection time (Speed Dev Time), the inverter will block output.

Group	Code	LCD Display	Parameter Setting		Unit
	73	Speed Dev Trip	1	Yes	-
PRT	74	Speed Dev Band	-	20.00	Hz
	75	Speed Dev Time	-	1.0	Sec

#### 10.2.10 Speed Sensor (Encoder) Fault Detection

This function can detect whether the encoder expansion module is installed to the inverter. When the encoder is installed, if the encoder signal cable (line drive type) connection is lost, encoder-related faults are detected. If a fault occurs, a message reading "Encoder Trip" is displayed.

Group	Code	LCD Display	Parameter Setting		Unit
PRT	77	Enc Wire Check	1	Yes	-
	78	Enc Check Time	-	1.0	sec

## 10.2.11 Fan Fault Detection

Group	Code	LCD Display	Parameter Setting		Unit
PRT	79	FAN Trip Mode	0	Trip	-
OUT	31-32	Relay 1,2	8	FAN Warning	-
OUT	33	Q1 Define			

## **Fan Fault Detection Setting Details**

Code	Description					
		Set the cooling fan fault mode.				
PRT-79 Fan Trip Mode	<b>Setti</b> 0	ng Trip	The inverter output is blocked and the fan trip is			
	1	Warning	displayed when a cooling fan error is detected.  When OUT-36 (Q1 Define) or OUT-31–35 (Relay1, 2) is set to "8 (FAN Warning)", the fan error signal is output and the operation continues.			
OUT-33 Q1 Define, OUT-31–32 Relay1, 2	When the code value is set to "8 (FAN Warning)", the fan error signal is output and operation continues. However, when the inverter's internal temperature rises above a certain level, output is blocked due to activation of overheat protection.					

# 10.2.12Low Voltage Fault Trip

Group	Code	LCD Display	Parameter Setting		Unit
PRT	81	LVT Delay	-	0.0	sec
OUT	31-32	Relay 1,2	11	Low Voltage	-
001	33	Q1 Define			

## **Low Voltage Fault Trip Setting Details**

Code	Description
PRT-81 LVT Delay	When inverter input power is lost and the internal DC link voltage drops below a certain voltage level, the inverter will block the output and a low

Code	Description
	voltage trip will occur. If the PRT-81 LVT Delay time is set, the inverter blocks output first when a low voltage trip condition arises, then a fault trip will occur after the low voltage trip decision time has passed. The warning signal for a low voltage fault trip can be provided using the multi-function output or a relay. However, the low voltage trip delay time (LVT Delay time) does not apply to warning signals.
OUT-33 Q1 Define, OUT-31–32 Relay1, 2	Set to "11 (Low Voltage)". The inverter stops the output first when a low voltage trip condition occurs, then a fault trip occurs after the low voltage trip decision time elapses.

# 10.2.13 Output Block via the Multi-Function Terminal

Group	Code	LCD Display	Parameter Setting		Setting Range	Unit
IN	65–72	Px Define	5	BX	-	-
PRT	45	BX Mode	-	0.0	0.0-600.0	

# **Output Block by Multi-function Terminal Setting Details**

Code	Description
IN-65–71 Px Define	When the operation of the multi-function input terminal is set to "5 (BX)" and is turned on during operation, the inverter blocks the output and "BX" is displayed on the keypad display. While "BX" is displayed on the keypad, the inverter's operation information including the operation frequency and current at the time of the BX signal can be monitored. The inverter resumes operation when the BX terminal turns off and operation command is input.
PRT-45	The default setting value of BX mode (PRT-45) is 0.0 [sec], and it allows the inverter to operate in free-run mode. If the BX terminal receives input, the inverter will block output immediately. If BX mode (PRT-45) is set to 0.1 [sec], the motor will decelerate by value set at PRT-45.  If PRT-45 set value is too small, the inverter cannot decelerate at that value and OVT may occur. Set the PRT45 time according to the inverter capacity and load.

## 10.2.14Trip Status Reset

Group	Code	LCD Display	Parameter Setting		Unit
IN	65-72	Px Define	3	RST	-

## **Trip Status Reset Setting Details**

Code	Description
IN-65–72 Px Define	Press the [Stop/Reset] key on the keypad or use the multi-function input terminal to restart the inverter. Set the multi-function input terminal to "3 (RST)" and turn on the terminal to reset the trip status.

## 10.2.15 Operation Mode On Optional Expansion Module Fault Trip

Optional extension module trips may occur when an optional extension module is used with the inverter. Set the operation mode for the inverter when a communication error occurs between the optional extension module and the inverter body, or when the optional extension module is detached during operation.

Group	Code	LCD Display	Parameter Setting		Unit
PRT 80		0	None		
	80	Opt Trip Mode	1	Free-Run	1:Free-Run
		2	Dec	1	

## **Optional Expansion Module Fault Trip Setting Details**

Code	Des	Description						
	Set	ting	Function					
	0	None	No operation					
PRT-80 Opt Trip Mode	1	Free-Run	The inverter output is blocked and fault trip information is shown on the keypad.					
	2	Dec	The motor decelerates to the value set at PRT-07 (Trip Dec Time).					

## 10.2.16 No Motor Trip

Group	Code No.	LCD Display	Parameter Setting		Setting Range	Unit
	31	No Motor Trip	0	None	-	-
PRT	32	No Motor Level		5	1–100	%
	33	No Motor Time		3.0	0.1–10.0	sec

#### **No Motor Trip Setting Details**

Code	Description
PRT-32 No Motor Level, PRT-33 No Motor Time	If the output current value [based on the rated current (BAS-13)] is lower than the value set at PRT-32 (No Motor Level), and if this continues for the time set at PRT-33 (No Motor Time), a "no motor trip" occurs.

#### ① Caution

If BAS-07 (V/F Pattern) is set to "1 (Square)", set PRT-32 (No Motor Level) to a value lower than the factory default. Otherwise, "No Motor Trip" due to a lack of output current will result when the 'No Motor Trip' operation is set.

## 10.2.17Low Voltage Fault Trip 2 During Operation

Group	Code	LCD Display	Parameter Setting range		Unit
PRT	82	Low Voltage2	00~11	00 : default	Bit

If input power is disconnected during inverter operation and internal DC voltage decreases lower than a certain voltage, the inverter disconnects the output and displays low voltage "2" on the keypad.

Even if the voltage increases and goes back to the normal state, unlike a low voltage fault, it remains in a fault state until the user unlocks the fault state.

If PRT-82 (LV2 Enable) is set to "01," and if the input power is disconnected during inverter operation and the internal DC voltage drops to lower than a certain voltage, the inverter stops output and displays "Low Voltage2." Unlike the low voltage trip (Low Voltage), the low voltage 2 (Low Voltage2) trip will not be reset even after the internal DC voltage of the inverter has recovered to above the trip level. Therefore, you must reset the inverter to reset the trip. The

trip history will not be stored after the reset.

Set PRT-82 (LV2 Enable) to "11" to store the trip history.

## **Low Voltage 2 Trip Details**

Code	Description							
	Set optio	Set options for Low Voltage2 trip operation.						
	Bit setting	Function						
		Disable Low Voltage2 trip (Low Voltage trip is used).						
PRT-82		Enable Low Voltage2 trip but do not store the trip history.						
		Disable Low Voltage2 trip (Low Voltage trip is used).						
		Enable Low Voltage2 trip and store the trip history.						

# **10.3 List of Faults and Warnings**

The following list shows the types of faults and warnings that can occur while using the iS7 inverter.

Category	Category		Details	
		Over Current1	Over current trip	
		Over Voltage	Over voltage trip	
	Latch type	External Trip	Trip due to an external signal	
		NTC Open	Temperature sensor fault trip	
Major fault		Over Current2	ARM short current fault trip	
		Fuse Open	Fuse open trip	
		Option Trip-x	Option fault trip	
		Over Heat	Over heat fault trip	
		Out Phase Open	Output open-phase fault trip	

Category		LCD Display	Details
		In Phase Open	Input open-phase fault trip
		Inverter OLT	Inverter overload fault trip
		Over Speed	Over speed fault trip
		Ground Trip	Ground fault trip
		Encoder Trip	Speed sensor fault trip
		Fan Trip	Fan fault trip
		ParaWrite Trip	Write parameter fault trip
		E-Thermal	Motor overheat fault trip
		Thermal Trip	Temperature fault trip
		Pre-PID Fail	Pre-PID operation fault trip
		IO Board Trip	IO Board connection fault trip
		Speed Dev Trip	Trip from speed deviation
		Ext-Brake	External brake fault trip
		No Motor Trip	No motor fault trip
	Level type	Low Voltage	Low voltage fault trip
		BX	Emergency stop fault trip
		Lost Command	Command loss trip
		Lost Keypad	Lost-keypad fault trip
		EEP Err	External memory error
		ADC Off Set	Analog input error
	Hardware	Watch Dog-1	CDI I Watch Day fault triin
	damage	Watch Dog-2	- CPU Watch Dog fault trip
		Gate Pwr Loss	DRV operation power error
		Over Load	Motor overload trip
Minorfoult		Under Load	Motor under load trip
Minor fault		Lost Command	Lost command fault trip
		Lost Keypad	Lost keypad fault trip
Marnin		Lost Command	Command loss fault trip warning
Warning		Over Load	Overload warning

Category	LCD Display	Details
	Under Load	Under load warning
	Inverter OLT	Inverter overload warning
	Fan Warning	Fan operation warning
	DB Warn %ED	Braking resistor braking rate warning
	Enc Conn Check	Enc connection error warning
	Enc Dir Check	Rotating direction error warning
	Lost Keypad	Lost keypad warning
	Retry Tr Tune	Rotor time constant tuning error
	Fire Mode	Fire mode warning
	PID Sleep	PID Sleep mode warning
	AUX Power On	AUX Power On warning

## 11 Communication Function

## 11.1 Introduction

This chapter explains the standards, installation process, and programs for the SV-iS7 inverter serial communication method when using personal computers or factory automation (FA) computers. The communication function for the SV-iS7 inverter series is designed to remotely operate or monitor the SV-iS7 inverter series using personal computers or FA computers.

## **Advantages of Operating the Inverter with Network Communication**

As the inverter can be operated or monitored by the user programs, it is easy to apply the inverter to factory automation.

Features	Examples of application						
Monitor or modify parameters via computers	<ul> <li>T_acc</li> <li>T_dec</li> <li>Frequency</li> <li>Lost command</li> </ul>						
Interface configuration for RS-485 standard	<ul> <li>Performs communication between the inverter and computers produced by numerous companies.</li> <li>Controls up to 16 inverters at a time with one computer using the multidrop link system.</li> <li>Provides an interface for noise immunity environments.</li> </ul>						

Inverters can communicate with computers embedded with the RS-232 module via RS-232/485 converters. The standards and performance of converters may vary depending on the manufacturer, but the basic functions are the same. For more details about standards and guidelines, users are advised to consult the manual provided by the specific manufacturer.

## ① Caution

Read this manual carefully before installation and operation. All instructions in this manual must be followed to avoid injury or prevent damage to other components.

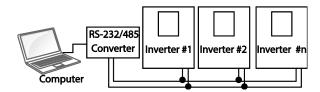
# **11.2 Specifications**

Category	Specifications
Communication method	RS-485
Transfer form	Bus type, Multi-drop link system
Inverter type name	SV-iS7 series
Converter	Embedded with RS-232
Number of connected inverters	Maximum of 16
Transfer distance	Maximum 1,200 m (recommended distance: within 700 m)
Recommended cable size	0.75 mm2 , (18AWG), Shielded twisted-pair (STP) wire
Installation type	Dedicated terminals (S+/S-/SG) on the control terminal block
Communication Power	Supplied by the inverter - insulated power source from the inverter's internal circuit communication power (supplied from the inverter)
Communication Speed	1,200/2,400/9,600/19,200/38,400 bps
Control procedure	Asynchronous communications system
Communication system	Half duplex system
Letter system	Modbus-RTU: BINARY/LS Bus: ASCII
Stop bit length	1-bit/2-bit
Sum check	2 byte
Parity check	None/Even/Odd

## 11.3 Communication System Configuration

In an RS-485 communication system, the PLC or computer is the master device and the inverter is the slave device. When using a computer as the master, the RS-232 converter must be integrated with the computer, so that it can communicate with the inverter through the RS-232/RS-485 converter. Specifications and performance of converters may vary depending on the manufacturer, but the basic functions are identical. Please refer to the converter manufacturer's user manual for details about features and specifications.

Connect the wires and configure the communication parameters on the inverter by referring to the following illustration of the communication system configuration.



- RS-485 terminal connection: Connect the RS-485 communication line to the S+/S-/SG terminals.
- Number of connectable inverters: Up to 16 inverters
- Number of extendable addresses (St ID): 1–250 addresses
- Length of effective communication lines: 1,200 m max. Keep it below 700 m for stable communication.

#### ① Caution

When wiring the communication line, make sure that the SG terminals on the PLC and inverter are connected. SG terminals prevent communication errors due to electronic noise interference.

Use a communication repeater to enhance the communication speed if you have to use a communication cable above 1,200 m, or to connect an additional inverter. A repeater is effective when smooth communication is not available due to noise interference.

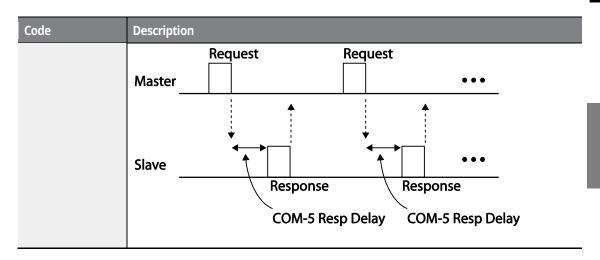
# **11.4 Basic Settings**

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	Parameter Setting		Setting Range	Unit
СОМ	01	Int485 St ID	-	1	1–250	-
	02	Int485 Proto	0	ModBus RTU	0-3	-
	03	Int485 BaudR	3	9600	0–5	bps
	04	Int485 Mode	0	D8 / PN / S1	0-3	-
	05	Resp Delay	-	5	0–1000	ms

## **Communication Parameters Setting Details**

Code	Descrip	Description					
COM-01 Int485 St ID	Sets th	Sets the inverter station ID between 1 and 250.					
	Select	one of the two b	uilt-in բ	protocols: Modbus-RTU and LS INV 485			
COM-02 Int485	Setting	g		Function			
Proto	0	Modbus-RTU		Modbus-RTU compatible protocol			
Proto	1	Reserved		Not used			
	2	LS INV 485		Dedicated protocol for the LS inverter			
COM-03 Int485 BaudR	Sets a	Sets a communication setting speed of up to 38,400 bps.					
	Set a communication configuration. Set the data length, parity check method, and the number of stop bits.						
COM-04 Int485	Setting						
Mode	0	D8/PN/S1		data / no parity check / 1 stop bit			
	1	D8/PN/S2		data / no parity check / 2 stop bits			
	2	D8/PE/S1	8-bit	data / even parity / 1 stop bit			
	3	D8/PO/S1	8-bit data / odd parity / 1 stop bit				
COM-05 Resp Delay	The built-in 485 communication (Modbus-RTU or LS INV 485) device performs as a slave. The slave iS7 responds to the master after the period of time set in this function code.						



# 11.5 Setting Operation Command and Frequency

After setting the DRV-06 (Cmd Source) to "3 (Int 485)" and DRV-07 (Freq Ref Src) to "7 (Int 485)," you can set common area parameters for the operation command and frequency via communication.

Group	Code	LCD Display	Parameter Setting		Unit
DRV	06	Cmd Source	3	Int 485	-
	07	Freq Ref Src	7	Int 485	-

## 11.6 Command Loss Protection

Configure the command loss decision standards and protective operations run when a communication problem lasts for a specified period of time.

Group	Code	LCD Display	Parame	ter Setting	Unit
PRT	12	Lost Cmd Mode	1	Free-Run	-
	13	Lost Cmd Time	-	1.0	Sec
	14	Lost Preset F	-	0.00	Hz
OUT	31-33	Relay1,2, Q1	12	Lost Command	-

## **Command Loss Protective Operation Setting Details**

Code	Desc	Description				
		•	to run when a communication error has occurred and time set at PRT-13.			
	Setti	ng	Function			
PRT-12 Lost Cmd Mode, PRT-13 Lost Cmd Time	0	None	The speed command immediately becomes the operation frequency without any protection function.			
	1	Free-Run	The inverter blocks output. The motor performs in free-run condition.			
	2	Dec	The motor decelerates and then stops.			
	3	Hold Input	Operates continuously with the speed of the inputted speed command until the loss of the speed command.  The inverter calculates the average input value for 10 seconds before the loss of the speed command and uses it as the speed reference.			
	4	Hold Output	Operates continuously with the operate frequency before the speed loss. The inverter calculates the average output value for 10 seconds before the loss of the speed command and uses it as the speed reference.			
	5	Lost Preset	The inverter operates at the frequency set at PRT-14 (Lost Preset F).			
PRT-14 Lost Preset F		ne Lost Preset fr o "5 (Lost Preset	requency that will be applied if PRT-12 (Lost Cmd Mode) is )."			

Caution) If PRT-13 (Lost Cmd Time) is set to "0.0" (sec), protection features may be activated even during a normal operation, depending on the type of command source. To prevent this, appropriately set the lost command decision time.

# 11.7 Setting Virtual Multi-Function inputs

Multi-function input can be controlled using a communication address (0h0385). Set codes COM-70-85 to the functions to operate, and then set the BIT relevant to the function to 1 at 0h0385 to operate it.

Group	Code	LCD Display	Parameter Setting		Unit
COM	70-85	Virtual DI x	0	None	-

Group	Code	LCD Display	Parameter Setting		Unit
	86	Virt DI Status	-	-	-

For example, if you want to send an Fx command by controlling a virtual multi-function input command addresses with Int485, the Fx function is performed if 0h0001 is input in 0h0385 after COM-70 (Virtual DI 1) is set to "FX". Before you configure the virtual multi-function inputs, set the DRV-06 (CMD source) depending on the command source.

Virtual multi-function operates independently from the analog multi-function inputs and cannot be set redundantly. Virtual multi-function input can be monitored using COM-86 (Virt DI Status).

## 11.8 Saving Parameters Defined by Communication

If you turn off the inverter after setting the common area parameters or keypad parameters via communication and operate the inverter, the changes are lost and the values changed via communication revert to the previous setting values when you turn on the inverter.

Set CNF-48 to "1 (Yes)" to allow all the changes over communication to be saved, so that the inverter retains all the existing values even after the power has been turned off.

Setting address 0h03E0 to "0" and then setting it again to "1" via communication allows the existing parameter settings to be saved. However, setting address 0h03E0 to "1" and then setting it to "0" does not carry out the same function.

Before reading the parameters utilizing CNF-46 (Parameter Read), make sure to save the parameter changes (Parameter Save) to read the parameter values reflecting the changes in the communication module parameters.

Group	Code	LCD Display	Setting Display		Unit
CNF 40	Davis and a Court	0	-No-	-	
CINF	CNF 48 F	Parameter Save	1	-Yes-	-

# 11.9 Communication Frame Monitoring

You can easily monitor the status (normal, CRC/Checksum error, other errors, etc.) of the communication frame being received from the master by using the keypad.

Group	Code	LCD Display	Setting Display		Unit
	90	Comm Mon Sel	0	Int 485	-
	91	Rcv Frame Num	-	-	-
COM	92 93 94	Err Frame Num	-	-	-
COM		NAK Frame Num	-	-	-
		Comm Update	0	-No-	
			1	-Yes-	-

## **Communication Frame Monitoring Details**

Code	Description
COM-90 Comm Mon Sel	Selects the communication channel to monitor.
COM-91 Rcv Frame Num	Counts the number of communication frames received normally from the master device.
COM-92 Err Frame Num	Counts the number of CRC errors when the Modbus-RTU is set and counts Checksum errors when the LS Inv 485 is set.
COM-93 NAK Frame Num	Counts the number of errors (communication address errors, data range errors, writing prohibition errors) that occur in the communication frames received from the master device.
COM-94 Comm Update	Reconnects the communication after the initial status parameter is changed to communication speed (baud rate), etc.

# 11.10 Special communication Area Settings

The following table lists the memory map of the entire memory addresses used for network communication in the iS7 series inverters.

Communication Area	Memory Map	Description
Common iS5 compatible	0h0000 - 0h00FF	Area compatible with iS5

Communication Area	Memory Map	Description
communication area		
	0h0100 - 0h01FF	Area registered in COM31–38, COM51–58
Parameter registration type area	0h0200 - 0h023F	Area registered in User Group
	0h0240 - 0h027F	Area registered in Macro Group
	0h0280 - 0h02FF	Reserved
	0h0300 - 0h037F	Inverter monitoring area
	0h0380 - 0h03DF	Inverter control area
	0h03E0 - 0h03FF	Inverter memory control area
	0h0400 - 0h0FFF	Reserved
	0h1100	DRV Grp
	0h1200	BAS Grp
	0h1300	ADV Grp
Common iS7	0h1400	CON Grp
communication area	0h1500	IN Grp
	0h1600	OUT Grp
	0h1700	COM Grp
	0h1800	APP Grp
	0h1900	AUT Grp
	0h1A00	APO Grp
	0h1B00	PRT Grp
	0h1C00	M2 Grp

# 11.11 Parameter Group for Periodical Data **Transmission**

By defining a parameter group for data transmission, the communication addresses registered in the communication function group (CM) can be used in communication. Parameter groups for data transmission may be defined to simultaneously transmit multiple parameters into the communication frame.

Group	Code No.	Function Display		ng Display	Unit
СОМ	31-38	Para Status-h	-	-	Hex
	51-58	Para Control-h	-	-	Hex

## **Parameter Group for Periodical Data Transmission Details**

Addresses	Description				
	Reads the parameter registered in COM-31-38 Status Para-h (read only).				
	Address	Parameter	Allotment for Bits		
	0h0100	Status Parameter #1	Parameter value registered at COM-31		
	0h0101	Status Parameter #2	Parameter value registered at COM-32		
01 04 00 01 04 07	0h0102	Status Parameter #3	Parameter value registered at COM-33		
0h0100-0h0107	0h0103	Status Parameter #4	Parameter value registered at COM-34		
	0h0104	Status Parameter #5	Parameter value registered at COM-35		
	0h0105	Status Parameter #6	Parameter value registered at COM-36		
	0h0106	Status Parameter #7	Parameter value registered at COM-37		
	0h0107	Status Parameter #8	Parameter value registered at COM-38		
	Reads and writes the parameter registered in COM-51-58 Control Para-h (both read and write.				
	Address	Parameter	Allotment for Bits		
	0h0110	Control Parameter #1	Parameter value registered at COM-51		
	0h0111	Control Parameter #2	Parameter value registered at COM-52		
0h0110-0h0117	0h0112	Control Parameter #3	Parameter value registered at COM-53		
	0h0113	Control Parameter #4	Parameter value registered at COM-54		
	0h0114	Control Parameter #5	Parameter value registered at COM-55		
	0h0115	Control Parameter #6	Parameter value registered at COM-56		
	0h0116	Control Parameter #7	Parameter value registered at COM-57		
	0h0117	Control Parameter #8	Parameter value registered at COM-58		

## ① Caution

When registering control parameters, register the operation speed (0h0005, 0h0380, 0h0381) and operation command (0h0006, 0h0382) parameters at the end of a parameter control frame. For example, when the parameter control frame has 5 parameter control items (Para Control - x), register the operation speed at Para Control-4 and the operation command to Para Control-5.

# 11.12 Parameter Group for Transmission of Macro Group and User Group at U&M Mode

By defining the user and macro parameter groups, communication can be carried out using the user defined user group (USR) and macro group (MAC) addresses that are registered in U&M mode.

Addresses	Descriptio	Description				
	Writes and reads the USR parameters set by the keypad via the addresses 0h0200–0h023F.					
	Address	Parameter	Allotment for Bits			
U&M>USR-1-64	0h0200	User Grp. Code 1	Parameter value registered at U&M>USR->1			
User Grp. Para h	0h0201	User Grp. Code 2	Parameter value registered at U&M>USR->2			
	0h023E	User Grp. Code 63	Parameter value registered at U&M>USR->63			
	0h023F	User Grp. Code 64	Parameter value registered at U&M>USR->64			
	Writes an 0h2400-0	•	rameters set by the keypad via the addresses			
	Address	Parameter	Allotment for Bits			
U&M>MAC-1-64	0h0240	Macro Grp. Code 1	Parameter value registered at U&M>MAC-1			
Macro Grp. Para	0h0241	Macro Grp. Code 2	Parameter value registered at U&M>MAC-2			
h						
	0h02A2	Macro Grp. Code 63	Parameter value registered at U&M>MAC-63			
	0h02A3	Macro Grp. Code 64	Parameter value registered at U&M>MAC-64			

## 11.13 Communication Protocol

#### 11.13.1 LS INV 485 Protocol

The slave device (inverter) responds to read and write requests from the master device (PLC or PC).

## 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 that uses characters 0-9 and A-F.
- CMD: Uses uppercase characters (returns an IF error if lowercase characters are encountered).

Character	ASCII-HEX	Command
'R'	52h	Read
<b>W</b> ′	57h	Write
'Χ'	58h	Request monitor registration
Υ′	59h	Perform monitor registration

- Data: ASCII-HEX (for example, when the data value is 3000: 3000  $\rightarrow$  '0"B"B"8'h  $\rightarrow$  30h 42h 42h 38h)
- Error code: ASCII-HEX (20h-7Fh)
- Transmission/reception buffer size: Transmission=39 bytes, Reception=44 bytes
- Monitor registration buffer: 8 Words
- SUM: Checks communication errors via sum.
- SUM=a total of the lower 8 bits values for station ID, command and data (Station ID+CMD+Data) in ASCII-HEX.
- For example, a command to read 1 address from address 3000: SUM='0'+'1'+'R'+'3'+'0'+'0'+'0'+'1' = 30h+31h+52h+33h+30h+30h+31h = 1A7h (the control value is not included: ENQ, ACK, NAK, etc.

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

#### Note

#### **Broadcasting**

Broadcasting 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 issued for commands transmitted by broadcasting.

#### **Error operation**

For two or more data communications, when an error occurs as a result of the previous data communication, the current data communication can be made normally regardless of the error occurred as a result of the previous data communication.

#### 11.13.1.1 Detailed Read Protocol

## **Read Request**

Reads successive n words from address XXXX.

ENQ	Station ID	CMD	Address	Number of Addresses	SUM	EOT
05h	'01'–'1F'	'R'	'XXXX'	'1'–'8' = n	XX′	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	2 bytes	1 byte

Total bytes=12. Characters are displayed inside single quotation marks(').

## **Read Normal Response**

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01'–'1F'	'R'	'XXXX'	'XX'	04h
1 byte	2 bytes	1 byte	n x 4 bytes	2 bytes	1 byte

Total bytes=  $(7 \times n \times 4)$ : a maximum of 39

## **Read Error Response**

NAK	Station ID	CMD	Error code	SUM	EOT
15h	ʻ01'-ʻ1F'	'R'	<b>'</b> **'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes=9

## 11.13.1.2 Detailed Write Protocol

## **Write Request**

ENQ	Station ID	CMD	Address	Number of Addresses	Data	SUM	EOT
05h	'01'–'1F'	W'	'XXXX'	'1'–'8' = n	'XXXX'	'XX'	04h
1 byte	2 bytes	1 byte	4 bytes	1 byte	n x 4 bytes	2 bytes	1 byte

Total bytes=  $(12 + n \times 4)$ : a maximum of 44

## **Write Normal Response**

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01'–'1F'	W'	'XXXX'	'XX'	04h
1 byte	2 bytes	1 byte	n x 4 bytes	2 bytes	1 byte

Total bytes=  $(7 + n \times 4)$ : a maximum of 39

## **Write Error Response**

NAK	Station ID	CMD	Error Code	SUM	EOT
15h	'01'–'1F'	'W'	' <del>**</del> '	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes=9

## 11.13.1.3 Monitor Registration Detailed Protocol

Monitor registration request is made to designate the type of data that requires continuous monitoring and periodic updating.

## **Monitor Registration Request**

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'–'1F'	'Χ'	'1'–'8'=n	'XXXX'	'XX'	04h
1 byte	2 bytes	1 byte	1 byte	n x 4 bytes	2 bytes	1 byte

Total bytes=  $(8 + n \times 4)$ : a maximum of 40

## **Monitor Registration Normal Response**

ACK	Station ID	CMD	SUM	EOT
06h	'01'–'1F'	'Χ'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	1 byte

Total bytes=7

## **Monitor Registration Error Response**

NAK	Station ID	CMD	Error Code	SUM	EOT
15h	'01'–'1F'	'Χ'	' <del>*</del> *'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes=9

#### 11.13.1.4 Monitor Execution Detailed Protocol

#### **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'–'1F'	Υ'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	1 byte

Total bytes=7

## **Monitor Registration Execution Normal Response**

ACK	Station ID	CMD	Data	SUM	EOT
06h	'01'–'1F'	Υ'	'XXXX'	'XX'	04h
1 byte	2 bytes	1 byte	n x 4 bytes	2 bytes	1 byte

Total bytes=  $(7 + n \times 4)$ : a maximum of 39

## **Monitor Registration Execution Error Response**

NAK	Station ID	CMD	Error Code	SUM	EOT
15h	'01'–'1F'	Υ'	<b>'</b> **'	'XX'	04h
1 byte	2 bytes	1 byte	2 bytes	2 bytes	1 byte

Total bytes=9

## 11.13.1.5 Error Code

Code	Abbreviation	Description
01: ILLEGAL FUNCTION	IF	The requested function cannot be performed by a slave because the corresponding function does not exist.
02: ILLEGAL DATA ADDRESS	IA	The received parameter address is invalid at the slave.
03: ILLEGAL DATA VALUE	ID	The received parameter data is invalid at the slave.
21: 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)
22: FRAME ERROR	FE	The frame size does not match.

## 11.13.2 Modbus-RTU protocol

## 11.13.2.1 Function Code and Protocol (unit: byte)

## Function Code #03 (Read Holding Register)

#### <Query>

## **Field Name** Slave Address **Function** Byte Count

Data Hi (Register 40108)

Data Lo (Register 40108)

Data Hi (Register 40109)

Data Lo (Register 40109)

Data Hi (Register 40110) Data Lo (Register 40110)

CRC Lo CRC Hi

<Response>

Sta	rtina	Address Hi

Starting Address Lo

# of Points Hi

**Field Name** 

Function

Slave Address

# of Points Lo

CRC Lo

CRC Hi

# Function Code #04 (Read Input Register)

#### <Query>

<res< th=""><th>po</th><th>nse</th><th>)</th></res<>	po	nse	)
	Ρ.		-

Field Name
Slave Address
Function
Starting Address Hi
Starting Address Lo
# of Points Hi
# of Points Lo
CRC Lo
CRC Hi

Field Name
Slave Address
Function
Byte Count
Data Hi (Register 30009)
Data Lo (Register 30009)
CRC Lo
CRC Hi

## Function Code #06 (Preset Single Register)

#### <Query>

## Field Name Slave Address Function Register Address Hi Register Address Lo Preset Data Hi Preset Data Lo

#### <Response>

Field Name
Slave Address
Function
Register Address Hi
Register Address Lo
Preset Data Hi
Preset Data Lo
CRC Lo
CRC Hi

#### Function Code #16 (hex 0x10) (Preset Multiple Register)

## <Query>

CRC Lo CRC Hi

Field Name
Slave Address
Function
Starting Address Hi
Starting Address Lo
# of Register Hi
# of Register Lo
Byte Count
Data Hi
Data Lo
Data Hi
Data Lo
CRC Lo
CRC Hi

#### <Response>

Field Name
Slave Address
Function
Starting Address Hi
Starting Address Lo
# of Register Hi
# of Register Lo
CRC Lo
CRC Hi

#### <Exception Code>

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

## <Response>

Field Name
Slave Address
Function*
Exception Code
CRC Lo
CRC Hi

<sup>\*</sup> Function value is the set value of the highest bit of the query function value.

## 11.13.3 iS7/iS5/iG5/iG5A Compatible Common Area Parameter

Address	Parameter	Scale	nit	R/W	Assigne	d conte	nt by b	it	
0h0000	Inverter model	-	-	R	B: iS7				
					0: 0.75 k	kW	1: 1.5	kW	2: 2.2 kW
					3: 3.7 kV	W	4: 5.5 k	¢W	5: 7.5 kW
					6: 11 kV	V	7: 15 k	W	8: 18.5 kW
0h0001	Invertor capacity			R	9: 22 kV	V 1	0: 30 k	:W	11: 37 kW
0110001	Inverter capacity	-	-	K	12: 45 k	W 1	3: 55 k	(W	14: 75 kW
					15: 90 k	W 1	6: 110	kW	17: 132 kW
					18: 160	kW 1	9: 200	kW	20: 220 kW
					21: 280	kW 2	22: 375	kW	65535: 0.4 kW
0h0002	Inverter input			R	0: 220 V	/ class			
0110002	voltage	_	-	ĸ	1: 400 V class				
0h0003	Version	-	-	R	Ex.) 0x0100: Version 1.00				
0110003	version			ĸ	0x0	101: Ve	rsion 1	1.01	
0h0004	Reserved	-	-	R/W	-				
0h0005	Command frequency	0.01	Hz	R/W	-				
	rrequericy				B15 R	eserved	<u>-</u>		
	Operating				-	: Keypa		1: Keypac	d Tora
	command							block Multi-st	•
0h0006	(option)	_	_	R	B12 1	7: Up		18: Down	19: STEADY
0110000	* Refer to	-		K	P11 20	0: AUTC	D-A	21: AUTO-B	22: V1
	additional description				25	3: I1		24: V2	25: I2
						6: Reser		27: Built-in48	35
					B9 28	୪: Comr	munica	ation option	

Address	Parameter	Scale	nit	R/W	Assig	Assigned content by bit				
						29: PLC option 30: JOG 31: PID				
					B8	0: Keypad 1: FX/RX-1 2: FX/RX-2				
					B7	3: Built-in 485 4: Communication option				
					B6	5: PLC option				
					B5	Reserved				
					B4	Emergency stop				
				R/W	В3	W: Trip reset (0 ->1) R: Trip status				
				IV VV	B2	Reverse operation (R)				
					B1	Forward operation (F)				
					В0	Stop (S)				
0h0007	Acceleration time	0.1	sec	R/W	-					
0h0008	Deceleration time	0.1	sec	R/W	-					
0h0009	Output current	0.1	Α	R	-					
0h000A	Output frequency	0.01	Hz	R	-					
0h000B	Output voltage	1	٧	R	-					
0h000C	DC Link voltage	1	V	R	-					
0h000D	Output power	0.1	kW	R	-					
					B15	0: Remote, 1: Keypad Local				
					B14	1: Frequency command by comm. (Built-in type, Option)				
					B13	1: Run command by comm. (Built-in type, Option)				
					B12	Reverse direction run command				
					B11	Forward direction run command				
					B10	Brake open signal				
OHOODE	Operation status				В9	Jog mode				
UNUUUE	Operation status	-	-	-	B8	Stop				
					B7	DC Braking				
					B6	Speed reached				
					B5	Decelerating				
					B4	Accelerating				
					В3	Operates depending on the set value of Fault (Trip) *OUT-30 Trip Out Mode				
					B2	Reverse operation				
	1			1	ı	<u>'</u>				

B1   Forward operation   B0   Stop	Address	Parameter	Scale	nit	R/W	Assig	ned content by bit
Bit   Reserved						B1	Forward operation
Pault trip   Fault trip   Fau						В0	Stop
Dh000F   Fault trip information   -						B15	Reserved
Pault trip information   -   -						B14	Reserved
Pault trip information						B13	Reserved
Pault trip information						B12	Reserved
Pault trip information   -   -						B11	Reserved
Pault trip information						B10	H/W-Diag
Information   -						B9	Reserved
B7   Reserved	OHOODE	Fault trip			D	B8	Reserved
B5   Reserved	0110001	information	_		K	В7	Reserved
B4   Reserved						B6	Reserved
B3   Level Type Trip     B2   Reserved     B1   Reserved     B0   Latch Type Trip     B15   Reserved     B14   Reserved     B13   Reserved     B14   Reserved     B15   Reserved     B16   Reserved     B17   Reserved     B18   Reserved     B19   Reserved     B19   Reserved     B10   P11 (I/O expansion)     B10   P11 (I/O expansion)     B11   Reserved     B12   Reserved     B13   Reserved     B14   Reserved     B15   Reserved     B16   P7     B17   P8     B18   P9 (I/O expansion)     B19   P10 (I/O expansion)     B10   P1   P10     B11   P2     B12   P3     B11   P2     B15   Reserved     B16   P7     B17   P8     B18   P9     B19   P10     B10   P10						B5	Reserved
B2   Reserved						B4	Reserved
B1   Reserved						В3	Level Type Trip
B0   Latch Type Trip						B2	Reserved
B15   Reserved						B1	Reserved
B14   Reserved						В0	Latch Type Trip
0h0010						B15	Reserved
0h0010 Input terminal information R R B12 Reserved B11 Reserved B10 P11 (I/O expansion) B9 P10 (I/O expansion) B8 P9 (I/O expansion) B7 P8 B6 P7 B5 P6 B4 P5 B3 P4 B2 P3 B1 P2 B0 P1  Oh0011 Output terminal R B15 Reserved B10 P10 (I/O expansion) B9 P10 (I/O expansion) B7 P8 B6 P7 B5 P6 B4 P5 B3 P4 B2 P3 B1 P2 B0 P1						B14	Reserved
Oh0010 Input terminal information R R B11 Reserved B10 P11 (I/O expansion) B9 P10 (I/O expansion) B7 P8 B6 P7 B5 P6 B4 P5 B3 P4 B2 P3 B1 P2 B0 P1 Oh0011 Output terminal R B11 Reserved B10 P11 (I/O expansion) B8 P9 (I/O expansion) B7 P8 B6 P7 B5 P6 B4 P5 B3 P4 B2 P3 B1 P2 B0 P1 B15 Reserved						B13	Reserved
Oh0010 Input terminal information R R B10 P11 (I/O expansion) B9 P10 (I/O expansion) B8 P9 (I/O expansion) B7 P8 B6 P7 B5 P6 B4 P5 B3 P4 B2 P3 B1 P2 B0 P1 Oh0011 Output terminal R B15 Reserved						B12	Reserved
Oh0010 Input terminal information -   R   B9   P10 (I/O expansion)						B11	Reserved
0h0010						B10	P11 (I/O expansion)
0h0010 information - R B7 P8 B6 P7 B5 P6 B4 P5 B3 P4 B2 P3 B1 P2 B0 P1  Oh0011 Output terminal - R B7 Reserved						B9	P10 (I/O expansion)
B7   P8     B6   P7     B5   P6     B4   P5     B3   P4     B2   P3     B1   P2     B0   P1     B15   Reserved   B15   Rese	060010	Input terminal			D	B8	P9 (I/O expansion)
B5   P6   B4   P5   B3   P4   B2   P3   B1   P2   B0   P1   B15   Reserved   B15   Reserv	0110010	information	-	-	K	B7	P8
B4   P5   B3   P4   B2   P3   B1   P2   B0   P1   B15   Reserved   B15   Reserved   B2   Reserved   B15						B6	P7
B3   P4     B2   P3     B1   P2     B0   P1     B15   Reserved   B15   R						B5	P6
B2   P3   B1   P2   B0   P1   B15   Reserved   B15   Re						B4	P5
B1   P2     B0   P1     P1   P2   P1   P2   P1   P2   P1   P2   P1   P2   P1   P2   P1   P1						В3	P4
B0 P1   B15 Reserved   B15 Reserve						B2	P3
Oh0011 Output terminal - R B15 Reserved						B1	P2
0h0011   . '   -   -   R   <del>                                </del>						В0	P1
VIIVVIII - I- I- IK	0h0011	Output terminal			D	B15	Reserved
	U110011	information	<u> </u>	-	K	B14	Reserved

Address	Parameter	Scale	nit	R/W	Assig	ned content by bit
					B13	Reserved
					B12	Reserved
					B11	Reserved
					B10	Reserved
					В9	Reserved
					B8	Reserved
					В7	Reserved
					В6	Reserved
					B5	Relay 5 (I/O expansion)
					B4	Relay 4 (I/O expansion)
					В3	Relay 3(I/O expansion)
					B2	Q1
					B1	Relay 2
					В0	Relay 1
0h0012	V1	0.01	%	R	V1 vo	ltage input
0h0013	V2	0.01	%	R	V2 vo	ltage input (expansion I/O)
0h0014	I1	0.01	%	R	I1 cur	rent input
0h0015	Motor rotation speed	1	rpm	R	Curre	ent motor rotation speed displayed
0h0016 - 0h0019	Reserved	-	-	_	-	
0h001A	Hz/rpm selection	-	-	R	0: Hz 1: rpr	unit n unit
0h001B	Motor poles displayed	-	_	R	Moto	r poles displayed

# 11.13.4Expansion Common Area Parameter

## 11.13.4.1 Inverter Monitoring Area Parameter (Read only)

Address	Parameter	Scale	unit	Assigned content by bit			
0h0300	Inverter model	-	-	iS7: 000Bh			
				0.75 kW: 3200h			
0h0301	Inverter capacity	-	-	1.5 kW: 4015h, 2.2 kW: 4022h, 3.7kW: 4037h, 5.5 kW: 4055h, 7.5 kW: 4075h, 11 kW: 4080h 15 kW: 40F0h, 18.5 kW: 4125h, 22 kW: 4160h, 30 kW: 41E0h, 37 kW: 4250h, 45 kW: 42D0h 55 kW: 4370h, 75 kW: 4480h, 90 kW: 45A0h 110 kW: 46E0h, 132 kW: 4840h, 160 kW: 4A00h 185 kW: 4B90h			
				200 V single phase open air cooling: 0220h			
				200 V 3 phase open air cooling: 0230h			
	Inverter input voltage /			200 V single phase forced cooling: 0221h			
0h0302	power supply type	_	_	200 V 3 phase forced cooling: 0231h			
0110302	(single phase, 3 phase) / cooling method			400 V single open air cooling: 0420h			
				400 V 3 phase open air cooling: 0430h			
				400 V single phase forced cooling: 0421h			
				400 V 3 phase forced cooling: 0431h			
0h0303	Invertor SAM version			Ex.) 0x0100: Version 1.00			
	Inverter S/W version			0x0101: Version 1.01			
0h0304	Reserved	-	-	-			
				B15 0000(0): Normal status			
				B14 0100(4): Warning status 1000(8): Fault status (operates			
				B13 according to set value of OUT-30 Trip			
0h0305	Inverter operating status	L		B12 Out Mode)			
0110303	Inverter operating status			B11			
				B10 _			
				В9			
				B8			

Address	Parameter	Scale	unit	Assign	ed content by bit	
				B7	0001(1): Speed search	
				В6	0010(2): Accelerating 0011(3): Steady speed	
				B5	0100(4): Decelerating	
					0101(5): Decelerating stop	
				B4	0110(6): H/W OCS 0111(7): S/W OCS	
					1000(8): Dwell operating	
				В3	- 0000(0): Stop	
				B2	0001(1): Forward operating	
				B1	0010(2): Reverse operating	
				В0	- 0011(3): DC operating (0 speed control)	
				B15		
				B14	Run command source	
	Inverter run frequency command source			B13	- 00000000(0):Keypad 00000001(1):Communication option	
				B12	0000010(2):App/PLC	
				B11	00000011(3):Built-in 485 00000100(4):Terminal Block	
				B10	00000100(4);1e11111111111111111111111111111111111	
				B9		
				B8	Frequency command source	
				B7	- Trequency command source	
0h0306		-	-	B6	00000000(0):Keypad speed	
				B5	0000001(1):Keypad torque	
				B4	00000010~00000100(2~4):Up/Down run speed	
				В3	00000101(5): V1 00000110(6): I1	
				B2	00000111(7): V2 00001000(8): I2	
				B1	- 00001001(9): Pulse   00001010(10):Bulit-in 485	
					00001010(10).Built-ii1 483	
					00001100(12): App(PLC)	
				В0	00001101(13): Jog 00001110(14): PID	
					00001111~00010110(15~22) : Auto Step 00011001~00100111(25~39) : Multi-	
					step speed frequency	
0h0307	Keypad S/W version		-	Ex.) 0	x0100: Version 1.00	

Address	Parameter	Scale	unit	Assigne	ed content by bit	
0h0308	Keypad Title version	-	-	C	0x0101: Version 1.01	
0h0309 - 0h30F	Reserved	-	-	-		
0h0310	Output current	0.1	Α	-		
0h0311	Output frequency	0.01	Hz	-		
0h0312	Output RPM	0	RPM	-		
0h0313	Motor feedback speed	0	RPM	-32768	rpm - 32767rpm (Having a polarity.)	
0h0314	Output voltage	1	٧	-		
0h0315	DC Link voltage	1	V	-		
0h0316	Output power	0.1	kW	-		
0h0317	Output torque	0.1	%	Excepti control	ion: It is not calculated during V/F	
0h0318	PID reference	0.1	%	-		
0h0319	PID feedback	0.1	%	-		
0h031A	Number of No.1 motor display	-	-	Numbe	er of No.1 motor display	
0h031B	Number of No.2 motor display	-	-	Numbe	er of No.2 motor display	
0h031C	Number of selected motor display	-	-	Number of selected motor display		
0h031D	Selection among Hz/rpm	-	-	0: Hz u 1: rpm		
0h031E -0h031F	Reserved	-	-	-		
				BI5	Reserved	
				BI4	Reserved	
				BI3	Reserved	
				BI2	Reserved	
0h0320	Digital input information			BI1	Reserved	
0110320	Digital input information	_	-	BI0	P11 (I/O expansion)	
				B9	P10 (I/O expansion)	
				B8	P9 (I/O expansion)	
				B7	P8 (Basic I/O)	
				В6	P7 (Basic I/O)	

Address	Parameter	Scale	unit	Assigne	d content by bit
				B5	P6 (Basic I/O)
				B4	P5 (Basic I/O)
				В3	P4 (Basic I/O)
				B2	P3 (Basic I/O)
				B1	P2 (Basic I/O)
				В0	P1 (Basic I/O)
				BI5	Reserved
				BI4	Reserved
				BI3	Reserved
				BI2	Reserved
				BI1	Reserved
				BI0	Reserved
				В9	Reserved
0h0321	Digital output information	-	-	B8	Reserved
0110321				В7	Reserved
				В6	Reserved
				B5	Relay 5 (I/O expansion)
				B4	Relay 4 (I/O expansion)
				В3	Relay 3 (I/O expansion)
				B2	Q1 (Basic I/O)
				B1	Relay 2 (Basic I/O)
				В0	Relay 1 (Basic I/O)
				B15	Virtual DI 16 (COM85)
				B14	Virtual DI 15 (COM84)
				B13	Virtual DI 14 (COM83)
0h0322	Virtual digital input			B12	Virtual DI 13 (COM82)
0110322	information	-	-	B11	Virtual DI 12 (COM81)
				BI0	Virtual DI 11 (COM80)
				B9	Virtual DI 10 (COM79)
				B8	Virtual DI 9 (COM78)

Address	Parameter	Scale	unit	Assigne	d content by bit			
				В7	Virtual DI 8 (COM77)			
				В6	Virtual DI 7 (COM76)			
				B5	Virtual DI 6 (COM75)			
				B4	Virtual DI 5 (COM74)			
				В3	Virtual DI 4 (COM73)			
				B2	Virtual DI 3 (COM72)			
				B1	Virtual DI 2 (COM71)			
				В0	Virtual DI 1 (COM70)			
0h0323	Selected motor display	-	-	0: No.	1 motor / 1: No.2 motor			
0h0324	AI1	0.01	%	Analog	input1 (Basic I/O)			
0h0325	AI2	0.01	%	Analog	input2 (Basic I/O)			
0h0326	AI3	0.01	%	Analog	input3 (I/O expansion)			
0h0327	AI4	0.01	%	Analog	input4 (I/O expansion)			
0h0328	AO1	0.01	%	Analog	output1 (Basic I/O)			
0h0329	AO2	0.01	%	Analog	output2 (Basic I/O)			
0h032A	AO3	0.01	%	Analog output3 (I/O expansion)				
0h032B	AO4	0.01	%	Analog output4 (I/O expansion)				
0h032C	Reserved	-	-	-				
0h032D	Temperature	1	C	-				
0h032E	Power consumption of inverter(kW/hour)	0.1	kWh	-				
0h032F	Power consumption of inverter(MW/hour)	1	MWh	-				
				BI5	Fuse Open Trip			
				BI4	Overheat Trip			
				BI3	Arm Short			
0h0330	Latch type trip			BI2	External Trip			
3110330	information-1			BI1	Overvoltage Trip			
				BI0	Overcurrent Trip			
				В9	NTC Trip			
-				B8	Overspeed Deviation			

Address	Parameter	Scale	unit	Assigne	ed content by bit
				B7	Overspeed
				В6	Input open-phase trip
				B5	Output open-phase trip
				B4	Ground Fault Trip
				В3	E-Thermal Trip
				B2	Inverter Overload Trip
				B1	Underload Trip
				В0	Overload Trip
				BI5	Low Voltage2
				BI4	Reserved
				BI3	Inverter output cutoff by terminal block input on Safety Option (applied to above 90 kW)
	Latch type trip information-2		-	BI2	Slot3 option board contact defectiveness
				BI1	Slot2 option board contact defectiveness
				BI0	Slot1 option board contact defectiveness
0h0331				B9	No MotorTrip
				B8	External Brake Trip
				B7	Basic IO board contact defectiveness
				B6	Pre PID Fail
				B5	Error on Parameter Write
				B4	Reserved
				В3	FAN Trip
				B2	PTC (Thermal sensor) Trip
				B1	Encoder Error Trip
				В0	MC Fail Trip
				B15	Reserved
0h0332	Level type trip information	-	-	B14	Reserved
-				B13	Reserved

Address	Parameter	Scale	unit	Assigned content by bit		
				B12	Reserved	
				B11	Reserved	
				B10	Reserved	
				В9	Reserved	
				B8	Reserved	
				В7	Reserved	
				В6	Reserved	
				B5	Reserved	
				B4	Reserved	
				В3	Keypad Lost Command	
				B2	Lost Command	
				B1	LV	
				В0	BX	
0h0333	H/W Diagnosis Trip information		-	B15	Reserved	
				B14	Reserved	
				B13	Reserved	
				B12	Reserved	
				B11	Reserved	
				B10	Reserved	
				В9	Reserved	
				B8	Reserved	
				В7	Reserved	
				B6	Reserved	
				B5	Reserved	
				B4	Gate Drive Power Loss	
				В3	Watchdog-2 error	
				B2	Watchdog-1 error	
				B1	EEPROM error	
				В0	ADC error	
0h0334	Warning information	-	-	B15	Reserved	

Address	Parameter	Scale	unit	Assigne	ed content by bit
				B14	Reserved
				B13	Reserved
				B12	Reserved
				B11	Reserved
				B10	Fire function operation
				В9	Auto Tuning fail
				B8	Keypad Lost
				В7	Encoder mis-wiring
				В6	Encoder mis-installation
				B5	DB
				B4	FAN operation
				В3	Lost command
				B2	Inverter Overload
				B1	Underload
				В0	Overload
0h0335- 0h033F	Reserved	-	-	-	
0h0340	On Time date	0	Day	Date of	finverter power On
0h0341	On Time minute	0	Min	Total m On Tim	ninute, except for total date, of inverter ne
0h0342	Run Time date	0	Day	Total n	umber of days of inverter run
0h0343	Run Time minute	0	Min	Total m	ninute, except for total day, of Run Time
0h0344	Fan Time date	0	Day	Total d	ays of cooling fan run
0h0345	Fan Time minute	0	Min	Total m	ninute except for total day of Fan time
0h0346	Reserved	-	-	-	
0h0347	Reserved	-	-	-	
0h0348	Reserved	-	-	-	
0h0349	Reserved	-	-	-	
0h034A	Option 1	-	_	0: None 2: Rese	

Address	Parameter	Scale	unit	Assigned content by bit	
0h034B	Option 2	-	-	4: Reserved 6: Reserved	5: Reserved 7: RNet,
0h034C	Option 3			8: Reserved 10: PLC 23: Encoder	9: Reserved 20: External IO-1

#### 11.13.4.2 Inverter Control Area Parameter (Reading and Writing Available)

Address	Parameter	Scale	unit	Bit a	llotment			
0h0380 note1)	Frequency command	0.01	Hz	Com	mand frequency setting			
0h0381	RPM command	1	rpm	com	mand RPM setting			
				В7	Reserved			
				В6	Reserved			
				B5	Reserved			
				B4	Reserved			
0h0382	Operating	-	_	В3	0→1: Free run stop			
	command			B2	0→1: Trip reset			
				B1	0:Reverse command 1:Forward command			
				В0	0:Stop command 1:Run command			
					forward operating command: 0003h,			
0h0383	Accelerating time	0.1	505		Reverse operating command: 0001h			
0110363	Decelerating time	0.1	sec	Acce	Accelerating time setting			
0h0384	time	0.1	sec	Dece	Decelerating time setting			
				BI5	Virtual DI 16 (COM85)			
				BI4	Virtual DI 15 (COM84)			
				BI3	Virtual DI 14 (COM83)			
				BI2	Virtual DI 13 (COM82)			
				BI1	Virtual DI 12 (COM81)			
				BIO	Virtual DI 11 (COM80)			
060305	Virtual digital			В9	Virtual DI 10 (COM79)			
0h0385	input control (0:Off, 1:On)	-	-	B8	Virtual DI 9 (COM78)			
	, , , ,			В7	Virtual DI 8 (COM77)			
				В6	Virtual DI 7 (COM76)			
				B5	Virtual DI 6 (COM75)			
				B4	Virtual DI 5 (COM74)			
				В3	Virtual DI 4 (COM73)			
				B2	Virtual DI 3 (COM72)			

Address	Parameter	Scale	unit	Bit a	llotment
				B1	Virtual DI 2 (COM71)
				В0	Virtual DI 1 (COM70)
				BI5	Reserved
				BI4	Reserved
				BI3	Reserved
				BI2	Reserved
				BI1	Reserved
				BI0	Reserved
				В9	Reserved
0h0386	Digital output control			В8	Reserved
0110360	(0:Off, 1:On)	_	-	В7	Reserved
				В6	Reserved
				B5	Q4 (I/O expansion, OUT36:None)
				B4	Q3 (I/O expansion, OUT35:None)
				В3	Q2 (I/O expansion, OUT34:None)
				B2	Q1 (basic I/O, OUT33:None)
				B1	Relay2 (basic I/O, OUT32:None)
				В0	Relay1 (basic I/O, OUT31:None)
0h0387	Reserved	-	-	Rese	erved
0h0388	PID reference	0.1	%	PID	reference command released
0h0389	PID feedback value	0.1	%	PID 1	feedback value
0h038A -0h038F	Reserved	-	-	-	
0h0390	Torque Ref	0.1	%	Torq	jue command
0h0391	Fwd Pos Torque Limit	0.1	%	Forv	vard motor ring torque limit
0h0392	Fwd Neg Torque Limit	0.1	%	Forv	vard regenerative torque limit
0h0393	Rev Pos Torque Limit	0.1	%	Reve	erse motor ring torque limit
0h0394	Rev Neg Torque	0.1	%	Reve	erse regenerative torque limit

Address	Parameter	Scale	unit	Bit allotment
	Limit			
0h0395	Torque Bias	0.1	%	Torque Bias
0h0395 -0h399	Reserved	-	-	-
0h039A	Anytime Para	1	-	CNF-20 value setting
0h039B	Monitor Line-1	-	-	CNF-21 value setting
0h039C	Monitor Line-2	-	-	CNF-22 value setting
0h039D	Monitor Line-3	-	-	CNF-23 value setting

- Note1) A frequency set via communication using the iS7 common area frequency address (0h0380, 0h0005) is not saved even when used with the parameter save function. To save a changed frequency to use after a power cycle, follow these steps:
- Set DRV-07 to Keypad-1 and select a random target frequency.
- Cmd Frequency (DRV-01, 0h1101): Set the frequency via communication into the parameter area frequency address (0h1101).
- Parameter Save (0h03E0): Set to "1" before turning off the power.
- The frequency set via communication will be displayed after turning the power off and on again.

# 11.13.4.3 Inverter Memory Control Area Parameter (Reading and Writing Available)

When setting parameters in the inverter memory control area, the values are reflected to the inverter operation and saved. Parameters set in other areas via communication are reflected in the inverter operation, but are not saved.

All set values are cleared following an inverter power cycle and revert back to their previous values. When setting parameters via communication, ensure that a parameter is saved prior to turning off the inverter.

Address	Parameter	Scale	unit	Changeable During Operation	Function		Page
0h03E0 note1)	Parameter saving	-	-	Х	0: No 1:	Yes	263
0h03E1 note1)	Monitor mode initialization	-	-	0	0: No 1:	Yes	264
0h03E2 note1)	Parameter initialization	-	-	X	0: No 2: Drv Grp 4: ADV Grp 6: IN Grp 8: COM Grp 10: AUT Grp 12: PRT Grp *No setting durin	1: All Grp 3: BAS Grp 5: CON Grp 7: OUT Grp 9: APP Grp 11: APO Grp 13: M2 Grp	264
0h03E3	Display changed parameter	-	-	0	0: No 1: Yes	<u> </u>	268
0h03E4	Macro function item	-	-	x	0: None 1: Draw App 2: Traverse		270
0h03E5 note1)	Deleted all fault history	-	-	0	0: No	1: Yes	268
0h03E6 note1)	User registration code deleted	-	-	0	0: No	1: Yes	268
0h03E7	Hide parameter mode	0	Hex	0	writing: 0 - 9999		266
0h03E8	Lock parameter				reading: 0: Unlock writing: 0 - 9999	< 1: Lock	
note 2)	mode	0	Hex	0	reading: 0: Unlock	< 1: Lock	267
0h03E9	Easy start on (easy parameter	-	-	0	0: No	1: Yes	271

Address	Parameter	Scale	unit	Changeable During Operation	Function		Page
	setup mode)						
0h03EA <sup>note1)</sup>	Initializing power consumption	-	-	0	0: No	1: Yes	299
0h03EB <sup>note1)</sup>	Initialize inverter operation accumulative time	-	-	0	0: No	1: Yes	299
0h03EC <sup>note1)</sup>	Initialize cooling fan accumulated operation time	-	-	0	0: No	1: Yes	272

Note 1

- Set parameters very carefully. After setting a parameter to "0" via communication, set it to another value. If a parameter has been set to a value other than 0 and a non-zero value is entered again, an error message is returned. The previously set value can be identified by reading the parameter when operating the inverter via communication.

Note that the execution time may take longer because the data is saved in the inverter, possibly interrupting communication.

#### Note 2

- The addresses 0h03E7 and 0h03E8 are parameters for entering the password. When the password is entered, the condition will change from "Lock" to "Unlock", and vice versa.

When the same parameter value is entered repeatedly, the parameter setting is executed just once. To enter the same value, change it to another value first and then re-enter the previous value. For example, if you want to enter 244 twice, enter it in the following order: 244 -> 0 -> 244.

## 12 Troubleshooting and Maintenance

This chapter explains how to troubleshoot a problem when inverter protective functions, fault trips, warning signals, or faults occur. If the inverter does not work normally after following the suggested troubleshooting steps, please contact the LS ELECTRIC Customer Support.

#### 12.1 Protection Functions

#### 12.1.1 Protection from Output Current and Input Voltage

Туре	Category	Details	Remarks
Over Load	Latch	Displayed when the motor overload trip is activated and the actual load level exceeds the set level. Operates when PRT-20 is set to any value other than "0".	-
Under Load	Latch	Displayed when the motor underload trip is activated and the actual load level is less than the set level. Operates when PRT-27 is set to any value other than "0".	-
Over Current1	Latch	Displayed when the inverter output current exceeds 200% of the rated current.	-
Over Voltage	Latch	Displayed when the internal DC circuit voltage exceeds the specified value.	-
Low Voltage	Level	Displayed when the internal DC circuit voltage is less than the specified value.	-
Ground 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 the inverter capacity.	-
E-Thermal	Latch	Displayed based on inverse time limit thermal characteristics to prevent motor overheating. Operates when PRT-40 is set to any value other than "0".	-
Out Phase Open	Latch	Displayed when a 3-phase inverter output has one or more phases in an open circuit condition. Operates when bit 1 of PRT-05 is set to "1".	-
In Phase	Latch	Displayed when a 3-phase inverter input has one or more	-

Туре	Category	Details	Remarks
Open		phases in an open circuit condition. Operates only when bit 2 of PRT-05 is set to "1".	
Inverter OLT	Latch	Displayed when the inverter has been protected from overload and resultant overheating, based on inverse time limit thermal characteristics. Allowable overload rates for the inverter are 150% for 1 min and 200% for 4 sec. Protection is based on the inverter rated capacity, and may vary depending on the device's capacity.	-
Low Voltage2	Latch	Displayed when the internal DC circuit voltage is less than the specified value during inverter operation.	-
Safety Opt Err	Latch	Displayed when a safety feature is activated to block the inverter output during an emergency.	-

## **12.1.2 Abnormal Circuit Conditions and External Signals**

Туре	Category	Details	Remarks
Fuse Open	Latch	Displayed when the inverter DC fuse is exposed to an overcurrent above 30 kW.	-
Over Heat	Latch	Displayed when the temperature of the inverter heat sink exceeds the specified value.	-
Over Current2	Latch	Displayed when the DC circuit in the inverter detects a specified level of excessive, short circuit current.	-
External Trip	Latch	Displayed when an external fault signal is provided by the multi-function terminal. Set one of the multi-function input terminals at IN-65–72 to "3 (External Trip)" to enable external trip.	-
ВХ	Level	Displayed when the inverter output is blocked by a signal provided from the multi-function terminal. Set one of the multi-function input terminals at IN-65–71 to "4 (BX)" to enable the input block function.	-
H/W-Diag	Fatal	Displayed when an error is detected in the memory (EEPRom), analog-digital converter output (ADC Off Set), or CPU watchdog (Watch Dog-1, Watch Dog-2).  EEP Err: An error in reading/writing parameters due to a keypad or memory (EEPRom) fault.	-

Туре	Category	Details	Remarks
		ADC Off Set: An error in the current sensing circuit (U/V/W terminal, current sensor, etc.). Gate Pwr Loss: An interruption in the supply of power to the IGBT Gate of a product rated 30 kW or higher (when a fault occurs in a 22 kW-rated product, the capacity settings should be checked).	
NTC Open	Latch	Displayed when an error is detected in the temperature sensor of the Insulated Gate Bipolar Transistor (IGBT).	-
Fan Trip	Latch	Displayed when an error is detected in the cooling fan. Set PRT-79 to "0" to activate fan trip (for models with a capacity below 22 kW).	-
IP54 FAN Trip	Latch	Displayed when the IP54 product detects an internal circulation at the cooling fan.	Only applied to IP54 product
Thermal Trip	Latch	Displayed when the resistance value exceeds the prescribed value after the external temperature sensor is connected to the terminal block. Operates when PRT-34 is set to any value other than "0".	-
ParaWrite Trip	Latch	Displayed when communication fails during parameter writing. Occurs when using an LCD keypad due to a control cable fault or a bad connection.	-
Over Speed Trip	Latch	Displayed when the motor speed exceeds the overspeed detection level. Set the detection level at PRT-70.	-
Dev Speed Trip	Latch	Displayed when the speed that received feedback from the encoder exceeds the set variation value. Operates when PRT-73 is set to "1".	-
Encoder Trip	Latch	Displayed when PRT-77 Enc Wire Check is set to "1" and an abnormality is detected for the set period of time.	-
Pre-PID Fail	Latch	Displayed when pre-PID is operating with functions set at APP-34–36. A fault trip occurs when a controlled variable (PID feedback) is measured below the set value and the low feedback continues, as it is treated as a load fault.	-
Ext-Brake	Latch	When Control Mode (DRV-09) is V/F or Sensorless1 or Sensorless2: The trip occurs when OUT-31–32 is set to BR control and the output current is lower than ADV-41 value (% for BAS-13) for about 10 seconds.	-

Туре	Category	Details	Remarks
		When Control Mode (DRV-09) is Vector: The trip occurs when OUT-31-32 is set to BR Control and the current is lower than half of the BAS-14 value.	

#### **12.1.3 Keypad and Optional Expansion Modules**

Туре	Category	Details	Remarks
Lost Keypad	Level	Displayed when operating commands come from the keypad or there is any problem with the communication between the keypad and inverter's main body in Keypad JOG mode. Operates when PRT-11 is set to any value other than "0" (occurs 2 seconds after the communication is interrupted).	-
Lost Command	Level	Displayed when a frequency or operation command error is detected during inverter operation by controllers other than the keypad (e.g. using a terminal block and a communication mode). Set PRT-12 to any value other than "0".	-
Option Trip-1	Latch	Displayed when the extension module is removed from option slot No. 1 after it was installed while the inverter was turned on, or when communication is not available with the inverter.	-
Option Trip-2	Latch	Displayed when the extension module is removed from option slot No. 2 after it was installed during power supply, or when communication is not available with the inverter.	-
Option Trip-3	Latch	Displayed when the extension module is removed from option slot No. 3 after it was installed during power supply, or when communication is not available with the inverter.	-
I/O Board Trip	Latch	Displayed when the basic and insulated I/O boards are disconnected or have a connection fault.	-

#### Note

**Level**: When the fault is corrected, the trip or warning signal disappears and the fault is not saved in the fault history.

**Latch**: When the fault is corrected and a reset input signal is provided, the trip or warning signal

disappears.

Fatal: When the fault is corrected, the fault trip or warning signal disappears only after the user turns off the inverter, waits until the charge indicator light goes off, and turns the inverter on again. If the inverter is still in a fault condition after it is powered on again, please contact the supplier or the LS ELETRIC Customer Support.

The function for saving the fault history and the fault signal output may not be performed if the functions are not set or the inverter is seriously damaged.

## **12.2 Warning Messages**

Туре	Description
Over Load	Displayed when the motor is overloaded. Operates when PRT-17 is set to "1". To operate, select "4 (Over Load)". Set the digital output terminal or relay (OUT31-33) to "4 (Over Load)" to receive overload warning output signals.
Under Load	Displayed when the motor is underloaded. Operates when PRT-25 is set to "1". Set the digital output terminal or relay (OUT31-33) to "6 (Under Load)" to receive underload warning output signals.
Inv Over Load	Displayed when the accumulated overload time is equivalent to 60% of the inverter overheat protection (inverter IOLT) level. Set the digital output terminal or relay (OUT31-33) to "5 (IOL)" to receive inverter overload warning output signals.
Lost Command	The Lost Command warning alarm occurs even when PRT-12 is set to "0". The warning alarm occurs based on the condition set at PRT-13-15. Set the digital output terminal or relay (OUT31-33) to "12 (Lost Command)" to receive lost command warning output signals.
Fan Warning	Displayed when an error is detected from the cooling fan while PRT-79 is set to "1". Set the digital output terminal or relay (OUT31-33) to "8 (Fan Warning)" to receive fan warning output signals.
DB Warn %ED	Displayed when the DB resistor usage rate exceeds the set value. Set the detection level at PRT-66.
Enc Conn Check	Displayed when "3 (Enc Test)" is set at BAS-20 (Auto Tuning) and no signal is input during the encoder test. Set the ENC Tune at OUT31–33 to release a signal.
Enc Dir Check	Displayed when "3 (Enc Test)" is set at BAS-20 (Auto Tuning) and the settings for A and B encoder phases are changed or are the opposite during the encoder test. Set the ENC Dir at OUT31-33 to release a signal.

Туре	Description
Lost Keypad	Displayed when operating commands come from the keypad or there is any problem with the communication between the keypad and inverter's main body in Keypad JOG mode after setting PRT-11 (Lost KPD Mode) to "0". Set the Lost Keypad (29) at OUT31-33.
Check Line PLZ	Displayed when there is any problem with communication between the keypad and the iS7 Control CPU (control connection cables).
Fire Mode	Displayed when the fire function is activated. If a contact signal output is required, set the Fire Mode (37) at OUT31-33.
PID Sleep	Displayed in PID Sleep mode. This warning is provided to distinguish the PID Sleep mode from a stopped state.
AUX Power On	Displayed when the control power is supplied with the auxiliary power module. If the auxiliary power module has been installed, an AUX Power On warning is provided instead of a Low Voltage trip when the main power is turned off.

# 12.3 Troubleshooting Fault Trips

Туре	Problem	Solution				
Over Load	The load is greater than the motor's rated capacity.	Ensure that the motor and inverter have appropriate capacity ratings.				
Over Load	The set value for the overload trip level (PRT-21) is too low.	Increase the set value for the overload trip level.				
	There is a motor-load connection problem.	Replace the motor and inverter with lower capacity models.				
Under Load	The set value for the underload level (PRT-29 and PRT-30) is less than the system's minimum load.	Increase the set value for the underload level.				
	Acc/dec time is too short compared to load inertia (GD2).	Increase acc/dec time.				
Over Current1	The inverter load is greater than the rated capacity.	Replace the inverter with a model that has increased capacity.				
	The load is greater than the motor's rated capacity.  The set value for the overload trip level (PRT-21) is too low.  There is a motor-load connection problem.  The set value for the underload level (PRT-29 and PRT-30) is less than the system's minimum load.  Acc/dec time is too short compared to load inertia (GD2).  The inverter load is greater than the rated capacity.  The inverter supplied an output while the motor was idling.	Operate the inverter after the motor has stopped or use the speed search function (CON-60).				

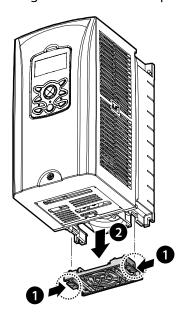
Туре	Problem	Solution				
	The mechanical brake of the motor is operating too fast.	Check the mechanical brake.				
	The deceleration time is too short for the load inertia (GD2).	Increase the deceleration time.				
	A generative load occurs at the inverter output.	Use the braking unit.				
Over Voltage	The input voltage is too high.	Check if the input voltage is above the specified value.				
	The set value for electronic thermal protection is too low.	Set an appropriate electronic thermal level.				
	The inverter has been operated at a low speed for an extended period.	Replace the motor with a model that supplies extra power to the cooling fan.				
	The input voltage is too low.	Check if the input voltage is below the specified value.				
Low Voltage /Low Voltage2	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 connected to the power source has a faulty connection.	Replace the magnetic contactor.				
Ground Trip	A ground fault has occurred in the inverter output wiring.	Check the output wiring.				
	The motor insulation is damaged.	Replace the motor.				
	The motor has overheated.	Reduce the load or operation frequency.				
E-Thermal	The inverter load is greater than the rated capacity.	Replace the inverter with a model that has increased capacity.				
Out Phase	The magnetic contactor on the output side has a connection fault.	Check the magnetic contactor on the output side.				
Open	The output wiring is faulty.	Check the output wiring.				
In Phase Open	The magnetic contactor on the input side has a connection fault.	Check the magnetic contactor on the input side.				
•	The input wiring is faulty.	Check the input wiring.				

Туре	Problem	Solution
	The DC link capacitor needs to be replaced.	Replace the DC link capacitor. Contact the retailer or the LS ELECTRIC Customer Support.
Inverter OLT	The load is greater than the rated motor capacity.	Replace the motor and inverter with models that have increased capacity.
	The torque boost level is too high.	Reduce the torque boost level.
	There is a problem with the cooling system.	Check if a foreign object is obstructing the air inlet, outlet, or vent.
Over Heat	The inverter cooling fan has been operating for an extended period.	Replace the cooling fan.
	The ambient temperature is too high.	Keep the ambient temperature below 50℃.
	The output wiring has short-circuited.	Check the output wiring.
Over Current2	There is a fault with the electronic semiconductor (IGBT).	Do not operate the inverter. Contact the retailer or the LS ELECTRIC Customer Support.
NTC Open	The ambient temperature is too low.	Keep the ambient temperature above 10℃.
NTC Open	There is a fault with the internal temperature sensor.	Contact the retailer or the LS ELECTRIC Customer Support.
FAN Trip	There is a foreign object in the inverter vent where the fan is located.	Remove the foreign object from the air inlet or outlet.
	The cooling fan needs to be replaced.	Replace the cooling fan.
	The fan connector is not connected.	Connect the fan connector.
IP54 FAN Trip	The power connector for the internal fan PCB board is not connected.	Connect the power connector for the internal fan PCB board.
	The cooling fan needs to be replaced.	Replace the cooling fan.
No Motor	The motor is not connected to the inverter output.	Check the wiring connections.
Trip	The current level for trip detection is not set properly.	Check the values of both BAS-13 (Rated current) and PRT-32 (No Motor Level).

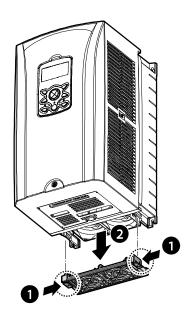
## 12.4 Replacing the Cooling Fan

#### 12.4.1 Products Rated below 7.5 kW

To replace the cooling fan, push the bracket on the bottom in the direction of the arrows in the diagram below and then pull it forward. Then, disconnect the fan connector.



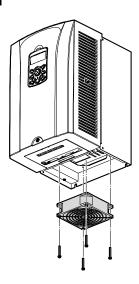




<Below 7.5 kW>

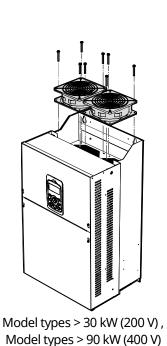
#### 12.4.2 Products Rated at 11-15 kW 200 V/400 V and 18.5-22 kW 400 V

To replace the cooling fan, loosen the screws at the bottom of the input and output terminals and disconnect the fan connector.

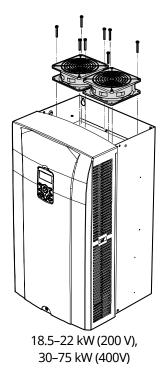


# 12.4.3 Products Rated at more than 30 kW (200 V) / 90 kW (400 V), and 18.5–22 kW (200 V) / 30–75 kW (200/400 V)

To replace the cooling fan, loosen the screws at the top of the product and disconnect the fan connector.



LS ELECTRIC



# 12.5 Daily and Regular Inspection Lists

			Inspection Cycl		/cle			
Inspection area	Inspection item	Inspection details	Daily			Inspection method	Judgment standard	Inspection equipment
			<i></i>	1	2			
Total	Ambient environment	Is the ambient temperature and humidity within the designated range, and is there any dust or foreign objects present?	0			Visual inspection	No ice (ambient temperature: -10°C -+40°C) and no condensation (ambient humidity below 50%)	Thermometer, hygrometer, recorder
	Inverter	Are there any abnormal vibrations or noise?	О			Visual inspection	No abnormality	
	Power voltage	Are the input and output voltages normal?	0			Measure voltages between R/S/T phases in the inverter terminal block.		Digital multimeter, tester
Input/Out put circuit	Total	1) Megger test (between input/output terminals and and earth terminal) 2) Is there anything loose in the device? 3) Is there any evidence of overheating in each part? 4) Cleaning		0 0	0	1) Disconnect the inverter and short R/S/T/U/V/W terminals, and then measure from each terminal to the ground terminal using Megger test equipment. 2) Tighten up all screws. 3) Visual inspection	1) Over 5MΩ 2), 3) No matter	DC 500 V Megger
	Cable connections	1) Are there any corroded cables?		О		Visual inspection	No abnormality	

			Inspect	tion Cy	<i>r</i> cle			
Inspection area	Inspection item	Inspection details	Daily		ular ear)	Inspection method	Judgment standard	Inspection equipment
				1	2			
		2) Is there any damage to cable insulation?		О				
	Terminal block	Is there any damage?		О		Visual inspection	No abnormality	
	Smoothing condenser	1) Is liquid leaking inside? 2) Is the safety apparatus in position? Is there any protuberance? 3) Check the power failure capacity.	0	0		1), 2) Visual inspection  3) Measure with a capacity meter.	1),2) No abnormality  3) Rated capacity over 85%	Capacity meter
	Relay	1) Is there any chattering noise during operation? 2) Is there any damage to the contacts?		0		1), 2) Visual inspection	1),2) No abnormality	
	Braking resistor	1) Is there any damage from resistance? 2) Check for disconnection.		0		1) Visual inspection 2) Disconnect one side and measure with a tester.	1) No abnormality 2) Must be within ±10% of the rated value of the resistor.	Digital multimeter / analog tester

#### ① Caution

Do not perform a megger test (insulation resistance test) on the control circuit of the inverter.

			Inspec	tion C	ycle			
Inspection area	Inspection item	Inspection details	Daily	Regu (Year)		Inspection method	Judgment standard	Inspection equipment
arca	165111	details	Dally	1	2	mediod	Janaara	счартисте
Control circuit Protection circuit	Operation check	1) Check for output voltage imbalance while the inverter is in operation. 2) Is there an error in the display circuit after the sequence protection test?		0		1) Measure voltage between the inverter output terminals U/V/W. 2) Test the inverter output protection in both short and open circuit conditions.	1) Balance the voltage between phases: within 4 V for 200 V series and within 8 V for 400 V series.  2) The circuit must work according to the sequence.	Digital multimeter or DC voltmeter
Cooling system	Cooling fan	1) Is there any abnormal vibration or sound? 2) Are any of the fan parts loose?	0	0		1) Turn it manually while the inverter is turned off. 2) Check all connected parts and tighten all screws.	1) It should turn smoothly.  2) No abnormality	
Display	Meter	Is the display value normal?	О	0		Check the command value on the display device.	Specified and managed values must match.	Voltmeter, ammeter, etc.
Motor	Total	1) Are there any abnormal vibrations or sound? 2) Is there any abnormal smell?	0			1) Visual inspection 2) Check the abnormality, such as overheating, damage, etc.	No abnormality	
	Isolation resistance	Megger test (between the input, output and earth terminals).			О	Disconnect the cables for terminals U/V/W and test the wiring.	Must be above 5 MΩ.	DC 500 V Megger

#### ① Caution

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

## **13Table of Functions**

#### 13.1 Parameter Mode – DRV Group (→DRV)

#### DRV Group (PAR → DRV)

								Note1)					
	Communi-					Shift in		Co	ont	rol	Мс	ode	
No.	cation Address	LCD Display	Name	Setting Range	Initial Value	Opera- tion	Page	V / F	S L	V C	SLT	V C T	
00	-	Jump Code	Jump code	1-99	9	0		0	0	0	0	0	
01	0h1101	Cmd Frequency	Target frequency	Starting frequency -maximum frequency (Hz)	0.0	0	138				Х		
02	0h1102	Cmd Torque	Torque command	-180–180 (%)	0.0	0	242	Χ	Χ	Χ	0	0	
03	0h1103	Acc Timed	Acceleration time	0–600 (sec)	Below 75 kW 20.0 Above 90 kW 60.0	0	165	0	0	0	0	0	
04	0h1104	Dec Time	Deceleration time	0-600 (sec)	Below 75 kW 30.0 Above 90 kW 90.0	0	165	0	0	0	0	0	
06	0h1106	Cmd Source	Command source	0 Keypad 1 Fx/Rx-1 2 Fx/Rx-2 3 Int 485 4 Field Bus 5 PLC	-1:Fx/Rx-1	Х	157	0	0	0	0	0	
07	0h1107	Freq Ref Src	Frequency reference source	0 Keypad-1 1 Keypad-2 2 V1		Х	138	0	0	0	Х	Х	
08	0h1108	Trq Ref Src	Torque reference source	3 I1 4 V2 5 I2 6 Int 485 7 Encoder 8 FieldBus 9 PLC 10 Synchro 11 Binary	0:Keypad-1	х	243	Х	Х	Х	0	0	
09 Note1)	0h1109	Control Mode	Control mode	0 V/F 1 V/F PG 2 Slip Compen 3 Sensorless-1 4 Sensorless-2 5 Vector	0:V/F	х	279 229 212 230 232 245	0	0	0	0	О	

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

VCT: Vector Torque mode,

Refer to the Options manual for options.

Note 1) Effectiveness of each code according to the Control Mode setting.

V/F: V/Fmode (PG included), SL: Sensorless-1, 2 mode, VC: Vector mode, SLT: Sensorless-1, 2 Torque mode,

#### DRV Group (PAR → DRV)

	Communi-					Shift in			Control Mode			
No.	cation Address	LCD Display	Name	Setting Range	Initial Value	Opera- tion	Page	V / F	S L	۷ ۷	S L T	V C T
10	0h110A	Torque Control	Torque control	0 No 1 Yes	0: No	Χ	230	Χ	Х	Χ	0	0
11	0h110B	Jog Frequency	Jog frequency	0.5–maximum frequency (Hz)	10.00	0	201	0	0	0	0	0
12	0h110C	Jog Acc Time	Jog run acceleration time	0-600 (sec)	20.0	0	201	0	0	0	0	0
13	0h110D	Jog Dec Time	Jog run deceleration time	0-600 (sec)	30.0	0	201	0	0	0	Χ	X
14	0h110E	Motor Capacity	Motor capacity		Dependent on inverter capacity	X	213	Ο	Ο	0	0	0
15	0h110F	Torque Boost	Torque boost method	0 Manual 1 Auto 2 Advanced Auto	0:Manual	Х	180	0	Х	Х	Χ	Х
16 Note2)	0h1110	Fwd Boost	Forward torque boost	0–15 (%)	Below 75kW 2.0 Above 90kW 1.0	Х	180	0	Х	Χ	Χ	X
17	0h1111	Rev Boost	Reverse torque boost	0–15(%)	Below 75kW 2.0 Above 90kW 1.0	Х	180			Χ		Χ
18	0h1112	Base Freq	Base frequency	30-400 (Hz)	60.00	Χ	175	0	0	0	0	0
19	0h1113	Start Freq	Starting frequency	0.01-10 (Hz)	0.50	Х	175	0	Χ	Χ	Χ	Χ
20	0h1114	Max Freq	Maximum frequency	40-400	60.00	Х	188	0	0	0	0	0
21	0h1115	Hz/Rpm Sel	Speed unit selection	0 Hz Display 1 Rpm Display	0:Hz	0	302	0	О	0	0	0
25	0h1119	Output Freq	Output speed monitoring	0-Max Frequency	0.00	0	303	0	0	0	0	0

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

 $<sup>^{\</sup>text{Note 2})}$  DRV-16–17 displayed only when DRV-15 (Torque Boost) is set as "Manual" or "Advanced Auto".

#### DRV Group (PAR → DRV)

	Communi-				Initial Value	Shift in		Control Mode					
No.	cation Address		Name	Setting Range		Opera- tion		V / F	S L	V C	S L T	V C T	
26 Note2)	0h111A	Adv ATB Filter	Adv ATB Filter	1~1000[msec]	100	0	181	Χ	Χ	Χ	0	0	
27	IONTITE	Adv ATB M Gain	Adv ATB M Gain	0~300.0[%]	50.0	0	181	0	0	0	0	0	
28	10h1110	Adv ATB G Gain	Adv ATB G Gain	0~300.0[%]	50.0	0	181	0	0	0	0	0	
30	0h111E	kW/HP Select	kW/HP Select	0 kW 1 HP	0: kW	0	297	0	0	0	Χ	X	

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

 $<sup>^{\</sup>text{Note 3}}$ ) DRV-26~28 code is displayed only when DRV-15 (Torque Boost) code value is "Advanced Auto

# 13.2 Parameter Mode – Basic Function Group (→BAS)

#### BAS Group(PAR → BAS)

	Communi-						Shift in		Co	ntro	ol M	lod	е
No.	cation Address	LCD Display	Name	Se	etting Range	Initial Value	Opera- tion	Page	V / F	S L	V C	S L T	V C T
00	-	Jump Code	Jump code	0-	99	20	0		0	0	0	0	0
			Auxiliary	0 1 2	None V1 I1								
01	0h1201	Aux Ref Src	reference source	3 4 5	V2 I2 Pulse	0:None	X	196	0	0	0	Х	X
02 Note <sup>3</sup> )	0h1202	Aux Calc Type	Auxiliary command calculation type	0 1 2 3 4 5 6	M+(G*A) M*(G*A) M/(G*A) M+(M*(G*A)) M+G*2(A-50%) M*(G*2(A-50%)) M/(G*2(A-50%)) M+M*G*2(A-50%)	0: M+(G*A)	х	196	0	0	0	х	х
03	0h1203	Aux Ref Gain	Auxiliary command gain	-2	00.0–200.0 (%)	100.0	О	196	0	0	0	Χ	Х
04	0h1204	Cmd 2nd Src	Second command source	0 Keypad 1 Fx/Rx-1		1: Fx/Rx-1	х	192	0	0	0	0	0
05	0h1205	Freq 2nd Src	Second frequency source	0	Keypad-1	0:Keypad-1	0	192	0	0	0	Χ	Х

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 3) BAS-02 code is displayed only when BAS-01 (Aux Ref Src) code has a value other than "None".

#### BAS Group (PAR → BAS)

No.	Communi- cation Address	LCD Display	Name	Set	tting Range	Initial Value	Shift in Opera- tion	Page	Co V / F	ntr S L	ol I V C	S	de V C T
06	0h1206	Trq 2nd Src	Second torque command source	1 2 3 4 5 6 7 8 9 10 11	Keypad-2 V1 I1 V2 I2 Int 485 Encoder FieldBus PLC Synchro Binary Type Keypad-2	-0:Keypad-1	О	192	Х	х	Х	0	0
07	0h1207	V/F Pattern	V/F pattern options	0 1 2 3	Linear Square User V/F Square2	0:Linear	х	176	0	0	Х	Х	Х
08	0h1208	Ramp T Mode	Acc/Dec standard frequency	0 1	Max Freq Delta Freq	0:Max Freq	х	166	0	0	0	Х	Х
09	0h1209	Time Scale	Time scale settings	0 1 2	0.01 sec 0.1 sec 1 sec	1:0.1 sec	x	166	0	0	0	X	Х
10	0h120A	60/50 Hz Sel	Input power frequency	0	60 Hz 50 Hz	0:60 Hz	Х	84	0	0	0	0	0
11	0h120B	Pole Number	Number of motor poles	248	3		Х		0	0	0	0	0
12	0h120C	Rated Slip	Rated slip speed	0-3	3000 (rpm)	Donondonton	Χ		0	0	0	0	0
13	0h120D	Rated Curr	Motor rated current	1–1	1000 (A)	Dependent on inverter capacity	Х		0	0	0	0	0
14	0h120E	Noload Curr	Motor no-load current	0.5	–1000 (A)		Х	213	0	0	0	0	0
15	0h120F	Rated Volt	Motor rated voltage		0-480 (V)	0	Х		0	0	0		0
16	0h1210	Efficiency	Motor efficiency		-100 (%)	Dependent on	Χ		0	0	0		0
17	0h1211	Inertia Rate	Load inertia rate	3–0	3	inverter capacity	Χ		0	0	0	0	0
18	0h1212	Trim Power %	Power display adjustment		-130 (%)		0	301	0	0	0	0	0
19	0h1213	AC Input Volt	Input power voltage	170 380	0-230 (V) 0-480 (V)	220 V 220 44x0 V 380	0	271	0	0	0	0	0
20	-	Auto Tuning	Auto tuning	1 2 3 4 5	None All ALL(Stdstl) Rs+Lsigma Enc Test Tr Tr(Stdstl)	0:None	Х	224	х	Ο	Ο	0	0

## BAS Group (PAR → BAS)

	·					Claife in		Со	ntr	ol I	Mod	de
No.	Communi -cation Address	LCD Display	Name	Setting Range	Initial Value	Shift in Opera- tion	Page	V / F	S L	V C	S L T	V C T
21	-	Rs	Stator resistance	Dependent on motor setting	-	X	224	Χ	0	0	0	0
22	-	Lsigma	Leakage inductance	Dependent on motor setting	-	Х	224	Χ	0	0	0	0
23	-	Ls	Stator inductance	Dependent on motor setting	-	Х	224	Χ	0	0	0	0
24 Note4)	-	Tr	Rotor time constant	25–5000 (ms)	-	Х	224	Χ	0	0	0	0
41 Note5)	0h1229	User Freq 1	User frequency 1	0-maximum frequency (Hz)	15.00	Х	177	0	Χ	Χ	Х	Χ
42	0h122A	User Volt 1	User voltage 1	0–100 (%)	25	Χ	177	0	Χ	Χ	Χ	Χ
43	0h122B	User Freq 2	User frequency 2	0-maximum frequency (Hz)	30.00	X	177	0	Χ	Χ	Χ	Χ
44	0h122C	User Volt 2	User voltage 2	0–100 (%)	50	Χ	177	0	Χ	Χ	Χ	Χ
45	0h122D	User Freq 3	User frequency 3	0-maximum frequency (Hz)	45.00	X	177	0	Χ	Χ	Х	Χ
46	0h122E	User Volt 3	User voltage 3	0–100 (%)	75	Χ	177	0	Χ	Χ	Χ	Χ
47	0h122F	User Freq 4	User frequency 4	0–maximum frequency (Hz)	60.00	Х	177	0	Χ	Χ	Х	Χ
48	0h1230	User Volt 4	User voltage 4	0–100 (%)	100	Χ	177	0	Χ	Χ	Х	Χ
50 Note6)	0h1232	Step Freq-1	Multi-step speed frequency 1		10.00	0	154	0	0	0	Х	X
51	0h1233	Step Freq-2	Multi-step speed frequency 2		20.00	0	154	0	0	0	Χ	Χ
52	0h1234	Step Freq-3	Multi-step speed frequency 3		30.00	0	154	0	0	0	Χ	Χ
53	0h1235	Step Freq-4	Multi-step speed frequency 4		40.00	0	154	0	0	0	Χ	Χ
54	0h1236	Step Freq-5	Multi-step speed frequency 5		50.00	0	154	0	0	0	Χ	Χ
55	0h1237	Step Freq-6	Multi-step speed frequency 6		60.00	0	154	0	0	0	Χ	Χ
56	0h1238	Step Freq-7	Multi-step speed frequency 7		60.00	0	154	0	0	0	Χ	Χ
57	0h1239	Step Freq-8	Multi-step speed frequency 8	Starting frequency -maximum	55.00	0	154	0	0	0	Χ	Χ
58	0h123A	Step Freq-9	Multi-step speed frequency 9	frequency(Hz)	50.00	0	154	0	0	0	Χ	Χ
59	0h123B	Step Freq- 10	Multi-step speed frequency 10	, , ,	45.00	0	154	0	0	0	Х	Χ
60	0h123C	Step Freq- 11	Multi-step speed frequency 11	у	40.00	0	154	0	0	0	Х	Χ
61	0h123D	Step Freq- 12	Multi-step speed frequency 12		35.00	0	154	0	0	0	Х	Χ
62	0h123E	Step Freq- 13	Multi-step speed frequency 13		25.00	0	154	0	0	0	Х	X
63	0h123F	Step Freq-	Multi-step speed frequency		15.00	0	154	0	0	0	Χ	Χ

	Communi					Shift in		Co	ntr	ol I	Mo	de
No.	-cation Address	LCD Display	Name	Setting Range	Initial Value		Page	V / F	S L	V C	S L T	V C T
		14	14									
64	0h1240	Step Freq- 15	Multi-step speed frequency 15		5.00	0	154	0	0	0	Χ	Χ
70	0h1246	Acc Time-1	Multi-step acceleration time 1	0–600 (sec)	20.0	0	168	0	0	0	Χ	Χ
71	0h1247	Dec Time-1	Multi-step deceleration time 1	0–600 (sec)	20.0	0	168	0	0	0	Χ	Χ
72 Note7)	0h1248	Acc Time-2	Multi-step acceleration time 2	0–600 (sec)	30.0	0	168	0	0	0	Х	Χ
73	0h1249	Dec Time-2	Multi-step deceleration time 2	0-600 (sec)	30.0	0	168	0	0	0	Χ	Χ
74	0h124A	Acc Time-3	Multi-step acceleration time 3	0-600 (sec)	40.0	0	168	0	0	0	Χ	Χ
75	0h124B	Dec Time-3	Multi-step deceleration time 3	0-600 (sec)	40.0	0	168	0	0	0	Χ	Χ
76	0h124C	Acc Time-4	Multi-step deceleration time 4	0-600 (sec)	50.0	0	168	0	0	0	Χ	Χ
77	0h124D	Dec Time-4	Multi-step deceleration time 4	0–600 (sec)	50.0	0	168	0	0	0	Χ	Χ
78	0h124E	Acc Time-5	Multi-step deceleration time 5	0–600 (sec)	60.0	0	168	0	0	0	Χ	Χ
79	0h124F	Dec Time-5	Multi-step deceleration time 5	0-600 (sec)	60.0	0	168	0	0	0	Χ	Χ
80	0h1250	Acc Time-6	Multi-step deceleration time 6	0-600 (sec)	70.0	0	168	0	0	0	Χ	Χ
81	0h1251	Dec Time-6	Multi-step deceleration time 6	0-600 (sec)	70.0	0	168	0	0	0	Χ	Χ
82	0h1252	Acc Time-7	Multi-step deceleration time 7	0-600 (sec)	80.0	0	168	0	0	0	Χ	Χ
83	0h1253	Dec Time-7	Multi-step deceleration time 7	0-600 (sec)	80.0	0	168	0	0	0	Χ	Χ

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 4) BAS-24 is shown only when DRV-09 Control Mode is set to "Sensorless-2" or "Vector".

Note 5) BAS-41-48 is displayed only when it is set as "User V/F" even if there is only one BAS-07 or M2-V/F Patt (M2-25).

Note 6) IN-50-64 is displayed only when it is set as "multi-step speed" (Speed -L.M.H,X) even if there is only one among multi-function input IN-65-72.

Note 7) displayed only when it is set as "multi-step Acc/Dec" (Xcel-L,M,H) even if there is only one among multi-function input IN-72-75.

# 13.3 Parameter Mode – Expansion Function Group (PAR→ADV)

#### **Expansion Function Group (PAR → ADV)**

	C:					a		Со	ntr	ol I	Мo	de
No.	Communi- cation Address	LCD Display	Name	Setting Range	Initial Value	Shift in Opera- tion	Page	V / F	S L	V C	S L T	V C T
00	-	Jump Code	Jump code	0-99	24	0	-	0	0		0	0
01	0h1301	Acc Pattern	Acceleration pattern	0 Linear	0:Linear	Χ	171	0	0		Χ	Χ
02	0h1302	Dec Pattern	Deceleration pattern	1 S-curve	U.Lii leai	Χ	171	0	0	0	Χ	Χ
03	0h1303	Acc S Start	S-curve acceleration start point gradient	1–100 (%)	40	Х	171	0	0	0	Χ	Х
04	0h1304	Acc S End	S-curve acceleration end point gradient	1–100 (%)	40	Χ	171	0	0	0	Χ	Х
05	0h1305	Dec S Start	S-curve deceleration start point gradient	1–100(%)	40	Χ	171	0	0	0	Χ	Х
06	0h1306	Dec S End	S-curve deceleration end point gradient	1–100 (%)	40	Χ	171	0	0	0	Χ	Х
07	0h1307	Start Mode	Start mode	0 Acc	0:Acc	Χ	183	0	0	0	Χ	Х
07	0111307	Start Woule	Startmode	1 Dc-Start	U.ACC	^	103	U	O	U	^	_
				0 Dec								
				1 Dc-Brake								
80	0h1308	Stop Mode	Stop mode	2 Free-Run	0:Dec	Χ	185	0	O	0	Χ	Χ
				3 Flux Braking								
				4 Power Braking								
			Calactian of probibited	0 None								
09	0h1309	Run Prevent	Selection of prohibited rotation direction	1 Forward Prev	0:None	Χ	162	0	0	0	Χ	Χ
			rotation direction	2 Reverse Prev								
10	0h130A	Davisar as Disa	Charle with a sure and	0 No	0.11-	0	162	0	_		V	·
10	UN 130A	Power-on Run	Start with power on	1 Yes	0:No	0	163	U	0	0	Χ	Χ
12 Note8)	0h130C	Dc-Start Time	Starting DC braking time	0–60 (sec)	0.00	Х	280	0	0	0	Χ	X
13	0h130D	Dc Inj Level	DC supply	0-200 (%)	50	Χ	280	0	0	0	Χ	Χ
14 Note9)	0h130E	Dc-Block Time	Output blocking time before DC braking	0-60 (sec)	0.10	Х	185	0	0	0	Χ	X
15	0h130F	Dc-Brake Time	DC braking time	0-60 (sec)	1.00	Χ	185	0	0	0	Χ	Χ
16	0h1310	Dc-Brake Level	DC braking rate	0-200 (%)	50	Χ	185	0	0		Χ	Χ
17	0h1311	Dc-Brake Freq	DC braking frequency	Starting frequency-60 (Hz)	5.00	Χ	185	0	0	0	Χ	Χ
20	0h1314	Acc Dwell Freq	Acceleration dwell frequency	Starting frequency -maximum frequency (Hz)	5.00	Х	280	0	0	0	Χ	Χ
21	0h1315	Acc Dwell Time	Acceleration dwell operation time	0-60.0 (sec)	0.00	Х	280	0	0	0	Χ	Х
22	0h1316	Dec Dwell Freq	Deceleration dwell frequency	Starting frequency -maximum frequency (Hz)	5.00	Х	280	0	0	0	Χ	Х
23	0h1317	Dec Dwell Time	Deceleration dwell operation time	0-60.0 (sec)	0.00	Х	280	0	0	0	Χ	Χ

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 8) ADV-12 is displayed only when ADV-07 "Stop Mode" is set as "DC-Start".

Note 9) ADV-14-17 is displayed only when ADV-08 "Stop Mode" is set as "DC-Brake".

#### **Expansion Function Group (PAR → ADV)**

No.	Communi- cation Address	LCD Display	Name	Setting Ran	ige	Initial Value	Shift in Opera- tion	Page	Co V / F	ntr S L	ol I V C	Mo S L T	de V C T
24	0h1318	Freq Limit	Frequency limit	0 No 1 Yes		0:No	X	188	0	О	0	Χ	X
25 Note <sup>10</sup> )	0h1319	Freq Limit Lo	Frequency lower limit	0-upper lim		0.50	0	188	0	0	0	Χ	Χ
26	0h131A	Freq Limit Hi	Frequency upper limit	0.5–maximı (Hz)	um frequency	60.00	Χ	188	0	0	0	Χ	Χ
27	0h131B	Jump Freq	Frequency jump	0 No 1 Yes		0:No	X	191	0	0	0	Χ	X
28 Note <sup>11</sup> )	0h131C	Jump Lo 1	Jump frequency lower limit 1	limit 1 (Hz)	quency upper	10.00	0	191	0	0	0	Χ	Χ
29	0h131D	Jump Hi 1	Jump frequency upper limit 1	1-maximur	n frequency (Hz)	15.00	0	191	0	0	0	Χ	Χ
30	0h131E	Jump Lo 2	limit 2	0-jump fred upper limit	2 (Hz)	20.00	0	191	0	0	0	Χ	Χ
31	0h131F	Jump Hi 2	Jump frequency upper limit 2	2-maximur	n frequency (Hz)	25.00	0	191	0	0	0	Χ	Χ
32	0h1320	Jump Lo 3	limit 3	0-jump fred upper limit	3 (Hz)	30.00	0	191	0	0	0	Χ	Χ
33	0h1321	Jump Hi 3	Jump frequency upper limit 3		ency lower limit n frequency (Hz)	35.00	0	191	0	0	0	Χ	Χ
34 Note <sup>10</sup> )	0h1322	Jog Freq Limit	Jog frequency limit	0 No 1 Yes		1:Yes	0	189	0	0	0	Χ	X
41 Note <sup>12</sup> )	0h1329	BR Rls Curr	Brake release current	0–180.0 (%)		50.0	0	280	0	0	0	Χ	Χ
42	0h132A	BR RIs Dly	Brake release delay time	0-10.00 (sed	c)	1.00	Х	280	0	0	0	Χ	Χ
44	0h132C	BR RIs Fwd Fr	Brake release forward frequency	0-400 (Hz)		1.00	Х	280	0	0	0	Χ	Χ
45	0h132D	BR RIs Rev Fr	Brake release reverse frequency	0-400 (Hz)		1.00	Х	280	0	0	0	Χ	Χ
46	0h132E	BR Eng Dly	Brake engage delay time	0–10 (sec)		1.00	Х	280	0	0	0	Χ	Χ
47	0h132F	BR Eng Fr	Brake engage frequency	0-400 (Hz)		2.00	Χ	280	0	0	0	Χ	Χ
50	0h1332	E-Save Mode	Energy saving operation	<ul><li>None</li><li>Manua</li><li>Auto</li></ul>	I	0:None	Х	248	0	0	Χ	Χ	X
<b>51</b> Note <sup>13</sup> )	0h1333	Energy Save	Energy saving amount	0–30 (%)		0	0	248	0	О	0	Χ	X
60	0h133C	Xcel Change Fr	Acc/dec time transition frequency	0-maximur	n frequency (Hz)	0.00	Х	170	0	0	0	Χ	Χ

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 10) ADV-25-26, 34 is displayed only when ADV-24 (Freq Limit) is set as "Freq Limit".

Note 11) ADV-28-33 is displayed only when ADV-27 (Jump Freq) is set as "Yes".

Note 12) ADV-41-47 is displayed only when a code of OUT-31-33 is set as "BR Control".

Note 13) ADV-51 is displayed only when ADV-50 (E-Save Mode) is set as a value other than "None".

## Expansion Function Group (PAR → ADV)

No.   Cation   Address		Communi-						Chift in		Со	ntr	ol N	Иo	de
Gain   Qain	No.	cation		Name	Set	tting Range				V / F	S L	۷ C	S L T	V C T
Color   Colo	61	-			0.1	-6000.0 (%)	100.0	0	302	0	0	0	Χ	X
Color   Colo				3-	0	x 1								Г
Scale   Scal			Land Carl	David diametral	1									l
A	62	-			2	x 0.01	0:x 1	0	302	0	0	О	Χ	Χ
63   0h133F			Scale	scale	3	x 0.001								l
63   0h133F					4									l
1   1   1   1   1   1   1   1   1   1	<u></u>	0F122E	Load Spd	Revolution display	0		0	0	202		_	_	_	
Section of Pan Control   Cooling fan control   2   Temp Control   Run   O   261   O   O   O   X   X	63	UN 133F			1	Mpm	U:rpm	U	302	U	U	U	U	ľ
Section of Pan Control   Cooling fan control   2   Temp Control   Run   O   261   O   O   O   X   X					0	During Run	0.0							
2   Temp Control   Null   Nu	64	0h1340	FAN Control	Cooling fan control	1			0	261	0	0	О	Χ	Χ
Oh   Oh   Oh   Oh   Oh   Oh   Oh   Oh							Kun							l
Mode			LL/D Cause	Up/down	0									Γı
Salve	65	0h1341		operation frequency	1	Vac	0:No	0	204	0	0	О	Χ	Х
On/Off Ctrl   On/Off Ctrl   On/Off Ctrl   On/Off Control   On/Off Contro			Mode		I	res								
On/Off Cort   On/Off Control options   2   11   12   12   13   V2   14   12   12   14   12   14   12   14   12   14   12   15   10   10   10   10   10   10   10					0	None								
Onlog			O (Off C+)	Output contact	1	V1								
Options   3   V2	66	0h1342		On/Off control	2	I1	0:None	Χ	282	0	0	О	0	0
On-Clevel   Output contact point			SIC	options	3	V2								l '
On level					4	I2								l
Oh   Oh   Oh   Oh   Oh   Oh   Oh   Oh	67	0h1343	On-C Level		10-	-100 (%)	90.00	Х	282	0	0	0	0	0
Off level   Point On level (%)   October   October   Point On level (%)   October   Octob	60	0b1244	Off C Lovel	Output contact point	-10	0.00-output contact	10.00	V	วดว	_	_	0		0
The first of the	68	UN 1344	Off-C Level				10.00	Χ	282	U	U	U	U	ľ
Mode   Selection   1   DI Dependent   Enable	70	0h1246	Run En	Safe operation	0	Always Enable		<b>&gt;</b>	200	0	0	)	)	
71	70	0111340	Mode	selection	1	DI Dependent	Enable	^	209	O	O	U	)	
Note   4   Oh   1347   Null Dis 3tbp   method   2   Q-Stop   Resume   Run   X   209   O   O   O   O   O   O   O   O   O					0	Free-Run								
2   Resume	71	0b1247	Pun Dic Ston	Safe operation stop	1	Q-Stop	0:Free-	V	200				0	
Resume	Note <sup>14</sup> )	0111547	Kuli Dis Stop		2	Q-Stop	Run	^	209	U	U	U	U	ľ
Table   Tabl					2	Resume								l
RegenAvd Mode	72	0h1348	Q-Stop Time		0-6	500.0 (sec)	5.0	0	209	0	0	0	0	0
Mode					Bit	001-111								
Mode	70	01-1240	RegenAvd	Regeneration evasion	0	Steady	001	V	202					
RegenAvd Sel   Selection of regeneration evasion function for press   Selection of regeneration evasion function for press   1   Yes   No   X   292   O   O   O   O   O   O   O   O   O	/3	0h1349			1		001	Х	292	U	O	O	U	O
74					2									l
74				Selection of	0									
To hand the process of the process o	74	0h134A				.,	No	Χ	292	0	0	0	0	0
RegenAvd Level level of regeneration evasion motion for press   400 V: 600–800   700 V   X   292   O   O   O   X   X    76  Note15) Oh134C   CompFreq Limit   Compensation frequency limit of regeneration for evasion for press   O-10.00 Hz   1.00 (Hz)   X   292   O   O   O   X   X    77  Oh134D   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    78  Oh134D   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    79  Oh134D   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    70  Oh134D   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    77  Oh134D   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    78  Oh134D   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    79  Oh134D   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    70  Oh134D   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    79  Oh134D   RegenAvd   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    70  Oh134D   RegenAvd   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    70  Oh134D   RegenAvd   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    70  Oh134D   RegenAvd   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    70  Oh134D   RegenAvd   RegenAvd   Regeneration evasion   O-100.00 Hz   Fo 0.06   O   X   X    71  Oh134D   RegenAvd   RegenAvd			Sei		l	Yes								l
Level evasion motion for press   400 V: 600–800   700 V   292   0   0   0   X   X   292   0   0   0   0   0   0   0   0   0				Operational voltage	20	0 V: 300-400	350 V							
76 Note15) Oh134C CompFreq Limit Compensation frequency limit of regeneration for evasion for press  RegenAvd Regeneration evasion O. 100 0 %	75	0h13//R	RegenAvd					v	202	$\circ$	$\cap$	$\circ$	Y	Y
76 Note15) 0h134C CompFreq   Compensation   frequency limit of regeneration for evasion for press  77	13	0111346	Level	evasion motion for	40	0 V: 600-800	700 V	^	232	0	U	U	^	^
76 Note15) Oh134C   CompFreq				press										L_
Note15) Unit regeneration for evasion for press  RegenAvd Regeneration evasion 0.100 0 % 100 0														l
RegenAvd Regeneration evasion 0, 100 0 % 50 0 (%) 0 292 0 0 0 V V	76	0h134C			η <sub>-</sub> -	10 00 Hz	1 00 (Hz)	X	292	0	0	0	χ	x
RegenAvd Regeneration evasion 0.100 0% 500 (%) 0 292 0 0 0 V V	Note15)	0111340	Limit			10.00112	1.00 (112)	^	252			J	^	ĺ.
Pgain   for press P gain   5 150.5 78   5 15	77	0h134D			0-1	100.0 %	50.0 (%)	0	292	0	0	0	Х	X
			Pgain	tor press P gain	ľ		30.0 (70)			Ú	Ĭ	Ĭ		

	Communi					el 16. 1		Coi	ntr	ol N	Иo	de
No.	Communi- cation Address	LCD Display	Name	Setting Range	Initial Value	Shift in Opera- tion	Page	V / F	S L	V C	S L T	V C T
78	0h134E	RegenAvd Igain	Regeneration evasion for press I gain	20-30000 (ms)	500 (ms)	0	292	0	0	0	Χ	Χ
79	0h134F	DB Turn On Lev	DB unit operating voltage	200 V : 350–400 (V) 400 V : 600–800 (V)	390 (V) 780 (V)	Х	296	0	0	0	0	0
80	0h1350	Fire Mode Sel	Select fire mode	0 None 1 Fire Mode 2 Fire Test	0:None	Х	294	0	0	0	X	Χ
81 Note16)	0h1351	Fire Mode Freq	Fire mode frequency	0-maximum frequency (Hz)	60.00	Х	294	0	0	0	X	Χ
82	0h1352	Fireq Mode Dir	Fire mode operating direction	0 Forward 1 Reverse	0:Forwar d	Х	294	0	0	0	Χ	Χ
83	-	Fire Mode Cnt	Fire mode counter	0-99	0	Х	294	0	0	0	Χ	Χ
85	0h1355	U/D Mode Sel	U/D Mode	0 U/D Normal 1 U/D Step 2 U/D Step+Norm	0:U/D Normal	Х	204	0	0	0	Х	Χ
86 Note17)	0h1356	U/D Step Freg	U/D step frequency	0-maximum frequency [Hz]	0.00	0	204	О	0	0	Χ	Х
87	0h1357	OVM Mode Sel	Voltage Drop compensation	0 No 1 Yes	0:No	Х	298	0	Х	0	0	0
91	0h135B	Auxiliary OPT	AUX Power Option Sel	0 No 1 Yes	0:No	Х	-	0	0	0	0	0
92 Note18)	0h135C	SlipGain Mot-H	slip compensation offsetting gain H	0~200[%]	50	0	213	О	Х	Х	X	Х
93	0h135D	SlipGain Gen-H	slip compensation regenerative gain H	0~200[%]	50	0	213	0	Х	Χ	Χ	Х
94	0h135E	SlipGain Mot-L	slip compensation offsetting gain L	0~200[%]	50	0	213	0	Х	Χ	Χ	X
95	0h135F	SlipGain Gen-L	slip compensation regenerative gain L	0~200[%]	50	0	213	0	Χ	Χ	Χ	Х
96	0h1360	Slip Filter	slip compensation filter	0~10000[msec]	300	0	213	0	Χ	Χ	Χ	Х
97	0h1361	Slip Comp Freq	slip compensation frequency	0~60.00[Hz]	5.00	0	213	0	Х	Х	Χ	Х
98	0h1362	Slip Gain Freq	slip compensation gain switchover frequency	0~20.00[Hz]	9.00	0	213	0	Х	X	Χ	Х

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

 $<sup>^{\</sup>text{Note 14)}}$  ADV-71-72 is displayed only when ADV-70 (Run En Mode) is set as "DI Dependent".

ADV-73 is displayed only when ADV-74 (RegenAvd Sel) is set as "Yes".

Note15) ADV-76-78 is displayed only when ADV-75 (RegenAvd Sel) is set as "Yes".

Note16) ADV-81-83 displayed only when ADV-80 (Fire Mode Sel) is set as "Fire Mode" or "Fire Test".

Note17) ADV-86 is displayed when ADV-85 (U/D Mode Sel)is not set to "U/D Normal".

Note18) ADV-92-98 is displayed only when DRV-09 (Control Mode) is set as "Slip Compen"

## 13.4 Parameter Mode – Control Function Group (→CON)

	Communi-							Shift in		Col	ntre	ol N	loc	le
No.	cation Address	LCD Display	Name	Setting R	Range	е	Initial Value		Page	V / F	S L	V C	S L T	V C T
00	-	Jump Code	Jump code	0-99			51	0		0	0	0	О	0
				Below 22 kW	(	0.7-15 (kHz)	5.0							
			Carrier	30-45 kW	v (	0.7–10 (kHz)	5.0							
04	0h1404	Carrier Freq	frequency	55-75 kW		0.7-7 (kHz)	5.0	0	255	О	0	О	0	0
				90-110 k		0.7-6 (kHz)	3.0							
				132-160		0.7-5 (kHz)	3.0							
				185-220		0.7-3 (kHz) 0.7-2 (kHz)	2.0							
							2.0 0:Normal							<u> </u>
05	0h1405	PWM Mode	Switching mode			ge PWM	PWM	X	255	О	0	0	О	0
09	0h1409	PreExTime	Initial excitation time	0-60 (sec		ge i vvivi	1.00	Х	237	Х	Х	0	0	0
10	0h140A	Flux Force	Initial excitation power supply	100-500	(%)		100.0	Х	237	Χ	Χ	0	0	0
11	0h140B	Hold Time	Continued operation duration	0–60 (sec	c)		Dependent on control mode	Х	237	Х	Х	0	X	Х
		ASR P	Speed controller											
12	0h140C	Gain 1	proportional gain 1	10–500 (9	%)		50.0	0	237	Х	Χ	0	Χ	X
13	0h140D	ASR I Gain 1	Speed controller integral gain 1	10-9999	(mse	ec)	300	0	237	Χ	Χ	0	Χ	X
15	0h140F	ASR P Gain 2	Speed controller proportional gain 2	10-500 (	%)		50.0	0	237	Χ	Х	0	Χ	X
16	0h1410	ASR I Gain 2	Speed controller integral gain 2	10-9999	(ms)		300	0	237	Χ	Χ	0	Χ	X
18	0h1412	Gain SW Freq	Gain exchange frequency	0–120 (H	lz)		0.00	Х	237	Χ	Χ	0	Χ	X
19	0h1413	Gain Sw Delay	Gain exchange time	0-100 (se	ec)		0.10	Х	237	Χ	Χ	0	Χ	X
20	0-1414	SL2 G	Sensorless 2nd	0 No			0.01-		222	V		_	·	V
20	0h1414	View Sel	gain display setting	1 Yes			0:No	0	233	Х	Х	Х	Χ	X
21	0h1415	ASR-SL P Gain1	Sensorless speed controller proportional gain1	0–5000 (9	%)		Dependent on motor capacity	О	233	Х	0	Х	X	X
22	0h1416	ASR-SL I Gain1	Sensorless speed controller integral gain 1	10-9999	(ms)		Dependent on motor capacity	0	233	Х	0	Χ	X	Х
23	0h1417	ASR-SL P	Senseless speed	1.0-1000	0.0 (%	)	Dependent	0	233	Χ	Χ	Χ	Χ	Χ

	Communi-					Shift in		Coi	ntr	ol N	Λo	de
No.	cation Address	LCD Display	Name	Setting Range	Initial Value	-	Page	V / F	S L	V C	S L T	V C T
Note <sup>17</sup> )		Gain2	controller proportional gain 2		on motor capacity							
24	0h1418	ASR-SL I Gain2	Sensorless2 speed controller integral gain 2	1.0–1000.0 (%)	Dependent on motor capacity	0	233	X	Χ	Х	Х	Х
26	0h141A	Observer Gain1	Sensorless2 measurer gain 1	0-30000	10500	О	233	Χ	Χ	Χ	X	Х
27	0h141B	Observer Gain2	Sensorless2 measurer gain 2	1–1000 (%)	100.0	0	233	Χ	Χ	Χ	Χ	Х
28	0h141C	Observer Gain3	Sancarlace?	0-30000	13000	0	233	Χ	Χ	Χ	Х	Х
29	0h141D	S-Est P Gain1	Sensorless2 speed estimator proportional gain 1	0-30000	Dependent on motor capacity	0	233	Х	X	Х	Х	Х
30	0h141E	S-Est I Gain1	Sensorless2 speed estimator integral gain 1	0-30000	Dependent on motor capacity	0	233	Х	Х	Х	X	Х

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 17) CON-23-28, 31-32 are displayed only when DRV-09 (Control Mode) is "Sensorless2" and CON-20 (SL2 G View Sel) is set as "Yes".

				,								_
No.	Communi- cation Address	LCD Display	Name	Setting Range	Initial Value	Shift in Opera- tion	Page	Co V / F	ntr S L	ol I V C	Mo S L T	de V C T
31	0h141F	S-Est P Gain2	Sensorless2 speed estimator proportional gain 2	1.0–1000.0 (%)	Dependen t on motor capacity	0	233	Х	Х	Х	Χ	Х
32	0h1420	S-Est I Gain2	Sensorless2 speed estimator integral gain 2	1.0–1000.0 (%)	Dependen t on motor capacity	0	233	Χ	Χ	Х	Χ	Х
34	0h1422	SL2 OVM Perc	Sensorless2 overvoltage modulation range adjustment	100–180 (%)	120	X	236	Х	0	Χ	Χ	Х
35	0h1423	SL2 L- ExcitLmt	Magnetic flux current minimum ratio	3~100[%]	10	0	242	Χ	Χ	Χ	0	Х
45 Note18)	0h142D	PG P Gain	PG operation proportional gain	0-9999	3000	0	229				Χ	Χ
46	0h142E	PG I Gain	PG operation integral gain	0-9999	50	0	229	0	Χ	Χ	Χ	Χ
47	0h142F	PG Slip Max%	PG operation maximum slip	0–200	100	X	229	0	Χ	Χ	Χ	Χ
48	-	ACR P Gain	Current controller P gain	0-10000	1200	0	233	Χ	0	0	0	0
49	-	ACR I Gain	Current controller I gain	0-10000	120	0	233	Χ	0		0	0
51	0h1433	ASR Ref LPF	Speed controller reference filter	0-20000 (ms)	0	X	238	Χ	0	0	Χ	Х
52	0h1434	Torque Out LPF	Torque controller output filter	0-2000 (ms)	0	X	238	Χ	Χ	Χ	0	0
53	0h1435	Torque Lmt Src	Torque limit setting options	<ul> <li>Keypad-1</li> <li>Keypad-2</li> <li>V1</li> <li>I1</li> <li>V2</li> <li>I2</li> <li>Int 485</li> <li>Encoder</li> <li>FieldBus</li> <li>PLC</li> <li>Synchro</li> <li>Binary Type</li> </ul>	0:Keypad- 1	X	238	х	Х	Х	0	0
54 Note19)	0h1436	FWD +Trq Lmt	Forward offsetting torque limit	0–200 (%)	180.0	0	238	Χ	Χ	X	0	0
55	0h1437	FWD -Trq Lmt	Forward offsetting torque limit	0–200 (%)	180.0	0	238	Χ	Х	Χ	0	0
56	0h1438	REV +Trq Lmt	Reverse regenerative torque limit	0–200 (%)	180.0	0	238	Χ	Χ	Χ	0	0
57	0h1439	REV -Trq Lmt	Reverse regenerative torque limit	0–200 (%)	180.0	0	238	Χ	Χ	Χ	0	0

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 19) CON-54-57 are displayed only when DRV-09 (Control Mode) is set as "Sensorless-1, 2" or "Vector". In addition, the initial value of the torque limit is changed to 150% when the ADV-74 RegenAvd Level function is set.



Note 18) CON-45-47 are displayed when the Encoder module is installed and Control mode is set as "V/F PG".

	Communi-					Shift in		M	Con ode	itro	l	
No.	cation Address	LCD Display	Name	Setting Range	Initial Value	Opera- tion	Page	V / F	S L	V C	S L T	V C T
58	0h143A	Trq Bias Src	Torque bias setting options	0 Keypad-1 1 Keypad-2 2 V1 3 I1 4 V2 5 I2 6 Int 485 7 FieldBus 8 PLC	0:Keypad-1	X				О		
59	0h143B	Torque Bias	Torque bias	-120–120 (%)	0.0	0	238	Χ	Χ	0	Χ	Χ
60	0h143C	Torque Bias FF	Torque bias compensation	0–100 (%)	0.0	О	238	Χ	Χ	0	Χ	Х
62	0h143E	Speed Lmt Src	Speed limit setting options	0 Keypad-1 1 Keypad-2 2 V1 3 I1 4 V2 5 I2 6 Int 485 7 FieldBus 8 PLC	0:Keypad-1	0	242	Х	x	X	Х	0
63	0h143F	FWD Speed Lmt	Forward speed limit	0-maximum frequency (Hz)	60.00	0	242	Χ	Χ	Χ	Χ	0
64	0h1440	REV Speed Lmt	Reverse speed limit	0-maximum frequency (Hz)	60.00	0	242	Χ	Χ	Χ	Χ	0
65	0h1441	Speed Lmt Gain	Speed limit operation gain	100–5000 (%)	500	0	242	Χ	Χ	Χ	Χ	0
66	0h1442	Droop Perc	Droop operation amount	0–100 (%)	0.0	О	244	Χ	Χ	Χ	Χ	0
67 Note20)	0h1443	Droop St Trq	Droop start torque	0–100 (%)	100.0	0	244	Χ	Χ	Χ	Χ	0
68	0h1444	SPD/TRQAcc T	Torque mode →speed mode exchange acceleration time	0-600 (sec)	20.0	0	244	Х	Х	Х	Х	0
69	0h1445	SPD/TRQAcc T	Torque mode →speed mode exchange deceleration time	0–600 (sec)	30.0	0	245	Χ	Х	X	Χ	0

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

 $<sup>^{\</sup>text{Note 20)}}$  CON-67 is displayed only when the Encoder option module is installed.

	Communi			Setting Range			Shift		1)Control N				ode
No.	-cation Address	LCD Display	Name			Initial Value	in Opera- tion	Page	V / F	S L	V C	S L T	V C T
70	0h1446	SS Mode	Speed search mode selection	0 1	Flying Start - 1 Flying Start - 2	0	Х	250	0	0	0	Χ	Χ
71	0h1447	Speed Search	Speed search operation selection	Bit 1	0000-1111 Speed search selection on acceleration Restart after		Х	250	0	0	0	Х	x
				3	trips Restart after instantaneous interruption Start immediately	0000 Below 75							
				4	after power On								
72 Note21)	0h1448	SS Sup- Current	Speed search standard current	80–200 (%)		Above 90 kW 100	-0	250	0	0	X	Х	X
73	0h1449	SS P-Gain	Speed search proportional gain	0-9999		100	0	250	0	0	Χ	Χ	Х
74	0h144A	SS I-Gain	Speed search integral gain	0-9999		200	0	250	0	0	Χ	Χ	Х
75	0h144B	SS Block Time	Output block time before speed search	0-60 (sec)		1.0	Х	250	0	0	Х	Х	Х
77	0h144D	KEB Select	Energy buffering selection	0 None 1 KEB-1 2 KEB-2		0:None	Х	245	0	0	0	Х	Х
78 Note21)	0h144E	KEB Start Lev	Energy buffering start level	110–200 (%)		130.0	Х	245	0	0	0	Χ	Х
79	0h144F	KEB Stop Lev	Energy buffering stop level	130-210 (%)		135.0	Х	245	0	0	0	Χ	Х
80	0h1450	KEB Gain	Energy buffering gain	1–2000		1000	0	245	0	0	0	Χ	Х
82 Note22)	0h1452	ZSD Frequency	Permanent detection frequency	0–10 (Hz)		2.00	0	318	Х	Х	0	Х	0
83	0h1453	ZSD Band	Permanent detection frequency band	0–2 (Hz)		1.00	0	318	Х	Х	0	Χ	0
86 Note23)	0h1456	KEB P Gain	Energy buffering P gain	0-20000		1500	0	246	0	0	0	Χ	Х
87	0h1457	KEB I Gain	Energy buffering I gain	1-20000		500	0	246	0	0	0	Χ	X
88	0h1458	KEB Slip Gain	Energy buffering slip gain	0–2000.0 (%)		30.0	0	246	0	0	0	Χ	X
89	0h1459	KEB Acc Time	Energy buffering acceleration time	0-600 (sec)		10.0	0	246	0	0	0	Χ	Х

No.	Communi -cation Address		Name	Set	ting Range	Initial Value	Shift in Opera- tion	Page	v	S L	trol V C	Mo S L T	V C T
90	0h145A	New AHR Sel	Select function for preventing current hunting	0 1	No Yes	0:No	0	293	0	Х	X	Х	Х
91	0h145B		Gain from current hunting prevention	0-32	2767	1000	X	293	0	Χ	Χ	Χ	Χ

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 21) CON-72-75 are displayed only when CON-71,77 is set as a bit or other than "None".

Note 22) CON-82-83 are displayed only when DRV-09 (Control Mode) is set as "Vector".

 $<sup>^{\</sup>text{Note 23})}$  CON-78-79,86-89 are displayed only when CON-77 (KEB Select) is set as "KEB-1" or "KEB-2"

Note 24) CON-91 is displayed only when CON-90 (New AHR Sel) is set as "Yes".

# 13.5 Parameter Mode – Input Terminal Block Function Group (→IN)

#### Input Terminal Block Function Group (PAR → IN)

	Communi					Ch ife in		Со	ntr	ol I	Mo	de
No.	Communi -cation Address	LCD Display	Name	Setting Range	Initial Value	Shift in Opera- tion		V / F	S L	V C	S L T	V C T
00	-	Jump Code	Jump code	0-99	65	0	-	0	0	0	0	0
01	0h1501	Freq at 100%	analog input	Start frequency- maximum frequency (Hz)	60.00	0	139	0	0	0	X	X
02	0h1502	Torque at 100%	Torque at maximum analog input	0–200 (%)	100.0	0	139	Χ	Χ	0	0	0
05	0h1505	V1 Monitor(V)		0-10 (V)	0.00	0	139	0	0	0	0	0
06	0h1506	V1 Polarity	V1 input polarity selection	0 Unipolar 1 Bipolar	0: Unipolar	0	139	0	0	0	0	О
07	0h1507	V1 Filter	V1 input filter time constant	0-10000 (ms)	10	0	139	0	0	0	0	0
08	0h1508	V1 Volt x1		0-10 (V)	0.00	0	139	0	0	0	0	0
09	0h1509	V1 Perc y1	V1 minimum output voltage (%)	0–100 (%)	0.00	0	139	0	0	0	0	0
10	0h150A	V1 Volt x2	V1 maximum input voltage	0-10 (V)	10.00	0	139	0	0	0	0	0
11	0h150B	V1 Perc y2	V1 maximum output voltage (%)	0–100 (%)	100.00	0	139	0	0	0	0	0
12 Note24)	0h150C	V1 (–)Volt x1'	V1 (-) minimum input voltage	-10–0 (V)	0.00	0	144	0	0	0	0	0
13	0h150D	V1(-)Perc y1'	V1 (–) minimum output voltage (%)	-100-0 (%)	0.00	0	144	0	0	0	0	0
14	0h150E	V1(-)Volt x2'	V1 (-) maximum input voltage	-10-0 (V)	-10.00	0	144	0	0	0	0	0
15	0h150F	V1(-)Perc y2'	V1 (-) maximum output voltage (%)	-100-0 (%)	-100.00	0	144	0	0	0	0	0
16	0h1510	V1 Inverting	Rotation direction change	0 No	0: No	0	139	0	0	0	0	0
		J	Ò	1 Yes		_						-
17	0h1511	V1 Quantizing	V1 quantization change	0.04-10 (%)	0.04	0	139					0
20	0h1514		I1 input display	0-20 (mA)	0.00	0	146					0
22 23		I1 Filter		0-10000 (ms)	10	0	146	0	0			0
23		I1 Curr x1	I1 minimum input current Output at I1 minimum	0-20 (mA)	4.00	U	146	0	O			
24		I1 Perc y1	current (%)	0–100 (%)	0.00	0	146		0			0
25	0h1519	I1 Curr x2		4-20 (mA)	20.00	0	146	0	0	0	0	0
26	0h151A	I1 Perc y2	Output at I1 maximum current	0-100 (%)	100.00	0	146	0	0	0	0	0
31	0h151F	I1 Inverting	Rotation direction change	0 No 1 Yes	0: No	0	146	0	0	0	0	0
32	0h1520	I1 Quantizing	I1 quantization level	0.04-10 (%)	0.04	0	146	0	0	0	0	0

Note 24) IN-12-15 codes are displayed only when IN-06 (V1 Polarity) is set as "Bipolar".

## Input Terminal Block Function Group (PAR → IN)

	Communi					Shift in		Со	ntr	ol N	/lod	le
No.	-cation Address	LCD Display	Name	Setting Range	Initial Value	Opera- tion	Page	V / F	S L	V C	S L T	V C T
35 Note 25)	0h1523	V2 Monitor(V)	V2 input display	0–10 (V)	0.00	0	148	0	0	0	0	0
36	0h1524	V2 Polarity	V1 input polarity selection	<ul><li>0 Unipolar</li><li>1 Bipolar</li></ul>	1: Bipolar	0	148	0	0	0	0	0
37	0h1525	V2 Filter	V2 input filter time constant	0–10000 (ms)	10	0	148	0	0	0	0	0
38	0h1526	V2 Volt x1	V2 minimum input voltage	0-10 (V)	0.00	0	148	0	0	0	0	0
39	0h1527	V2 Perc y1	Output at V2 minimum voltage (%)	0–100 (%)	0.00	О	148	0	0	0	0	0
40	0h1528	V2 Volt x2	V2 maximum input voltage	0–10 (V)	10.00	0	148	0	0	0	0	0
41	0h1529	V2 Perc y2	Output at V2 maximum voltage (%)	0–100 (%)	100.00	О	148	0	0	0	0	0
42	0h152A	V2 -Volt x1'	V2 -minimum input voltage	-10-0 (V)	0.00	0	148	0	0	0	0	0
43	0h152B	V2–Perc y1'	Output at V2–minimum voltage (%)	-100-0 (%)	0.00	0	148	0	0	0	0	0
44	0h152C	V2 -Volt x2'	V2 -maximum input voltage	-10-0 (V)	-10.00	0	148	0	0	0	0	0
45	0h152D	V2 –Perc y2'	Output at V2–maximum voltage (%)	-100–0 (%)	- 100.00	О	148	0	0	0	0	0
46	0h152E	V2 Inverting	Rotation direction change	0 No 1 Yes	0:No	0	148	0	0	0	0	0
47	0h152F	V2 Quantizing	V2 quantization level	0.04–10 (%)	0.04	0	148	0	0	0	0	0
50	0h1532	I2 Monitor(mA )	I2 input display	0-20 (mA)	0.00	0	149	0	0	0	0	0
52	0h1534	I2 Filter	I2 input filter time constant	0-10000 (ms)	15	0	149	0	0	0	0	0
53	0h1535	I2 Curr x1	I2 minimum input current	0-20 (mA)	4.00	0	149	0	0	0	0	0
54	0h1536	I2 Perc y1	Output at I2 minimum current (%)	0–100 (%)	0.00	0	149	0	0	0	0	0
55	0h1537	I2 Curr x2	I2 maximum input current	0-20 (mA)	20.00	0	149	0	0	0	0	0
56	0h1538	I2 Perc y2	Output at I2 maximum current (%)	0–100 (%)	100.00	0	149	0	0	0	0	0
61	0h153D	I2 Inverting	Rotation direction change	0 No 1 Yes	0:No	0	149	0	0	0	0	0
62	0h153F	I2 Quantizing	I2 quantization level	0.04–10 (%)	0.04	0	149	0	0	0	0	0

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 25) IN-35-62 codes are displayed only when the expansion IO module is installed.

## Input Terminal Block Function Group (PAR → IN)

	Communi-						Shift in			nti ode			
No.	cation Address	LCD Display	Name	Set	ting Range	Initial Value	Opera- tion		۷	S	V C	S L T	V C T
65	0h1541	P1 Define	P1 terminal function setting	0	NONE FX	1:FX	Х	158	О	0	0	0	0
66	0h1542	D2 Dofino	P2 terminal function setting	2	RX	2:RX	X	158	Χ	~	0		_
67	0h1543	P2 Define	P3 terminal function setting		RST	5:BX	X	346			0		
68	0h1544		P4 terminal function setting	4	External Trip	3:RST	X	335			0		
69	0h1545		P5 terminal function setting		BX	7:Sp-L	X	345		0		0	0
70	0h1546		P6 terminal function setting		IOG	8:Sp-M	X	201	0		0		
71	0h1547		P7 terminal function setting	7	Speed-L	9:Sp-H	X	154			0		
72	0h1548			8	Speed-M	6:JOG	X	154	0	$\circ$	0	$^{\circ}$	$\overline{0}$
73 Note26)	0h1549		P9 terminal function setting	9	Speed-H	0:NONE	X	154			0		
74	0h154A	P10 Define	P10 terminal function setting	10	Speed-X	0:NONE	Х	154	_	0	0	0	0
75	0h154B	P11 Define	P11 terminal function setting	11	XCEL-L	0:NONE	Х	168	U	)	U	0	U
				12	XCEL-M			168					
				13	RUN Enable			209					
				14	3-Wire			208					
				15	2nd Source			192					
				16	Exchange			260					
				17	Up			204					
				18	Down			204					
				19	U/D Save			204					
				20	U/D Clear			204					
				21	Analog Hold			153					
				22	I-Term Clear			212 212					
				23 24	PID Openloop P Gain2	-		212					
				25	XCEL Stop	-		174	1				
				26	2nd Motor			258					
				27	Try Offset Lo	1		278	1				
				28	Try Offset Hi	1		278	1				
				29	Interlock 1	1		289	1				
				30	Interlock 2	1		289	1				
				31	Interlock 3			289	1				
					Interlock 4	1		289	1				

The grey cells indicate a hidden code which is only visible when setting a code.

 $^{\text{Note}\,26)}$  IN73-75 codes are displayed only when the expansion IO module is installed.

## Input Terminal Block Function Group (PAR → IN)

No.	Communi- cation Address	LCD Display	Name	Satting Danga	Initial Value	Shift in Opera- tion	Page	Co V / F	ntr S L	ol I V C	S L	de V C T
				33 -Reserved- 34 Pre Excite 35 Speed/Torque 36 ASR Gain 2 37 ASR P/PI 38 Timer In 39 Thermal In 40 Dis Aux Ref 41 SEQ-1 42 SEQ-2 43 Manual 44 Go Step 45 Hold Step 46 FWD JOG 47 REV JOG 48 Trq Bias 49 XCEL-H 50 KEB Select								
85	0h1555	DI On Delay	Multi-function input terminal On filter	51   Fire Mode 0-10000 (ms)	10	0	294 194	0	0	0	0	0
86	0h1556	DI Off Delay	Multi-function input terminal Off filter	0–10000 (ms)	3	0	194	0	0	0	0	0
87	0h1557	DINC/NO Sel	Multi-function input contact point selection	P8 – P1 0 A contact point (NO) 1 B contact point (NC)	0000 0000	Х	194	0	0	0	0	0
88	0h1558	RunOn Delay	Operating command delay time	0–100 (sec)	0.00	Х	194	0	0	0	0	0
89	0h1559	InCheck Time	Sequential command delay time	1–5000 (ms)	1	X	194	0	0	0	0	0
90	0h155A	DI Status	Multi-function input terminal status	P8 – P1 O Open (Off) Connection (On)	0000 0000	0	194	0	0	0	0	0

# 13.6 Parameter Mode – Output Terminal Block Function Group (→OUT)

## Output Terminal Block Function Group (PAR → OUT)

No.	Communi -cation Address	LCD Display		Setting Range	Initial Value	Shift in Opera- tion	Page	V / F	S L	ol I V C	S L T	V C T
00	-	JumpCode	Jump code	0-99	30	0	-	0	0	0	0	0
01	0h1601	AO1 Mode	Analog output 1	<ul> <li>Frequency</li> <li>Current</li> <li>Voltage</li> <li>DC Link Volt</li> <li>Torque</li> <li>Watt</li> <li>Idss</li> <li>Iqss</li> <li>Target Freq</li> <li>Ramp Freq</li> <li>Speed Fdb</li> <li>Speed Dev</li> <li>PIDRef Value</li> <li>PIDFdb Value</li> <li>PID Output</li> <li>Constant</li> </ul>	0: Frequency	0	306	О	0	0	0	0
02	0h1602	AO1 Gain	Analog output1 gain	-1000–1000(%)	100.0	0	306	0	0	0	0	0
03	0h1603	AO1 Bias	Analog output 1 bias	-100-100(%)	0.0	0	306	0	0		0	
04	0h1604	AO1 Filter	Analog output1 filter	0–10000 (ms)	5	0	306	0	0	0		0
05	0h1605	AO1 Const %	Analog constant output	0-1000(%)	0.0	0	306		0			0
06	0h1606	AO1 Monitor	Analog output 1 monitor	0–1000(%)	0.0	-	306	0	0	0	0	0
07	0h1607	AO2 Mode	Analog output 2 item	<ul> <li>Frequency</li> <li>Current</li> <li>Voltage</li> <li>DC Link Volt</li> <li>Torque</li> <li>Watt</li> <li>Idss</li> <li>Igss</li> <li>Target Freq</li> <li>Ramp Freq</li> <li>Speed Fdb</li> <li>Speed Dev</li> <li>PIDRef Value</li> <li>PIDFbk Value</li> <li>PID Output</li> <li>Constant</li> </ul>	0: Frequency	0	309	Ο	Ο	О	0	0

## Output Terminal Block Function Group (PAR → OUT)

	Communi	LCD			v:.:.1	Shift in			nti ode			
No.	-cation Address	LCD Display	Name	Setting Range	Initial Value	Opera- tion	Page	V / F	S L	V C	S L T	V C T
80	0h1608	AO2 Gain	Analog output 2 gain	-1000–1000 (%)	80.0	0	309	0	0			0
09	0h1609	AO2 Bias	Analog output 2 bias	-100–100 (%)	20.0	0	309		0			0
10	0h160A	AO2 Filter	Analog output 2 filter	0-10000 (ms)	5	0	309	0	0	0	0	0
11	0h160B	AO2 Const %	Analog constant output 2	0–100 (%)	0.0	0	309	0	0	0	0	0
12	0h160C	AO2 Monitor	Analog output 2 monitor		0.0	0	309	0	0	0	0	0
<b>14</b> Note27)	0h160E	AO3 Mode	Analog output 3 item	0 Frequency 1 Current 2 Voltage 3 DC Link Volt 4 Torque 5 Watt 6 Idss 7 Iqss 8 Target Freq 9 Ramp Freq 10 Speed Fdb 11 Speed Dev 12 PID Ref Value 13 PID Fbk Value 14 PID Output 15 Constant	0: Frequency	0	312	Ο	Ο	Ο	Ο	0
15	0h160F	AO3 Gain	Analog output 3 gain	-1000–1000 (%)	100.0	0	312	0	0	0	0	0
16	0h1610	AO3 Bias	Analog output 3 bias	-100-100 (%)	0.0	0	312		0			0
17	0h1611	AO3 Filter	Analog output 3 filter	0-10000 (ms)	5	0	312	0	0	0	0	0
18	-	AO3 Const %	Analog constant output 3	0–100 (%)	0.0	0	312	0	0	0	0	0
19	0h1613	AO3 Monitor	Analog output 3 monitor		0.0	0	312	0	0	0	0	0
20	0h1614	AO4 Mode	Analog output 4 item	0 Frequency 1 Current 2 Voltage 3 DC Link Volt 4 Torque 5 Watt 6 Idss 7 Iqss 8 Target Freq 9 Ramp Freq 10 Speed Fdb 11 Speed Dev 12 PID Ref Value 13 PID Fbk Value 14 PID Output 15 Constant	0: Frequency		313	Ο	Ο	0	Ο	0

## Output Terminal Block Function Group (PAR → OUT)

	Communi					Initial	Shift in			nt ode	rol		
No.	-cation Address	LCD Display			tting Range	Value	Opera- tion		V / F	S L	V C	S L T	V C T
21	0h1615	AO4 Gain	Analog output 4 gain		00–1000 (%)	80.0	-	313	0	0	0	0	0
22	0h1616	AO4 Bias	Analog output 4 bias		0–100 (%)	20.0	0	313		0			0
23	0h1617	AO4 Filter	Analog output 4 filter	0-1	10000 (ms)	5	0	313	0	0	0	0	0
24	-	AO4 Const %	Analog constant output 4	0-1	100 (%)	0.0	0	313	0	0	0	0	0
25	0h1619	AO4 Monitor	Analog output 4 monitor		1000 (%)	0.0	0	313	0	0	0	0	0
					000 - 111								
				1	Low voltage								
30	0h161E	Trip Out Mode	Failure output item	2	Failure other than low voltage	010	0	314	0	0	Ο	О	0
				3	Final failure of automatic restart								
31	0h161F	Relay 1	Multi-function relay 1	0	NONE	29:Trip	0	314	0	0	0	0	0
32	0h1620	Relay 2	Multi-function relay 2	1	FDT-1	14:Run	0	314	0	0	0	0	0
33	0h1621	Q1 Define	Multi-function output 1	2	FDT-2	1:FDT-1	0	314	0	0	0	0	0
34 Note28)	0h1622	Relay 3	Multi-function relay 3	3	FDT-3	2:FDT-2	0						0
35	0h1623	Relay 4	Multi-function relay 4	4	FDT-4	3:FDT-3	0	314	0	0	0	0	0
36	0h1624	Relay 5	Multi-function relay 5	5	Over Load	4:FDT-4	0	314	0	0	0	0	0
				6	IOL								
				7	Under Load								
				8	Fan Warning								
				9	Stall								
				10	Over Voltage	4							
				11	Low Voltage	4							
					Over Heat Lost Command	-							
					Run	-							
					Stop	-							
					Steady								
					Inverter Line	+							
					Comm Line								
					Speed Search								
					Step Pulse	1							
					Seq Pulse	1							
					Ready	1							
					Trv Acc	1							
				24	Trv Dec	1							
					MMC								
					Zspd Dect								
					Torque Dect								
	1	1		28	Timer Out								1

Note 27) OUT 14-25 codes are displayed only when the expansion IO module is installed.

Note 28) OUT 34-36 codes are displayed only when the expansion IO module is installed.



## Output Terminal Block Function Group (PAR → OUT)

	Communi						Shift in			nti ode			
No.	-cation Address	LCD Display	Name	Set	ting Range	Initial Value	Opera- tion	Page	V / F	S L	۷ ۷	S L T	V C T
				30 31 32 33 34 35 36 37	Trip Lost Keypad DB Warn %ED ENC Tune ENC Dir On/Off Control BR Control KEB Operating Fire Mode Run2								
41	0h1629	DO Status	Multi-function output monitoring	-		000	Х	314		-	-	-	_
50	0h1632	DO On Delay	Multi-function output On delay	0–1	00 (sec)	0.00	О	321	0	0	Ο	0	0
51	0h1633	DO Off Delay	Multi-function output Off delay	0–1	00 (sec)	0.00	0	321	0	0	0	0	0
52	0h1634	DO NC/NO Sel	Multi-function output contact point selection	Q1, 0 1	Relay2,Relay1 A contact point (NO) B contact point (NC)	000	х	321	0	0	0	0	0
53	0h1635	TripOut OnDly	Failure output On delay	0–1	00 (sec)	0.00	0	320	0	0	0	0	0
54	0h1636	TripOut OffDly	Failure output Off delay	0–1	00.00 (sec)	0.00	0	320	0	0	0	0	0
55	0h1637	TimerOn Delay	Timer On delay	0-1	00.00 (sec)	0.00	0	273	0	0	0	0	0
56	0h1638	TimerOff Delay	Timer Off delay		00.00 (sec)	0.00	0	273	0	0	0	0	0
57	0h1639	FDT Frequency	Detected frequency	-	naximum quency (Hz)	30.00	О	315	0	0	0	0	О
58	0h163A	FDT Band	Detected frequency width	-	naximum quency (Hz)	10.00	0	315	0	0	0	0	0
59	0h163B	TD Level	Detected torque amount		50 (%)	100	0	242	Χ	Х	0	Х	0
60	0h163C	TD Band	Detected torque width	0–1	0 (%)	5.0	0	242	Χ	Χ	0	Χ	0

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

# 13.7 Parameter Mode - Communication Function Group (→COM)

#### Communication Function Group (PAR → COM)

	Communi-				Initial	Shift in			nt ode			
No.	cation Address	LCD Display	Name	0-99	Value	Opera- tion	Page	V / F	S L	V C	S L T	V C T
00	-	Jump Code	Jump code	0-99	20	0	-	0	0	0	0	0
01	0h1701	Int485 St ID	Built-in communication inverter ID		1	0	354	0	0	O	0	0
02	0h1702	Int485 Proto	Built-in communication protocol	<ul><li>1Reserved</li><li>2 Serial Debug</li></ul>	0: ModBus RTU	О	354	0	0	0	0	0
03	0h1703	Int485 BaudR	Built-in communication speed	1 2400 bps 2 4800 bps 3 9600 bps 4 19200 bps	3: 9600 bps	0	354	0	0	0	0	0
04	0h1704	Int485 Mode	Built-in communication frame setting	1 D8/PN/S2 2 D8/PE/S1	0: D8/PN/S1	-	354	0	0	0	0	0
05	0h1705	Resp Delay	Transmission delay after reception	0-1000 (ms)	5 ms	0	354	0	О	О	0	0
06 Note29-1)	0h1706	FBus S/W Ver	Communication option S/W version	-	1.00	0	Option	0	0	0	0	0
07	0h1707	FBus ID	Communication option inverter ID	0-255	1	0	Option	0	0	0	0	0
08	0h1708	FBUS BaudRate	FBus communication speed	-	12 Mbps		Option	0	0	0	0	0
09	0h1709	FieldBus LED	Communication option LED status	-	-	0	Option	0	O	0	0	0
30	0h171E	ParaStatus Num	Number of output parameters	0-8	3	0	359	0	0	0	0	0
31	0h171F	Para Stauts-1	Output address 1	0000-FFFF Hex	000A	0	359	0		0		0
32	0h1720	Para Stauts-2	Output address 2	0000-FFFF Hex	000E	0	359	0				0
33	0h1721	Para Stauts-3	Output address 3	0000-FFFF Hex	000F	0	359	0		0		0
34	0h1722	Para Stauts-4	Output address 4	0000-FFFF Hex	0000	0	359			0		0
35	0h1723	Para Stauts-5	Output address 5	0000-FFFF Hex	0000	0	359	0	0	0		0
36	0h1724	Para Stauts-6	Output address 6	0000-FFFF Hex	0000	0	359			0		0
37 38	0h1725	Para Stauts-7	Output address 7	0000-FFFF Hex	0000	0	359 359	0	0	0		0
<b>3</b> 8	0h1726	Para Stauts-8	Output address 8	0000-FFFF Hex	0000	U	359	U	U	U	U	U

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 29-1) COM 06-17 codes are displayed only when the communication module is installed.

Refer to the Options manual for options.

## Communication Function Group (PAR → COM)

No.	Communi- cation Address	LCD Display	Name	Settin	g Range	Initial Value	Shift in Opera- tion	Page	Co V / F	ntro S L	ol N V C	/loc S L T	de V C T
50	0h1732	Para Ctrl Num	Number of input parameters	0–8		2	О	359	0	0			0
51	0h1733	Para Control-1	Input address 1		FFF Hex	0005	Χ	359	0	0		_	0
52	0h1734		Input address 2		FFF Hex	0006	Χ	359	0	0	_	_	0
53	0h1735		Input address 3	1-0000	FFF Hex	0000	X	359	0	0	0	0	0
54	0h1736		Input address 4	0000-F	FFF Hex	0000	Χ	359	0	0		_	0
55	0h1737		Input address 5		FFF Hex	0000	Χ	359	0	0		_	0
56	0h1738	Para Control-6	Input address 6		FFFF Hex	0000	Χ	359	0	0			0
57	0h1739	Para Control-7	Input address 7	0000-F	FFF Hex	0000	Χ	359	0	0	0	0	0
58	0h173A	Para Control-8	Input address 8	1-0000	FFF Hex	0000	Χ	359	0	0	0	0	0
68	0h1744	FBus Swap Sel	Profibus swap	0 1	No Yes	0:No	х	Option	0	0	0	0	0
70	0h1746	Virtual DI 1	Communication multi- function input 1	0	None	0:None	0	356	0	0	0	0	0
71	0h1747	Virtual DI 2	Communication multi- function input 2	1	FX	0:None	О	356	0	0	0	0	0
72	0h1748	Virtual DI 3	Communication multi- function input 3	2	RX	0:None	0	356	0	0	0	0	0
73	0h1749	Virtual DI 4	Communication multi- function input 4	3	RST	0:None	О	356	0	0	0	0	0
74	0h174A	Virtual DI 5	Communication multi- function input 5	4	External Trip	0:None	0	356	0	0	0	0	0
75	0h174B	Virtual DI 6	Communication multi- function input 6	5	BX	0:None	0	356	0	0	0	0	0
76	0h174C	Virtual DI 7	Communication multi- function input 7	6	JOG	0:None	0	356	0	0	0	0	0
77	0h174D	Virtual DI 8	Communication multi- function input 8	7	Speed-L	0:None	0	356	0	0	0	0	0
78	0h174E	Virtual DI 9	Communication multi- function input 9	8	Speed-M	0:None	0	356	0	0	0	0	0
79	0h174F	Virtual DI 10	Communication multi- function input 10	9	Speed-H	0:None	0	356	0	0	0	0	0
80	0h1750	Virtual DI 11	Communication multi- function input 11	10	Speed-X	0:None	0	356	0	0	0	0	0
81	0h1751	Virtual DI 12	Communication multi- function input 12	11	XCEL-L	0:None	0	356	0	0	0	0	0
82	0h1752	Virtual DI 13	Communication multi- function input 13	12	XCEL-M	0:None	0	356	0	0	0	0	0
83	0h1753	Virtual DI 14	Communication multi- function input 14	13	RUN Enable	0:None	0	356	0	0	0	0	0
84	0h1754	Virtual DI 15	Communication multi- function input 15	14	3-Wire	0:None	О	356	0	0	0	0	0
85	0h1755	Virtual DI 16	Communication multi- function input 16	15	2nd Source	0:None	0	356	0	0	0	0	0
				16	Exchange						П		
					Up/Down	1							
				19	Reserved	0:None	0	-	О	0	0	0	0
				20	U/D Clear	1							
				21	Analog Hold	1							

	Communi-					Tuitial	Shift in		Cor	ntro	۱lo	/loc	le
No.	cation Address	LCD Display	Name	Settin	g Range	Initial Value	Opera- tion	Page	V / F	S L	۷ C	L T	V C T
				22 23 24 25 26 27 28 29 30 31 32 33	I-Term Clear PID Openloop P Gain2 XCEL Stop 2nd Motor Trv Offset Lo Trv Offset Hi Interlock 1 Interlock 2 Interlock 3 Interlock 4 Reserved								
				34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51	Pre Excite Speed/Torqu e ASR Gain 2 ASR P/PI Timer In Thermal In Dis Aux Ref SEQ-1 SEQ-2 Manual Go Step Hold Step FWD JOG REV JOG Trq Bias XCEL-H KEB Select Fire Mode								
86	0h1756	Virt DI Status	Communication multi- function input monitoring	-	-	0	X	356	0	0	0	0	0
90	0h175A	Comm Mon Sel	Monitor type selection	0 1	Int 485 Keypad	0: Int 485	0	358	0	0	О	0	0
91	0h175B	RcvFrame Num	Number of reception frames	-		0	-	358	0	0	О	0	0
92	0h175C	Err Frame Num	Number of error frames	-		0	-	358	0	0	0	0	0
93	0h175D	Nak Frame Num	Number of writing error frames	-		0	-	358	0	0	0	0	0
94 note <sup>29</sup> -2)		Comm Update	Communication update	0 1	No Yes	0	-	358	0	0	0	0	0

<sup>note29-2)</sup> COM 94 is displayed when the communication option module is installed.

## 13.8 Parameter Mode – Applied Function Group (→APP)

#### **Applied Function Group (PAR → APP)**

No.	Communi- cation Address	LCD Display	Name	Setting Range 0-99 0 None		Initial Value	tion	Page	V / F	S L	ol N V C	S L T	de V C T
00	-	Jump Code	Jump code			20	0	-	0	0	0	0	0
01	0h1801	App Mode	Applied function selection	0 1 2 3 4	None Traverse Proc PID Reserved Auto Sequence	0: None	х	-	0	0	0	X	Х
08 Note <sup>30</sup> )	0h1808	Trv Apmlit %	Traverse operating range	0-2	20 (%)	0.0	0	278	0	0	0	Χ	X
09	0h1809	Trv Scramb %	Traverse scramble magnitude	0-5	60 (%)	0.0	0	278	0	0	0	Χ	X
10	0h180A	Trv Acc Time	Traverse acceleration time	0.1	-600.0 (sec)	2.0	0	278	0	0	0	Χ	Χ
11	0h180B	Trv Dec Time	Traverse deceleration time	0.1	-600.0 (sec)	3.0	0	278	0	0	0	Χ	X
12	0h180C	Trv Offset Hi	Traverse offset upper limit	0-2	20.0 (%)	0.0	0	278	0	0		Χ	Χ
13	0h180D	Trv Offset lo	Traverse offset lower limit	0-2	20.0 (%)	0.0	0	278	0	0	0	Χ	Χ
16 Note <sup>31</sup> )	0h1810	PID Output	PID output monitor	(%)		0.00	-	215	0	0	0	Χ	X
17	0h1811	PID Ref Value	PID reference monitor	(%)		50.00	-	215	0	0	0	Χ	Χ
18	0h1812	PID Fdb Value	PID feedback monitor	(%)		0.00	-	215	0	0	0	Χ	Χ
19	0h1813	PID Ref Set	PID reference setting	-10	0–100 (%)	50%	0	215	0	0	0	Χ	Χ
20	0h1814	PID Ref Source	PID reference selection	0 1 2 3 4 5 6 7 8 9	Keypad V1 I1 V2 I2 Int 485 Encoder FieldBus PLC Synchro Binary Type	0:Key pad	x	215	0	0	0	X	x

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 30) APP 08-13 codes are displayed only when APP-01 (App Mode) is set as "Traverse".

Note 31) APP 16-45 codes are displayed only when APP-01 (App Mode) is set as "Proc PID" or APP-01(App Mode) is set as "MMC" and Requl Bypass (APO-34) is set as "No".

## Applied Function Group (PAR → APP)

	Ca:					el 16. 1		Co	ntr	ol N	/loc	le
No.	Communi- cation Address	LCD Display	Name	Setting Range	Initial Value	Shift in Opera- tion		V / F	S L	V C	S L T	V C T
21	0h1815	PID F/B Source	PID feedback selection	0 V1 1 I1 2 V2 3 I2 4 Int 485 5 Encoder 6 FieldBus 7 PLC 8 Synchro 9 Binary Type	0:V1	X	215				Х	
22	0h1816	PID P-Gain	PID proportional gain	0-1000 (%)	50.0	0	215	0			Χ	
23	0h1817	PID I-Time	PID integral time	0-200.0 (sec)	10.0	0	215	0			Χ	_
24	0h1818	PID D-Time	PID differential time	0-1000 (ms)	0	0	215	0	0			Χ
25	0h1819	PID F-Gain	PID feed forward gain	0-1000.0 (%)	0.0	0	215	0			Χ	_
26	0h181A	P Gain Scale	Proportional gain scale	0-100.0 (%)	100.0	Χ	215	0	0			X
27	0h181B	PID Out LPF	PID output filter	0-10000 (ms)	0	0	215	0	0	0	Χ	X
28	0h181C	PID Mode	PID mode select	0 Process PID 1 Normal PID	0:Process PID	215	215	О	0	0	Х	Χ
29	0h181D	PID Limit Hi	PID upper limit frequency	PID lower limit frequency (Hz)-300 (Hz)	60.00	0	215	0	0	0	Х	X
30	0h181E	PID Limit Lo	PID lower limit frequency	-300–PID upper limit frequency (Hz)	-60.00	0	215	0	0	0	Х	X
31	0h181F	PID Out Inv	PID output inverse	0 No 1 Yes	0:No	215	215	0	0	0	Χ	Χ
32	0h1820	PID Out Scale	PID output scale	0.1–1000 (%)	100.0	Х	215	0	0	0	Χ	Χ
34	0h1822	Pre-PID Freq	PID control period movement frequency	0–maximum frequency (Hz)	0.00	Х	215	0	0	0	Χ	Χ
35	0h1823	Pre-PID Exit	PID control period movement level	0–100 (%)	0.0	Х	215	0	0	Ο	Χ	Χ
36	0h1824	Pre-PID Delay	PID control period movement delay time	0–9999 (sec)	600	0	215	0	0	Ο	Χ	Χ
37	0h1825	PID Sleep DT	PID sleep mode delay time	0-999.9 (sec)	60.0	0	215	0	0	0	Χ	Χ
38	0h1826	PID Sleep Freq	PID sleep mode frequency	0–maximum frequency (Hz)	0.00	0	215	0	0	Ο	Χ	Χ
39	0h1827	PID WakeUp Lev	PID wake up level	0–100 (%)	35	0	215	0	0	0	Χ	Χ
40	0h1828	PID WakeUp Mod	PID wake up mode setting	0 Below Level 1 Above Level 2 Beyond Level	0:Below Level	0	215	0	0	0	Х	X
41	0h1829	PID Rev Run En	PID reverse operation	0 No 1 Yes	0:No	х	215	0	0	0	Х	X
42				0 % 1 Bar 2 mBar 3 Pa	0:%	0	215	0	0	0	Х	Х

No.	Communi- cation Address		Name	Set	tting Range	Initial Value	Shift in Opera- tion		Coi V / F	ntro S L	ol N V C	/loc S L T	de V C T
				_	КРа								
				5	Hz								
					rpm								
				7	V								
				8	I								
				9	kW								
				10	HP								
				11									
				12	°F								
43	0h182B	PID Unit Gain	PID unit gain	0–3	300 (%)	100.00	0	215	0	0	0	Χ	Χ
				0	X 0.01								
		DID Hoit		1	X 0.1								
44	0h182C	PID Unit Scale	PID unit scale	2	X 1	2:x 1	0	215	0	0	0	Χ	Χ
		Scale		3	X 0.1								
				4	X 0.01								
45	0h182D	PID P2-Gain	PID 2 <sup>nd</sup> proportional gain	0-1	1000 (%)	100.0	Х	215	0	0	0	Χ	X

Note 31) APP 16-45 codes are displayed only when APP-01 (App Mode) is set as "Proc PID" or APP-01(App Mode) is set as "MMC" and Requl Bypass (APO-34) is set as "No".

# 13.9 Parameter Mode – Auto Sequence Operation Group (→AUT)

## Auto Sequence Operation Group (PAR → AUT)

	Communi-						Shift in		Co	ntr	ol I	Иo	de
No.	cation Address	LCD Display	Name	Set	tting Range	Initial Value	Opera- tion	Page	V / F	S L	<b>V</b> V	S L T	V C T
00	-	Jump Code	Jump code	0-9		10	0	-	0	0	0	Χ	Χ
01	0h1901	Auto Mode	Auto operation type	0 1	Auto-A Auto-B	0:Auto-A	х	274	0	0	0	Χ	Х
02 Note <sup>3</sup> 2)	0h1902	Auto Check	Auto operation terminal delay time	0.0	)2-2.00 (sec)	0.10	Х	274	0	0	0	Χ	Χ
03	0h1903	Seq Select	Sequence type selection	1-2	2	1	0	274	0	0	0	Χ	Χ
04 Note <sup>33</sup> )	0h1904	Step Number 1	Number of sequence 1 steps	1-8	3	2	0	274	0	0	0	Χ	X
05 Note <sup>3</sup> 4)	0h1905	Step Number 2	Number of sequence 2 steps	1-8	3	2	0	274	0	0	0	Χ	Χ
10 Note <sup>3</sup> 5)		Seq 1/1 Freq	1/1 step frequency		11-maximum quency (Hz)	11.00	0	274	0	0	_	Χ	Χ
11	0h190B	Seq 1/1 XcelT		0.1	-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
12	0h190C	Seq 1/1 SteadT	1/1 steady speed operation time	0.1	-600.0 (sec)	5.0	0	274	0	0	0	Χ	Х
13	0h190D	Seq 1/1 Dir	1/1 operation direction	0	Reverse Forward	1:Forward	0	274	0	0	0	Χ	Χ
14	0h190E	Seq 1/2 Freq	1/2 step frequency		01-maximum equency (Hz)	21.00	0	274	0	0	0	Χ	Х
15	0h190F	Seq 1/2 XcelT	1/2 Acc/Dec time		-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
16	0h1910	Seq 1/2 SteadT	1/2 steady speed operation time	0.1	-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
17	0h1911	Seq 1/2 Dir	1/2 operation direction	0 1	Reverse Forward	1:Forward	0	274	0	0	0	Χ	Χ
18	0h190E	Seq 1/3 Freq	1/3 step frequency		01-maximum equency (Hz)	31.00	0	274	0	0	0	Χ	Х
19	0h190F	Seq 1/3 XcelT		0.1	-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
20	0h1910	Seq 1/3 SteadT	1/3 steady speed operation time	0.1	-600.0 (sec)	5.0	О	274	0	0	0	Χ	Χ
21	0h1915	Seq 1/3 Dir	1/3 operation direction	0	Reverse Forward	1:Forward	0	274	0	0	0	Χ	Х
22	0h1906	Seq 1/4 Freq	1/4 step frequency		11-maximum quency (Hz)	41.00	0	274	0	0	0	Χ	Х
23	0h1907	Seq 1/4 XcelT		0.1	-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
24	0h1918	Seq 1/4 SteadT	1/4 steady speed operation time	0.1	-600.0 (sec)	5.0	О	274	0	0	0	Χ	Χ
25	0h1919	Seq 1/4 Dir	1/4 operation direction	0	Reverse Forward	1:Forward	О	274	0	0	0	Χ	Х
26	0h191A	Seq 1/5 Freq	1/5 step frequency		11-maximum quency (Hz)	51.00	0	274	0	0	0	Χ	Χ
27	0h191B	Seq 1/5 XcelT	1/5 Acc/Dec time		-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
28	0h191C	Seq 1/5 SteadT	1/5 steady speed operation time	0.1	-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
29	0h191D	Seq 1/5 Dir	1/5 operation direction	0	Reverse	1:Forward	0	274	0	0	0	Χ	Χ

	Communi-					cl :c: :		Со	ntr	ol I	Иo	de
No.	cation Address	LCD Display	Name	Setting Range	Initial Value	Shift in Opera- tion	Page	V / F	S L	V C	S L T	V C T
				1 Forward								
30	0h191E	Seq 1/6 Freq	1/6 step frequency	0.01-maximum frequency (Hz)	60.00	0	274	0	0	0	Χ	Х
31	0h191F	Seq 1/6 XcelT	1/6 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
32	0h1920	Seq 1/6 SteadT	1/6 steady speed operation time	0.1–600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
33	0h1921	Seq 1/6 Dir	1/6 operation direction	0 Reverse 1 Forward	1:Forward	0	274	0	0	0	Χ	Χ
34	0h1922	Seq 1/7 Freq	1/7 step frequency	0.01-maximum frequency (Hz)	51.00	0	274	0	0	0	Χ	Χ
35	0h1923	Seq 1/7 XcelT	1/7 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
36	0h1924	Seq 1/7 SteadT	1/7 steady speed operation time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
37	0h1925	Seq 1/7 Dir	1/7 operation direction	0 Reverse 1 Forward	1:Forward	0	274	0	0	0	Χ	X
38	0h1926	Seq 1/8 Freq	1/8 step frequency	0.01-maximum frequency (Hz)	21.00	0	274	0	0	0	Χ	Χ
39	0h1927	Seq 1/8 XcelT	1/8 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
40	0h1928	Seq 1/8 SteadT	1/8 steady speed operation time	0.1–600.0 (sec)	5.0	0	274	0	0	0	Χ	Х
41	0h1929	Seq 1/8 Dir	1/8 operation direction	0 Reverse 1 Forward	1:Forward	0	274	0	0	0	Χ	X
43 Note <sup>3</sup> 6)	0h192B	Seq 2/1 Freq	2/1 step frequency	0.01-maximum frequency (Hz)	12.00	0	274	0	0	0	Χ	Χ
44	0h192C	Seq 2/1 XcelT	2/1 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
45	0h192D	Seq 2/1 SteadT	2/1 steady speed operation time	0.1–600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
46	0h192E	Seq 2/1 Dir	2/1 operation direction	<ul><li>0 Reverse</li><li>1 Forward</li></ul>	1:Forward	0	274	0	0	0	Χ	Χ
47	0h192F	Seq 2/2 Freq	2/2 step frequency	0.01-maximum frequency (Hz)	22.00	0	274	0	0	0	Χ	Χ
48	0h1930	Seq 2/2 XcelT	2/2 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
49	0h1931	Seq 2/2 SteadT	2/2 steady speed operation time	0.1–600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
50	0h1932	Seq 2/2 Dir	2/2 operation direction	<ul><li>0 Reverse</li><li>1 Forward</li></ul>	1:Forward	0	274	0	0	0	Χ	Χ
51	0h1933	Seq 2/3 Freq	2/3 step frequency	0.01-maximum frequency (Hz)	32.00	0	274	0	0	0	Χ	X
52	0h1934		2/3 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
53	0h1935	Seq 2/3 SteadT	2/3 steady speed operation time	0.1–600.0 (sec)	5.0	0	274	0	0	0	Χ	Х
54	0h1936	Seq 2/3 Dir	2/3 operation direction	<ul><li>0 Reverse</li><li>1 Forward</li></ul>	1:Forward	0	274	0	0	0	Χ	Χ
52	0h1937	Seq 2/4 Freq	2/4 step frequency	0.01-maximum frequency (Hz)	42.00	0	274	0	0	0	Χ	Χ
56	0h1938	Seq 2/4 XcelT	2/4 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
57	0h1939	Seq 2/4 SteadT	2/4 steady speed operation time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
58	0h193A	Seq 2/4 Dir	2/4 operation direction	0 Reverse 1 Forward	1:Forward	0	274	0	0	0	Χ	X
59	0h193B	Seq 2/5 Freq	2/5 step frequency	0.01-maximum	52.00	0	274	0	0	0	Χ	Χ

	Communi-					Chift in		Co	ntr	ol I	Mo	de
No.	cation Address	LCD Display	Name	Setting Range	Initial Value	Shift in Opera- tion	Page	V / F	S L	۷ C	S L T	V C T
				frequency (Hz)								
60	0h193C	Seq 2/5 XcelT	2/5 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
61	0h193D	Seq 2/5 SteadT	2/5 steady speed operation time	0.1-600.0 (sec)	5.0	0	274	О	0	0	Χ	Х
62	0h193E	Seq 2/5 Dir	2/5 operation direction	<ul><li>0 Reverse</li><li>1 Forward</li></ul>	1:Forward	0	274	0	0	0	Χ	Χ
63	0h193F	Seq 2/6 Freq	2/6 step frequency	0.01-maximum frequency (Hz)	60.00	0	274	0	0	0	Χ	Χ
64	0h1940	Seq 2/6 XcelT	2/6 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
65	0h1941	Seq 2/6 SteadT	2/6 steady speed operation time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
66	0h1942	Seq 2/6 Dir	2/6 operation direction	0 Reverse 1 Forward	1:Forward	0	274	0	0	0	Χ	Х
67	0h1943	Seq 2/7 Freq	2/7 step frequency	0.01-maximum frequency (Hz)	52.00	0	274	0	0	0	Χ	X
68	0h1944	Seq 2/7 XcelT	2/7 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
69	0h1945	Seq 2/7 SteadT	2/7 steady speed operation time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Х
70	0h1946	Seq 2/7 Dir	2/8 operation direction	0 Reverse 1 Forward	1:Forward	0	274	0	0	0	Χ	Х
71	0h1947	Seq 2/8 Freq	2/8 step frequency	0.01-maximum frequency (Hz)	22.00	0	274	0	0	0	Χ	X
72	0h1948	Seq 2/8 XcelT	2/8 Acc/Dec time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Χ	Χ
73	0h1949	Seq 2/8 SteadT	2/8 steady speed operation time	0.1-600.0 (sec)	5.0	0	274	0	0	0	Х	X
74	0h194A	Seq 2/8 Dir	2/8 operation direction	0 Reverse 1 Forward	1:Forward	0	274	0	0	О	Х	Х

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 32) AUT group is displayed only when APP-01(App Mode) is set as "Auto Sequence".

Note 33) AUT-04 codes are displayed only when AUT-03 Seq Select) is set as "1".

Note 34) AUT-05 codes are displayed only when AUT-03 (Seq Select) is set as "2".

Note 35) AUT-10-41 codes are displayed only when AUT-03 (Seq Select) is set as "1".

Note 36) AUT-43-74 codes are displayed only when AUT-03 (Seq Select) is set as "2".

# 13.10 Parameter Mode – Option Module Function Group (→APO)

## Option Module Function Group (PAR → APO)

	Communi-					Toitial	Shift in			ont ode	rol e		
No.	cation Address	LCD Display	Name	Se	tting Range	Initial Value	Opera- tion	Page	V / F	S L	V C	S L T	V C T
00	-	Jump Code	Jump code	0-9	99	20	0		0	0	0	0	0
		_		0	None								
01 Note <sup>37</sup> )	0h1A01	Enc Opt Mode	Encoder function item	1	Feedback	0:None	0	150	0	0	О	0	0
		'		2	Reference								
				0	Line Driver								
04	0h1A04	Enc Type Sel	Encoder type selection	1	Totem or Com	0:Line Driver	X	150	0	0	О	0	0
		Type Sei	Sciection	2	Open Collector	Driver							
				0	(A+B)								
05	0h1A05	Enc Pulse Sel	Encoder pulse direction	1	-(A+B)	0: (A+B)	Χ	150	0	0	О	0	0
		ruise sei	direction	2	A	(A+D)							
06	0h1A06	Enc Pulse Num	Number of encoder pulses	10	-5000	1024	X	150	0	0	0	0	0
80	0h1A08	Enc Monitor	Feedback monitor	-		-	0	150	0	0	0	0	0
09	0h1A09	Pulse Monitor	Reference monitor	-		-	0	150	0	0	0	0	0
10	0h1A0A	Enc Filter	Encoder input filter	0-	10000 (ms)	3	0	150	0	0	0	0	0
11	0h1A0B	Enc Pulse x1	Encoder minimum input pulse	0-	100 (kHz)	0.0	0	150	0	Χ	0	Χ	0
12	0h1A0C	Enc Perc y1	Output at encoder minimum pulse (%)	0-	100 (%)	0.00	0	150	0	Χ	О	Χ	0
13	0h1A0D	Enc Pulse x2	Encoder maximum input pulse	0-2	200 (kHz)	100	0	150	0	Χ	О	Χ	0
14	0h1A0E	Enc Perc y2	Encoder maximum pulse output (%)	0-	100 (%)	100	0	150	0	Χ	0	Χ	0
20 Note <sup>38</sup> )	0h1A14	Aux Motor Run	Display of number of auxiliary motor movements	0-4	4	0	0	283	0	0	0	Х	Χ
21	0h1A15	Starting Aux	Starting auxiliary motor selection	1-4	4	1	Х	283	0	0	0	Χ	Χ
22	0h1A16	AutoOp Time	Auto change operation time	X:>	(X (Min)	0:00	0	283	0	0	0	Χ	Χ
23	0h1A17	Start Freq 1	1st auxiliary motor starting frequency	0-0	60 (Hz)	49.99	0	283	0	0	О	Χ	Χ
24	0h1A18	Start Freq 2	2nd auxiliary motor starting frequency	0-0	60 (Hz)	49.99	0	283	0	0	0	Χ	X
25	0h1A19	Start Freq 3	3rd auxiliary motor starting frequency	0-0	60 (Hz)	49.99	0	283	0	0	0	Χ	X
26	0h1A1A	Start Freq 4	4th auxiliary motor	0-0	60 (Hz)	49.99	0	283	0	0	0	Χ	Χ

No.	Communi-					Tuitial	Shift in			ont ode			
No.	cation Address	LCD Display	Name	Set	ting Range	Initial Value	Opera- tion	Page	V / F	S L	V C	S L T	V C T
			starting frequency										
27	0h1A1B	Stop Freq 1	1st auxiliary motor stop frequency	0-6	60 (Hz)	15.00	0	283	0	0	0	Χ	Х
28	0h1A1C	Stop Freq 2	2nd auxiliary motor stop frequency	0-6	60 (Hz)	15.00	0	283	0	0	0	Χ	Χ
29	0h1A1D	Stop Freq 3	3rd auxiliary motor stop frequency	0-6	60 (Hz)	15.00	0	283	0	0	0	Х	Χ
30	0h1A1E	Stop Freq 4	4th auxiliary motor stop frequency	0-6	60 (Hz)	15.00	0	283	0	0	0	Х	Χ
31	0h1A1F	Aux Start DT	Auxiliary motor starting delay time	0-3	600.0 (sec)	60.0	0	283	0	0	0	Х	Χ
32	0h1A20	Aux Stop DT	Auxiliary motor stop delay time	0-3	8600.0 (sec)	60.0	0	283	0	0	0	Χ	Χ
33	0h1A21	Num of Aux	Auxiliary motor number selection	0-4		4	Х	283	0	0	О	Χ	Χ
34	0h1A22	Regul Bypass	Bypass selection	0	No	0:No	Х	283	0	0	0	X	Х
J4	UTTTAZZ	Regul Dypass	Буразз зелесион	1	Yes	0.110	^	203	Ü	Ü	Ü	^	^
				0	None								
35	0h1A23	Auto Ch Mode	Auto change mode selection	1	Aux	1: Aux	X	283	0	0	0	Χ	Χ
				2	Main								
36	0h1A24	Auto Ch Time	Auto change time	0-9	9:00 (min)	72:00	0	283	0	0	0	Χ	Χ
38	0h1A26	Interlock	Interlock selection	0	No	0:No	0	283	0	0	О	Χ	Х
			Intorio di monoment	1	Yes -360.0								
39	0h1A27	Interlock DT	Interlock movement delay time	(se		5.0	0	283	0	0	0	Χ	Χ
40	0h1A28	Actual Pr Diff	Auxiliary motor movement pressure difference	0–1	00 (%)	2	0	283	0	0	0	Х	Х
41	0h1A29	Aux Acc Time	Main motor acceleration time when number of pumps decreases	0-6	500.0 (sec)	2.0	0	283	0	0	0	Х	Х
42	0h1A2A	Aux Dec Time	Main motor deceleration time when number of pumps increases	0-6	600.0 (sec)	2.0	0	283	Ο	0	0	Х	Х
58 Note <sup>39</sup> )	0h1A3A	PLC LED Status	PLC option LED status	-		-	0	Option	0	0	0	0	0
59	0h1A3B	PLC S/W Ver	PLC option module S/W version	1		1.X	0	Option	0	0	0	0	0
60	0h1A3C	PLC Wr Data 1	PLC write data 1	0-F	FFF (Hex)	0000	0	Option	0	0	0	0	0
61	0h1A3D	PLC Wr Data 2	PLC write data 2	0-F	FFF (Hex)	0000	0	Option	0	0	0	0	0
62	0h1A3E	PLC Wr Data 3	PLC write data 3	0-F	FFF (Hex)	0000	0	Option	_	4		_	0
63	0h1A3F	PLC Wr Data 4	PLC write data 4	0-F	FFF (Hex)	0000	0	Option		-	_	_	0
64	0h1A40	PLC Wr Data 5	PLC write data 5	0-F	FFF (Hex)	0000	0	Option	0	0	0	0	0

	Communi-					Shift in			ntı ode			
No.	cation Address	LCD Display	Name	Setting Range	Initial Value	Opera- tion	Page	V / F	S L	۷ C	S L T	V C T
65	0h1A41	PLC Wr Data 6	PLC write data 6	0-FFFF (Hex)	0000	0	Option	0	0	0	0	0
66	0h1A42	PLC Wr Data 7	PLC write data 7	0-FFFF (Hex)	0000	0	Option	0	0	0	0	0
67	0h1A43	PLC Wr Data 8	PLC write data 8	0-FFFF (Hex)	0000	0	Option	0	0	О	0	0
76	0h1A4C	PLC Rd Data 1	PLC read data 1	0-FFFF (Hex)	0000	0	Option	0	0	0	0	0
77	0h1A4D	PLC Rd Data 2	PLC read data 2	0-FFFF (Hex)	0000	0	Option	0	0	0	0	0
78	0h1A4E	PLC Rd Data 3	PLC read data 3	0-FFFF (Hex)	0000	0	Option	0	0	0	0	0
79	0h1A4F	PLC Rd Data 4	PLC read data 4	0-FFFF (Hex)	0000	0	Option	0	0	0	0	0
80	0h1A50	PLC Rd Data 5	PLC read data 5	0-FFFF (Hex)	0000	0	Option	0	0	0	0	0
81	0h1A51	PLC Rd Data 6	PLC read data 6	0-FFFF (Hex)	0000	0	Option	0	0	0	0	0
82	0h1A52	PLC Rd Data 7	PLC read data 7	0-FFFF (Hex)	0000	0	Option	0	0	0	0	0
83	0h1A53	PLC Rd Data 8	PLC read data 8	0-FFFF (Hex)	0000	0	Option	0	0	0	0	0

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

Note 37) APO-01-14 codes are displayed only when the encoder module is installed.

Note 38) APO-20-42 codes are displayed only when APP-01 (App Mode) is set as "MMC".

Note 39) APO-58-83 codes are displayed only when the PLC option module is installed.

# 13.11 Parameter Mode – Protective Function Group (→PRT)

Protective Function Group (PAR → PRT)

PIO	tective	runction e	roup (PAR 🖚	PKI)								
No.	Communi- cation Address	LCD Display	Name	Setting Range	Initial Value	Shift in Opera- tion		Cc V / F	ntı S L	ol I V C	Mo S L T	de V C T
00	-	Jump Code	Jump code	0-99	40	0		0	0	0	O	
04	0h1B04	Load Duty	Load amount setting	0 Normal Duty 1 Heavy Duty	1:Heavy Duty	Х	326	0	0	0	О	0
05	0h1B05	Phase Loss Chk	Input/output open- phase protection	Bit 00–11  1 Output open phase 2 Input open phase	00	Х	333	0	0	0	0	0
06	0h1B06	IPO V Band	Input voltage range during open-phase	1–100 (V)	40	X	333	0	0	0	0	0
07	0h1B07	Trip Dec Time	Deceleration time at fault trip	0-600 (sec)	3.0	0	336	0	0	0	0	0
08	0h1B08	RST Restart	Starting selection on trip reset	0 No 1 Yes	0:No	0	253	0	0	0	0	0
09	0h1B09	Retry Number	Number of automatic restarts	0–10	0	0	253	0	0	0	0	0
10 Note40)	0h1B0A	Retry Delay	Automatic restart delay time	0-60.0 (sec)	1.0	0	253	0	0	0	0	0
11	0h1B0B	Lost KPD Mode	Keypad command loss operation mode	0 None 1 Warning 2 Free-Run 3 Dec	-0:None	0	336	0	0	0	0	0
12	0h1B0C	Lost Cmd Mode	Speed command loss operation mode	0 None 1 Free-Run 2 Dec 3 Hold Input 4 Hold Output 5 Lost Preset	-0:None	0	338	0	0	0	0	0
13 Note41)	0h1B0D	Lost Cmd Time	Speed command loss judgment time	0.0–120 (sec)	1.0	0	338	0	0	0	0	0
14	0h1B0E	Lost Preset F	Operation frequency at speed command loss	Start frequency -maximum frequency (Hz)	0.00	0	338	0	0	0	0	0
15	0h1B0F	AI Lost Level	Analog input loss judgment level	0 Half of x1 1 Below x1	0:Half of x1	0	338	0	0	0	0	0
17	0h1B11	OL Warn Select	Overload alarm selection	0 No 1 Yes	0:No	0	326	0	0		_	0
18	0h1B12	OL Warn Level	Overload alarm level	30-180 (%)	150	0	326	0	0		0	
19	0h1B13	OL Warn Time	Overload alarm time	0-30.0 (sec)	10.0	0	326	0	0	0	0	0
20	0h1B14	OL Trip Select	Motion at overload trip	0 None 1 Free-Run 2 Dec	1:Free- Run	0	326	0	0			0
	•	•		• •	•	•	•	•	•	_	-	_

Protective Function Group (PAR → PRT)

		<del></del>	310ap (17tit 2	· · · · · /						_	_	_	_
No.	Communi- cation Address	LCD Display	Name	Setting Range	e	Initial Value	Shift in Opera- tion		V / F	S L	۷ C	S L T	de V C T
21	0h1B15	OL Trip Level	Overload trip level	30-200 (%)		180	0	326	0	0	0		
22	0h1B16	OL Trip Time	Overload trip time	0-60 (sec)		60.0	0	326	0	0	0	0	0
25	0h1B19	UL Warn Sel	Under load alarm selection	0 No 1 Yes		0:No	0	341	0	0	0	0	0
26	0h1B1A	UL Warn Time	Under load alarm time	0-600.0 (sec)		10.0	0	341	0	0	0	0	0
27	0h1B1B	UL Trip Sel	Under load trip selection	0 None 1 Free-Run 2 Dec		0:None	0	341	0	0	0	0	0
28	0h1B1C	UL Trip Time	Under load trip time	0-600 (sec)		30.0	0	341	0	0	0	0	0
29	0h1B1D	UL LF Level	Under load lower limit level	10-30 (%)		30	0	341	0	0	0	0	0
30	0h1B1E	UL BF Level	Under load upper limit level	10-100 (%)		30	0	341	0	0	0	0	0
31	0h1B1F	No Motor Trip	Operation on no motor trip	0 None 1 Free-Run		0: None	0	347	0	0	0	0	0
32 Note42)	0h1B20	No Motor Level	No motor detection current level	1–100 (%)		5	0	347	0	0	0	0	0
33	0h1B21	No Motor Time	No motor detection delay	0.1–10.0 (sec)		3.0	0	347	0	0	0	0	0
34	0h1B22	Thermal-T Sel	Operation at motor overheat detection	0 None 1 Free-Run 2 Dec		0:None	0	331	0	0	0	0	0
35	0h1B23	Thermal In Src	Thermal sensor input	0 None 1 V1 2 I1 3 V2 4 I2		0:None	х	331	0	0	0	0	0
36	0h1B24	Thermal-T Lev	Thermal sensor fault level	0–100 (%)		50.0	0	331					
37	0h1B25	Thermal-T Area	Thermal sensor fault area	0 Low 1 High		0:Low	0	331	0	0	0	0	0
40	0h1B28	ETH Trip Sel	Electronic thermal fault trip prevention selection	0 None 1 Free-Run 2 Dec		0:None	0	324	0	0	0	0	0
41	0h1B29	Motor Cooling	Motor cooling fan type	0 Self-cool 1 Forced-coo	ol	0:Self- cool	0	324	0	0	0	0	0
42	0h1B2A	ETH 1min	Electronic thermal one minute rating	120-200 (%)		150	0	324	О	0	0	0	0
43	0h1B2B	ETH Cont	Electronic thermal prevention continuous rating	50-200 (%)		120	0	324	0	0	0	0	0
45	0h1B2D	BX Mode	BX mode select	0 (sec) 0.1-600.0 (sec)	Free-run Dec	0.0 (Free- run)	0	345	0	0	0	Χ	Х

## Protective Function Group (PAR → PRT)

Communi Nocation Address  Name  Setting Range  Setting Range  Shift in Operation V S F L  Bit 00000-11111  O Accelerating 0001 (Mode1) 1 Accelerating	o X O	V C T
0 Accelerating 0001 (Mode1)	o x o	
0001 (Mode2) 0 Steady speed		X
Chart from one	охо	X
	о х о	X
53 Oh1B35 Stall Freq 2 Stall frequency 2 Stall frequency 2 Stall frequency 2 Go.00 O G.00 O G.0	охо	Х
	ОХО	X
Chall from come 2	охо	
56   Oh1B38   Stall Level 3   Stall level 3   30–250 (%)   180   X   328   O   C	ОХО	X
Stall frequency 3  57 Oh1B39 Stall Freq 4 Stall frequency 4  Stall frequency 3  -maximum frequency 60.00 O 328 O (Hz)	o x o	X
58 Oh1B3A Stall Level 4 Stall level 4 30–250 (%) 180 X 328 O C	ОХО	X
	000	0
70 Oh1B46 Over SPD Overspeed decision frequency 20–130 (%) 120.0 O 343 X	хох	0
Ilme	хох	0
73 Oh1B49 Speed Dev Trip Speed error failure 0 No O 343 X X	хох	Х
74 Oh1B4A Speed Dev Band Speed error width 2-maximum frequency (Hz) 20.00 O 343 X	хох	Х
Ilme	хох	Х
CHECK CHECK I TES	хох	0
Time une	хох	0
79 Oh1B4F FAN Trip Mode Cooling fan fault selection 0 Trip 1:War ning 0 344 O C	000	0
lwlode   optional module trip   2   Dec   -kun	000	0
	000	0
82 Oh1B52 LV2 Enable Select 'Low Voltage2' during 0 No O:No X 347 O C	000	0

No. Commu	ni LCD Display	Name	Setting	Range	Initial	Shift in	Page	Control Mode
		operation	1	Yes				

<sup>\*</sup> The grey cells indicate a hidden code which is only visible when setting a code.

# 13.12 Parameter Mode – 2nd Motor Function Group (→M2)

#### 2nd Motor Function Group (PAR → M2)

	Communi					Shift in		Co	Control		Иo	de
No.	-cation Address	LCD Display	Name	Setting Range	Initial Value	Opera- tion		V / F	S L	V C	S L T	V C T
00	-	Jump Code	Jump code	0–99	14	0	-	0	0	Χ	0	Χ
04	0h1C04	M2-Acc Time	Acceleration time	0–600 (sec)	Below 75 kW 20.0 Above 90 kW 60.0	U	258	0	Ο	Х	0	Χ
05	0h1C05	M2-Dec Time	Deceleration time	0-600 (sec)	Below 75 kW 30.0 Above 90 kW 90.0		258	0	0	Х	0	Χ
06	0h1C06	M2-Capacity	Motor capacity	0 0.2 kW 21 185 kW	-	Х	258		0		О	
07	0h1C07	M2-Base Freq	Base frequency	30-400 (Hz)	60.00	Χ	258	0	0	Χ	0	X
08	0h1C08	M2-Ctrl Mode	Control mode	0 V/F 1 V/F PG 2 Slip Compen 3 Sensorless-1 4 Sensorless-2	0:V/F	х	258	0	0	Х	0	X
10	0h1C0A	M2-Pole Num	Motor pole	2-48		Χ	258	0	0	Χ	0	Χ
11	0h1C0B	M2-Rated Slip	Rated slip speed	0-3000 (rpm)	1	X	258	0	0	Χ	0	Χ
12	0h1C0C	M2-Rated Curr	Motor rated current	1.0-1000.0 (A)	1	X	258	0	0	Χ	0	Χ
13	0h1C0D	M2-Noload Curr	Motor no-load current	0.5-1000.0 (A)	1	X	258	0	0		0	
14	0h1C0E	M2-Rated Volt	Motor rated voltage	180-480 (V)	Danandantan	Χ	258	0	0	Χ	0	X
15	0h1C0F	M2-Efficiency	Motor efficiency	70-100 (%)	Dependent on motor capacity	Χ	258					
16	0h1C10	M2-Inertia Rt	Load inertia ratio	0–8	Thotol capacity	Χ	258		$\sim$	v	$\overline{}$	v
17	-	M2-Rs	Stator resistance	0-9.999 (Ω)		Χ	258	U	U	^	0	^
18	-	M2-Lsigma	Leak inductance	0-99.99 (mH)		Χ	258					
19	-	M2-Ls	Stator inductance	0-999.9 (mH)		Χ	258	0	0	Χ	0	X
20	-	M2-Tr	Rotor time constant	25-5000 (ms)		Χ	258	0	0	Χ	0	X
25	0h1C19	M2-V/F Patt	V/F pattern	0 Linear 1 Square 2 User V/F	0:Linear	Х	258	0	0	Х	0	Χ
26	0h1C1A	M2-Fwd Boost	Forward torque boost	0-15 (%)	Below 75 kW: 2.0	Χ	258		0		0	
27	0h1C1B	M2-Rev Boost	Reverse torque boost	0-15 (%)	Above 90 kW: 1.0	X	258	0			0	
28	0h1C1C	M2-Stall Lev	Stall prevention level	30-150 (%)	150	Χ	258		0			
29	0h1C1D	M2-ETH 1min	Electronic thermal one	100-200 (%)	150	Χ	258	0	0	Χ	0	Χ

Note 40) PRT-10 codes are displayed only when PRT-09(Retry Number) is set above "0".

Note 41) PRT-13-15 codes are displayed only when PRT-12(Lost Cmd Mode) is not "None".

Note 42) PRT-32-33 codes are displayed only when PRT-31(No Motor Trip is set as "Free-Run".

No.	Communi	LCD Display	Name	Setting Range	Initial Value	Shift in	Page	Со	ntr	ol I	Иo	de
			minute rating									
30	0h1C1E	IM2-FTH Cont	Electronic thermal continuous rating	50-150 (%)	100	Х	258	0	0	Χ	0	X
40	0h1C28	M2- LoadSpdGain	Revolution display gain	0.1-6000.0 (%)	100.0	0	258	0	0	0	0	0
41	0h1C29	M2- LoadSpdScal	Revolution display scale	0 x 1 1 x 0.1 2 x 0.01 3 x 0.001 4 x 0.0001	0:x 1	0	258	0	0	0	0	0
42	0h1C2A	M2- LoadSpdUnit	Revolution display unit	0 Rpm 1 Mpm	0:rpm	0	258	0	0	0	0	0

# 13.13 Trip Mode (TRP Current (or Last-x))

## Trip Mode (TRP Last-x)

No.	LCD Display	Name	Set	tting Range	Initial Value	Page
00	Trip Name (x)	Trip type display	-		-	304
01	Output Freq	Output frequency at trip	-		-	304
02	Output Current	Output current at trip	-		-	304
03	Inverter State	Acc/Dec status at trip	-		-	304
04	DCLink Voltage	DC voltage	DC voltage -		-	304
05	Temperature	NTC temperature	-		-	304
06	DI State	Status of input terminals	-		0000 0000	304
07	DO State	Status of output terminals	-		000	304
80	Trip On Time	Trip time since power on	-		0000DAY 00hr:00mm	304
09	Trip Run Time	Trip time since operation start	-		0000DAY 00hr:00mm	304
10	Trip Delete	Delete trip history	0	No Yes	0:No	305

# 13.14 Config Mode (CNF)

## Config Mode (CNF)

No.	LCD Display	Name	Setting Range	Initial Value	Page
00	Jump Code	Jump code	0-99	1	-

No.	LCD Display	Name	Se	tting Range	Initial Value	Page
				English		
				Russian		
01	Language Sel	Keypad language selection		Español	0. English	323
01	Language Ser	Reypud language selection		Polski	0. 2.19.1311	323
				Turkish		
02	LCD Contrast	LCD contrast adjustment	-	TUIKISIT	_	272
10	Inv S/W Ver	Inverter S/W version	-		1.XX	272
11	KeypadS/W Ver	Keypad S/W version	-		1.XX	272
12	KPD Title Ver	Keypad title version	-		1.XX	272
20 Note43	Anytime Para	Status display	0	Frequency	0: Frequency	303
21	Monitor Line-1	Monitor mode display 1	1	Speed	0: Frequency	299
		Monitor mode			2:Output	
22	Monitor Line-2	display 2	2	Output Curren	Current	299
			3	Output Voltage	2	
			4	Output Power		
				WHour Counte	r	
			6	DCLink Voltage	!	
			7	DI State		
			8	DO State	<del>-</del> - -	
			9	V1 Monitor (V)		
				V1 Monitor (%)		
				I1 Monitor (mA		
	Monitor Line-3	tor Line-3 Monitor mode display 3		I1 Monitor (%)		
				V2 Monitor (V)		
23				V2 Monitor (%)	3:Output	299
23	IVIOLITO ELITO S			I2 Monitor (mA	- VOITAGE	233
				I2 Monitor (%)	-	
				PID Output		
				PID ref Value		
				PID Fdb Value		
				Torque	-	
				Torque Limit		
				Trq Bias Ref		
				Speed Limit		
				Load Speed		
				Temperature		
			0	No		
24	Mon Mode Init	Monitor mode initialization	1	Yes	0:No	299
30	Option-1 Type	Option slot 1 type display	0	None	0:None	Option
31	Option-2 Type	Option slot 2 type display	1	PLC	0:None	Option
		- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1- 1-	2	Profi	,	
32	Option-3 Type	Option slot 3 type display	3	Ext. I/O	0:None	Option
<i>J</i> _	Spaint 3 type	Space. Side of type display	4	Encoder		Sparion
			0	No		
40	Parameter Init	Parameter initialization	1	All Grp	<b>-</b>  -	264
			[1	Migih		1

LCD Display			ting Range	Initial Value	Page
	1	2	DRV Grp		
		3	BAS Grp		
		4	ADV Grp		
		5	CON Grp	1	
		6	IN Grp		
		7	OUT Grp	1	
		8	COM Grp		
		9	APP Grp		
		10	AUT Grp		
		11	APO Grp		
		12	PRT Grp		
		13	M2 Grp		
Changed Dava	Display changed parameter	0	View All	Od Gover All	260
Changed Para		1	View Changed	U:view Ali	268
		0	None		
N 4 +:  / C -	Multi Euroption Louvitono	1	JOG Key	0.11	260
Multi Key Sei	iviuiti-function key item	2	Local/Remote	U:None	268
		3	UserGrp SelKey		
		0	None		
Macro Select	Macro function item	1	Draw App	0:None	270
		2	Traverse		
5 AU.T.	51	0	No	0.11	272
Erase All Trip	Delete trip history	1	Yes	U:NO	272
	51	0	No	0.11	250
UserGrp AliDei	Delete user registration code	1	Yes	U:NO	268
		0	No		0.50
Parameter Read	Read parameters	1	Yes	U:No	263
D		0	No	0.11	262
Parameter Write	Write parameters	1	Yes	U:NO	263
		0	No		0.50
Parameter Save	Save parameters	1	Yes	U:No	263
View Lock Set	Hide parameter mode	0-9		Unlocked	266
View Lock Pw				Password	266
Key Lock Set	- · · · · · · · · · · · · · · · · · · ·	_		Unlocked	267
	•	0-9	9999		267
-		0	No		070
Add Title Del	Additional title update	1	Yes	U:No	272
		0	No		
Easy Start On	Simple parameter setting	1	Yes	0:No	271
		0	No		
WHCount Reset	Power consumption initialization	1		0:No	272
		00			
On-time	Accumulated inverter motion time			-	272
	1				1
Run-time	I Accumulated inverter operation time. I		hr:00mm	-	272
Time Reset	Accumulated inverter operation time	0	No	0:No	272
	Erase All Trip  UserGrp AllDel  Parameter Read  Parameter Write  Parameter Save  View Lock Set  View Lock Pw  Key Lock Set  Key Lock Pw  Add Title Del  Easy Start On  WHCount Reset  On-time	Multi Key Sel  Multi-function key item  Macro Select  Macro function item  Erase All Trip  Delete trip history  UserGrp AllDel  Parameter Read  Read parameters  Parameter Write  Write parameters  Parameter Save  View Lock Set  Hide parameter mode  View Lock Pw  Result Dock Password for hiding parameter mode  Key Lock Pw  Password for locking parameter edit  Key Lock Pw  Add Title Del  Easy Start On  Simple parameter setting  WHCount Reset  Paccumulated inverter motion time	Changed Para  Display changed parameter  Display	B   COM Grp   9   APP Grp   10   AUT Grp   11   APO Grp   11   APO Grp   12   PRT Grp   13   M2 Grp   13   M2 Grp   15   M2 Grp   16   M2 Grp   17   M2 Grp   17   M2 Grp   18   M2 Grp   19   M2 Grp   10   M2 Grp   10   M2 Grp   10   M2 Grp   10   M2 Green   10   M2 Gr	B   COM Grp   9   APP Grp   10   AUT Grp   11   APO Grp   11   APO Grp   12   PRT Grp   13   M2 Grp   13   M2 Grp   10   None   15   View Changed   17   View Changed   17   View Changed   18   View Changed   19   O   None   O   O   None   O

#### **Table of Functions**

No.	LCD Display	Name	Set	ting Range	Initial Value	Page
		initialization	1	Yes		
74	Fan Time	3 - 1		00DAY hr:00mm	-	272
75	Fan Time Rst	Accumulated cooling fan operation time initialization	_	No Yes	1 <b>-</b>	272

Note 43) Item 7 and 8 are not in the Anytime Para item.

# 13.15 User/Macro Mode – Draw Operation Function Group→MC1

#### U&M → MC1

	M → MC1				
No.	LCD Display	Name	Setting Range	Initial Value	Page
00	Jump Code	Jump code	0-99	1	-
01	Acc Time	Acceleration time	0-600 (sec)	Below 75 kW 20	171
	/ lee riirie	/ teceleration time	0 000 (300)	Above 90 kW 60	17.
02	Dec Time	Deceleration time	0-600 (sec)	Below 75 kW 30	171
	Dec Time	Beccieration time	0 000 (500)	Above 90 kW 90	
03	Cmd Source	Command source	0-5	1:Fx/Rx-1	159
04	Freq Ref Src	Frequency reference source	0-9	2:V1	137
05	Control Mode	Control mode	0-5	0:V/F	175
06	Aux Ref Src	Auxiliary reference source	0-4	2:I1	196
07	Aux Calc Type	Auxiliary calculation type	0-7	0	196
80	Aux Ref Gain	Auxiliary reference gain	-200-200 (%)	100.0	196
09	V1 Polarity	V1 input polarity selection	0–1	0:Unipolar	138
10	V1 Filter	V1 input filter time constant	0-10000 (ms)	10	138
11	V1 Volt x1	V1 minimum input voltage	0-10 (V)	0.00	138
12	V1 Perc y1	Output at V1 minimum voltage (%)	0-100 (%)	0.00	138
13	V1 Volt x2	V1 maximum input voltage	0-10 (V)	10.00	138
14	V1 Perc y2	Output at V1 maximum voltage (%)	0-100 (%)	100.00	138
15	V1 –Volt x1'	V1 -minimum input voltage	-10-0 (V)	0.00	138
16	V1 –Perc y1'	Output at V1 –minimum voltage (%)	-100-0 (%)	0.00	138
17	V1 –Volt x2'	V1-maximum input voltage	-10-0 (V)	-10.00	138
18	V1 –Perc y2	Output at V1 -maximum voltage (%)	-100-0 (%)	-100.00	138
19	V1 Inverting	Rotation direction change	0–1	0:No	138
20	I1 Monitor(mA)	I1 input amount display	0-20 (mA)	0.00	146
21	I1 Polarity	I1 polarity display	0–1	0	146
22	I1 Filter	I1 input filter time constant	0-10000 (ms)	10	146
23	I1 Curr x1	I1 minimum input current	0-20 (mA)	4.00	146
24	I1 Perc y1	Output at I1 minimum current (%)	0-100 (%)	0.00	146
25	I1 Curr x2	I1 maximum input current	4-20 (mA)	20.00	146
26	I1 Perc y2	Output at I1 maximum current (%)	0-100 (%)	100.00	146
27	I1 Curr x1'	I1 -minimum input current	-20-0 (mA)	0.00	146
28	I1 Perc y1'	Output at I1 - minimum current (%)	-100-0 (%)	0.00	146
29	I1 Curr x2'	I1 – maximum input current	-20-0 (mA)	-20.00	146
30	I1 Perc y2'	Output at I1 maximum current (%)	-100–0 (%)	-100.00	146
31	I1 Inverting	Rotation direction change	0–1	0:No	146
32	P1 Define	P1 terminal function setting	0–48	0:FX	
33	P2 Define	P2 terminal function setting	0-48	1:RX	159
34	P3 Define	P3 terminal function setting	0-48	5:BX	345

# 13.16 User/Macro mode – Traverse Operation Function Group (→MC2)

## Traverse Operation Function Group (U&M → MC2)

No.	LCD Display	Name	Setting Range	Initial Value	Initial Value	
00	Jump Code	Jump code	0–99	1		-
01	Acc Time	A goal a ration time a	0.600(555)	Below 75 kW	20	-278
Οī	Acc Time	Acceleration time	0-600 (sec)	Above 90 kW	60	72/8
02	Dec Time	Deceleration time	0.600(555)	Below 75 kW	30	278
02	Dec Time	Deceieration time	0-600 (sec)	Above 90 kW	90	2/8
03	Cmd Source	Command source	0–5	1:Fx/Rx-1		278
04	Freq Ref Src	Frequency reference source	0–9	0:Keypad-1		278
05	Control Mode	Control mode	0–5	0:V/F		278
06	App Mode	Applied function selection	0–4	1:Traverse		278
07	Trv Apmlit %	Traverse operating range	0–20 (%)	0.0		278
08	Trv Scramb %	Traverse scramble magnitude	0–50 (%)	0.0		278
09	Trv Acc Time	Traverse acceleration time	0.1-600 (sec)	2.0		278
10	Trv Dec Time	Traverse deceleration time	0.1-600 (sec)	2.0		278
11	Trv Offset Hi	Traverse offset upper limit	0–20 (%)	0.0		278
12	Trv Offset lo	Traverse offset lower limit	0–20 (%)	0.0		278
13	P1 Define	P1 terminal function setting	0–48	0:FX		278
14	P2 Define	P2 terminal function setting	0–48	1:RX		278
15	P3 Define	P3 terminal function setting	0-48	5:BX		278
16	P4 Define	P4 terminal function setting	0-48	27:Trv		278
17	P5 Define	P5 terminal function setting	0-48	28:Trv		278

# 14 Safety Funtion STO(Safe Torque Off)

The iS7 Inverter series provides resilient safety features via optional safety expansion module. When an emergency arises, it instantly blocks inverter output to protect the operator and reduce the risk.

## 14.1 Safety Standard Product

The performance levels for the safety function are as follows.

EN ISO 13849-1: Category 3, PL Class d

EN 61508: SIL 2 (EN 60204-1, Stop Category 0)

#### ① Caution

When using the safety function, perform a risk assessment for the system and ensure that it meets the safety requirements.

#### Note

When wiring the inverter or performing maintenance, the inverter must be turned off. The safety function is not used to block the power supply to the motor or insulate the inverter electrically.

## 14.2 About the Safety Function

The safety function is a safety torque off (STO) function used to prevent a torque and to block the power supply to the motor by interrupting the gate using hard wires.

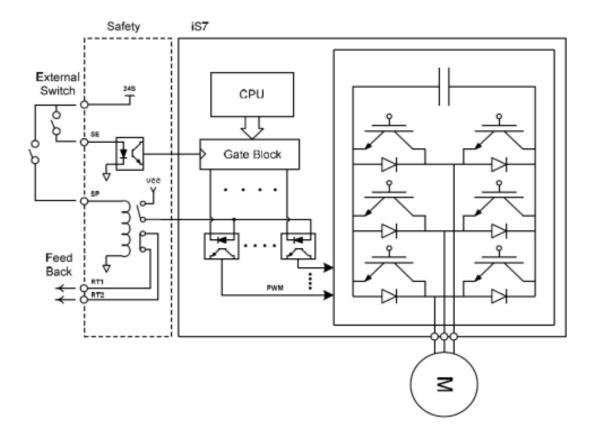
#### STO (Safety Torque Off): IEC61800-5-2

The STO function is independently connected to each input signal for 2 channels (SE(SFT11) and SP(SFT2)). The connected circuit cuts off the operation signal for the inverter output and turns off the power modules.

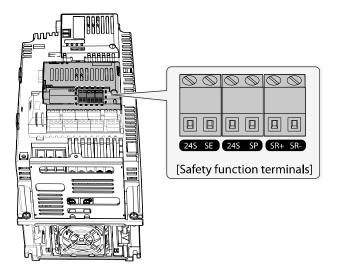
If the safety function is activated during operation, the inverter blocks the output and the motor enters Free Run mode. Also, the "Safety Opt Err" message is displayed on the keypad.

To release the fault trip, short-circuit terminal block to return to the normal operation status and press the [STOP/RESET] key.

## 14.2.1 Safety Function Wiring Diagram



#### 14.2.2 Installing the Safety Board to 0.75–160 kW Product



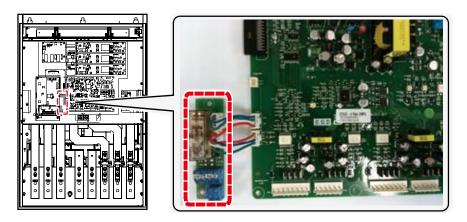
#### ① Caution

Because 0.75-160kW products provide safety purpose product, therefore please use this product with safety option.

Safety options are not available for general products.

#### 14.2.3 Installing the Safety Board to 185–375 kW Product

Please buy safety option and apply to standard products because there is no safety product for 185-375kW.



Refer to the following figure and install the safety board to the main SMPS board of the inverter using cable connectors.

## 14.2.4 Safety Function Terminal Description

24S – SE (SFT1)	24S – SP (SFT2)	SR + SR-		
Short: Normal operation	Short: Normal operation	B Contact relay output		
Open: Safety Trip (output blockage )	Open: Safety Trip (output blockage)	terminal		

## 14.2.5 Cable Specification for Signal Terminal Block Wiring

Terminal	Terminal		ickness	Florenizal Chandoud		
Variety	Name	mm² AWG		Electrical Standard		
24S	Safety Input power	0.33–1.25mm² (16–22 AWG) Shield type twisted-pair wire		24 VDC, Max. 10 mA		
SE	Safety Input 1 (SFT1)			Short: Safety function stop		
SP	Safety Input 2 (SFT2)			Shield type Open: Safety function op		Open: Safety function operation
SR+,SR-	Safety function completion output relay			DC 24 V, 5 A below (B contact)		

#### ① Caution

The length of the safety wiring at the input terminal must be less than 30 m. Longer wiring can Using over 30M may cause malfunctions because of noise.

## 15 Marine Certification

Marine classification is that the structure and equipment of the ship has been estimated from the test with the certain standards for certificate issued and given by classification society. SV-IS7 Series is certificated with product testing, process, production equipment and test equipment to install on the shipping.

## 15.1 DNV (Det Norske Veritas) Marine Certification **Details**

Certification Institute	DNV (Det Norske Veritas)
Certificate Number	TAE00001S1
Certified Model Types	Frequency Converter for Asynchronous Motors SV series (Range: 0.75 kW-375 kW 200–400 VAC supply)
Compliance	Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft Det Norske Veritas' Offshore Standards

## 15.2 Bureau Veritas (Marine & Offshore Division) **Marine Certification Details**

Certification Institute	Bureau Veritas (Marine&Off shore Division)
Certificate Number	40183/AO BV
Certified Model Types	SV-iS7 series (Range: 0.75 kW-75 kW, 200V / 0.75 kW-375 kW, 400V)
Compliance	Bureau Veritas Rules for the Classification of Steel Ships

## 15.3 ABS Marine Certification Details

Certification institute	ABS (American Bureau of Shipping)
Certificate Number	14-BK1291913-PDA
Certified Model Types	SV-iS7 series (Range: 0.75 kW-75 kW, 200V / 0.75 kW-90 kW, 400V)
Compliance	Installation of the product on an ABS class vessel, MODU or facility

## **15.4 KR Marine Certification Details**

Certification institute	KR (Korean Resister)
Certificate Number	PTD25585-AC003
Certified Model Types	SV-iS7 series (Range: 0.75 kW-75 kW, 200V / 0.75 kW-375 kW, 400V)
Compliance	Korean Resister's Rules for Classification of Steel Ships

# 15.5 Marine Certification Models for SV-iS7 Products

Туре		DNV	BV	ABS	KR
	SV0008iS7-2□□□V	0	0	0	0
	SV0015iS7-2□□□V	0	0	0	0
	SV0022iS7-2□□□V	0	0	0	0
	SV0037iS7-2□□□□V	0	0	0	0
	SV0055iS7-2□□□□V	0	0	0	0
	SV0075iS7-2□□□□V	0	0	0	0
0.51	SV0110iS7-2□□□V	0	0	0	0
3-Phase 200V	SV0150iS7-2□□□□V	0	0	0	0
	SV0185iS7-2□□□□V	0	0	0	0
	SV0220iS7-2□□□V	0	0	0	0
	SV0300iS7-2□□□V	0	0	0	0
	SV0370iS7-2□□□V	0	0	0	0
	SV0450iS7-2□□□V	0	0	0	0
	SV0550iS7-2□□□V	0	0	0	0
	SV0750iS7-2□□□V	0	0	0	0
	SV0008iS7-4□□□V	0	0	0	0
0.51	SV0015iS7-4□□□V	0	0	0	0
3-Phase 400V	SV0022iS7-4□□□V	0	0	0	0
	SV0037iS7-4□□□□V	0	0	0	0
	SV0055iS7-4□□□V	0	0	0	0

Туре		DNV	BV	ABS	KR
	SV0075IS7- 4□□□□V	0	0	0	0
	SV0110iS7-4□□□□V	0	0	0	0
	SV0150iS7-4□□□□V	0	0	0	0
	SV0185iS7-4□□□□V	0	0	0	0
	SV0220iS7-4□□□□V	0	0	0	0
	SV0300iS7-4□□□□V	0	0	0	0
	SV0370iS7-4□□□□V	0	0	0	0
	SV0450iS7-4□□□□V	0	0	0	0
	SV0550iS7-4□□□□V	0	0	0	0
	SV0750iS7-4□□□□V	0	0	0	0
	SV0900iS7-4□□□□V	0	0	0	0
	SV1100iS7-4	0	0	Х	0
	SV1320iS7-4□□□□V	0	0	Х	0
	SV1600iS7-4□□□□V	0	0	Х	0
	SV1850iS7-4□□□□V	0	0	Х	0
	SV2200iS7-4□□□□V	0	0	Х	0
	SV2800iS7-4□□□□V	0	0	Х	0
	SV3150iS7-4	0	0	Х	0
	SV3750iS7-4□□□□V	0	0	X	0

# **16 Using a Single Phase Power Source**

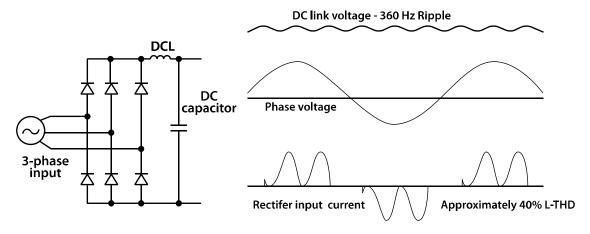
## 16.1 Single Phase Rating

The SV-iS7 series inverter is a three-phase variable frequency drive (VFD). When applying single-phase power to a three-phase VFD, there are several limitations that need to be considered.

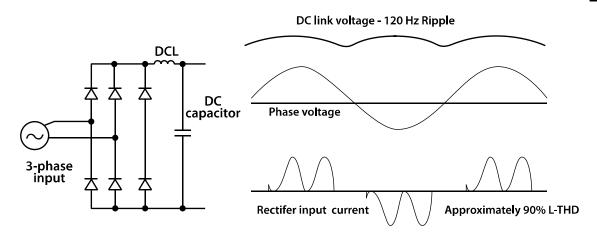
The standard pulse-width-modulated (PWM) VFDs use a 6-pulse diode rectifier. The 6-pulse rectification results in 360 Hz DC bus ripple when using a three-phase 60 Hz power supply. However, when using a single-phase power source, the DC bus ripple becomes 120 Hz. The input current and harmonics increase, and the VFDs DC bus circuit is subject to higher stress in order to deliver equivalent power.

Input current distortion of 90% THD and greater can be expected under single-phase input, compared to approximately 40% with three-phase input as indicated in Figure 2.

Therefore, use of a single-phase requires the three-phase VFD power rating to be reduced (derated) to avoid over stressing the rectifier and the DC link components.



<Figure-1 Typical Three-Phase Configuration>



<Figure-2 Typical Single-Phase Configuration>

## 16.2 Power(HP), Input Current and Output Current

When using a three-phase VFD with single-phase input, derating the drive's output current and horsepower will be necessary due to the increase in DC bus ripple voltage and current. In addition, the input current through the remaining two phases on the diode bridge converter will approximately double, creating another derating consideration for the VFD. Input current harmonic distortion will increase, making the overall input power factor low.

Input current distortion over 100% is likely under single-phase conditions without a reactor. Therefore, the reactor is always required for such applications.

Using a motor that is selected by the three-phase drive ratings with single-phase input may result in poor performance and premature drive failure.

The selected drive of single-phase current ratings must meet or exceed the motor current ratings as indicated in the following table.

Single-Phase Current Rating (200V/60Hz)*								
ri and	[HP]	Output Amp		Input Amp				
[kW]	[nr]	HD [A]	ND [A]	HD [A]	ND [A]			
0.75kW	1	2.6	4.1	4.3	6.8			
1.5kW	2	4.0	6.0	6.9	10.6			
2.2kW	3	6.2	8.2	11.2	14.9			
3.7kW	5	8.1	12	14.9	21.3			

Single-Phase C	Single-Phase Current Rating (200V/60Hz)*									
[kW]	THDI	Output Amp		Input Amp						
[KVV]	[HP]	HD [A]	ND [A]	HD [A]	ND [A]					
5.5kW	7.5	12	16	22.1	28.6					
7.5kW	10	16	23	28.6	41.2					
11kW	15	24	31	44.3	54.7					
15kW	20	31	38	55.9	69.7					
18.5kW	25	38	45	70.8	82.9					
22kW	30	45	64	85.3	116.1					
30kW	40	60	75	121.0	152.0					
37kW	50	75	93	154.0	190.0					
45kW	60	93	114	191.0	231.0					
55kW	75	114	149	233.0	302.0					
75kW	100	149	178	305.0	362.0					

<sup>\*</sup> The drive ratings in table are valid for 60 Hz input only.

## **16.3 Input Frequency and Voltage Tolerance**

The AC supply voltage must be within the required voltage range of 240/480 VAC +10% to -5% to maximize motor power production.

The standard product with three-phase voltage input has an allowable range of +10% to -15%. A stricter input voltage tolerance of +10 to -5% applies when using the drive with a single-phase supply. The average bus voltage with single-phase input is lower than the equivalent of a three-phase input. Therefore, the maximum output voltage (motor voltage) will be lower with a single-phase input.

The minimum input voltage must be no less than 228 VAC for 240 volt models and 456 VAC for 480 V models, to ensure motor voltage production of 207 VAC and 415 VAC, respectively.

If full motor torque must be developed near the base speed (full power) it will be necessary to maintain a rigid incoming line voltage so that adequate motor voltage can be produced.

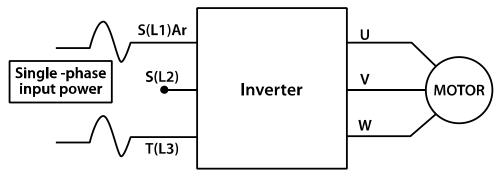
Operating a motor at reduced speed (reduced power), or using a motor with a base voltage that is lower than the incoming AC supply rating (ex. 208 VAC motor with a 240 VAC supply) will also minimize the effect of voltage deprivation ( 240 VAC Input for 208 V motor, 480 VAC Input for 400 V motor).

# 16.4 Wiring and Peripheral Device

It is important that input wiring and branch circuit protection be selected based on the drive's single-phase input current rating indicated in Table 1–2.

The single-phase input current after derating differs from the three-phase input indicated on the VFD nameplate.

Refer to the following figure and connect the single-phase AC input wiring to the inverter's R[L1] and T[L3] terminals.



<Figure-3 Terminal Wiring Diagram>

### **Note**

The drive ratings in Table 1 are valid for 60 Hz input only.

Single-F	hase	Rating	(200V/6	60Hz)*									
		Single-Phase Current Rating			Wire Selec	tion	FUSE		DC Lir		МССВ	Electronic Contactor	
[kW]	[HP]	Output	t Amp	Input Amp		AWG							Contactor
		HD [A]	ND [A]	HD [A]	ND [A]	R,S,T	U,V,W	[A]	[V]	[mH]	[A]	LS ELECTRIC(UL	Гуре)
0.75kW	1	2.6	4.1	4.3	6.8	14	14	10				UTE100/15A	MC-9b
1.5kW	2	4.0	6.0	6.9	10.6	14	14	15				UTE100/15A	MC-12b
2.2kW	3	6.2	8.2	11.2	14.9	14	14	20				UTE100/30A	MC-18b
3.7kW	5	8.1	12	14.9	21.3	12	12	32				UTE100/30A	MC-32a
5.5kW	7.5	12	16	22.1	28.6	10	10	50		D:14. :	_	UTS150/50A	MC-40a
7.5kW	10	16	23	28.6	41.2	8	8	63		Built-i	n	UTS150/60A	MC-50a
11kW	15	24	31	44.3	54.7	6	6	80				UTS150/100A	MC-65a
15kW	20	31	38	55.9	69.7	4	4	100	500V			UTS150/125A	MC-100a
18.5kW	25	38	45	70.8	82.9	2	2	125				UTS150/150A	MC-130a
22kW	30	45	64	85.3	116.1	1	1	160				UTS250/175A	MC-150a
30kW	40	60	75	121.0	152.0	1/0	1/0	200		0.24	200	UTS250/225A	MC-150a
37kW	50	75	93	154.0	190.0	2/0	2/0	250		0.2	240	UTS400/300A	MC-225a
45kW	60	93	114	191.0	231.0	2/0	2/0	350		0.17	280	UTS400/350A	MC-330a
55kW	75	114	149	233.0	302.0	3/0	3/0	400		0.12	360	UTS600/500A	MC-400a
75kW	100	149	178	305.0	362.0	4/0	4/0	450		0.1	500	UTS600/600A	MC-630a

<sup>\*</sup>The drive ratings in Table 1 are valid for 60 Hz input only.

Table 1. Single-Phase Rating(240 V/60 Hz)

Single-F	hase	Rating	(400V/6	0Hz)										
		Single-Phase Current Rating				Wire Select	Selection		FUSE		nk	МССВ	Electronic Contactor	
[kW]	[HP]	Output	Amp	Input Amp		AWG	AWG		FUSL		е	IVICCD	Contactor	
		HD [A]	ND [A]	HD [A]	ND [A]	R,S,T	U,V,W	[A]	[V]	[mH]	[A]	LS ELECTRIC(UL 1	Гуре)	
0.75kW	1	1.4	2.2	2.2	3.7	14	14	10				UTE100/15A	MC-9b	
1.5kW	2	2.1	3.2	3.6	5.7	14	14	10				UTE100/15A	MC-9b	
2.2kW	3	2.8	4.1	5.5	7.7	14	14	15				UTE100/15A	MC-12b	
3.7kW	5	4.1	6.1	7.5	11.1	14	14	20				UTE100/15A	MC-18b	
5.5kW	7.5	6.1	8.0	11.0	14.7	12	12	32				UTE100/30A	MC-22b	
7.5kW	10	8.1	12	14.4	21.9	12	12	35				UTE100/30A	MC-32a	
11kW	15	12	16	22.0	26.4	10	10	50			UTS150/50A	MC-40a		
15kW	20	16	20	26.6	35.5	8	8	63				UTS150/60A	MC-50a	
18.5kW	25	20	23	35.6	41.1	6	6	70				UTS150/80A	MC-65a	
22kW	30	23	31	41.6	55.7	4	4	100	500V	Built-ir	ı	UTS150/100A	MC-65a	
30kW	40	32	39	55.5	67.5	4	4	125				UTS150/125A	MC-100a	
37kW	50	39	47	67.9	81.7	4	2	125				UTS150/150A	MC-130a	
45kW	60	47	57	82.4	101.8	1	1	160				UTS250/175A	MC-150a	
55kW	75	57	78	102.6	143.6	1/0	1/0	200				UTS250/225A	MC-185a	
75kW	100	78	94	143.4	173.4	2/0	2/0	250				UTS400/300A	MC-225a	
90kW	120	95	116	174.7	212.9	4/0	4/0	350				UTS400/400A	MC-330a	
110kW	150	116	138	213.5	254.2	4/0	4/0	400				UTS600/500A	MC-400a	
132kW	180	134	165	255.6	315.3	300	300	450				UTS600/600A	MC-400a	
160kW	225	166	189	316.3	359.3	400	400	450				UTS600/600A	MC-630a	

Table 2. Single-Phase Rating (480 V/60 Hz)

### 16.5 Other Considerations

The following lists other precautions that need to be considered when using a three-phase VFD using single-phase power source.

- Depending on the increased DC ripple, sensorless mode may result in poor performance when operating a three-phase inverter using single-phase power supply.
- If a phase open trip occurs, cancel the input phase open protection bit setting (PRT-05: Phase Loss Chk).
- Do not allow the current to exceed the single-phase rating. Motor capacity, motor overload trip, and E-thermal functions must be set to protect motor.
- A reactor is always required. Use a model type that comes with built-in DC reactor. The iS7 200 V 30–75kW and 400 V 280–375 kW products do not have built-in DC reactors. Install an external AC reactor separately for these model types (Do not install DC reactors externally).

# 17 Storage and Disposal

### 17.1 Storage

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

- Store the product in the same environmental conditions as specified for operation (refer to <u>3.1 Installation Considerations</u> on page<u>17</u>.
- When storing the product for a period longer than 3 months, store it between 0°C and 65°C, to prevent depletion of the electrolytic capacitor.
- Do not expose the drive to snow, rain, fog, or dust.
- Package the inverter in a way that prevents contact with moisture. Keep the moisture level below 70% in the package by including a desiccant, such as silica gel.
- If the product is exposed to a humid or dusty environment, separate the product and then keep it in an adequate environment that is suitable for product operation.

### ① Caution

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

## 17.2 Disposal

When disposing of the product, categorize it as general industrial waste. Recyclable materials are included in the product, so recycle them whenever possible. The packing materials and all metal parts can be recycled



#### **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:

STARVERT-iS7 series

Trade Mark:

LS ELECTRIC Co., Ltd.

#### Conforms with the essential requirements of the directives:

2014/35/EU Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits

2014/30/EU Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to electromagnetic compatibility

Based on the following specifications applied:

EN 61800-3:2004/A1:2012 EN 61800-5-1:2007

and therefore complies with the essential requirements and provisions of the 2014/35/CE and 2014/30/CE Directives.

Place:

Cheonan, Chungnam,

**Korea** 

된 남 건

2019.2.13

(Signature / Date)

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

#### **EMI / REI POWER LINE FILTERS**

LS ELECTRIC inverters, iS7 series



#### **RFI FILTERS**

THE LS RANGE OF POWER LINE FILTERS **FEP ( Standard )** SERIES, HAVE BEEN SPECIFICALLY DESIGNED WITH HIGH FREQUENCY **LS ELECTRIC INVERTERS.** THE USE OF LS FILTERS, WITH THE INSTALLATION ADVICE OVERLEAF HELP TO ENSURE TROUBLE FREE USE ALONG SIDE SENSITIVE DEVICES AND COMPLIANCE TO CONDUCTED EMISSION AND IMMUNITY STANDARS TO EN 50081.

#### **CAUTION**

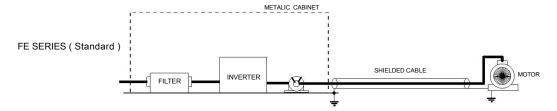
IN CASE OF A LEAKAGE CURRENT PROTECTIVE DEVICES IS USED ON POWER SUPPLY, IT MAY BE FAULT AT POWER-ON OR OFF. IN AVOID THIS CASE, THE SENSE CURRENT OF PROTECTIVE DEVICE SHOULD BE LARGER

#### RECOMMENDED INSTALLATION INSTRUCTIONS

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

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

IT IS IMPORTANT THAT ALL LEAD LENGHTS ARE KEPT AS SHORT AS POSSIBLE AND THAT INCOMING MAINS AND OUTGOINGMOTORCABLESARE KEPTWELLSEPARATED.



PR0062



iS7 series / Sta	ndard Filter	rs									
INVERTER	POWER	CODE	CURRENT	VOLTAGE	LEAKAGE CURRENT	DIMENSIONS L W H	MOUNTING Y X	WEIGHT	MOUNT	FIG.	OUTPUT CHOKES
THREE PHASE											
SV0300iS7-2	30kW	FEP-T180	180A	220-480VAC	0.7mA 80mA	332 x 170 x 120	115 x 155	8.4 Kg	-	В	FS-3
SV0370iS7-2	37kW	FEP-T250	250A	220-480VAC	0.7mA 80mA	392 x 190 x 116	240 x 165	9.1 Kg	-	В	FS-3
SV0450iS7-2	45kW	FEP-T320	320A	220-480VAC	0.7mA 80mA	392 x 260 x 116	240 x 235	9.8 Kg	-	В	FS-4
SV0550iS7-2	55kW	FEP-T320	320A	220-480VAC	0.7mA 80mA	392 x 260 x 116	240 x 235	9.8 Kg	-	В	FS-4
SV0750iS7-2	75kW	FEP-T400	400A	220-480VAC	0.7mA 80mA	392 x 260 x 116	240 x 235	10.3 Kg	-	В	FS-4

SV0300~0750IS7 EN 55011 CLASS A GROUP 2 IEC/EN 61800-3 C3

iS7 series / Sta	ındard Filte	rs									
INVERTER	POWER	CODE	CURRENT	VOLTAGE	LEAKAGE CURRENT	DIMENSIONS L W H	MOUNTING Y X	WEIGHT	MOUNT	FIG.	OUTPUT CHOKES
THREE PHASE											
SV0300iS7-4	30kW	FE-T100-2	100A	220-480VAC	1.3mA 150mA	420 x 200 x 130	408 x 166	13.8 Kg	-	Α	FS-3
SV0370iS7-4	37kW	FE-T100-2	100A	220-480VAC	1.3mA 150mA	420 x 200 x 130	408 x 166	13.8 Kg	-	В	FS-3
SV0450iS7-4	45kW	FEP-T150	150A	220-480VAC	1.3mA 150mA	332 x 170 x 120	115 x 155	8 Kg	-	В	FS-3
SV0550iS7-4	55kW	FEP-T150	150A	220-480VAC	1.3mA 150mA	332 x 170 x 120	115 x 155	8 Kg	-	В	FS-3
SV0750iS7-4	75kW	FEP-T180	180A	220-480VAC	1.3mA 150mA	332 x 170 x 120	115 x 155	8.4 Kg	-	В	FS-3
SV0900iS7-4	90KW	FEP-T250	250A	220-480VAC	1.3mA 150mA	392 x 190 x 116	240 x 165	9.1 Kg	-	В	FS-4
SV1100iS7-4	110KW	FEP-T400	400A	220-480VAC	1.3mA 150mA	392 x 260 x 116	240 x 235	10.3 Kg	-	В	FS-4
SV1320iS7-4	132KW	FEP-T400	400A	220-480VAC	1.3mA 150mA	392 x 260 x 116	240 x 235	10.3 Kg	-	В	FS-4
SV1600iS7-4	160KW	FEP-T600	600A	220-480VAC	1.3mA 150mA	392 x 260 x 116	240 x 235	11 Kg	-	В	FS-4
SV1850iS7-4	185KW	FEP-T600	600A	220-480VAC	1.3mA 150mA	392 x 260 x 116	240 x 235	11 Kg	-	В	FS-4
SV2200iS7-4	220KW	FEP-T1000	1000A	220-480VAC	1.3mA 150mA	460 x 280 x 166	290 x 255	18 Kg	-	В	FS-4
SV2800iS7-4	280KW	FEP-T1000	1000A	220-480VAC	1.3mA 150mA	460 x 280 x 166	290 x 255	18 Kg	-	В	FS-4
SV3150iS7-4	315KW	FEP-T1000	1000A	220-480VAC	1.3mA 150mA	460 x 280 x 166	290 x 255	18 Kg	-	В	FS-4
SV3750iS7-4	375KW	FEP-T1600	1600A	220-480VAC	1.3mA 150mA	592 x 300 x 166	340 x 275	27 Kg	-	В	FS-4

SV0300~2200 iS7-4 EN 55011 CLASS A

GROUP 2

IEC/EN 61800-3 C3 IEC/EN 61800-3 C4

CLASS A SV2800~3750 iS7-4 EN 55011

FE SERIES (Standard)

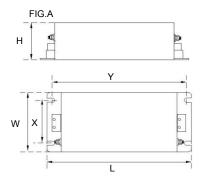
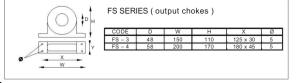


FIG.B  $\oplus$  $\oplus$  $\mathbf{w}|\mathbf{x}$ 

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

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# **Product Warranty**

### **Warranty Information**

Fill in this warranty information form and keep this page for future reference or when warranty service may be required.

Product Name	LS ELECTRIC Inverter	Date of Installation	
Model Name	SV-iS7	Warranty Period	
	Name (or company)		
Customer Info	Address		
	Contact Info.		
	Name		
Retailer Info	Address		
	Contact info.		

### **Warranty Period**

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

### **Warranty Service Information**

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

#### **Non-Warranty Service**

A service fee will be incurred for malfunctions in the following cases:

- intentional abuse or negligence
- power supply problems or from other appliances being connected to the product

### **Product Warranty**

- acts of nature (fire, flood, earthquake, gas accidents etc.)
- modifications or repair by unauthorized persons
- missing authentic LS ELECTRIC rating plates
- expired warranty period

### **Visit Our Website**

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

### **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.

### **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 quidelines 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 EurAsian Conformity mark (EAC) indicates that the product conforms to all technical regulations of the Eurasian Customs Union assessment procedures. This means that it meets all requirements and technical regulations applicable to the product, and that it can be serviced in all service centers of the producer in the territory of all Customs Union member countries.

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