SINUS H

USER MANUAL

-Installation and Programming Instructions-

Issued on 07/03/17 R.02 Software Version 32 51

English

- This manual is integrant and essential to the product. Carefully read the instructions contained herein as they provide important hints for use and maintenance safety.
- This device is to be used only for the purposes it has been designed to. Other uses should be considered improper and dangerous. The manufacturer is not responsible for possible damages caused by improper, erroneous and irrational uses.
- Enertronica Santerno S.p.A. is responsible for the product in its original setting.
- Any changes to the structure or operating cycle of the product must be performed or authorized by Enertronica Santerno S.p.A..
- Enertronica Santerno S.p.A. assumes no responsibility for the consequences resulting by the use of non-original spare-parts.
- Enertronica Santerno S.p.A. reserves the right to make any technical changes to this manual and to the product without prior notice. If printing errors or similar are detected, the corrections will be included in the new releases of the manual.
- The information contained herein is the property of Enertronica Santerno S.p.A. and cannot be reproduced. Enertronica Santerno S.p.A. enforces its rights on the drawings and catalogues according to the law.



Enertronica Santerno S.p.A. Via della Concia, 7 - 40023 Castel Guelfo (BO) Italy Tel. +39 0542 489711 - Fax +39 0542 489722 santerno.com info@santerno.com



Revision Index

The following subjects covered in this User Manual (Installation and Programming Instructions) R.02 have been added or changed in respect to revision R.01:

- Information about the protection level for connection terminals and devices added.
- Cable Wiring detailed for IP20 0034 model too.
- Figures for Terminals in IP20 0034 model and IP66 models added.
- References to AO2 Analog Output and A2/C2 Digital Output added [0034 model only].
- Bracket dimensions and mounting for LCD keypad added.
- Section about Sensorless Vector Control for PM (Permanent-Magnet) Syn Motors added.
- Table for the recommended MCCB for RMS symmetrical amperes added.
- Statement about maximum distance (3m) for remoting the graphic keypad added.
- References to PTC Trip and MC Fail Trip removed.
- Some measures in External Dimensions table fixed.
- RS-232/RS-485 converter replaced by USB/RS-485 converter.
- Values of Heat Emission updated.
- Section about Applying Drives to Single-Phase Input Application added.
- EMC footprint and standard filters: "EN55011 (B class)" changed to "EN55011 (Group 1 Class A)" and "EN55011 (A class)" changed to "EN55011 (Group 2 Class A)"
- Unused EMC filter models removed (2S from the footprint filters and 4T from the standard filters).
- Stated that the Output Ferrite is required also for the drive models featuring built-in filters.

Santerno User Manuals mentioned in this Instructions Guide

The following Santerno User Manuals are mentioned throughout this Instructions Guide:

- 15W0102B500 Motor Drives Accessories User Manual
- 15W0176B100 Sinus H Conduit Kit and Flange Kit Manual



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

A 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 that, if not avoided, could result in minor injury or property damage.

Safety information

▲ Danger

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



⚠ Warning

- 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.
- Check the information about the protection level for the circuits and devices.

 The following connection terminals and devices are the Electrical Protection level 0. It means that the circuit protection level depends on the basic insulation. If there is no basic insulation or it has failed, electric shock accident may occur. When installing or wiring the connection terminals and devices, take the same protective action as for the power wiring.
 - Multi-function Input: P1-P7 for IP20 models, P1-P5 for IP66 models, CM
 - Analog Frequency Input: VR, V1, I2, TI
 - Safety Function: SA, SB, SC
 - Analog Output: AO, AO2 [0034 model only], TO
 - Digital Output: Q1, EG, 24, A1/C1/B1, A2/C2 [0034 model only]
 - Communication: S+/S-/SG
 - Fan
- The protection level of this equipment (inverter) is the Electrical Protection level 1.

① Caution

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





Note

Maximum allowed prospective short-circuit current at the input power connection is defined in IEC 60439-1 as 100 kA. Depending on the selected MCCB, the SINUS H Series is suitable for use in circuits capable of delivering a maximum of 100 kA RMS symmetrical amperes at the drive's maximum rated voltage. The following table lists the recommended MCCB for RMS symmetrical amperes.

	ABB Tmax	LSIS Susol		LSIS Meta	asol		
Working	TIB160	UTE100	UTS150	ABS33c	ABS53c	ABS63c	ABS103c
Voltage	(B/C/N) [kA]	(E/N) [kA]	(N/H/L) [kA]	[kA]	[kA]	[kA]	[kA]
240V(50/60Hz)	25/40/50	50/65	65/100/150	30	35	35	85
480V(50/60Hz)	8/10/15	25/35	35/65/100	7.5	10	10	26



Quick Reference Table

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

Situation	Reference
I want to run a slightly higher rated motor than the inverter's rated capacity.	<u>p. 276</u>
I want to configure the inverter to start operating as soon as the power source is applied.	<u>p. 139</u>
I want to configure the motor's parameters.	<u>p.205</u>
I want to set up sensorless vector control.	<u>p.208</u>
Something seems to be wrong with the inverter or the motor.	<u>p. 295, p.405</u>
What is auto tuning?	<u>p.205</u>
What are the recommended wiring lengths?	<u>p. 295, p.405</u>
The motor is too noisy.	<u>p. 240</u>
I want to apply PID control on my system.	<u>p. 196</u>
What are the factory default settings for P1-P7 (IP20 models) or P1-P5 (IP66 models) multi-function terminals?	<u>p. 51</u>
I want to view all of the parameters I have modified.	<u>p. 249</u>
I want to review recent fault trip and warning histories.	<u>p. 371</u>
I want to change the inverter's operation frequency using a potentiometer.	<u>p. 81</u>
I want to install a frequency meter using an analog terminal.	<u>p. 53</u>
I want to display the supply current to motor.	<u>p. 84</u>
I want to operate the inverter using a multi-step speed configuration.	<u>p. 131</u>
The motor runs too hot.	<u>p. 274</u>
The inverter is too hot.	<u>p. 283</u>
The cooling fan does not work.	<u>p. 411</u>
I want to change the items that are monitored on the keypad.	<u>p. 270</u>



1	Prepa	aring th	e Installation	16
	1.1	Produ	ct Identification	16
	1.2	Part N	ames for IP20 models	18
	1.3	Part N	ames for IP66 models	21
	1.4	Installa	ation Considerations	23
	1.5	Select	ing and Preparing a Site for Installation	24
	1.6	Cable	Selection	28
2	Insta	lling the	e Inverter	30
	2.1	Moun	ting the Inverter	32
	2.2	Cable'	Wiring	36
	2.3	Post-Ir	nstallation Checklist	63
	2.4	Test Ru	Jn	65
3	Learr	ning to f	Perform Basic Operations	67
	3.1	About	the Keypad	67
		3.1.1	About the Display	68
		3.1.2	Operation Keys	69
		3.1.3	Control Menu	70
	3.2	Learni	ng to Use the Keypad	71
		3.2.1	Group and Code Selection	71
		3.2.2	Navigating Directly to Different Codes	72
		3.2.3	Setting Parameter Values	73
		3.2.4	Configuring the [ESC] Key	74
	3.3	Actual	Application Examples	76
		3.3.1	Acceleration Time Configuration	76
		3.3.2	Frequency Reference Configuration	77
		3.3.3	Jog Frequency Configuration	
		3.3.4	Initializing All Parameters	
		3.3.5	Frequency Setting (Potentiometer) and Operation (Terminal Input	t)81



	3.3.6	Frequency Setting (Potentiometer) and Operation (Keypad)	82
3.4	Monito	oring the Operation	84
	3.4.1	Output Current Monitoring	84
	3.4.2	Fault Trip Monitoring	85
3.5	About	the LCD keypad (graphic keypad)	87
	3.5.1	Operation Keys	87
	3.5.2	Bracket dimensions and mounting	89
	3.5.3	About the Display	90
	3.5.4	Display Modes	93
3.6	Learni	ng to Use the LCD keypad (graphic keypad)	96
	3.6.1	Display Mode Selection	96
	3.6.2	Switching Groups	99
	3.6.3	Navigating through the Codes (Functions)	101
	3.6.4	Navigating Directly to Different Codes	103
	3.6.5	Parameter settings	104
	3.6.6	Monitoring the Operation	106
3.7	Fault N	Monitoring	109
	3.7.1	Monitoring Faults during Inverter Operation	109
	3.7.2	Monitoring Multiple Fault Trips	110
3.8	Param	eter Initialization	112
Learr	ning Bas	sic Features	113
4.1	Setting	g Frequency Reference	116
	4.1.1	Keypad as the Source (KeyPad-1 setting)	117
	4.1.2	Keypad as the Source (KeyPad-2 setting)	117
	4.1.3	V1 Terminal as the Source	118
	4.1.4	Setting a Frequency Reference with Input Voltage (Terminal I2)	125
	4.1.5	Setting a Frequency with TI Pulse Input	127
	4.1.6	Setting a Frequency Reference via RS-485 Communication	129
4.2	Freque	ency Hold by Analog Input	130
4.3	Chang	ging the Displayed Units (Hz←Rpm)	131
4.4	Settino	g Multi-step Frequency	131

4



4.5	Comm	and Source Configuration	133
	4.5.1	The Keypad as a Command Input Device	133
	4.5.2	Terminal Block as a Command Input Device (Fwd/Rev Run Com	-
	4.5.3	Terminal Block as a Command Input Device (Run and Rotation	134
	1.0.0	Direction Commands)	135
	4.5.4	RS-485 Communication as a Command Input Device	136
4.6	Local/F	Remote Mode Switching	136
4.7	Forwar	rd or Reverse Run Prevention	138
4.8	Power-	on Run	139
4.9	Reset a	and Restart	140
4.10	Setting	Acceleration and Deceleration Times	141
	4.10.1	Acc/Dec Time Based on Maximum Frequency	141
	4.10.2	Acc/Dec Time Based on Operation Frequency	143
	4.10.3	Multi-step Acc/Dec Time Configuration	144
	4.10.4	Configuring Acc/Dec Time Switch Frequency	146
4.11	Acc/De	ec Pattern Configuration	147
4.12	Stoppi	ng the Acc/Dec Operation	149
4.13	8 V/F(Vo	Itage/Frequency) Control	150
	4.13.1	Linear V/F Pattern Operation	150
		Square Reduction V/F pattern Operation	
		User V/F Pattern Operation	
4.14	•	Boost	
		Manual Torque Boost	
		Auto Torque Boost	
4.15	-	t Voltage Setting	
4.16	Start M	lode Setting	
	4.16.1		
		Start After DC Braking	
4.17	•	lode Setting	
		Deceleration Stop	
	4.17.2	Stop After DC Braking	157



		4.17.3	Free Run Stop	159
		4.17.4	Power Braking	159
	4.18	Freque	ncy Limit	160
		4.18.1	Frequency Limit Using Maximum Frequency and Start Frequency	160
		4.18.2	Frequency Limit Using Upper and Lower Limit Frequency Values	161
		4.18.3	Frequency Jump	162
	4.19	2nd Op	peration Mode Setting	163
	4.20	Multi-fu	unction Input Terminal Control	164
	4.21	P2P Set	tting	166
	4.22	Multi-k	eypad Setting	167
	4.23	User Se	equence Setting	168
	4.24	Fire Mo	ode Operation	175
5	Learn	ing Adv	anced Features	178
	5.1	Operat	ing with Auxiliary References	179
	5.2	Jog op	eration	184
		5.2.1	Jog Operation 1-Forward Jog by Multi-function Terminal	185
		5.2.2	Jog Operation 2-Fwd/Rev Jog by Multi-function Terminal	186
		5.2.3	Jog Operation by Keypad	187
	5.3	Up-do/	vn Operation	188
	5.4	3-Wire	Operation	189
	5.5	Safe Op	peration Mode	190
	5.6	Dwell (Operation	192
	5.7	'	mpensation Operation	
	5.8	PID Cor	ntrol	196
		5.8.1	PID Basic Operation	197
		5.8.2	Pre-PID Operation	202
		5.8.3	PID Operation Sleep Mode	202
		5.8.4	PID Switching (PID Openloop)	203
	5.9	Auto Tu	uning	205
	5.10	Sensor	less Vector Control for Induction Motors	208
		5.10.1	Sensorless Vector Control Operation Setting for Induction Motors.	211



	5.10.2 Sensorless Vector Control Operation Guide for Induction Mc	tors 215
5.11	Sensorless Vector Control for PM (Permanent-Magnet) Syn Motors	s217
	5.11.1 Detecting the Initial Pole Position	219
	5.11.2 Sensorless Vector Control Mode Settings for PM Synchronou	
	5.11.3 Guidelines for Running a PM Synchronous Motor in Sensorle	ess Vector
	Control Mode	
5.12	Kinetic Energy Buffering Operation	228
5.13	Torque Control	229
5.14	Energy Saving Operation	233
	5.14.1 Manual Energy Saving Operation	233
	5.14.2 Automatic Energy Saving Operation	233
5.15	Speed Search Operation	234
5.16	Auto Restart Settings	238
5.17	Operational Noise Settings (carrier frequency settings)	240
5.18	2 nd Motor Operation	241
5.19	Supply Power Transition	243
5.20	Cooling Fan Control	244
5.21	Input Power Frequency and Voltage Settings	245
5.22	Read, Write, and Save Parameters	245
5.23	Parameter Initialization	246
5.24	Parameter View Lock	247
5.25	Parameter Lock	248
5.26	Changed Parameter Display	249
5.27	User Group	249
5.28	Easy Start On	251
5.29	Config(CNF) Mode	252
5.30	Timer Settings	253
5.31	Brake Control	254
5.32	Multi-Function Output On/Off Control	256
5.33	Press Regeneration Prevention	257



	5.34	Analog	g Output	258
		5.34.1	Voltage and Current Analog Output	258
		5.34.2	Analog Pulse Output	261
	5.35	Digital	Output	263
		5.35.1	Multi-function Output Terminal and Relay Settings	263
		5.35.2	Fault Trip Output using Multi-Function Output Terminal and	Relay 267
		5.35.3	Multi-function Output Terminal Delay Time Settings	268
	5.36	Keypa	d Language Settings	269
	5.37	Operat	tion State Monitor	270
	5.38	Operat	tion Time Monitor	272
6	Learn	ing Pro	tection Features	274
	6.1	Motor	Protection	274
		6.1.1	Electronic Thermal Motor Overheating Prevention (ETH)	274
		6.1.2	Overload Early Warning and Trip	276
		6.1.3	Stall Prevention and Flux Braking	277
	6.2	Inverte	er and Sequence Protection	281
		6.2.1	Open-phase Protection	281
		6.2.2	External Trip Signal	282
		6.2.3	Inverter Overload Protection	283
		6.2.4	Speed Command Loss	284
		6.2.5	Dynamic Braking (DB) Resistor Configuration	286
	6.3	Under	load Fault Trip and Warning	287
		6.3.1	Fan Fault Detection	289
		6.3.2	Lifetime Diagnosis of Components	289
		6.3.3	Low Voltage Fault Trip	292
		6.3.4	Output Block by Multi-Function Terminal	292
		6.3.5	Trip Status Reset	293
		6.3.6	Inverter Diagnosis State	293
		6.3.7	Operation Mode on Option Card Trip	294
		6.3.8	No Motor Trip	294
		6.3.9	Low Voltage Trip 2	295
	6.4	Fault/V	Warning List	295



7	RS-48	35 Comi	munication Features	298
	7.1	Comm	nunication Standards	298
	7.2	Comm	nunication System Configuration	299
		7.2.1	Communication Line Connection	299
		7.2.2	Setting Communication Parameters	300
		7.2.3	Setting Operation Command and Frequency	301
		7.2.4	Command Loss Protective Operation	302
		7.2.5	Setting Virtual Multi-Function Input	303
		7.2.6	Saving Parameters Defined by Communication	303
		7.2.7	Total Memory Map for Communication	304
		7.2.8	Parameter Group for Data Transmission	305
	7.3	Comm	nunication Protocol	306
		7.3.1	Modbus-RTU Protocol	306
	7.4	Comp	atible Common Area Parameter	309
	7.5	Sinus I	H Expansion Common Area Parameter	312
		7.5.1	Monitoring Area Parameter (Read Only)	312
		7.5.2	Control Area Parameter (Read/Write)	317
		7.5.3	Inverter Memory Control Area Parameter (Read and Write)	319
8	Table	of Fund	ctions	322
	8.1	Opera	tion Group	322
	8.2	Drive (group (PAR→dr)	324
	8.3	Basic F	Function group (PAR→bA)	329
	8.4	Expan	ded Function group (PAR→Ad)	334
	8.5	Contro	ol Function group (PAR→Cn)	340
	8.6	Input ⁻	Terminal Block Function group (PAR→In)	348
	8.7	Outpu	ıt Terminal Block Function group (PAR→OU)	353
	8.8	Comm	nunication Function group (PAR→CM)	358
	8.9	Applic	ation Function group (PAR→AP)	363
	8.10	Protec	tion Function group (PAR→Pr)	366
	8.11		lotor Function group (PAR→M2)	
	8.12		equence group (US)	



	8.13	User Sequence Function group(UF)	377
	8.14	Groups for LCD Keypad Only	397
		8.14.1 Trip Mode (TRP Last-x)	397
		8.14.2 Config Mode (CNF)	397
9	Troub	oleshooting	401
	9.1	Trips and Warnings	401
		9.1.1 Fault Trips	401
		9.1.2 Warning Messages	404
	9.2	Troubleshooting Fault Trips	405
	9.3	Troubleshooting Other Faults	407
10	Maint	tenance	412
	10.1	Regular Inspection Lists	412
		10.1.1 Daily Inspections	412
		10.1.2 Annual Inspections	413
		10.1.3 Bi-annual Inspections	415
	10.2	Storage and Disposal	416
		10.2.1 Storage	416
		10.2.2 Disposal	416
11	Techr	nical Specification	417
	11.1	Input and Output Specification	417
	11.2	Product Specification Details	427
	11.3	External Dimensions (IP 20 Type)	430
	11.4	External Dimensions (IP 66 Type)	435
	11.5	Peripheral Devices Specification	438
	11.6	Fuse and Reactor Specifications	439
	11.7	Terminal Screw Specification	442
	11.8	Braking Resistor Specification	443
	11.9	Continuous Rated Current Derating	446
	11.10	Heat Emission	449
12	Apply	ying 2T and 4T Drives to Single-Phase Input Application	451
	12.1	Introduction	451



	12.2	Power(HP), Input Current and Output Current	452
	12.3	Input Frequency and Voltage Tolerance	453
13		ing	
	13.1	UL mark	454
	13.2	CE mark	454
		13.2.1 Low Voltage Directive	454
		13.2.2 EMC Directive	454
Ind	ех		459



1 Preparing the Installation

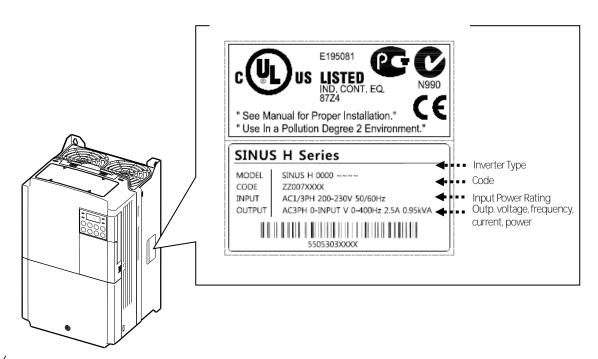
This chapter provides details on product identification, part names, correct installation and cable specifications. To install the inverter correctly and safely, carefully read and follow the instructions.

1.1 Product Identification

The SINUS H Inverter is manufactured in a range of product groups based on drive capacity and power source specifications. Product name and specifications are detailed on the rating plate. The illustration on the next page shows the location of the rating plate. Check the rating plate before installing the product and make sure that the product meets your requirements. For more detailed product specifications, refer to 11.11/10.2016/j.check.nih.gov/ refer to 11.11/10.2016/j.check.nih.gov/ refer to 11.11/10.2

Note

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





SINUS H 0001	4T	В	A2	K	2
		_	l		<u> </u>

	Product Identification			- Input												
	Code	kW	Size IP20	Size IP66		power	Br	ake		Filter	Key	/pad	Enclo	sure		
ENERTRONICA SANTERNO S.P.A. inverter	0001	0.4	Eu_A	n.a.	2S	1 phase 200-240 Vac	В		A1		Κ	,	2			
	0002	0.75	Eu_B	n.a.	2S		200-240		В		A1		Κ		2	
	0003	1.5	Eu_B	n.a.	2S			В		A1		Κ		2		
	0005	2.2	Eu_C	n.a.	2S		В		A1	_	Κ		2			
	0001	0.4	A1	IP66_A	2T	3 phase 200-240 Vac	В			C2 Category It, C3 Category	Κ	K	2/6			
	0002	0.75	A2	IP66_A	2T		В				K = Keypad included	2/6				
	0003	1.5	B1	IP66_B	2T		В	ō				p	2/6			
	0005	2.2	B2	IP66_B	2T		В	Brake included X=Brake not included					2/6			
	0007	4	С	IP66_B	2T		В	Incl	-	ent, ner			2/6			
	0011	5.5	D	IP66_C	2T		В	iot	-	I= No filter integrated A1= Integrated Filter for First Environment, C2 Category A2= Integrated Filter for Second Environment, C3 Category			2/6			
ËR	0014	7.5	D	IP66_C	2T		В	ker				2/6	99,			
A SANT	0017	11	Е	IP66_D	2T		В	Bra	-			incl	2/6	2= IP20 6=IP66		
	0020	15	F	IP66_E	2T		В	\times	-			ad	2/6			
\leq	0001	0.4	Eu_A	IP66_A	4T	3 phase 380-480 Vac	В	ged	A2			eyp	2/6			
ROI	0002	0.75	Eu_A	IP66_A	4T				В	cluc	A2	No er fa	Κ	_	2/6	2=
FRT	0003	1.5	Eu_B	IP66_B	4T				В	e Li	A2	= Filtor Iter	Κ	\checkmark	2/6	
E	0005	2.2	Eu_B	IP66_B	4T				В	rak	A2	ed d Fi	Κ		2/6	
	0007	4	Eu_C	IP66_B	4T				В	B=B	A2	grat	Κ		2/6	
	0011	5.5	D	IP66_C	4T		В		A2	nte; :egr	Κ		2/6			
	0014	7.5	D	IP66_C	4T		Vac B A2 K	Κ		2/6						
	0017	11	E	IP66_D	4T		B B B	В	A	A2		Κ		2/6		
	0020	15	E	IP66_D	4T			├		A2		Κ	<	2/6		
	0025	18.5	F	IP66_E	4T				В		A2		Κ		2/6	
	0030	22	F	IP66_E	4T				A2		Κ		2/6			
	0034	30	G	n.a.	4T		Χ		A2		Κ		2			

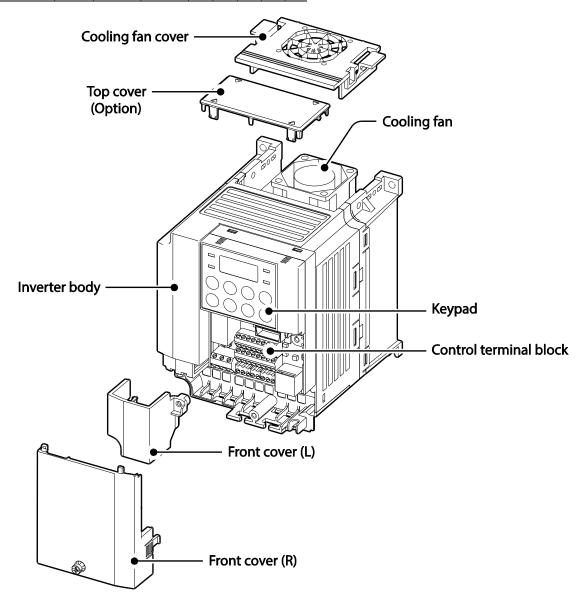
The motor power is based on 230Vac for models "2S/T" and on 400Vac for models "4T", considering the Heavy load condition.



1.2 Part Names for IP20 models

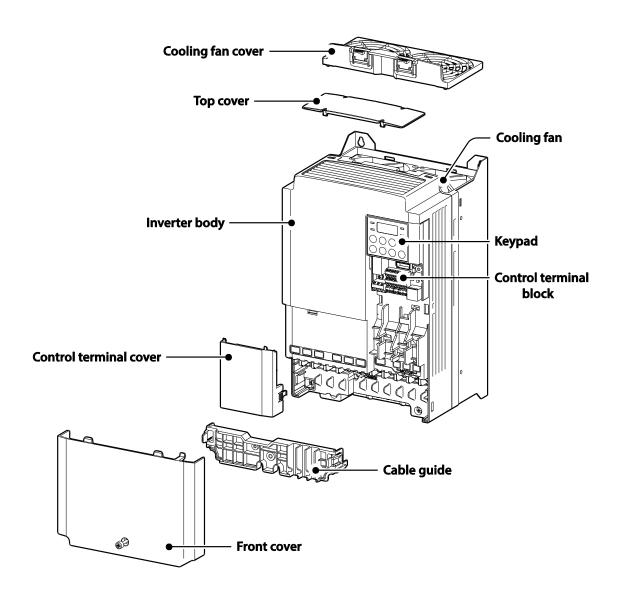
The illustration below displays part names for IP20 models. Details may vary between product groups.

Sizes Eu A, Eu B, Eu C1, Eu C2, A1, A2, B1, B2, C2



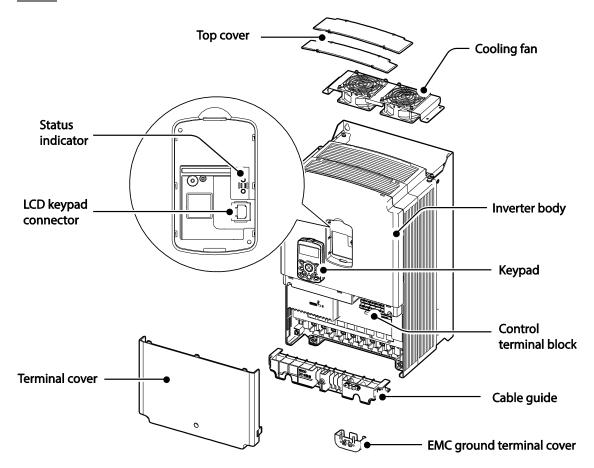


Sizes D, E, F





Size G

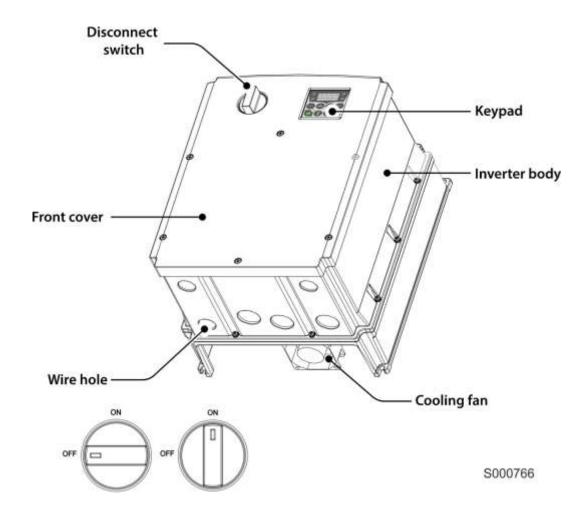




1.3 Part Names for IP66 models

The illustration below displays part names for IP66 models. Details may vary between product groups.

Full product

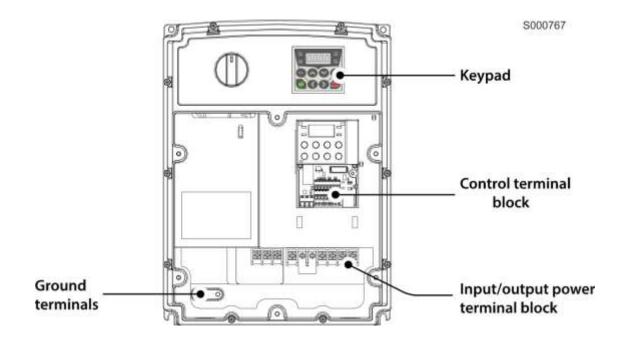


Do not operate Disconnect Switch when motor is operating.

Cooling fan is only supported to $5.5{\sim}7.5kW$ products.



Front cover removed



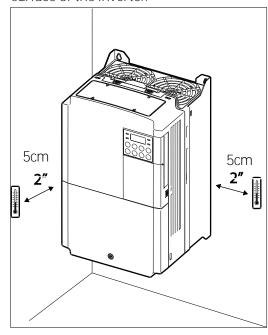


1.4 Installation Considerations

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				
Ambient Temperature*	Heavy Duty: -10–50°C (14–104°F) Normal Duty: -10– 40°C (14–122°F)				
Ambient Humidity	90% relative humidity (no condensation)				
Storage Temperature	-20-65°C (-4-149°F)				
Environmental Factors	An environment free from corrosive or flammable gases, oil residue or dust				
Altitude/Vibration	Lower than 1000m (3280ft) above sea level/less than 1G (9.8m/sec ²)				
Air Pressure	70 – 106kPa				

^{*} The ambient temperature is the temperature measured at a point 5cm (2") from the surface of the inverter.



① Caution

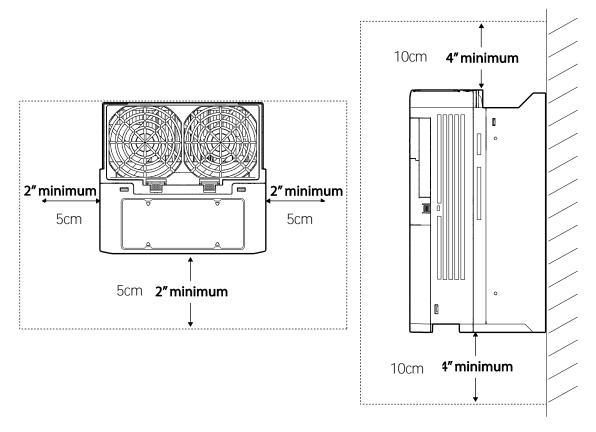
Do not allow the ambient temperature to exceed the allowable range while operating the inverter.



1.5 Selecting and Preparing a Site for Installation

When selecting an installation location consider the following points:

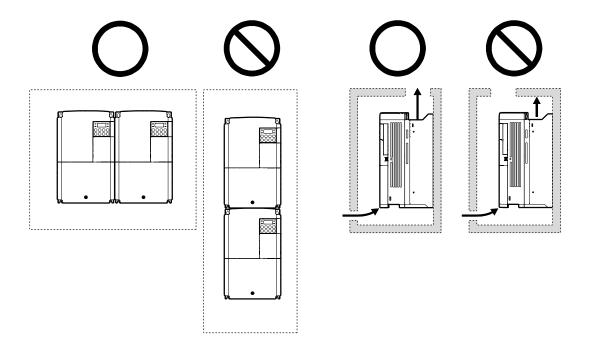
- The inverter must be installed on a wall that can support the inverter's weight.
- The location must be free from vibration. Vibration can adversely affect the operation of the inverter.
- The inverter can become very hot during operation. Install the inverter on a surface that is fire-resistant or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



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 the ventilation louver. The cooling fan
must be positioned to efficiently transfer the heat generated by the operation of the
inverter.

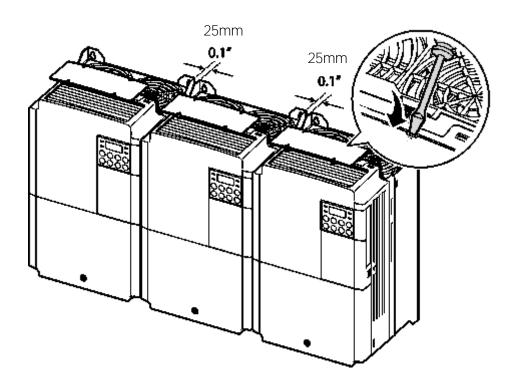








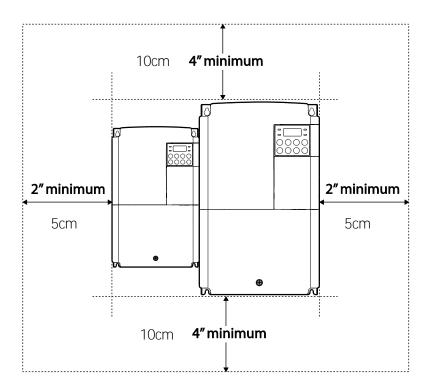
If you are installing multiple inverters in one location, arrange them side-by-side and remove the top covers. The top covers MUST be removed for side-by-side installations. Use a flat head screwdriver to remove the top covers.







• If you are installing multiple inverters, of different ratings, provide sufficient clearance to meet the clearance specifications of the largest inverter.





1.6 Cable Selection

When you install power and signal cables in the terminal blocks, only use cables that meet the required specification for the safe and reliable operation of the product. Refer to the following information to assist you with cable selection.

① Caution

- Wherever possible use cables with the largest cross-sectional area for mains power wiring, to ensure that voltage drop does not exceed 2%.
- Use copper cables rated for 600V, 75°C for power terminal wiring.
- Use copper cables rated for 300V, 75°C for control terminal wiring.

Ground Cable and Power Cable Specifications

Sinus H Model			Ground		Power I/O					
(Voltage / Code / kW)			mm ²	AWG	mm²		AWG			
					R/S/T	U/V/W	R/S/T	U/V/W		
2S	0001	0.4	3.5	12	2	2	14	14		
20	0002	0.75								
	0003	1.5								
	0005	2.2			3.5	3.5	12	12		
2T	0001	0.4			2	2	14	14		
~ '	0002	0.75								
	0003	1.5								
	0005	2.2								
	0007	4			3.5	3.5	12	12		
	0011	5.5	5.5	10	6	6	10	10		
	0014	7.5								
	0017	11	14	6	10	10	8	8		
	0020	15			16	16	6	6		
4T	0001	0.4	2	14	2	2	14	14		
• •	0002	0.75								
	0003	1.5								
	0005	2.2								
	0007	4								
	0011	5.5	3.5	12	2.5	2.5	14	14		
	0014	7.5			4	4	12	12		
	0017	11	8	8	,	,	10	10		
	0020	15	4.4	,	6	6	10	10		
	0025	18.5	14	6	10	10	8	8		
	0030	22	1/	Г	٥٢	٥٢	4	4		
	0034	30	16	5	25	25	4	4		



Signal (Control) Cable Specifications

Terminals	Signal Cable							
	Without Crimp		With Crimp Terminal Connectors					
	Terminal Connec	tors						
	(Bare wire)		(Bootlace Ferrule)					
	mm ²	AWG	mm ²	AWG				
P1-P7*/CM/VR/V1/I2	0.75	18	0.5	20				
/AO/AO2 [0034								
model only]/								
Q1/EG/24/TI/TO*								
/SA,SB,SC/S+,S-,SG								
A1/C1/B1,A2/C2	1.0	17	1.5	15				
[0034 model only]	1.0	17	1.0	10				

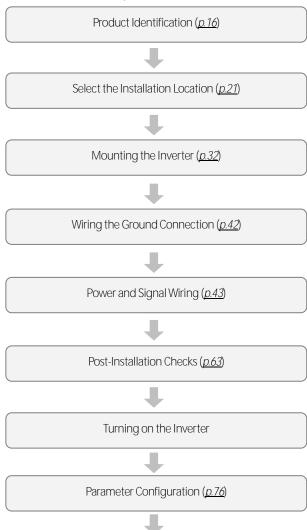
^{*} IP66 models do not support P6/P7/TI/TO terminal. Refer to Step 4 Control Terminal Wiring on page 47.



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

Installation Flowchart (Basic Configuration Diagram)

The flowchart lists the sequence to be followed during installation. The steps cover equipment installation and testing of the product. More information on each step is referenced in the steps.

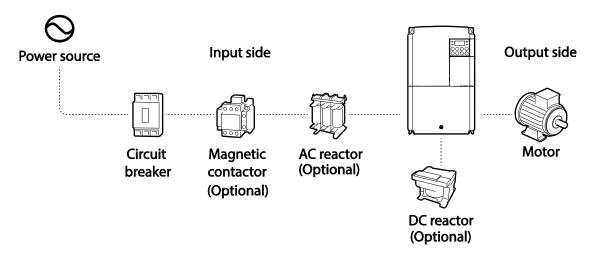




Testing (<u>p.65</u>)

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). Ensure that all of the required peripherals and optional devices (resistor brakes, contactors, noise filters, etc.) are available. For more details on peripheral devices, refer to <u>11.5 Peripheral Devices Specification</u> on page <u>438</u>.



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.
- Do not start or stop the inverter using a magnetic contactor, installed on 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 10m (33ft) from the power source if the input power exceeds 10 times
 of inverter capacity. Refer to 11.6 Fuse and Reactor Specifications on page 439 and
 carefully select a reactor that meets the requirements.

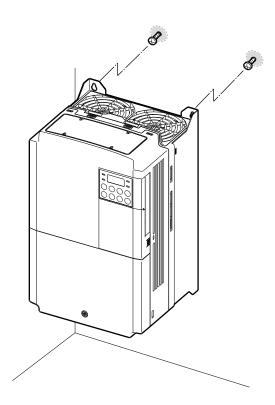


2.1 Mounting the Inverter

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

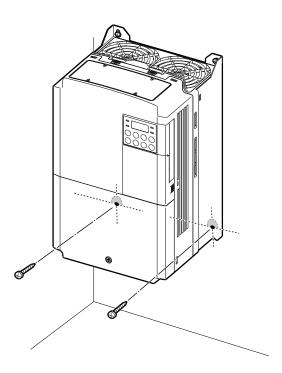
Select a wall or panel suitable to support the installation. Refer to <u>11.3 External Dimensions</u> (IP 20 Type) on page <u>430</u> and check the inverter's mounting bracket dimensions.

- 1 Use a level to draw a horizontal line on the mounting surface, and then carefully mark the fixing points.
- 2 Drill the two upper mounting bolt holes, and then install the mounting bolts. Do not fully tighten the bolts at this time. Fully tighten the mounting bolts after the inverter has been mounted.





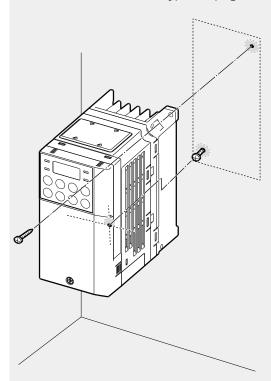
3 Mount the inverter on the wall or inside a panel using the two upper bolts, and then fully tighten the mounting bolts. Ensure that the inverter is placed flat on the mounting surface, and that the installation surface can securely support the weight of the inverter.





Note

The quantity and dimensions of the mounting brackets vary based on frame size. Refer to <u>11.3</u> <u>External Dimensions (IP 20 Type)</u> on page <u>430</u> for detailed information about your model.

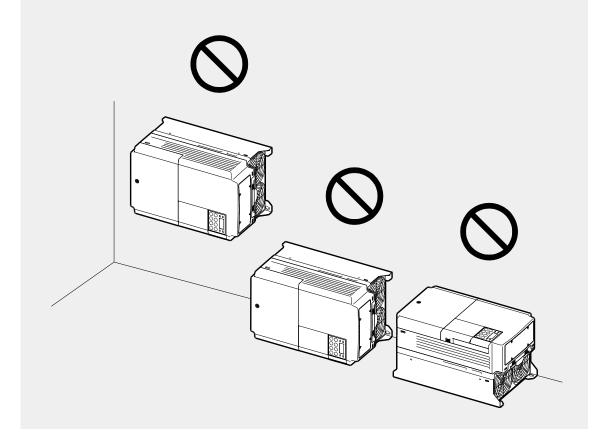


Inverters with small frame sizes Eu_A, Eu_B, A1, A2 (0.4-0.8kW) have only two mounting brackets. Inverters with large frame sizes have 4 mounting brackets.



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 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.





2.2 Cable Wiring

Open the front cover, remove the cable guides and control terminal cover, and then install the ground connection as specified. Complete the cable connections by connecting an appropriately rated cable to the terminals on the power and control terminal blocks.

Read the following information carefully before carrying out wiring connections to the inverter. All warning instructions must be followed.

① Caution

- Install the inverter before carrying out wiring connections.
- Ensure that no small metal debris, such as wire cut-offs, remain inside the inverter. Metal debris in the inverter may cause inverter failure.
- Tighten terminal screws to their specified torque. Loose terminal block screws may allow
 the cables to disconnect and cause short circuit or inverter failure. Refer to <u>11.7 Terminal</u>
 <u>Screw Specification</u> on page <u>442</u> for torque specifications.
- Do not place heavy objects on top of electric cables. Heavy objects may damage the cable and result in electric shock.
- The power supply system for this equipment (inverter) is a grounded system. Only use a grounded power supply system for this equipment (inverter). Do not use a TT, TN, IT, or corner grounded system with the inverter.
- The equipment may generate direct current in the protective ground wire. When installing the residual current device (RCD) or residual current monitoring (RCM), only Type B RCDs and RCMs can be used.
- Use cables with the largest cross-sectional area, appropriate for power terminal wiring, to ensure that voltage drop does not exceed 2%.
- Use copper cables rated at 600V, 75°C for power terminal wiring.
- Use copper cables rated at 300V, 75°C for control terminal wiring.
- If you need to re-wire the terminals due to wiring-related faults, ensure that the inverter keypad display is turned off and the charge lamp under the front 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.



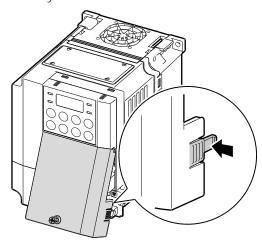
Step 1 Front Cover, Control Terminal Cover and Cable Guide

The front cover, control terminal cover and cable guide must be removed to install cables. Refer to the following procedures to remove the covers and cable guide. The steps to remove these parts may vary depending on the inverter model.

Sizes A, A1, A2, B, C

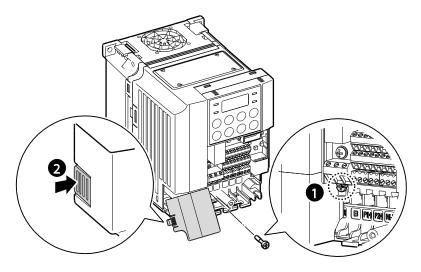
For the Inverter Size definition refer to page 16.

1 Loosen the bolt that secures the front cover (right side). Push and hold the latch on the right side of the cover. Then remove the cover by lifting it from the bottom and moving it away from the front of the inverter.



2 Remove the bolt that secures the front cover (left side) (1). Push and hold the latch on the left side of the cover. Then remove the cover by lifting it from the bottom and moving it away from the front of the inverter (2).





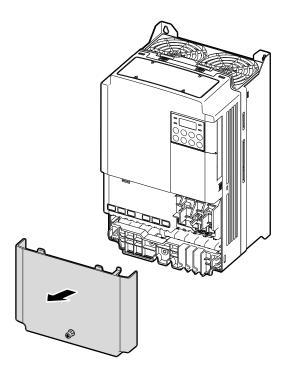
3 Connect the cables to the power terminals and the control terminals. For cable specifications, refer to <u>1.6 Cable Selection</u> on page <u>28</u>.



Sizes D, E, F

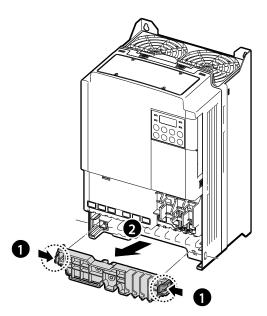
For the Inverter Size identification refer to page 16.

1 Loosen the bolt that secures the front cover. Then remove the cover by lifting it from the bottom and away from the front.

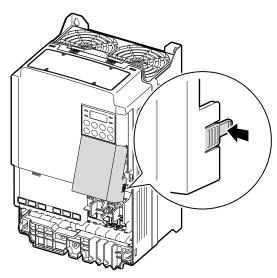


Push and hold the levers on both sides of the cable guide (1) and then remove the cable guide by pulling it directly away from the front of the inverter (2). In some models where the cable guide is secured by a bolt, remove the bolt first.





3 Push and hold the tab on the right side of the control terminal cover. Then remove the cover by lifting it from the bottom and moving it away from the front of the inverter.



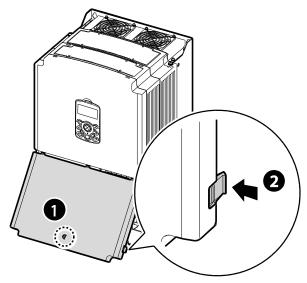
4 Connect the cables to the power terminals and the control terminals. For cable specifications, refer to <u>1.6 Cable Selection</u> on page <u>28</u>.



Size G

For the Inverter Size identification refer to page 16.

Loosen the bolt that secures the terminal cover (1). Push and hold the latch on the right side of the cover (2). Then remove the cover by lifting it from the bottom and moving it away from the front of the inverter.



2 Connect the cables to the power terminals and the control terminals. For cable specifications, refer to *1.6 Cable Selection* on page *28*.

Note

To connect an LCD keypad, remove the plastic knock-out from the bottom of the front cover (right side) or from the control terminal cover. Then connect the signal cable to the RJ-45 port on the control board.

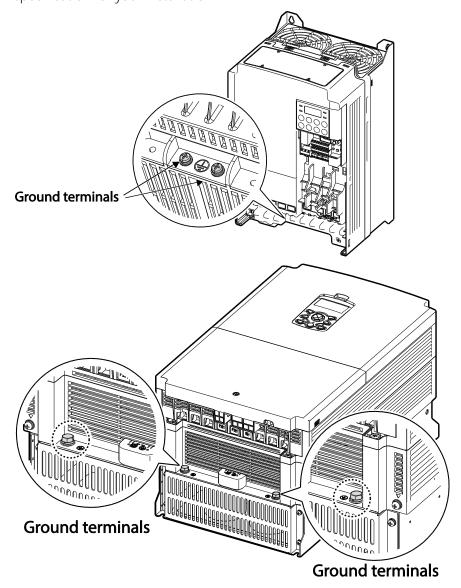
See the picture in Step 4 Control Terminal Wiring.



Step 2 Ground Connection

Remove the front cover(s), cable guide, and the control terminal cover. Then follow the instructions below to install the ground connection for the inverter.

1 Locate the ground terminal and connect an appropriately rated ground cable to the terminals. Refer to <u>1.6 Cable Selection</u> on page <u>28</u> to find the appropriate cable specification for your installation.



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



Note

- 2T products require Class 3 grounding. Resistance to ground must be < 100Ω.
- 4T products require Special Class 3 grounding. Resistance to ground must be < 10Ω.

⚠ 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.

Step 3 Power Terminal Wiring

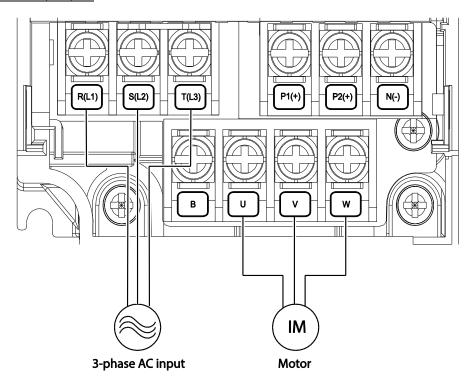
The following illustration shows the terminal layout on the power terminal block. Refer to the detailed descriptions to understand the function and location of each terminal before making wiring connections. Ensure that the cables selected meet or exceed the specifications in <u>1.6 Cable Selection</u> on page <u>28</u> before installing them.

① Caution

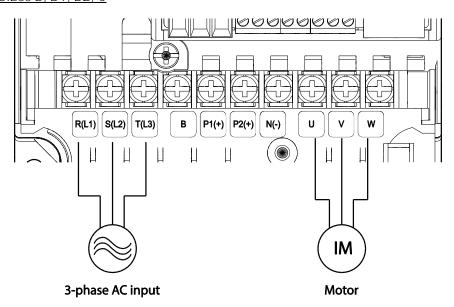
- Tighten terminal screws to their specified torque. Loose terminal screws may allow the cables to disconnect and cause short circuit or inverter failure. Over tightening terminal screws may damage the terminals and cause short circuits and malfunctions.
- Use copper cables rated for 600V, 75°C for power terminal wiring.
- Use copper cables rated for 300V, 75°C for control terminal wiring.
- Do not connect two wires in a single terminal for power cable connections.
- Power supply cables must be connected to the R, S, and T terminals. Connecting
 power cables to the U, V, and W terminals will cause internal damage to the inverter.
 Connect motors to the U, V, and W terminals. Phase sequence arrangement is not
 necessary.



Sizes A, A1, A2

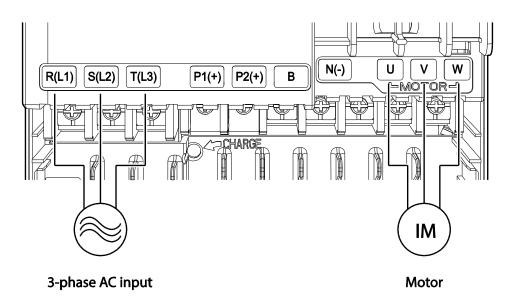


Sizes B, B1, B2, C

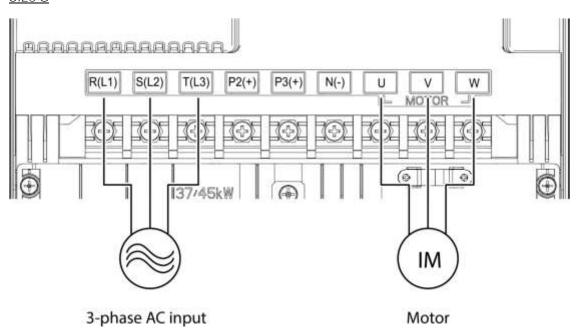




Sizes D, E, F



Size G





Power Terminal Labels and Descriptions

Terminal Labels	Name	Description
R(L1)/S(L2)/T(L3)	AC power input terminal	Mains supply AC power connections.
P2(+)/N(-)	DC link terminal	DC voltage terminals.
		DC reactor wiring connection. (When you use
P1(+)/P2(+)	DC reactor terminal	the DC reactor, must remove short-bar) [all
		models except for 0034 model]
P2(+)/B	Brake resistor terminals	Brake resistor wiring connection.
P3(+)/N(-)	Brake unit terminals	Brake unit wiring connection. [0034 model only]
U/V/W	Motor output terminals	3-phase induction motor wiring connections.

Note

• For SINUS H 2S line (Single Phase), the AC Power input terminals to be use are R(L1) and T(L3).

On this line Terminal S(L2) is providerd with no screw.

Note

- Use STP (Shielded Twisted Pair) cables to connect a remotely located motor with the inverter. Do not use 3 core cables.
- Make sure that the total cable length does not exceed-200m (660ft). For inverters < = 4.0kW capacity, ensure that the total cable length does not exceed 50m (165ft).
- 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 malfunction of equipment connected to the inverter.
- Voltage drop is calculated by using the following formula: Voltage Drop (V) = $[\sqrt{3} X \text{ cable resistance } (m\Omega/m) X \text{ cable length } (m) X \text{ current}(A)] / 1000$
- Use cables with the largest possible cross-sectional area to ensure that voltage drop is minimized over long cable runs. Lowering the carrier frequency and installing a micro surge filter may also help to reduce voltage drop.

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

⚠ Warning

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.

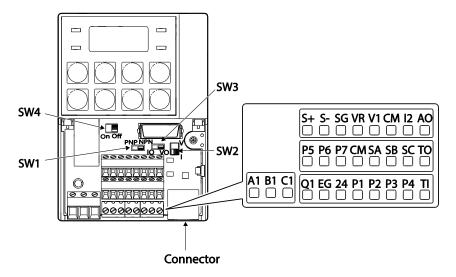


① Caution

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

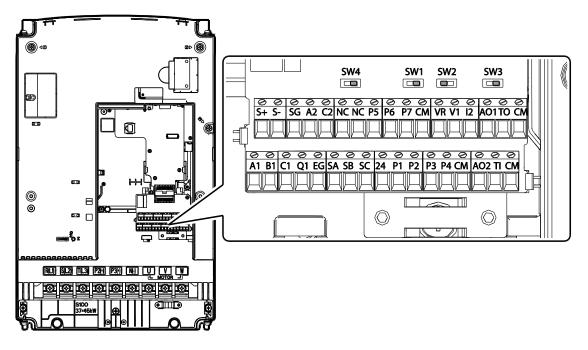
Step 4 Control Terminal Wiring

The illustrations below show the detailed layout of control wiring terminals, and control board switches. Refer to the detailed information provided below and $\underline{1.6 \ Cable \ Selection}$ on page $\underline{28}$ before installing control terminal wiring and ensure that the cables used meet the required specifications.

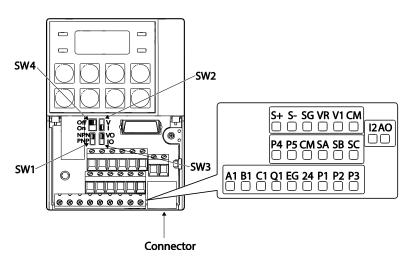


<Terminals in IP20 models except for 0034 model (Multiple I/O)>





<Terminals in IP20 model 0034 only (Standard I/O (M))>



< Terminals in IP66 models (Standard I/O) >

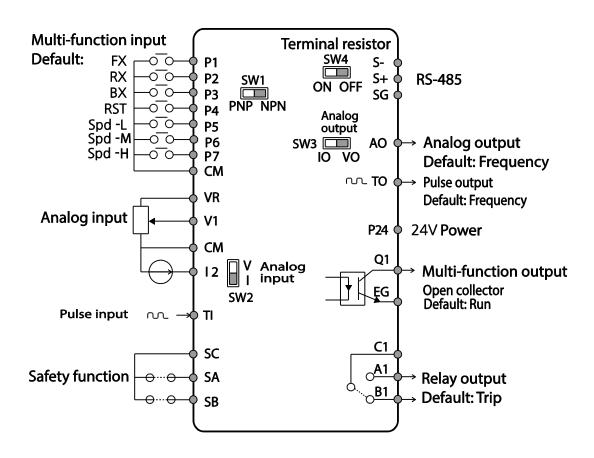


Control Board Switches

Switch	Description
SW1	NPN/PNP mode selection switch
SW2	analog voltage/current input terminal selection switch
SW3	analog voltage/current output terminal selection switch
SW4	Terminating Resistor selection switch

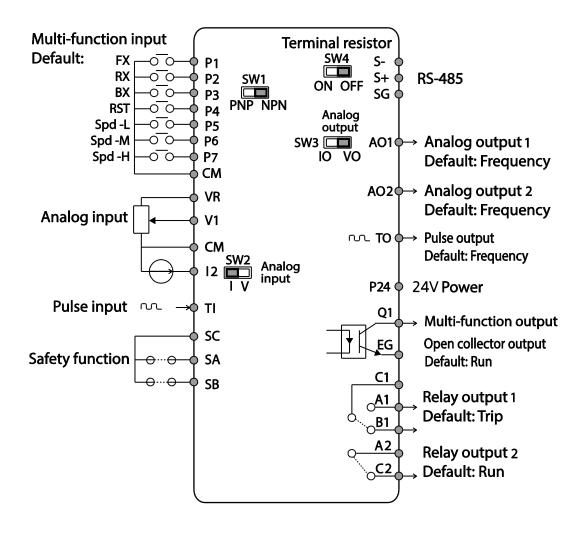
Connector

Name	Description
Connector	Connect to LCD keypad



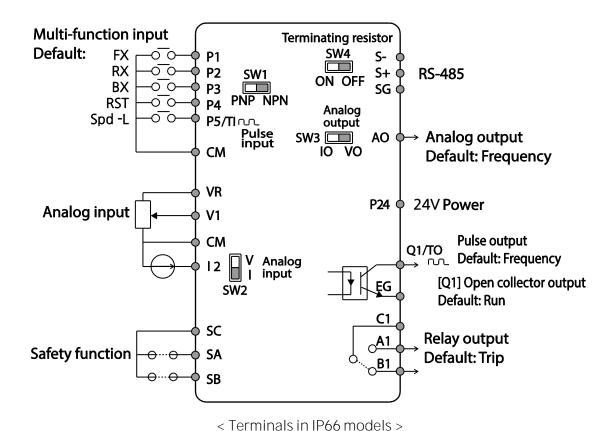
< Terminals in IP20 models except for 0034 model >





< Terminals in IP20 model 0034 only >





Input Terminal Labels and Descriptions

Function	Label	Name	Description
Multi- function terminal configuration	IP66 models	Multi-function Input	Configurable for multi-function input terminals. Factory default terminals and setup are as follows: P1: Fx P2: Rx P3: BX P4: RST P5: Speed-L P6: Speed-M P7: Speed-H (P6 and P7 not available in IP66 models).
	CM	Common Sequence	Common terminal for analog terminal inputs and outputs.



Function	Label	Name	Description
Analog input configuration	VR	Potentiometer frequency reference input	Used to setup or modify a frequency reference via analog voltage or current input. • Maximum Voltage Output: 12V • Maximum Current Output: 100mA, • Potentiometer: 1–5kΩ
	V1	Voltage input for frequency reference input	Used to setup or modify a frequency reference via analog voltage input terminal. • Unipolar: 0–10V (12V Max.) • Bipolar: -10–10V (±12V Max.)
Analog input configuration	I2	Voltage/current input for frequency reference input Pulse input for frequency reference input	Used to setup or modify a frequency reference via analog voltage or current input terminals. Switch between voltage (V2) and current (I2) modes using a control board switch (SW2). V2 Mode: • Unipolar: 0–10V (12V Max.) I2 Mode • Input current: 4–20mA • Maximum Input current: 24mA • Input resistance: 249Ω Setup or modify frequency references using pulse inputs from 0 to 32kHz. • Low Level: 0–0.8V • High Level: 3.5–12V (In case of IP66 models, Pulse input TI and Multi-
	(pulse train)	function terminal P5 share the same terminal. Set the In.69 P5 Define to 54(TI).)	
Safety functionality configuration	SA	Safety input A	Used to block the output from the inverter in an emergency. Conditions: Normal Operation: Both the SA and SB
	SB	Safety input B	 terminals are connected to the SC terminal. Output Block: One or both of the SA and SB terminals lose connection with the SC terminal.
	SC	Safety input power source	DC 24V, < 25mA



Output/Communication Terminal Labels and Descriptions

Function	Label	Name	Description
	AO	Voltage/Current Output	Used to send inverter output information to external devices: output frequency, output current, output voltage, or a DC voltage. Operate switch (SW3) to select the signal output type (voltage or current) at the AO terminal. Output Signal Specifications: Output Voltage: 0–10V Maximum output voltage/current: 12V/10mA Output current: 0–20mA (Load resistance: Less than 500 Ω) Maximum output current: 24mA Factory default output: Frequency
Analog output	AO2 [0034 model only]	Analog voltage output terminal	Use to send inverter output information, such as output frequency, output current, output voltage, or DC voltage to external devices. • Output voltage: 0-10 V • Maximum output voltage/current: 12V/10 mA
, maleg earpar	ТО	Pulse Output	Sends pulse signals to external devices to provide a single output value from the inverter of either: output frequency, output current, output voltage, or DC voltage. Output Signal Specifications: Output frequency: 0–32kHz Output voltage: 0–12V Factory default output: Frequency (In case of IP66 models, Pulse output TO and Multifunction output Q1 share the same terminal. Set the OU.33Q1 Define to 38(TO).) When connecting to a pulse between the inus H inverters, IP20 model ↔ IP20 model: Connect TO → TI, CM → CM IP66 model ↔ IP66 model: Connect Q1 → P5, EG → CM IP20 model ↔ IP66 model: Not supported.
Digital output	Q1	Multi-functional	DC 26V, 100mA or less

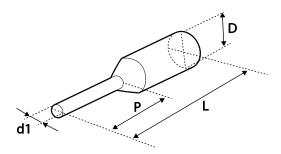




Function	Label	Name	Description
		(open collector)	Factory default output: Run
	EG	Common	Common ground contact for an open collector (with external power source)
	24	External 24V power source	Maximum output current: 150mA
	A1/C1/B1	Fault signal output	 Sends out alarm signals when the inverter's safety features are activated (AC 250V <1A, DC 30V < 1A). 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 [0034 model only]	Multi-functional relay output terminal	The signal is generated while operating. Define and use the multi-functional relay output terminal (Less than AC250 V 5A, Less than DC30 V 5A).
Communication	S+/S-/SG	RS-485 signal line	Used to send or receive RS-485 signals. Refer to 7 <u>RS-485 Communication Features</u> on page <u>298</u> for more details.

Preinsulated Crimp Terminal Connectors (Bootlace Ferrule)

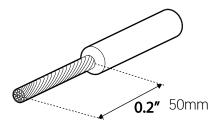
Use preinsulated crimp terminal connectors to increase reliability of the control terminal wiring. Refer to the specifications below to determine the crimp terminals to fit various cable sizes.



Cable Spec.		Dimensions (mm/inches)				
AWG	mm ²	L*	Р	d1	D	
26	26 0.25	10.4 / 0.40	6.0 / 0.23	1.1 / 0.042	25/01	
20		12.4 / 0.48	8.0 / 0.31	1.17 0.042	2.3 / 0.1	
22	0.50	12.0 / 0.46	6.0 / 0.23	1.3 / 0.051	3.2 / 0.12	
20	0.75	12.0 / 0.46	6.0 / 0.23	1.5 / 0.058	3.4 / 0.13	

* If the length (L) of the crimp terminals exceeds 12.7mm (0.5") after wiring, the control terminal cover may not close fully.

To connect cables to the control terminals without using crimp terminals, refer to the following illustration detailing the correct length of exposed conductor at the end of the control cable.

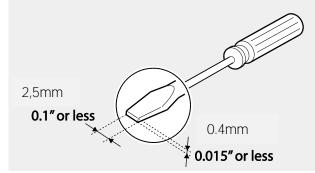


Note

- While making wiring connections at the control terminals, ensure that the total cable length does not exceed 50m (165ft).
- Ensure that the length of any safety related wiring does not exceed 30m (100ft).



- Ensure that the cable length between an LCD keypad and the inverter does not exceed 3m (10ft). Cable connections longer than 3m (10ft) may cause signal errors.
- Use ferrite material to protect signal cables from electro-magnetic interference.
- Take care when supporting cables using cable ties, to apply the cable ties no closer than 15cm (6 inches) from the inverter. This provides sufficient access to fully close the front cover.
- When making control terminal cable connections, use a small flat-tip screw driver (2.5mm wide (0.1") and 0.4mm thick (0.015") at the tip).



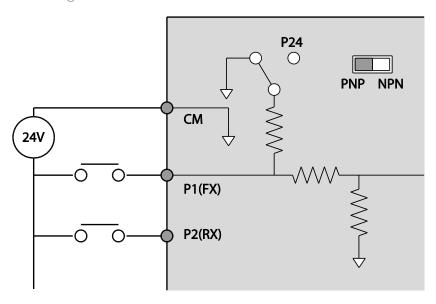
Step 5 PNP/NPN Mode Selection

The Sinus H inverter supports both PNP (Source) and NPN (Sink) modes for sequence inputs at the terminal. Select an appropriate mode to suit requirements using the PNP/NPN selection switch (SW1) on the control board. Refer to the following information for detailed applications.

PNP Mode (Source)

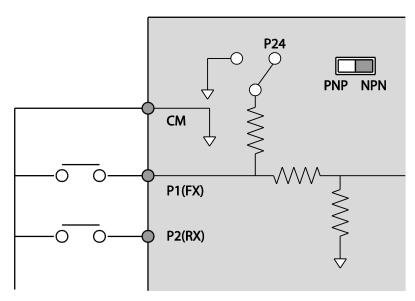
Select PNP using the PNP/NPN selection switch (SW1). Note that the factory default setting is NPN mode. CM is is the common ground terminal for all analog inputs at the terminal, and P24 is 24V internal source. If you are using an external 24V source, build a circuit that connects the external source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





NPN Mode (Sink)

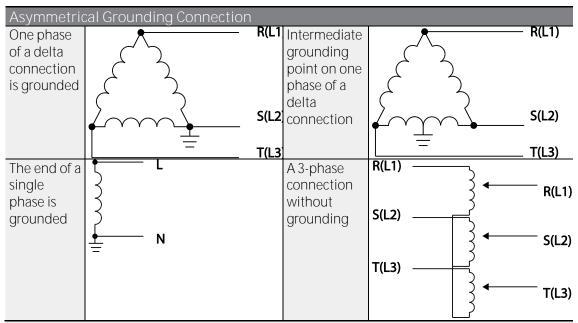
Select NPN using the PNP/NPN selection switch (SW1). Note that the factory default setting is NPN mode. CM is is the common ground terminal for all analog inputs at the terminal, and P24 is 24V internal source.





Step 6 Disabling the EMC Filter for Power Sources with Asymmetrical Grounding

EMC filter is built in the two products Sinus H 2S (EN55011 Group 1 Class A = EN 61800-3 C2) and Sinus H 4T (EN55011 Group 2 Class A = EN61800-3 C3). An EMC filter prevents electromagnetic interference by reducing radio emissions from the inverter. EMC filter use is not always recommended, as it increases leakage current. If an inverter uses a power source with an asymmetrical grounding connection, the EMC filter MUST be turned off.



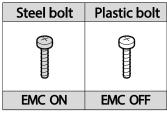
▲ Danger

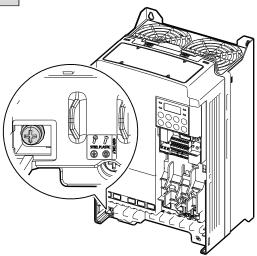
- Do not activate the EMC filter if the inverter uses a power source with an asymmetrical grounding structure, for example a grounded delta connection. Personal injury or death by electric shock may result.
- Wait at least 10 minutes before opening the covers and exposing the terminal connections. Before starting work on the inverter, test the connections to ensure all DC voltage has been fully discharged. Personal injury or death by electric shock may result.



Sizes A, A1, A2, B, B1, B2, C, D, E, F

Before using the inverter, confirm the power supply's grounding system. Disable the EMC filter if the power source has an asymmetrical grounding connection. Refer to the figures below to locate the EMC filter on/off terminal and replace the metal bolt with the plastic bolt. If the EMC filter is required in the future, reverse the steps and replace the plastic bolt with the metal bolt to reconnect the EMC filter.





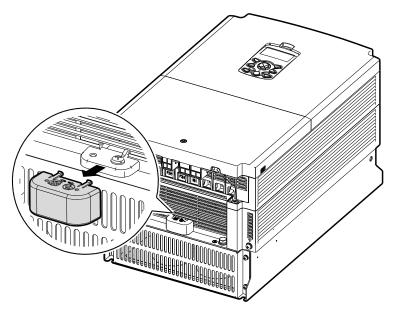
Size G

Refer to the figures below to locate the EMC filter on/off terminal and replace the metal bolt with the plastic bolt. If the EMC filter is required in the future, reverse the steps and replace the plastic bolt with the metal bolt to reconnect the EMC filter.

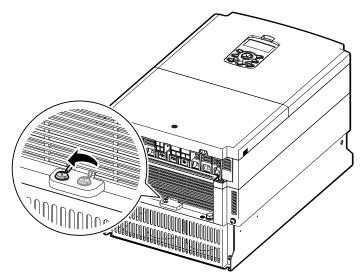
Follow the instructions listed below to disable the EMC filters.



Remove the EMC ground cover located at the bottom of the inverter.



Remove the EMC ground cable from the right terminal (EMC filter-ON / factory default), and connect it to the left terminal (EMC filter-OFF / for power sources with asymmetrical grounding).

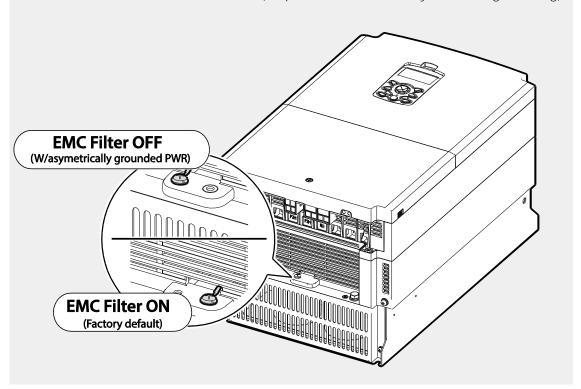


If the EMC filter is required in the future, reverse the steps and connect the EMC ground cable to the right terminal to enable the EMC filter.



Note

The terminal on the right is used to ENABLE the EMC filter (factory default). The terminal on the left is used to DISABLE the EMC filter (for power sources with asymmetrical grounding).



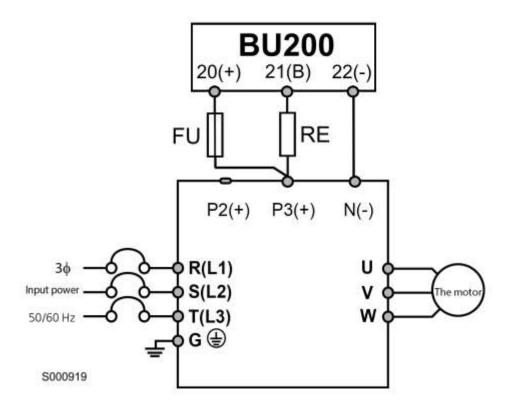
Step 7 Selecting the BU200 brake unit [0034 model only]

For the 0034 model inverter an external BU200 brake unit shall be used.

See the following picture for the recommended connection: RE is the brake resistor, FU is a protection fuse.

See 15W0102B500 Motor Drives Accessories - User Manual for further details about BU200.





Step 8 Re-assembling the Covers and Routing Bracket

Re-assemble the cable routing bracket and the covers after completing the wiring and basic configurations. Note that the assembly procedure may vary according to the product group or frame size of the product.



2.3 Post-Installation Checklist

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

Items	Check Point	Ref.	Result
	Is the installation location appropriate?	p.21	
	Does the environment meet the inverter's operating conditions?	<u>p.24</u>	
Installation	Does the power source match the inverter's rated input?	p.417	
Location/Power I/O Verification	Is the inverter's rated output su fficient to supply the equipment? (Degraded performance will result in certain circumstances. Refer to <u>11.9 Continuous Rated Current Derating</u> on page <u>446</u> for details.	<u>p.417</u>	
	Is a circuit breaker installed on the input side of the inverter?	<u>p.30</u>	
	Is the circuit breaker correctly rated?	p.417	
	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.)	<u>p.43</u>	
	Are the motor output cables connected in the correct phase rotation (U/V/W)? (Caution: motors will rotate in reverse direction if three phase cables are not wired in the correct rotation.)	<u>p.43</u>	
Power Terminal	Are the cables used in the power terminal connections correctly rated?	<u>p.28</u>	
Wiring	Is the inverter grounded correctly?	p.42	
	Are the power terminal screws and the ground terminal screws tightened to their specified torques?	<u>p. 43</u>	
	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)?	<u>p.30</u>	
	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.)	<u>p.43</u>	



Items	Check Point	Ref.	Result
	Are STP (shielded twisted pair) cables used for control		
	terminal wiring?	-	
	Is the shielding of the STP wiring properly grounded?	-	
	If 3-wire operation is required, are the multi-function		
	input terminals defined prior to the installation of the	<u>p.47</u>	
Control	control wiring connections?		
Terminal Wiring	Are the control cables properly wired?	<u>p.47</u>	
	Are the control terminal screws tightened to their	<u>p.36</u>	
	specified torques?	<u>p.oo</u>	
	Is the total cable length of all control wiring < 50m	<u>p.55</u>	
	(165ft)?		
	Is the total length of safety wiring < 30m (100ft)?	<u>p.55</u>	
	Are optional cards connected correctly?	<u>-</u>	
	Is there any debris left inside the inverter?	<u>p.36</u>	
	Are any cables contacting adjacent terminals, creating	_	
	a potential short circuit risk?		
	Are the control terminal connections separated from	_	
	the power terminal connections?		
Miscellaneous	Have the capacitors been replaced if they have been in	_	
	use for > 2 years?		
	Have the fans been replaced if they have been in use	_	
	for > 3 years?		
	Has a fuse been installed for the power source?	p.439	
	Are the connections to the motor separated from other	_	
	connections?		

Note

STP (Shielded Twisted Pair) cable has a highly conductive, shielded screen around twisted cable pairs. STP cables protect conductors from electromagnetic interference.



2.4 Test Run

After the post-installation checklist has been completed, follow the instructions below to test the inverter.

- 1 Turn on the power supply to the inverter. Ensure that the keypad display light is on.
- 2 Select the command source.
- 3 Set a frequency reference, and then check the following:
 - If V1 is selected as the frequency reference source, does the reference change according to the input voltage at VR?
 - If V2 is selected as the frequency reference source, is the voltage/current selector switch (SW2) set to voltage, and does the reference change according to the input voltage?
 - If I2 is selected as the frequency reference source, is the voltage/current selector switch (SW2) set to current, and does the reference change according to the input current?
- 4 Set the acceleration and deceleration time.
- 5 Start the motor and check the following:
 - Ensure that the motor rotates in the correct direction (refer to the note below).
 - Ensure that the motor accelerates and decelerates according to the set times, and that the motor speed reaches the frequency reference.

Note

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

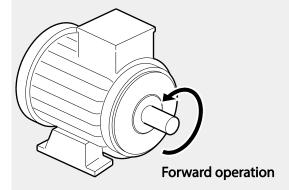
Verifying the Motor Rotation

- On the keypad, set the drv (Frequency reference source) code in the Operation group to 0 (Keypad).
- 2 Set a frequency reference.
- 3 Press the [RUN] key. Motor starts forward operation.
- 4 Observe the motor's rotation from the load side and ensure that the motor rotates



counterclockwise (forward).

If the motor rotates in the reverse direction, two of the U/V/W terminals need to be switched.



① Caution

- Check the parameter settings before running the inverter. Parameter settings may have to be adjusted depending on the load.
- To avoid damaging the inverter, do not supply the inverter with an input voltage that exceeds the rated voltage for the equipment.
- Before running the motor at maximum speed, confirm the motor's rated capacity. As inverters can be used to easily increase motor speed, use caution to ensure that motor speeds do not accidently exceed the motor's rated capacity.



3 Learning to Perform Basic Operations

This chapter describes

- the keypad layout and functions
- the LCD keypad (graphic keypad) layout and functions [*]

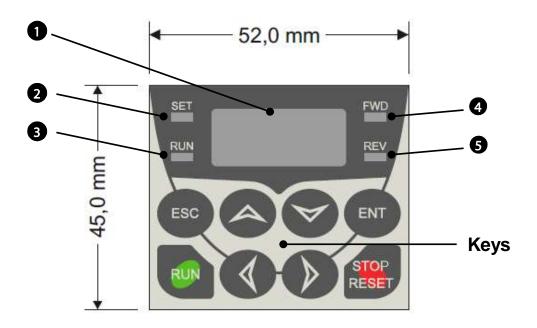
It also introduces parameter groups and codes, required to perform basic operations. The chapter also outlines the correct operation of the inverter before advancing to more complex applications. Examples are provided to demonstrate how the inverter actually operates.

Note [*]

The LCD keypad is standard in the 0034 model and is an option in all the other models.

3.1 About the Keypad

The keypad is composed of two main components – the display and the operation (input) keys. Refer to the following illustration to identify part names and functions.





3.1.1 About the Display

The following table lists display part names and their functions.

No.	Name	Function
0	7-Segment Display	Displays current operational status and parameter
U	7 Segment Display	information.
•	SET Indicator	LED flashes during parameter configuration and when the
2	3LT ITIGICATOI	ESC key operates as the multi-function key.
A	RUN Indicator	LED turns on (steady) during an operation, and flashes
8	RON IIIdicatoi	during acceleration or deceleration.
4	FWD Indicator	LED turns on (steady) during forward operation.
6	REV Indicator	LED turns on (steady) during reverse operation.

The table below lists the way that the keypad displays characters (letters and numbers).

	0		А		K		U
1	1		В		L		V
5	2		С	D (М		W
3	3		D	ñ	Ν		X
4	4		E		0	171	Υ
5	5	lj.	F		Р	D O d	Z
5	6		G		Q	-	-
7	7		Н	P	R	1	-
8	8	D D	I		S	-	-
9	9		J		T	-	-



3.1.2 Operation Keys

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

Key	Name	Description
RUN	[RUN] key	Used to run the inverter (inputs a RUN command).
STOP RESET	[STOP/RESET] key	STOP: stops the inverter. RESET: resets the inverter following fault or failure condition.
	[▲] key, [▼] key	Switch between codes, or to increase or decrease parameter values.
[∢] key, [▶] key		Switch between groups, or to move the cursor during parameter setup or modification.
ENT	[ENT] key	Used to select, confirm, or save a parameter value.
250	[ESC] key	A multi-function key used to configure different functions, such as: • Jog operation • Remote/Local mode switching • Cancellation of an input during parameter setup

① Caution

Install a separate emergency stop switch in the circuit. The [STOP/RESET] key on the keypad works only when the inverter has been configured to accept an input from the keypad.



3.1.3 Control Menu

The Sinus H inverter control menu uses the following groups.

Group	Display	Description
Operation	-	Configures basic parameters for inverter operation. These include reference frequencies and acceleration or deceleration times. Frequencies will only be displayed if an LCD keypad is in use.
Drive		Configures parameters for basic operations. These include jog operation, motor capacity evaluation, torque boost, and other keypad related parameters.
Basic		Configures basic parameters, including motor-related parameters and multi-step frequencies.
Advanced		Configure acceleration or deceleration patterns and to setup frequency limits.
Control		Configures sensorless vector - related features.
Input Terminal		Configures input terminal-related features, including digital multi-functional inputs and analog inputs.
Output Terminal		Configures output terminal–related features such as relays and analog outputs.
Communication		Configures communication features for RS-485 or other communication options.
Application		Configures PID control–related sequences and operations.
Protection	Pr	Configures motor or inverter protection features.
Motor 2 (Secondary Motor)	, , ,	Configures secondary motor related features. The secondary motor (M2) group appears on the keypad only when one of the multi-function input terminals (In.65-71 in IP20 models, In.65-69 in IP66 models) has been set to 26 (Secondary motor).
User Sequence		Used to implement simple sequences with various
User Sequence Function		function blocks.



3.2 Learning to Use the Keypad

The keypad enables movement between groups and codes. It also enables users to select and configure functions. At code level, you can set parameter values to turn on or off specific functions, or decide how the functions will be used. Refer to 8 <u>Table of Functions</u> on page <u>322</u> to find the functions you need.

Confirm the correct values (or the correct range of the values), and then follow the examples below to configure the inverter with the keypad.

3.2.1 Group and Code Selection

Follow the examples below to learn how to switch between groups and codes.

Step	Instruction	Keypad Display
1	Move to the group you want using the [◀] and [▶] keys.	
2	Move up and down through the codes using the [▲] and [▼] keys until you locate the code that you require.	
3	Press the [ENT] key to	-



save the change.

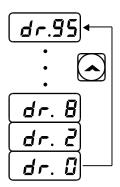
Note

For some settings, pressing the [▲] or [▼] key will not increase or decrease the code number by 1. Code numbers may be skipped and not be displayed. This is because certain code numbers have been intentionally left blank (or reserved) for new functions to be added in the future. Also some features may have been hidden (disabled) because a certain code has been set to disable the functions for relevant codes.

As an example, if Ad.24 (Frequency Limit) is set to 0 (No), the next codes, Ad.25 (Freq Limit Lo) and Ad.26 (Freq Limit Hi), will not be displayed. If you set code Ad.24 to 1 (Yes) and enable the frequency limit feature, codes Ad.25 and 26 will appear to allow the maximum and minimum frequency limitations to be set up.

3.2.2 Navigating Directly to Different Codes

The following example details navigating to code dr. 95, from the initial code in the Drive group (dr. 0). This example applies to all groups whenever you would like to navigate to a specific code number.



Step	Instruction	Keypad Display
1	Ensure that you are currently at the first code of the Drive group (dr.0).	(fr.I
2	Press the [ENT] key. Number '9' will flash.	
3	Press the [▼] key to display '5,' the first 1s' place of the group destination, '95.'	
4	Press the [◀] key to move to the 10s' place. The cursor will move to the left and '05' will be displayed. This time, the number '0' will be flashing.	[5



Step	Instruction	Keypad Display
5	Press the [▲] key to increase the number from '0' to '9,' the	95
5	10s place digit of the destination, '95.'	
6	Press the [ENT] key. Code dr.95 is displayed.	[dr. 55]

3.2.3 Setting Parameter Values

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

Step	Instruction	Keypad Display
1	Select the group and code to setup or modify parameter settings, and then press the [ENT] key. The first number on the right side of the display will flash.	5.3
2	Press the [◀] or [▶] key to move the cursor to the number that you would like to modify.	() () () () () () () () () () () () () () () (
3	Press the [▲] or [▼] key to adjust the value, and then press the [ENT] key to confirm it. The selected value will flash on the display.	5.0 5.0 5.0 4.0
4	Press the [ENT] key again to save the change.	-

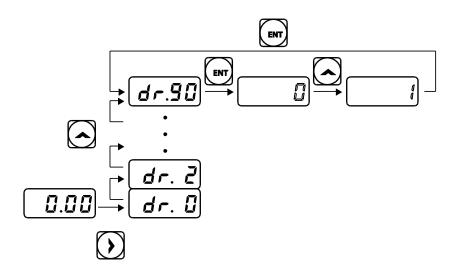


Note

- A flashing number on the display indicates that the keypad is waiting for an input from the user. Changes will be saved when the [ENT] key is pressed while the number is flashing. The setting change will be canceled if you press any other key.
- Each code's parameter values have default features and ranges specified. Refer to 8 <u>Table of Functions</u> on page <u>322</u> for information about the features and ranges before setting or modifying parameter values.

3.2.4 Configuring the [ESC] Key

The [ESC] key is a multi-functional key that can be configured to carry out a number of different functions. Refer to <u>4.6 Local/Remote Mode Switching</u> on page <u>136</u> for more information about the other functions of the [ESC] key. The following example shows how to configure the [ESC] key to perform a jog operation.





Step	Instruction	Keypad Display
1	Ensure that you are currently at the first code of the Operation group, and that code 0.00 (Command Frequency) is displayed.	0.00
2	Press the [▶] key. You have moved to the initial code of the Drive group (dr.0).	dr.O
3	Press the [▲] or [▼] key to select code 90 (ESC key configuration), and then press the [ENT] key. Code dr.90 currently has an initial parameter value of, 0 (adjust to the initial position).	dr. 30
4	Press the [▲] key to modify the value to 1 (Jog key) and then press the [ENT] key. The new parameter value will flash.	
5	Press the [ENT] key again to save changes.	-

Note

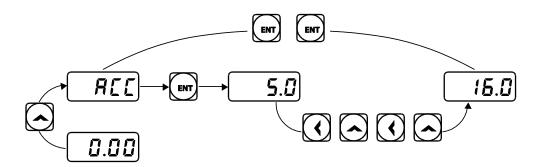
- If the code dr. 90 (ESC key configuration) is set to 1 (JOG Key) or 2 (Local/Remote), the SET indicator will flash when the [ESC] key is pressed.
- The factory default setting for code dr. 90 is 0 (move to the initial position). You can navigate back to the initial position (code 0.00 of the Operation group) immediately, by pressing the [ESC] key while configuring any codes in any groups.



3.3 Actual Application Examples

3.3.1 Acceleration Time Configuration

The following is an example demonstrating how to modify the ACC (Acceleration time) code value (from 5.0 to 16.0) from the Operation group.



Step	Instruction	Keypad Display
1	Ensure that the first code of the Operation group is selected, and code 0.00 (Command Frequency) is displayed.	0.00
2	Press the [▲] key. The display will change to the second code in the Operation group, the ACC (Acceleration Time) code.	FIL
3	Press the [ENT] key. The number '5.0' will be displayed, with '0' flashing. This indicates that the current acceleration time is set to 5.0 seconds. The flashing value is ready to be modified by using the keypad.	5.5
4	Press the [◀] key to change the first place value. '5' will be flashing now. This indicates the flashing value, '5' is ready to be modified.	5.0
5	Press the [▲] key to change the number '5' into '6', the first place value of the target number '16.'	[]. <u>[</u>
6	Press the [◀] key to move to the 10s, place value. The number in the 10s position, '0' in '06' will start to flash	5. 5.5
7	Press the [▲] key to change the number from '0' to '1', to	



	match the 10s place value of the target number'16,' and then press the [ENT] key. Both digits will flash on the display.	
8	Press the [ENT] key once again to save changes. 'ACC' will be displayed. The change to the acceleration time setup has been completed.	

3.3.2 Frequency Reference Configuration

The following is an example to demonstrate configuring a frequency reference of 30.05 (Hz) from the first code in the Operation group (0.00).



Step	Instruction	Keypad Display
1	Ensure that the first code of the Operation group is selected, and the code 0.00 (Command Frequency) is displayed.	0.00
2	Press the [ENT] key. The value, 0.00 will be displayed with the '0' in the 1/100s place value flashing.	
3	Press the [◀] key 3 times to move to the 10s place value. The '0' at the 10s place value will start to flash.	
4	Press the [▲] key to change it to '3,' the 10s place value of the target frequency, '30.05.'	
5	Press the [▶] key 3 times. The '0' at the 1/100s place position will flash.	a.a.
6	Press the [▲] key to change it to '5,' the 1/100 place value of the target frequency, '30.05,' and then press the [ENT] key. The parameter value will flash on the display.	[][][]
7	Press the [ENT] key once again to save changes. Flashing stops. The frequency reference has been configured to 30.05 Hz.	30.05

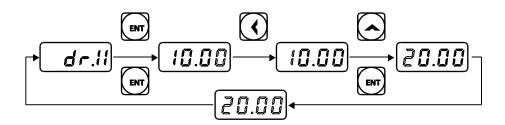
Note



- A flashing number on the display indicates that the keypad is waiting for an input from the user. Changes are saved when the [ENT] key is pressed while the value is flashing. Changes will be canceled if any other key is pressed.
- The Sinus H inverter keypad display can display up to 4 digits. However, 5-digit figures can be used and are accessed by pressing the [◀] or [▶] key, to allow keypad input.

3.3.3 Jog Frequency Configuration

The following example demonstrates how to configure Jog Frequency by modifying code 11 in the Drive group (Jog Frequency) from 10.00(Hz) to 20.00(Hz). You can configure the parameters for different codes in any other group in exactly the same way.

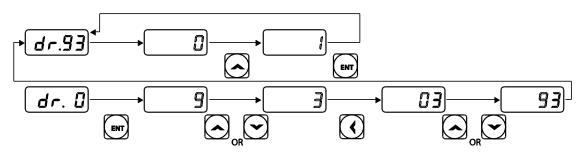


Step	Instruction	Keypad Display
1	Go to code 11(Jog Frequency) in the Drive group.	Gr. : :
2	Press the [ENT] key. The current Jog Frequency value (10.00) for code dr.11 is displayed.	
3	Press the [◀] key 3 times to move to the 10s place value. Number '1' at the 10s place position will flash.	[# [
4	Press the [▲] key to change the value to '2,' to match the 10s place value of the target value'20.00,' and then press the [ENT] key. All parameter digits will flash on the display.	
5	Press the [ENT] key once again to save the changes. Code dr.11 will be displayed. The parameter change has been completed.	(dr. 1 1)



3.3.4 Initializing All Parameters

The following example demonstrates parameter initialization using code dr.93 (Parameter Initialization) in the Drive group. Once executed, parameter initialization will delete all modified values for all codes and groups.



Step	Instruction	Keypad Display
1	Go to code 0 (Jog Frequency) in the Drive group.	(dr. Ū)
2	Press the [ENT] key. The current parameter value (9) will be displayed.	
3	Press the [q] key to change the first place value to '3' of the target code, '93.'	
4	Press the [◀] key to move to the 10s place position. '03' will be displayed.	
5	Press the [▲] or [▼] key to change the '0' to '9' of the target code, '93.'	
6	Press the [ENT] key. Code dr.93 will be displayed.	dr.93
7	Press the [ENT] key once again. The current parameter value for code dr.93 is set to 0 (Do not initialize).	
8	Press the [▲] key to change the value to 1 (All Grp), and then press the [ENT] key. The parameter value will flash.	
9	Press the [ENT] key once again. Parameter initialization begins. Parameter initialization is complete when code dr.93 reappears on the display.	[dr.93]

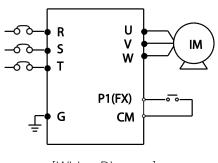
Note

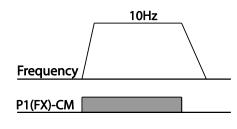
Following parameter initialization, all parameters are reset to factory default values. Ensure that parameters are reconfigured before running the inverter again after an initialization.



Frequency Setting (Keypad) and Operation (via Terminal Input)

Step	Instruction	Keypad Display
1	Turn on the inverter.	-
2	Ensure that the first code of the Operation group is selected, and code 0.00 (Command Frequency) is displayed, then press the [ENT] key. The first digit on the right will flash.	
3	Press the [◀] key 3 times to go to the 10s place position. The number '0' at the 10s place position will flash.	
4	Press the [A] key to change it to 1, and then press the [ENT] key. The parameter value (10.00) will flash.	
5	Press the [ENT] key once again to save changes. A change of reference frequency to 10.00 Hz has been completed.	10.00
6	Refer to the wiring diagram at the bottom of the table, and close the switch between the P1 (FX) and CM terminals. The RUN indicator light flashes and the FWD indicator light comes on steady. The current acceleration frequency is displayed.	SET 10.00 REV
7	When the frequency reference is reached (10Hz), open the switch between the P1 (FX) and CM terminals. The RUN indicator light flashes again and the current deceleration frequency is displayed. When the frequency reaches 0Hz, the RUN and FWD indicator lights turn off, and the frequency reference (10.00Hz) is displayed again.	SET 10.00 FWD





[Wiring Diagram]

[Operation Pattern]

Note

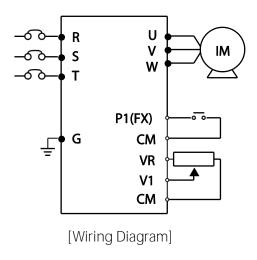
The instructions in the table are based on the factory default parameter settings. The inverter may not work correctly if the default parameter settings are changed after the inverter is purchased. In such cases, initialize all parameters to reset the values to factory default parameter settings before following the instructions in the table (refer to <u>5.23 Parameter Initialization</u> on page <u>246</u>).

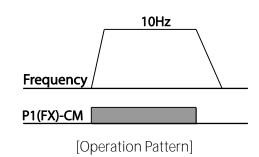


3.3.5 Frequency Setting (Potentiometer) and Operation (Terminal Input)

Step	Instruction	Keypad Display
1	Turn on the inverter.	-
2	Ensure that the first code of the Operation group is selected, and the code 0.00 (Command Frequency) is displayed.	<u> </u>
3	Press the [▲] key 4 times to go to the Frq (Frequency reference source) code.	FF
4	Press the [ENT] key. The Frq code in the Operation group is currently set to 0 (keypad).	
5	Press the [A] key to change the parameter value to 2 (Potentiometer), and then press the [ENT] key. The new parameter value will flash.	
6	Press the [ENT] key once again. The Frq code will be displayed again. The frequency input has been configured for the potentiometer.	FP
7	Press the [▼] key 4 times. Returns to the first code of the Operation group (0.00).From here frequency setting values can be monitored.	(
8	Adjust the potentiometer to increase or decrease the frequency reference to 10Hz.	-
9	Refer to the wiring diagram at the bottom of the table, and close the switch between the P1 (FX) and CM terminals. The RUN indicator light flashes and the FWD indicator light comes on steady. The current acceleration frequency is displayed.	SET I II II II REV
10	When the frequency reference is reached (10Hz), open the switch between the P1 (FX) and CM terminals. The RUN indicator light flashes again and the current deceleration frequency is displayed. When the frequency reaches 0Hz, the RUN and FWD indicators turn off, and the frequency reference (10.00Hz) is displayed again.	SET I D. D D FWD REV







Note

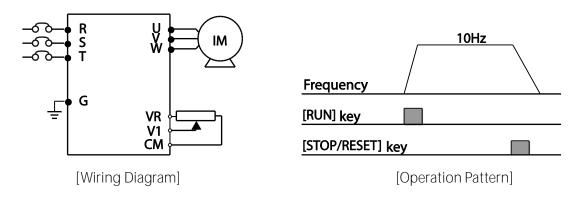
The instructions in the table are based on the factory default parameter settings. The inverter may not work correctly if the default parameter settings are changed after the inverter is purchased. In such cases, initialize all parameters to reset the factory default parameter settings before following the instructions in the table (refer to <u>5.23 Parameter Initialization</u> on page <u>246</u>).

3.3.6 Frequency Setting (Potentiometer) and Operation (Keypad)

Step	Instruction	Keypad Display
1	Turn on the inverter.	-
2	Ensure that the first code of the Operation group is selected, and the code 0.00 (Command Frequency) is displayed.	0.00
3	Press the [▲] key 4 times to go to the drv code.	
4	Press the [ENT] key. The drv code in the Operation group is currently set to 1 (Analog Terminal).	
5	Press the [▼] key to change the parameter value to 0 (Keypad), and then press the [ENT] key. The new parameter value will flash.	
6	Press the [ENT] key once again. The drv code is displayed again. The frequency input has been configured for the keypad.	(dru)
7	Press the [▲] key. To move to the Frq (Frequency reference source) code.	FF



Step	Instruction	Keypad Display
8	Press the [ENT] key. The Frq code in the Operation group is set to 0 (Keypad).	
9	Press the [A] key to change it to 2 (Potentiometer), and then press the [ENT] key. The new parameter value will flash.	
10	Press the [ENT] key once again. The Frq code is displayed again. The frequency input has been configured for potentiometer.	(FP
11	Press the [▼] key 4 times. Returns to the first code of the Operation group (0.00). From here frequency setting values can be monitored.	0.00
12	Adjust the potentiometer to increase or decrease the frequency reference to 10Hz.	-
13	Press the [RUN] key on the keypad. The RUN indicator light flashes and the FWD indicator light comes on steady. The current acceleration frequency is displayed.	SET TO D FWD REV
14	When the frequency reaches the reference (10Hz), press the [STOP/RESET] key on the keypad. The RUN indicator light flashes again and the current deceleration frequency is displayed. When the frequency reaches 0Hz, the RUN and FWD indicator lights turn off, and the frequency reference (10.00Hz) is displayed again.	SET I I I I I I REV



Note

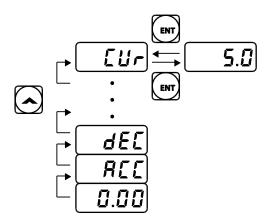
The instructions in the table are based on the factory default parameter settings. The inverter may not work correctly if the default parameter settings are changed after the inverter is purchased. In such cases, initialize all parameters to reset the factory default parameter settings before following the instructions in the table (refer to <u>5.23 Parameter Initialization</u> on page <u>246</u>).



3.4 Monitoring the Operation

3.4.1 Output Current Monitoring

The following example demonstrates how to monitor the output current in the Operation group using the keypad.



Step	Instruction	Keypad Display
1	Ensure that the first code of the Operation group is selected, and the code 0.00 (Command Frequency) is displayed.	0.00
2	Press the [▲] or [▼] key to move to the Cur code.	
3	Press the [ENT] key. The output current (5.0A) is displayed.	5.0
4	Press the [ENT] key again. Returns to the Cur code.	

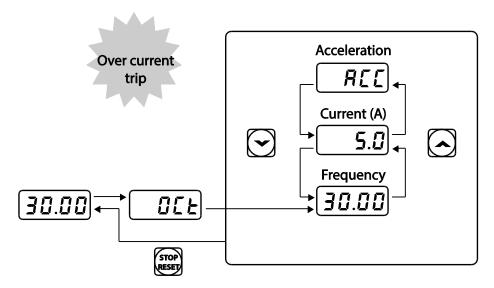
Note

You can use the dCL (DC link voltage monitor) and vOL (output voltage monitor) codes in the Operation group in exactly the same way as shown in the example above, to monitor each **function's** relevant values.



3.4.2 Fault Trip Monitoring

The following example demonstrates how to monitor fault trip conditions in the Operation group using the keypad.

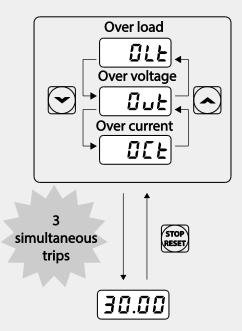


Step	Instruction	Keypad Display
1	Refer to the example keypad display. An over current trip fault has occurred.	
2	Press the [ENT] key, and then the [▲] key. The operation frequency at the time of the fault (30.00Hz) is displayed.	30.00
3	Press the [▲] key. The output current at the time of the fault (5.0A) is displayed.	5.0
4	Press the [▲] key. The operation status at the time of the fault is displayed. ACC on the display indicates that the fault occurred during acceleration.	
5	Press the [STOP/RESET] key. The inverter resets and the fault condition is cleared. The frequency reference is displayed on the keypad.	30.00



Note

• If multiple fault trips occur at the same time, a maximum of 3 fault trip records can be retrieved as shown in the following example.



If a warning condition occurs while running at a specified frequency, the current frequency and the signal will be displayed alternately, at 1 second intervals. Refer to 6.3 Under load Fault Trip and Warning on page 287 for more details.

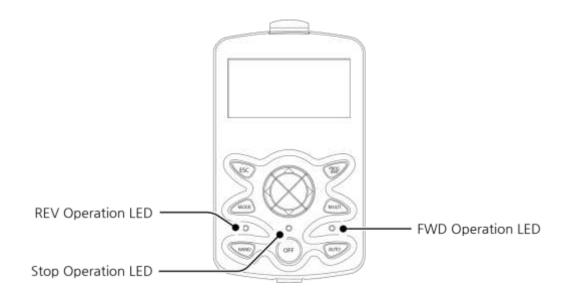


3.5 About the LCD keypad (graphic keypad)

The LCD keypad (graphic keypad) is composed of two main components – the LCD graphic display and the operation (input) keys. Refer to the following illustration to identify part names and functions.

3.5.1 Operation Keys

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

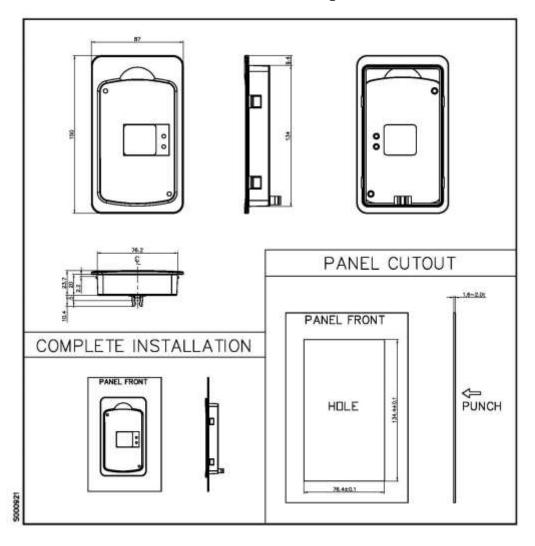




Key	Name	Description		
MODE	[MODE] Key	Used to switch between modes.		
PROG	[PROG / Ent] Key	Used to select, confirm, or save a parameter value.		
	[UP] key [DOWN] key	Switch between codes or increase or decrease parameter values.		
	[LEFT] key [RIGHT] key	Switch between groups or move the cursor during parameter setup or modification.		
MULTI	[MULTI] Key	Used to perform special functions, such as user code registration.		
ESC	[ESC] Key	 Used to cancel an input during parameter setup. Pressing the [ESC] key before pressing the [PROG / ENT] key reverts the parameter value to the previously set value. Pressing the [ESC] key while editing the codes in any function group makes the keypad display the first code of the function group. Pressing the [ESC] key while moving through the modes makes the keypad 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 reversed direction.		
STOP /RESET	[STOP/RESET] Key	Used to stop motor operation. Used to reset the inverter following fault or failure condition.		



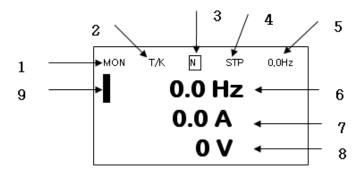
3.5.2 Bracket dimensions and mounting



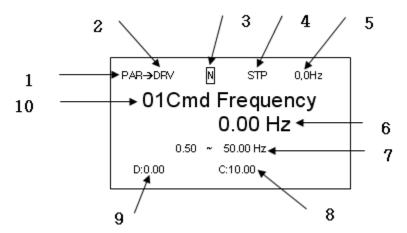


3.5.3 About the Display

Monitor mode display



Parameter settings display





Names displayed in monitor mode and parameter settings

No.	Names displayed in monitor mode	No.	Names displayed in parameter settings
1	Mode	1	Mode
2	Operating/frequency command	2	Group
3	Multi-functional key settings	3	Multi-functional key settings
4	Inverter operation status	4	Inverter operation status
5	Items displayed in the status window	5	Items displayed in the status window
6	Monitor mode display 1	6	Display parameters
7	Monitor mode display 2	7	Available settings range
8	Monitor mode display 3	8	Existing setting values
9	Monitor mode cursor	9	Factory default values
		10	Code numbers and names

Display details

No.	Name	Display	Description	
	Mode	MON	Monitor Mode	
1		PAR	Parameter Mode	
I		TRP	Trip Mode	
		CNF	Config Mode	
		K	Keypad operation command	
	Operation	0	Field Bus communication option operation command	
	commands	А	Application option operation command	
		R	Internal 485 operation command	
		T	Terminal operation command	
2		K	Keypad frequency command	
		V	V1 input frequency command	
	Frequency	Р	Pulse input frequency command	
	commands	U	Frequency command for UP operation (Up - Down operation)	
		D	Frequency command for DOWN operation (Up - Down operation)	



No.	Name	Display	Description	
		S	Frequency command for STOP operation (Up - Down operation)	
		0	FBus Option frequency command	
		J	Jog frequency command	
		R	Int 485 frequency command	
		1~9, A~F	Multi-step frequency command	
		JOG Key	Keypad JOG operation mode	
3	Multi- functional key	Local/Remote	Able to select either local or remote operation	
	settings	UserGrpSelKe y	Register or delete user group parameters in parameter mode	
	Inverter	STP	Motor stopped	
		FWD	Operating in forward direction	
		REV	Operating in reverse direction	
		DC	DC output	
4		WAN	Warning	
4	operation status	STL	Stall	
		SPS	Speed Search	
		OSS	S/W overcurrent protective function is on	
		OSH	H/W overcurrent protective function is on	
		TUN	Auto Tuning	



3.5.4 Display Modes

The Sinus H inverter uses 5 modes to monitor or configure different functions. The parameters in Parameter mode are divided into smaller groups of relevant functions. Press the [Mode] key to change to Parameter mode.

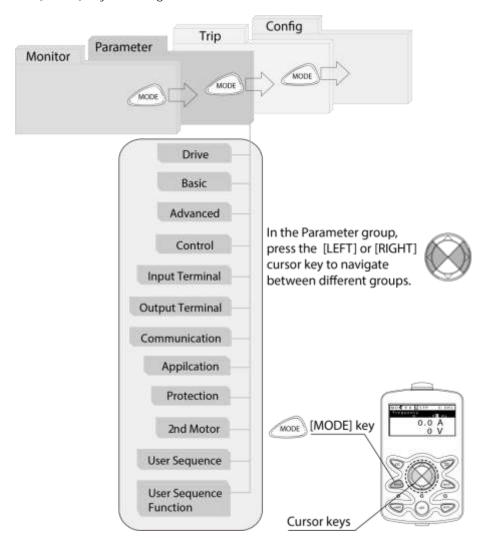




Table of Display Modes

The following table lists the 5 display modes used to control the inverter functions.

Mode Name	Keypad Display	Description		
Monitor mode MON this mode, inform reference, operat		Displays the inverter's operation status information. In this mode, information including the inverter's frequency reference, operation frequency, output current, and voltage may be monitored.		
Parameter mode PAR Used to config inverter. These		Used to configure the functions required to operate the inverter. These functions are divided into 14 groups based on purpose and complexity.		
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 may be monitored. This mode is not displayed if the inverter is not at fault and fault trip history does not exist.		
Config mode CNF CNF Used to directly settings keypad environ		Used to configure the inverter features that are not directly related to the operation of the inverter. The settings you can configure in the Config mode include keypad display language options, monitor mode environment settings, communication module display settings, and parameter duplication and initialization.		



Parameter Setting Mode

The following table lists the functions groups under Parameter mode.

Function Group Name	Keypad Display	Description		
Drive	DRV	Configures basic operation parameters. These include ACC/Dec time settings, operation command settings, and functions necessary for operation.		
Basic	BAS	Configures basic operation parameters. These parameters include motor parameters and multi-step frequency parameters.		
Advanced	ADV	Configures acceleration or deceleration patterns, frequency limits, energy saving features, and, regeneration prevention features.		
Control CON Co		Configures the features related to speed search and KEB (kinetic energy buffering).		
Input Terminal	IN	Configures input terminal-related features, including digital multi-functional inputs and analog inputs.		
Output Terminal OUT		Configures output terminal-related features, including digital multi-functional outputs and analog outputs.		
Communication	СОМ	Configures the communication features for the RS-485, Modbus-RTU. Optional communication module related features may be configured as well, if one is installed.		
Application APP Cor		Configures functions related to auto sequence operation and PID control.		
Protection	PRT	Configures motor and inverter protection features.		
Motor 2 (Secondary motor) M2 Configures the secondary motor-r		Configures the secondary motor-related features.		
User Sequence	USS	Used to implement simple sequences with various		
User Sequence Function	USF	Used to implement simple sequences with various function blocks.		



3.6 Learning to Use the LCD keypad (graphic keypad)

The LCD keypad (graphic keypad) enables movement between groups and codes. It also enables users to select and configure functions. At code level, you can set parameter values to turn specific functions on or off or decide how the functions will be used. For detailed information on the codes in each function group, refer to <u>8. Table of Functions</u> on page <u>322</u>. Confirm the correct values (or the correct range of the values), then follow the examples below to configure the inverter with the keypad.

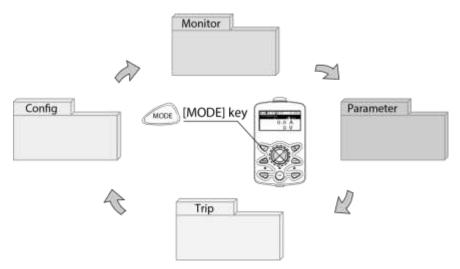
Note

• The graphic keypad may be remoted up to a maximum allowable distance of 3m.

3.6.1 Display Mode Selection

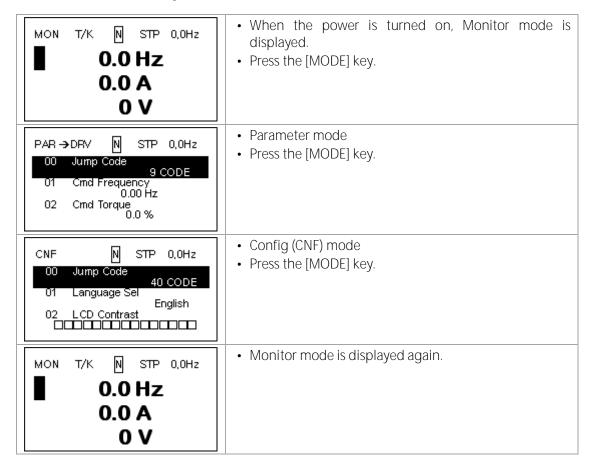
The following figure illustrates how the display modes change when you press the [Mode] button on the keypad. You can continue to press the [Mode] key until you get to the desired mode.

User mode and Trip mode are not displayed when all the inverter settings are set to the factory default (User mode must be configured before it is displayed on the keypad, and Trip mode is displayed only when the inverter is at fault, or has previous trip fault history).





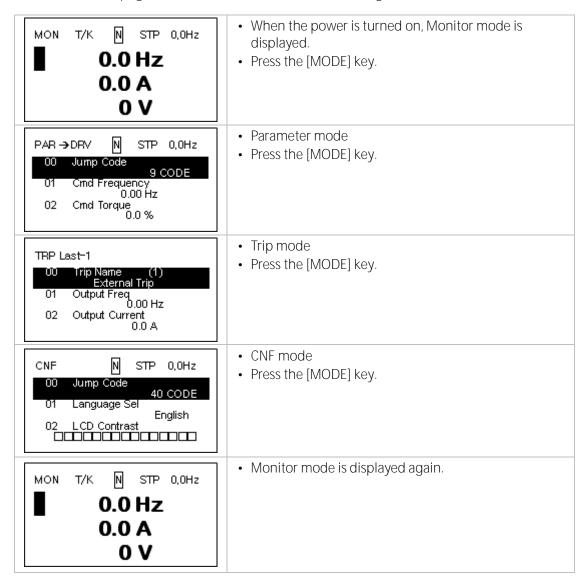
Mode selection in factory default condition





Switching between groups when Trip mode is added

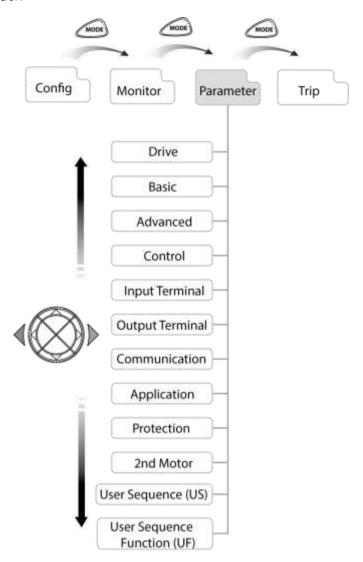
Trip mode is accessible only when the inverter has trip fault history. Refer to <u>4. Learning</u> <u>Basic Features</u> on page <u>113</u> for information about monitoring faults.





3.6.2 Switching Groups

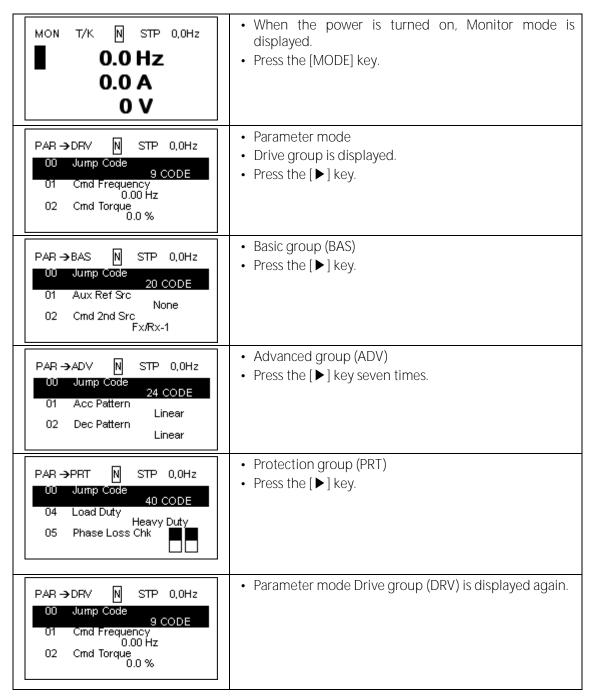
Press the [MODE] key to display a specific mode. Modes displayed change in the following order:





Switching between Groups in Parameter Display Mode

After entering Parameter mode from Monitor mode, press the [▶] key to change the display as shown below. Press the [◄] key to return to the previous mode.

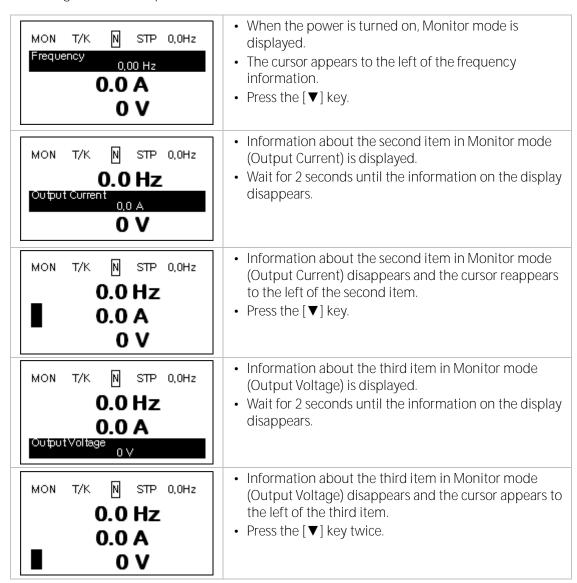




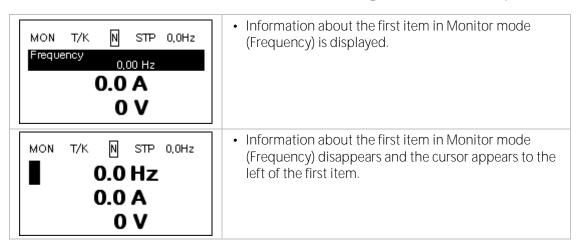
3.6.3 Navigating through the Codes (Functions)

Code Navigation in Monitor mode

In monitor mode, press the [A, [Y]] key to display frequency, the output current, or voltage according to the cursor position.

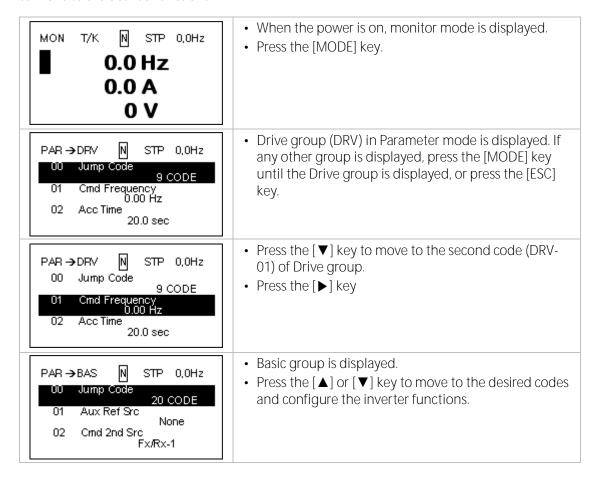






Code Navigation in Parameter mode

The following examples show you how to move through codes in different function groups (Drive group and Basic group) in Parameter mode. In parameter mode, press the $[\blacktriangle]$ or $[\blacktriangledown]$ key to move to the desired functions.

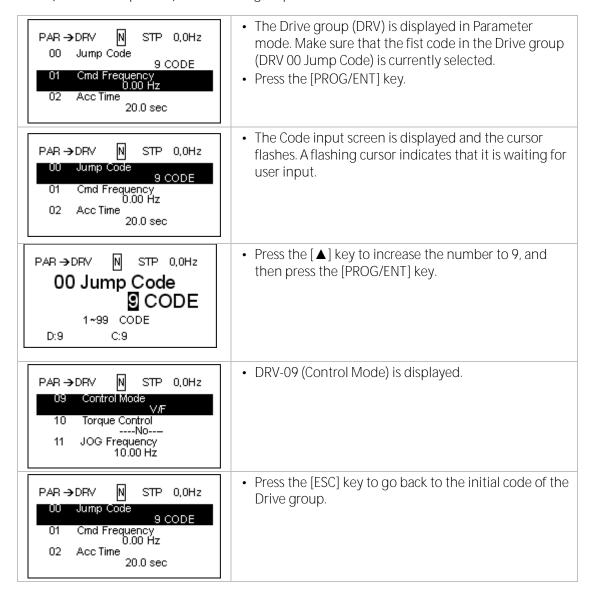




3.6.4 Navigating Directly to Different Codes

Parameter mode and Config mode allow direct jumps to specific codes. The code used for this feature is called the Jump Code. The Jump Code is the first code of each mode. The Jump Code feature is convenient when navigating for a code in a function group that has many codes.

The following example shows how to navigate directly to code DRV- 09 from the initial code (DRV-00 Jump Code) in the Drive group.

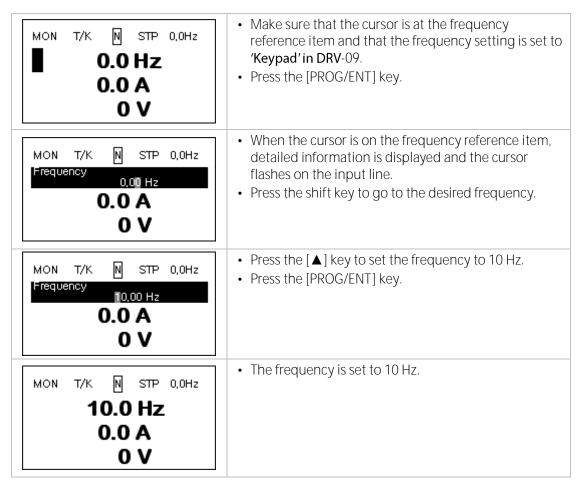




3.6.5 Parameter settings

Parameter settings available in Monitor mode

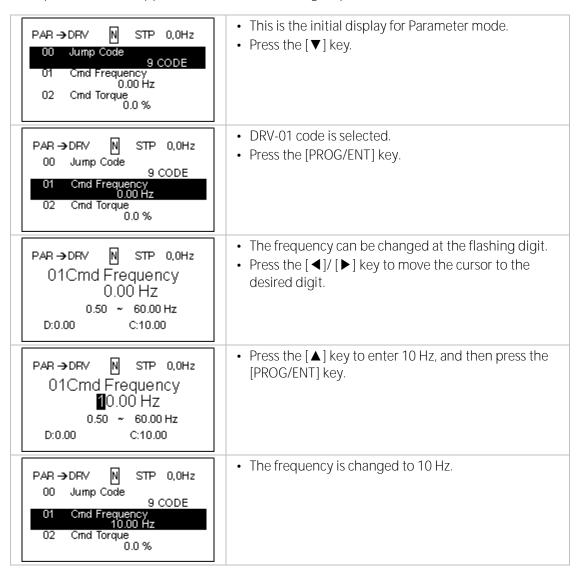
The Sinus H inverter allows basic parameters to be modified in Monitor mode. The following example shows how to set the frequency.





Parameter settings in other modes and groups

The following example shows how to change the frequency in the Drive group. This example can also be applied to other modes and groups.

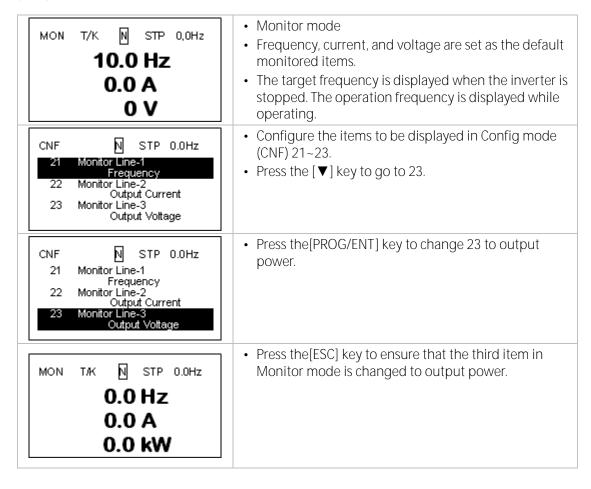




3.6.6 Monitoring the Operation

How to use Monitor mode

There are 3 types of items that may be monitored in Monitor mode. Some items, including frequency, may be modified. Users can select the items to be displayed in Config mode (CNF).





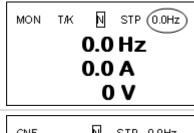
Items available for monitoring

	Items available for monitoring					
Mod e	Numbe r	Display	Set ⁻	ting 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 State		
			8	DO State		
			9	V1 Monitor[V]		
CNF			10	V1 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 Fbk Value		
			20	Torque		
			21	Torque Limit		
			22	Trq Bias Ref		
			23	Speed Limit		

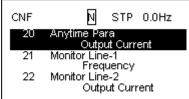


How to use the status bar

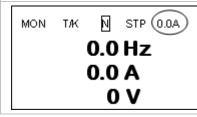
On the top-right corner of the display, there is a display item. This item is displayed as long as the inverter is on, regardless of the mode the inverter is operating in.



- Monitor mode
- In the top-right corner of the display, the frequency reference is displayed (factory default).



- Enter Config mode and go to CNF-20 to select the item to display.
- Press the [PROG/ENT] key to change the item to 'Output Current.'
- On the top-right corner of the display, the unit changes from 'Frequency' to 'Current.'



• In monitor mode, the status bar item is changes to 'Current.'



3.7 Fault Monitoring

3.7.1 Monitoring Faults during Inverter Operation

The following example shows how to monitor faults that occurred during inverter operation.

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 occurred.
TRP Last-1 01 Output Freq 48.30 Hz 02 Output Current 33.3 A 03 Inverter State Stop	 Press the [▼] key to view the information on the inverter at the time of fault, including the output frequency, output current, and operation type.
MON T/K N STP 0,0A 0.0 Hz 0.0 A 0 V	When the inverter is reset and the fault trip is released, the keypad display returns to the screen it was at when the fault trip occurred.



3.7.2 Monitoring Multiple Fault Trips

The following example shows how to monitor multiple faults that occur at the same time.

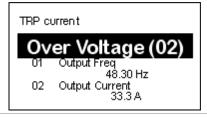
TRP current Over Voltage (02) 01 Output Freq 48.30 Hz 02 Output Current 33.3 A	 If multiple fault trips occur at the same time, the number of fault trips occurred is displayed on the right side of the fault trip type. Press the [PROG/ENT] key.
TRP current 00 Trip Name (02) 0 Over Voltage 1 External Trip	 The types of fault trips that occurred 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 returns to the screen it was at when the fault trip occurred.



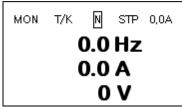
Learning to Perform Basic Operations

Fault trip history saving and monitoring

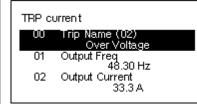
When fault trips occur, the trip mode saves the content. Up to five fault trips are saved in the history. Trip mode saves when the inverter is reset, and when a Low Voltage fault trip occurs due to power outages. If a trip occurs more than five times, the information for the five previous trips are automatically deleted.



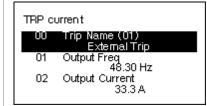
• If a fault trip occurs during inverter operation, the inverter enters Trip mode automatically and displays the type of fault trip that occurred.



- After the [RESET] key or terminal is pressed, the fault trip is saved automatically and returns to the screen it was on before the fault trip occurred.
- Press the [MODE] key toenterTrip mode.



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

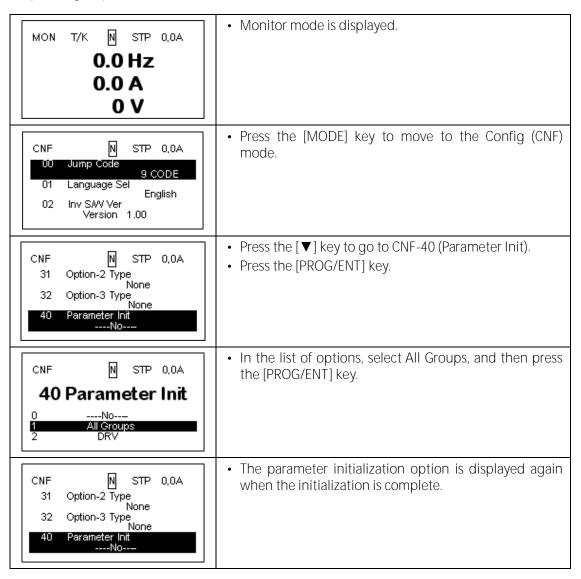


- The fault trip changes position and is saved in Last-2 code.
- When a fault trip occurs again, the content in Last-2 is moved to Last-3.



3.8 Parameter Initialization

The following example demonstrates how to revert all the parameter settings back to the factory default (Parameter Initialization). Parameter initialization may be performed for separate groups in Parameter mode as well.





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

Basic Tasks	Description	Ref.
Frequency reference source configuration for the keypad	Configures the inverter to allow you to setup or modify frequency reference using the Keypad.	<u>p.117</u>
Frequency reference source configuration for the terminal block (input voltage)	Configures the inverter to allow input voltages at the terminal block (V1, V2) and to setup or modify a frequency reference.	<u>p.118,</u> <u>p.125</u>
Frequency reference source configuration for the terminal block (input current)	Configures the inverter to allow input currents at the terminal block (I2) and to setup or modify a frequency reference.	<u>p.124</u>
Frequency reference source configuration for the terminal block (input pulse)	Configures the inverter to allow input pulse at the terminal block (TI) and to setup or modify a frequency reference.	<u>p.127</u>
Frequency reference source configuration for RS-485 communication	Configures the inverter to allow communication signals from upper level controllers, such as PLCs or PCs, and to setup or modify a frequency reference.	<u>p.129</u>
Frequency control using analog inputs	Enables the user to hold a frequency using analog inputs at terminals.	<u>p.130</u>
Motor operation display options	Configures the display of motor operation values. Motor operation is displayed either in frequency (Hz) or speed (rpm).	p.131
Multi-step speed (frequency) configuration	Configures multi-step frequency operations by receiving an input at the terminals defined for each step frequency.	<u>p.131</u>
Command source configuration for keypad buttons	Configures the inverter to allow the manual operation of the [FWD], [REV] and [Stop] keys.	<u>p.133</u>
Command source configuration for terminal block inputs	Configures the inverter to accept inputs at the FX/RX terminals.	<u>p.134</u>
Command source configuration for RS-485 communication	Configures the inverter to accept communication signals from upper level controllers, such as PLCs or PCs.	<u>p.136</u>



Basic Tasks	Description	Ref.
Local/remote switching via the [ESC] key	Configures the inverter to switch between local and remote operation modes when the [ESC] key is pressed. When the inverter is operated using remote inputs (any input other than one from the keypad), this configuration can be used to perform maintenance on the inverter, without losing or altering saved parameter settings. It can also be used to override remotes and use the keypad immediately in emergencies.	p.136
Motor rotation control	Configures the inverter to limit a motor's rotation direction.	<u>p.138</u>
Automatic start-up at power-on	Configures the inverter to start operating at power-on. With this configuration, the inverter begins to run and the motor accelerates as soon as power is supplied to the inverter. To use automatic start-up configuration, the operation command terminals at the terminal block must be turned on.	p.139
Automatic restart after reset of a fault trip condition	Configures the inverter to start operating when the inverter is reset following a fault trip. In this configuration, the inverter starts to run and the motor accelerates as soon as the inverter is reset following a fault trip condition. For automatic start-up configuration to work, the operation command terminals at the terminal block must be turned on.	p.139
Acc/Dec time configuration based on the Max. Frequency	Configures the acceleration and deceleration times for a motor based on a defined maximum frequency.	p.141
Acc/Dec time configuration based on the frequency reference	Configures acceleration and deceleration times for a motor based on a defined frequency reference.	<u>p.143</u>
Multi-stage Acc/Dec time configuration using the multi-function terminal	Configures multi-stage acceleration and deceleration times for a motor based on defined parameters for the multi-function terminals.	<u>p.144</u>
Acc/Dec time transition speed (frequency) configuration	Enables modification of acceleration and deceleration gradients without configuring the multi-functional terminals.	<u>p.146</u>
Acc/Dec pattern configuration	Enables modification of the acceleration and deceleration gradient patterns. Basic patterns to choose from include linear and S-curve patterns.	<u>p.147</u>
Acc/Dec stop command	Stops the current acceleration or deceleration and controls motor operation at a constant speed. Multi-function terminals must be configured for this command.	<u>p.149</u>
Linear V/F pattern operation	Configures the inverter to run a motor at a constant torque. To maintain the required torque, the operating frequency may vary during operation.	<u>p.150</u>



Basic Tasks	Description	Ref.
Square reduction V/F pattern operation	Configures the inverter to run the motor at a square reduction V/F pattern. Fans and pumps are appropriate loads for square reduction V/F operation.	<u>p.151</u>
User V/F pattern configuration	Enables the user to configure a V/F pattern to match the characteristics of a motor. This configuration is for special-purpose motor applications to achieve optimal performance.	<u>p.152</u>
Manual torque boost	Manual configuration of the inverter to produce a momentary torque boost. This configuration is for loads that require a large amount of starting torque, such as elevators or lifts.	<u>p.153</u>
Automatic torque boost	Automatic configuration of the inverter that provides "auto tuning" that produces a momentary torque boost. This configuration is for loads that require a large amount of starting torque, such as elevators or lifts.	<u>p.154</u>
Output voltage adjustment	Adjusts the output voltage to the motor when the power supply to the inverter differs from the motor's rated input voltage.	<u>p.155</u>
Accelerating start	Accelerating start is the general way to start motor operation. The typical application configures the motor to accelerate to a target frequency in response to a run command, however there may be other start or acceleration conditions defined.	<u>p.156</u>
Start after DC braking	Configures the inverter to perform DC braking before the motor starts rotating again. This configuration is used when the motor will be rotating before the voltage is supplied from the inverter.	<u>p.156</u>
Deceleration stop	Deceleration stop is the typical method used to stop a motor. The motor decelerates to 0Hz and stops on a stop command, however there may be other stop or deceleration conditions defined.	<u>p.157</u>
Stopping by DC braking	Configures the inverter to apply DC braking during motor deceleration. The frequency at which DC braking occurs must be defined and during deceleration, when the motor reaches the defined frequency, DC braking is applied.	p.157
Free-run stop	Configures the inverter to stop output to the motor using a stop command. The motor will free-run until it slows down and stops.	<u>p.159</u>
Power braking	Configures the inverter to provide optimal, motor deceleration, without tripping over-voltage protection.	<u>p.159</u>
Start/maximum frequency configuration	Configures the frequency reference limits by defining a start frequency and a maximum frequency.	<u>p.160</u>
Upper/lower frequency limit configuration	Configures the frequency reference limits by defining an upper limit and a lower limit.	<u>p.161</u>



Basic Tasks	Description	Ref.
Frequency jump	Configures the inverter to avoid running a motor in mechanically resonating frequencies.	<u>p.162</u>
2 nd Operation Configuration	Used to configure the 2 nd operation mode and switch between the operation modes according to your requirements.	<u>p.163</u>
Multi-function input terminal control configuration	Enables the user to improve the responsiveness of the multi-function input terminals.	<u>p.164</u>
P2P communication configuration	Configures the inverter to share input and output devices with other inverters.	p.166
Multi-keypad configuration	Enables the user to monitor multiple inverters with one monitoring device.	<u>p.167</u>
User sequence configuration	Enables the user to implement simple sequences using various function blocks.	<u>p.168</u>

4.1 Setting Frequency Reference

The Sinus H inverter provides several methods to setup and modify a frequency reference for an operation. The keypad, analog inputs [for example voltage (V1, V2) and current (I2) signals], or RS-485 (digital signals from higher-level controllers, such as PC or PLC) can be used.

Group	Code	Name	LCD Display	Para Sett	ameter :ing	Setting Range	Unit																																		
				0	KeyPad-1																																				
				1	KeyPad-2																																				
			Ref Freq Src 2 V1 4 V2 5 I2 6 Int 485 8 Field Bus	2	V1																																				
	Frequency reference source	Ref Freq Src		Ref Freq Src	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Cro	Dof From Sro	Dof From Sro	Dof From Sro	Dof From Sro	Dof Erog Src	Dof Eroa Src	Dof Eroa Src	Dof Eroa Src	Dof Eroa Src	4	V2	0-12							
					5	12	0-12	-																																	
																	6	Int 485																							
				12	Pulse																																				



4.1.1 Keypad as the Source (KeyPad-1 setting)

You can modify frequency reference by using the keypad and apply changes by pressing the [ENT] key. To use the keypad as a frequency reference input source, go to the Frq (Frequency reference source) code in the Operation group and change the parameter value to 0 (Keypad-1). Input the frequency reference for an operation at the 0.00(Command Frequency) code in the Operation group.)

Group	Code	Name		Parameter Setting		Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	0	KeyPad-1	0–12	
Operation	0.00	Frequency reference		0.00		Min to Max Frq*	Hz

^{*} You cannot set a frequency reference that exceeds the Max. Frequency, as configured with dr.20.

4.1.2 Keypad as the Source (KeyPad-2 setting)

You can use the $[\blacktriangle]$ and $[\blacktriangledown]$ 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 the Frq (Frequency reference source) code in the Operation group and change the parameter value to 1 (Keypad-2). This allows frequency reference values to be increased or decreased by pressing the $[\blacktriangle]$ and $[\blacktriangledown]$ keys.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	1	KeyPad-2	0–12	-
Operation	0.00	Frequency reference		0.00		Min to Max Frq*	Hz

^{*} You cannot set a frequency reference that exceeds the Max. Frequency, as configured with dr.20.

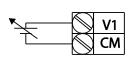


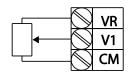
4.1.3 V1 Terminal as the Source

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

4.1.3.1 Setting a Frequency Reference for 0-10V Input

Set code 06 (V1 Polarity) to 0 (unipolar) in the Input Terminal group (IN). 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		ameter ting	Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	2	V1	0–12	-
(01	Frequency at maximum analog input	Freq at 100%		kimum Juency	0.00- Max. Frequency	Hz
	05	V1 input monitor	V1 Monitor [V]	0.00)	0.00-12.00	V
	06	V1 polarity options	V1 Polarity	0	Unipolar	0-1	-
	07	V1 input filter time constant	V1 Filter	100		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	10.0	00	0 .00- 12.00	V
	11	V1 output at maximum voltage (%)	V1 Perc y2	100	.00	0–100	%
	16	Rotation direction options	V1 Inverting	0	No	0–1	-
	17	V1 Quantizing level	V1 Quantizing	0.04	1	0.00*, 0.04 – 10.00	%

^{*} Quantizing is disabled if '0' is selected.

0–10V Input Voltage Setting Details

Code	Description
	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(%).
In.01 Freq at 100%	 Set code In.01 to 40.00 and use default values for codes In.02–In.16. Motor will run at 40.00Hz when a 10V input is provided at V1. Set code In.11 to 50.00 and use default values for codes In.01–In.16. Motor will run at 30.00Hz (50% of the default maximum frequency–60Hz) when a 10V input is provided at V1.
In.05 V1 Monitor[V]	Configures the inverter to monitor the input voltage at V1.



Code	Description
	V1 Filter may be used when there are large variations between reference frequencies. Variations can be mitigated by increasing the time constant, but this will require 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
In.07 V1 Filter	Frequency 100% 63% V1 Filter(t)
	[V1 Filter]
	These parameters are used to configure the gradient level and offset values of the Output Frequency, based on the Input Voltage. Frequency reference
In.08 V1 Volt x1– In.11 V1 Perc y2	In.11
	In.09 V1 input
	[Volt x1-In.11 V1 Perc y2]
In.16 V1 Inverting	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.



Code Description

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).

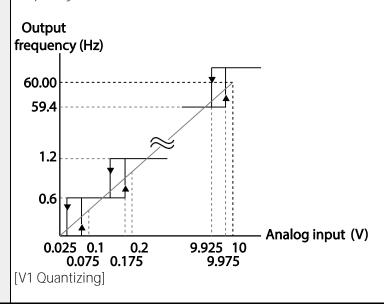
You can also turn on the low-pass filter using code In.07 to reduce the noise, but increasing the value will reduce responsiveness and may cause pulsations (ripples) in the output frequency.

Parameter values for quantizing refer to a percentage based on the maximum input. Therefore, if the value is set to 1% of the analog maximum input (60Hz), the output frequency will increase or decrease by 0.6Hz per 0.1V difference.

When the analog input is increased, an increase to 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.

In.17.V1 Quantizing

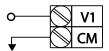
As a result, the output frequency will be different at acceleration and deceleration, mitigating the effect of analog input changes over the output frequency.



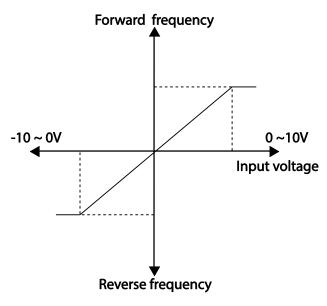


4.1.3.2 Setting a Frequency Reference for -10-10V Input

Set the Frq (Frequency reference source) code in the Operation group to 2 (V1), and then set code 06 (V1 Polarity) to 1 (bipolar) in the Input Terminal group (IN). Use the output voltage from an external source to provide input to V1.



[V1 terminal wiring]



[Bipolar input voltage and output frequency]

Group	Code	Name	LCD Display		rameter tting	Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	2	V1	0–12	-
	01	Frequency at maximum analog input	Freq at 100%	60.	00	0- Max Frequency	Hz
	05	V1 input monitor	V1 Monitor	0.00		0.00-12.00V	V
In	06	V1 polarity options	V1 Polarity	1	Bipolar	0–1	-
111	12	V1 minimum innut		0.00		10.00-0.00V	V
	13	V1 output at minimum voltage (%)	V1- Perc y1	0.0	0	-100.00 – 0.00%	%

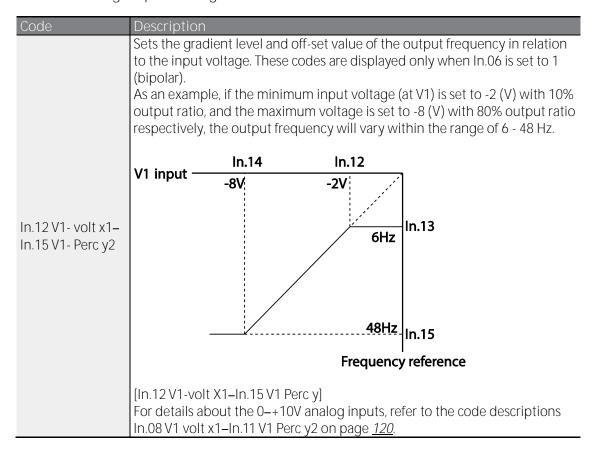


1	14	V1maximum input voltage	V1- Volt x2	-10.00	-12.00 – 0.00V	V
1	15	V1 output at maximum voltage (%)	V1- Perc y2	-100.00	-100.00 - 0.00%	%

Rotational Directions for Different Voltage Inputs

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

-10-10V Voltage Input Setting Details





4.1.3.3 Setting a Reference Frequency using Input Current (I2)

You can set and modify a frequency reference using input current at the I2 terminal after selecting current input at SW 2. Set the Frq (Frequency reference source) code in the Operation group to 5 (I2) and apply 4–20mA input current to I2.

Group	Code	Name	LCD Display	Parar Setti	meter ng	Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	5	12	0-12	-
l.	01	Frequency at maximum analog input	Freq at 100%	60.00		0- Maximum Frequency	Hz
In	50	12 input monitor	12 Monitor	0.00		0.00-24.00	mA
	52	I2 input filter time constant	12 Filter	100		0-10000	ms

Group	Code	Name	LCD Display	Para Sett	meter ing	Setting Range	Unit
53 54 55 56 61 62	53	I2 minimum input current	I2 Curr x1	4.00		0.00-20.00	mA
	54	I2 output at minimum current (%)	I2 Perc y1	0.00		0-100	%
	55	I2 maximum input current	I2 Curr x2	20.00)	0.00-24.00	mA
	56	I2 output at maximum current (%)	I2 Perc y2	100.0	00	0.00-100.00	%
	61	I2 rotation direction options	I2 Inverting	0	No	0-1	-
	62	12 Quantizing level	I2 Quantizing	0.04		0*, 0.04– 10.00	%

^{*} Quantizing is disabled if '0' is selected.



Input Current (I2) Setting Details

In.01 Freq at 100% In.50 I2 Monitor	 Configures the frequency reference for operation at the maximum current (when In.56 is set to 100%). If In.01 is set to 40.00Hz, and default settings are used for In.53–56, 20mA input current (max) to I2 will produce a frequency reference of 40.00Hz. If In.56 is set to 50.00 (%), and default settings are used for In.01 (60Hz) and In.53–55, 20mA input current (max) to I2 will produce a frequency reference of 30.00Hz (50% of 60Hz). Used to monitor input current at I2. Configures the time for the operation frequency to reach 63% of target
C	Configures the time for the operation frequency to reach 63% of target
In 52 I2 Filtor	, , ,
fre	frequency based on the input current at I2.
In.53 I2 Curr x1– In.56 I2 Perc y2	Frequency Reference In.56 In.53 In.55 [Gradient and off-set configuration based on output frequency]

4.1.4 Setting a Frequency Reference with Input Voltage (Terminal I2)

Set and modify a frequency reference using input voltage at I2 (V2) terminal by setting SW2 to V2. Set the Frq (Frequency reference source) code in the Operation group to 4 (V2) and apply 0-12V input voltage to I2 (=V2, Analog current/voltage input terminal). Codes In.35-47 will not be displayed when I2 is set to receive current input (Frq code parameter is set to 5).



Group	Cod e	Name	LCD Display	Parame Setting		Setting Range	Unit
Operatio n	Frq	Frequency reference source	Freq Ref Src	4	V2	0–12	-
	35	V2 input display	V2 Monitor	0.00		0.00-12.00	V
	37	V2 input filter time constant	V2 Filter	100		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
	41	Output% at maximum V2 voltage	V2 Perc y2	100.00		0.00–100.00	%
	46	Invert V2 rotational direction	V2 Inverting	0	No	0-1	-
	47	V2 quantizing level	V2 Quantizing	0.04		0.00*, 0.04 – 10.00	%

^{*} Quantizing is disabled if '0' is selected.



4.1.5 Setting a Frequency with TI Pulse Input

Set a frequency reference by setting the Frq (Frequency reference source) code in Operation group to 12 (Pulse). In case of IP66 models, set the In.69 P5 Define to 54(TI) and provide 0–32.00kHz pulse frequency to P5.

Group	Code	Name	LCD Display		ameter ting	Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	12	Pulse	0–12	-
	69	P5 terminal function setting	P5 Define	54	TI	0-54	-
	01	Frequency at maximum analog input	Freq at 100%	60.00		0.00– Maximum frequency	Hz
	91	Pulse input display	Pulse Monitor	0.00		0.00–50.00	kHz
	92	TI input filter time constant	TI Filter	10		0–9999	ms
In	93	TI input minimum pulse	TI PIs x1	0.00		0.00-32.00	kHz
	94	Output% at TI minimum pulse	TI Perc y1	0.00		0.00–100.00	%
	95	TI Input maximum pulse	TI Pls x2	32.0	00	0.00-32.00	kHz
	96	Output% at TI maximum pulse	TI Perc y2	100	.00	0.00-100.00	%
	97	Invert TI direction of rotation	TI Inverting	0	No	0-1	-
	98	TI quantizing level	TI Quantizing	0.04	1	0.00*, 0.04 – 10.00	%

^{*} Data shaded in grey is applied only for IP66 models.

^{*}Quantizing is disabled if '0' is selected.



TI Pulse Input Setting Details

Code	Description				
In.69 P5 Define	In case of IP66 models, Pulse input TI and Multi-function terminal P5 share the same terminal. Set the In.69 P5 Define to 54(TI).				
In.01 Freq at 100%	 Configures the frequency reference at the maximum pulse input. The frequency reference is based on 100% of the value set with In.96. If In.01 is set to 40.00 and codes In.93–96 are set at default, 32kHz input to TI yields a frequency reference of 40.00Hz. If In.96 is set to 50.00 and codes In.01, In.93–95 are set at default, 32kHz input to the TI terminal yields a frequency reference of 30.00Hz. 				
In.91 Pulse Monitor	Displays the pulse frequency supplied at TI.				
In.92 TI Filter	Sets the time for the pulse input at TI to reach 63% of its nominal frequency (when the pulse frequency is supplied in multiple steps).				
In.93 TI Pls x1– In.96 TI Perc y2	Frequency reference In.96 In.94 In.95 In.95 In.95 In.95 In.95				
In.97 TI Inverting- In.98 TI Quantizing	Identical to In.16-17 (refer to In.16 V1 Inverting/In.17.V1 Quantizing on page 120).				



4.1.6 Setting a Frequency Reference via RS-485 Communication

Control the inverter with upper-level controllers, such as PCs or PLCs, via RS-485 communication. Set the Frq (Frequency reference source) code in the Operation group to 6 (Int 485) and use the RS-485 signal input terminals (S+/S-/SG) for communication. Refer to 7_RS-485 Communication Features on page 298.

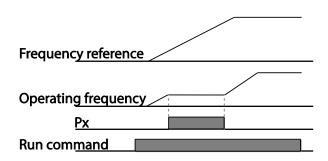
Group	Code	Name	LCD Display		rameter tting	Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	6	Int 485	0–12	-
	01	Integrated RS-485 communication inverter ID	Int485 St ID	-	1	1-250	-
CM	03	Integrated communication speed	Int485 BaudR	3	9600 bps	0-7	-
		Integrated		0	D8/PN/S1		
	04	communication	Int485 Mode	1	D8/PN/S2	- 0-3	
	04	frame configuration	III.405 Mode	2	D8/PE/S1		[
		Traffic configuration		3	D8/PO/S1		



4.2 Frequency Hold by Analog Input

If you set a frequency reference via 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 fixed upon an analog input signal.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	0 1 2 4 5 6 8 12	Keypad-1 Keypad-2 V1 V2 I2 Int 485 Field Bus Pulse	0-12	-
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define(Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	21	Analog Hold	0-54	-





4.3 Changing the Displayed Units (Hz↔Rpm)

You can change the units used to display the operational speed of the inverter by setting Dr. 21 (Speed unit selection) to 0 (Hz) or 1 (Rpm). This function is available only with the LCD keypad.

Group	Code	Name	LCD Display	Parameter Setting :		Setting Range	Unit
dr	21	Speed unit	Hz/Rpm Sel	0	Hz Display	0.1	
ar 21	selection	пz/крптзег	1	Rpm Display	0-1	-	

4.4 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 with the Frq code in the Operation group. Px terminal parameter values 7 (Speed-L), 8 (Speed-M) and 9 (Speed-H) are recognized as binary commands and work in combination with Fx or Rx run commands. The inverter operates according to the frequencies set with St.1–3 (multi-step frequency 1–3), bA.53–56 (multi-step frequency 4–7) and the binary command combinations.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	St1-St3	Multi-step frequency 1–3	Step Freq - 1– 3	-		0-Maximum frequency	Hz
bA	53–56	Multi-step frequency 4–7	Step Freq - 4– 7	-		0-Maximum frequency	Hz
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define(Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	7 8 9	Speed-L Speed-M Speed-H	0–54	-
	89	Multi-step command delay time	InCheck Time	1		1–5000	ms



Multi-step Frequency Setting Details

Code	Description					
Operation group	Configure mult					
St 1-St3	,	f an LCD keypad is in use, bA.50–52 is used instead of St1–St3 (multi-step				
Step Freq - 1-3	frequency 1-3)					
bA.53-56	Configure mul	ti-step frequer	ncy 4–7.			
Step Freq - 4-7						
In.65-71 for P1-P7 in IP20 models, In.65-69 for P1-P5 in IP66 models Px Define	Choose the terr relevant codes models) to 7(Sr. Provided that to and Speed-Hore available. Step 0 P3 P4 P5 FX RX [An example of	(In.65-71 for P1 beed-L), 8(Spee erminals P3, P4	-P7 in IP20 mo d-M), or 9(Spee and P5 have b following mult	dels, In.65-69 foed-H). een set to Spee	or P1-P5 in IP66 ed-L, Speed-M	
	Speed	Fx/Rx	P5	P4	P3	
	0	√	-	-	-	
		./	-	-	Y	
	3	✓	-	✓	- -	
	4	√	<u>-</u> ✓	_	_	
	5	→	→	-	√	
	6	√	√	√	-	
	7	✓	✓	✓	✓	



Code	Description
	Set a time interval for the inverter to check for additional terminal block
	inputs after receiving an input signal.
In.89 InCheck	
Time	After adjusting In.89 to 100ms and an input signal is received at P5, the
	inverter will search for inputs at other terminals for 100ms, before
	proceeding to accelerate or decelerate based on P5's configuration.

4.5 Command Source Configuration

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

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
		Command Source		0	Keypad		
			Cmd Source*	1	Fx/Rx-1	0-4	
Operation	drv			2	Fx/Rx-2		-
				3	Int 485		
				4	Field Bus	7	

^{*} Displayed under DRV-06 on the LCD keypad.

4.5.1 The Keypad as a Command Input Device

The keypad can be selected as a command input device to send command signals to the inverter. This is configured by setting the drv (command source) code to 0 (Keypad). Press the [RUN] key on the keypad to start an operation, and the [STOP/RESET] key to end it.

group	Code	Name	H (H) Display	Paran Settir		Setting Range	Unit
Operation	drv	Command source	Cmd Source*	0	KeyPad	0-4	-

^{*} Displayed under DRV-06 on the LCD keypad.



4.5.2 Terminal Block as a Command Input Device (Fwd/Rev Run Commands)

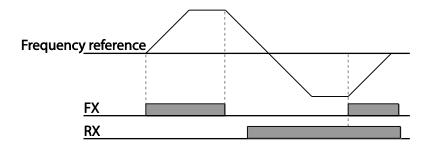
Multi-function terminals can be selected as a command input device. This is configured by setting the drv (command source) code in the Operation group to 1(Fx/Rx). Select 2 terminals for the forward and reverse operations, and then set the relevant codes (2 of the 5 multi-function terminal codes, In.65-71 for P1-P7 in IP20 models, In.65-69 for P1-P5 in IP66 models) 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 operation.

Group	Code	Name	LCD Display	Para Sett	imeter ing	Setting Range	Unit
Operation	drv	Command source	Cmd Source*	1	Fx/Rx-1	0-4	-
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define(Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	2	Fx Rx	0-54	-

^{*} Displayed under DRV-06 on the LCD keypad.

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

Code	Description
Operation group	Set to 1(Fx/Rx-1).
drv-Cmd Source	Set to 1(FX/KX-1).
In.65-71 (P1-P7 in	
IP20 models),	Accian a terminal for forward (EV) apprection
In.65-69 (P1-P5 in	Assign a terminal for forward (Fx) operation.
IP66 models)	Assign a terminal for reverse (Rx) operation.
Px Define	





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

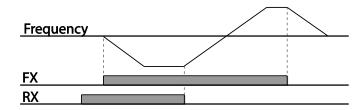
Multi-function terminals can be selected as a command input device. This is configured by setting the drv (command source) code in the Operation group to 2(Fx/Rx-2). Select 2 terminals for run and rotation direction commands, and then select the relevant codes (2 of the 5 multi-function terminal codes, In.65-71 for P1-P7 in IP20 models, In.65-69 for P1-P5 in IP66 models) 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		ameter ting	Setting Range	Unit
Operation	Drv	Command source	Cmd Source*	2	Fx/Rx-2	0-4	-
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define(Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	2	Fx Rx	0-54	-

^{*} Displayed under DRV-06 on the LCD keypad.

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

Code	Description
Operation group	Set to 2(Fx/Rx-2).
drv Cmd Source	Jet to z(1 x/ xx-z).
In.65-71 (P1-P7 in	
IP20 models),	Assign a terminal for run command (Fx).
In.65-69 (P1-P5 in	Assign a terminal for changing rotation direction (Rx).
IP66 models)	Assign a termination changing rotation direction (Kx).
Px Define	





4.5.4 RS-485 Communication as a Command Input Device

Internal RS-485 communication can be selected as a command input device by setting the drv (command source) code in the Operation 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 Sg terminals at the terminal block. For more details, refer to 7 <u>RS-485 Communication Features</u> on page <u>298</u>.

Group	Code	Name	LCD Display	Paran Settir		Setting Range	Unit
Operation	drv	Command source	Cmd Source*	3	Int 485	0-4	-
	01	Integrated communication inverter ID	Int485 St ID	1		1-250	-
CM	02	Integrated communication protocol	Int485 Proto	0	ModBus RTU	0	-
	03	Integrated communication speed	Int485 BaudR	3	9600 bps	0-7	-
	04	Integrated communication frame setup	Int485 Mode	0	D8 / PN / S1	0-3	-

^{*} Displayed under DRV-06 on the LCD keypad.

4.6 Local/Remote Mode Switching

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

The [ESC] key is a programmable key that can be configured to carry out multiple functions. For more details, refer to <u>3.2.4 Configuring the [ESC] Key</u> on page <u>74</u>.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
dr	90	[ESC] key functions	-	2	Local/Remote	0–2	-
Operation	drv	Command source	Cmd	1	Fx/Rx-1	0-4	
			Source*				-

^{*} Displayed under DRV-06 on the LCD keypad.



Local/Remote Mode Switching Setting Details

Code	Description
dr.90 [ESC] key functions	Set dr.90 to 2(Local/Remote) to perform local/remote switching using the [ESC] key. Once the value is set, the inverter will automatically begin operating in remote mode. Changing from local to remote will not alter any previously configured parameter values and the operation of the inverter will not change. Press the [ESC] key to switch the operation mode back to "local." The SET light will flash, and the inverter will operate using the [RUN] key on the keypad. Press the [ESC] key again to switch the operation mode back to "remote." The SET light will turn off and the inverter will operate according to the previous drv code configuration.

Note

Local/Remote Operation

- Full control of the inverter is available with the keypad during local operation (local operation).
- During local operation, jog commands will only work if one of the multi-function terminals (codes In.65-71 for P1-P7 in IP20 models, In.65-69 for P1-P5 in IP66 models) is set to 13(RUN Enable) and the relevant terminal is turned on.
- During remote operation (remote operation), the inverter will operate according to the
 previously set frequency reference source and the command received from the input
 device.
- If Ad.10 (power-on run) is set to O(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 Ad.10 (power-on run) is set to O(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 operation when switching to remote operation mode, and then starts operation when the next command is given.

① Caution

Use local/remote operation mode switching only when it is necessary. Improper mode switching may result in interruption of the inverter's operation.

4.7 Forward or Reverse Run Prevention

The rotation direction of motors can be configured to prevent motors to only run in one direction. Pressing the [REV] key on the LCD keypad when direction prevention is configured, will cause the motor to decelerate to 0Hz and stop. The inverter will remain on.

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

Forward/Reverse Run Prevention Setting Details

Code	Description						
	Choose a direction to prevent.						
	Setting		Description				
Ad.09 Run	0	None	Do not set run prevention.				
Prevent	1	Forward Prev	Set forward run prevention.				
	2 Rev	Reverse Prev	Set reverse run prevention.				

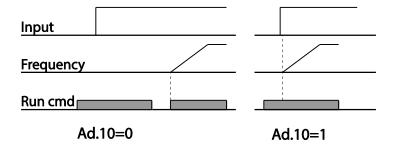


4.8 Power-on Run

A power-on command can be setup to start an inverter operation after powering up, based on terminal block operation commands (if they have been configured). To enable power-on run set the drv (command source) code to 1(Fx/Rx-1) or 2 (Fx/Rx-2) in the Operation group.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	drv	Command source	Cmd Source*	1, 2	Fx/Rx-1 or Fx/Rx-2	0–4	-
Ad	10	Power-on run	Power-on Run	1	Yes	0–1	-

^{*} Displayed under DRV-06 on the LCD keypad.



Note

- A fault trip may be triggered if the inverter starts operation while a motor's load (fan-type load) is in free-run state. To prevent this from happening, set bit4 to 1 in Cn. 71 (speed search options) of the Control group. The inverter will perform a speed search at the beginning of the operation.
- If the speed search is not enabled, the inverter will begin 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 first be turned off, and then turned on again to begin the inverter's operation.

① Caution

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

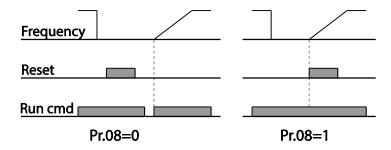


4.9 Reset and Restart

Reset and restart operations can be setup for inverter operation following a fault trip, based on the terminal block operation command (if it is configured). When a fault trip occurs, the inverter cuts off the output and the motor will free-run. Another fault trip may be triggered if the inverter begins its operation while motor load is in a free-run state.

Group	Code	Name	LCD Display	Para Sett	ameter ting	Setting Range	Unit
Operation	drv	Command source	Cmd Source*	1 2	Fx/Rx-1 or Fx/Rx-2	0–4	-
	08	Reset restart setup	RST Restart	1	Yes	0–1	
Pr	09	No. of auto restart	Retry Number	0		0–10	
	10	Auto restart delay time	Retry Delay	1.0		0–60	sec

^{*} Displayed under DRV-06 in an LCD keypad.



Note

- To prevent a repeat fault trip from occurring, set Cn.71 (speed search options) bit 2 equal 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 be first turned off, and then turned on again to begin the inverter's operation.

① Caution

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



4.10 Setting Acceleration and Deceleration Times

4.10.1 Acc/Dec Time Based on Maximum Frequency

Acc/Dec time values can be set based on maximum frequency, not on inverter operation frequency. To set Acc/Dec time values based on maximum frequency, set bA. 08 (Acc/Dec reference) in the Basic group to 0 (Max Freq).

Acceleration time set at the ACC (Acceleration time) code in the Operation group (dr.03 in an LCD keypad) refers to the time required for the inverter to reach the maximum frequency from a stopped (0Hz) state. Likewise, the value set at the dEC (deceleration time) code in the Operation group (dr.04 in an LCD keypad) refers to the time required to return to a stopped state (0Hz) from the maximum frequency.

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



Acc/Dec Time Based on Maximum Frequency - Setting Details

Code	Description							
	Set the parameter value to 0 (Max Freq) to setup Acc/Dec time based on maximum frequency.							
	Config	uration	Description					
	0	Max Freq	Set the Acc/Dec time based on maximum frequency.					
	1	Delta Freq	Set the Acc/Dec time based on operating frequency.					
bA.08 Ramp T Mode	If, for example, maximum frequency is 60.00Hz, the Acc/Dec times are set to 5 seconds, and the frequency reference for operation is set at 30Hz (half of 60Hz), the time required to reach 30Hz therefore is 2.5 seconds (half of 5 seconds). Max. Freq. Frequency Run cmd Dec. time Dec. time							
	more ac	curate Acc/Dec times	-related values. It is particularly useful when a are required because of load characteristics, ange needs to be extended.					
bA.09 Time scale	Config	uration	Description					
S. NO / TITTO Soulo	0	0.01sec	Sets 0.01 second as the minimum unit.					
	1	0.1sec	Sets 0.1 second as the minimum unit.					
	2	1sec	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 at 6000 seconds, a time scale change from 1 second to 0.01 second will result in a modified acceleration time of 60.00 seconds.

4.10.2 Acc/Dec Time Based on Operation Frequency

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

Group	Cod e	Name	LCD Display	Para Sett	ameter ing	Setting Range	Unit
Operatio	ACC	Acceleration time	Acc Time	20.0		0.0-600.0	sec
n	dEC	Deceleration time	Dec Time	30.0		0.0-600.0	sec
bA	08	Acc/Dec reference	Ramp T Mode	1	Delta Freq	0–1	-

Acc/Dec Time Based on Operation Frequency – Setting Details

Code	Description Set the para Maximum f	ameter value to 1 ((Delta Freq) to set Acc/Dec times based on	
	Configura	tion	Description	
	0 M	1ax Freq	Set the Acc/Dec time based on Maximum frequency.	
	1 D	elta Freq	Set the Acc/Dec time based on Operation frequency.	
bA.08 Ramp T Mode	If Acc/Dec times are set to 5 seconds, and multiple frequency reference used in the operation in 2 steps, at 10Hz and 30 Hz, each acceleration swill take 5 seconds (refer to the graph below).			
	Frequency	'	30Hz	
	Run cmd	10Hz 5 7 5 sec 5 s	12 time	



4.10.3 Multi-step Acc/Dec Time Configuration

Acc/Dec times can be configured via a multi-function terminal by setting the ACC (acceleration time) and dEC (deceleration time) codes in the Operation group.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operat	ACC	Acceleration time	Acc Time	20	.0	0.0-600.0	sec
ion	dEC	Deceleration time	Dec Time	30	.0	0.0-600.0	sec
bΛ	70-82	Multi-step acceleration time1-7	Acc Time 1-7	X.X	X	0.0-600.0	sec
bA	71-83	Multi-step deceleration time1-7	Dec Time 1-7	x.xx		0.0-600.0	sec
	65-71		Px Define(Px:	11	XCEL-L		
	in IP20 models,	Px terminal	P1-P7 in IP20 models,	1 2	XCEL-M	0-54	_
In	65-69 in IP66 models	configuration	P1-P5 in IP66 models)	4	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	Description
bA. 70–82 Acc Time 1–7	Set multi-step acceleration time1-7.
bA.71–83 Dec Time 1–7	Set multi-step deceleration time1-7.



Code	Description								
	Choose inputs.	Choose and configure the terminals to use for multi-step Acc/Dec time inputs.							
	Config	guration	Description						
	11	XCEL-L	Acc/Dec command	I-L					
	12	XCEL-M	Acc/Dec command	I-M					
	49	XCEL-H	Acc/Dec command	I-H					
In.65-71 (P1-P7 in IP20 models), In.65-69 (P1-P5 in IP66 models) Px Define	control set with If, for ex respect Freque P4 P5 Run cm	the acceleration n bA.70-82 and b cample, the P4 ar ively, the followir Acc1 Acc1 Acc0	Acc3 Dec0 Dec1	on parameter values S XCEL-L and XCEL lable. Dec2 Dec3					
	A	cc/Dec time	P5	P4					
		0	-	-					
		2	<u>-</u> ✓	Y					
		3	✓	√					
In.89 In Check Time	In.89 is inverte	set to 100ms and r searches for oth	rter to check for other te I a signal is supplied to tl er inputs over the next 1 e will be set based on th	he P4 terminal, the 100ms. When the time					



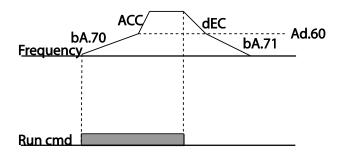
4.10.4 Configuring Acc/Dec Time Switch Frequency

You can switch between two different sets of Acc/Dec times (Acc/Dec gradients) by configuring the switch frequency without configuring the multi-function terminals.

Group	Cod e	Name	LCD Display	Parameter Setting	Setting Range	Unit
Operation	ACC	Acceleration time	Acc Time	10.0	0.0-600.0	sec
Operation	dEC	Deceleration time	Dec Time	10.0	0.0-600.0	sec
bA	70	Multi-step acceleration time1	Acc Time-1	20.0	0.0-600.0	sec
	71	Multi-step deceleration time1	Dec Time-1	20.0	0.0-600.0	sec
Ad	60	Acc/Dec time switch frequency	Xcel Change Frq	30.00	0-Maximum frequency	Hz

Acc/Dec Time Switch Frequency Setting Details

Code	Description
Ad.60 Xcel Change Fr	After the Acc/Dec switch frequency has been set, Acc/Dec gradients configured at bA.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 configured gradient level, configured for the ACC and dEC codes, will be used. If you configure the multi-function input terminals P1-P7 (IP20 models), P1-P5 (IP66 models) 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 instead of the Acc/Dec switch frequency configurations.





4.11 Acc/Dec Pattern Configuration

Acc/Dec gradient level patterns can be configured to enhance and smooth the inverter's acceleration and deceleration curves. Linear pattern features a linear increase or decrease to the output frequency, at a fixed rate. For an S-curve pattern a smoother and more gradual increase or decrease of output frequency, ideal for lift-type loads or elevator doors, etc. S-curve gradient level can be adjusted using codes Ad. 03-06 in the Advanced group.

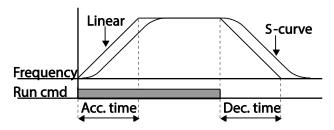
Grou p	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
bA	08	Acc/Dec reference	Ramp T mode	0	Max Freq	0–1	-
	01	Acceleration pattern	Acc Pattern	0	Linear	0-1	-
	02	Deceleration pattern	Dec Pattern	1	S-curve	70-1	-
	03	S-curve Acc start gradient	Acc S Start	40		1-100	%
Ad	04	S-curve Acc end gradient	Acc S End	40		1-100	%
	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

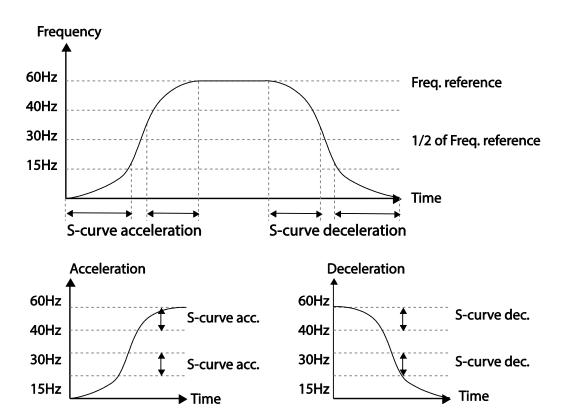
Code	Description
Ad.03 Acc S Start	Sets the gradient level as acceleration starts when using an S-curve, Acc/Dec pattern. Ad. 03 defines S-curve gradient level as a percentage, up to half of total acceleration. If the frequency reference and maximum frequency are set at 60Hz and Ad.03 is set to 50%, Ad. 03 configures acceleration up to 30Hz (half of 60Hz). The inverter will operate S-curve acceleration in the 0-15Hz frequency range (50% of 30Hz). Linear acceleration will be applied to the remaining acceleration within the 15-30Hz frequency range.
Ad.04 Acc S End	Sets the gradient level as acceleration ends when using an S-curve Acc/Dec pattern. Ad. 03 defines S-curve gradient level as a percentage, above half of total acceleration. If the frequency reference and the maximum frequency are set at 60Hz and Ad.04 is set to 50%, setting Ad. 04 configures acceleration to increase from 30Hz (half of 60Hz) to 60Hz (end of acceleration). Linear acceleration will be applied within the 30-45Hz frequency range. The inverter will perform an S-curve acceleration for the remaining acceleration in the 45-60Hz frequency range.



Ad.05 Dec S Start – Sets the rate of S-curve deceleration. Configuration for codes Ad.05 and Ad.06 Dec S End Ad.04.



[Acceleration / deceleration pattern configuration]



[Acceleration / deceleration S-curve parrten configuration]



Note

The Actual Acc/Dec time during an S-curve application

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

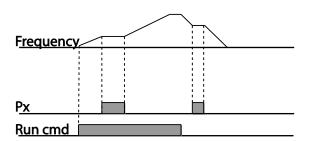
① Caution

Note that actual Acc/Dec times become greater than user defined Acc/Dec times when S-curve Acc/Dec patterns are in use.

4.12 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	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define(Px: P1- P7 in IP20 models, P1-P5 in IP66 models)	25	XCEL Stop	0-54	-





4.13 V/F(Voltage/Frequency) Control

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

4.13.1 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 partcularly useful when a constant torque load is applied.

Group	Code	Name	LCD Display	Paramet	er Setting	Setting Range	Unit
dr	09	Control mode	Control Mode	0	V/F	0–6	-
	18	Base frequency	Base Freq	50.00		30.00-400.00	Hz
	19	Start frequency	Start Freq	0.50		0.01-10.00	Hz
bA	07	V/F pattern	V/F Pattern	0	Linear	0-3	-

Linear V/F Pattern Setting Details

Code	Description
dr.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.
dr.19 Start Freq	Sets the start frequency. A start frequency is a frequency at which the inverter starts voltage output. The inverter does not produce 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, output voltage will continue until the operation frequency reaches a full-stop (0Hz). Base Freq. Inverter's rated voltage Voltage Run cmd



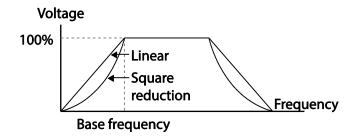
4.13.2 Square Reduction V/F pattern Operation

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 whole frequency range.

Grou p	Code	Name	LCD Display			Setting Range	Unit
bA 07 V/F patt		V/F pattorn	V/F Dattorn	1	Square	0.2	
		V/F pattern	n V/F Pattern		Square2	0-3	-

Square Reduction V/F pattern Operation - Setting Details

Code	Description						
	Sets the parameter value to 1(Square) or 3(Square2) according to the load's start characteristics.						
	Setting		Function				
bA.07 V/F Pattern	1	Square	The inverter produces output voltage proportional to 1.5 square of the operation frequency.				
	3	Square2	The inverter produces output voltage proportional to 2 square of the operation frequency. This setup is ideal for variable torque loads such as fans or pumps.				





4.13.3 User V/F Pattern Operation

The Sinus H inverter allows the configuration of user-defined V/F patterns to suit the load characteristics of special motors.

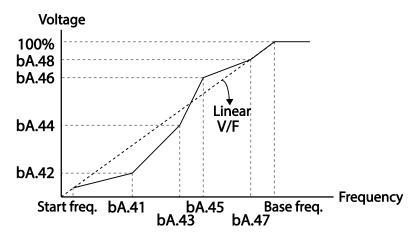
Group	Cod e	Name	LCD Display	Para Sett	ameter ting	Setting Range	Unit
	07	V/F pattern	V/F Pattern	2	User V/F	0-3	-
-	41	User Frequency1	User Freq 1	15.00		0-Maximum frequency	Hz
	42	User Voltage1	User Volt 1	25		0–100	%
	43	User Frequency2	User Freq 2	30.00		0-Maximum frequency	Hz
bA	44	User Voltage2	User Volt 2	50		0–100	%
	45	User Frequency3	User Freq 3	45.00		0-Maximum frequency	Hz
	46	User Voltage3	User Volt 3	75		0–100	%
	47	User Frequency4	User Freq 4	Maximum frequency		0-Maximum frequency	Hz
	48	User Voltage4	User Volt 4	100		0–100	%

User V/F pattern Setting Details

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



The 100% output voltage in the figure below is based on the parameter settings of bA.15 (motor rated voltage). If bA.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 configure the output pattern away from a linear V/F pattern. Non-linear V/F patterns may cause insufficient motor torque or motor overheating due to over-excitation.
- When a user V/F pattern is in use, forward torque boost (dr.16) and reverse torque boost (dr.17) do not operate.

4.14 Torque Boost

4.14.1 Manual Torque Boost

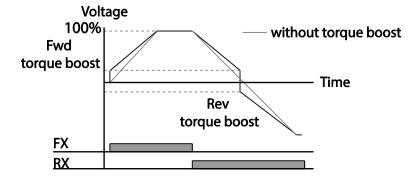
Manual torque boost enables users to adjust output voltage during low speed operation or motor start. Increase low speed torque or improve motor starting properties by manually increasing output voltage. Configure manual torque boost while running loads that require high starting torque, such as lift-type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

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



Manual Torque Boost Setting Details

Code	Description
dr.16 Fwd Boost	Set torque boost for forward operation.
dr.17 Rev Boost	Set torque boost for reverse operation.



① Caution

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

4.14.2 Auto Torque Boost

Auto torque boost enables the inverter to automatically calculate the amount of output voltage required for 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 (bA.20) has to be performed before auto torque boost can be configured [Refer to <u>5.9 Auto Tuning</u> on page <u>205</u>]. Similarly to manual torque boost, configure auto torque boost while running a load that requires high starting torque, such as lift-type loads.

Grou p	Code	Name	II ('I) I)ichlay	Para Sett	ameter ing	Setting Range	Unit
Dr	15	torque boost mode	Torque Boost	1	Auto	0-1	-
bA	20	auto tuning	Auto Tuning	3	Rs+Lsigma	0–6	-

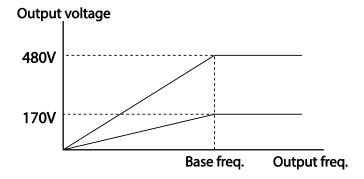


4.15 Output Voltage Setting

Output voltage settings are required when a motor's rated voltage differs from the input voltage to the inverter. Set bA.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 bA.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 bA.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, when the input voltage is lower than the parameter setting, the input voltage will be the inverter output voltage.

Grou p	Code	Name		Parameter Setting	Setting Range	Unit
bA	15	Motor rated voltage	Rated Volt	0	0, 170-480	V



4.16 Start Mode Setting

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



4.16.1 Acceleration Start

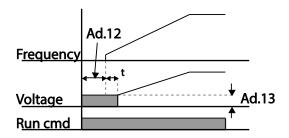
Acceleration start is a general acceleration mode. If there are no extra settings applied, the motor accelerates directly to the frequency reference when the command is input.

Grou p	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Ad	07	Start mode	Start mode	0	Acc	0-1	-

4.16.2 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 its inertia, DC braking will stop the motor, allowing the motor to accelerate from a stopped condition. 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 the mechanical brake is released.

Grou p	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	07	Start mode	Start Mode	1	DC-Start	0–1	-
Ad	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.

Learning Basic Features

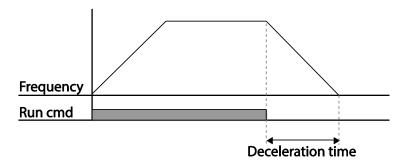
4.17 Stop Mode Setting

Select a stop mode to stop the inverter operation.

4.17.1 Deceleration Stop

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

Grou p	Code	Name	H (T) Display	Parameter Setting		Setting Range	Unit
Ad	08	Stop mode	Stop Mode	0	Dec	0-4	-



4.17.2 Stop After DC Braking

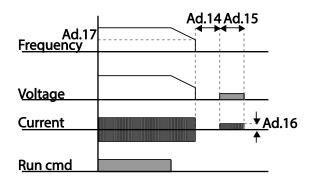
When the operation frequency reaches the set value during deceleration (DC braking frequency), the inverter stops the motor by supplying DC power to the motor. With a stop command input, the inverter begins decelerating the motor. When the frequency reaches the DC braking frequency set at Ad.17, the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

Grou p	Code	Name	LCD Display	Param Settin		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
Ad	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



DC Braking After Stop Setting Details

Code	Description
Ad.14 DC-Block Time	Set the time to block the inverter output before DC braking. If the inertia of the load is great, or if DC braking frequency (Ad.17) is set too high, a fault trip may occur due to overcurrent conditions when the inverter supplies DC voltage to the motor. Prevent overcurrent fault trips by adjusting the output block time before DC braking.
Ad.15 DC-Brake Time	Set the time duration for the DC voltage supply to the motor.
Ad.16 DC-Brake Level	Set the amount of DC braking to apply. The parameter setting is based on the rated current of the motor.
Ad.17 DC-Brake Freq	Set 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, dwell operation will not work and DC braking will start instead.



① Caution

- Note that the motor can overheat or be damaged if excessive amount of DC braking is applied to the motor, or DC braking time is set too long.
- 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.



4.17.3 Free Run Stop

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

Grou	Code	Name	LCD Display	Parar Setti	meter ng	Setting Range	Unit
Ad	08	Stop Method	Stop Mode	2	Free-Run	0-4	-
Freque voltage							
Run cm	nd						

① Caution

Note that 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 if the inverter output is blocked.

4.17.4 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	Paran	neter Setting	Setting Range	Unit
Ī	Ad	80	Stop mode	Stop Mode	4	Power Braking	0-4	-



① Caution

- To prevent overheating or damaging the motor, do not apply power braking to the 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 Pr.50 (stall prevention and flux braking) and Ad.08 (power braking) are set, power braking will take precedence and operate.
- Note that if deceleration time is too short or inertia of the load is too great, an overvoltage fault trip may occur.
- Note that if a free run stop is used, the actual deceleration time can be longer than the preset deceleration time.

4.18 Frequency Limit

Operation frequency can be limited by setting maximum frequency, start frequency, upper limit frequency and lower limit frequency.

4.18.1 Frequency Limit Using Maximum Frequency and Start Frequency

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
dr	19	Start frequency	Start Freq	0.50	0.01-10.00	Hz
	20	Maximum frequency	Max Freq	50.00	40.00-400.00	Hz

Frequency Limit Using Maximum Frequency and Start Frequency - Setting Details

Code	Description
dr.19 Start Freq	Set the lower limit value for speed unit parameters that are expressed in Hz or rpm. If an input frequency is lower than the start frequency, the parameter value will be 0.00.
dr.20 Max Freq	Set 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.





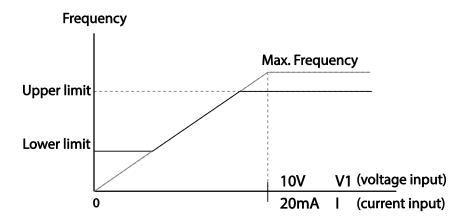
4.18.2 Frequency Limit Using Upper and Lower Limit Frequency Values

Grou p	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Ad	24	Frequency limit	Freq Limit	0 No		0–1	-
	25	Frequency lower limit value	Freq Limit Lo	0.50		0.0-maximum frequency	Hz
	26	Frequency upper limit value	Freq Limit Hi	Maximum frequency		minimum- maximum frequency	Hz

Frequency Limit Using Upper and Lower Limit Frequencies - Setting Details

Code	Description
Ad.24 Freq Limit	The initial setting is 0(No). Changing the setting to 1(Yes) allows the setting of frequencies between the lower limit frequency (Ad.25) and the upper limit frequency (Ad.26). When the setting is 0(No), codes Ad.25 and Ad.26 are not visible.
Ad.25 Freq Limit Lo, Ad.26 Freq Limit Hi	Set an upper limit frequency to all speed unit parameters that are expressed in Hz or rpm, except for the base frequency (dr.18). Frequency cannot be set higher than the upper limit frequency.

— without upper / lower limits





4.18.3 Frequency Jump

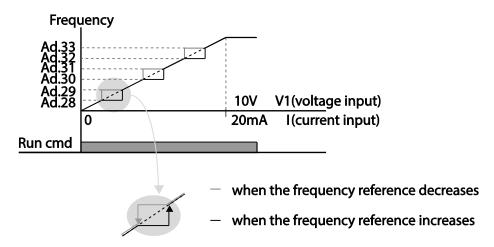
Use frequency jump to avoid mechanical resonance frequencies. Jump through frequency bands when a motor accelerates and decelerates. Operation frequencies cannot be set within the pre-set frequency jump band.

When a frequency setting 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	Parameter Setting		Setting Range	Unit		
	27	Frequency jump	Jump Freq	0	No	0–1	-		
	28	Jump frequency lower limit1	Jump Lo 1	10.00		10.00		0.00-Jump frequency upper limit 1	Hz
	29	Jump frequency upper limit1	Jump Hi 1	15.00		15.00		Jump frequency lower limit 1-Maximum frequency	Hz
Ad	30	Jump frequency lower limit 2	Jump Lo 2	20.00		0.00-Jump frequency upper limit 2	Hz		
	31	Jump frequency upper limit 2	Jump Hi 2	25.00		25.00		Jump frequency lower limit 2-Maximum frequency	Hz
	32	Jump frequency lower limit 3	Jump Lo 3	30.00		30.00		0.00-Jump frequency upper limit 3	Hz
	33	Jump frequency upper limit 3	Jump Hi 3	35.00		35.00		Jump frequency lower limit 3-Maximum frequency	Hz



Learning Basic Features



4.19 2nd 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 swiching can be used to stop remote control during an operation using the communication option and to switch 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. 65-71 and set the parameter value to 15 (2nd Source).

Grou p	Code	Name	LCD Display	Para Sett	imeter ing	Setting Range	Uni t
Oper	drv	Command source	Cmd Source*	1	Fx/Rx-1	0-4	-
Oper ation	Frq	Frequency reference source	Freq Ref Src	2	V1	0–12	-
	04	2 nd Command source	Cmd 2nd Src	0	Keypad	0-4	-
bA	05	2 nd Frequency reference source	Freq 2nd Src	0	KeyPad-1	0–12	-
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define(Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	15	2nd Source	0–54	-

^{*} Displayed under DRV-06 in an LCD keypad.



2nd Operation Mode Setting Details

Code	Description
	If signals are provided to the multi-function terminal set as the 2 nd
bA.04 Cmd 2nd	command source (2nd Source), the operation can be performed using the
Src	set values from bA.04-05 instead of the set values from the drv and Frq
bA.05 Freq 2nd	codes in the Operation group.
Src	The 2nd command source settings cannot be changed while operating with
	the 1st command source (Main Source).

① Caution

- When setting the multi-function terminal to the 2nd command source (2nd Source) and input (On) the signal, operation state is changed because the frequency setting and the Operation command will be changed to the 2nd command. Before shifting input to the multi-function terminal, ensure that the 2nd command is correctly set. Note that if the deceleration time is too short or inertia of the load is too high, an overvoltage fault trip may occur.
- Depending on the parameter settings, the inverter may stop operating when you switch the command modes.

4.20 Multi-function Input Terminal Control

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

Grou p	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
In	85	Multi-function input terminal On filter	DI On Delay	10	0-10000	ms
	86	Multi-function input terminal Off filter	DI Off Delay	3	0-10000	ms
	87	Multi-function input terminal selection	DI NC/NO Sel	0 0000*	-	-
	90	Multi-function input terminal status	DI Status	0 0000*	-	-

^{*} Displayed as a part on the keypad.



Multi-function Input Terminal Control Setting Details

Code	Description								
In.85 DI On Delay,		If the input terminal's state is not changed during the set time, when the							
In.86 DI Off Delay		erminal receives an input, it is recognized as On or Off.							
In.87 DI NC/NO Sel	indicator light below. With the configured as on, it indicate: Closed) conta models, from	right to left.	nat is on as shown in the table ates that the terminal is ontact. With the top segment d as a B terminal (Normally P7 in IP20 models, P1-P5 in IP66						
	Туре	B terminal status (Normally	A terminal status (Normally						
	IZ I	Closed)	Open)						
	Keypad								
	LCD keypad								
In.90 DI Status	A terminal usi turning on. Th turned on. Wh behave conve	onfiguration of each contact. Whing dr.87, the On condition is income Off condition is indicated who have contacts are configured as Exersely. Terminals are numbered From right to left.	dicated by the top segment en the bottom segment is 3 terminals, the segment lights						
	Туре	A terminal setting (On)	A terminal setting (Off)						
	Keypad	B							
	LCD keypad								



4.21 P2P Setting

The P2P function is used to share input and output devices between multiple inverters. To enable P2P setting, RS-485 communication must be turned on .

Inverters connected through P2P communication are designated as either a master or a slave . The master inverter controls the input and output of the slave inverter. The slave inverter provides input and output actions. When using the multi-function output, the slave inverter can select to use either the master inverter's output or its own output. When using P2P communication, first designate the slave inverter and then the master inverter. If the master inverter is designated first, connected inverters may interpret the condition as a loss of communication.

Master Parameter

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
CM	95	P2P Communication selection	Int 485 Func	1	P2P Master	0-3	-
	80	Analog input1	P2P In V1	0		0-12,000	%
	81	Analog input2	P2P In I2	0		-12,000 - 12,000	%
US	82	Digital input	P2P In DI	0		0-0x7F	bit
	85	Analog output	P2P Out AO1	0		0-10,000	%
	88	Digital output	P2P Out DO	0		0-0x03	bit

Slave Parameter

Grou p	Cod e	Name	LCD Display	Parameter Setting		Setting Range	Unit
CM	95	P2P Communication selection	Int 485 Func	2	P2P Slave	0-3	-
OIVI	96	P2P DO setting selection	P2P OUT Sel	0	No	0-2	bit

P2P Setting Details

Code	Description
CM.95 Int 485 Func	Set master inverter to 1(P2P Master), slave inverter to 2(P2P Slave).
US.80–82 P2P Input Data	Input data sent from the slave inverter.
US.85, 88 P2P Output Data	Output data transmitted to the slave inverter.



4.22 Multi-keypad Setting

Use multi-keypad settings to control more than one inverter with one keypad. To use this function, first configure RS-485 communication.

The group of inverters to be controlled by the keypad will include a master inverter. The master inverter monitors the other inverters, and slave inverter responds to the master inverter's input. When using multi-function output, a slave inverter can select to use either the master inverter's output or its own output. When using the multi keypad, first designate the slave inverter and then the master inverter. If the master inverter is designated first, connected inverters may interpret the condition as a loss of communication.

Master Parameter

Grou p	Code	Name	LCD Display		ameter ting	Setting Range	Unit
СМ	95	P2P Communication selection	Int 485 Func	3	KPD-Ready	0-3	-
	03	Multi-keypad ID	Multi KPD ID	3		3-99	-
CNF	42	Multi-function key selection	Multi Key Sel	4	Multi KPD	0-4	-

Slave Parameter

Group	Code	Name	LCD Display		ameter ting	Setting Range	Unit
	01	Station ID	Int485 St ID	3		3-99	-
CM	95	P2P communication options	Int 485 Func	3	KPD-Ready	0-3	-

Multi-keypad Setting Details

Code	Description
014 04 1 1405 01 15	Prevents conflict by designating a unique identification value to an
CM.01 Int485 St ID	inverter. Values can be selected from numbers between 3-99.
CM.95 Int 485 Func	Set the value to 3(KPD-Ready) for both master and slave inverter
CNF-03 Multi KPD ID	Select an inverter to monitor from the group of inverters.
CNF-42 Multi key Sel	Select a multi-function key type 4(Multi KPD) .



① Caution

- The multi-keypad feature will not work when the multi-keypad ID (CNF-03 Multi-KPD ID) setting is identical to the RS-485 communication station ID (CM-01 Int485 st ID) setting.
- The master/slave setting cannot be changed while the inverter is operating in slave mode.

4.23 User Sequence Setting

User Sequence creates a simple sequence from a combination of different function blocks. The sequence can comprise of a maximum of 18 steps using 29 function blocks and 30 void parameters.

1 Loop refers to a single execution of a user configured sequence that contains a maximum of 18 steps. Users can select a Loop Time of between 10-1,000ms.

The codes for user sequences configuration can be found in the US group (for user sequence settings) and the UF group (for function block settings).

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
AP	02	User sequence activation	User Seq En	0	0–1	-
	01	User sequence operation command	User Seq Con	0	0–2	-
	02	User sequence operation time	User Loop Time	0	0–5	-
	11- 28	Output address link1-18	Link UserOut1- 18	0	0-0xFFFF	-
115	31 - 60	Input value setting1-30	Void Para1-30	0	-9999–9999	-
	80	Analog input 1	P2P In V1(-10- 10 V)	0	0-12,000	%
	81	Analog input 2	P2P In I2	0	-12,000	%
	82	Digital input	P2P In D	0	-12,000	bit
	85	Analog output	P2P Out AO1	0	0-0x7F	%
	88	Digital output	P2P Out DO	0	0-0x03	bit
	01	User function 1	User Func1	0	0-28	-
LIE	02	User function input 1-A	User Input 1-A	0	0-0xFFFF	-
UF	03	User function input 1-B	User Input 1-B	0	0-0xFFFF	-
	04	User function input 1-C	User Input 1-C	0	0-0xFFFF	-



Learning Basic Features

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	05	User function output 1	User Output 1	0	-32767- 32767	-
	06	User function 2	User Func2	0	0-28	-
	07	User function input 2-A	User Input 2-A	0	0-0xFFFF	-
	08	User function input 2-B	User Input 2-B	0	0-0xFFFF	-
	09	User function input 2-C	User Input 2-C	0	0-0xFFFF	-
	10	User function output 2	User Output 2	0	-32767 - 32767	-
	11	User function 3	User Func3	0	0-28	-
	12	User function input 3-A	User Input 3-A	0	0-0xFFFF	-
	13	User function input 3-B	User Input 3-B	0	0-0xFFFF	-
	14	User function input 3-C	User Input 3-C	0	0-0xFFFF	-
	15	User function output 3	User Output 3	0	-32767 - 32767	-
	16	Uer function 4	User Func4	0	0-28	-
	17	User function input 4-A	User Input 4-A	0	0-0xFFFF	-
	18	User function input 4-B	User Input 4-B	0	0-0xFFFF	-
	19	User function input 4-C	User Input 4-C	0	0-0xFFFF	-
	20	User function output 4	User Output 4	0	-32767 - 32767	-
UF	21	User function 5	User Func5	0	0-28	-
	22	User function input 5-A	User Input 5-A	0	0-0xFFFF	-
	23	User function input 5-B	User Input 5-B	0	0-0xFFFF	-
	24	User function input 5-C	User Input 5-C	0	0-0xFFFF	-
	25	User function output 5	User Output 5	0	-32767 - 32767	-
	26	User function 6	User Func6	0	0-28	-
	27	User function input 6-A	User Input 6-A	0	0-0xFFFF	-
	28	User function input 6-B	User Input 6-B	0	0-0xFFFF	-
	29	User function input 6-C	User Input 6-C	0	0-0xFFFF	-
	30	User function output 6	User Output 6	0	-32767 - 32767	-
	31	User function 7	User Func7	0	0-28	-
	32	User function input 7-A	User Input 7-A	0	0-0xFFFF	-
	33	User function input 7-B	User Input 7-B	0	0-0xFFFF	-





Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	34	User function input 7-C	User Input 7-C	0	0-0xFFFF	-
	35	User function output 7	User Output 7	0	-32767- 32767	-
	36	User function 8	User Func8	0	0-28	-
	37	User function input 8-A	User Input 8-A	0	0-0xFFFF	-
	38	User function input8-B	User Input 8-B	0	0-0xFFFF	-

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	39	User function input 8-C	User Input 8-C	0	0-0xFFFF	-
	40	User function output 8	User Output 8	0	-32767- 32767	-
	41	User function 9	User Func9	0	0-28	-
	42	User function input 9-A	User Input 9-A	0	0-0xFFFF	-
	43	User function input 9-B	User Input 9-B	0	0-0xFFFF	-
	44	User function input 9-C	User Input 9-C	0	0-0xFFFF	-
	45	User function output 9	User Output 9	0	-32767- 32767	-
	46	User function 10	User Func10	0	0-28	-
	47	User function input 10-A	User Input 10-A	0	0-0xFFFF	-
	48	User function input 10-B	User Input 10-B	0	0-0xFFFF	-
UF	49	User function input 10-C	User Input 10-C	0	0-0xFFFF	-
UF	50	User function output 10	User Output 10	0	-32767- 32767	-
	51	User function 11	User Func11	0	0-28	-
	52	User function input 11-A	User Input 11-A	0	0-0xFFFF	-
	53	User function input 11-B	User Input 11-B	0	0-0xFFFF	-
	54	User function input 11-C	User Input 11-C	0	0-0xFFFF	-
	55	User function output 11	User Output 11	0	-32767- 32767	-
	56	User function 12	User Func12	0	0-28	-
	57	User function input 12-A	User Input 12-A	0	0-0xFFFF	-
	58	User function input 12-B	User Input 12-B	0	0-0xFFFF	-
	59	User function input 12-C	User Input 12-C	0	0-0xFFFF	-
	60	User function output 12	User Output 12	0	-32767-	-



Learning Basic Features

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
					32767	
	61	User function 13	User Func13	0	0-28	-
	62	User function input 13-A	User Input 13-A	0	0-0xFFFF	-
	63	User function input 13-B	User Input 13-B	0	0-0xFFFF	-
	64	User function input 13-C	User Input 13-C	0	0-0xFFFF	-
	65	User function output 13	User Output 13	0	-32767 - 32767	-
	66	User function 14	User Func14	0	0-28	-
	67	User function input 14-A	User Input 14-A	0	0-0xFFFF	-

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	68	User function input14-B	User Input 14-B	0	0-0xFFFF	-
	69	User function input 14-C	User Input 14-C	0	0-0xFFFF	-
	70	User function output14	User Output 14	0	-32767 - 32767	-
	71	User function 15	User Func15	0	0-28	-
	72	User function input 15-A	User Input 15-A	0	0-0xFFFF	-
	73	User function input 15-B	User Input 15-B	0	0-0xFFFF	-
	74	User function input 15-C	User Input 15-C	0	0-0xFFFF	-
	75	User function output 15	User Output 15	0	-32767 - 32767	-
UF	76	User function 16	User Func16	0	0-28	-
	77	User function input 16-A	User Input 16-A	0	0-0xFFFF	-
	78	User function input 16-B	User Input 16-B	0	0-0xFFFF	-
	79	User function input 16-C	User Input 16-C	0	0-0xFFFF	-
	80	User function output 16	User Output 16	0	-32767 - 32767	-
	81	User function 17	User Func17	0	0-28	-
	82	User function input 17-A	User Input 17-A	0	0-0xFFFF	-
	83	User function input 17-B	User Input 17-B	0	0-0xFFFF	-
	84	User function input 17-C	User Input 17-C	0	0-0xFFFF	-
	85	User function output 17	User Output 17	0	-32767-	-



Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
					32767	
	86	User function 18	User Func18	0	0-28	-
	87	User function input 18-A	User Input 18-A	0	0-0xFFFF	-
	88	User function input 18-B	User Input 18-B	0	0-0xFFFF	-
	89	User function input 18-C	User Input 18-C	0	0-0xFFFF	-
	90	User function output 18	User Output 18	0	-32767- 32767	-

User Sequence Setting Details

Code	Description
AP.02 User Seq En	Display the parameter groups related to a user sequence.
	Set Sequence Run and Sequence Stop with the keypad.
US.01 User Seq Con	Parameters cannot be adjusted during an operation. To adjust
	parameters, the operation must be stopped.
US.02 User Loop Time	Set the user sequence Loop Time.
03.02 03cl L00p 11111c	User sequence loop time can be set to 0.01s/0.02s/ 0.05s/0.1s/0.5s/1s.
	Set parameters to connect 18 Function Blocks. If the input value is
US.11-28	0x0000, an output value cannot be used.
Link UserOut1–18	To use the output value in step 1 for the frequency reference (Cmd
LITIK OSCIOUTI-10	Frequency), input the communication address(0x1101) of the Cmd
	frequency as the Link UserOut1 parameter.
US.31–60 Void Para1–	Set 30 void parameters. Use when constant (Const) parameter input is
30	needed in the user function block.
	Set user defined functions for the 18 function blocks.
	If the function block setting is invalid, the output of the User Output@
UF.01 - 90	is -1.
	All the outputs from the User Output@ are read only, and can be used
	with the user output link@ (Link UserOut@) of the US group.

Function Block Parameter Structure

Туре	Description
User Func @*	Choose the function to perform in the function block.
User Input @-A	Communication address of the function's first input parameter.
User Input @-B	Communication address of the function's second input parameter.
User Input @-C	Communication address of the function's third input parameter.
User Output @	Output value (Read Only) after performing the function block.

^{* @} is the step number (1-18).



User Function Operation Condition

Number	Туре	Description
0	NOP	No Operation.
1	ADD	Addition operation, (A + B) + C
'	7.DD	If the C parameter is 0x0000, it will be recognized as 0.
2	SUB	Subtraction operation, (A - B) - C
_	002	If the C parameter is 0x0000, it will be recognized as 0.
3	ADDSUB	Addition and subtraction compound operation, (A + B) - C
5	NDD30D	If the C parameter is 0x0000, it will be recognized as 0.
4	MIN	Output the smallest value of the input values, MIN(A, B, C).
	171117	If the C parameter is 0x0000, operate only with A, B.
5	MAX	Output the largest value of the input values, MAX(A, B, C).
		If the C parameter is 0x0000, operate only with A, B.
6	ABS	Output the absolute value of the A parameter, A . This operation does not use the B, or C parameter.
		Output the negative value of the A parameter, -(A).
7	NEGATE	This operation does not use the B, or C parameter.
_		Remainder operation of A and B, A % B
8	REMAINDER	This operation does not use the C parameter.
	MPYDIV	Multiplication, division compound operation, (A x B)/C.
9		If the C parameter is 0x0000, output the multiplication operation of
		(A x B).
		Comparison operation: if $(A > B)$ the output is C; if $(A < /=B)$ the
4.0	COMPARE-GT	output is 0.
10	(greater than)	If the condition is met, the output parameter is C. If the condition is
	,	not met, the output is 0(False). If the C parameter is 0x0000 and if
		the condition is met, the output is 1(True). Comparison operation; if (A >/= B) output is C; if (A < B) the output is
	COMPARE-GTEQ	Comparison operation, if $(A > 7 = B)$ output is C, if $(A < B)$ the output is 0.
11	(great than or	If the condition is met, the output parameter is C. If the condition is
	equal to)	not met, the output is 0(False). If the C parameter is 0x0000 and if
	l equal to)	the condition is met, the output is 1(True).
		Comparison operation, if(A == B) then the output is C. For all other
	COMPARE-	values the output is 0.
12	EQUAL	If the condition is met, the output parameter is C. if the condition is
	EQUAL	not met, the output is O(False). If the C parameter is 0x0000 and if
		the condition is met, the output is 1(True).
		Comparison operation, if(A!= B) then the output is C. For all other
1.0	COMPARE-	values the output is 0.
13	NEQUAL	If the condition is met, the output parameter is C. If the condition is
		not met, the output is 0(False). If the C parameter is 0x0000 and if
		the condition is met, the output is 1(True).



Number	Туре	Description
14	TIMER	Adds 1 each time a user sequence completes a loop. A: Max Loop, B: Timer Run/Stop, C: Choose output mode. If input of B is 1, timer stops (output is 0). If input is 0, timer runs. If input of C is 1, output the current timer value. If input of C is 0, output 1 when timer value exceeds A(Max) value. If the C parameter is 0x0000, C will be recognized as 0. Timer overflow Initializes the timer value to 0.
15	LIMIT	Sets a limit for the A parameter. If input to A is between B and C, output the input to A. If input to A is larger than B, output B. If input of A is smaller than C, output C. B parameter must be greater than or equal to the C parameter.
16	AND	Output the AND operation, (A and B) and C. If the C parameter is 0x0000, operate only with A, B.
17	OR	Output the OR operation, (A B) C. If the C parameter is 0x0000, operate only with A, B.
18	XOR	Output the XOR operation, (A ^ B) ^ C. If the C parameter is 0x0000, operate only with A, B.
19	AND/OR	Output the AND/OR operation, (A andB) C. If the C parameter is 0x0000, operate only with A, B.
20	SWITCH	Output a value after selecting one of two inputs, if (A) then B otherwise C. If the input at A is 1, the output will be B. If the input at A is 0, the output parameter will be C.
21	BITTEST	Test the B bit of the A parameter, BITTEST(A, B). If the B bit of the A input is 1, the output is 1. If it is 0, then the output is 0. The input value of B must be between 0-16. If the value is higher than 16, it will be recognized as 16. If input at B is 0, the output is always 0.
22	BITSET	Set the B bit of the A parameter, BITSET(A, B). Output the changed value after setting the B bit to input at A. The input value of B must be between 0-16. If the value is higher than 16, it will be recognized as 16. If the input at B is 0, the output is always 0. This operation does not use the C parameter.
23	BITCLEAR	Clear the B bit of the A parameter, BITCLEAR(A, B). Output the changed value after clearing the B bit to input at A. The input value of B must be between 0-16. If the value is higher than 16, it will be recognized as 16. If the input at B is 0, the output is always 0. This operation does not use the C parameter.
24	LOWPASSFILTER	Output the input at A as the B filter gains time constant, B x US-02 (US Loop Time. In the above formula, set the time when the output of A reaches 63.3%



Learning Basic Features

Number	Туре	Description
		C stands for the filter operation. If it is 0, the operation is started.
25	PI_CONTROL	P, I gain = A, B parameter input, then output as C. Conditions for PI_PROCESS output: C = 0: Const PI, C = 1: PI_PROCESS-B >= PI_PROCESS-OUT >= 0, C = 2: PI_PROCESS-B >= PI_PROCESS-OUT >= -(PI_PROCESS-B), P gain = A/100, I gain = 1/(Bx Loop Time), If there is an error with PI settings, output -1.
26	PI_PROCESS	A is an input error, B is an output limit, C is the value of Const Pl output. Range of C is 0-32,767.
27	UPCOUNT	Upcounts the pulses and then output the value- UPCOUNT(A, B, C). After receiving a trigger input (A), outputs are upcounted by C conditions. If the B inputs is 1, do not operate and display 0. If the B inputs is 0, operate. If the C parameter is 0, upcount when the input at A changes from 0 to 1. If the C parameter is 1, upcount when the input at A is changed from 1 to 0. If the C parameter is 2, upcount whenever the input at A changes. Output range is: 0-32767
Number	Туре	Description
28	DOWNCOUNT	Downcounts the pulses and then output the value- DOWNCOUNT(A, B, C). After receiving a trigger input (A), outputs are downcounted by C conditions. If the B input is 1, do not operate and display the initial value of C. If the B input is 0, operate. Downcounts when the A parameter changes from 0 to 1.

Note

The PI process block (PI_PROCESS Block) must be used after the PI control block (PI_CONTROL Block) for proper PI control operation. PI control operation cannot be performed if there is another block between the two blocks, or if the blocks are placed in an incorrect order.

4.24 Fire Mode Operation

This function is used to allow the inverter to ignore minor faults during emergency situations, such as fire, and provides continuous operation to fire pumps.

When turned on, Fire mode forces the inverter to ignore all minor fault trips and repeat a Reset and Restart for major fault trips, regardless of the restart trial count limit. The retry



delay time set at PR. 10 (Retry Delay) still applies while the inverter performs a Reset and Restart.

Fire Mode Parameter Settings

Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Unit
Ad	80	Fire Mode selection	Fire Mode Sel	1	Fire Mode	0–2	-
	81	Fire Mode frequency	Fire Mode Freq	0-60		0–60	
	82	Fire Mode run direction	Fire Mode Dir	0–1		0–1	
	83	Fire Mode operation count	Fire Mode Cnt	Not	configurable	-	-
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define (Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	51	Fire Mode	0–54	-

The inverter runs in Fire mode when Ad. 80 (Fire Mode Sel) is set to '2 (Fire Mode)', and the multi-function terminal (In. 65-71) configured for Fire mode (51: Fire Mode) is turned on. The Fire mode count increases by 1 at Ad. 83 (Fire Mode Count) each time a Fire mode operation is run.

① Caution

Fire mode operation may result in inverter malfunction. Note that Fire mode operation voids the product warranty – the inverter is covered by the product warranty only when the Fire mode count is '0.'

Fire Mode Function Setting Details

Code	Description	Details
Ad.81 Fire	Fire mode	The frequency set at Ad. 81 (Fire mode frequency) is used for
Mode	frequency	the inverter operation in Fire mode. The Fire mode frequency
frequency	reference	takes priority over the Jog frequency, Multi-step frequencies,
		and the keypad input frequency.
Dr.03 Acc	Fire mode	When Fire mode operation is turned on, the inverter
Time /	Acc/Dec times	accelerates for the time set at Dr.03 (Acc Time), and then
Dr.04 Dec		decelerates based on the deceleration time set at Dr.04 (Dec
Time		Time). It stops when the Px terminal input is turned off (Fire
		mode operation is turned off).



Learning Basic Features

Code	Description	Details
PR.10 Retry Delay	Fault trip process	Some fault trips are ignored during Fire mode operation. The fault trip history is saved, but trip outputs are disabled even when they are configured at the multi-function output terminals.
		Fault trips that are ignored in Fire mode BX, External Trip, Low Voltage Trip, Inverter Overheat, Inverter Overload, Overload, Electrical Thermal Trip, Input/Output Open Phase, Motor Overload, Fan Trip, No Motor Trips, and other minor fault trips.
		For the following fault trips, the inverter performs a Reset and Restart until the trip conditions are released. The retry delay time set at PR. 10 (Retry Delay) applies while the inverter performs a Reset and Restart.
		Fault trips that force a Reset Restart in Fire mode Over Voltage, Over Current1(OC1), Ground Fault Trip
		The inverter stops operating when the following fault trips occur:
		Fault trips that stop inverter operation in Fire mode H/W Diag, Over Current 2 (Arm-Short)



5 Learning Advanced Features

This chapter describes the advanced features of the Sinus H inverter. Check the reference page in the table to see the detailed description for each of the advanced features.

Advanced Tasks	Description	Ref.
Auxiliary frequency operation	Use the main and auxiliary frequencies in the predefined formulas to create various operating conditions. Auxiliary frequency operation is ideal for Draw Operation* as this feature enables fine-tuning of operation speeds.	<u>p.179</u>
Jog operation	Jog operation is a kind of a manual operation. The inverter operates to a set of parameter settings predefined for Jog operation, while the Jog command button is pressed.	<u>p.184</u>
Up-down operation	Uses the upper and lower limit value switch output signals (i.e. signals from a flow meter) as Acc/Dec commands to motors.	<u>p.188</u>
3-wire operation	3-wire operation is used to latch an input signal. This configuration is used to operate the inverter by a push button.	<u>p.189</u>
Safety operation mode	This safety feature allows the inverter's operation only after a signal is input to the multi-function terminal designated for the safety operation mode. This feature is useful when extra care is needed in operating the inverter using the multi-purpose terminals.	p.190
Dwell operation	Use this feature for the lift-type loads such as elevators, when the torque needs to be maintained while the brakes are applied or released.	<u>p.192</u>
Slip compensation	This feature ensures that the motor rotates at a constant speed, by compensating for the motor slip as a load increases.	<u>p.194</u>
PID control	PID control provides constant automated control of flow, pressure, and temperature by adjusting the output frequency of the inverter.	<u>p.196</u>
Auto-tuning	Used to automatically measure the motor control parameters to optimize the inverter's control mode performance.	<u>p.205</u>
Sensorless vector control	An efficient mode to control magnetic flux and torque without special sensors. Efficiency is achieved through the high torque characteristics at low current when compared with the V/F control mode.	<u>p.208</u>
Energy buffering operation	Used to maintain the DC link voltage for as long as possible by controlling the inverter output frequency during power interruptions, thus to delay a low voltage fault trip.	<u>p.228</u>
Energy saving operation	Used to save energy by reducing the voltage supplied to motors during low-load and no-load conditions.	<u>p.229</u>



Learning Advanced Features

Advanced Tasks	Description	Ref.
Speed search operation	Used to prevent fault trips when the inverter voltage is output while the motor is idling or free-running.	<u>p.234</u>
Auto restart operation	Auto restart configuration is used to automatically restart the inverter when a trip condition is released, after the inverter stops operating due to activation of protective devices (fault trips).	<u>p.238</u>
Second motor operation	Used to switch equipment operation by connecting two motors to one inverter. Configure and operate the second motor using the terminal input defined for the second motor operation.	<u>p.241</u>
Commercial power source switch operation	Used to switch the power source to the motor from the inverter output to a commercial power source, or vice versa.	<u>p.243</u>
Cooling fan control	Used to control the cooling fan of the inverter.	p.244
Timer settings	Set the timer value and control the On/Off state of the multi- function output and relay.	<u>p.253</u>
Brake control	Used to control the On/Off operation of the load's electronic braking system.	<u>p.254</u>
Multi-function output On/Off control	Set standard values and turn On/Off the output relays or multi- function output terminals according to the analog input value.	<u>p.256</u>
Regeneration prevention for press operation.	Used during a press operation to avoid motor regeneration, by increasing the motor operation speed.	<u>p.257</u>

^{*} Draw operation is an openloop tension control. This feature allows a constant tension to be applied to the material that is drawn by a motor-driven device, by fine-tuning the motor speed using operation frequencies that are proportional to a ratio of the main frequency reference.

5.1 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 finetune the main reference.

Group	Code	Name	H (T) H) ishlav	Para Sett		Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	0	Keypad-1	0–12	-



Group	Code	Name	LCD Display	Para Sett	ameter ing	Setting Range	Unit
	01	Auxiliary frequency reference source	Aux Ref Src	1	V1	0–4	-
bA	02	Auxiliary frequency reference calculation type	Aux Calc Type	0	M+(G*A)	0–7	-
	03	Auxiliary frequency reference gain	Aux Ref Gain	0.0		-200.0–200.0	%
In	65 – 71	Px terminal configuration	Px Define	40	dis Aux Ref	0~54	-

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 Frq code has been set to 0(Keypad-1), and the inverter is operating at a main reference frequency of 30.00Hz. Signals at -10 – +10V 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 27.00-33.00Hz [Codes In.01-16 must be set to the default values, and In.06 (V1 Polarity), set to 1 (Bipolar)].

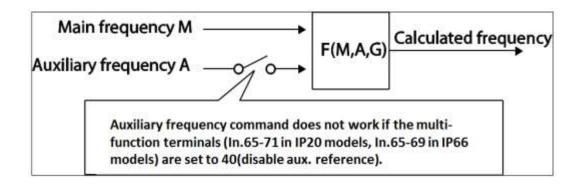
Auxiliary Reference Setting Details

Code	Description						
	Set th	ne input typ	be to be used for the auxiliary frequency reference.				
	0						
	Con	figuration	Description				
	0	None	Auxiliary frequency reference is disabled.				
	1	V1	Sets the V1 (voltage) terminal at the control terminal				
			block as the source of auxiliary frequency reference.				
bA.01 Aux Ref Src	3	V2	Sets the V2 (voltage) terminal at the control terminal				
DA.UTAUX NEI SIC			block as the source of auxiliary frequency reference				
			(SW2 must be set to "voltage").				
	4	12	Sets the I2 (current) terminal at the control terminal				
			block as the source of auxiliary frequency reference				
			(SW2 must be set to "current").				
	5	Pulse	Sets the TI (pulse) terminal at the control terminal				
			block as the source of auxiliary frequency reference.				



Learning Advanced Features

Code	Description					
	Set the auxiliary reference gain with bA.03 (Aux Ref Gain) to configure the auxiliary reference and set the percentage to be reflected when calculating the main reference. Note that items 4–7 below may result in either plus (+) or minus (-) references (forward or reverse operation) even when unipolar analog inputs are used.					
	Configuration	Formula for frequency reference				
	0 M+(G*A)	Main reference+(bA.03xbA.01xIn.01)				
bA.02 Aux Calc Type	1 M*(G*A)	x(bA.03xbA.01)				
	2 M/(G*A)	Main reference/(bA.03xbA.01)				
	3 M+{M*(G*A)}	Main reference +{Main reference x(bA.03xbA.01)}				
	4 M+G*2*(A-50)	Main reference+bA.03x2x(bA.01-50)x In.01				
	5 M*{G*2*(A-50)}	Main reference x{bA.03x2x(bA.01-50)}				
	6 M/{G*2*(A-50)}	Main reference/{bA.03x2x(bA.01-50)}				
	7 M+M*G*2*(A-	Main reference+Main reference x				
	50)	bA.03x2x(bA.01-50)				
		e gain (%) y reference (Hz or rpm) or gain (%)				
bA.03 Aux Ref Gain	Adjust the size of the input (bA.01 Aux Ref Src) configured for auxiliary frequency.					
In.65-71 (P1-P7 in IP20 models), In.65-69 (P1-P5 in IP66 models) Px Define		function input terminals to 40(dis Aux Ref) and turn uxiliary frequency reference. The inverter will operate lency reference only.				





Auxiliary Reference Operation Ex #1

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

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

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

Set	ting*	Calculating final command frequency**
0	M[Hz]+(G[%]*A[Hz])	30Hz(M)+(50%(G)x36Hz(A))=48Hz
1	M[Hz]*(G[%]*A[%])	30Hz(M)x(50%(G)x60%(A))=9Hz
2	M[Hz]/(G[%]*A[%])	30Hz(M)/(50%(G)x60%(A))=100Hz
3	M[Hz]+{M[Hz]*(G[%]*A[%])}	30Hz(M)+{30[Hz]x(50%(G)x60%(A))}=39Hz
4	M[Hz]+G[%]*2*(A[%]-50[%])[Hz]	30Hz(M)+50%(G)x2x(60%(A)-50%)x60Hz=36Hz
5	M[HZ]*{G[%]*2*(A[%]-50[%])}	30Hz(M)x{50%(G)x2x(60%(A)-50%)}=3Hz
6	M[HZ]/{G[%]*2*(A[%]-50[%])}	30Hz(M)/{50%(G)x2x(60%-50%)}=300Hz
7	M[HZ]+M[HZ]*G[%]*2*(A[%]-	30Hz(M)+30Hz(M)x50%(G)x2x(60%(A)-
	50[%])	50%)=33Hz

^{*}M: main frequency reference (Hz or rpm)/G: auxiliary reference gain (%)/A: auxiliary frequency reference (Hz or rpm) or gain (%).

Auxiliary Reference Operation Ex #2

Keypad Frequency Setting is Main Frequency and I2 Analog Voltage is Auxiliary Frequency

- Main frequency: Keypad (Operation frequency 30Hz)
- Maximum frequency setting (dr.20): 400Hz
- Auxiliary frequency setting (bA.01): I2 [Display by percentage(%) or auxiliary frequency(Hz) depending on the operation setting condition]
- Auxiliary reference gain setting (bA.03): 50%
- In.01–32: Factory default

^{**}If the frequency setting is changed to rpm, it is converted to rpm instead of Hz.



Example: an input current of 10.4mA is applied to I2, with the frequency corresponding to 20mA of 60Hz. The table below shows auxiliary frequency A as $24Hz(=60[Hz] \times (10.4[mA]-4[mA])/(20[mA] - 4[mA])$) or $40\%(=100[\%] \times ((10.4[mA] - 4[mA])/(20[mA] - 4[mA])$).

Set	ting*	Calculating final command frequency**
0	M[Hz]+(G[%]*A[Hz])	30Hz(M)+(50%(G)x24Hz(A))=42Hz
1	M[Hz]*(G[%]*A[%])	30Hz(M)x(50%(G)x40%(A))=6Hz
2	M[Hz]/(G[%]*A[%])	30Hz(M)/(50%(G)x40%(A))=150Hz
3	M[Hz]+{M[Hz]*(G[%]*A[%])}	30Hz(M)+{30[Hz]x(50%(G)x40%(A))}=36Hz
4	M[Hz]+G[%]*2*(A[%]-50[%])[Hz]	30Hz(M)+50%(G)x2x(40%(A)-50%)x60Hz=24Hz
5	M[HZ]*{G[%]*2*(A[%]-50[%])	30Hz(M)x{50%(G)x2x(40%(A)-50%)} = - 3Hz(Reverse)
6	M[HZ]/{G[%]*2*(A[%]-50[%])}	30Hz(M)/{50%(G)x2x(60%-40%)} = - 300Hz(Reverse)
7	M[HZ]+M[HZ]*G[%]*2*(A[%]- 50[%])	30Hz(M)+30Hz(M)x50%(G)x2x (40%(A)– 50%)=27Hz

^{*} M: main frequency reference (Hz or rpm)/G: auxiliary reference gain (%)/A: auxiliary frequency reference Hz or rpm) or gain (%).

Auxiliary Reference Operation Ex #3

V1 is Main Frequency and I2 is Auxiliary Frequency

- Main frequency: V1 (frequency command setting to 5V and is set to 30Hz)
- Maximum frequency setting (dr.20): 400Hz
- Auxiliary frequency (bA.01): 12[Display by percentage (%) or auxiliary frequency (Hz) depending on the operation setting condition]
- Auxiliary reference gain (bA.03): 50%
- In.01-32: Factory default

^{**}If the frequency setting is changed to rpm, it is converted to rpm instead of Hz.



Example: an input current of 10.4mA is applied to I2, with the frequency corresponding to 20mA of 60Hz. The table below shows auxiliary frequency Aas $24Hz(=60[Hz]x\{(10.4[mA]-4[mA])/(20[mA]-4[mA])\}$ or $40\%(=100[\%] \times \{(10.4[mA]-4[mA])/(20[mA]-4[mA])\}$.

Set	ting*	Calculating final command frequency**
0	M[Hz]+(G[%]*A[Hz])	30Hz(M)+(50%(G)x24Hz(A))=42Hz
1	M[Hz]*(G[%]*A[%])	30Hz(M)x(50%(G)x40%(A))=6Hz
2	M[Hz]/(G[%]*A[%])	30Hz(M)/(50%(G)x40%(A))=150Hz
3	M[Hz]+{M[Hz]*(G[%]*A[%])}	30Hz(M)+{30[Hz]x(50%(G)x40%(A))}=36Hz
4	M[Hz]+G[%]*2*(A[%]-50[%])[Hz]	30Hz(M)+50%(G)x2x(40%(A)-50%)x60Hz=24Hz
5	M[HZ]*{G[%]*2*(A[%]-50[%])}	30Hz(M)x{50%(G)x2x(40%(A)-50%)}=-
		3Hz(Reverse)
6	M[HZ]/{G[%]*2*(A[%]-50[%])}	30Hz(M)/{50%(G)x2x(60%-40%)}=-
		300Hz(Reverse)
7	M[HZ]+M[HZ]*G[%]*2*(A[%]-	30Hz(M)+30Hz(M)x50%(G)x2x(40%(A)-
	50[%])	50%)=27Hz

^{*} 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 result due to analog input variation and deviations in the calculations.

5.2 Jog operation

The jog operation allows for a temporary control of the inverter. You can enter a jog operation command using the multi-function terminals or by using the [ESC] key on the keypad.

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.

^{**}If the frequency setting is changed to rpm, it is converted to rpm instead of Hz.



5.2.1 Jog Operation 1-Forward Jog by Multi-function Terminal

The jog operation is available in either forward or reverse direction, using the keypad or multi-function terminal inputs. The table below lists parameter setting for a forward jog operation using the multi-function terminal inputs.

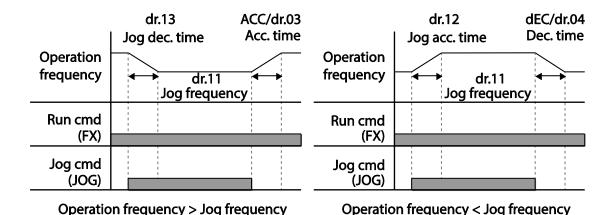
Group	Code	Name	LCD Display	Param Settin		Setting Range	Unit
dr	11	Jog frequency	JOG Frequency	10.00		0.50- Maximum frequency	Hz
	12	Jog operation acceleration time	JOG Acc Time	20.00		0.00-600.00	sec
	13	Jog operation deceleration time	JOG Dec Time	30.00		0.00-600.00	sec
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define (Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	6	JOG	-	-

Forward Jog Description Details

Code	Description				
In.65-71 (P1-P7 in IP20 models),	Select the jog frequency from				
In.65-69 (P1-P5 in IP66 models)	P1- P7 in IP20 models and then select 6. Jog from In.65-71				
Px Define	P1- P5 in IP66 models and then select 6. Jog from In.65-69				
	P1 1(FX)				
	P5 6(JOG)				
	CM				
	[Terminal settings for jog operation]				
dr.11 JOG Frequency	Set the operation frequency.				
dr.12 JOG Acc Time	Set the acceleration speed.				
dr.13 JOG Dec Time	Set the deceleration speed.				



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.

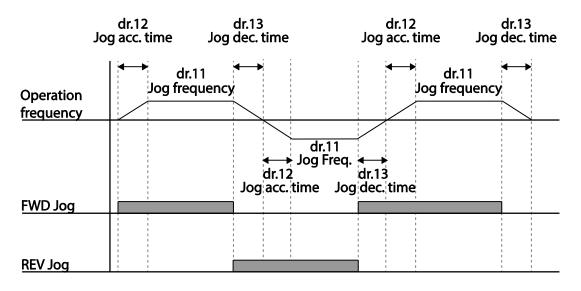


5.2.2 Jog Operation 2-Fwd/Rev Jog by Multi-function Terminal

For jog operation 1, an operation command must be entered to start 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 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	Para sett	ameter ting	Setting Range	Unit
dr	11	Jog frequency	JOG Frequency	10.0	00	0.50-Maximum frequency	Hz
	12	Jog operation acceleration time	JOG Acc Time	20.0	00	0.00-600.00	sec
	13	Operation deceleration time	JOG Dec Time	30.0	00	0.00-600.00	sec
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define (Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	46 47	FWD JOG REV JOG	-	-



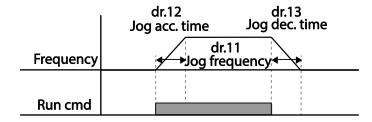


5.2.3 Jog Operation by Keypad

Group	Code	Name	LCD Display			Setting Range	Unit
Dr	90	[ESC] key functions	-	1	JOG Key	-	-
	06	Command source	Cmd Source*	0	Keypad	-	-

^{*} Displayed under DRV-06 on the LCD keypad.

Set dr.90 to 1(JOG Key) and set the drv code in the Operation group to 0(Keypad). When the [ESC] key is pressed, the SET display light flashes and the jog operation is ready to start. Pressing the [RUN] key starts the operation and the inverter accelerates or decelerates to the designated jog frequency. Releasing the [RUN] key stops the jog operation. Set the Acc/Dec time for the jog operation frequency at dr.12 and dr.13.





5.3 Up-down Operation

The Acc/Dec time can be controlled through input at the multi-function terminal block. Similar to a flowmeter, the up-down operation can be applied easily to a system that uses the upper-lower limit switch signals for Acc/Dec commands.

Group	Code	Name	LCD Display	Parame Setting		Setting Range	Unit
Ad	65	Up-down operation frequency save	U/D Save Mode	1	Yes	0-1	-
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define (Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	17 18 20	Up Down U/D Clear	-	-

Up-down Operation Setting Details

Code	Description				
In.65-71 (P1-P7 in IP20 models), In.65-69 (P1-P5 in IP66 models) Px Define	18 (Down), resp begins when the	Select two terminals for up-down operation and set them to 17 (Up) and 18 (Down), respectively. With the operation command input, acceleration begins when the Up terminal signal is on. Acceleration stops and constant speed operation begins when the signal is off.			
	During operation, deceleration begins when the Down signal is on. Deceleration stops and constant speed operation begins when both Up and Down signals are entered at the same time.				
	Frequency				
	P4(Up)				
	P5(Down)				
	Run cmd (FX)				



Code	Description					
Ad.65 U/D Save Mode		ant speed operation, the operating frequency is saved				
iviode		in the following conditions: the operation command (Fx or lt trip occurs, or the power is off.				
	When the operation command is turned on again, or when the inverter regains the power source or resumes to a normal operation from a fault trip, it resumes operation at the saved frequency. To delete the saved frequency, use the multi-function terminal block. Set one of the multi-function terminals to 20 (U/D Clear) and apply signals to it during constant speed operation. The saved frequency and the up-down operation configuration will be deleted. Saved					
	frequency					
	Output frequency					
	P3(U/D Clear)					
	P4 (Up)					
	Run cmd(FX)					

5.4 3-Wire Operation

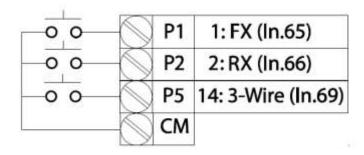
The 3-wire operation latches the signal input (the signal stays on after the button is released), and is used when operating the inverter with a push button.

Group	Code	Name	LCD Display	Param Setting		Setting Range	Unit
Operation	drv	Command source	Cmd Source*	1	Fx/Rx - 1	-	-
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define (Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	14	3-Wire	-	-

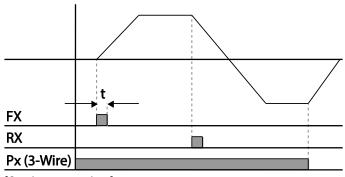
^{*} Displayed under DRV-06 in an LCD keypad.



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



[Terminal connection for 3-wire operation]



[3-wire operation]

5.5 Safe Operation Mode

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

Group	Code	Name	LCD Display		ameter ting	Setting Range	Unit
Ad	70 Safe operation selection		Run En Mode	1	DI Dependent	-	-
	71	Safe operation stop mode	Run Dis Stop	0	Free-Run	0-2	-
72 Safe op		Safe operation deceleration time	Q-Stop Time	5.0		0.0-600.0	sec



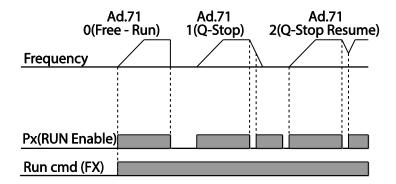


Group	Code	Name	LCD Display		ameter ting	Setting Range	Unit
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define (Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	13	RUN Enable	-	-

Safe Operation Mode Setting Details

Code	Description				
In.65-71 (P1-P7 in IP20 models), In.65-69 (P1-P5 in IP66 models)	From the multi-function terminals, select a terminal to operate in safe operation mode and set it to 13 (RUN Enable).				
Px Define			le		
Ad.70 Run En Mode	Setti		Function		
	0	Always Enable	Enables safe operation mode.		
	1	DI Dependent	Recognizes the operation command from a multi-function input terminal.		
Ad.71 Run Dis Stop		e operation of the operation mode	inverter when the multi-function input terminal is off.		
	Setti	ng	Function		
	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 operation mode. It stops after deceleration and then the operation can resume only when the operation command is entered again. The operation will not begin if only the multifunction 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 multifunction terminal is on, the operation resumes as soon as the operation command is entered again.		
Ad.72 Q-Stop Time	Sets the deceleration time when Ad.71 (Run Dis Stop) is set to 1 (Q-Stop) or 2 (Q-Stop Resume).				





5.6 Dwell Operation

The dwell operation is used to manitain torque during the application and release of the brakes on lift-type loads. Inverter dwell operation is based on the Acc/Dec dwell frequency and the dwell time set by the user. The following points also affect dwell operation:

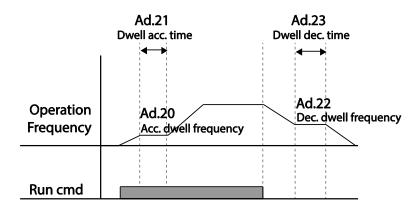
- Acceleration Dwell Operation: When an operation command runs, acceleration
 continues until the acceleration dwell frequency and constant speed is reached within
 the acceleration dwell operation time (Acc Dwell Time). After the Acc Dwell Time has
 passed, acceleration is carried out based on the acceleration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

When dr.09 (Control Mode) is set to 0 (V/F), the inverter can be used for operations with dwell frequency before opening the mechanical brake of lift-type loads, such as an elevator.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
Ad	20	Dwell frequency during acceleration	Acc Dwell Freq	5.00	Start frequency – Maximum frequency	Hz
	21	Operation time during acceleration	Acc Dwell Time	0.0	0.0–10.0	S
22 D		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	S



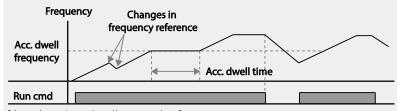
Learning Advanced Features



Note

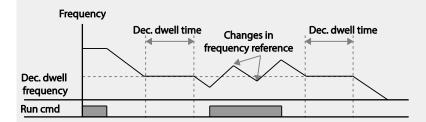
Dwell operation does not work when:

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



[Acceleration dwell operation]

Although 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 by simple frequency change (which is not a deceleration due to a stop operation), or during external brake control applications.



[Deceleration dwell operation]



① Caution

When a dwell operation is carried out for a lift - type load before its mechanical brake is released, motors can be damaged or their lifecyle reduced due to overflow current in the motor.

5.7 Slip Compensation Operation

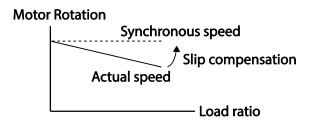
Slip refers to the variation between the setting frequency (synchronous speed) and motor rotation speed. As the load increases there can be variations between the setting frequency and motor rotation speed. Slip compensation is used for loads that require compensation of these speed variations.

Group	Code	Name	LCD Display	Pai	rameter Setting	Setting Range	Unit
dr	09	Control mode	Control Mode	2	Slip Compen	-	-
	14	Motor capacity	Motor Capacity	2	0.75 kW (0.75 kW based)	0-15	-
bA	11	Number of motor poles	Pole Number	4		2-48	-
	12	Rated slip speed	Rated Slip	90	(0.75 kW based)	0-3000	rpm
	13	Rated motor current	Rated Curr	3.6	(0.75 kW based)	1.0-1000.0	А
	14	Motor no-load current	Noload Curr	1.6	(0.75 kW based)	0.5-1000.0	А
	16	Motor efficiency	Efficiency	72	(0.75 kW based)	64-100	%
	17	Load inertia rate	Inertia Rate	0 (0	0.75 kW based)	0-8	-



Slip Compensation Operation Setting Details

Code	Description			
dr.09 Control Mode	Set dr.09 to 2 (Slip Compen) to carry out the slip compensation operation.			
dr.14 Motor	Set the capacity of the motor connected to the inverter.			
Capacity				
bA.11 Pole Number	Enter the number of poles from the motor rating plate.			
bA.12 Rated Slip	Enter the number of rated rotations from the motor rating plate.			
bA.13 Rated Curr	Enter the rated current from the motor rating plate.			
bA.14 Noload Curr	Enter the measured current when the load on the motor axis is removed and when the motor is operated at the rated frequency. If no-load current is difficult to measure, enter a current equivalent to 30-50% of the rated motor current.			
bA.16 Efficiency	Enter the efficiency from the motor rating place.			
bA.17 Inertia Rate	Select load inertia based on motor inertia.			
	Setting Function			
	0 Less than 10 times motor inertia			
	1 10 times motor inertia			
	2-8 More than 10 times motor inertia			
	$f_s = f_r - \frac{Rpm \times P}{120}$ f_s =Rated slip frequency f_r =Rated frequency rpm =Number of the rated motor rotations P =Number of motor poles			





5.8 PID Control

Pid control is one of the most common auto-control methods. It uses a combination of proportional, integral, and differential (PID) control that provides 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 speed by using feedback about the existing speed level
	of the equipment or machinery to be controlled. Control
	maintains consistent speed or operates at the target speed.
Pressure control	Controls pressure by using feedback about the existing pressure
	level of the equipment or machinery to be controlled. Control
	maintains consistent pressure or operates at the target pressure.
Flow control	Controls flow by using feedback about the amount of existing
	flow in the equipment or machinery to be controlled. Control
	maintains consistent flow or operates at a target flow.
Temperature control	Controls temperature by using feedback about the existing
	temperature level of the equipment or machinery to be
	controlled. Control maintains a consistent temperature or
	operates at a target termperature.



5.8.1 PID Basic Operation

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

Group	Code	Name	LCD Display	Par	ameter Setting	Setting Range	Uni t
AP	01	Application function selection	App Mode	2	Proc PID	0–2	-
	16	PID output monitor	PID Output	-		-	-
	17	PID reference monitor	PID Ref Value	-		-	-
	18	PID feedback monitor	PID Fdb Value	-		-	-
	19	PID reference setting	PID Ref Set	50.0	00	-100.00- 100.00	%
	20	PID reference source	PID Ref Source	0	Keypad	0-11	-
	21	PID feedback source	PID F/B Source	0	V1	0-10	-
	22	PID controller proportional gain	PID P-Gain	50.0)	0.0-1000.0	%
	23	PID controller integral time	PID I-Time	10.0)	0.0-200.0	sec
	24	PID controller differential time	PID D-Time	0		0-1000	mse c
	25	PID controller feed- forward compensation gain	PID F-Gain	0.0		0-1000	%
	26	Proportional gain scale	P Gain Scale	100	.0	0.0-100.0	%
	27	PID output filter	PID Out LPF	0		0-10000	ms
	29	PID maximum frequency	PID Limit Hi	50.0	00	-300.00- 300.00	Hz
	30	PID minimum frequency	PID Limit Lo	-50.00 -300.00- 300.00		-300.00- 300.00	Hz
	31	PID output reverse	PID Out Inv	0	No	0-1	-
	32	PID output scale	PID Out Scale	100	.0	0.1-1000.0	%
	34	PID controller motion frequency	Pre-PID Freq	0.00)	0-Maximum frequency	Hz
	35	PID controller motion level	Pre-PID Exit	0.0		0.0-100.0	%
	36	PID controller motion delay time	Pre-PID Delay	600		0-9999	sec



Group	Code	Name	LCD Display	Para	ameter Setting	Setting Range	Uni t
AP	37	PID sleep mode delay time	PID Sleep DT	60.0)	0-999.9	sec
	38	PID sleep mode frequency	PID Sleep Freq	0.00)	0-Maximum frequency	Hz
	39	PID wake-up level	PID WakeUp Lev	35		0-100	%
	40	PID wake-up mode selection	PID WakeUp Mod	0	Below Level	0-2	-
	42	PID controller unit selection	PID Unit Sel	0	%	0-12	-
	43	PID unit gain	PID Unit Gain	100	.0	0-300	%
	44	PID unit scale	PID Unit Scale	2	x 1	0-4	-
	45	PID 2 nd proportional gain	PID P2-Gain	100	.00	0-1000	%
In	65-71 in IP20 model s, 65-69 in IP66 model s	Px terminal configuration	Px Define (Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	22 23 24	I-Term Clear PID Openloop P Gain2		-

PID Basic Operation Setting Details

Code	Description
AP.01 App Mode	Set the code to 2 (Proc PID) to select functions for the process PID.
AP.16 PID Output	Displays the existing output value of the PID controller. The unit, gain, and
	scale that were set at AP. 42-44 are applied on the display.
AP.17 PID Ref Value	Displays the existing reference value set for the PID controller. The unit,
	gain, and scale that were set at AP. 42-44 are applied on the display.
AP.18 PID Fdb Value	Displays the input value of the PID controller that is included in the latest
	feedback. The unit, gain, and scale that were set at AP. 42-44 are applied
	on the display.
AP.19 PID Ref Set	When AP.20 (PID control reference source) is set to 0 (Keypad), the
	reference value can be entered. If the reference source is set to any other
	value, the setting values for AP.19 are void.



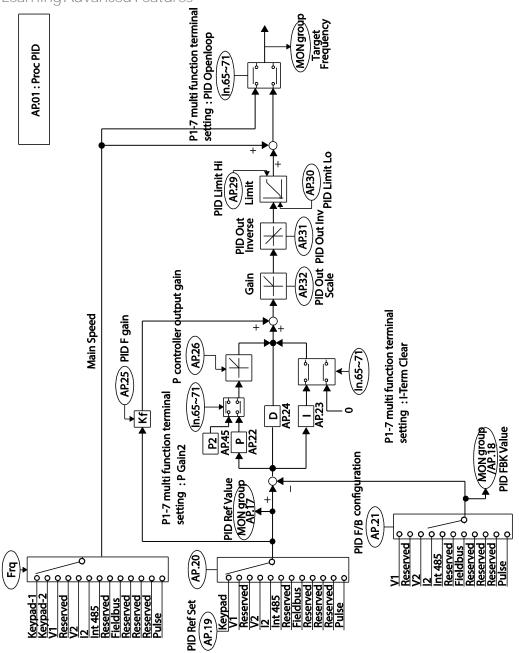
Code	Description
AP.20 PID Ref Source	Selects the reference input for the PID control. If the V1 terminal is set to
	PID feedback source (PID F/B Source), the V1 terminal cannot be set to the PID reference source (PID Ref Source). To set V1 as a reference source,
	change the feedback source.
	change the recapack source.
	Setting Function
	0 Keypad Keypad
	1 V1 -10-10V input voltage terminal
	3 V2 I2 analog input terminal
	4 12 [When analog voltage/current input terminal selection switch (SW2) at the terminal block is set to I (current),
	input 4-20mA current. If it is set to V (voltage), input 0-
	10V voltage]
	5 Int. 485 RS-485 input terminal
	7 FieldBus Communication command via a communication option
	card
	11 Pulse TI Pulse input terminal (0-32kHz Pulse input) When using the keypad, the PID reference setting can be displayed at
	AP.17. When using the LDC keypad, the PID reference setting can be
	monitored from the config mode (CNF) -06-08, set to 17 (PID Ref Value).
	ğ i i i i i i i i i i i i i i i i i i i
AP.21 PID F/B Source	
	input, except the keypad input (Keypad-1 and Keypad-2). Feedback
	cannot be set to an input item that is identical to the item selected as the reference. For example, when Ap.20 (Ref Source) is set to 1 (V1), for AP. 21
	(PID F/B Source), an input other than the V1 terminal must be selected.
	When using the LCD keypad, the volume of feedback can be monitored
	using a code from the config mode (CNF) -06-08, by setting it to 18 (PID
	Fbk Value).
AP.22 PID P-Gain,	Sets the output ratio for differences (errors) between reference and
AP.26 P Gain Scale	feedback. If the Pgain is set to 50%, then 50% of the error is output. The setting range for Pgain is 0.0-1,000%. For ratios below 0.1%, use AP.26 (P
	Gain Scale).
AP.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 remaining
	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
AP.24 PID D-Time	on, all of the accumulated errors are deleted. Sets the output volume for the rate of change in errors. If the differential
AL.24 FID D-HIHE	time (PID D-Time) is set to 1ms and the rate of change in errors per sec is
	100%, output occurs at 1% per 10ms.
	<u> </u>



Code	Docc	rintion					
AP.25 PID F-Gain		ription	that adds the target to the DID suitant Adjustics this value				
AP.25 PID F-Gain		Sets the ratio that adds the target to the PID output. Adjusting this value					
4 D O 7 D D O 1 L D E	leads to a faster response.						
AP.27 PID Out LPF			ne output of the PID controller changes too fast or the entire				
			stable, due to severe oscillation. In general, a lower value				
			e=0) is used to speed up response time, but in some cases a				
			increases stability. The higher the value, the more stable the				
A D 0 0 D 1 D 1 D 1 D 1 D 1 D 1 D 1 D 1 D			r output is, but the slower the response time.				
AP.29 PID Limit Hi,	Limit	s the ou	tput of the controller.				
AP.30 PID Limit Lo							
AP.32 PID Out Scale			olume of the controller output.				
AP.42 PID Unit Sel			of the control variable (available only on the LCD keypad).				
	Sett		Function				
	0	%	Displays a percentage without a physical quantity given.				
	1	Bar	Various units of pressure can be selected.				
	2	mBar					
	3	Pa					
	4	kPa					
	5	Hz	Displays the inverter output frequency or the motor				
	6	rpm	rotation speed.				
	7	V					
	8	I					
	9	kW					
	10	HP					
	11	°C	Displays in Celsius or Fahrenheit.				
	12	°F					
AP.43 PID Unit Gain,		•	ize to fit the unit selected at AP.41 PID Unit Sel.				
AP.44 PID Unit Scale	l' laja.	513 1110 3	ize to fit the drift selected dt/\(\frac{1}{2}\). Fit is offit self.				
AP.45 PID P2-Gain	The PID controller 's gain can be adjusted using the multi-function						
711.4311D12 Gaiii	terminal. When a terminal is selected from In.65-71 in IP20 models, In.65-						
			odels and set to 24 (P Gain2), and if the selected terminal is				
			gain set in AP.22 and AP.23 can be switched to the gain set in				
	AP.45		gain set in Ai .22 and Ai .25 can be switched to the gain set in				
	MF.40	٠.					







[PID control block diagram]

Note

When the PID switch operation (switching from PID operation to general operation) enters the multi-function input, [%] values are converted to [Hz] values. The normal PID output, PID OUT, is unipolar, and is limited by AP.29 (PID Limit Hi) and AP.30 (PID Limit Lo). A calculation of 100.0% is



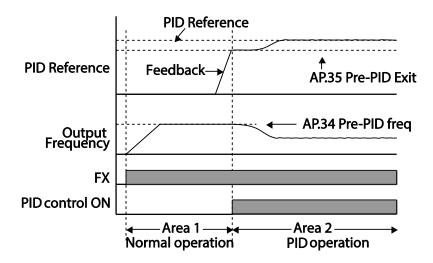
based on the dr.20 (Max Freq) parameter setting.

5.8.2 Pre-PID Operation

When an operation command is entered that does not include PID control, general acceleration occurs until the set frequency is reached. When the controlled variables increase to a particular point, the PID operation begins.

Pre-PID Operation Setting Details

Code	Description
AP.34 Pre-PID Freq	When general acceleration is required, the frequency up to general acceleration is entered. If Pre-PID Freq is set to 30Hz, the general operation
	continues until the control variable (PID feedback variable) set at AP. 35 is
	exceeded.
AP.35 Pre-PID Exit,	When the feedback variable of the PID controller is higher than the value
AP.36 Pre-PID	set at AP. 35, the PID control operation begins. However, when a value is set
Delay	for AP.36 (Pre-PID Delay) and a feedback variable less than the value set at
	AP.35 is maintained for a set amount of time, the "pre-PID Fail" fault trip will
	occur and the output will be blocked.



5.8.3 PID Operation Sleep Mode

If the operation continues at a frequency lower than the set condition for PID operation, the

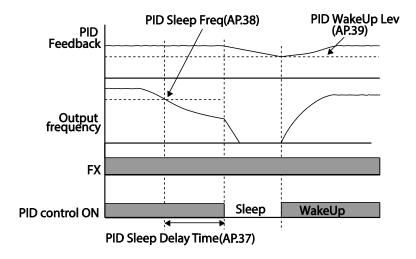


Learning Advanced Features

PID operation sleep mode starts. When PID operation sleep mode starts, the operation will stop until the feedback exceeds the parameter value set at AP.39 (PID WakeUp Lev).

PID Operation Sleep Mode Setting Details

Code	Description
AP.37 PID Sleep DT,	If an operation frequency lower than the value set at AP.38 is maintained
AP.38 PID Sleep Freq	for the time set at AP.37, the operation stops and the PID operation sleep mode starts.
AP.39 PID WakeUp	Starts the PID operation when in PID operation sleep mode.
Lev,	If AP. 40 is set to 0 (Below Level), the PID operation starts when the
AP.40 PID WakeUp	feedback variable is less than the value set as the AP. 39 parameter
Mod	setting. If AP. 40 is set to 1 (Above Level), the operation starts when the
	feedback variable is higher than the value set at AP. 39. If AP. 40 is set to 2
	(Beyond Level), the operation starts when the difference between the
	reference value and the feedback variable is greater than the value set at
	AP. 39.



5.8.4 PID Switching (PID Openloop)

When one of the multi-function terminals (In. 65-71) is set to 23 (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.





Operation mode	PID On	Normal Op.	PID On →
Run cmd		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
PID Openloop			



5.9 Auto Tuning

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

Example - Auto Tuning Based on 0.75 kW, 230 V Motor

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
dr	14	Motor capacity	Motor Capacity	2 0.75 kW	0-16	-
bA	11	Motor pole number	Pole Number	4	2-48	-
	12	Rated slip speed	Rated Slip	40	0-3000	rpm
	13	Rated motor current	Rated Curr	3.6	1.0-1000.0	А
	14	Motor no-load current	Noload curr	1.6	0.5-1000.0	А
	15	Motor rated voltage	Rated Volt	230	0, 170-480	V
	16	Motor efficiency	Efficiency	72	64-100	%
	20	Auto tuning	Auto Tuning	0 None	-	-
	21	Stator resistance	Rs	2.60	Depends on the motor setting	Ω
	22	Leakage inductance	Lsigma	17.94	Depends on the motor setting	mH
	23	Stator inductance	Ls	174.4	Depends on the motor setting	mH
	24	Rotor time constant	Tr	145	25-5000	ms



Auto Tuning Default Parameter Setting

Motor		Rated	No-load	Rated Slip	Stator	Leakage	Stator
Capaci ⁻	ty	Current	Current	Frequency	Resistance	Inductance	Inductance
(kW)		(A)	(A)	(Hz)	$(\mathbf{\Omega})$	(mH)	(mH)
2S	0: 0.2	1.1	0.8	3.33	14.0	40.4	385
	1: 0.4	2.4	1.4	3.33	6.70	26.9	206
2T	2: 0.75	3.4	1.7	3.00	2.60	17.94	174.4
	3: 1.1	4.7	2.3	2.84	1.89	13.05	126.8
	4: 1.5	6.4	2.6	2.67	1.17	9.29	115.8
	5: 2.2	8.6	3.3	2.33	0.84	6.63	90.7
	6: 3	8.6	3.3	2.33	0.84	6.63	90.7
	7: 3.7	13.8	5.0	2.33	0.50	4.48	59.7
	8: 4	14.9	5.4	2.15	0.463	4.14	55.2
	9: 5.5	21.0	7.1	1.50	0.314	3.19	41.5
	10: 7.5	28.2	9.3	1.33	0.169	2.844	31.86
	11: 11	40.0	12.4	1.00	0.120	1.488	23.91
	12: 15	53.6	15.5	1.00	0.084	1.118	19.07
	13: 18.5	65.6	19.0	1.00	0.0676	0.819	15.59
4T	0: 0.2	0.7	0.5	3.33	28.0	121.2	1045
71	1: 0.4	1.4	0.8	3.33	14.0	80.8	610
	2: 0.75	2.0	1.0	3.00	7.81	53.9	512
	3: 1.1	2.8	1.4	2.84	5.68	39.2	372
	4: 1.5	3.7	1.5	2.67	3.52	27.9	346
	5: 2.2	5.0	1.9	2.33	2.520	19.95	269.5
	6: 3	5.0	1.9	2.33	2.520	19.95	269.5
	7: 3.7	8.0	2.9	2.33	1.500	13.45	177.8
	8: 4	8.6	3.1	2.15	1.388	12.44	164.5
	9: 5.5	12.1	4.1	1.50	0.940	9.62	124.5
	10: 7.5	16.3	5.4	1.33	0.520	8.53	95.2
	11: 11	23.2	7.2	1.00	0.360	4.48	71.2
	12: 15	31.0	9.0	1.00	0.250	3.38	57
	13: 18.5	38.0	11.0	1.00	0.168	2.457	46.47
	14: 22	44.5	12.5	1.00	0.168	2.844	41.10
	15: 30	60.5	16.9	1.00	0.126	2.133	30.23
	16: 37	74.4	20.1	1.00	0.101	1.704	25.49

^{*}When Dr.09 (Control Mode) is set to 6 (PM Sensorless), auto tuning will configure the rated current and the stator resistor values by default.



Auto Tuning Parameter Setting Details

Code	Des	cription	
		ect an auto tunir [] key to run the	ng type and run it. Select one of the options and then press the e auto tuning.
	Se	tting	Function
	0	None	Auto tuning function is not enabled. Also, if you select one of the auto tuning options and run it, the parameter value will revert back to "0" when the auto tuning is complete.
	1	All (rotating type)	Measures all motor parameters, including stator resistance (Rs), stator inductance (Lsigma), no-load current (Noload Curr), rotor time constant (Tr), etc., while the motor is rotating. As 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. However, note that the rotor time constant (Tr) must be measured in a stopped position.
bA.20 Auto Tuning	2	All (static type)	Measures all parameters while the motor is in the stopped position. Measures stator resistance (Rs), stator inductance (Lsigma), no-load current (Noload Curr), rotor time constant (Tr), etc., while the motor is in the stopped position. As the motor is not rotating while the parameters are measured, the measurements are not affected when the load is connected to the motor spindle. However, when measuring parameters, do not rotate the motor spindle on the load side.
	3	Rs+Lsigma (rotating type)	Measures parameters while the motor is rotating. The measured motor parameters are used for auto torque boost or sensorless vector control.
	6	Tr (static type)	Measures the rotor time constant (Tr) with the motor in the stopped position and Control Mode (dr.09) is set to IM Sensorless.
	7	All (PM)	When dr.09 (Control Mode) is set to 6 (PM Sensorless), the motor parameters are measured in the stopped position. Check the motor's rating plate for motor specifications, such as the base frequency (dr.18), rated voltage (bA.15), pole number (bA.11). Then, perform auto tuning by setting bA.20 to 7 [All (PM)]. The auto tuning operation will configure the bA.21 (Rs), bA.28 [Ld (PM)], bA.29 [Lq (PM)], and bA.30 (PM Flux Ref) parameters.



Code	Description
Curr ha 21	Displays motor parameters measured by auto tuning. For parameters that are not included in the 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 volage and efficiency on the **motor's** rating plate and enter the data. The default parameter setting is used for values that are not entered.
- When measuring all parameters after selecting 2 (All static type) at bA20: compared with rotation type auto tuning where parameters are measured while the motor is rotating, parameter values measured with static auto tuning may be less accurate. Inaccuracy of the measured parameters may degrade the performance of sensorless operation. Therefore, run static type auto tuning by selecting 2 (All) only when the motor cannot be rotated (when gearing and belts cannot be separated easily, or when the motor cannot be separated mechanically from the load).
- In PM synchronous motor sensorless control mode, check the motor's rating plate and enter the motor specifications, such as the base frequency, pole number, rated current and voltage, and efficiency, before performing auto tuning and detecting other motor parameters by setting bA.20 (Auto Tuning) to 7 [All (PM)]. The detected parameter values may not be accurate if the motor's base specifications are not entered.

5.10 Sensorless Vector Control for Induction Motors

Sensorless vector control is an operation to carry out vector control without the rotation speed feedback from the motor but with an estimation of the motor rotation speed calculated by the inverter. Compared to V/F control, sensorless vector control can generate greater torque at a lower level of current.

Group	Code	Name	LCD Display		arameter etting	Setting Range	Unit
dr	09	Control mode	Control Mode	4	IM Sensorless	-	-
	14	Motor capacity	Motor	D	epends on the	0-15	-
			Capacity	m	notor capacity		
	18	Base frequency	Base Freq	5	0	30-400	Hz



Learning Advanced Features

Group	Code	Name	LCD Display	Para	ameter	Setting	Unit
'				Sett		Range	
bA	11	Motor pole number	Pole Number	4		2-48	-
	12	Rated slip speed	Rated Slip	Dep	ends on the	0-3000	Hz
				mot	or capacity		
	13	Rated motor current	Rated Curr		ends on the	1-1000	Α
					or capacity		
	14	Motor no-load current	Noload curr		ends on the	0.5-1000	Α
					or capacity		
	15	Rated motor voltage	Rated Volt		/380/440/480	0, 170-480	V
	16	Motor efficiency	Efficiency		ends on the	64-100	%
					or capacity		
	20	Auto tuning	Auto Tuning	1	All	-	-
Cn	09	Pre-Excite time	PreExTime	1.0		0.0-60.0	S
	10	Pre-Excite amount	Flux Force	100.		100.0-300.0	%
	20	Sensorless second gain	SL2 G View Sel	1	Yes	0-1	-
		display setting					
	21	Sensorless speed	ASR-SL P		ends on the	0-5000	%
		controller proportional	Gain1	mot	or capacity		
		gain1	400011014	_		10.0000	
	22	Sensorless speed	ASR-SLI Gain1		ends on the	10-9999	ms
		controller integral gain		mot	or capacity		
	23*	Sensorless speed	ASR-SL P	Don	ends on the	1-1000	%
	23	controller proportional	Gain2		or capacity	1-1000	70
		gain 2	Gairiz	IIIOt	or capacity		
	24*	Sensorless speed	ASR-SL I Gain2	Den	ends on the	1-1000	%
	27	controller integral gain	/ OK SET Gairiz		or capacity	1 1000	70
		2		11101	or supusity		
	26*	Flux estimator	Flux P Gain	Dep	ends on the	10-200	%
		proportional gain			or capacity		
	27*	Flux estimator integral	Flux I Gain		ends on the	10-200	%
		gain			or capacity		
	28*	Speed estimator	S-Est P Gain1		ends on the	0-32767	-
		proportional gain		mot	or capacity		



Group	Code	Name	LCD	Para	ameter	Setting	Unit
			Display	Sett		Range	
Cn	29*	Speed estimator integral	S-Est I	Dep	ends on the	100-1000	-
		gain1	Gain1		or capacity		
	30*	Speed estimator integral	S-Est I		ends on the	100-10000	-
		gain2	Gain2	mot	or capacity		
	31*	Sensorless current	ACR SL P	75		10-1000	-
		controller proportional	Gain				
		gain					
	32*	Sensorless current	ACR SL I	120		10-1000	-
		controller integral gain	Gain				
	52	Torque controller output	Torque	0		0-2000	ms
		filter	Out LPF				
	53	Torque limit setting	Torque	0	Keypad-1	0-12	-
			Lmt Src				
	54	Forward direction	FWD +Trq	180.	0	0.0-200.0	%
		retrograde torque limit	Lmt				
	55	Forward direction	FWD -Trq	180.	0	0.0-200.0	%
		regenerative torque limit	Lmt				
	56	Reverse direction	REV +Trq	180.	0	0.0-200.0	%
		regenerative torque limit	Lmt				
	57	Reverse direction	REV -Trq	180.	0	0.0-200.0	%
		retrograde torque limit	Lmt				
	85*	Flux estimator	Flux P	370		100-700	-
	0.11	proportional gain 1	Gain1				
	86*	Flux estimator	Flux P	0		0-100	-
		proportional gain 2	Gain2	100			
	87*	Flux estimator	Flux P	100		0-500	-
	0.04	proportional gain 3	Gain3			0.000	
	88*	Flux estimator integral	Flux I	50		0-200	-
	00*	gain 1	Gain1	F.0		0.000	
	89*	Flux estimator integral	Flux I	50		0-200	-
	00*	gain2	Gain2	F0		0.000	
	90*	Flux estimator integral	Flux I	50		0-200	-
	91*	gain 3	Gain3	20		0.40	
	91"	Sensorless voltage	SL Volt	30		0-60	-
	92*	compensation 1	Comp1	20		0.40	
	92	Sensorless voltage	SL Volt	20		0-60	-
	02*	compensation 2	Comp2	20		0.40	
	93*	Sensorless voltage	SL Volt	20		0-60	-
	94*	compensation 3	Comp3			00 0 110 0	0/
	94"	Sensorless field	SL FW Freq	95.0		80.0-110.0	%
		weakening start					
		frequency					



Learning Advanced Features

Group	Code				Setting Range	Unit
	95*	Sensorless gain switching frequency	SL Fc Freq	2.00	0.00-8.00	Hz

^{*}Cn.23-32 and Cn.85-95 can be displayed only when Cn.20 is set to 1 (Yes).

① Caution

For high-performance operation, the parameters of the motor connected to the inverter output must be measured. Use auto tuning (bA.20 Auto Tuning) to measure the parameters before you run sensorless vector operation. To run high-performance sensorless vector control, the inverter and the motor must have the same capacity. If the motor capacity is smaller than the inverter capacity by more than two levels, control may be inaccurate. In that case, change the control mode to V/F control. When operating with sensorless vector control, do not connect multiple motors to the inverter output.

5.10.1 Sensorless Vector Control Operation Setting for Induction Motors

To run sensorless vector control operation, set dr.09 (Control Mode) to 4 (IM sensorless), select the capacity of the motor you will use at dr.14 (Motor Capacity), and select the appropriate codes to enter the rating plate information of the motor.

Code	Input (Motor Rating Plate Information)
drv.18 Base Freq	Base frequency
bA.11 Pole Number	Motor pole number
bA.12 Rated Slip	Rated slip
bA.13 Rated Curr	Rated current
bA.15 Rated Volt	Rated voltage
bA.16 Efficiency	Efficiency (when no information is on the rating plate, default values are
	used.)

After setting each code, set bA.20 (Auto tuning) to 1 (All - rotation type) or 2 (All - static type) and run auto tuning. Because rotation type auto tuning is more accurate than static type auto tuning, select 1 (All - rotation type) and run auto tuning if you can rotate the motor.

Note

Excitation Current

A motor can be operated only after magnetic flux is generated by current flowing through a coil. The power supply used to generate the magnetic flux is called the excitation current. The stator coil that is used with the inverter does not have a permanent magnetic flux, so the magnetic flux must be generated by supplying an excitation current to the coil before operating the motor.



Sensorless Vector Control Operation Setting Details for Induction Motors

Code	Description				
Cn.20 SL2 G View Sel	Setting	Function			
	0 No	Does not display sensorless (II) vector control gain code.			
	1 Yes	Allows the user to set various gains applied when the			
		motor rotates faster than medium speed (approx. 1/2 of			
		the base frequency) through sensorless (II) vector			
	control. Codes available when setting to 1 (Yes): Cn.23 ASR-SL P Gain2/Cn.24				
		n2/Cn.26 Flux P Gain/Cn.27 Flux I Gain Gain3/Cn.28 S-Est P			
	Gain1/Cn.29	9 S-Est I Gain1/Cn.30 S-Est I Gain1/Cn.31 ACR SL P Gain/Cn.32			
	ACR SL I Gain				
Cn.09 PreExTime	Sets pre-excitation time. Pre-excitation is used to start the operation				
Cn.10 Flux Force		ning excitation up to the motor's rated flux. e reduction of the pre-excitation time. The motor flux			
CH. TO Flux Force		to the rated flux with the time constant as shown in the			
	following figure. To reduce the time taken to reach the rated flux, a				
	0 0	r flux base value than the rated flux must be provided.			
		agnetic flux reaches the rated flux, the provided motor flux			
	base value is	reduced.			
		ı			
	Magnet	ic flux			
		Cn.10 Flux Force			
		A			
	Excitation current				
		Co 00 Pue Fe Time			
	Run cmd Cn.09 PreExTime				
0 44 11 117	0				
Cn.11 Hold Time		-speed control time (hold time) in the stopped position.			
	The output is blocked after zero-speed operation for a set period when the motor decelerates and is stopped by a stop command.				
	the motor ac				
		Hald time a state or and			
		Hold time at stop cmd			
	Output volta	age			
	Erogues				
	Frequency				
	Ru <u>n cmd</u>				



Code	Description
Cn.21 ASR-SL P Gain1, Cn.22 ASR-SL I Gain1	Changes the speed PI controller gain during sensorless vector control. For a PI speed controller, P gain is a proportional gain for the speed deviation. If speed deviation becomes higher than the torque the output command increases accordingly. As the value increases, the faster the speed deviation decreases. The speed controller I gain is the integral gain for speed deviation. It is the time taken for the gain to reach the rated torque output command while a constant speed deviation continues. The lower the value becomes, the faster the speed deviation decreases.
Cn.23 ASR-SL P Gain2, Cn.24 ASR-SL I Gain2	Appears only when 1 (Yes) is selected for Cn.20 (SL2 G view Sel). The speed controller gain can be increased to more than the medium speed for sensorless vector control. Cn.23 ASR-SL P Gain2 is set as a percentage of the low speed gain Cn.21 ASR-SL P Gain1 - if P Gain 2 is less than 100.0%, the responsiveness decreases. For example, if Cn.21 ASR-SL P Gain1 is 50.0% and Cn.23 ASR-SL P Gain2 is 50.0%, the actual middle speed or faster speed controller P gain is 25.0%. Cn.24 ASR-SL I Gain2 is also set as a percentage of the Cn.22 ASR-SL I Gain1. For I gain, the smaller the I gain 2 becomes, the slower the response time becomes. For example, if Cn.22 ASR-SL I Gain1 is 100ms and Cn.24 ASR-SL I Gain2 is 50.0%, the middle speed or faster speed controller I gain is 200 ms. The controller gain is set according to the default motor parameters and Acc/Dec time.
Cn.26 Flux P Gain, Cn.27 Flux I Gain, Cn.85-87 Flux P Gain13, Cn.88-90 Flux I Gain1- 3	Sensorless vector control requires the rotor flux estimator. For the adjustment of flux estimator gain, refer to <u>5.10.2 Sensorless Vector Control Operation</u> on page <u>215</u> .
Cn.28 S-Est P Gain1, Cn.29 S-Est I Gain1, Cn.30 S-Est I Gain2	Speed estimator gain for sensorless vector control can be adjusted. To adjust speed estimator gain, refer <u>5.10.2 Sensorless Vector Control Operation</u> on page <u>215</u> .
Cn.31 ACR SL P Gain, Cn.32 ACR SL I Gain	Adjusts the P and I gains of the sensorless current controller. For the adjustment of sensorless current controller gain, refer to <u>5.10.2</u> <u>Sensorless Vector Control Operation</u> on page <u>215</u> .



Code	Description					
Cn.53 Torque Lmt Src		ue limit setting, using the keypad, terminal block				
	analog input (V1 and I2) or communication power. When setting torque					
			ue size by limiting the speed controller output. Set			
	the retrograde and regenerative limits for forward and reverse					
	operation		<u>, </u>			
	Setting		Function			
	0	KeyPad-1	Sets the torque limit with the keypad.			
	1	KeyPad-2				
	2	V1	Sets the torque limit with the analog input			
	4	V2	terminal of the terminal block.			
	5	12				
	6	Int 485	Sets the torque limit with the communication terminal of the terminal block.			
	8	FieldBus	Sets the torque limit with the FieldBus communication option.			
	12	Pulse	Sets the torque limit with the pulse input of the terminal block.			
	The torque limit can be set up to 200% of the rated motor torque.					
Cn.54 FWD +Trq Lmt	Sets the torque limit for forward retrograde (motoring) operation.					
Cn.55 FWD –Trg Lmt	Sets the torque limit for forward regenerative operation.					
Cn.56 REV +Trg Lmt	Sets the torque limit for reverse regenerative operation.					
Cn.57 REV –Trg Lmt	Sets the torque limit for reverse retrograde (motoring) operation.					
In.02 Torque at 100%			orque. For example, if In.02 is set to 200% and an			
,	input voltage (V1) is used, the torque limit is 200% when 10V is ente					
	However, when the VI terminal is set up with the factory default					
	and the torque limit setup uses a method other than the keypad, check the parameter settings in the monitor mode. In the Config Mode CNF.21-23 (only displayed when using LCD keypad), select 21 (Torque limit).					
Cn.91-93	Adjust output voltage compensation values for sensorless vector					
SL Volt Comp1-3			oltage compensation, refer to <u>5.10.2 Sensorless</u>			
			<u>tion</u> to on page <u>215</u> .			
Cn.52 Torque Out LPF	Sets the time constant for torque command by setting the torque					
	controlle	er output filt	er.			

Caution

Adjust the controller gain according to the load's characteristics. However, the motor can overheat or the system may become unstable depending on the controller gain settings.



Note

Speed controller gain can improve the speed control waveform while monitoring the changes in speed. If speed deviation does not decrease quickly, increase the speed controller P gain or decrease I gain (time in ms). However, if the P gain is increased too high or I gain is decreased too low, severe vibration may occur. If oscillation occurs in the speed waveform, try to increase I gain (ms) or reduce P gain to adjust the waveform.

5.10.2 Sensorless Vector Control Operation Guide for Induction Motors

Problem	Relevant function code	Troubleshooting
The amount of starting torque is insufficient.	bA.24 Tr Cn.09 PreExTime Cn.10 Flux Force Cn.31 ACR SL P Gain	Set the value of Cn. 90 to be more than 3 times the value of bA.24 or increase the value of Cn.10 by increments of 50%. If the value of Cn.10 is high, an overcurrent trip at start can occur. In this case, reduce the value of Cn.31 by decrements of 10.
	Cn.54–57 Trq Lmt Cn.93 SL Volt Comp3	Increase the value of Trg Lmt (Cn.54-57) by increments of 10%.
		Increase the value of Cn.93 by increments of
The output frequency is higher than the base frequency during no-load operation at low speed (10Hz or lower).	Cn.91 SL Volt Comp1	Decrease the value of Cn.91 by decrements of 5.
The motor hunts* or the amount of torque is not sufficient while the load is increasing at low speed (10Hz or lower).	Cn.04 Carrier Freq	If the motor hunts at low speed, increase the value of Cn.22 by increments of 50m/s, and if hunting does not occur, increase the value of Cn.21 to find the optimal operating condition.
	Cn.21 ASR-SL P Gain1 Cn.22 ASR-SL I Gain1 Cn.93 SL Volt Comp3	If the amount of torque is insufficient, increase the value of Cn.93 by increments of 5.
		If the motor hunts or the amount of torque is insufficient in the 5-10Hz range, decrease the value of Cn.04 by increments of 1kHz (if Cn.04 is set to exceed 3kHz).



Problem	Relevant function code	Troubleshooting
The motor hunts or overcurrent trip occurs in regenerative load at low speed (10 Hz or lower).	Cn.92 SL Volt Comp2 Cn.93 SL Volt Comp3	Increase the value of Cn.92-93 by increments of 5 at the same time.
Over voltage trip occurs due to sudden acceleration/deceleration or sudden load fluctuation (with no brake resistor installed) at mid speed (30Hz or higher).	Cn.24 ASR-SL I Gain2	Decrease the value of Cn.2 by decrements of 5%.
Over current trip occurs due to sudden load fluctuation at high speed (50 Hz or higher).	Cn.54–57 Trq Lmt Cn.94 SL FW Freq	Decrease the value of Cn.54-57 by decrements of 10% (if the parameter setting is 150% or higher). Increase/decrease the value of Cn.94 by increments/decrements of 5% (set below 100%).
The motor hunts when the load increases from the base frequency or higher.	Cn.22 ASR-SL I Gain1 Cn.23 ASR-SL I Gain2	Increase the value of Cn.22 by increments of 50m/s or decrease the value of Cn.24 by decrements of 5%.
The motor hunts as the load increases.	Cn.28 S-Est P Gain1 Cn.29 S-Est I Gain1	At low speed (10Hz or lower), increase the value of Cn.29 by increments of 5. At mid speed (30 Hz or higher), increase the value of Cn.28 by increments of 500. If the parameter setting is too extreme, over current trip may occur at low speed.
The motor speed level decreases.	bA.20 Auto Tuning	Select 6. Tr (static type) from bA. 24 and run bA.24 Rotor time constant tuning.

^{*}Hunting: Symptom of irregular vibration of the equipment.



5.11 Sensorless Vector Control for PM (Permanent-Magnet) Syn Motors

Sensorless vector control is an operation that carries out vector control without rotation speed feedback from the motor but, instead, with an estimation of the motor rotation speed calculated by the inverter.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	09	Control mode	Control Mode	6 PM Sensorless	-	-
	14	Motor capacity	Motor Capacity	Depends on the motor capacity	0–15	-
dr	18	Base frequency	Base Freq	Depends on the PM motor capacity	30–180	Hz
	20	Maximum frequency	Max Freq	Depends on the PM motor capacity	40–180	Hz
	11	Motor pole number	Pole Number	4	2-48	-
	13	Rated motor current	Rated Curr	Depends on the motor capacity	1–1000	А
	15	Motor-rated voltage	Rated Volt	220/380/440/480	170–480	V
	16	Motor efficiency	Efficiency	Depends on the motor capacity	64–100	%
	19	Motor input voltage	AC Input Volt	230/400	170-480	
bA	20	Auto tuning	Auto Tuning	7	All (PM)	-
	32	Q-axis inductance scale	Lq (PM) Scale	100%	50–150	%
	34	Auto tuning level for Ld and Lq	Ld,Lq Tune Lev	33.3%	20.0–50.0	%
	35	Auto tuning frequency for Ld and Lq	Ld,Lq Tune Hz	100.0%	80.0–150.0	%
	12	PM speed controller P gain 1	ASR P Gain 1	100	0–5000	-
	13	PM speed controller I gain 1	ASR I Gain 1	150	0–5000	-
Cn	15	PM speed controller P gain 2	ASR P Gain 2	100	0–5000	-
	16	PM speed controller I gain 2	ASR I Gain 2	150	0–9999	-
	33	PM D-axis back-EMF estimated gain (%)	PM EdGain Perc	100.0	0–300.0	%
	34	PM Q-axis back-EMF	PM EqGain	100.0	0-300.0	%



Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
		estimated gain (%)	Perc			
	35	Initial pole position estimation retry	PD Repeat Num	2	0–10	-
	36	Initial pole position estimation interval	Pulse Interval	20	1–100	ms
	37	Initial pole position estimation pulse current (%)	Pulse Curr %	15	10–100	%
	38	Initial pole position estimation pulse voltage (%)	Pulse Volt %	500	100–4000	-
	39	PM dead-time range (%)	PMdeadBand Per	100.0	50.0–200.0	%
	40	PM dead-time voltage (%)	PMdeadVolt Per	100.0	50.0–200.0	%
	41	PM speed estimator proportional gain	PM SpdEst Kp	100	0-32000	-
	42	PM speed estimator integral gain	PM SpdEst Ki	10	0-32000	-
	43	PM speed estimator proportional gain 2	PM SpdEst Kp 2	300	0-32000	-
	44	PM speed estimator integral gain 2	PM SpdEst Ki 2	30	0-32000	-
	45	Speed estimator feedforward high speed range (%)	PM Flux FF %	300	0–1000	%
	46	Initial pole position estimation type	Init Angle Sel	1: Angle Detect	0–2	0-2
	48	Current controller P gain	ACR P Gain	1200	0–10000	-
	49	Current controller I gain	ACR I Gain	120	0–10000	-
	50	Voltage controller limit	V Con HR	10.0%	0–1000	%
	51	Voltage controller I gain	V Con Ki	10.0%	0–20000	%
	52	Torque controller output filter	Torque Out LPF	0	0–2000	msec
	53	Torque limit source	Torque Lmt Src	0	Keypad-1	0–12
	54	FWD reverse torque limit	FWD +Trq Lmt	180.0	0.0-200.0	%
	55	FWD regenerative torque limit	FWD -Trq Lmt	180.0	0.0-200.0	%



Learning Advanced Features

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
	56	REV regenerative torque limit	REV +Trq Lmt	180.0	0.0-200.0	%
	57	REV reverse torque limit	REV -Trq Lmt	180.0	0.0–200.0	%

① Caution

For high-performance operation, the parameter values of the motor connected to the inverter output must be estimated. Configure the motor-related Basic function group parameters by entering the motor specification values on the rating plate. Then, perform auto tuning by setting bA. 20 (Auto Tuning) to 7 [All (PM)] to automatically measure other parameters before operating a PM synchronous motor in sensorless vector control mode. For high-performance PM sensorless vector control, the inverter and the motor must have the same capacity. The inverter control may be inaccurate if the motor capacity and the inverter capacity do not match. In sensorless vector control mode, do not connect multiple motors to the inverter output.

5.11.1 Detecting the Initial Pole Position

Initial pole position detection is a process to match the rotor position calculated by the inverter and the actual rotor position in a motor. In a permanent-magnet (PM) synchronous motor, rotor flux is generated from the permanent magnet attached to the rotor. Therefore, to run the motor in vector control mode, the exact rotor position (flux position) must be detected for accurate control of the torque generated by the motor.

At Cn. 46 (InitAngle Sel), select the type of initial pole position detection.

When Cn. 46 is set to 0 (None), the motor is operated according to the pole position estimated by the inverter's internal algorithm, instead of actually detecting the physical position of the rotor pole.

When Cn. 46 is set to 1 (Angle Detect), the motor is operated according to the pole position detected by changes in the current. The voltage pulse input is used to detect the pole position and results in a small amount of noise at motor startup.

When Cn. 46 is set to 2 (Alignment), the inverter forcefully align the rotor position by supplying DC current for a certain period of time.



Group	Code	Name	LCD display	Se	tting	Setting range	Unit
	35	Pole position detection retry count	PD Repeat Num	1		0–10	-
	36	Pole position detection interval	Pulse Interval 20		1–100	Ms	
Cn	37	Pole position detection pulse current (%)	Pulse Curr %	15		10–100	%
CH	38	Pole position detection pulse voltage (%)	Pulse Volt %	50	0	100–4000	-
	46			0	None		
		Pole position detection type	Init Angle Sel	1	Angle Detect	0–2	-
				2	Alignment		

5.11.2 Sensorless Vector Control Mode Settings for PM Synchronous Motors

To operate a PM synchronous motor in sensorless vector control mode, set dr.09 (Control Mode) to 6 (PM Sensorless), select the motor capacity at dr.14 (Motor Capacity), and enter the appropriate codes in the Basic (bA) group with the motor specification values found on the motor's rating plate. If a specific motor capacity does not exist in the setting options, select a higher motor capacity that is closest to the actual motor capacity.

Code	ImpatValues(Nation's Rating Plate Information)
dr.18 Base Freq	Base frequency
dr.20 Max Freq	Maximum frequency
bA.11 Pole Number	Motor pole number
bA.13 Rated Curr	Rated current
bA.15 Rated Volt	Rate voltage
bA.16 Efficiency	Efficiency
bA.19 AC Input Volt	Input power voltage

After entering the codes, set bA.20 (Auto tuning) to 7 [All(PM)] and perform a static auto tuning operation. When auto tuning is complete, the bA.21 (Rs), bA.28 Ld (PM), bA. 29 Lq (PM), and bA. 30 (PM Flux Ref) parameters are automatically measured and saved.



Sensorless Vector Control Operation Setting Details

Code	Description		
Cn.4 Carrier Freq	Sets the PWM interrupter cycle and sampling frequency cycle for a PM synchronous motor operation in sensorless vector control mode. The default carrier frequency is set at 5 kHz, and the setting range is 2–10 kHz.		
	Sets the zero-speed control time (hold time) in the stopped position. The output is blocked after zero-speed operation for a set period when the motor decelerates and is stopped by a stop command.		
Cn.11 Hold Time	Output voltage Hold time at stop cmd		
	Frequency		
	Run cmd		
	Changes the speed PI controller gain during a PM synchronous motor operation in sensorless vector control mode. For a PI speed controller, P gain is a proportional gain for the speed deviation. If the speed deviation becomes greater than the torque, the output command will increase accordingly. The higher the value becomes, the faster the speed deviation will decrease.		
Cn.12 ASR P Gain1, Cn.13 ASR I Gain1 Cn.15 ASR P Gain2 Cn.16 ASR I Gain2	The speed controller I gain is the integral gain for speed deviation. It is the time taken for the gain to reach the rated torque output command while constant speed deviation continues. The lower the value becomes, the faster the speed deviation will decrease.		
	As the motor inertia varies by motor, the gain values should be changed according to the motor speeds. Cn.12 and Cn. 13 set the low speed P/I controller gain values, while Cn.15 and Cn.16 set the high speed P/I controller gain values, so that an appropriate gain value can be used for different motor speeds.		



Code	Description					
Cn.33 PM EdGain Perc, Cn.34 PM EqGain Perc	To ensure that the back-EMF with rotor position information can be appropriately estimated during a PM synchronous motor operation in sensorless vector control mode, set these values as a percentage of the proportional gain, which is designed to have stable estimator polarity. Higher values result in faster responses, with higher chances of increased motor vibration. Excessively low values may result in motor startup failure due to slow response rate.					
Cn.41 PM SpdEst Kp, Cn.42 PM SpdEst Ki Cn.43 PM SpdEst Kp2 Cn.44 PM SpdEst Ki2	Set these parameters to change the speed estimator gain during a PM synchronous motor operation in sensorless vector control mode. If fault trips occur or excessive oscillation is observed at low speeds, decrease the value at Cn.41 in 10% decrements until the motor operates stably. If ripples occur during normal operation, increase the value at Cn. 42. In addition to this, the values at Cn.43 and Cn.44 are used in 2S/T Sinus H models only, according to the following pictures. Applied Value Applied Value Base Freq./20 Base Freq./12 Freq. Output Freq. Output Freq.					



Learning Advanced Features

Code	Description				
Cn.39 PMdeadBand Per Cn.40PMdeadVolt Per	Sets the output compensation values during a PM synchronous motor operation in sensorless vector control mode. If the motor fails to operate at low speeds at or below 5% of the rated motor speed, increase the values set at Cn.39 and Cn.40 by 10% increments. Decrease the values in 10% decrements if a clanking noise occurs at motor startup and motor stop.				
Cn.45 PM Flux FF %	Sets the high-speed portion of the feed forward rate against the back-EMF during a PM synchronous motor operation in sensorless vector control mode. Feed forwarding enhances operation of the speed estimator. Increase the value at Cn.45 in 10% increments to suppress motor oscillation under load. A fault trip may occur if this value is set too high.				
Cn.48 ACR P-Gain Cn.49 ACR I-Gain	motor. The P gain is the proportion current deviation decrin voltage output com The I gain is the integround operation decribed. However, the gain valuatrip may occur due to	or the PI current controller in a synchronous ortional gain for the current deviation. The eases faster with higher values, as the deviation mand increases with increased deviation. al gain for the current deviation. Deviation in reases with higher values. Lues are limited by the carrier frequency. A fault interference if you set the gain values too high.			
	input (V1 and I2), or in The torque limit value limiting the speed con	que limit input: Keypad, terminal block analog put via network communication. is used to adjust the torque reference size by troller output. The reverse and regenerative et for operations in the forward or reverse			
	Setting	Function			
	0 KeyPad-1 1 KeyPad-2	Sets the torque limit via the keypad.			
0.507	2 V1	Sets the torque limit via the analog input			
Cn.53 Torque Lmt Src	4 V2	terminals of the terminal block.			
	5 12				
	6 Int 485	Sets the torque limit via the communication terminal of the terminal block.			
	8 FieldBus	Sets the torque limit with the FieldBus communication option.			
	9 UserSeqLink	Sets the torque limit with a user sequence output. The torque reference is received via the common area addresses.			
	12 Pulse	Sets the torque limit with the pulse input of the terminal block.			
	The torque limit can b	e set up to 200% of the rated motor torque.			



Code	Description
Cn.54 FWD +Trq Lmt	Sets the reverse torque limit for forward operation.
Cn.55 FWD -Trq Lmt	Sets the regenerative torque limit for forward operation.
Cn.56 REV +Trq Lmt	Sets the regenerative torque limit for reverse operation.
Cn.57 REV –Trq Lmt	Sets the reverse torque limit for reverse operation.
In.02 Torque at 100%	Sets the maximum torque. For example, if In.02 is set to 200% and an input voltage (V1) is used, the torque limit will be 200% when 10 V is entered. However, when the V1 terminal is set to the factory default setting and the torque limit input source is any device other than the keypad, check the parameter settings in Monitor mode. Set CnF.21–23 (only displayed when an LCD keypad is used) to 21 (Torque limit).
Cn.52 Torque Out LPF	Sets the time constant for torque command by setting the torque controller output filter.

① Caution

Adjust the controller gain according to the load's characteristics. However, the motor can overheat or the system can become unstable depending on the controller gain settings.

Note

Speed controller gain can improve the speed control waveform while monitoring the changes in speed. If the speed deviation does not decrease fast enough, increase the speed controller P gain or decrease I gain (time in ms). However, if the P gain value is increased too much or the I gain value is decreased too much, severe vibrations may occur. If oscillation occurs in the speed waveform, try to increase the I gain (ms) or reduce the P gain to adjust the waveform.



5.11.3 Guidelines for Running a PM Synchronous Motor in Sensorless Vector Control Mode

Problem	Relevant function code	Troubleshooting
Starting torque is insufficient.	Cn.48 ACR P-Gain Cn.39 PMdeadBand Per	If an overcurrent trip occurs at startup, try decreasing the value at Cn.48 in 10% decrements.
	Cn.40 PMdeadVolt Per	Try increasing the value at Cn.39 or Cn.40 in 10% increments.
The motor hunts* when starting up.	Cn.40 PMdeadVolt Per	Try decreasing the value at Cn.40 in 10% decrements.
The motor hunts with regenerative load at low speed (10Hz or lower), or an "OCT" fault trip occurs.	Cn.40 PMdeadVolt Per	Try increasing the value at Cn.40 in 10% increments.
The motor hunts or the torque is not sufficient while the load is increasing at low speed (10Hz or lower).	Cn.04 Carrier Freq Cn.12 ASR P Gain 1 Cn.13 ASR I Gain 1	If the motor hunts at low speeds, try increasing the value at Cn.13 in 50 msec increments. If the motor does not hunt, try increasing the value at Cn.12 in 10% increments until the motor runs in an optimal operation condition. If the motor hunts and the torque is not sufficient at 5–10Hz speed range, and if the carrier frequency at Cn.04 is set to more than 3 kHz, try decreasing the value in 1 kHz decrements.
The motor hunts excessively during no-load operation when rated current is supplied to the motor.	Cn.12 ASR P Gain 1 Cn.13 ASR I Gain 1 Cn.15 ASR P Gain 2 Cn.16 ASR I Gain 2	Try decreasing the speed controller gains at Cn. 12–16 in 30% decrements.
The value at bA.30 (PM Flux Ref) becomes "0" after performing an auto tuning operation by setting bA. 20 to 7 [All (PM)].	bA.11 Pole Number bA.15 Rated Volt dr.18 Base Freq	Refer to the motor's rating plate and set the pole number at bA.11 (Pole Number), or enter a calculated pole number: Pole Number = (120 x BaseFreq/BaseRPM) Refer to the motor's rating plate and set the rated voltage and base frequency at bA-15 (Rated Volt) and dr.18 (Base Freq), and then run auto tuning again by setting



Problem	Relevant function code	Troubleshooting
Fault trips occur after a static auto tuning.	bA.21 Rs bA.28 Ld (PM) bA.29 Lq (PM) bA.30 PM Flux Ref	bA-20 (Auto Tuning) to 7 [All (PM)]. Motor operation may fail if a static PM auto tuning result is not accurate. Refer to the motor's rating plate and set the motor-related parameters again.
"OVT" occurs due to abrupt acceleration, deceleration, or massive load change while the motor is operated at midspeed (above 30Hz).	Cn.16 ASR I Gain 2	Try decreasing the value at Cn.16 in 5% decrements.
Speed variation occurs during an operation at rated motor speed, or during an overloaded high speed operation.	Cn.45 PM Flux FF % Cn.50 V Con HR Cn.51 V Con Ki	If the motor is operated at the rated speed, try decreasing the value at Cn.50 in 5% increments. If the motor response is slow, try increasing the value at Cn.51 in 5% increments (or, try increasing the value at Cn.45 in 100% increments).
"OC1" fault trip or jerking occurs during a high speed operation.	Cn.41 PM SpdEst Kp Cn.42 PM SpdEst Ki	Try increasing the value at Cn. 41 in increments of 10 and the value at Cn.42 in increments of 1. Note that a fault trip may occur if the values at Cn. 41 and Cn.42 are set too high.
Jerking occurs during a low speed operation.	Cn.13 ASR I Gain 1	Try increasing the value at Cn.13 (low speed range speed controller I gain) to eliminate jerking.
A "clanking" noise is heard at the beginning of startup or during deceleration.	Cn.12 ASR P Gain 1 Cn.13 ASR I Gain 1 Cn.40 PMdeadVolt Per	Try increasing the values at Cn.12 and Cn.13 in 10% increments, or try decreasing the value at Cn.40 in 10% decrements.
The motor cannot reach the speed reference when it is operated at or above the rated speed, or when the acceleration is not responsive.	Cn.50 V Con HR Cn.51 V Con Ki	Try increasing the value at Cn.50 in 1% increments if the motor cannot reach the speed reference. Try increasing the value at Cn.51 in 10% increments if the motor acceleration is not responsive.
"OC1" trip occurs after an abrupt regenerative load (over 100%).	Cn.12 ASR P Gain 1 Cn.13 ASR I Gain 1	Try decreasing the values at Cn.12 and Cn.13 in 10% decrements.
The motor jerks during acceleration.	Cn.42 PM SpdEst Ki	Try increasing the speed estimator proportional gain at Cn.42 in increments of 5.





Problem	Relevant function code	Troubleshooting
A massive current rises when the motor is stopped during a 20:1 speed startup.	Cn.13 ASR I Gain 1	Try increasing the value at Cn. 13 in 10% increments.
An oscillation occurs when an abrupt load is applied to the motor during a low speed operation.	Cn.41 PM SpdEst Kp Cn.42 PM SpdEst Ki	Try increasing the values at Cn. 41 and Cn.42 in 10% increments.
During a PM speed search, the speed search stops at around 20% of the base frequency, and the motor is stopped and starts again after a massive current rises.	Cn.69 SS Pulse Curr	Try decreasing the value at Cn.69 in 5% decrements.
During a high-speed operation in PM control mode utilizing the kinetic energy buffering, a massive current rises at around 20% of the base frequency, the motor is stopped, and it fails to start.	Cn.78 KEB Start Lev Cn.79 KEB Stop Lev Cn.80 KEB P Gain Cn.81 KEB I Gain	Try increasing the values at Cn.78 and Cn.79 in 5% increments, or try doubling the gain values at Cn.80 and Cn. 81.
1. When the motor is overloaded, the maximum torque limit current is supplied to the motor at startup, and the motor fails to operate due to an inverter overload fault trip. 2. Speed search fails when the a load exceeding the rated load is applied to the motor at each speed section, or a current equal to or exceeding 150% of the rated current is supplied to the motor.	bA.29 Lq (PM)	This happens when the Lq parameter value is decreasing due to certain causes, such as self-saturation. Try increasing the value (100%) at bA.32 in 5% increments.
A fault trip occurs when the motor tries to start up or accelerate from a free run at certain speed range.	Cn.71 Speed Search	During a PM synchronous motor operation in sensorless vector mode, the motor starts up after the initial pole position detection is made. To accelerate the motor in a free-run state, enable speed search at acceleration by setting bit 0 (0001) at Cn.71 (Speed



Problem	Relevant function code	Troubleshooting
		Search).
During a low speed operation, the output speed search becomes unstable when a massive load exceeding the rated load is abruptly applied to the motor.		The motor control may become unstable due to input voltage deviation during a low-speed operation with low voltage input. Try decreasing the values at Cn.31 and Cn.40 in 10% decrements.

^{*}Hunting: Symptom of irregular vibration of the equipment.

5.12 Kinetic Energy Buffering Operation

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	Cod e	Name	LCD Display	Para Sett		Setting Range	Unit
77	77	Kinetic energy buffering selection	KEB Select	1	Yes	-	-
Cn	Cn start level	Kinetic energy buffering start level	KEB Start Lev	130		110–140	%
CH		Kinetic energy buffering stop level	KEB Stop Lev	135		125–145	%
	80	Kinetic energy buffering gain	KEB Gain	1000)	1–20000	-



Kinetic Energy Buffering Operation Setting Details

Code	Descr	iption	
		the kir inected	netic energy buffering operation when the input power is d.
	Setti	ng	Function
Cn.77 KEB Select	0	No	General deceleration is carried out until a low voltage trip occurs.
	1	Yes	The inverter power frequency is controlled and the regeneration energy from the motor is charged by the inverter.
Cn.78 KEB Start Lev, Cn.79 KEB Stop Lev	The se	t value	and stop points of the kinetic energy buffering operation. s must be based on the low voltage trip level as 100% and I (Cn. 79) must be set higher than the start level (Cn.78).
Cn.80 KEB Gain	using use a l value. If inpu kinetic Gain) a	the am ower g t powe energ at half	in used to control the kinetic energy buffering operation ount of load-side inertia moment. If the load inertia is high, pain value, and if the load inertia is low, use a higher gain er is disconnected and the motor vibrates severely while the by buffering operation is carried out, set the gain (Cn.80: KEB the previously set value. If the gain is lowered too much, a rip may occur during the kinetic energy buffering operation

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 variable torque load (for example, fan or pump loads).

5.13 Torque Control

When the motor output torque is greater than the load, the speed of motor becomes too fast. To prevent this, set the speed limit. (The torque control function cannot be used while the speed limit function is running.)

The torque control function controls the motor to maintain the preset torque value. The motor rotation speed maintains the speed constantly when the output torque and load torque of the motor keep a balance. Therefore, the motor rotation speed is decided by the load when controlling the torque.



Torque control setting option

Group	Code	Name	LCD Display	Para	ameter Setting	Unit
dr	09	Control mode	Control Mode	4	IM Sensorless	-
dr	10	Torque control	Torque Control	1	Yes	-

Torque control setting option details

Group	Code	Name	Para	meter Setting	Unit
	02	Cmd Torque	-	0.0	%
	08	Trq Ref Src	0	Keypad-1	-
dr	09	Control Mode	4	IM Sensorless	-
dr	10	Torque Control	1	Yes	-
	22	(+) Trq Gain	-	50-150	%
	23	(-) Trq Gain	-	50-150	%
bA	20	Auto Tuning	1	Yes	-
	62	Speed LmtSrc	0	Keypad-1	-
Cn	63	FWD Speed Lmt	-	60.00	Hz
Cn	64	REV Speed Lmt	-	60.00	Hz
	65	Speed Lmt Gain	-	100	%
In	65-71	Px Define	35	Speed/Torque	-
	31-33	Relay x or Q1	27	Torque Dect	-
OU	59	TD Level	-	100	%
	60	TD Band	-	5.0	%

Note

- To operate in torque control mode, basic operation conditions must be set. For more information, refer to <u>5.10.2 Sensorless Vector Control Operation</u> on page <u>215</u>.
- The torque control cannot be used in a low speed regeneration area or low load conditions.
- If you change the rotation direction while operating, an over current trip or low speed reverse direction error will be generated.



Learning Advanced Features

Torque reference setting option

The torque reference can be set using the same method as the target frequency setting. If Torque Control Mode is selected, the target frequency is not used.

Grou p	Cod e	Name	LCD Display	Pa	rameter Setting	Unit
				0	Keypad-1	
dr	00	Torque reference cotting	Tra Dof Cro	1	Keypad-2	
dr	08	Torque reference setting	Trq Ref Src	2	V1]-
				6	Int 485	
	02	Torque command	Cmd Torque	-18	30-180	%
				0	Keypad-1	
				1	Keypad-2	- - - -
	62	Speed limit setting	Speed I mtSre	2	V1	
	02		Speed LmtSrc	4	V2	
Cn				5	12	
					Int 485	
	63	Positive-direction speed limit	FWD Speed Lmt	0-Maximum frequency		Hz
	64	Negative-direction speed limit	REV Speed Lmt	nt 0- Maximum frequency		Hz
	65	Speed limit operation gain	Speed Lmt Gain	10	0-5000	%
In	02	Torque at maximum analog input	Torque at 100%	-12	2.00-12.00	mA
	21	Monitor mode display 1	Monitor Line-1	1	Speed	
CNF*	22	Monitor mode display 2	Monitor Line-2	2	Output Current	
	23	Monitor mode display 3	Monitor Line-3	3	Output Voltage	

^{*}Available on LCD keypad only.



Torque reference setting details

Code	Description					
code	Select an input method to use as the torque reference.					
		ameter ting	Description			
dr 00	0	Keypad-1	Sets the torque reference with the keypad.			
dr-08	1	Keypad-2				
	2	V1	Sets the torque reference using the voltage or current input terminal of the terminal block.			
	6	Int 485	Sets the torque reference with the communication terminal of the terminal block.			
Cn-02	The torq		ce can be set up to 180% of the maximum rated motor			
In-02	Sets the maximum torque. You can check the set maximum torque in Monitor (MON) mode.					
CNF-21-23	Selection Ref).	•	from the Config(CNF) mode and then select(19 Torque			

Speed limit details

Code	Desc	cription				
	Select a method for setting the speed limit value.					
		ameter ting	Description			
Cn-62	0	Keypad-1 Keypad-2	Sets the speed limit value with the keypad.			
	6	V1 Int 485	Sets the speed limit value using the same method as the frequency command. You can check the setting in Monitor (MON) mode.			
Cn-63	Sets	the positive-	direction speed limit value.			
Cn-64	Sets	the negative	e-direction speed limit value.			
Cn-65	Sets the decrease rate of the torque reference when the motor speed exceeds the speed limit value.					
CNF-21~23	Select a parameter from the Config (CNF) mode and then select21 Torque Bias.					
In 65-71	you	turn on the t	nctional input terminal to set as the (35 Speed/Torque). If erminal while the operation is stopped, it operates in peed limit) mode.			

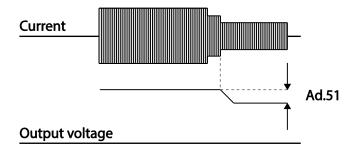


5.14 Energy Saving Operation

5.14.1 Manual Energy Saving Operation

If the inverter output current is lower than the current which is set at bA.14 (Noload Curr), the output voltage must be reduced as low as the level set at Ad.51 (Energy Save). The voltage before the energy saving operation starts will become the base value of the percentage. Manual energy saving operation will not be carried out during acceleration and deceleration.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Ad	50	Energy saving operation	E-Save Mode	1	Manual	-	-
Au	51	Energy saving amount	Energy Save	30		0–30	%



5.14.2 Automatic Energy Saving Operation

The amount of energy saving can be automatically calculated based on the rated motor current (bA.13) and the no-load current (bA.14). From the calculations, the output voltage can be adjusted.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Ad	50	Energy saving operation	E-Save Mode	2	Auto	1	-

① Caution

If operation frequency is changed or acceleration and /deceleration is carried out by a stop command during the energy saving operation, the actual Acc/Dec time may take longer than the set Acc/Dec time due to the time required to return to the gerneral operation from the energy saving operation.



5.15 Speed Search Operation

This operation is used to prevent fault trips that can occur while the inverter output voltage is disconnected and the motor is idling. Because 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
	69	PM speed search pulse current	SS Pulse Curr	15		10~100	%
70	70	Speed search mode selection	SS Mode	0 1 2	Flying Start-1 Flying Start-2 Flying Start-3	-	-
	71	Speed search operation selection	Speed Search	1 3 9		-	bit
Cn	Cn 72	Speed search reference current	SS Sup- Current	-		80-200	%
	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
OLL	31	Multi-function relay 1 item	Relay 1	19	Speed		
OU 3:	33	Multi-function output 1 item	Q1 Define	19	Search	-	-

^{*}Displayed as Displayed as Displayed as Displayed as Displayed as Displayed Displayed





Speed Search Operation Setting Details

Code	Description				
Cn.69 SS Pulse Curr	parameter is only dis Sensorless).	n current based on the motor's rated current. This played when dr.09 (Control Mode) is set to 6 (PM			
Cn.70 SS Mode	Select a speed search Setting O Flying Start- 1 Flying Start- 2 Flying Start-	Function The speed search is carried out as it controls the inverter output current during idling below the Cn.72 (SS Sup-Current) parameter setting. If the direction of the idling motor and the direction of operation command at restart are the same, a stable speed search function can be performed at about 10 Hz or lower. However, if the direction of the idling motor and the direction of operation command at restart are different, the speed search does not produce a satisfactory result because the direction of idling cannot be established.			
	3	synchronous motor. It is used when dr.09 (Control Mode) is set to 6 (PM Sensorless).			



Code Speed search can be selected from the following 4 options. If the top display segment is on it is enabled (On), and if the bottom segment is on it is disabled (Off). Bit Setting On Status Bit setting Off Status Item Keypad LCD keypad Type and Functions of Speed Search Setting Setting Function bit4 bit3 bit2 bit1 Speed search for general acceleration Initialization after a fault trip Restart after instantaneous power Cn.71 Speed Search interruption Starting with power-on Speed search for general acceleration: If bit 1 is set to 1 and the inverter operation command runs, acceleration starts with 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 output voltage. The speed search function prevents such fault trip from occurring. Initialization after a fault trip: If Bit 2 is set to 1 and Pr.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 [Reset] key is pressed (or the terminal block is initialized) after a fault trip. Automatic restart after reset of a fault trip: 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.



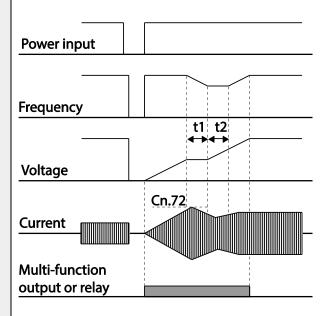
Learning Advanced Features

Description

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 control.

If the current increases above the value set at Cn.72, the voltage stops increasing and the frequency decreases (t1 zone). If the current decreases below the value set at Cn.27, 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.



 Starting with power-on: Set bit 4 to 1 and Ad.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.



Code	Description
Cn.72 SS Sup-Current	The amount of current flow is controlled during speed search operation based on the motor's rated current. If Cn.70 (SS mode) is set to 1 (Flying Start-2), this code is not visible.
Cn.73 SS P/I-Gain, Cn.75 SS Block Time	The P/I gain of the speed search controller can be adjusted. If Cn.70 (SS Mode) is set to 1 (Flying Start-2), different factory defaults based on motor capacity are used and defined in dr.14 (Motor Capacity).

Note

- If operated within the rated output, the Sinus H series inverter is designed to withstand instantaneous power interruptions within 15 ms and maintain normal operation. Based on the rated heavy load current, safe operation during an instantaneous power interruption is guaranteed for 2S, 2T and 4T inverters (whose rated input voltages are 200-240 VAC and 380-480 VAC respectively).
- The DC voltage inside the inverter may vary depending on the output load. If the power interruption time is longer than 15 ms, a low voltage trip may occur.

① Caution

When operating in sensorless II mode while the starting load is in free-run, the speed search function (for general acceleration) must be set for smooth operation. If the speed search function is not set, an overcurrent trip or overload trip may occur.

5.16 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.

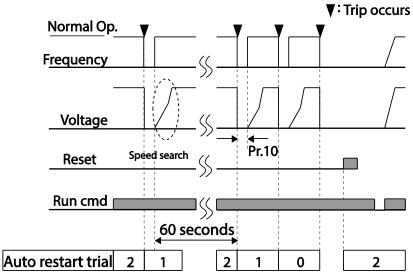
Group	Code	Name	LCD Display	Param Setting		Setting Range	Unit
	80	Select start at trip reset	RST Restart	0	No	0–1	-
Pr	09	Auto restart count	Retry Number	0		0–10	-
10	10	Auto restart delay time	Retry Delay	1.0		0.0-60.0	S
	71	Select speed search operation	Speed Search	-		0000*-1111	bit
	72	Speed search startup current	SS Sup- Current	150		80-200	%
Cn	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	S

^{*}Displayed as on the keypad.



Auto Restart Setting Details

Code	Description
Pr.08 RST Restart, Pr.09 Retry Number, Pr.10 Retry Delay	Only operates when Pr.08 (RST Restart) is set to 1(Yes). The number of attempts to try the auto restart is set at Pr.09 (Auto Restart Count). If a fault trip occurs during operation, the inverter automatically restarts after the set time programmed at Pr.10 (Retry Delay). At each restart, the inverter counts the number of tries and subtracts it from the number set at Pr.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 Pr.09 (Auto Restart Count). If the inverter stops due to low voltage, emergency stop (Bx), inverter overheating, or hardware diagnosis, an auto restart is not activated. At auto restart, the acceleration options are identical to those of speed search operation. Codes Cn.72-75 can be set based on the load. Information about the speed search function can be found at <u>5.15 Speed Search</u> Operation on page <u>234</u> .



[Example of auto restart with a setting of 2]

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.



5.17 Operational Noise Settings (carrier frequency settings)

Group	Code	Name	LCD Display	I Daramatar Cattina		Setting Range	Unit
Cn	04	Carrier Frequency	Carrier Freq	3.0		1.0-15.0	kHz
CH	05	Switching Mode	PWM* Mode	0	Normal PWM	0-1	-

^{*} PWM: Pulse width modulation

Operational Noise Setting Details

Code	Description				
Cn.04 Carrier Freq	Adjust 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 switching speed in this process refers to the carrier frequency. If the carrier frequency is set high, it reduces operational noise from the motor, and if the carrier frequency is set low, it increases operational noise from the motor.				
	changing the load r (LowLeakage PWM) when 0 (Normal PW Low leakage PWM i minimize degradati	The heat loss and leakage current from the inverter can be reduced by changing the load rate option at Cn.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 2 phase PWM modulation mode, which helps minimize degradation and reduces switching loss by approximately 30%.			
O - OF DIAMANA - I	Item	Carrier fr	equency		
Cn.05 PWM Mode		1.0kHz	15kHz		
		Low Leakage PWM	Normal PWM		
	Motor noise	↑	\downarrow		
	Heat generation	\downarrow	↑		
	Noise generation	ļ	Î		
	Leakage current	\downarrow	1		



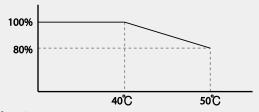
Note

Carrier Frequency at Factory Default Settings (all models)

- Normal load: 2kHz (Max 5kHz)
- Heavy load: 3kHz (Max 15kHz)

Sinus H Series Inverter Derating Standard

- Sinus H inverter is designed to respond to two types of load rates. Heavy load (heavy duty) and normal load (normal duty). The overload rate represents an acceptable load amount that exceeds rated load, and is expressed in a ratio based on the rated load and the duration. The overload capacity on the Sinus H series inverter is 150%/1min for heavy loads, and 120%/1min for normal loads.
- The current rating differs from the load rating, as it also has an ambient temperature limit. For derating specifications, refer to 11.9 Continuous Rated Current Derating on page 446.
- Current rating for ambient temperature at normal load operation.



[Ambient temperature versus current rating at normal load]

• Guaranteed carrier frequency for current rating by load.

Inverter capacity	Normal load	Heavy load
0.4-30kW	2kHz	6kHz

5.18 2nd Motor Operation

The 2nd motor operation is used when a single inverter switch operates two motors. Using the 2nd motor operation, a parameter for the 2nd motor is set. The 2nd motor is operated when a multi-function terminal input defined as a 2nd motor function is turned on.

(Group	Code	Name	LCD Display	Param Setting		Setting Range	Unit
lı	n	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define(Px: P1- P7 for IP20 models, P1-P5 for IP66 models)	26	2nd Motor	-	-



2nd Motor Operation Setting Details

Code	Description
IP20 models), In.65-69 (P1-P5 in	Set one of the the multi-function input terminals to 26 (2 nd Motor) to display M2 (2 nd motor group) group. An input signal to a multi-function terminal set to 2 nd 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 2 nd motor parameter. Pr.50 (Stall Prevent) must be set first, before M2.28 (M2-Stall Lev) settings can be used. Also, Pr.40 (ETH Trip Sel) must be set first, before M2.29 (M2-ETH 1min) and M2.30 (M2-ETH Cont) settings.

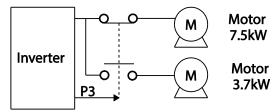
Parameter Setting at Multi-function Terminal Input on a 2nd Motor

Code	Description	Code	Description
M2.04 Acc Time	Acceleration time	M2.16 Inertia Rt	Load inertia rate
M2.05 Dec Time	Deceleration time	M2.17 Rs	Stator resistance
M2.06 Capacity	Motor capacity	M2.18 Lsigma	Leakage inductance
M2.07 Base Freq	Motor base frequency	M2.19 Ls	Stator inductance
M2.08 Ctrl Mode	Control mode	M2.20 Tr	Rotor time constant
M2.10 Pole Num	Pole number	M2.25 V/F Patt	V/F pattern
M2.11 Rate Slip	Rated slip	M2.26 Fwd Boost	Forward torque boost
M2.12 Rated Curr	Rated current	M2.27 Rev Boost	Reverse torque boost
M2.13 Noload Curr	No-load current	M2.28 Stall Lev	Stall prevention level
M2.14 Rated Volt	Motor rated voltage	M2.29 ETH 1min	Motor heat protection
			1min rating
M2.15 Efficiency	Motor efficiency	M2.30 ETH Cont	Motor heat protection
			continuous rating

Example - 2nd Motor Operation

Use the 2nd motor operation when switching operation between a 7.5kW motor and a secondary 3.7kW motor connected to terminal P3. Refer to the following settings.

Group	Code	Name	LCD Display	Para Setti	meter ing	Setting Range	Unit
In	67	Terminal P3 configuration	P3 Define	26	2nd Motor	-	-
M2	06	Motor capacity	M2-Capacity	-	3.7kW	-	-
IVIZ	08	Control mode	M2-Ctrl Mode	0	V/F	-	-





5.19 Supply Power Transition

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	Parar Setti	meter ng	Setting Range	Unit
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define(Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	16	Exchange	-	-
OH	31	Multi-function relay1 items	Relay1	17	Inverter Line	-	-
OU 3	33	Multi-function output1 items	Q1 Define	18	Comm Line	-	-

Supply Power Transition Setting Details

Code	Description				
In.65-71 (P1-P7 in IP20 models), In.65-69 (P1-P5 in IP66 models) Px Define	When the motor power source changes from inverter output to main supply power, 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.				
	Set multi-function relay or multi-function output to 17 (Inverter Line) or 18 (COMM line). Relay operation sequence is as follows.				
		Speed search			
	Output frequency				
OU.31 Realy 1					
Define,	Run cmd				
OU.33 Q1 Define	Px(Exchange)				
	Relay1 (Inverter Line)				
	Q1(Comm Line)				
	5	00ms 500ms			



5.20 Cooling Fan Control

This function turns the inverter's heat-sink cooling fan on and off. It is used in situations where the load stops and starts frequently, or noise free environment is required. The correct use of cooling fan control can extend the cooling fan's life.

Group	Code	Name	H CD Display			Setting Range	Unit
Ad	64	Cooling fan control	FAN Control	0	During Run	0-2	-

Cooling Fan Control Detail Settings

Code	Desc	ription	
	Set	tings	Description
Ad.64 Fan Control	0	During Run	Cooling fan runs when the power is supplied to the inverter and the operation command is on. The cooling fan stops when the power is supplied to the inverter and the operation command is off. When the inverter heat sink temperature is higher than its set value, the cooling fan operates automatically regardless of its operation status.
	1	Always On	Cooling fan runs constantly if the 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

Despite setting Ad.64 to O(During Run), if the heat sink temperature reaches a set level by current input harmonic wave or noise, the cooling fan may run as a protection function.



5.21 Input Power Frequency and Voltage Settings

Select the frequency for inverter input power. If the frequency changes from 50Hz to 60Hz, all other frequency (or RPM) settings including the maximum frequency, base frequency etc., will change to 60Hz. Likewise, changing the input power frequency setting from 50Hz to 60Hz will change all related function item settings from 50Hz to 60Hz.

Group	Code	Name	LLCD Display	Parar Settir		Setting Range	Unit
bA	10	Input power frequency	60/50 Hz Sel	1	50Hz	0-1	-

Set Inverter input power voltage at bA.19. Low voltage fault trip level changes automatically to the set voltage standard.

Group	Code	Name	H (H) Display			Setting Range	Unit
hΛ	19	Input power voltage	AC Input Volt	2S/T	230	170-240	V
bA		Input power voltage		4T	400	320-480	

5.22 Read, Write, and Save Parameters

Use read, write and save function parameters on the inverter to copy parameters from the inverter to the keypad or from the keypad to the inverter.

Group	Code	Name	LCD Display			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	-	-

^{*}Available on LCD keypad only.

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 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 copied parameters. If an error occurs during parameter writing, previous saved data will be used. If there is no saved data on the Keypad, 'EEP Rom Empty' message will be displayed.



Code	Description
CNF-48 Parameter	As parameters set during communication transmission are saved to RAM, the setting values will be lost if the power goes off and on. When setting parameters during communication transmission, select 1 (Yes)
	from CNF-48 code to save the set parameter.

5.23 Parameter Initialization

User changes to parameters can be initialized (reset) to factory default settings on all or selected groups. However, during a fault trip situation or operation, parameters cannot be initialized.

Group	Code	Name	LCD Display			Setting Range	Unit
dr*	93	Parameter initialization	-	0	No	0-16	
CNF**	40	Parameter initialization	Parameter Init	0	No	0-16	

^{*} For keypad

Parameter Initialization Setting Details

Code	Desc	Description				
	Sett	ing	LCD Display	Function		
	0	No	No	-		
	1	Initialize all groups	All Grp	Initialize all data. Select 1(All Grp) and press [PROG/ENT] key to start initialization. On completion, 0(No) will be displayed.		
1.00		Initialize dr group	DRV Grp	Initialize data by groups.		
dr.93,	3	Initialize bA group	BAS Grp	Select initialize group and		
CNF-40 Parameter Init	4	Initialize Ad group	ADV Grp	press [PROG/ENT] key to		
	5	Initialize Cn group	CON Grp	start initialization. On		
	6	Initialize In group	IN Grp	completion, O(No) will be		
	7	Initialize OU group	OUT Grp	displayed.		
	8	Initialize CM group	COM Grp			
	9	Initialize AP group	APP Grp			
	12	Initialize Pr group	PRT Grp			
	13	Initialize M2 group	M2 Grp			
	16	Initialize OperationGroup	SPS Grp			

^{**} For LCD keypad



5.24 Parameter View Lock

Use parameter view lock to hide parameters after registering and entering a user password.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
CNF*	50	Parameter view lock	View Lock Set	Unlocked	0-9999	
CINE	51	Parameter view lock password	View Lock Pw	Password	0-9999	

^{*} Available on LCD keypad only.

Parameter View Lock Setting Details

Code	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 Pw	 [PROG/ENT] key on CNF-51 code will show the previous password input window. If registration is made for the first time, enter 0. It is the factory default. If a password had been set, enter the saved password. 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 will be displayed.				
CNF-50 View Lock Set	To enable parameter view lock, enter a registered password. [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.				



5.25 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
	94	Password registration	-	-	0-9999	-
dr	95	Parameter lock password	-	-	0-9999	-
	52	Parameter lock	Key Lock Set	Unlocked	0-9999	-
CNF*	53	Parameter lock password	Key Lock PW	Password	0-9999	-

^{*}Available on LCD keypad only.

Parameter Lock Setting Details

Code	Descri	ption				
	_	Register a password to prohibit parameter modifications. Follow the procedures below to register a password.				
	No	Procedures				
CNF-53 Key Lock Pw	1	Press the [PROG/ENT] key on CNF-53 code and the saved password input window will be displayed. If password registration is being made 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 move to next stage until the user enters a valid password).				
	4	Register a new password.				
	5	After registration, Code CNF-51 will be displayed.				
CNF-52 Key Lock Set	will be Once e allow t	ble parameter lock, enter the registered password. [Locked] sign displayed on the screen to indicate that prohibition is enabled. enabled, Pressing the [PROG/ENT] key on function code will not the display edit mode to run. To disable parameter modification wition, re-enter the password. The [Locked] sign will disapear.				

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.



5.26 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	H (`H) H)ishlav	Parame Setting		Setting Range	Unit
CNF*	41	Changed parameter display	Changed Para	0	View All	-	-

^{*} Available on LCD keypad only.

Changed Parameter Display Setting Details

Code	Descr	Description					
CNF-41 Changed Para	Setting		Function				
	0	View All	Display all parameters				
	1	View Changed	Display changed parameters only				

5.27 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	Parameter Setting		Setting Range	Unit
CNF*	42	Multi-function key settings	Multi Key Sel	3	UserGrp SelKey	-	-
	45	Delete all user registered codes	UserGrp AllDel	0	No	-	-

^{*} Available on LCD keypad only.



User Group Setting Details

User Group Setting	Details	
Code	Descrip [*]	tion
	Select 3(group pa user gro item on	UserGrp SelKey) from the multi-function key setting options. If user arameters are not registered, setting the multi-function key to the up select key (UserGrp SelKey) will not display user group (USR Grp) the Keypad. The procedures below to register parameters to a user group.
	No	Procedure
	1	Set CNF- 42 to 3(UserGrp SelKey). A licon will be displayed at the top of the LCD display.
CNF-42 Multi-Key Sel	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. 1 USR → REG U STP 60.0Hz 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	Set a code number (3) to use to register the parameter in the user group. Select code number and press [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, and more in the user group.



Learning Advanced Features

Code	Descrip	otion
	Follow	the procedures below to delete parameters in the user group.
	No.	Settings
	1	Set CNF- 42 to 3(UserGrp SelKey). A icon will be displayed at the top of the LCD display.
	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	Move to YES on the deletion confirmation screen, and press the [PROG/ENT] key.
	5	Deletion completed.
CNF-25 UserGrp AllDel	Set to 1	(Yes) to delete all registered parameters in the user group.

5.28 Easy Start On

Run Easy Start On to easily setup 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 On.

Group	Code	Name	II CD Dienlay	Paramete Setting	er	Setting Range	Unit
CNF*	61	Parameter easy start settings	Easy Start On	1	Yes	1	-

^{*}Available on LCD keypad only.

Easy Start On Setting Details

Code	Description				
	Follow the procedures listed below to set parameter easy start.				
	No	Procedures			
	1	Set CNF-61 (Easy Start On) to 1(Yes).			
CNF-61 Easy Start	2	Select 1(All Grp) in CNF-40 (Parameter Init) to initialize all			
		parameters in the inverter.			
On	3	Restarting the inverter will activate the Easy Start On. Set the values in the following screens on the LCD keypad. To escape from the Easy Start On, press the [ESC] key.			



Code	Description
	Start Easy Set: Select Yes.
	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 60/50Hz 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 operation frequency.
	When the settings are completed, the minimum parameter setting on the motor has been made. The LCD keypay will return to a monitoring display. Now the motor can be operated with the command source set at DRV-06.

5.29 Config(CNF) Mode

The config mode parameters are used to configure the LCD 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	-	
ONE*	11	Keypad S/W version	Keypad S/W Ver	X.XX	-	-
CNF*	12	Keypad title version	KPD Title Ver	X.XX	-	-
	30-32	Power slot type	Option-x Type	None	-	-
	44	Erase trip history	Erase All Trip	No	-	-
	60	Add title update	Add Title Up	No	-	-
	62	Initialize accumulated electric energy	WH Count Reset	No	-	-

^{*} Available on the LCD keypad only.



Config Mode Parameter Setting Details

Code	Description
CNF-2 LCD contrast	Adjusts LCD brightness/contrast on the LCD keypad.
CNF-10 Inv S/W Ver, CNF-11 Keypad S/W Ver	Check OS version in the inverter and on the LCD keypad.
CNF-12 KPD title Ver	Checks title version on the LCD keypad.
CNF-30–32 Option-x type	Checks type of powerboard installed in 1-3 power slot.
CNF-44 Erase all trip	Deletes stored trip history.
CNF-60 Add Title Up	When 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 LCD keypad from the inverter. Reconnecting the LCD keypad to the inverter updates titles.
CNF-62 WH Count Reset	Initialize accumulated electric energy consumption count.

5.30 Timer Settings

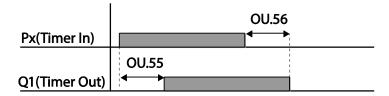
Set a multi-function input terminal to a timer and On/Off control the multi-function output and relay according to the timer settings.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define(Px: P1- P7 in IP20 models, P1-P5 in IP66 models)	38	Timer In	-	-
	31	Multi-function relay1	Relay 1				
OU	33	Multi-function output1	Q1 Define	28	Timer Out	-	-
	55	Timer on delay	Timer on delay	3.00		0.00-100	sec
	56	Timer off delay	Timer off delay			0.00-100	sec



Timer Setting Details

Code	Description
In.65-71 (P1-P7 in IP20 models), In.65-69 (P1-P5 in IP66 models) Px Define	Choose one of the multi-function input terminals and change it to a timer terminal by setting it to 38 (Timer In).
OU.31 Relay1, OU.33 Q1 Define	Set multi-function output terminal or relay to be used as a timer to 28 (Timer out).
OU.55 TimerOn Delay, OU.56 TimerOff Delay	Input a signal (On) to the timer terminal to operate a timer output (Timer out) after the time set at OU.55 has passed. When the multi-function input terminal is off, multi-function output or relay turns off after the time set at OU.56.



5.31 Brake Control

Brake control is used to control the On/Off operation of electronic brake load system.

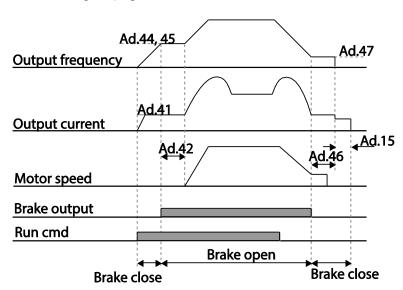
Group	Code	Name	LCD Display	Para Setti	meter ing	Setting Range	Unit
dr	09	Control mode	Control Mode	0	V/F	-	-
	41	Brake open current	BR RIs Curr	50.0		0.0-180%	%
	42	Brake open delay time	BR RIs DIy	1.00		0.0-10.0	sec
	44	Brake open forward	BR RIs Fwd Fr	1.00		0-Maximum	Hz
	44	frequency	DK KIST WUTT	1.00		frequency	114
Ad	45	Brake open reverse	BR RIs Rev Fr	1.00		0-Maximum	Hz
	40	frequency	DK KIS KEV I I			frequency	
	46	Brake close delay time	BR Eng Dly	1.00		0.00-10.00	sec
	47	Brake close frequency	BR Eng Fr	2.00		0-Maximum	Hz
	47	brake close frequericy	DK ENG FI			frequency	
OU	31	Multi-function relay1 item	Relay 1	35	BR Control:		
	33	Multi-function	Q1 Define	30	DK COITHOL	-	-
		output1 item	Q i Dellile				



Learning Advanced Features

When brake control is activated, DC braking (Ad.12) at inverter start and dwell operation (Ad.20-23) do not operate.

- Brake release sequence: During motor stop state, if an operation command is entered, the inverter accelerates up to brake release frequency (Ad.44- 45) in forward or in reverse direction. After reaching brake release frequency, if motor current reaches brake release current (BR RIs Curr), the output relay or multi function output terminal for brake control sends a release signal. Once the signal has been sent, acceleration will begin after maintaining frequency for brake release delay time (BR RIs Dly).
- Brake engage sequence: If a stop command is sent during operation, the motor decelerates. Once the output frequency reaches brake engage frequency (BR Eng Fr), the motor stops deceleration and sends out a brake engage signal to a preset output terminal. Frequency is maintained for the brake engage delay time (BR Eng Dly) and will become 0 afterwards. If DC braking time (Ad.15) and DC braking resistance (Ad.16) are set, inverter output is blocked after DC braking. For DC braking, refer to <u>4.17.2 Stop After DC Braking</u> on page <u>157</u>.





5.32 Multi-Function Output On/Off Control

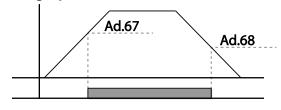
Set reference values (on/off level) for analog input and control output relay or multifunction output terminal on/off status accordingly.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
66 Ad 67	66	Output terminal on/off control mode	On/Off Ctrl Src	1	V1	-	-
	67	Output terminal on level	On-C Level	90.00		Output terminal off level-100.00%	%
	68	Output terminal off level	Off-C Level	10.	00	0.00-Output terminal on level	%
OU	31	Multi-function relay1 item	Relay 1	34 On/Off			
	33	Multi-function output1 item	Q1 Define	34	OH/OH	-	-

Multi-function Output On/Off Control Setting Details

Code	Description
Ad.66 On/Off Ctrl Src	Select analog input On/Off control.
Ad.67 On-C Level , Ad.68 Off-C Level	Set On/Off level at the output terminal.

Analog input



Multi-function relay output



5.33 Press Regeneration Prevention

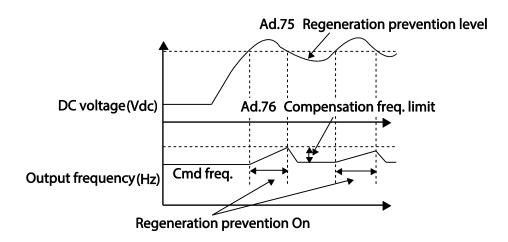
Press regeneration prevention is used during press operations to prevent braking during the regeneration process. If motor regeneration occurs during a press operation, motor operation speed automatically goes up to avoid the regeneration zone.

Grou p	Cod e	Name	LCD Display	Parame Setting		Setting Range	Unit
	74	Select press regeneration prevention for press	RegenAvd Sel	0	No	0–1	-
		Press regeneration		350V		2S/T: 300-400V	
Ad 76	75	prevention operation voltage level	RegenAvd Level	700V		4T: 600-800V	V
	76	Press regeneration prevention compensation frequency limit	CompFreq Limit	1.00(Hz)		0.00– 10.00Hz	Hz
	77	Press regeneration prevention P gain	RegenAvd Pgain	50.0(%)		0.0-100.0%	%
	78	Press regeneration prevention I gain	RegenAvd Igain	500(ms)		20–30000ms	ms

Press Regeneration Prevention Setting Details

1 1 055 Regeneration 1	revention setting betans
Code	Description
Ad.74 RegenAvd Sel	Frequent regeneration voltage from a press load during constant speed motor operation may force excessive work on the brake unit which may damage or shorten the brake life. To prevent this situation, select Ad.74 (RegenAvd Sel) to control DC link voltage and disable the brake unit operation.
Ad.75 RegenAvd Level	Set brake operation prevention level voltage when the DC link voltage goes up due to regeneration.
Ad.76 CompFreq Limit	Set alternative frequency width that can replace actual operation frequency during regeneration prevention.
Ad.77 RegenAvd Pgain, Ad.78 RegenAvd Igain	To prevent regeneration zone, set P gain/I gain in the DC link voltage supress PI controller.





Note

Press regeneration prevention does not operate during accelerations or decelerations, but it only operates during constant speed motor operation. When regeneration prevention is activated, output frequency may change within the range set at Ad.76 (CompFreq Limit).

5.34 Analog Output

An analog output terminal provides output of 0-10V voltage, 4-20mA current, or 0-32kHz pulse.

5.34.1 Voltage and Current Analog Output

An output size can be adjusted by selecting an output option at AO(Analog Output) terminal. Set the analog voltage/current output terminal setting switch (SW3) to change the output type (voltage/current).

AO1: 0-10 V Voltage / 4-20 mA Current Output

Group	Code	Name LCD Display Parameter Setting S		Setting Range	Unit		
	01	Analog output1	AO1 Mode	0	Frequency	0–15	-
	02	Analog output1 gain	AO1 Gain	100.0		-1000.0-1000.0	%
	03	Analog output1 bias	AO1 Bias	0.0		-100.0–100.0	%
OU	04	Analog output1 filter	AO1 Filter	5		0-10000	ms
	05	Analog constant output1	AO1 Const %	0.0		0.0-100.0	%
	06	Analog output1 monitor	AO1 Monitor	0.0		0.0-1000.0	%



Learning Advanced Features

AO2: 0-10 V Current output [0034 model only]

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	07	Analog output2	AO2 Mode	0 Frequency (0–15	-
	08	Analog output2 gain	AO2 Gain	100.0		-1000.0–1000.0	%
	09	Analog output 2 bias	AO2 Bias	0.0		-100.0–100.0	%
OU	10	Analog output2 filter	AO2 Filter	5		0-10000	ms
	11	Analog constant output2	AO2 Const %	0.0		0.0-100.0	%
12		Analog output2 monitor	AO2 Monitor	0.0		0.0-1000.0	%

Voltage and Current Analog Output Setting Details

Code	Desc	cription				
	Selec	ct a constant v	value for output. The following example for output voltage setting.			
	Set	ting	Function			
	0	Frequency	Outputs operation frequency as a standard. 10V output is made from the frequency set at dr.20(Max Freq)			
	1	Output Current	10V output is made from 200% of inverter rated current (heavy load).			
	2	Output Voltage	Sets the outputs based on the inverter output voltage. 10V output is made from a set voltage in bA.15 (Rated V). If 0V is set in bA.15, 2S/T and 4T models output 10V based on the actual input voltages (240V and 480V respectively).			
	3 DC Link Outputs inverter DC link voltage as a standard. Volt Outputs 10V when the DC link voltage is 410Vdc for 2S/1 and 820Vdc for 4T models.					
OU.01 AO1	4	Torque	Outputs the generated torque as a standard. Outputs 10V 250% of motor rated torque.			
Mode	5	Ouput Monitors output wattage. 200% of rated output is the max display voltage (10V).				
	6	Idse	Outputs the maximum voltage at 200% of no load current.			
	7	Iqse	Outputs the maximum voltage at 250% of rated torque current			
			$rated\ torque\ current = \sqrt{rated\ current^2 - no\ load\ current^2}$			
	8	Target Freq	Outputs set frequency as a standard. Outputs 10V at the maximum frequency (dr.20).			
	9	Ramp	Outputs frequency calculated with Acc/Dec function as a			
		Freq	standard. May vary with actual output frequency. Outputs 10V.			
	12	PID Ref	Outputs command value of a PID controller as a standard.			
		Value	Outputs approximately 6.6V at 100%.			
	13	PID Fdk	Outputs feedback volume of a PID controller as a standard.			
		Value	Outputs approximately 6.6V at 100%.			
	14	PID	Outputs output value of a PID controller as a standard. Outputs			



	Οι	utput	approximately 10V at 100%.			
	15 Cc	nstan				
			t value and offset. If frequency is selected as an output item, it will wn below.			
	$A01 = \frac{F}{}$	requ MaxF	$\frac{ency}{creq} \times AO1 \ Gain + AO1 \ Bias$			
	OU.02 (A	.O1 Ga	ow illustrates the analog voltage output (AO1) changes depend on ain) and OU.3 (AO1 Bias) values. Y-axis is analog output voltage (0-10V), value of the output item.			
			e maximum frequency set at dr.20 (Max Freq) is 60Hz and the present ncy is 30Hz, then the x-axis value on the next graph is 50%.			
OU.02			OU.02 AO1 Gain			
AO1			100.0% (Factory default) 80.0%			
Gain, OU.03 AO1 Bias		0.0% Factory default	10V 8V 5V 0% 50% 80% 100% 0% 50% 80% 100%			
		20.0%	10V 7V 2V 0% 50% 80% 100% 0% 50% 80% 100%			
OU.04 AO1 Filter	Set filter	time o	constant on analog output.			
OU.05 A01 Const %	0		ut at OU.01 (AO1 Mode) is set to 15(Constant), the analog voltage endent on the set parameter values (0-100%).			
OU.06 AO1 Monitor	Monitors analog output value. Displays the maximum output voltage as a percentage (%) with 10V as the standard.					



5.34.2 Analog Pulse Output

Output item selection and pulse size adjustment can be made for the TO (Pulse Output) terminal.

Group	Code	Name	LCD Display		ameter ting	Setting Range	Unit
	33	Multi-function output 1	Q1 define	38	TO	0-38	-
	61	Pulse output setting	TO Mode	0	Frequency	0–15	-
	62	Pulse output gain	TO Gain	100	0.0	-1000.0 – 1000.0	%
OU	63	Pulse output bias	TO Bias	0.0		-100.0-100.0	%
OU	64	Pulse output filter	TO Filter	5		0-10000	ms
	65	Pulse output constant output2	TO Const %	0.0		0.0-100.0	%
	66	Pulse output monitor	TO Monitor	0.0		0.0-1000.0	%

Analog Pulse Output Setting Details

Code	Description
OU.33 Q1 Define	In case of IP66 models, pulse output TO and multi-function output Q1 share the same terminal. Set OU.33 to 32kHz pulse output and follow the instructions below to make wiring connections that configure the open collector output circuit. 1. Connect a 1/4W, 560Ω resistor between VR and Q1 terminals. 2. Connect EG and CM terminals. When wiring the resistor, a resistance of 560Ω or less is recommended to stably provide 32kHz pulse output. S+ S- SG VR V1 CM P4 P5 CM SA SB SC P4 P5 CM SA SB SC A1 B1 C1 Q1 EG 24 P1 P2 P3 A1 B1 C1 Q1 EG 24 P1 P2 P3 A1 B1 C1 Q1 EG 24 P1 P2 P3 A1 B1 C1 Q1 EG 24 P1 P2 P3



When connecting to a pulse between the Sinus H inverters, please connect pulse output(Q1-EG) to pulse input(TI-CM) directly without resistor and wire.

- IP20 model ↔ IP20 model: Connect TO → TI, CM → CM
- IP66 model ↔ IP66 model: Connect Q1 → P5, EG → CM
- IP20 model ↔ IP66 model: Not supported.

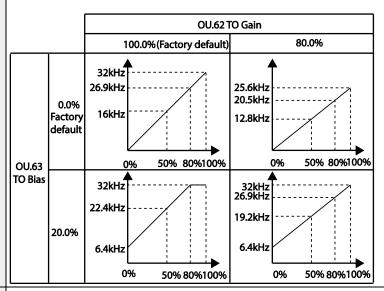
Adjusts output value and offset. If frequency is selected as an output, it will operate as shown below.

$$TO = \frac{Frequency}{MaxFreq} \times TO Gain + TO Bias$$

The following graph illustrates that the pulse output (TO) changes depend on OU.62 (TO Gain) and OU.63 (TO Bias) values. The Y-axis is an analog output current(0-32kHz), and X-axis is % value on output item.

For example, if the maximum frequency set with dr.20 (Max Freq) is 60Hz and present output frequency is 30Hz, then the x-axis value on the next graph is 50%.

OU.62 TO Gain, OU.63 TO Bias



OU.64 TO Filter Sets filter time constant on analog output.

OU.65 TO Const % If analog output item is set to constant, the analog pulse output is dependent on the set parameter values.

OU.66 TO Monitor Monitor analog output value. Displays the maximum output pulse (32kHz) as a percentage (%) of the standard.

Learning Advanced Features

Note

OU.08 AO2 Gain and OU.09 AO2 Bias Tuning Mode on 4-20mA output

- 1 Set OU.07 (AO2 Mode) to constant, and set OU.11 (AO2 Const %) to 0.0 %.
- 2 Set OU.09 (AO2 Bias) to 20.0% and then check current output. 4mA output should be displayed.
- If the value is less than 4mA, gradually increase OU.09 (AO2 Bias) until 4mA is measured. If the value is more than 4mA, gradually decrease OU.09 (AO2 Bias) until 4mA is measured.
- 4 Set OU.11 AO2 Const % to 100.0%

 Set OU.08 (AO2 Gain) to 80.0% and measure current output at 20mA. If the value is less than 20mA, gradually increase OU.08 (AO2 Gain) until 20mA is measured. If the value is more than 20mA, gradually decrease OU.08 (AO2 Gain) until 20mA is measured.

The functions for each code are identical to the descriptions for the 0-10V voltage outputs with an output range 4-20mA.

5.35 Digital Output

5.35.1 Multi-function Output Terminal and Relay Settings

Group	Code	Name	LCD Display	Para Set	ameter ting	Setting Range	Unit
OU	30	Fault output item	Trip Out Mode	010	*	-	bit
	31	Multi-function relay1 setting	Relay 1	29	Trip	-	-
	33	Multi-function output1 setting	Q1 Define	14	Run	-	-
	41	Multi-function output monitor	DO Status	-		00–11	bit
	57	Detection frequency	FDT Frequency	30.00		0.00-	
	58	Detection frequency band	FDT Band	d 10.00		Maximum frequency	Hz
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal configuration	Px Define(Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	16	Exchange	-	-

^{*}Displayed as Displayed as Displayed as Displayed as Displayed as Displayed Displayed



Multi-function Output Terminal and Relay Setting Details



3	FDT-3	Outputs a signal when the Absolute value (output frequency-operation frequency) < detected frequency width/2. Detected frequency width is 10Hz. When detected frequency is set to 30Hz, FDT-3 output is as shown in the graph below. 35Hz Frequency Q1 Run cmd
4	FDT-4	Output signal can be separately set for acceleration and deceleration conditions. In acceleration: Operation frequency Detected frequency In deceleration: Operation frequency-Detected frequency width/2) Detected frequency width is 10Hz. When detected frequency is set to 30Hz, FDT-4 output is as shown in the graph below. 30Hz Frequency Q1 Run cmd
5	Overload	Outputs a signal at motor overload.
6	IOL	Outputs a signal when a fault is triggered from a protective function operation by inverter overload inverse proportion.
7	Underload	Outputs a signal at load fault warning.
8	Fan Warning	Outputs a signal at fan fault warning.
9	Stall	Outputs a signal when a motor is overloaded and stalled.



 1	ı	
10	Over voltage	Outputs a signal when the inverter DC link voltage
		rises above the protective operation voltage.
11	Low Voltage	Outputs a signal when the inverter DC link voltage drops below the low voltage protective level.
12	Over Heat	Outputs signal when the inverter overheats.
13	Lost	Outputs a signal when there is a loss of analog
	command	input terminal and RS-485 communication
		command at the terminal block.
		Outputs a signal when communication power and
		expansion an I/O power card is installed, and also
		outputs a signal when losing analog input and
		communication power commands.
14	RUN	Outputs a signal when operation command is
		entered and the inverter outputs voltage.
		No signal output during DC braking.
		Frequency
		Q1
		Run cmd
		<u>Null Cilid</u>
15	Stop	Outputs a signal at operation command off, and
		when there is no inverter output voltage.
16	Steady	Outputs a signal in steady operation.
	,	
17	Inverter line	Outputs a signal while the motor is driven by the
		inverter line.
18	Comm line	Outputs a signal while the motor is driven by a
		commercial power source. For details, refer to <u>5.19</u>
		Supply Power Transition on page 243.
19	Speed search	Outputs a signal during inverter speed search
		operation.
		For details, refer to <u>5.15 Speed Search</u> Operation on
22	Doody	page <u>234.</u>
22	Ready	Outputs signal when the inverter is in stand by
		operation and ready to receive an external operation command.
28	Timer Out	A timer function to operate terminal output after a
20	Timer Out	certain time by using multi-function terminal block
		input. For more details, refer to <u>5.30 Timer Settings</u> on
		page <u>253</u> .
29	Trip	Outputs a signal after a fault trip
	"	Refer to <u>5.32 Multi-Function Output On/Off Control</u>
		on page <u>256</u> .



Learning Advanced Features

31	DB Warn %ED	Refer to <u>6.2.5 Dynamic Braking (DB) Resistor</u>
		<u>Configuration</u> on page <u>286</u> .
34	On/Off	Outputs a signal using an analog input value as a
	Control	standard.
		Refer to <u>5.32 Multi-Function Output On/Off Control</u>
		on page <u>256</u> .
35	BR Control	Outputs a brake release signal.
		Refer to <u>5.31 Brake Control</u> on page <u>254</u> .

5.35.2 Fault Trip Output using Multi-Function Output Terminal and Relay

The inverter can output fault trip state using multi-function output terminal (Q1) and relay (Relay 1).

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
	30	Fault trip output mode	Trip Out Mode	010		-	bit
	31	Multi-function relay1	Relay 1	29	Trip	-	-
\cap II	33	Multi-function output1	Q1 Define	14	Run	-	-
OU	53	Fault trip output on delay	TripOut OnDly	0.00		0.00–100.00	sec
	54	Fault trip output off delay	TripOut OffDly	0.00		0.00–100.00	sec



Fault Trip Output by Multi-function Output Terminal and Relay - Setting Details

Code	Description						
	Fault trip relay operates based on the fault trip output settings.						
	Item		bit on	bit off			
	Кеура	d					
	LCD keypad	b					
OU.30 Trip Out Mode	OU. 31, and rela	Select fault trip output terminal/relay and select 29(Trip Mode) at codes OU. 31, 33. When a fault trip occurs in the inverter, the relevant terminal and relay will operate. Depending on the fault trip type, terminal and relay operation can be configured as shown in the table below.					
	Setting			Function			
	bit3	bit2	bit1				
			✓	Operates when low voltage fault trips occur			
		√		Operates when fault trips other than low voltage occur			
	✓			Operates when auto restart fails (Pr. 08-09)			
OU.31 Relay1	Set relay	y outpu	it (Relay 1	1).			
OU.33 Q1 Define	Select output for multi-function output terminal (Q1). Q1 is open collector TR output.						
OU.53 TripOut On Dly, OU.54 TripOut OffDly	time de	If a fault trip occurs, trip relay or multi-function output operates after the time delay set in OU.53. Terminal is off with the input initialized after the time delay set in OU.53.					

5.35.3 Multi-function Output Terminal Delay Time Settings

Set on-delay and off-delay times separately to control the output terminal and relay operation times. The delay time set at codes OU.50-51 applies to multi-function output terminal (Q1) and relay (Relay 1), except when the multi-function output function is in fault trip mode.

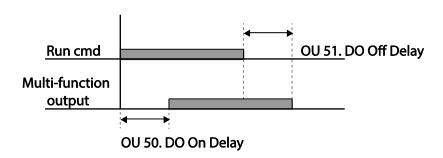
Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
OU	50	Multi-function output On delay	DO On Delay	0.00	0.00-100.00	S
	51	Multi-function output Off delay	DO Off Delay	0.00	0.00-100.00	S
	52	Select multi-function output terminal	DO NC/NO Sel	00*	00-11	bit

^{*} Displayed as Displayed as Displayed as Displayed as Displayed as Displayed Displayed



Output Terminal Delay Time Setting Details

Code	Description						
OU.52 DO NC/NO Sel	Select terminal type for relay and multi-function output terminal. An additional three terminal type selection bits at the terminal block will be added when an expansion I/O is added. By setting the relevant bit to 0, it will operate A terminal (Normally Open), and setting it to 1 will operate B terminal (Normally Closed). Shown below in the table are Relay 1 and Q1 settings starting from the right bit.						
	Item	bit on	bit off				
	Keypad						
	LCD keypad						



5.36 Keypad Language Settings

The language to be displayed on the LCD keypad is English only.

Group	Code	Name	LCD Display	Parame Setting		Setting Range	Unit
CNF*	01	Select keypad language	Language Sel	0	English	0: English	-

^{*} Available on LCD keypad only.



5.37 Operation State Monitor

The inverter's operation condition can be monitored using the LCD keypad. If the monitoring option is selected in config (CNF) mode, a maximum of four items can be monitored simultaneously. Monitoring mode displays three different items on the LCD keypad, but only one item can be displayed in the status window at a time.

Group	Code	Name	LCD Display			Setting Range	Unit
	20	Display item condition display window	Anytime Para	0	Frequency	-	-
	21	Monitor mode display 1	Monitor Line- 1	0	Frequency	-	Hz
CNF*	22	Monitor mode display 2	Monitor Line- 2	2	Output Current	-	А
	23	Monitor mode display 3	Monitor Line- 3	3	Output Voltage	-	V
	24	Monitor mode initialize	Mon Mode Init	0	No	-	-

^{*}Available on LCD keypad only.

Operation State Monitor Setting Details

Code	Descr	iption					
	Select items to display on the top-right side of the LCD keypad screen. Choose the parameter settings based on the information to be displayed. Codes CNF-20–23 share the same setting options as listed in the table below.						
	Setti	ing	Function				
	0	Frequency	On stop, displays the set frequency. During operation, displays the actual output frequency (Hz).				
CNF-20 AnyTime Para	1	Speed	On stop, displays the set speed (rpm). During operation, displays the actual operating speed (rpm).				
	2	Output Current	Displays output current.				
	3	Output Voltage	Displays output voltage.				
	4	Output Power	Displays output power.				
	5	WHour Counter	Displays inverter power consumption.				
	6	DCLink	Displays DC link voltage within the inverter.				



Learning Advanced Features

		Valtaga				
		Voltage	D'ante e la la la contrata de la contrata del contrata del contrata de la contrata de la contrata de la contrata de la contrata del contrat			
	7	DI Status	Displays input terminal status of the			
			terminal block. Starting from the right,			
		5.0.0.	displays P1-P8.			
	8	DO Status	Displays output terminal status of the			
			terminal block. Starting from the right,			
			Relay1, Relay2, and Q1.			
	9	V1 Monitor[V]	Displays the input voltage value at terminal			
			V1 (V).			
	10	V1 Monitor[%]	Displays input voltage terminal V1 value as			
			a percentage. If -10V, 0V, +10V is measured,			
			-100%, 0%, 100% will be displayed.			
	13	V2 Monitor[V]	Displays input voltage terminal V2 value			
			(V).			
	14	V2 Monitor[%]	Displays input voltage terminal V2 value as			
			a percentage.			
	15	12	Displays input current terminal I2 value (A).			
	10	Monitor[mA]	Displays input current terminariz value (11).			
	16	I2 Monitor[%]	Displays input current terminal 12 value as			
	10	12 1010111101 [70]	a percentage.			
	17	DID Output	Displays output of PID controller.			
		PID Output				
	18	PID Ref Value	Displays reference value of PID controller.			
	19	PID Fdb Value	Displays feedback volume of PID controller.			
	20	Torque	If the torque reference command mode			
			(DRV-08) is set to a value other than			
			keypad (0 or 1), the torque reference value			
			is displayed.			
	21	Torque Limit	If torque limit setting (Cn.53) is set to a			
			value other than keypad (0 or 1), the			
			torque limit value is displayed.			
	23	Spd Limit	If the speed limit setting (Cn.62) on torque			
		,	control mode is set to a value other than			
			keypad (0 or 1), the speed limit setting is			
			displayed.			
	Select	the items to be a	displayed in monitor mode. Monitor mode is			
CNF-21-23 Monitor Line-			e when the inverter is powered on. A total of			
X						
X	three items, from monitor line-1 to monitor line-3, can be displayed simultaneously.					
CNE 24 Map Mada Init	,					
CNF-24 Mon Mode Init	Selecting 1(Yes) initializes CNF-20-23.					



Note

Inverter power consumption

Values are calculated using voltage and current. Electric power is calculated every second and the results are accumulated. Setting CNF-62 (WH Count Reset) value to 1(Yes) will reset cumulated electric energy consumption. Power consumption is displayed as shown below:

- Less than 1,000 kW: Units are in kW, displayed in 999.9 kW format.
- 1–99 MW: Units are in MW, displayed in 99.99 MWh format.
- 100–999 MW: Units are in MW, displayed in 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 65,535MW will reset the value to 0, and units will return to kW. It will be displayed in 999.9 kW format).

5.38 Operation Time Monitor

Monitors inverter and fan operation time.

Group	Code	Name	LCD Display			Setting Range	Unit
	70	Inverter operation accumulated time	On-time	0/00	/00 00:00	-	min
	71	Inverter operation accumulated time	Run-time	0/00	/00 00:00	-	min
CNF*	72	Inverter operation accumulated time initialization	Time Reset	0	No	0–1	-
	74	Cooling fan operation accumulated time	Fan time	0/00	0/00 00:00	-	min
	75	Cooling fan operation accumulated time initialization	Fan Time Reset	0	No	0–1	-

^{*}Available on LCD keypad only.



Learning Advanced Features

Operation Time Monitor Setting Details

Code	Description
CNF-70 On-time	Displays accumulated power supply time. Information is displayed in [YY/MM/DD Hr: Min (0/00/00 00: 00)] format.
CNF-71 Run-time	Displays accumulated time of voltage output by operation command input. Information is displayed in [YY/MM/DD Hr: Min (0/00/00 00: 00)] format.
CNF-72 Time Reset	Setting 1(Yes) will delete power supply accumulated time (On-time) and operation accumulated time (Run-time) and is displayed as 0/00/00 00:00 format.
CNF-74 Fan time	Displays accumulated time of inverter cooling fan operation. Information will be displayed in [YY/MM/DD Hr: Min (0/00/00 00: 00)] format.
CNF-75 Fan Time Reset	Setting 1(Yes) will delete cooling fan operation accumulated time(ontime) and operation accumulated time (Run-time) and will display it in 0/00/00 00:00 format.



6 Learning Protection Features

Protection features provided by the Sinus H series inverter are categorized into two types: protection from overheating damage to the motor, and protection against the inverter malfunction.

6.1 Motor Protection

6.1.1 Electronic Thermal Motor Overheating Prevention (ETH)

ETH is a protective function that uses the output current of the inverter without a separate temperature sensor, to predict a rise in motor temperature to protect the motor based on its heat characteristics.

Group	Code	Name	LCD Display			Setting range	Unit
Pr	40	Electronic thermal prevention fault trip selection	ETH Trip Sel	0	None	0-2	-
	41	Motor cooling fan type	Motor Cooling	0	Self-cool	-	-
	42	Electronic thermal one minute rating	ETH 1min	150		120-200	%
	43	Electronic thermal prevention continuous rating	ETH Cont	120		50-150	%

Electronic Thermal (ETH) Prevention Function Setting Details

Code	Des	Description					
Pr.40 ETH Trip Sel		ETH can be selected to provide motor thermal protection. The LCD screen displays "E-Thermal."					
	Set	ting	Function				
	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.				



Code	Description				
Pr.41 Motor Cooling		mode of the cooling fan, attached to the motor.			
3					
	Setting	Function			
	0 Self-cool	As the cooling fan is connected to the motor axis,			
		the cooling effect varies, based on motor speed. Most universal induction motors have this design.			
	1 Forced-	Additional power is supplied to operate the cooling			
	cool	fan. This provides extended operation at low speeds.			
		Motors designed for inverters typically have this			
		design.			
	Continuous				
	rated current (%)			
	100	Pr.41=1			
	95	Pr.41=0			
		F1.41=0			
	65				
		Frequency (Hz)			
		20 60			
Pr.42 ETH 1 min		input current that can be continuously supplied to the oute, based on the motor-rated current (bA.13).			
Pr.43 ETH Cont		it of current with the ETH function activated. The range			
		ne set values that can be used during continuous			
	operation without the protection function.				
	Current				
	l l l				
	Pr.42				
	Pr.43				
		60 ETH trip time (seconds)			



6.1.2 Overload Early Warning and Trip

A warning or fault 'trip' (cutoff) occurs when the motor reaches an overload state, based on the **motor's** rated current. The amount of current for warnings and trips can be set separately.

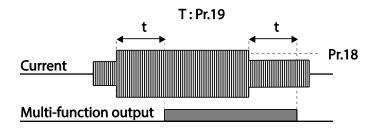
Group	Code	Name	LCD Display			Setting range	Unit
Pr	04	Load level setting	Load Duty	1	Heavy Duty	-	-
	17	Overload warning selection	OL Warn Select	1	Yes	0-1	-
	18	Overload warning level OL Warn Leve		150		30-180	%
	19	Overload warning time	OL Warn Time	10.0		0-30	S
	20	Motion at overload trip	OL Trip Select	1	Free-Run	-	-
	21	Overload trip level	OL Trip Level	180		30-200	%
	22	Overload trip time	OL Trip Time	60.0		0-60.0	S
OU	31	Multi-function relay 1 item	Relay 1	5	Over Load	-	-
	33	Multi-function output 1 item	Q1 Define				

Overload Early Warning and Trip Setting Details

Code	Desc	Description					
Pr.04 Load Duty	Select the load level.						
	Set	ting	Function				
		Normal	Used in underloads, like fans and pumps (overload				
	0	Duty	tolerance: 120% of rated underload current for 1 minute).				
			Used in heavy loads, like hoists, cranes, and parking				
	1	Heavy Duty	devices (overload tolerance: 150% of rated heavy load current for 1 minute).				
Pr.17 OL Warn	If the	e overload read	ches the warning level, the terminal block multi-function				
Select			d relay are used to output a warning signal. If 1 (Yes) is				
			erate. If 0 (No) is selected, it will not operate.				
Pr.18 OL Warn			rrent to the motor is greater than the overload warning				
Level,	I	•	el) and continues at that level during the overload				
Pr.19 OL Warn Time	I	,	Varn Time), the multi-function output (Relay 1, Q1) sends				
	a wa	rning signal. W	/hen Over Load is selected at OU.31 and 33, the multi-				
	func	tion output tei	rminal or relay outputs a signal. The the signal output				
	does	not block the	inverter output.				



Code	Description						
Pr.20 OL Trip Select	Select the inverter protective action in the event of an overload fault trip.						
	Set	ting	Function				
	0	None	No protective action is taken.				
	1	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	Dec	If a fault trip occurs, the motor decelerates and stops.				
Pr.21 OL Trip Level,	Whe	n the current s	supplied to the motor is greater than the preset value at				
Pr.22 OL Trip Time	the	overload trip le	vel (OL Trip Level) and continues to be supplied during				
	the overload trip time (OL Trip Time), the inverter output is either blocked						
	acco	rding to the pr	reset mode from Pr. 17 or slows to a stop after				
	dece	eleration.	·				



Note

Overload warnings warn of an overload before an overload fault trip occurs. The overload warning signal may not work in an overload fault trip situation, if the overload warn level (OL Warn Level) and the overload warn time (OL Warn Time) are set higher than the overload trip level (OL Trip Level) and overload trip time (OL Trip Time).

6.1.3 Stall Prevention and Flux Braking

The stall prevention function is a protective function that prevents motor stall caused by overloads. If a motor stall occurs due to an overload, the inverter operation frequency is adjusted automatically. When stall is caused by overload, high currents are induced in the motor may cause motor overheat or damage the motor and interrupt operation of the motor-driven devices.

To protect the motor from overload faults, the inverter output frequency is adjusted automatically, based on the size of load.





Group	Code	Name	LCD Display	Param Settin		Setting range	Unit
Pr	50	Stall prevention and flux braking	Stall Prevent	Stall Prevent 0000*		-	bit
	51	Stall frequency 1	Stall Freq 1	50.00		Start frequency– Stall Freq 1	Hz
	52	Stall level 1	Stall Level 1	180		30-250	%
	53	Stall frequency 2	Stall Freq 2	50.00		Stall Freq 1–Stall Freq 3	Hz
	54	Stall level 2	Stall Level 2	180		30-250	%
	55	Stall frequency 3	Stall Freq 3	50.00		Stall Freq 2-Stall Freq 4	Hz
	56	Stall level 3	Stall Level 3	180		30-250	%
	57	Stall frequency 4	Stall Freq 4	50.00		Stall Freq 3– Maximum frequency	Hz
	58	Stall level 4	Stall Level 4	180		30-250	%
OU	31	Multi-function relay 1 item	Relay 1	9 Sta	III	-	-
	33	Multi-function output 1 item	Q1 Define				

^{*} The value is displayed on the keypad as a larger larger.

Stall Prevention Function and Flux Braking Setting Details

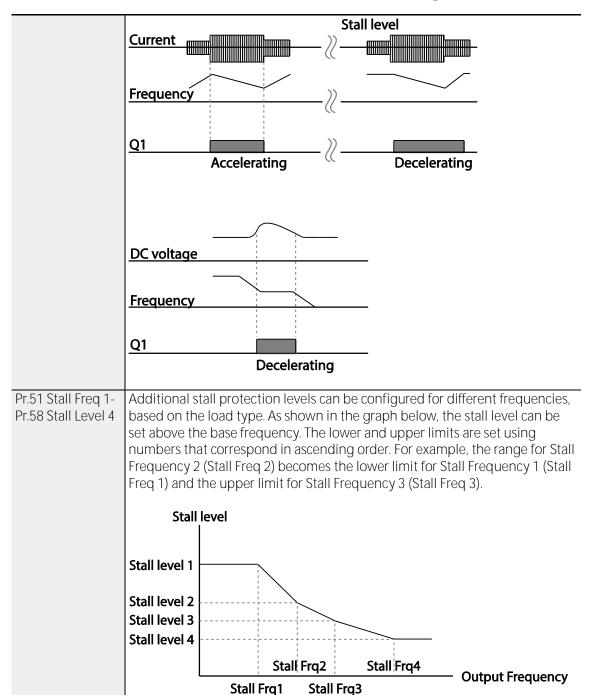
Code	Descripti	on				
Pr.50 Stall Prevent	operating correspor	Stall prevention can be configured for acceleration, deceleration, or while operating a motor at constant speed. When the top LCD segment is on, the corresponding bit is set. When the bottom LCD segment is on, the				
	correspor				D. (0.5)	
	Item	<u></u>	<u> 3it Status (C</u>)n)	Bit Status (Off)	
	Keypad	Į Q				
	LCD key	pad				
	Setting				Function	
	Bit 4	Bit 3	Bit 2	Bit 1		
				✓	Stall protection during acceleration	
			✓		Stall protection while operating at	
					a constant speed	
		✓			Stall protection during	
					deceleration	



Learning Protection Features

	1	
✓		Flux braking during deceleration
Settin	9	Function
0001	Stall protection during acceleration	If inverter output current exceeds the preset stall level (Pr. 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 (dr.19). If the current level causes deceleration below the preset level while operating the stall protection function, the motor resumes acceleration.
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.
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.
1000	Flux braking during deceleration	When using flux braking, deceleration time may be reduced because regenerative energy is expended at the motor.
1100	Stall protection and flux braking during deceleration	Stall protection and flux braking operate together during deceleration to achieve the shortest and most stable deceleration performance.







Note

Stall protection and flux braking operate together only during deceleration. Turn on the third and fourth bits of Pr.50 (Stall Prevention) to achieve the shortest and most stable deceleration performance without triggering an overvoltage 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 may be damaged easily.

① Caution

- Use caution when decelerating while using stall protection as depending on the load, the deceleration time can take longer than the time set. 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.

6.2 Inverter and Sequence Protection

6.2.1 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 output may cause the motor to stall, due to a lack of torque.

Group	Code	Name	LCD Display	Parameter Setting	Setting range	Unit
Pr	05	Input/output open- phase protection	Phase Loss Chk	10*	-	bit
	06	Open-phase input voltage band	IPO V Band	40	1-100V	V

^{*} The value is displayed on the keypad as





Input and Output Open-phase Protection Setting Details

Code	Description			
Pr.05 Phase Loss Chk, Pr.06 IPO V Band	When open-phase protection is operating, input and output configurations are displayed differently. When the top LCD segment is On he corresponding bit is set to On. When the bottom LCD segment is On, he corresponding bit is set to Off.			
	Item	Bit status (On)	Bit status (Off)	
	Keypad			
	LCD keypad			
	Setting		Function	
	Bit 2	Bit 1		
		✓	Output open-phase protection	
	✓		Input open-phase protection	

6.2.2 External Trip Signal

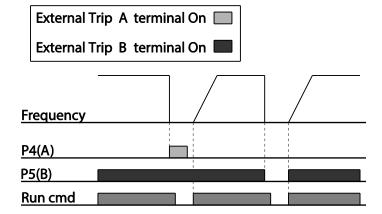
Set one of the multi-function input terminals to 4 (External Trip) to allow the inverter to stop operation when abnormal operating conditions arise.

Group	Code	Name	LCD Display	Parai Setti	meter ng	Setting range	Unit
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal setting options	Px Define (Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	4	External Trip	-	-
	87	Multi-function input contact selction	DI NC/NO Sel			-	bit

Learning Protection Features

External Trip Signal Setting Details

Code	Descriptio	n										
Sel	Selects the (0), it opera	tes as	an À c	contac	t (Nor	mally	Open)					
	operates as The corresp							s follov	VS:			
	Bit	11	10	9	8	7	6	5	4	3	2	1
	Terminal					P7	P6	P5	P4	P3	P2	P1



6.2.3 Inverter Overload Protection

When the inverter input current exceeds the rated current, a protective function is activated to prevent damages to the inverter based on inverse proportional characteristics.

Group	Code	Name	LCD Display	Paramet	er Setting	Setting range	Unit
OU	31	Multi-function relay 1	Relay 1	6	IOL	-	-
	33	Multi-function output 1	Q1 Define				

Note

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%, 36sec).



6.2.4 Speed Command Loss

When setting operation speed using an analog input at the terminal block, communication options, or the keypad, 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	Name	LCD Display	Parar Setti	meter ng	Setting range	Unit
Pr	12	Speed command loss operation mode	Lost Cmd Mode	1	Free-Run	-	-
	13	Time to determine speed command loss	Lost Cmd Time	1.0		0.1-120	S
	14	Operation frequency at speed command loss	Lost Preset F	0.00		Start frequency– Max. frequency	Hz
	15	Analog input loss decision level	Al Lost Level	0	Half of x1		-
OU	31	Multi-function Relay 1	Relay 1	13	Lost Command	-	-
	33	Multi-function output 1	Q1 Define				

Speed Command Loss Setting Details

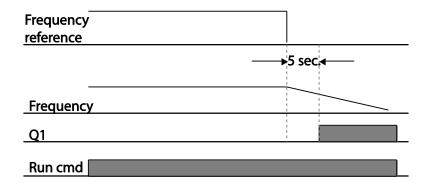
Code	Descri	ption	
Pr.12 Lost Cmd	In situa	itions when spee	d commands are lost, the inverter can be
Mode	configu	ured to operate ir	n a specific mode:
	Settin	ıg	Function
	0	None	The speed command immediately becomes the operation frequency without any protection function.
	1	Free-Run	The inverter blocks output. The motor performs in free-run condition.
	2	Dec	The motor decelerates and then stops at the time set at Pr.07 (Trip Dec Time).
	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.



Learning Protection Features

Code	Descrip	otion	
	5	Lost Preset	The inverter operates at the frequency set at Pr. 14 (Lost Preset F).
Pr.15 Al Lost Level,	_		nd decision time for speed command loss when
Pr.13 Lst Cmd Time		nalog input.	
	Setting	,	Function
	0	Half of x1	Based on the values set at In.08 and In.12, protective operation starts when the input signal is reduced to half of the initial value of the analog input set using the speed command (Frq code of Operation group) and it continues for the time (speed loss decision time) set at Pr. 13 (Lost Cmd Time). For example, set the speed command to 2 (V1) at the Frq code in the Operation group, and 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.
	1	Below x1	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 Pr.13 (Lost Cmd Time). Codes In.08 and In.12 are used to set the standard values.
Pr.14 Lost Preset F			ed commands are lost, set the operation mode
			o 5 (Lost Preset). This operates the protection equency so that the operation can continue.

Set Pr.15 (Al Lost Level) to 1 (Below x 1), Pr.12 (Lost Cmd Mode) to 2 (Dec), and Pr.13 (Lost Cmd Time) to 5 sec. Then it 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 Pr.13 (Lost Cmd Time) is passed.

6.2.5 Dynamic Braking (DB) Resistor Configuration

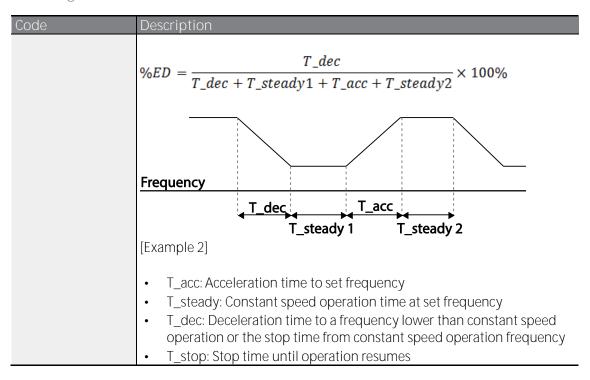
For Sinus H series, the braking resistor circuit is integrated inside the inverter.

Group	Code	Name	LCD Display	Parar	neter Setting	Setting range	Unit
Pr	66	Braking resistor configuration	DB Warn %ED	10		0-30	%
OU	31	Multi-function relay 1 item	Relay 1	31	DB Warn %ED	-	-
		Multi-function output 1 item	Q1 Define				

Dynamic Braking Resistor Setting Details

Code	Description
Pr.66 DB Warn %ED	Set 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:
	$\%ED = \frac{T_dec}{T_acc + T_steady + T_dec + T_stop} \times 100\%$
	Frequency
	T_acc T_steady 1 T_dec T_stop [Example 1]

Learning Protection Features



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.

6.3 Under load Fault Trip and Warning

Group	Code	Name	LCD Display	Param	neter Setting	Setting range	Unit
Pr	04	Load level selection	Load Duty	0	Normal Duty	-	
	25	Under load	UL Warn Sel	1	Yes	0-1	-
		warning selection					
	26	Under load	UL Warn	10.0		0-600	sec
		warning time	Time				
	27	Under load trip	UL Trip Sel	1	Free-Run	-	-
		selection					
	28	Under load trip	UL Trip Time	30.0		0-600	sec
		timer					
	29	Under load upper	UL LF Level	30		10-100	%
		limit level					
	30	Under load lower	UL BF Level	30	_	10-100	%
		limit level					



Under Load Trip and Warning Setting Details

Code	Description			
Pr.27 UL Trip Sel	Sets the underload fault trip occurs. If set to O(None), does not detect			
	the underload fault trip. If set to 1 (Free-Run), the output is blocked in			
	an underload fault trip situation. If set to 2 (Dec), the motor decelerates			
	and stops when an underload trip occurs.			
Pr.25 UL Warn Sel	Sets the underload warning options. Set to 1(Yes) and set the multi-			
	function output terminals (at OU-31 and 33) to 7 (Underload). The			
	warning signals are output when an underload condition arises.			
Pr.26 UL Warn Time,	The protection function operates when the underload level condition			
Pr.28 UL Trip Time	explained above is maintained for a set warning time or fault trip time.			
·	This function does not operate if energy-saving operation is activated			
	at Ad-50 (E-Save Mode).			
Pr.29 UL LF Level,	Setting Heavy Duty			
Pr.30 UL BF Level	- Do not support Pr.29.			
	- At Pr.30, the underload level is decided based on the motor's rated			
	current.			
	Content.			
	Output current			
	D: 20			
	Pr.30			
	Rated slip ×2 Output frequency			
	Setting Normal Duty			
	- At Pr.29, the under load rate is decided based on twice the operation			
	frequency of the motor's rated slip speed (bA.12 Rated Slip).			
	- At Pr.30, the under load rate is decided based on the base frequency set			
	at dr.18 (Base Freq). An upper limit and lower limit is based on the			
	inverter's rated current.			
	Output current			
	Pr.30			
	Pr.29 Output fraguency			
	Output frequency			
	Rated slip ×2 Base frequency			



Learning Protection Features

6.3.1 Fan Fault Detection

Group	Code	Name	LCD Display			Setting range	Unit
Pr		Cooling fan fault selection	FAN Trip Mode	1		Warning	
OU	31	Multi-function relay 1	Relay 1	8	FAN Warning		-
OU	33	Multi-function output 1	Q1 Define				

Fan Fault Detection Setting Details

Code	Descrip	otion						
Pr.79 FAN Trip Mode	Set the cooling fan fault mode.							
	Settin	g	Function					
	0	Trip	The inverter output is blocked and the fan trip is					
			displayed when a cooling fan error is detected.					
	1	Warning	When OU.33 (Q1 Define) and OU.31 (Relay1) are					
			set to 8 (FAN Warning), the fan error signal is					
			output and the operation continues.					
OU.33 Q1 Define,	When t	he code value is	set to 8 (FAN Warning), the fan error signal is					
OU.31 Relay1	output	and operation co	ontinues. However, when the inverter inside					
	temperature rises above a certain level, output is blocked due to activation							
	of overl	neat protection.	·					

6.3.2 Lifetime Diagnosis of Components

Registering a capacitance reference for inspection

Note

To perform a capacitor diagnosis, a capacitance reference must be measured and registered by setting Pr-61 (CAP Diag) to 1 (Ref Diag) when the inverter is used for the first time. The measured reference value is saved at Pr-63 and is used as the reference for the capacitor life diagnosis.

Refer to the following instructions to measure a reference capacitance.

- Set an appropriate capacitor diagnosis current based on the inverter's rated output at Pr-60 (CAP DiagCurr).
 - The capacitor diagnosis current is a direct current that is applied to the capacitor for inspection, and is defined asin a percentage of the rated inverter output. Because the



value is defined based on the inverter output, set an appropriate value if the motor has smaller rated current.

- 2 At Pr-62 (CAP Exchange Level), set the capacitor replacement warning level to a value between 50.0% and 95.0%
- 3 Set Pr-61 (CAP Diag) to "1" (Ref Diag). Then, the direct current set at Pr-60 (CAP DiagCurr) is output.
 - The capacitor diagnosis is only available when the inverter is stopped.
 - If Pr-61is set to 1 (Ref Diag), the displayed value at Pr-63 reflects 100% of the measured capacitance.
 - If you plan to perform a capacitor diagnosis using Pr-61(CAP Diag), the initial capacitance must be measured when the inverter is used for the first time. A capacitance measured on a used inverter leads to inaccurate inspection results due to an incorrect reference capacitance value.
- 4 Turn off the input to the inverter.
- 5 Turn on the inverter when a low voltage trip (LVT) occurs.
- 6 View the value displayed at Pr-63 (CAP Diag Level). When Pr-61 is set to "1" (Ref Diag), Pr-63 displays 100% of the capacitance.

[Main Capacitor Diagnosis details]

Group	Code	Name	LCD Display	Setting value	Se	etting Range	Unit
	60	Capacitance Diagnose current Level	CAP. DiagPerc	0.0	10	.0-100.0	%
		CAP. Diagnosis mode			0	None	
	61		CAP. Diag	0	1	Ref Diag	%
Pr					2	Pre Diag	
					3	Init Diag	
	62	CAP Exchange Level	CAP Exchange Level	0	50	.0 ~ 95.0	%
	63	CAP Diag Level	CAP Diag Level	0) ~ 100.0	%

Inspecting the capacitor life and initializing the capacitance reference

Refer to the following instructions to inspect the capacitor life and initialize the capacitance reference.



Note

To perform a capacitor diagnosis, a capacitance reference must be measured and registered by setting Pr-61 (CAP Diag) to 1 (Ref Diag) when the inverter is used for the first time. The measured reference value is registered at PRT-63, and is used as the reference for the capacitor life diagnosis.

- On an inverter whose run time has reached the cumulated time for capacitor replacement, set Pr-61 (CAP Diag) to 2 (Pre Diag).
- 2 Check the value displayed at Pr-63 (CAP Diag Level). If the value displayed at Pr-63 is smaller than the value set at Pr-62 (CAP. Level 1), a capacitor replacement warning (CAP Exchange) will occur.
- While the capacitor replacement warning continues, confirm that the first bit at Pr-89 (Inverter State) is set.
- 4 Set Pr-62 to 0.0%. The capacitor replacement warning (CAP Exchange) will be released.
- 5 Set Pr-61 to 3 (CAP. Init) and make sure that the value displayed at Pr-63has changed to 0.0%.

Lifetime diagnosis for fans

Enter the Pr-87(Fan exchange warning level) code (%). After the selected usage (%) is reached (out of 50,000 hours), the fan exchange warning message will appear in the multifunctional output or keypad.

The total fan usage level (%) appears at Pr-86. When exchanging fans, you may initialize the accumulated value to 0 by setting the CNF-75 (Initializing accumulated time for cooling fans) to 1.

Grou	Cod	Name	LCD Display	Setting value		Setting	Unit
Pr -	86	Accumulated percentof fan usage	FAN Time Perc	0.0		0.0-6553.5	%
	87	Fan exchange warning Level	FAN Exchange level	90.0		0.0-100.0	%
CNF*	75	Initialize operation	FAN Time Rst	0	No	-	-
		time of cooling fans		1	Yes		
	31	Multi-function relay 1	Relay 1		E		-
OU	32	Multi-function relay 2	Relay 2	38	FAN		
	33	Multi-function output 1	Q1 Define		Exchange		

^{*}Available on LCD keypad only.



6.3.3 Low Voltage Fault Trip

When inverter input power is lost and the internal DC link voltage drops below a certain voltage level, the inverter stops output and a low voltage trip occurs.

Group	Code	Name	LCD Display	Parameter Setting		Setting range	Unit
Pr	81	Low voltage trip decision delay time	LVT Delay	0.0		0-60	sec
OU	31	Multi-function relay 1	Relay 1	11	Low Voltage		-
	33	Multi-function output 1	Q1 Define				

Low Voltage Fault Trip Setting Details

Code	Description
j	If the code value is set to 11 (Low Voltage), the inverter stops the output first when a low voltage trip condition arises, then a fault trip occurs after the low voltage trip decision time is 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.

6.3.4 Output Block by Multi-Function Terminal

When the multi-function input terminal is set as the output block signal terminal and the signal is input to the terminal, then the operation stops.

Group	Code	Name	LCD Display	Para Setti	meter ng	Setting range	Unit
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal setting options	Px Define (Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	5	BX	-	-



Learning Protection Features

Output Block by Multi-Function Terminal Setting Details

Code	Description
In.65-71 (P1-P7 in	When the operation of the multi-function input terminal is set to 5 (BX)
IP20 models),	and is turned on during operation, the inverter blocks the output and 'BX'
In.65-69 (P1-P5 in	is displayed on the keypad display. While 'BX' is displayed on the keypad
IP66 models)	screen, the inverter's operation information including the operation
Px Define	frequency and current at the time of BX signal can be monitored. The
	inverter resumes operation when the BX terminal turns off and operation
	command is input.

6.3.5 Trip Status Reset

Restart the inverter using the keypad or analog input terminal, to reset the trip status.

Group	Code	Name	LCD Display			Setting range	Unit
In	65-71 in IP20 models, 65-69 in IP66 models	Px terminal setting options	Px Define (Px: P1-P7 in IP20 models, P1-P5 in IP66 models)	3	RST	-	-

Trip Status Reset Setting Details

Code	Description
In.65-71 (P1-P7 in	Press [Stop/Reset] key on the keypad or use the multi-function input
IP20 models),	terminal to restart the inverter. Set the multi-function input terminal to 3
In.65-69 (P1-P5 in	(RST) and turn on the terminal to reset the trip status.
IP66 models)	
Px Define	

6.3.6 Inverter Diagnosis State

Check the diagnosis of components or devices for inverter to check if they need to be replaced.

Group	Code	Name	LCD Display	Parameter Setting	Sett	Setting Range		
		CAP, FAN replacement warning	Inverter State		Bit	00-10		
PRT	89				00	-	Bit	
PKI	09					01	CAP Warning	DIL
					10	FAN Warning		



6.3.7 Operation Mode on Option Card Trip

Option card trips may occur when an option card is used with the inverter. Set the operation mode for the inverter when a communication error occurs between the option card and the inverter body, or when the option card is detached during operation.

Group	Code	Name	LCD Display	0		Setting range	Unit
Pr	80	Operation mode on	Opt Trip Mode	0	None	0-3	-
		option card trip		1	Free-Run		
				2	Dec		

Operation Mode on Option Trip Setting Details

Code	Descrip	tion	
Pr.80 Opt Trip Mode	Setting	9	Function
	0	None	No operation
	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 Pr.07 (Trip Dec Time).

6.3.8 No Motor Trip

If an operation command is run when the motor is disconnected from the inverter output terminal, a 'no motor trip' occurs and a protective operation is performed by the system.

Group	Code	Name	LCD Display	Para Setti		Setting range	Unit
Pr	31	Operation on no motor trip	No Motor Trip	0	None	-	-
	32	No motor trip current level	No Motor Level	5		1-100	%
	33	No motor detection time	No Motor Time	3.0		0.1-10	S



No Motor Trip Setting Details

Code	Description
Pr.32 No Motor	If the output current value [based on the rated current (bA.13)] is lower
Level, Pr.33 No	than the value set at Pr.32 (No Motor Level), and if this continues for the
Motor Time	time set at Pr.33 (No Motor Time), a 'no motor trip' occurs.

① Caution

If bA.07 (V/F Pattern) is set to 1 (Square), set Pr.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.

6.3.9 Low Voltage Trip 2

If you set the Pr-82(LV2 Selection) code to Yes (1), the trip notification is displayed when a low voltage trip occurs. In this case, even if the voltage of the DC Link condenser is higher than the trip level, the LV2 trip will not be retrieved. To retrieve the trip, reset the inverter. The trip history will not be saved.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
Pr	82	LV2 Selection	LV2 Enable	Yes(1)	0/1	-

6.4 Fault/Warning List

The following list shows the types of faults and warnings that can occur while using the Sinus H inverter. Please refer to <u>6 Learning Protection Features</u> on page <u>274</u> for details about faults and warnings.



Category		LCD Display	Details
Major fault		Over Current1	Over current trip
		Over Voltage	Over voltage trip
		External Trip	Trip due to an external signal
		NTC Open	Temperature sensor fault trip
		Over Current2	ARM short current fault trip
		Option Trip-x*	Option fault trip*
		Over Heat	Over heat fault trip
		Out Phase Open	Output open-phase fault trip
		In Phase Open	Input open-phase fault trip
		Inverter OLT	Inverter overload fault trip
		Ground Trip	Ground fault trip
		Fan Trip	Fan fault trip
		E-Thermal	Motor overheat fault trip
		Pre-PID Fail	Pre-PID operation failure
		IO Board Trip	IO Board connection fault trip
		Ext-Brake	External brake fault trip
		No Motor Trip	No motor fault trip
		Low Voltage 2	Low voltage fault trip during operation
		ParaWrite Trip**	Write parameter fault trip
	Level type	Low Voltage	Low voltage fault trip
		ВХ	Emergency stop fault trip
		Lost Command	Command loss trip
		Safety A(B) Err	Safety A(B) contact trip
	Hardware	EEP Err	External memory error
	damage	ADC Off Set	Analog input error
		Watch Dog-1	CPU Watch Dog fault trip
		Watch Dog-2	
Minor fault	·	Over Load	Motor overload fault trip
		Under Load	Motor underload fault trip



Learning Protection Features

Category	LCD Display	Details
Warning	Lost Command	Command loss fault trip warning
	Over Load	Overload warning
	Under Load	Under load warning
	Inverter OLT	Inverter overload warning
	Fan Warning	Fan operation warning
	DB Warn %ED	Braking resistor braking rate warning
	Retry Tr Tune	Rotor time constant tuning error
	CAP Exchange	Capacitor replacement warning
	FAN Exchange	Fan replacement warning

^{*} Applies only when an option board is used.
** Displayed on an LCD keypad only.



This section in the user manual explains how to control the inverter with a PLC or a computer over a long distance using the RS-485 communication features. To use the RS-485 communication features, connect the communication cables and set the communication parameters on the inverter. Refer to the communication protocols and parameters to configure and use the RS-485 communication features.

7.1 Communication Standards

Following the RS-485 communication standards, Sinus H products exchange data with a PLC and computer. The RS-485 communication standards support the Multi-drop Link System and offer an interface that is strongly resistant to noise. Please refer to the following table for details about the communication standards.

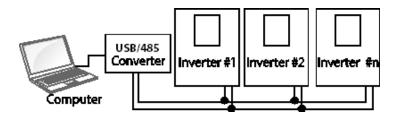
Item	Standard
Communication	RS-485/Bus type, Multi-drop Link System
method/Transmission	
type	
Inverter type name	Sinus H
Number of connected inverters/ Transmission distance	Maximum of 16 inverters / Maximum1,200m (recommended distance: within 700m)
Recommended cable size	0.75mm ² , (18AWG), Shielded Type Twisted-Pair (STP) Wire
Installation type	Dedicated terminals (S+/S-/SG) on the control terminal block
Power supply	Supplied by the inverter - insulated power source from the inverter's internal circuit
Communication speed	1,200/2,400/9,600/19,200/38,400/57,600/115,200 bps
Control procedure	Asynchronous communications system
Communication system	Half duplex system
Character system	Modbus-RTU: Binary
Stop bit length	1-bit/2-bit
Frame error check	2 bytes
Parity check	None/Even/Odd



7.2 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 USB converter must be integrated with the computer, so that it can communicate with the inverter through the USB/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.



7.2.1 Communication Line Connection

Make sure that the inverter is turned off completely, and then connect the RS-485 communication line to the S+/S-/SG terminals of the terminal block. The maximum number of inverters you can connect is 16. For communication lines, use shielded twisted pair (STP) cables

The maximum length of the communication line is 1,200 meters, but it is recommended to use no more than 700 meters of communication line to ensure stable communication. Please use a repeater to enhance the communication speed when using a communication line longer than 1,200 meters or when using a large number of devices. A repeater is effective when smooth communication is not available due to noise interference.

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.



7.2.2 Setting Communication Parameters

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

Communication Parameters Setting Details

Code	Description					
CM.01 Int485 St ID	Set the inverter station ID b	et the inverter station ID between 1 and 250.				
CM.03 Int485 BaudR	Set a communication setting speed up to 115,200 bps.					
	Setting	Function				
	0	1,200 bps				
	1	2,400 bps				
	2	4,800 bps				
	3	9,600 bps				
	4	19,200 bps				
	5 38,400 bps					
	6	56K bps				
	7	115 Kbps				



Code	Description					
CM.04 Int485 Mode	Set a communication conf method, and the number of	iguration. Set the data length, parity check of stop bits.				
	Setting Function					
	0 D8/PN/S1	8-bit data / no parity check / 1 stop bit				
	1 D8/PN/S2	8-bit 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				
CM.05 Resp Delay	Set the response time for the slave (inverter) to react to the request from the master. Response time is used in a system where the slave device response is too fast for the master device to process. Set this code to an appropriate value for smooth master-slave communication. Request Request Naster					
		sponse Response M.5 Resp Delay CM.5 Resp Delay				

7.2.3 Setting Operation Command and Frequency

To select the built-in RS485 communication as the source of command, set the Frq code to 6 (Int485) on the keypad (basic keypad with 7-segment display). On an LCD keypad, set the DRV code to 3 (Int485). Then, set common area parameters for the operation command and frequency via communication.

Group	Code	Name	LCD Display	Para Setti		Setting range	Unit
Pr	12	Speed command loss operation mode	Lost Cmd Mode	1	Free-Run	0-5	-
	13	Time to determine speed command loss	Lost Cmd Time	1.0		0.1-120	S
	14	Operation frequency at speed command loss	Lost Preset F	0.00		Start frequency– Maximum frequency	Hz



Group	Code	Name	LCD Display	Parameter Setting		Setting range	Unit
OU	31	Multi-function relay 1	Relay 1	13	Lost Command	0-35	-
	33	Multi-function output 1	Q1 Define				
Operation	DRV	Command source	Cmd Source*	3	Int 485	0-4	-
	Frq	Frequency setting method	Freq Ref Src	6	Int 485	0-12	-

^{*} Displayed in DRV-06 on an LCD keypad.

7.2.4 Command Loss Protective Operation

Configure the command loss decision standards and protective operations run when a communication problem lasts for a specified period of time.

Command Loss Protective Operation Setting Details

Code	Descrip	otion			
Pr.12 Lost Cmd Mode, Pr.13 Lost Cmd Time	Select the operation to run when a communication error has occurred ar lasted exceeding the time set at Pr. 13.				
	Setting	9	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.		
	2	Dec	The motor decelerates and then stops at the time set at Pr.07 (Trip Dec Time).		
	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 Pr. 14 (Lost Preset F).		



7.2.5 Setting Virtual Multi-Function Input

Multi-function input can be controlled using a communication address (0h0385). Set codes CM.70–77 to the functions to operate, and then set the BIT relevant to the function to 1 at 0h0322 to operate it. Virtual multi-function operates independently from In.65-71 in IP20 models, In.65-69 in IP66 models multi-function inputs and cannot be set redundantly. Virtual multi-function input can be monitored using CM.86 (Virt DI Status). Before you configure the virtual multi-function inputs, set the DRV code according to the command source.

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

Example: When sending an Fx command by controlling virtual multi-function input in the common area via Int485, set CM.70 to FX and set address 0h0322 to 0h0001.

Note

The following are values and functions that are applied to address 0h0322:.

Setting	Function
0h0001	Forward operation (Fx)
0h0003	Reverse operation (Rx)
0h0000	Stop

7.2.6 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 comunication 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. Parameters defined by communication can only be saved using an LCD keypad.

Group	Code	Name	LCD Display	Parar Setti		Setting range	Unit
CNF*	48	Save parameters	Parameter	0	No	0 -1	-
			Save	1	Yes		

^{*}Available on an LCD keypad only.

7.2.7 Total Memory Map for Communication

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



7.2.8 Parameter Group for 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 group for data transmission may be defined to transmit multiple parameters at once, into the communication frame.

Group	Code	Name	LCD Display	Paran Settir		Setting range	Unit
СМ	31-38	Output communication address x	Para Status-x	-	-	0000-FFFF	Hex
	51-58	Input communication address x	Para Control-x	-	-	0000-FFFF	Hex

Currently Registered CM Group Parameter

Address	Parameter	Assigned content by bit
0h0100- 0h0107	Status Parameter- 1- Status Parameter-8	Parameter communication code value registered at CM.31-38 (Read-only)
0h0110- 0h0117	Control Parameter- 1- Control Parameter- 8	Parameter communication code value registered at CM.51-58 (Read/Write access)

Note

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.



7.3 Communication Protocol

The built-in RS-485 communication supports the Modbus-RTU protocol.

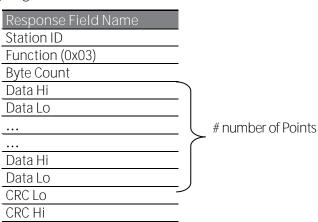
7.3.1 Modbus-RTU Protocol

7.3.1.1 Function Code and Protocol (unit: byte)

In the following section, station ID is the value set at CM.01 (Int485 St ID), and starting address is the communication address (starting address size is in bytes). For more information about communication addresses, refer to 7.4Compatible Common Area Parameter on page 309.

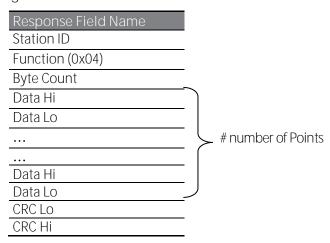
Function Code #03: Read Holding Register

Query Field Name
Station ID
Function(0x03)
Starting Address Hi
Starting Address Lo
of Points Hi
of Points Lo
CRC Lo
CRC Hi



Function Code #04: Read Input Register

Query Field Name
Station ID
Function(0x04)
Starting Address Hi
Starting Address Lo
of Points Hi
of Points Lo
CRC Lo
CRC Hi





Function Code #06: Preset Single Register

Query Field Name
Station ID
Function (0x06)
Starting Address Hi
Register Address Lo
Preset Data Hi
Preset Data Lo
CRC Lo
CRC Hi

Response Field Name
Station ID
Function (0x06)
Register Address Hi
Register Address Lo
Preset Data Hi
Preset Data Lo
CRC Lo
CRC Hi

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

Query Field Name
Station ID
Function (0x10)
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
Station ID
Function (0x10)
Starting Address Hi
Starting Address Lo
of Register Hi
of Register Lo
CRC Lo
CRC Hi

number of Points

Exception Code

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



Response

Field Name
Station ID
Function*
Exception Code
CRC Lo
CRC Hi

^{*} The function value uses the top level bit for all query values.

Example of Modbus-RTU Communication in Use

When the Acc time (Communication address 0x1103) is changed to 5.0 sec and the Dec time (Communication address 0x1104) is changed to 10.0 sec.

Frame Transmission from Master to Slave (Request)

Item	Station	Functio	Starting	# of	Byte	Data 1	Data 2	CRC
	ID	n	Address	Register	Count			
Hex	0x01	0x10	0x1102	0x0002	0x04	0x0032	0x0064	0x1202
Descriptio	CM.01	Preset	Starting	-	-	50	100	-
n	Int485	Multiple	Address -1			(ACC	(DEC	
	St ID	Register	(0x1103-1)			time	time	
						5.0sec)	10.0sec)	

Frame Transmission from Slave to Master (Response)

Item	Station ID	Function	Starting Address	# of Register	CRC
Hex	0x01	0x10	0x1102	0x0002	0xE534
Description	CM.01	Preset	Starting Address -	-	-
	Int485 St ID	Multiple	1		
		Register	(0x1103-1)		



7.4 Compatible Common Area Parameter

The following are common area parameters compatible with Sinus M.

Dh0002	Comm. Address	Parameter	Scale	Unit	R/W	Assigned Content by Bit
2: 0005 [2.2 kW], 4: 0011 [5.5 kW], 5: 0014 [7.5 kW], 6: 0017 [11 kW], 7: 0020 [15 kW], 8: 0025 [18.5 kW], 9: 0030 [22 kW], 10: 0034 [30 kW], 256: 0001 [0.4 kW], 259: 0007 [4.0 kW] voltage 0h0003	0h0000	Inverter model	-	-		
Voltage	0h0001	Inverter capacity	-	-	R	2: 0005 [2.2 kW], 4: 0011 [5.5 kW], 5: 0014 [7.5 kW], 6: 0017 [11 kW], 7: 0020 [15 kW], 8: 0025 [18.5 kW],
Oh0003	0h0002		-	-	R	
Oh0004 Reserved - - R/W 0h0005 Command frequency 0.01 Hz R/W 0h0006 Operation command (option) - - R B15 Reserved B13 1: Keypad Torq B12 2-16: Terminal block multi B11 step speed B10 17: Up, 18: Down B9 19: STEADY 22: V1, 24: V2, 25: I2, 26: Reserved 27: Built-in 485 28: Communication option 30: JOG, 31: PID B8 0: Keypad B7 1: Fx/Rx-1 B6 2: Fx/Rx-2 3: Built-in 485 4: Communication option R/W B5 Reserved Reserved B4 Emergency stop	0h0003		-	-	R	Example 0h0100: Version 1.00
Oh0005 Command frequency 0.01 Hz R/W 0h0006 Operation command (option) - - R B15 Reserved B14 0: Keypad Freq, B13 1: Keypad Torq B12 2-16: Terminal block multi step speed B10 17: Up, 18: Down 19: STEADY B2: V1, 24: V2, 25: I2, 26: Reserved 27: Built-in 485 B8 0: Keypad B7 1: Fx/Rx-1 B6 2: Fx/Rx-2 3: Built-in 485 4: Communication option R/W B5 Reserved B4 Emergency stop	0h0004	Reserved	-	-	R/W	'
Oh0006 Operation command (option) - R B15 Reserved B14 0: Keypad Freq, B13 1: Keypad Torq B12 2-16: Terminal block multi B11 step speed B10 17: Up, 18: Down B9 19: STEADY 22: V1, 24: V2, 25: I2, 26: Reserved 27: Built-in 485 28: Communication option 30: JOG, 31: PID B8 0: Keypad B7 1: Fx/Rx-1 B6 2: Fx/Rx-2 3: Built-in 485 4: Communication option R/W B5 Reserved		Command	0.01	Hz		
R: Trip status B2 Reverse operation (R) B1 Forward operation (F)	0h0006	Operation				B14 0: Keypad Freq, B13 1: Keypad Torq B12 2-16: Terminal block multistep speed B10 17: Up, 18: Down B9 19: STEADY 22: V1, 24: V2, 25: I2, 26: Reserved 27: Built-in 485 28: Communication option 30: JOG, 31: PID B8 0: Keypad B7 1: Fx/Rx-1 B6 2: Fx/Rx-2 3: Built-in 485 4: Communication option B5 Reserved B4 Emergency stop B3 W: Trip initialization (0→1), R: Trip status B2 Reverse operation (R)



Comm. Address	Parameter	Scale	Unit	R/W	Assigned	Content by Bit
					ВО	Stop (S)
0h0007	Acceleration time	0.1	S	R/W	-	
0h0008	Deceleration time	0.1	S	R/W	-	
0h0009	Output current	0.1	Α	R	-	
0h000A	Output frequency	0.01	Hz	R	-	
0h000B	Output voltage	1	V	R	-	
0h000C	DC link voltage	1	V	R	-	
0h000D	Output power	0.1	kW	R	-	
0h000E	Operation status	-	-	R	B15	0: Remote, 1: Keypad Local
					B14	1: Frequency command source by communication (built-in, option)
					B13	1: Operation command source by communication (built-in, option)
					B12	Reverse operation
						command
					B11	Forward operation
						command
					B10	Brake release signal
					В9	Jog mode
					B8	Drive stopped.
					B7	DC Braking
					В6	Speed reached
					B5	Decelerating
					B4	Accelerating
					В3	Fault Trip - operates
						according to Pr.30 setting
					B2	Operating in reverse
						direction
					B1	Operating in forward
						direction
					B0	Stopped
0h000F	Fault trip	-	-	R	B15	Reserved
	information				B14	Reserved
					B13	Reserved
					B12	Reserved
					B11	Reserved
					B10	H/W-Diag
					В9	Reserved
					B8	Reserved
					В7	Reserved



		0 1		5 0 4 /		5	
Comm. Address	Parameter	Scale	Unit	R/W	Assigned	Content by Bit	
					В6	Reserved	
					B5	Reserved	
					B4	Reserved	
					В3	Level Type trip	
					B2	Reserved	
					B1	Reserved	
					В0	Latch Type trip	
0h0010	Input terminal	-	_	R	B15-	Reserved	
	information				B7		
					B6	P7	
					B5	P6	
					B4	P5	
					В3	P4	
					B2	P3	
					B1	P2	
					ВО	P1	
0h0011	Output terminal	-	-	R	B15	Reserved	
	information				B14	Reserved	
					B13	Reserved	
					B12	Reserved	
					B11	Reserved	
					B10	Reserved	
					В9	Reserved	
					B8	Reserved	
					B7	Reserved	
					B6	Reserved	
					B5	Reserved	
					B4	Reserved	
					B3	Reserved	
					B2	Reserved	
					B1	MO	
					B0	Relay 1	
0h0012	V1	0.01	%	R	V1 input v		
0h0013	V2	0.01	%	R	V2 input v	ŭ	
0h0014	12	0.01	%	R	12 input cu	0	
0h0015	Motor rotation	1	rpm	R		xisting motor rotation	
	speed		1		speed	<u> </u>	
0h0016	Reserved	-	-	-	-		
- 0h0019							
0h001A	Select Hz/rpm	-	-	R	0: Hz unit, 1: rpm unit		
0h001B	Motor poles	-	-	R		e number of poles for the	
					selected n	notor	



7.5 Sinus H Expansion Common Area Parameter

7.5.1 Monitoring Area Parameter (Read Only)

Comm. Address	Parameter	Scale	Unit	Assigned content by bit		
0h0300	Inverter model	-	-	Sinus H: 0006h		
0h0301	Inverter capacity	-	-	0001 [0.4 kW]: 1900h, 0002 [0.75 kW]: 3200h		
				0003 [1.5 kW]: 4015h, 0005 [2.2 kW]: 4022h		
				0007 [4.0 kW]: 4040h, 0011 [5.5 kW]: 4055h		
				0014 [7.5 kW]: 4075h, 0017 [11 kW]: 40B0h		
				0020 [15 kW]: 40F0h, 0025 [18.5 kW]: 4125h		
				0030 [22 kW]: 4160h, 0034 [30 kW]: 41E0h		
0h0302	Inverter input	-	-	2S self cooling: 0220h,		
	voltage/power			2S forced cooling: 0221h		
	(Single phase, 3-phase)/cooling			2T self cooling: 0230h, 2T forced cooling: 0231h		
	method			4T self cooling: 0430h,		
				4T forced cooling: 0431h		
0h0303	Inverter S/W	-	-	(Ex) 0h0100: Version 1.00		
	version			0h0101: Version 1.01		
0h0304	Reserved	-	-	-		
0h0305	Inverter	-	-	B15 0: Normal state		
	operation state			4: Warning occurred 8: Fault occurred [operates		
				B13 according to Pr. 30 (Trip Out		
				B12 Mode) setting.]		
				B11		
				B8		
				B7 1: Speed searching		
				B6 2: Accelerating		
				B5 3: Operating at constant rate 4: Decelerating		
				B4 5: Decelerating to stop		
				6: H/W OCS		
				7: S/W OCS 8: Dwell operating		
				o. Dwell operating		



Comm. Address	Parameter	Scale	Unit	Assigned	content by bit
a.a. eee				В3	0: Stopped
				B2	1: Operating in forward direction
				B1	2: Operating in reverse direction 3: DC operating (0 speed control)
				В0	o. Do operating to speed control,
0h0306	Inverter operation frequency	-	-	B15 B14 B13	Operation command source 0: Keypad 1: Communication option
	command			B12	3: Built-in RS 485
	source			B11	4: Terminal block
				B10	
				B9	-
				B8 B7	Frequency command source
				В6	0: Keypad speed
				B5	1: Keypad speed
				B4	2-4: Up/Down operation speed
				В3	5: V1, 7: V2, 8: I2
				B2	9: Pulse
				B1	10: Built-in RS 485
				ВО	11: Communication option 13: Jog 14: PID
					25-39: Multi-step speed frequency
0h0307	LCD keypad S/W version	-	-	(Ex.) 0h01	00: Version 1.00
0h0308	LCD keypad title version	-	-	(Ex.) 0h01	01: Version 1.01
0h0309 -0h30F	Reserved	_	_	-	
0h0310	Output current	0.1	Α	-	
0h0311	Output	0.01	Hz	-	
	frequency				
0h0312	Output rpm	0	rpm	-	
0h0313	Motor feedback	0	rpm	-32768 rp	m-32767 rpm (directional)
01.001.1	speed				
0h0314	Output voltage	1	V	-	
0h0315	DC Link voltage	1	V	-	
0h0316	Output power	0.1	kW	-	
0h0317	Output torque	0.1	%	-	
0h0318	PID reference	0.1	%	-	
0h0319	PID feedback	0.1	%	-	



Comm. Address	Parameter	Scale	Unit	Assigned co	ntent by bit
0h031A	Display the	-	-	Displays the	number of poles for the first
	number of poles			motor	
	for the 1st motor				
0h031B	Display the	-	-	Displays the	number of poles for the 2nd
	number of poles			motor	
0h031C	for the 2 nd motor Display the			Displays the	number of poles for the
UNU3 IC	number of poles	-	-	selected mot	number of poles for the
	for the selected			selected mot	Ol
	motor				
0h031D	Select Hz/rpm	-	-	0: Hz, 1: rpm	
0h031E	Reserved	-	-	-	
- 0h031F					
0h0320	Digital input			BI5	Reserved
	information			-	-
				B7	Reserved
				B6	P7(I/O board)
				B5	P6(I/O board)
				B4	P5(I/O board)
				B3	P4(I/O board)
				B2	P3(I/O board)
				B1	P2(I/O board)
				B0	P1(I/O board)
0h0321	Digital output	-	-	BI5	Reserved
	information			-	Reserved
				B4	Reserved
				B3	Reserved
				B2	Reserved
				B1	Q1
				B0	Relay 1
0h0322	Virtual digital	-	-	B15	Reserved
	input			-	Reserved
	information			B8	Reserved
				B7	Virtual DI 8(CM.77)
				B6	Virtual DI 7(CM.76)
				B5	Virtual DI 6(CM.75)
				B4	Virtual DI 5(CM.74)
				B3	Virtual DI 4(CM.73)
				B2	Virtual DI 3(CM.72)
				B1	Virtual DI 2(CM.71)
		ļ		B0	Virtual DI 1(CM.70)
0h0323	Display the	-	-	0: 1st motor/	1: 2nd motor
	selected motor				



Comm.	Parameter	Scale	Unit	Assigned (content by bit
Address	A 11	0.01	0/	Analagina	++\/1 /1/O be and\
0h0324 0h0325	Al1 Reserved	0.01	%	Arialog Imp	ut V1 (I/O board)
0h0326	AI3	0.01	%	Analogina	ut V2 (I/O board)
0h0327	AI3	0.01	%		ut 12 (1/0 board)
0h0328	A01	0.01	%		put 1 (I/O board)
0h0329	AO2	0.01	%		put 2 (I/O board)
0h0324	AO3	0.01	%	Reserved	.put 2 (1/0 board)
0h032B	AO4	0.01	%	Reserved	_
0h032C	Reserved	0.01	70	kezei ved	
		-	-	-	
0h032D	Inverter module temperature	1	$^{\circ}$	[0034 mode	el only]
0h032E	Inverter power consumption	1	kWh	[0034 mode	el only]
0h032F	Inverter power consumption	1	MWh	[0034 mode	el only]
0h0330	Latch type trip	-	-	BI5	Fuse Open Trip
	information - 1			BI4	Over Heat Trip
				BI3	Arm Short
				BI2	External Trip
				BI1	Overvoltage Trip
				BIO	Overcurrent Trip
				В9	NTC Trip
				B8	Reserved
				B7	Reserved
				B6	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
0h0331	Latch type trip	-	-	BI5	Reserved
	information - 2			BI4	Reserved
				BI3	Safety B
				BI2	Safety A
				BI1	Reserved
				BI0	Bad option card
				В9	No motor trip
				B8	External brake trip
				B7	Bad contact at basic I/O
					board
				В6	Pre PID Fail



Comm.	Parameter	Scale	Unit	Assigned co	ntent by bit
Address				3	
				B5	Error while writing parameter
				B4	Reserved
				B3	FAN Trip
				B2	Reserved
				B1	Reserved
				B0	Reserved
0h0332	Level type trip	-	-	B15	Reserved
	information			-	-
				B8	Reserved
				B7	Reserved
				B6	Reserved
				B5	Reserved
				B4	Reserved Keymand Last Command
				B3 B2	Keypad Lost Command
					Lost Command
				B1 B0	LV BX
0h0333	H/W Diagnosis	_	_	B15	Reserved
0110333	Trip information		-	D10	Reserved
				B6	Reserved
				B5	Queue Full
				B4	Reserved
				B3	Watchdog-2 error
				B2	Watchdog-1 error
				B1	EEPROM error
				В0	ADC error
0h0334	Warning	-	-	B15	Reserved
	information			-	Reserved
				B10	Reserved
				В9	Auto Tuning failed
				B8	Keypad lost
				В7	Encoder disconnection
				B6	Wrong installation of encoder
				B5	DB
				B4	FAN running
				B3	Lost command
				B2	Inverter Overload
				B1	Underload
				B0	Overload



Comm.	Parameter	Scale	Unit	Assigned content by bit
Address				
0h0335 -0h033F	Reserved	-	-	-
060240	On Time date	0	Dov	Total number of days the inverter has been
0h0340	On time date	U	Day	Total number of days the inverter has been powered on
0h0341	On Time minute	0	Min	Total number of minutes excluding the total number of On Time days
0h0342	Run Time date	0	Day	Total number of days the inverter has driven the motor
0h0343	Run Time minute	0	Min	Total number of minutes excluding the total number of Run Time days
0h0344	Fan Time date	0	Day	Total number of days the heat sink fan has been running
0h0345	Fan Time minute	0	Min	Total number of minutes excluding the total number of Fan Time days
0h0346	Reserved	-	-	-
-0h0348				
0h0349	Reserved	-	-	-
0h034A	Option 1	-	-	0: None, 9: CANopen
0h034B	Reserved	-	-	
0h034C	Reserved			

7.5.2 Control Area Parameter (Read/Write)

Comm. Address	Parameter	Scale	Unit	Assign	ed Content by Bit					
0h0380	Frequency command	0.01	Hz	Comma	Command frequency setting					
0h0381	RPM command	1	rpm	Comma	and rpm setting					
0h0382	Operation	-	-	В7	Reserved					
	command			В6	Reserved					
				B5	Reserved					
				B4	Reserved					
				В3	0 → 1: Free-run stop					
				B2	0 → 1: Trip initialization					
				B1	0: Reverse command, 1: Forward					
					command					
				ВО	0: Stop command, 1: Run command					
				Examp	le: Forward operation command 0003h,					



Comm. Address	Parameter	Scale	Unit		ed Content by Bit
					e operation command 0001h
0h0383	Acceleration time	0.1	S	Acceler	ration time setting
0h0384	Deceleration time	0.1	S	Decelei	ration time setting
0h0385	Virtual digital	-	-	BI5	Reserved
	input control			-	Reserved
	(0: Off, 1:On)			B8	Reserved
	,			B7	Virtual DI 8(CM.77)
				В6	Virtual DI 7(CM.76)
				B5	Virtual DI 6(CM.75)
				B4	Virtual DI 5(CM.74)
				B3	Virtual DI 4(CM.73)
				B2	Virtual DI 3(CM.72)
				B1	Virtual DI 2(CM.71)
				BO	Virtual DI 1(CM.70)
0h0386	Digital	_	_	BI5	Reserved
0110000	output			BI4	Reserved
	control			BI3	Reserved
	(0:Off, 1:On)			BI2	Reserved
	,			BI1	Reserved
				BIO	Reserved
				B9	Reserved
				B8	Reserved
				B7	Reserved
				B6	Reserved
				B5	Reserved
				B4	Relay 4 (Ext I/O, OUT-31: None)
				B3	Relay 3 (Ext I/O, OUT-31: None)
				B2	Relay 2 (0034 model only, OUT-31: None)
				B1	Q1 (all models, OUT-33: None)
				ВО	Relay 1 (all models, OUT-31: None)
0h0387	Reserved	-	-	Reserve	· · · · · · · · · · · · · · · · · · ·
0h0388	PID reference	0.1	%		erence command
0h0389	PID feedback value	0.1	%		dback value
0h038A	Motor rated current	0.1	А	-	
0h038B	Motor rated voltage	1	V	-	
0h038C- 0h038F	Reserved			-	
0h0390	Torque Ref	0.1	%	Torque	command
	1 - 1 - 1 - 1 - 1		1		• •



Comm. Address	Parameter	Scale	Unit	Assigned Content by Bit
0h0391	Fwd Pos Torque Limit	0.1	%	Forward motoring torque limit
0h0392	Fwd Neg Torque Limit	0.1	%	Forward regenerative torque limit
0h0393	Rev Pos Torque Limit	0.1	%	Reverse motoring torque limit
0h0394	Rev Neg Torque Limit	0.1	%	Reverse regenerative torque limit
0h0395	Torque Bias	0.1	%	Torque bias
0h0396-0h399	Reserved	-	-	-
0h039A	Anytime Para	-	-	Set the CNF.20* value (refer to <u>5.37 Operation</u> <u>State Monitor</u> on page 270)
0h039B	Monitor Line-1	-	-	Set the CNF.21* value (refer to <u>5.37 Operation</u> <u>State Monitor</u> on page 270)
0h039C	Monitor Line-2	-	-	Set the CNF.22* value (refer to <u>5.37 Operation</u> <u>State Monitor</u> on page 270)
0h039D	Monitor Line-3	-	-	Set the CNF.23* value (refer to <u>5.37 Operation</u> <u>State Monitor</u> on page 270)

^{*} Displayed on an LCD keypad only.

Note

A frequency set via communication using the 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:

- 1 Set dr.07 to Keypad-1 and select a random target frequency.
- 2 Set the frequency via communication into the parameter area frequency address (0h1101).
- 3 Perform the parameter save (0h03E0: '1') before turning off the power. After the power cycle, the frequency set before turning off the power is displayed.

7.5.3 Inverter Memory Control Area Parameter (Read and Write)

Comm. Address	Parameter	Scale		Changeable During Operation	Function
0h03E0	Save parameters	-	-	Χ	0: No, 1:Yes
0h03E1	Monitor mode	-	-	0	0: No, 1:Yes



Comm. Address	Parameter	Scale	Unit	Changeable During Operation	Function
01.0050	initialization				
0h03E2	Parameter initialization	-	-	X	0: No, 1: All Grp, 2: Drv Grp 3: bA Grp, 4: Ad Grp, 5: Cn Grp 6: In Grp, 7: OU Grp, 8: CM Grp 9: AP Grp, 12: Pr Grp, 13: M2 Grp Setting is prohibited during fault trip interruptions.
0h03E3	Display changed parameters	-	-	0	0: No, 1: Yes
0h03E4	Reserved	-	-	-	-
0h03E5	Delete all fault history	-	-	0	0: No, 1: Yes
0h03E6	Delete user- registrated codes	-	-	0	0: No, 1: Yes
0h03E7	Hide parameter mode	0	Hex	0	Write: 0-9999 Read: 0: Unlock, 1: Lock
0h03E8	Lock parameter mode	0	Hex	0	Write: 0-9999 Read: 0: Unlock, 1: Lock
0h03E9	Easy start on (easy parameter setup mode)	-	-	0	0: No, 1: Yes
0h03EA	Initializing power consumption	-	-	0	0: No, 1: Yes
0h03EB	Initialize inverter operation accumulative time	-	-	0	0: No, 1: Yes
0h03EC	Initialize cooling fan accumulated operation time	-	-	0	0: No, 1: Yes



Note

- 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 to the inverter operation, but are not saved. All set values are cleared following an inverter power cycle and revert back to its previous values. When setting parameters via communication, ensure that a parameter save is completed prior to shutting the inverter down.
- 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.
- 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 continuously, the parameter is executed just once. Therefore, if the same value is entered again, 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.

① Caution

It may take longer to set the parameter values in the inverter memory control area because all data is saved to the inverter. Be careful as communication may be lost during parameter setup if parameter setup is continues for an extended period of time.



8 Table of Functions

This chapter lists all the function settings for Sinus H series inverter. Set the parameters required according to the following references. If a set value input is out of range, the following messages will be displayed on the keyboard. In these cases, the inverter will not operate with the [ENT] key.

- Set value not allocated: rd
- Set value repetition (multi-function input, PID reference, PID feedback related): OL
- Set value not allowed (select value, V2, I2): no

8.1 Operation Group

The Operation group is used only in the basic keypad mode. It will not be displayed on an LCD keypad. If the LCD keypad is connected, the corresponding functions will be found in the Drive(DRV) group.

SL: Sensorless vector control (dr.09) , I – IM Sensorless, P – PM Sensorless

*O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code	Comm. Address	Name	Keypad Display	Setti	ng Range	Initial Value	Property*	V/F	SL	Ref.
	0h1F00	Target frequency	0.00		ximum iency(Hz)	0.00	O/7	0	I/P	<u>p.72</u>
-	0h1F01	Acceleration time	ACC	0.0-6	00.0(s)	20.0	O/7	0	I/P	<u>p.141</u>
-	0h1F02	Deceleration time	dEC	0.0-6	00.0(s)	30.0	O/7	0	I/P	<u>p.141</u>
-	0h1F03	Command source	drv	0 1 2 3 4	Keypad Fx/Rx-1 Fx/Rx-2 Int 485 Field Bus ¹	1: Fx/Rx-1	X/7	Ο	I/P	p.133
-	0h1F04	Frequency	Frq	0	Keypad-	0:	X/7	0	I/P	p.116

¹ Table of options are provided separately in the option manual.



Table of Functions

Code	Comm. Address	Name	Keypad Display	Setting Ra	nge	Initial Value	Property*	V/F	SL	Ref.
		reference		1		Keypad-				
		source		1 Keyp	oad-	1				
				2						
				2 V1						
				4 V2						
				5 I2						
				6 Int 4						
					l Bus					
				12 Puls	Э					
-	0h1F05	Multi-step	St1	0.00-Maxir		10.00	0/7	0	I/P	p.131
		speed		frequency	(Hz)					
		frequency 1								
-	0h1F06	Multi-step	St2	0.00-Maxir	num	20.00	O/7	0	I/P	p.131
		speed		frequency	(Hz)					
		frequency 2								
-	0h1F07	Multi-step	St3	0.00-Maxir	num	30.00	0/7	0	I/P	p.131
		speed		frequency	(Hz)					
		frequency 3								
-	0h1F08	Output	CUr				-/7	0	I/P	<u>p.84</u>
		current								
-	0h1F09	Motor	Rpm				-/7	Ο	I/P	-
		revolutions								
		per minute								
-	0h1F0A	Inverter	dCL	-		-	-/7	0	I/P	<u>p.84</u>
		direct								
		current								
		voltage								
-	0h1F0B	Inverter	vOL				-/7	Ο	I/P	<u>p.84</u>
		output								
		voltage								
-	0h1F0C	Out of order	nOn				-/7	Ο	I/P	-
		signal								
-	0h1F0D	Select	drC	F Forward	l run	F	O/7	Ο	I/P	-
		rotation		r Reverse	run					
		direction		1.3.3.30						



8.2 Drive group (PAR→dr)

In the following table, data shaded in grey will be displayed when the related code has been selected.

SL: Sensorless vector control (dr.09), I – IM Sensorless, P – PM Sensorless

*O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code dr	Comm Addr	Name	LCD Display	Set	ting Range	Initial value	Property *	V/F	SL	Ref.
00	-	Jump Code	Jump Code	1-99		9	O/A	0	I/P	<u>p.72</u>
01 ²	0h1101	Target frequency	Cmd Freque ncy	Start fre Maximu frequen		0.00	O/L	0	I/P	<u>p.77</u>
02	0h1102	Torque command	Cmd Torque	-180~18	30[%]	0.0	O/A	Χ	I	-
032	0h1103	Acceleratio n time	Acc Time	0.0-600	.0(s)	20.0	O/L	0	I/P	<u>p.141</u>
042	0h1104	Deceleratio n time	Dec Time	0.0-600	.0(s)	30.0	O/L	Ο	I/P	<u>p.141</u>
06 ²	0h1106	Command source	Cmd Source	0 1 2 3 4	Keypad Fx/Rx-1 Fx/Rx-2 Int 485 Field Bus	1: Fx/Rx-1	X/L	0	I/P	<u>p.133</u>
072	0h1107	Frequency reference source	Freq Ref Src	0 1 2 4 5 6 8 12	Keypad-1 Keypad-2 V1 V2 I2 Int 485 Field Bus Pulse	0: Keypad -1	X/L	0	I/P	p.116
08	0h1108	Torque reference setting	Trq Ref Src	0 1 2 4 5 6 8 12	Keypad-1 Keypad-2 V1 V2 I2 Int 485 FieldBus Pulse	0: Keypad -1	X/A	X	I	-

² Displayed when an LCD keypad is in use.



Code dr	Comm Addr	Name	LCD Display	Set	ting Range	Initial value	Property *	V/F	SL	Ref.
09	0h1109	Control mode	Control Mode	0 2 4 6	V/F Slip Compen IM Sensorless PM Sensorless	0: V/F	X/A	Ο	I/P	p.150 , p.194 , p.208
10	0h110A	Torque Control	Torque Control	0	No Yes	0: No	X/A	Χ	I/P	-
11	0h110B	Jog frequency	Jog Freque ncy	0.00, Start frequency- Maximum frequency(Hz) 0.0-600.0(s)		10.00	O/A	Ο	I/P	<u>p.185</u>
12	0h110C	Jog run acceleratio n time	Jog Acc Time	0.0-600.0(s)		20.0	O/A	Ο	I/P	<u>p.185</u>
13	0h110D	Jog run deceleratio n time	Jog Dec Time	0.0-600.0(s)		30.0	O/A	Ο	I/P	<u>p.185</u>
14	0h110E	Motor capacity	Motor Capacit y	0: 0.2 kW, 1: 0.4 kW 2: 0.75 kW, 3: 1.1 kW 4: 1.5 kW, 5: 2.2 kW 6: 3.0 kW, 7: 3.7 kW 8: 4.0 kW, 9: 5.5 kW 10: 7.5 kW, 11: 11.0 kW 12: 15.0 kW, 13: 18.5 kW		Varies by Motor capacit y	X/A	0	I/P	p.205
15	0h110F	Torque boost options	Torque Boost	0	Manual Auto	0: Manual	X/A	0	Х	-
16 ³	0h1110	Forward Torque boost	Fwd Boost	0.0-15.0	0(%)	2.0	X/A	Ο	Х	p.153
17 ³	0h1111	Reverse Torque boost	Rev Boost	0.0-15.0	0(%)	2.0	X/A	Ο	Х	<u>p.153</u>

³ Displayed when dr.15 is set to 0 (Manual)





Code dr	Comm Addr	Name	LCD Display	Se	etting Range	Initial value	Property *	V/F	SL	Ref.
18	0h1112	Base frequency	Base Freq	[V/F, S 40.00- [IM Se 30.00- [PM Se	400.00(Hz) lip Compen] 120.00(Hz) nsorless] 180.00(Hz) ensorless]	50.00	X/A	Ο	I/P	p.150
19	0h1113	Start frequency	Start Freq	0.01-1	0.00(Hz)	0.50	X/A	Ο	I/P	<u>p.150</u>
20	0h1114	Maximum frequency	Max Freq	[V/F, S 40.00- [IM Se 40.00-	400.00(Hz) Ilip Compen] 120.00(Hz) Insorless] 180.00(Hz) ensorless]	50.00	X/A	Ο	I/P	p.160
21	0h1115	Select speed unit	Hz/Rpm Sel	0	Hz Display Rpm Display	0:Hz Display	O/L	Ο	I/P	<u>p.131</u>
224	0h1116	(+)Torque gain	(+)Trq Gain		150.0[%]	100.0	O/A	Χ	1	-
23 ⁴	0h1117	(-)Torque gain	(-)Trq Gain	50.0 ~	150.0[%]	100.0	O/A	Χ	I	-
244	0h1118	(-)Torque gain 0	(-)Trq Gain0	50.0 ~	150.0[%]	80.0	O/A	Χ	I	-
25 ⁴	0h1119	(-)Torque offset	(-)Trq Offset	0.0 ~ 1	100.0[%]	40.0	O/A	Χ	I	-
80 ⁵	0h1150	Select ranges at power input		displa input 0 1 2 3 4	ranges inverter ys at power Run frequency Acceleration time Deceleration time Command source Frequency reference source Multi-step speed frequency1 Multi-step	0: run frequen cy	0/7	0	I/P	-

⁴ Displayed when dr.10 is set to 1 (YES)

 $^{^{\}rm 5}$ Will not be displayed when an LCD keypad is in use



speed frequency2				
- l				
7 Multi-step				
speed				
frequency3				
8 Output current				
9 Motor RPM				
10 Inverter DC				
voltage				
11 User select				
signal (dr.81)				
12 Currently out of order				
13 Select run				
direction				
14 output current2				
15 Motor RPM2				
16 Inverter DC				
voltage2				
17 User select				
	0/7	0	I/P	_
monitor selected code output	0//		1/ [-
code 0 Output voltage				
voltage(V)				
1 Output electric				
power(kW)				
2 Torque(kgf·m)				
	0/7	0	I/P	p.249
changed 1 View Changed View All				ľ
	X/7	0	I/P	<u>p.74</u> ,
functions position None	, , ,		., .	p.136
1 JOG Key				p.187
2 Local/Remote				
	X/A	0	I/P	-
opy 1 SmartDownload				
3 SmartUpLoad				
	X/7	0	I/P	p.246
inizialization 1 All Grp				
2 dr Grp				
3 bA Grp				





Code dr	Comm Addr	Name	LCD Display	(Setting Range	Initial value	Property *	V/F	SL	Ref.
				4	Ad Grp					
				5	Cn Grp					
				6	In Grp					
				7	OU Grp					
				8	CM Grp					
				9	AP Grp					
				12	Pr Grp					
				13	M2 Grp					
				16	run Grp					
945	0h115E	Password		0-			0/7	Ο	I/P	<u>p.247</u>
		registration		9999						
95 ⁵	0h115F	Parameter		0-			0/7	Ο	I/P	<u>p.248</u>
		lock		9999						
		settings								
975	0h1161	Software	-				-/7	Ο	I/P	-
		version								
98	0h1162	Display I/O	IO S/W				-/A	Ο	I/P	-
		board	Ver							
		version								
99	0h1163	Display I/O	IO H/W	0	Multiple IO		-/A	Ο	I/P	-
		board H/W	Ver	1	Standard IO					
		version		2	Standard IO (M)					
					Refer to Step 4					
					Control					
					Terminal					
					Wiring on					
					page 47.					



8.3 Basic Function group (PAR→bA)

In the following table, the data shaded in grey will be displayed when a related code has been selected.

SL: Sensorless vector control function (dr.09) , I – IM Sensorless, P – PM Sensorless * O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code bA	CommA ddr	Name	LCD Display	Setting Range	Initial Value	Property*	V/F	SL	Ref.
00	-	Jump Code	Jump Code	1-99	20	0	0	I/P	<u>p.72</u>
01	0h1201	Auxiliary reference source	Aux Ref Src	0 None 1 V1 3 V2 4 I2 6 Pulse	0:None	X/A	0	I/P	<u>p.179</u>
02 ⁶	0h1202	Auxiliary command calculation type	Aux Calc Type	0 M+(G*A) 1 Mx (G*A) 2 M/(G*A) 3 M+[M*(G*A)] 4 M+G*2(A-50%) 5 Mx[G*2(A-50%)] 6 M/[G*2(A-50%)] 7 M+M*G*2(A-50%)	0: M+(GA)	X/A	Ο	I/P	<u>p.179</u>
036	0h1203	Auxiliary command gain	Aux Ref Gain	-200.0-200.0(%)	100.0	O/A	Ο	I/P	<u>p.179</u>
04	0h1204	2nd command source	Cmd 2nd Src	0 Keypad 1 Fx/Rx-1 2 Fx/Rx-2 3 Int 485 4 FieldBus	1: -Fx/Rx-1	X/A	Ο	I/P	<u>p.163</u>
05	0h1205	2nd frequency source	Freq 2nd Src	0 Keypad-1 1 Keypad-2 2 V1 4 V2 5 I2	0: Keypad- 1	O/A	О	I/P	p.163

⁶ Displayed if bA.01 is not set to 0 (None).





Code bA	CommA ddr	Name	LCD Display	S	etting Range	Initial Value	Property*	V/F	SL	Ref.
				6	Int 485					
				8	FieldBus					
				12	Pulse					
				0	Keypad-1					
				1	Keypad-2					
		2nd Torque		2	V1	0:				
06	0h1206	command	Trq 2nd	4	V2	Keypad-	0	Χ	1	
		source	Src	5	12	1				
				6	Int 485					
				8	FieldBus					
				12	Pulse					
		\//E is attack	\ / / \	0	Linear	0.				
07	0h1207	V/F pattern options	V/F	2	Square User V/F	0: Linear	X/A	Ο	Χ	p.150
		options	Pattern	3		Linear				
		Acc/dec		0	Square 2 Max Freq					-
08	0h1208	standard	Ramp T	U	iviax rieq	0:	X/A	0	I/P	n 1/11
	0111200	frequency	Mode	1	Delta Freq	Max Freq	MA	U	1/17	<u>p.141</u>
		Time scale	Time	0	0.01 sec					
09	0h1209	settings	Scale	1	0.1 sec	1:0.1 sec	X/A	О	I/P	<u>p.141</u>
			000.0	2	1 sec					<u> </u>
10	01.400.4	Input	60/50 Hz	0	60Hz	4 5011	\//A		1./5	
10	0h120A	power	Sel	1	50Hz	1:50Hz	X/A	0	I/P	<u>p.245</u>
		frequency Number of								
11	0h120B	motor	Pole	2-4	Ι Q	4	X/A	0	I/P	n 101
11	UIIIZUB	poles	Number	2-2	+0	4	\/A	U	1/17	<u>p.194</u>
		Rated slip								
12	0h120C	speed	Rated Slip	0-3	8000(Rpm)		X/A	Ο	1	<u>p.194</u>
		Motor				Depende				
13	0h120D	rated	Rated Curr	1.0	-1000.0(A)	nt on	X/A	0	I/P	p.194
10	0111202	current	ratoa oan	1.0	1000.00, 1	motor	7071		., .	<u>p. 17 1</u>
		Motor				setting				
14	0h120E	noload	Noload	0.0	-1000.0(A)	3	X/A	0	1	p.194
		current	Curr		,		·			,
		Motor								
15	0h120F	rated	Rated Volt	0, 1	170-480 (V)	0	X/A	0	I/P	p.155
		voltage								
						Depende				
16	0h1210	Motor	Efficiency	64-100(%)		nt on	X/A	0	I/P	p.194
. 0	3213	efficiency		04-100(%)		motor			'' '	, ,,,,,
17	0h1211	Load	Inertia	0-8)	setting 0	X/A	0	I/P	n 101
17	UIIIZII	LUau	пісі на	U-C)	U	// /A	U	1/ [<u>p.194</u>



Code bA	CommA ddr	Name	LCD Display	Setting Range	Initial Value	Property*	V/F	SL	Ref.
		inertia rate	Rate						
18	0h1212	Trim power display	Trim Power %	70-130(%)	100	O/A	О	I/P	-
19	0h1213	Input power voltage	AC Input Volt	170-480V	230/400 V	O/A	Ο	I/P	<u>p.245</u>
20	0h1214	Auto Tuning	Auto Tuning	0 None 1 All (Rotation type) 2 ALL (Static type) Rs+Lsigma (Rotation type) 6 Tr (Static type) 7 All PM	0:None	X/A	X	I/P	p.205
21	0h1215	Stator resistance	Rs		Depende	X/A	Х	I/P	<u>p.205</u>
22	0h1216	Leakage inductance	Lsigma	Dependent on motor setting	nt on motor	X/A	Χ	I	<u>p.205</u>
23	0h1217	Stator inductance	Ls		setting	X/A	Χ	1	<u>p.205</u>
24 ⁷	0h1218	Rotor time constant	Tr	25-5000(ms)		X/A	Χ	1	<u>p.205</u>
25 ⁷	0h1219	Stator inductance scale	Ls Scale	50-150[%]	100	X/A	Χ	I	-
267	0h121A	Rotor time constant scale	Tr Scale	50-150[%]	100	X/A	Χ	I	-
28 ⁸	0h121C [R/O]	D-axis inductance	Ld (PM)	Settings vary	0	X/A	Χ	Р	-
29 ⁸	0h121D [R/O]	Q-axis inductance	Lq (PM)	depending on the motor	0	X/A	Х	Р	-
30 ⁸	0h121E [R/O]	Flux reference	PM Flux Ref	specifications.	0.147	X/A	Χ	Р	-
31 ⁷	0h121F	Regeneration inductance scale	Ls Regen Scale	70-100[%]	80	X/A	Х	I	-

⁷ Displayed when dr.09 is set to 4(IM Sensorless)

⁸ Displayed when dr.09 (Control Mode) is set to 6 (PM Sensorless).





Code bA	CommA ddr	Name	LCD Display	Setting Range	Initial Value	Property*	V/F	SL	Ref.
328	0h1220 [R/O]	Q-axis inductance scale	Lq(PM) Scale	50-150[%]	100	X/A	X	Р	-
348	0h1222 [R/O]	PM auto tuning level	Ld,Lq Tune Lev	20.0-50.0[%]	33.3	X/A	X	Р	-
35 ⁸	0h1223 [R/O]	PM auto tuning frequency	Ld,Lq Tune Hz	80.0-150.0[%]	150.0	X/A	Х	Р	-
419	0h1229	User frequency1	User Freq 1	0.00-Maximum frequency(Hz)	15.00	X/A	О	Χ	<u>p.152</u>
429	0h122A	User voltage1	User Volt 1	0-100(%)	25	X/A	0	X	<u>p.152</u>
439	0h122B	User frequency2	User Freq 2	0.00-0.00- Maximum frequency(Hz)	30.00	X/A	0	Х	<u>p.152</u>
449	0h122C	User voltage2	User Volt 2	0-100(%)	50	X/A	0	Χ	<u>p.152</u>
45 ⁹	0h122D	User frequency3	User Freq 3	0.00-Maximum frequency(Hz)	45.00	X/A	0	Х	<u>p.152</u>
46 ⁹	0h122E	User voltage3	User Volt 3	0-100(%)	75	X/A	0	Χ	<u>p.152</u>
47 ⁹	0h122F	User frequency4	User Freq 4	0.00-Maximum frequency(Hz)	Maximu m frequenc y	X/A	0	Х	<u>p.152</u>
489	0h1230	User voltage4	User Volt 4	0-100(%)	100	X/A	0	Х	<u>p.152</u>
50 ¹⁰	0h1232	Multi-step speed frequency1	Step Freq-	0.00-Maximum frequency(Hz)	10.00	O/L	0	I/P	<u>p.131</u>
51 ¹⁰	0h1233	Multi-step speed frequency2	Step Freq- 2	0.00-Maximum frequency(Hz)	20.00	O/L	0	I/P	<u>p.131</u>
52 ¹⁰	0h1234	Multi-step speed frequency3	Step Freq-	0.00-Maximum frequency(Hz)	30.00	O/L	0	I/P	<u>p.131</u>
53 ¹¹	0h1235	Multi-step	Step Freq-	0.00-Maximum	40.00	O/A	0	I/P	<u>p.131</u>

 $^{^{\}rm 9}$ Displayed if either bA.07 or M2.25 is set to 2 (User V/F).

 $^{^{\}rm 10}$ Displayed when an LCD keypad is in use.

 $^{^{11}\,}$ Displayed if one of In.65-71 is set to Speed-L/M/H



Code bA	CommA ddr	Name	LCD Display	Setting Range	Initial Value	Property*	V/F	SL	Ref.
		speed frequency4	4	frequency(Hz)					
54 ¹¹	0h1236	Multi-step speed frequency5	Step Freq- 5	0.00-Maximum frequency(Hz)	50.00	O/A	0	I/P	p.131
55 ¹¹	0h1237	Multi-step speed frequency6	Step Freq- 6	0.00-Maximum frequency(Hz)	Maximu m frequenc y	O/A	0	I/P	<u>p.131</u>
56 ¹¹	0h1238	Multi-step speed frequency7	Step Freq- 7	0.00-Maximum frequency(Hz)	Maximu m frequenc y	O/A	0	I/P	<u>p.131</u>
70	0h1246	Multi-step acceleration time1	Acc Time-	0.0-600.0(s)	20.0	O/A	Ο	I/P	<u>p.144</u>
71	0h1247	Multi-step deceleration time1	Dec Time-	0.0-600.0(s)	20.0	O/A	Ο	I/P	<u>p.144</u>
72 ¹²	0h1248	Multi-step acceleration time2	Acc Time- 2	0.0-600.0(s)	30.0	O/A	Ο	I/P	<u>p.144</u>
73 ¹²	0h1249	Multi-step deceleration time2	Dec Time- 2	0.0-600.0(s)	30.0	O/A	Ο	I/P	<u>p.144</u>
74 ¹²	0h124A	Multi-step acceleration time3	Acc Time-	0.0-600.0(s)	40.0	O/A	Ο	I/P	<u>p.144</u>
75 ¹²	0h124B	Multi-step deceleration time3	Dec Time-	0.0-600.0(s)	40.0	O/A	0	I/P	<u>p.144</u>
76 ¹²	0h124C	Multi-step acceleration time4	Acc Time-	0.0-600.0(s)	50.0	O/A	0	I/P	<u>p.144</u>
77 ¹²	0h124D	Multi-step deceleration time4	Dec Time- 4	0.0-600.0(s)	50.0	O/A	Ο	I/P	<u>p.144</u>
78 ¹²	0h124E	Multi-step acceleration time5	Acc Time- 5	0.0-600.0(s)	40.0	O/A	О	I/P	<u>p.144</u>
79 ¹²	0h124F	Multi-step	Dec Time-	0.0-600.0(s)	40.0	O/A	0	I/P	<u>p.144</u>

 $^{^{\}rm 12}$ Displayed if one of In.65-71 is set to Xcel-L/M/H.



Code bA	CommA ddr	Name	LCD Display	Setting Range	Initial Value	Property*	V/F	SL	Ref.
		deceleration time5	5						
80 ¹²	0h1250	Multi-step acceleration time6	Acc Time-	0.0-600.0(s)	30.0	O/A	0	I/P	<u>p.144</u>
81 ¹²	0h1251	Multi-step deceleration time6	Dec Time-	0.0-600.0(s)	30.0	O/A	Ο	I/P	<u>p.144</u>
82 ¹²	0h1252	Multi-step acceleration time7	Acc Time-	0.0-600.0(s)	20.0	O/A	0	I/P	<u>p.144</u>
83 ¹²	0h1253	Multi-step deceleration time7	Dec Time- 7	0.0-600.0(s)	20.0	O/A	Ο	I/P	<u>p.144</u>

8.4 Expanded Function group (PAR→Ad)

In the following table, the data shaded in grey will be displayed when a related code has been selected.

SL: Sensorless vector control (dr.09) , I – IM Sensorless, P – PM Sensorless

*O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code Ad	Comm. Addr	Name	LCD Display	Setting Range		Initial Value	Property*	V/F	SL	Ref.
00	-	Jump Code	Jump Code	1-9	9	24	O/A	О	I/P	<u>p.72</u>
01	0h1301	Acceleration pattern	Acc Pattern	0	Linear	0: Linear	X/A	О	I/P	<u>p.147</u>
02	0h1302	Deceleration pattern	Dec Pattern	1	S-curve	o. Lii ieai	X/A	Ο	I/P	<u>p.147</u>
03 ¹³	0h1303	S-curve acceleration start point gradient	Acc S Start	1-1	00(%)	40	X/A	0	I/P	<u>p.147</u>
04 ¹³	0h1304	S-curve acceleration end point gradient	Acc S End	1-1	00(%)	40	X/A	Ο	I/P	<u>p.147</u>

¹³ Displayed when Ad. 01 is set to 1 (S-curve).



Code Ad	Comm. Addr	Name	LCD Display	Se	etting Range	Initial Value	Property*	V/F	SL	Ref.
05 ¹⁴	0h1305	S-curve deceleration start point gradient	Dec S Start	1-1	00(%)	40	X/A	0	I/P	<u>p.147</u>
06 ¹⁴	0h1306	S-curve deceleration end point gradient	Dec S End		00(%)	40	X/A	0	I/P	<u>p.147</u>
07	0h1307	Start Mode	Start Mode	0	Acc DC-Start	0:Acc	X/A	0	I/P	<u>p.155</u>
08 ¹⁵	0h1308	Stop Mode	Stop Mode	0 1 2 4	Dec DC-Brake Free-Run Power Braking	-0:Dec	X/A	Ο	I/P	<u>p.157</u>
09	0h1309	Selection of prohibited rotation direction	Run Prevent	0 1 2	None Forward Prev Reverse Prev	0: None	X/A	0	I/P	p.138
10	0h130A	Starting with power on	Power-on Run	0	No Yes	0:No	O/A	О	I/P	<u>p.139</u>
12 ¹⁶	0h130C	DC braking time at startup	DC-Start Time	0.0	0-60.00(s)	0.00	X/A	0	I/P	<u>p.155</u>
13	0h130D	Amount of applied DC	DC Inj Level	0-2	200(%)	50	X/A	0	I/P	<u>p.155</u>
14 ¹⁷	0h130E	Output blocking time before DC braking	DC-Block Time	0.00- 60.00(s)		0.10	X/A	0	I/P	p.157
15 ¹⁷	0h130F	DC braking time	DC-Brake Time	0.0	0- 60.00(s)	1.00	X/A	0	I/P	<u>p.157</u>

¹⁴ Displayed when Ad. 02 is set to 1 (S-curve).

 $^{^{15}}$ DC braking and power braking (Ad.08, stop mode options 1 and 4) are not available when dr.09 (Control Mode) is set to 6 (PM Sensorless).

¹⁶ Displayed when Ad. 07 is set to 1 (DC-Start).

¹⁷ Displayed when Ad. 08 is set to 1 (DC-Brake).





Code Ad	Comm. Addr	Name	LCD Display	Setting Range	Initial Value	Property*	V/F	SL	Ref.
16 ¹⁷	0h1310	DC braking rate	DC-Brake Level	0-200(%)	50	X/A	0	I/P	<u>p.157</u>
17 ¹⁷	0h1311	DC braking frequency	DC-Brake Freq	Start frequency- 60Hz	5.00	X/A	0	I/P	<u>p.157</u>
20	0h1314	Dwell frequency on acceleration	Acc Dwell Freq	Start frequency- Maximum frequency(Hz)	5.00	X/A	0	I/P	<u>p.192</u>
21	0h1315	Dwell operation time on acceleration	Acc Dwell Time	0.0-60.0(s)	0.0	X/A	0	I/P	<u>p.192</u>
22	0h1316	Dwell frequency on deceleration	Dec Dwell Freq	Start frequency- Maximum frequency(Hz)	5.00	X/A	0	I/P	<u>p.192</u>
23	0h1317	Dwell operation time on deceleration	Dec Dwell Time	0.0-60.0(s)	0.0	X/A	0	I/P	<u>p.192</u>
24	0h1318	Frequency limit	Freq Limit	0 No 1 Yes	0:No	X/A	Ο	I/P	<u>p.161</u>
25 ¹⁸	0h1319	Frequency lower limit value	Freq Limit Lo	0.00-Upper limit frequency(Hz)	0.50	O/A	Ο	I/P	<u>p.161</u>
26 ¹⁸	0h131A	Frequency upper limit value	Freq Limit Hi	Lower limit frequency- Maximum frequency(Hz)	maximum frequency	X/A	0	I/P	<u>p.161</u>
27	0h131B	Frequency jump	Jump Freq	0 No 1 Yes	0:No	X/A	Ο	I/P	<u>p.162</u>
28 ¹⁹	0h131C	Jump frequency lower limit1	Jump Lo 1	0.00-Jump frequency upper limit1(Hz)	10.00	O/A	0	I/P	<u>p.162</u>
29 ¹⁹	0h131D	Jump frequency upper limit1	Jump Hi 1	Jump frequency lower limit1-	15.00	O/A	0	I/P	<u>p.162</u>

¹⁸ Displayed when Ad. 24 is set to 1 (Yes).

¹⁹ Displayed when Ad. 27 is set to 1 (Yes).



Code Ad	Comm. Addr	Name	LCD Display	Setting Range	Initial Value	Property*	V/F	SL	Ref.
				Maximum frequency(Hz)					
30 ¹⁹	0h131E	Jump frequency lower limit2	Jump Lo 2	0.00-Jump frequency upper limit2(Hz)	20.00	O/A	0	I/P	<u>p.162</u>
31 ¹⁹	0h131F	Jump frequency upper limit2	Jump Hi 2	Jump frequency lower limit2- Maximum frequency(Hz)	25.00	O/A	0	I/P	<u>p.162</u>
32 ¹⁹	0h1320	Jump frequency lower limit3	Jump Lo 3	0.00-Jump frequency upper limit3(Hz)	30.00	O/A	0	I/P	<u>p.162</u>
33 ¹⁹	0h1321	Jump frequency upper limit3	Jump Hi 3	Jump frequency lower limit3- Maximum frequency(Hz)	35.00	O/A	0	I/P	<u>p.162</u>
41 ²⁰	0h1329	Brake release current	BR RIs Curr	0.0-180.0(%)	50.0	O/A	О	I/P	<u>p.254</u>
42 ²⁰	0h132A	Brake release delay time	BR RIs DIy	0.00-10.00(s)	1.00	X/A	О	I/P	<u>p.254</u>
44 ²⁰	0h132C	Brake release Forward frequency	BR RIs Fwd Fr	0.00-Maximum frequency(Hz)	1.00	X/A	0	I/P	<u>p.254</u>
45 ²⁰	0h132D	Brake release Reverse frequency	BR RIs Rev Fr	0.00-Maximum frequency(Hz)	1.00	X/A	0	I/P	<u>p.254</u>
46 ²⁰	0h132E	Brake engage delay time	BR Eng Dly	0.00-10.00(s)	1.00	X/A	Ο	I/P	<u>p.254</u>
47 ²⁰	0h132F	Brake engage frequency	BR Eng Fr	0.00-Maximum frequency(Hz)	2.00	X/A	0	I/P	<u>p.254</u>
50	0h1332	Energy saving operation	E-Save Mode	0 None1 Manual2 Auto	0:None	X /A	0	Χ	<u>p.229</u>
51 ²¹	0h1333	Energy saving level	Energy Save	0-30(%)	0	O/A	0	Χ	<u>p.229</u>
60	0h133C	Acc/Dec time transition	Xcel Change Fr	0.00-Maximum frequency(Hz)	0.00	X/A	0	I/P	<u>p.146</u>

 $^{^{\}rm 20}$ Displayed if either OU.31 or OU.33 is set to 35 (BR Control).

²¹ Displayed if Ad.50 is not set to 0 (None).





Code Ad	Comm. Addr	Name	LCD Display	Se	tting Range	Initial Value	Property*	V/F	SL	Ref.
		frequency								
61	0h133D	Rotation count speed gain	Load Spd Gain	0.1	~6000.0[%]	100.0	O/A	0	I/P	-
62	0h133E	Rotation count speed scale	Load Spd Scale	0 1 2 3 4	x 1 x 0.1 x 0.01 x 0.001 x 0.0001	0: x 1	O/A	Ο	I/P	-
63	0h133F	Rotation count speed unit	Load Spd Unit	0	Rpm mpm	0: rpm	O/A	0	I/P	-
64	0h1340	Cooling fan control	FAN Control	0 1 2	During Run Always ON Temp Control	0:During Run	O/A	0	I/P	<u>p.244</u>
65	0h1341	Up/down operation frequency save	U/D Save Mode	0	No Yes	0:No	O/A	0	I/P	<u>p.188</u>
66	0h1342	Output contact On/Off control options	On/Off Ctrl Src	0 1 3 4 6	None V1 V2 I2 Pulse	0:None	X/A	0	I/P	<u>p.188</u>
67	0h1343	Output contact On level	On-Ctrl Level	COI	tput ntact off el- 100.00%	90.00	X/A	0	I/P	<u>p.256</u>
68	0h1344	Output contact Off level	Off-Ctrl Level	COI	00.00-output ntact on el (%)	10.00	X/A	0	I/P	<u>p.256</u>
70	0h1346	Safe operation selection	Run En Mode	0	Always Enable DI Dependent	0:Always Enable	X/A	0	I/P	p.190
71 ²²	0h1347	Safe operation stop options	Run Dis Stop	0 1 2	Free-Run Q-Stop Q-Stop Resume	0:Free- Run	X/A	Ο	I/P	p.190
72 ²²	0h1348	Safe operation deceleration	Q-Stop Time	0.0	-600.0(s)	5.0	O/A	0	I/P	<u>p.190</u>

 $^{^{\}rm 22}$ Displayed when Ad.70 is set to 1 (DI Dependent).



Code Ad	Comm. Addr	Name	LCD Display	Setting Range		Initial Value	Property*	V/F	SL	Ref.
		time								
74 ²³	0h134A	Selection of regeneration evasion	RegenAvd	0	No	0:No	X/A	0	1	p.257
	01110171	function for press	Sel	1	Yes	0.110	7071		'	<i>p.201</i>
		Voltage level of regeneration	RegenAvd	2S/	T: 300-400V	350				
75 ²³	0h134B	evasion motion for press	Level	4T:	600-800V	700	X/A	Ο		<u>p.257</u>
76 ²⁴	0h134C	Compensation frequency limit of regeneration evasion for press	CompFreq Limit	0.0	0- 10.00Hz	1.00	X/A	0	_	p.257
77 ²⁴	0h134D	Regeneration evasion for press P gain	RegenAvd Pgain	0.0	- 100.0%	50.0	O/A	0	I	<u>p.257</u>
78 ²⁴	0h134E	Regeneration evasion for press I gain	RegenAvd Igain	20-	-30000(ms)	500	O/A	0	I	<u>p.257</u>
79	0h134F	DB Unit turn on voltage	DB Turn		n ²⁵ ~400[V]	390[V]	X/A	0	I/P	-
		level	On Lev	4T: Mir	า ²⁵ ~800[V]	780[V]				
80	0h1350	Fire mode selection	Fire Mode Sel	0	None Fire Mode	0:None	X/A	0	I/P	<u>p.175</u>
				2	Fire Mode Test					
81 ²⁶	0h1351	Fire mode frequency	Fire Mode Freq		0~60.00(Hz]	60.00	X/A	0	I/P	<u>p.175</u>
82 ²⁶	0h1352	Fire mode direction	Fire Mode Dir	0	Forward Reverse	0: Forward	X/A	0	I/P	<u>p.175</u>
83 ²⁶		Fire Mode	Fire Mode	Cai	n not be					<u>p.175</u>

 $^{^{\}rm 23}$ Displayed when dr.09 (Control Mode) is not set to 6 (PM Sensorless).

²⁴ Displayed when Ad.74 is set to 1 (Yes).

²⁵ DC voltage value (convert bA.19 AC Input voltage) + 20V (2S/T type) or + 40V (4T type)

²⁶ Displayed when Ad.80 is set to 1 (Yes).



Code Ad	Comm. Addr	Name	LCD Display	Setting Range	Initial Value	Property*	V/F	SL	Ref.
		Count	Cnt	modified					

8.5 Control Function group (PAR→Cn)

In the following table, the data shaded in grey will be displayed when a related code has been selected.

SL: Sensorless vector control (dr.09), I – IM Sensorless, P – PM Sensorless

*O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code Cn	Comm Addr	Name	LCD Display		ig Range	Initial Value	Property *	V/F	SL	Ref.
00	-	Jump Code	Jump Code	1-99		4	O/A	Ο	I/P	<u>p.72</u>
04	0h1404		Carrier Freq	Heavy Duty	V/F: 1.0- 15.0(kHz) 27 SL: 2.0- 15.0(kHz)	3.0	X/A	0	I/P	<u>p.240</u>
04	0h1404			Normal Duty ²⁸	V/F: 1.0- 5.0 (kHz) ²⁹ SL: 2.0- 5.0(kHz)	2.0				<u>p.240</u>
05	0h1405	Switching mode	PWM Mode	0	Normal PWM Lowleaka ge PWM	0:Normal PWM	X/A	0	I	<u>p.240</u>
09 ³⁰	0h1409	Initial excitation time	PreExTim e	0.00-60.0		1.00	X/A	Χ	I	<u>p.212</u>

 $^{^{27}}$ In case of 0.4~4.0kW, the setting range is 2.0~15.0(kHz).

²⁸ PM synchronous motor sensorless vector control mode does not support normal duty operation [when dr.09 (Control Mode) is set to 6 (PM Sensorless)].

 $^{^{29}}$ In case of 0.4~4.0kW, the setting range is 2.0~5.0(kHz).

³⁰ Displayed when dr.09 (Control Mode) is not set to 6 (PM Sensorless).



Code Cn	Comm Addr	Name	LCD Display	Se	tting Range	Initial Value	Property *	V/F	SL	Ref.
10 ³⁰	0h140A	Initial excitation amount	Flux Force	100.0)-300.0(%)	100.0	X/A	Χ	I	<u>p.212</u>
11 ³⁰	0h140B	Continued operation duration	Hold Time	0.00-	60.00(s)	0.00	X/A	X	1	<u>p.212</u>
12 ³¹	0h140D	PM S/L speed controller proportional gain1	ASR P Gain 1	0~500	00	100	X/A	Χ	Р	
1331	0h140F	PM S/L speed controller integral gain1	ASR P Gain 1	0~500	00	150	X/A	X	Р	
15 ³¹	0h1410	PM S/L speed controller proportional gain2	ASR P Gain 1	0~5000		100	X/A	Х	Р	
16 ³¹	0h1410	PM S/L speed controller integral gain2	ASR P Gain 1	0~99	99	150	X/A	Х	Р	
2030	0h1414	Sensorless 2 nd gain display setting	SL2 G View Sel	0	No Yes	0:No	O/A	Χ	I	<u>p.212</u>
21 ³⁰	0h1415	Sensorless speed controller proportional gain1	ASR-SL P Gain1	0-500	00(%)	Dependent on motor	O/A	X	I	p.212
22 ³⁰	0h1416	Sensorless speed controller integral gain1	ASR-SL1 Gain1	10-9999(ms)		setting	O/A	Χ	I	<u>p.212</u>
23 ³²	0h1417	Sensorless speed controller proportional	ASR-SL P Gain2	1.0-1000.0(%)		Dependent on motor setting	O/A	Х	I	<u>p.212</u>

³¹ Displayed when dr.09 (Control Mode) is set to 6 (PM Sensorless).

 $^{^{32}}$ Displayed when dr.09 is set to 4 (IM Sensorless) and Cn.20 is set to 1 (YES).



Code Cn	Comm Addr	Name	LCD Display	Setting Range	Initial Value	Property *	V/F	SL	Ref.
		gain2							
24 ³²	0h1418	Sensorless speed controller integral gain2	ASR-SL1 Gain2	1.0-1000.0(%)		O/A	Χ	I	<u>p.212</u>
25 ³²	0h1419	Sensorless speed controller integral gain 0	ASR-SL I Gain0	1.0~999.9(ms)		O/A	Χ	I	-
26 ³²	0h141A	Flux estimator proportional gain	Flux P Gain	10-200(%)		O/A	Χ	I	<u>p.212</u>
27 ³²	0h141B	Flux estimator integral gain	Flux I Gain	10-200(%)		O/A	Χ	I	<u>p.212</u>
28 ³²	0h141C	Speed estimator proportional gain	S-Est P Gain1	0-32767		O/A	Χ	I	<u>p.212</u>
29 ³²	0h141D	Speed estimator integral gain1	S-Est I Gain1	100-1000		O/A	Χ	I	<u>p.212</u>
30 ³²	0h141E	Speed estimator integral gain2	S-Est I Gain2	100-10000		O/A	Χ	I	p.212
31 ³²	0h141F	Sensorless current controller proportional gain	ACR SL P Gain	10-1000		O/A	Х	I	<u>p.212</u>
32 ³²	0h1420	Sensorless current controller integral gain	ACR SL I Gain	10 -1000		O/A	X	I	<u>p.212</u>
33 ³³	0h1421	PM D-axis back-EMF estimation gain [%]	PM EdGain Perc	0~300.0[%]	100.0	X/A	Х	Р	-
34 ³³	0h1422	PM Q-axis back-EMF estimation gain [%]	PM EqGain Perc	0~300.0[%]	100.0	X/A	Х	Р	-

 $^{^{\}rm 33}$ Displayed when dr.09 (Control Mode) is set to 6 (PM Sensorless).



Code Cn	Comm Addr	Name	LCD Display	Setting Range		Initial Value	Property *	V/F	SL	Ref.
35 ³³	0h1423	Initial pole position detection retry number	PD Repeat Num	0~10		2	X/A	Х	Р	-
36 ³³	0h1424	Initial pole position detection pulse interval	Pulse Interval	1~100)	20	X/A	Χ	Р	-
37 ³³	0h1425	Initial pole position detection current level [%]	Pulse Curr %	10~10	00	15	X/A	X	Р	-
38 ³³	0h1426	Initial pole position detection voltage level [%]	Pulse Volt %	100~4	-000	500	X/A	X	Р	-
39 ³³	0h1427	PM dead time range [%]	PMdead Band Per	50.0~	100.0	100.0	X/A	Χ	Р	-
40 ³³	0h1428	PM dead time voltage [%]	Pmdead Volt Per	50.0~	100.0	100.0	X/A	Х	Р	-
41 ³³	0h1429	Speed estimator P gain1	PM SpdEst Kp	0~320	000	100	X/A	Х	Р	-
4233	0h142A	Speed estimator I gain1	PM SpdEst Ki	0~320	000	10	X/A	Х	Р	-
43 ³³	0h142B	Speed estimator P gain2	PM SpdEst Kp 2	0~320	000	300	X/A	Х	Р	-
44 ³³	0h142C	Speed estimator I gain2	PM SpdEst Ki 2	0~320	000	30	X/A	Х	Р	-
45 ³³	0h142D	Speed estimator feed forward high speed rate [%]	PM Flux FF %	0~100[%]		30.0	X/A	Х	Р	-
		Initial pole position	Init	0 None						
46 ³³	0h142E	detection	Angle Sel	1 Angle		1	X/A	Χ	Р	-
48 ³³	0h1430	options Current	ACR P	2 Align		1200	O/A	Χ	I/P	
	0111700	Janon	/ \OI\ I	0-10000		1200	OIT	^	1/ 1	L



Code Cn	Comm Addr	Name	LCD Display	Setting Range	Initial Value	Property *	V/F	SL	Ref.
		controller P gain	Gain						
49 ³³	0h1431	Current controller I gain	ACR I Gain	0-10000	120	O/A	Χ	I/P	-
50 ³³	0h1432	Voltage controller limit	V Con HR	0~100.0[%]	10.0	X/A	Χ	Р	-
51 ³³	0h1433	Voltage controller I gain	V Con Ki	0~1000.0[%]	10.0	X/A	X	Р	-
52	0h1434	Torque controller output filter	Torque Out LPF	0-2000(ms)	0	X/A	Χ	I/P	<u>p.212</u>
53	0h1435	Torque limit setting options	Torque Lmt Src	 Keypad-1 Keypad-2 V1 V2 I2 Int 485 FieldBus Pulse 	0: Keypad-1	X/A	X	I/P	<u>p.212</u>
54 ³⁴	0h1436	Positive- direction reverse torque limit	FWD +Trq Lmt	0.0-200.0(%)	180	O/A	Х	I/P	<u>p.212</u>
55 ³⁴	0h1437	Positive- direction regeneration torque limit	FWD -Trq Lmt	0.0-200.0(%)	180	O/A	Х	I/P	<u>p.212</u>
56 ³⁴	0h1438	Negative- direction regeneration torque limit	REV +Trq Lmt	0.0-200.0(%)	180	O/A	X	I/P	<u>p.212</u>
57 ³⁴	0h1439	Negative- direction reverse torque limit	REV -Trq Lmt	0.0-200.0(%)	180	O/A	X	I/P	<u>p.212</u>
62 ³⁴	0h143E	Speed limit Setting	Speed Lmt Src	0 Keypad-1 1 Keypad-2 2 V1 4 V2 5 I2 6 Int 485	0: Keypad-1	X/A	Х	I/P	-

³⁴ Displayed when dr.09 is set to 4 (IM Sensorless). This will change the initial value of the parameter at Ad.74 (Torque limit) to 150%.



Code Cn	Comm Addr	Name	LCD Display	Se	tting Range	Initial Value	Property *	V/F	SL	Ref.
				7	FieldBus					
63 ³⁴	0h143F	Positive- direction speed limit	FWD Speed Lmt		- Maximum uency (Hz)	50.00	O/A	Х	I/P	-
64 ³⁴	0h1440	Negative- direction speed limit	REV Speed Lmt		- Maximum uency (Hz)	50.00	O/A	Χ	I/P	-
65 ³⁴	0h1441	Speed limit operation gain	Speed Lmt Gain	100~	5000[%]	500	O/A	Χ	I/P	-
69 ³⁵	0h1445	PM speed search current	SS Pulse Curr	10~1		15	O/A	Χ	Р	-
		Spood soarch		0	Flying Start- 1 ³⁶	0.				
70	0h1446	Speed search mode	SS Mode	1	Flying Start- 2	0: Flying	X/A	О	I/P	<u>p.234</u>
		selection		2	Flying Start- 3 ³⁵	- Start-1				
				bit	0000-1111					
				000	Selection of speed search on acceleration					
71	Oh1447		Speed Search	001	When starting on initialization after fault trip	0000 ³⁷	X/A	0	I/P	<u>p.234</u>
71 (010	When restarting after instantaneo us power interruption					
				100	When starting with power					

³⁵ Displayed when dr.09 (Control Mode) is set to 6 (PM Sensorless).

 $^{^{\}rm 36}$ Will not be displayed if dr.09 is set to 4 (IM Sensorless).

³⁷ The initial value 0000 will be displayed on the keypad as a .



Code Cn	Comm Addr	Name	LCD Display	Setting Range		Initial Value	Property *	V/F	SL	Ref.
					on					
72 ³⁸	0h1448	Speed search reference current	SS Sup- Current	80-20	00(%)	150	O/A	0	I/P	<u>p.234</u>
73 ³⁹	0h1449	Speed search proportional gain	SS P- Gain	0-9999		Flying Start-1: 100 Flying Start-2: 600 ⁴⁰	O/A	О	1	<u>p.234</u>
74 ³⁹	0h144A	Speed search integral gain	SS I- Gain	0-999	99	Flying Start-1 : 200 Flying Start-2 : 1000	O/A	Ο	1	<u>p.234</u>
75 ³⁹	0h144B	Output blocking time before speed search	SS Block Time	0.0-6	0.0(s)	1.0	X/A	0	I/P	p.234
76 ³⁹	0h144C	Speed search Estimator gain	Spd Est Gain	50-15	50(%)	100	O/A	Ο	I	-
77	0h144D	Energy buffering selection	KEB Select	0	No Yes	0:No	X/A	Ο	I/P	<u>p.228</u>
78 ⁴¹	0h144E	Energy buffering start level	KEB Start Lev	110.0	-140.0(%)	125.0	X/A	0	I/P	<u>p.228</u>
79 ⁴¹	0h144F	Energy buffering stop level	KEB Stop Lev	125.0-145.0(%)		130.0	X/A	0	I/P	<u>p.228</u>
80 ⁴¹	0h1450	Energy buffering gain	KEB Gain	1-20000		1000	O/A	О	I/P	<u>p.228</u>
85 ⁴²	0h1455	Flux estimator proportional	Flux P Gain1	100-700		370	O/A	Χ	I	<u>p.212</u>

³⁸ Displayed when any of the Cn.71 code bits are set to 1 and Cn70 is set to 0 (Flying Start-1).

³⁹ Displayed when any of the Cn.71 code bits are set to 1.

 $^{^{40}}$ The initial value is 1200 when the motor-rated capacity is less than 7.5 kW

⁴¹ Displayed when Cn.77 is set to 1 (Yes).

⁴² Displayed when Cn.20 is set to 1 (Yes).



Code Cn	Comm Addr	Name	LCD Display	Setting Range	Initial Value	Property *	V/F	SL	Ref.
		gain1							
81 ⁴¹	0h1451	Energy buffering I gain	KEB I Gain	1~20000	500	O/A	0	I/P	p.217
82 ⁴¹	0h1452	Energy buffering Slip gain	KEB Slip Gain	0~2000.0%	30.0	O/A	0	I	<u>p.217</u>
83 ⁴¹	0h1453	Energy buffering acceleration time	KEB Acc Time	0.0~600.0(s)	10.0	O/A	0	I/P	<u>p.217</u>
85 ⁴³	0h1455	Flux estimator proportional gain1	Flux P Gain1	100-700	370	O/A	Χ	1	<u>p.212</u>
86 ⁴²	0h1456	Flux estimator proportional gain2	Flux P Gain2	0-100	0	O/A	Х	I	<u>p.212</u>
87 ⁴²	0h1457	Flux estimator proportional gain3	Flux P Gain3	0-500	100	O/A	Χ	1	<u>p.212</u>
88 ⁴²	0h1458	Flux estimator integral gain1	Flux I Gain1	0-200	50	O/A	X	I	<u>p.212</u>
89 ⁴²	0h1459	Flux estimator integral gain2	Flux I Gain2	0-200	50	O/A	Χ		<u>p.212</u>
90 ⁴²	0h145A	Flux estimator integral gain3	Flux I Gain3	0-200	50	O/A	Χ	I	<u>p.212</u>
91 ⁴²	0h145B	Sensorless voltage compensation1	SL Volt Comp1	0-60		O/A	Х	I	<u>p.212</u>
92 ⁴²	0h145C	Sensorless voltage compensation2	SL Volt Comp2	0-60	Dependent on motor	O/A	Χ	I	<u>p.212</u>
93 ⁴²	0h145D	Sensorless voltage compensation 3	SL Volt Comp3	0-60	setting	O/A	Χ	I	<u>p.212</u>
94 ⁴²	0h145E	Sensorless field weakening start frequency	SL FW Freq	80.0-110.0(%)	100.0	X/A	Χ	I	<u>p.208</u>
95 ⁴²	0h145F	Sensorless	SL Fc	0.00-8.00(Hz)	2.00	X/A	Χ		<u>p.208</u>

 $^{^{\}rm 43}$ Displayed when Cn.20 is set to 1 (Yes).



Code Cn	Comm Addr	Name	LCD Display	Setting Range	Initial Value	Property *	V/F	SL	Ref.
		gain switching frequency	Freq						

8.6 Input Terminal Block Function group (PAR→In)

In the following table, the data shaded in grey will be displayed when a related code has been selected.

SL: Sensorless vector control (dr.09) , I – IM Sensorless, P – PM Sensorless

*O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code In	Comm. Address	Naml/P	LCD Display	Setting Range		Initial Value	Property *	V/F	SL	Ref.
00	-	Jump Code	Jump Code	1-99		65	O/A	Ο	I/P	<u>p.72</u>
01	0h1501	Frequency for maximum analog input	Freq at 100%	Ma	art equency- aximum equency(Hz)	Maximum frequency	O/A	0	I/P	<u>p.118</u>
02	0h1502	Torque at maximum analog input	Torque at100%	0.0)-200.0(%)	100.0	O/A	Χ	Χ	-
05	0h1505	V1 input voltage display	V1 Monitor(V)	-12	2.00-12.00(V)	0.00	-/A	0	I/P	<u>p.118</u>
06	0h1506	V1 input polarity selection	V1 Polarity	0	Unipolar Bipolar	0: Unipolar	X/A	0	I/P	<u>p.118</u>
07	0h1507	Time constant of V1 input filter	V1 Filter	0-1	10000(ms)	100	O/A	0	I/P	<u>p.118</u>
08	0h1508	V1 Minimum input voltage	V1 Volt x1	0.0	00-10.00(V)	0.00	O/A	О	I/P	<u>p.118</u>
09	0h1509	V1 output at Minimum voltage (%)	V1 Perc y1	0.0	00-100.00(%)	0.00	O/A	Ο	I/P	<u>p.118</u>
10	0h150A	V1 Maximum input voltage	V1 Volt x2	0.00-12.00(V)		10.00	O/A	Ο	I/P	<u>p.118</u>
11	0h150B	V1 output at Maximum voltage (%)	V1 Perc y2	0.00-100.00(%)		100.00	O/A	Ο	I/P	<u>p.118</u>



Code In	Comm. Address	Naml/P	LCD Display	Setting Range		Initial Value	Property *	V/F	SL	Ref.
12 ⁴⁴	0h150C	V1 Minimum input voltage	V1 -Volt x1'	-10	.00- 0.00(V)	0.00	O/A	0	I/P	<u>p.122</u>
13 ⁴⁴	0h150D	V1output at Minimum voltage (%)	V1 -Perc y1'	-10	0.00-0.00(%)	0.00	O/A	0	I/P	<u>p.122</u>
14 ⁴⁴	0h150E	V1 Maximum input voltage	V1 -Volt x2'	-12	.00- 0.00(V)	-10.00	O/A	0	I/P	<u>p.122</u>
15 ⁴⁴	0h150F	V1 output at Maximum voltage (%)	V1 -Perc y2'	-10	0.00-0.00(%)	-100.00	O/A	0	I/P	<u>p.122</u>
16	0h1510	V1 rotation direction change	V1 Inverting	0	No Yes	0: No	O/A	0	I/P	<u>p.118</u>
17	0h1511	V1 quantization level	V1 Quantizing		0 ⁴⁵ , 0.04- 00(%)	0.04	X/A	0	I/P	<u>p.118</u>
35 ⁴⁶	0h1523	V2 input voltage display	V2 Monitor(V)	0.0	0-12.00(V)	0.00	-/A	0	I/P	<u>p.125</u>
37 ⁴⁶	0h1525	V2 input filter time constant	V2 Filter	0-1	0000(ms)	100	O/A	Ο	I/P	<u>p.125</u>
38 ⁴⁶	0h1526	V2 Minimum input voltage	V2 Volt x1	0.0	0-10.00(V)	0.00	O/A	Χ	I/P	<u>p.125</u>
39 ⁴⁶	0h1527	V2 output at Minimum voltage (%)	V2 Perc y1	0.0	0-100.00(%)	0.00	O/A	Ο	I/P	<u>p.125</u>
40 ⁴⁶	0h1528	V2 Maximum input voltage	V2 Volt x2	0.0	0-10.00(V)	10	O/A	Χ	I/P	<u>p.125</u>
41 ⁴⁶	0h1529	V2 output at Maximum voltage (%)	V2 Perc y2	0.0	0-100.00(%)	100.00	O/A	0	I/P	p.125
46 ⁴⁶	0h152E	V2 rotation direction change	V2 Inverting	0	No Yes	0:No	O/A	0	I/P	p.125
47 ⁴⁶	0h152F	V2 quantization level	V2 Quantizing		0 ⁴⁵ , 0.04-	0.04	O/A	Ο	I/P	<u>p.125</u>

⁴⁴ Displayed when In.06 is set to 1 (Bipolar).

 $^{^{\}rm 45}$ Quantizing is not used when set to 0.

 $^{^{46}}$ Displayed when V is selected on the analog current/voltage input circuit selection switch (SW2).





Code In	Comm. Address	Naml/P	LCD Display	Setting Range		Initial Value	Property *	V/F	SL	Ref.
50 ⁴⁷	0h1532	I2 input current display	I2 Monitor (mA)	0-2	24(mA)	0.00	-/A	0	I/P	<u>p.124</u>
52 ⁴⁷	0h1534	12 input filter time constant	12 Filter	0-1	0000(ms)	100	O/A	О	I/P	<u>p.124</u>
53 ⁴⁷	0h1535	I2 minimum input current	12 Curr x1	0.0	0-20.00(mA)	4.00	O/A	Ο	I/P	<u>p.124</u>
54 ⁴⁷	0h1536	I2 output at Minimum current (%)	I2 Perc y1	0.0	0-100.00(%)	0.00	O/A	Ο	I/P	<u>p.124</u>
55 ⁴⁷	0h1537	I2 maximum input current	12 Curr x2	0.0	0-24.00(mA)	20.00	O/A	Ο	I/P	<u>p.124</u>
56 ⁴⁷	0h1538	I2 output at Maximum current (%)	I2 Perc y2	0.0	0-100.00(%)	100.00	O/A	Ο	I/P	<u>p.124</u>
61 ⁴⁷	0h153D	Changing rotation direction of I2	I2 Inverting	1	No Yes	0:No	O/A	Ο	I/P	<u>p.124</u>
62 ⁴⁷	0h153E	I2 quantization level	I2 Quantizing		0 ⁴⁵ ,0.04- 00(%)	0.04	O/A	Ο	I/P	<u>p.124</u>
		P1 terminal		0	None					
65	0h1541	function setting	P1 Define	1	Fx	1:Fx	X/A	Ο	I/P	<u>p.133</u>
66	0h1542	P2 terminal function setting	P2 Define	2	Rx	2:Rx	X/A	0	I/P	<u>p.133</u>
67	0h1543	P3 terminal function setting	P3 Define	3	RST	5:BX	X/A	0	I/P	<u>p.293</u>
68	0h1544	P4 terminal function setting	P4 Define	4	External Trip	3:RST	X/A	0	I/P	<u>p.282</u>
69	0h1545	P5 terminal function setting	P5 Define	5	BX	7:Sp-L	X/A	0	I/P	<u>p.292</u>
70	0h1546	P6 terminal function setting	P6 Define	6	JOG	8:Sp-M	X/A	0	I/P	<u>p.184</u>
71	0h1547	P7 terminal function	P7 Define	7	Speed-L	9:Sp-H	X/A	Ο	I/P	<u>p.131</u>

 $^{^{\}rm 47}$ Displayed when I is selected on the analog current/voltage input circuit selection switch (SW2).



Code In	Comm. Address	Naml/P	LCD Display	Se	etting Range	Initial Value	Property *	V/F	SL	Ref.
		setting								
				8	Speed-M					p.131
				9	Speed-H					<u>p.131</u>
				11	XCEL-L					p.144
				12	XCEL-M					<u>p.144</u>
				13	RUN					p.190
					Enable					
				14						<u>p.189</u>
				15	2nd Source					<u>p.163</u>
				16	Exchange					<u>p.243</u>
				17	Up					<u>p.188</u>
				18	Down					<u>p.188</u>
				20	U/D Clear					<u>p.188</u>
				21	Analog					p.130
				21	Hold					<i>p.130</i>
				22	I-Term					p.197
					Clear					<i>p.177</i>
				23	PID					p.197
					Openloop					
				24						<u>p.197</u>
				25	XCEL Stop					<u>p.149</u>
				26	2nd Motor					<u>p.241</u>
				34	Pre Excite					<u>-</u>
				38	Timer In					<u>p.253</u>
				40	dis Aux Ref					<u>p.179</u>
				46	FWD JOG					<u>p.186</u>
				47	REV JOG					<u>p.186</u>
				49	XCEL-H					<u>p.144</u>
				50	User Seq					<u>p.168</u>
				51						<u>p.175</u>
				54	TI ⁴⁸					p.127
				P7-	P1 in IP20					
		Multi function			dels,					
		Multi-function input terminal			P1 in IP66	, =				
84	0h1554	On filter	DI Delay Sel		dels	111 1111 ⁴⁹	O/A	0	I/P	<u>p.164</u>
		selection		0	Disable(Off)					
		3310011011			1 1					
				1	Enable(On)					<u> </u>

 $^{^{\}rm 48}$ Displayed when P5 is selected on Px terminal function. (IP66 models only.)

⁴⁹ The initial value 111 1111 will be displayed on the keypad as



Code In	Comm. Address	Naml/P	LCD Display	Se	tting Range	Initial Value	Property *	V/F	SL	Ref.
85	0h1555	Multi-function input terminal On filter	DI On Delay	0-10000(ms)		10	O/A	0	I/P	<u>p.164</u>
86	0h1556	Multi-function input terminal Off filter	DI Off Delay	0-1	0000(ms)	3	O/A	0	I/P	<u>p.164</u>
87	0h1557	Multi-function input contact selection	DI NC/NO Sel	P7- P1 in IP20 models, P5-P1 in IP66 models 0 A contact (NO) 1 B contact (NC)		000 0000 ⁵⁰	X/A	0	I/P	<u>p.164</u>
89	0h1559	Multi-step command delay time	InCheck Time	1-5000(ms)		1	X/A	0	I/P	<u>p.131</u>
90	0h155A	Multi-function input terminal status	DI Status	mo P5-	P1 in IP20 dels, P1 in IP66 dels release(Off) Connection (On)	000 0000 ⁵⁰	-/A	0	I/P	p.164
91	0h155B	Pulse input amount display	Pulse Monitor (kHz)	0.0	0-50.00(kHz)	0.00	-/A	Ο	I/P	<u>p.127</u>
92	0h155C	TI input filter time constant	TI Filter	0-9	999(ms)	10	O/A	О	I/P	<u>p.127</u>
93	0h155D	TI Minimum input pulse	TI PIs x1	0.0	0-32.00(kHz)	0.00	O/A	Ο	I/P	<u>p.127</u>
94	0h155E	TI output at Minimum pulse (%)	TI Perc y1	0.0	0-100.00(%)	0.00	O/A	Ο	I/P	<u>p.127</u>
95	0h155F	TI Maximum input pulse	TI PIs x2	0.00-32.00(kHz)		32.00	O/A	О	I/P	<u>p.127</u>
96	0h1560	TI Output at Maximum pulse (%)	TI Perc y2	0-100(%)		100.00	O/A	0	I/P	<u>p.127</u>
97	0h1561	TI rotation	TI	0	No	0:No	O/A	Ο	I/P	<u>p.127</u>



Code In	Comm. Address	Naml/P	LCD Display	Setting Range		Initial Value	Property *	V/F	SL	Ref.
		direction change	Inverting	1	Yes					
98	0h1562	TI quantization level	TI Quantizing		0 ⁴⁵ , 0.04- 00(%)	0.04	O/A	0	I/P	<u>p.127</u>
				Bi t	00~11					
00	0h1E40	SW1(NPN/PNP)	IO SW	00	NPN, V2	01	/ ^		L/D	
99	0h1563	SW2(V1/V2[I2]) status	State	01	NPN, I2	UT	-/A	U	I/P	_
		status		10	PNP, V2					
				11	PNP, I2					

8.7 Output Terminal Block Function group (PAR→OU)

SL: Sensorless vector control (dr.09) , I – IM Sensorless, P – PM Sensorless * O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code OU	Comm. Addr	Name	LCD Display	Setting Range		Initial Value	Prope rty*	V/F	SL	Ref.
00	-	Jump Code	JumpCode	1-99		30	O/A	0	I/P	<u>p.72</u>
01	0h1601	Analog output 1 item	AO1 Mode	0 1 2 3 4 5 6 7 8 9 10 12 13 14 15	Frequency Output Current Output Voltage DCLink Voltage Torque Output Power Idse Iqse Target Freq Ramp Freq Speed Fdb PID Ref Value PID Output Constant	0:Freq uency	O/A	Ο	I/P	<u>p.258</u>
02	0h1602	Analog output 1 gain	AO1 Gain	-10	00.0-1000.0(%)	100.0	O/A	Ο	I/P	p.258
03	0h1603	Analog	AO1 Bias	-10	0.0-100.0(%)	0.0	O/A	0	I/P	p.258





Code OU	Comm. Addr	Name	LCD Display	Setting Range	Initial Value	Prope rty*	V/F	SL	Ref.
		output 1 bias							
04	0h1604	Analog output 1 filter	AO1 Filter	0-10000(ms)	5	O/A	О	I/P	<u>p.258</u>
05	0h1606	Analog constant output 1	AO1 Const %	0.0-100.0(%)	0.0	O/A	Ο	I/P	<u>p.258</u>
06	0h1606	Analog output 1 monitor	AO1 Monitor	` ′	0.0	-/A	Ο	I/P	<u>p.258</u>
07	0h1607	Analog output 2 item	AO2 Mode [0034 model only]	 O Frequency Output Current Output Voltage DCLink Voltage Torque Output Power Idse Iqse Target Freq Ramp Freq Speed Fdb PID Ref Value PID Fdb Value PID Output Constant 					
08	0h1608	Analog output 2 gain	AO2 Gain [0034 model only]	-1000.0~1000.0(%)	100.0	0	Ο	I/P	<u>p.258</u>
09	0h1609	Analog output 2 bias	AO2 Bias [0034 model only]	-100.0~100.0(%)	0.0	0	Ο	I/P	<u>p.258</u>
10	0h160A	Analog output 2 filter	AO2 Filter [0034 model only]	0~10000(ms)	5	0	0	I/P	<u>p.258</u>
11	0h160B	Analog constant output 2	AO2 Const % [0034 model only]	0.0~100.0(%)	0.0	О	О	I/P	<u>p.258</u>
12	0h160C	Analog output 2 monitor	AO2 Monitor [0034 model	0.0~1000.0(%)	0.0		Ο	I/P	<u>p.258</u>



Code OU	Comm. Addr	Name	LCD Display		Setting Range	Initial Value	Prope rty*	V/F	SL	Ref.	
			only]								
				bit	000-111						
				1	Low voltage						
		Fault			Any faults						
30	0h161E	output	Trip Out	2	other than low	010 ⁵¹	O/A	0	I/P	<u>p.267</u>	
		item	Mode		voltage				., .		
					Automatic						
				3	restart final						
				_	failure					ļ	
				0	None						
				1	FDT-1						
				2	FDT-2						
				3	FDT-3						
				4	FDT-4						
				5	Over Load						
				6 7	IOL Under Load						
				8	Fan Warning						
					9	Stall					
				10	Over Voltage						
				11	Low Voltage						
				12	Over Heat						
		Multi- function		13	Lost Command						
31	0h161F	relay 1	Relay 1	14	Run	29:Trip	O/A	Ο	I/P	<u>p.263</u>	
		item		15	Stop						
		Itterri		16	Steady						
				17	Inverter Line						
				18	Comm Line						
				19	Speed Search						
				22	Ready						
				28	Timer Out						
					Trip						
				31	DB Warn%ED						
				34	On/Off Control						
				35	BR Control						
				36	CAP.Warning						
				37	FAN Exchange						
				38	Fire Mode		<u> </u>			L	



Code OU	Comm. Addr	Name	LCD Display	Setting Range	Initial Value	Prope rty*	V/F	SL	Ref.
33	0h1621	Multi- function output1 item	Q1 Define	0 None 1 FDT-1 2 FDT-2 3 FDT-3 4 FDT-4 5 Over Load 6 IOL 7 Under Load 8 Fan Warning 9 Stall 10 Over Voltage 11 Low Voltage 12 Over Heat 13 Lost Command 14 Run 15 Stop 16 Steady 17 Inverter Line 18 Comm Line 19 Speed Search 22 Ready 28 Timer Out 29 Trip 31 DB Warn%ED 34 On/Off Control 35 BR Control 36 CAP.Warning 37 FAN Exchange 38 Fire Mode 39 TO ⁵²	14:Run	O/A	0	I/P	p.263
41	0h1629	Multi- function output monitor	DO Status	-	00	-/A	-	-	p.263
50	0h1632	Multi- function output On delay	DO On Delay	0.00-100.00(s)	0.00	O/A	0	I/P	<u>p.268</u>
51	0h1633	Multi- function	DO Off Delay	0.00-100.00(s)	0.00	O/A	0	I/P	<u>p.268</u>

⁵² Supported in IP66 models only.



Code OU	Comm. Addr	Name	LCD Display	Setting Range		Initial Value	Prope rty*	V/F	SL	Ref.
		output Off delay								
52	0h1634	Multi- function output contact selection	DO NC/NO Sel	Q1, 0	Relay1 A contact (NO) B contact (NC)	00 ⁵³	X/A	0	I/P	p.268
53	0h1635	Fault output On delay	TripOut OnDly	0.00-100.00(s)		0.00	O/A	0	I/P	<u>p.267</u>
54	0h1636	Fault output Off delay	TripOut OffDly	0.00-100.00(s)		0.00	O/A	0	I/P	<u>p.267</u>
55	h1637	Timer On delay	TimerOn Delay	0.00-100.00(s)		0.00	O/A	О	I/P	<u>p.253</u>
56	0h1638	Timer Off delay	TimerOff Delay	0.00-100.00(s)		0.00	O/A	О	I/P	<u>p.253</u>
57	0h1639	Detected frequency	FDT Frequency	0.00-Maximum frequency(Hz)		30.00	O/A	0	I/P	p.263
58	0h163A	Detected frequency band	FDT Band)-Maximum quency(Hz)	10.00	O/A	0	I/P	<u>p.263</u>
61	0h163D	Pulse output gain	TO Mode	7 Iqse		0: Freque ncy	O/A	0	I/P	p.261
62	0h163E	Pulse output	TO Gain	-10	00.0-1000.0(%)	100.0	O/A	Ο	I/P	<u>p.261</u>

 $^{^{53}}$ The initial value 00 will be displayed on the keypad as $\hfill\Box$ $\hfill\Box$.



Code OU	Comm. Addr	Name	LCD Display	Setting Range	Initial Value	Prope rty*	V/F	SL	Ref.
		gain							
63	0h163F	Pulse output bias	TO Bias	-100.0-100.0(%)	0.0	O/A	0	I/P	<u>p.261</u>
64	0h1640	Pulse output filter	TO Filter	0-10000(ms)	5	O/A	0	I/P	<u>p.261</u>
65	0h1641	Pulse output constant output 2	TO Const %	0.0-100.0(%)	0.0	O/A	Ο	I/P	p.261
66	0h1642	Pulse output monitor	TO Monitor	0.0-1000.0(%)	0.0	-/A	О	I/P	<u>p.261</u>

8.8 Communication Function group (PAR→CM)

In the following table, the data shaded in grey will be displayed when a related code has been selected.

SL: Sensorless vector control (dr.09) , I – IM Sensorless, P – PM Sensorless

*O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code CM	Comm. Addr	Name	LCD Display	Setting Range		Initial Value	Prope rty*	V/F	SL	Ref.					
00	-	Jump Code	Jump Code	1-99		20	O/A	Ο	I/P	<u>p.72</u>					
01	0h1701	Built-in communication inverter ID	Int485 St ID 1-250		50	1	O/A	0	I/P	<u>p.300</u>					
02 ⁵⁴	0h1702	Built-in communication protocol	Int485 Proto	0	ModBus RTU	0: ModBus RTU	O/A	0	I/P	<u>p.300</u>					
		Built-in communication speed	Int485 BaudR	0	1200 bps										
									1	2400 bps	3:				
03 ⁵⁴	0h1703			2	4800 bps		O/A	0	I/P	n 200					
03	0111703			3	9600 bps		U/A	U	1/ [<u>p.300</u>					
				4	19200 bps										
				5	38400 bps										



Code CM	Comm. Addr	Name	LCD Display	Se	etting Range	Initial Value	Prope rty*	V/F	SL	Ref.
				6 7	56 Kbps 115 Kbps ⁵⁴					
04 ⁵⁴	0h1704	Built-in communication frame setting	Int485 Mode	0 D8/PN/S1 1 D8/PN/S2 2 D8/PE/S1 3 D8/PO/S1		0: - D8/PN/S - 1	O/A	0	I/P	<u>p.300</u>
05 ⁵⁴	0h1705	Transmission delay after reception	Resp Delay	0-1000(ms)		5ms	O/A	Ο	I/P	<u>p.300</u>
06 ⁵⁵	0h1706	Communication option S/W version	FBus S/W Ver	-		0.00	O/A	Ο	I/P	-
07 ⁵⁵	0h1707	Communication option inverter ID	FBus ID	0-255		1	O/A	Ο	I/P	-
08 ⁵⁵	0h1708	FIELD BUS communication speed	FBUS BaudRate	-		12Mbps	-/A	Ο	I/P	-
09 ⁵⁵	0h1709	Communication option LED status	FieldBus LED	-		-	O/A	Ο	I/P	-
30	0h171E	Number of output parameters	ParaStatus Num	111 8		3	O/A	0	I/P	
31 ⁵⁶	0h171F	Output Communication address1	Para Stauts-1	0000-FFFF Hex		000A	O/A	Ο	I/P	<u>p.305</u>
32 ⁵⁶	0h1720	Output Communication address2	Para Stauts-2	000	00-FFFF Hex	000E	O/A	0	I/P	<u>p.305</u>
33 ⁵⁶	0h1721	Output Communication address3	Para Stauts-3	000	00-FFFF Hex	000F	O/A	0	I/P	<u>p.305</u>
34 ⁵⁶	0h1722	Output Communication address4	Para Stauts-4	000	00-FFFF Hex	0000	O/A	0	I/P	<u>p.305</u>
35 ⁵⁶	0h1723	Output Communication address5	Para Stauts-5	000	00-FFFF Hex	0000	O/A	Ο	I/P	<u>p.305</u>

⁵⁴ 115,200bps

 $^{^{\}rm 55}$ Displayed only when a communication option card is installed.

 $^{^{\}rm 56}$ Only the range of addresses set at COM-30 is displayed.





Code	Comm.	Nome	LCD	Setting Range		Initial	Prope	V/F	CI	Dof
CM	Addr	Name	Display	56	etting Range	Value	rty*	V/F	SL	Ref.
36 ⁵⁶	0h1724	Output Communication address6	Para Stauts-6	000	00-FFFF Hex	0000	O/A	Ο	I/P	<u>p.305</u>
37 ⁵⁶	0h1725	Output Communication address7	Para Stauts-7	000	00-FFFF Hex	0000	O/A	Ο	I/P	<u>p.305</u>
38 ⁵⁶	0h1726	Output Communication address8	Para Stauts-8	000	00-FFFF Hex	0000	O/A	0	I/P	<u>p.305</u>
50	0h1732	Number of input parameters	Para Ctrl Num	0-8		2	O/A	0	I/P	
51 ⁵⁷	0h1733	Input Communication address1	Para Control-1	0000-FFFF Hex		0005	X/A	0	I/P	<u>p.305</u>
52 ⁵⁷	0h1734	Input Communication address2	Para Control-2	0000-FFFF Hex		0006	X/A	0	I/P	<u>p.305</u>
53 ⁵⁷	0h1735	Input Communication address3	Para Control-3	0000-FFFF Hex		0000	X/A	0	I/P	<u>p.305</u>
54 ⁵⁷	0h1736	Input Communication address4	Para Control-4	000	00-FFFF Hex	0000	X/A	0	I/P	<u>p.305</u>
55 ⁵⁷	0h1737	Input Communication address5	Para Control-5	0000-FFFF Hex		0000	X/A	0	I/P	<u>p.305</u>
56 ⁵⁷	0h1738	Input Communication address6	Para Control-6	000	00-FFFF Hex	0000	X/A	0	I/P	<u>p.305</u>
57 ⁵⁷	0h1739	Input Communication address7	Para Control-7	0000-FFFF Hex		0000	X/A	0	I/P	<u>p.305</u>
58 ⁵⁷	0h173A	Input Communication address8	Para Control-8	000	00-FFFF Hex	0000	X/A	0	I/P	<u>p.305</u>
68	0h1744	Field bus data swap	FBus Swap Sel	0	No Yes	0	X/A	0	I/P	<u>p.305</u>
70	0h1746	Communication multi-function input 1	Virtual DI 1	0	None	0:None	O/A	0	I/P	<u>p.318</u>
71	0h1747	Communication	Virtual DI	1	Fx	0:None	O/A	0	I/P	<u>p.318</u>

 $^{^{\}rm 57}$ Only the range of addresses set at COM-50 is displayed.



Code CM	Comm. Addr	Name	LCD Display	Se	etting Range	Initial Value	Prope rty*	V/F	SL	Ref.
		multi-function input 2	2							
72	0h1748	Communication multi-function input 3	Virtual DI 3	2	Rx	0:None	O/A	0	I/P	<u>p.318</u>
73	0h1749	Communication multi-function input 4	Virtual DI 4	3	RST	0:None	O/A	0	I/P	<u>p.318</u>
74	0h174A	Communication multi-function input 5	Virtual DI 5	4	External Trip	0:None	O/A	0	I/P	<u>p.318</u>
75	0h174B	Communication multi-function input 6	Virtual DI 6	5	BX	0:None	O/A	0	I/P	<u>p.318</u>
76	0h174C	Communication multi-function input 7	Virtual DI 7	6	JOG	0:None	O/A	0	I/P	<u>p.318</u>
77	0h174D	Communication multi-function input 8	Virtual DI 8	7 8 9 11 12 13 14 15 16 17 18 20 21 22 23 24 25 26 34 40 46	Speed-L Speed-M Speed-H XCEL-L XCEL-M RUN Enable 3-Wire 2nd Source Exchange Up Down U/D Clear Analog Hold I-Term Clear PID Openloop P Gain2 XCEL Stop 2nd Motor Pre Excite Timer In dis Aux Ref FWD JOG	0:None	O/A	Ο	I/P	p.318



Code CM	Comm. Addr	Name	LCD Display	Se	etting Range	Initial Value	Prope rty*	V/F	SL	Ref.
				49	XCEL-H					
86	0h1756	Communication multi-function input monitoring	Virt DI Status	-		0	X/A	0	I/P	<u>p.303</u>
90	0h175A	Selection of data frame communication monitor	Comm Mon Sel	1	Int485 KeyPad	0	O/A	0	I/P	-
91	0h175B	Data frame Rev count	Rcv Frame Num	0~6	5535	0	O/A	0	I/P	-
92	0h175C	Data frame Err count	Err Frame Num	0~6	5535	0	O/A	Ο	I/P	-
93	0h175D	NAK frame count	NAK Frame Num	0~6	5535	0	O/A	0	I/P	-
94 ⁵⁸	-	Communication data upload	Comm Update	0	No Yes	0:No	-/A	0	I/P	-
95	0h175F	P2P communication selection	Int 485 Func	0 1 2 3	Disable All P2P Master P2P Slave KPD-Ready	0: Disable All	X/A	0	I/P	<u>p.166</u>
96 ⁵⁹	0h1760 [RO]	DO setting selection	P2P OUT Sel	Bit 001 010	000~111 Analog output Multi- function relay	0:No	O/A	0	I/P	p.166

 $^{^{\}rm 58}$ Displayed only when a communication option card is installed.

⁵⁹ Displayed when AP.01 is set to 2 (Proc PID).



8.9 Application Function group (PAR→AP)

In the following table, the data shaded in grey will be displayed when a related code has been selected.

SL: Sensorless vector control (dr.09), I – IM Sensorless, P – PM Sensorless

*O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code AP	Comm. Addr	Name	LCD Display	Sett Ran		Initial Value	Prop erty*	V/ F	SL	Ref.
00	-	Jump Code	Jump Code	1-99		20	O/A	0	I/P	<u>p.72</u>
01	0h1801	Application function selection	App Mode	0 1 2	None - Proc PID	0: None	X/A	Ο	I/P	<u>p.197</u>
02	0h1802	Enable user sequence	User Seq En	0	No Yes	0:No	X/A	Ο	I/P	<u>p.168</u>
16 ⁶⁰	0h1810	PID output monitor	PID Output	(%)		0.00	-/A	Ο	I/P	<u>p.197</u>
17 ⁶¹	0h1811	PID reference monitor	PID Ref Value	(%)		50.00	-/A	Ο	I/P	<u>p.197</u>
18 ⁶¹	0h1812	PID feedback monitor	PID Fdb Value	(%)		0.00	-/A	Ο	I/P	<u>p.197</u>
19 ⁶¹	0h1813	PID reference setting	PID Ref Set).00- 00(%)	50.00	O/A	Ο	I/P	<u>p.197</u>
20 ⁶¹	0h1814	PID reference source	PID Ref Source	0 1 3 4 5 7 11	Keypad V1 V2 I2 Int 485 FieldBus Pulse	0: Keypad	X/A	0	I/P	p.197
21 ⁶¹	0h1815	PID feedback source	PID F/B Source	0 2 3 4 6 10	V1 V2 I2 Int 485 FieldBus Pulse	0:V1	X/A	Ο	I/P	p.197
22 ⁶¹	0h1816	PID controller proportional	PID P-Gain	0.0-	0.0(%)	50.0	O/A	Ο	I/P	<u>p.197</u>

⁶⁰ Displayed when AP.01 is set to 2 (Proc PID).

⁶¹ Displayed when AP.01 is set to 2 (Proc PID).





Code AP	Comm. Addr	Name	LCD Display	Setti Ranc		Initial Value	Prop erty*	V/ F	SL	Ref.
,	7 (6) 6)	gain		114119		74.00	0. 1			
23 ⁶¹	0h1817	PID controller integral time	PID I-Time	0.0-2	00.0(s)	10.0	O/A	Ο	I/P	<u>p.197</u>
24 ⁶¹	0h1818	PID controller differentiation time	PID D-Time	0-100)0(ms)	0	O/A	0	I/P	<u>p.197</u>
25 ⁶¹	0h1819	PID controller feed-forward compensation gain	PID F-Gain	0.0-	.0(%)	0.0	O/A	0	I/P	<u>p.197</u>
26 ⁶¹	0h181A	Proportional gain scale	P Gain Scale	0.0-100.0(%)		100.0	X/A	0	I/P	<u>p.197</u>
27 ⁶¹	0h181B	PID output filter	PID Out LPF	0-10000(ms)		0	O/A	0	I/P	<u>p.197</u>
28 ⁶¹	0h181C	PID Mode	PID Mode	1	Process PID Normal PID	0	X/A	0	I/P	-
29 ⁶¹	0h181D	PID upper limit frequency	PID Limit Hi		ower Jency- JO(Hz)	50.00	O/A	0	I/P	p.197
30 ⁶¹	0h181E	PID lower limit frequency	PID Limit Lo	uppe	00 -PID er limit iency(Hz	-50.00	O/A	0	I/P	p.197
31 ⁶¹	0h181F	PID output inverse	PID Out Inv		No Yes	0:No	X/A	О	I/P	<u>p.197</u>
32 ⁶¹	0h1820	PID output scale	PID Out Scale	0.1- 1000	.0(%)	100.0	X/A	О	I/P	<u>p.197</u>
34 ⁶¹	0h1822	PID controller motion frequency	Pre-PID Freq	0.00- Maxii frequ	mum iency(Hz	0.00	X/A	0	I/P	<u>p.197</u>
35 ⁶¹	0h1823	PID controller motion level	Pre-PID Exit	0.0-1	00.0(%)	0.0	X/A	0	I/P	<u>p.197</u>
36 ⁶¹	0h1824	PID controller motion delay time	Pre-PID Delay	0-999	99(s)	600	O/A	0	I/P	<u>p.197</u>
37 ⁶¹	0h1825	PID sleep mode delay time	PID Sleep DT		99.9(s)	60.0	O/A	0	I/P	<u>p.197</u>
38 ⁶¹	0h1826	PID sleep mode	PID Sleep Freq	0.00- Maxii	mum	0.00	O/A	Ο	I/P	<u>p.197</u>



Code AP	Comm. Addr	Name	LCD Display	Set [*] Ran	ige	Initial Value	Prop erty*	V/ F	SL	Ref.
		frequency		freq	uency(Hz					
39 ⁶¹	0h1827	PID wake-up level	PIDWakeUp Lev	0-10	00(%)	35	O/A	О	I/P	<u>p.197</u>
				0	Below Level					
40 ⁶¹	0h1828	PID wake-up mode setting	PID WakeUp Mod	1	Above Level	0:Belo w Level	O/A	0	I/P	<u>p.197</u>
				2	Beyond Level					
				0	%					
				1	Bar					
				2	mBar					
				3	Pa					
				5	kPa Hz					
61	01.400.4	PID controller		6	грт		0.44			
42 ⁶¹	0h182A	unit selection	PID Unit Sel	7	V	0:%	O/A	0	I/P	<u>p.197</u>
				8	I					
				9	kW					
				10	HP					
				11	°C					
				12	°F					
43 ⁶¹	0h182B	PID unit gain	PID Unit Gain	0.00)- .00(%)	100.00	O/A	0	I/P	<u>p.197</u>
				0	x100					
			PID Unit	1 x10						
44 ⁶¹	0h182C	PID unit scale	Scale	2 x 1		2:x 1	O/A	Ο	I/P	<u>p.197</u>
			Scarc	3	x 0.1					
		DID 0		4	x 0.01					
45 ⁶¹	0h182D	PID 2nd proportional gain	PID P2-Gain	0.0- 100	0.0(%)	100.0	X/A	Ο	I/P	<u>p.197</u>

⁶¹ Displayed when AP.01 is set to 2 (Proc PID).



8.10 Protection Function group (PAR→Pr)

In the following table, the data shaded in grey will be displayed when a related code has been selected.

SL: Sensorless vector control (dr.09), I – IM Sensorless, P – PM Sensorless

*O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code Pr	Comm. Address	Name	LCD Display	Setting Range		Initial Value	Property*	V/F	SL	Ref.
00	-	Jump Code	Jump Code	O Named Duty		40	O/A	0	I/P	<u>p.72</u>
04	0h1B04	Load level	Load	0	Normal Duty	1:Heavy	X/A	0	I/P	p.276
04	0111004	setting	Duty	1	Heavy Duty	Duty	N/A	U	1/1	<u>p.270</u>
				bit	00-11					
05	0h1B05	Input/output open-phase	Phase Loss Chk	01 Output open phase		10 ⁶²	X/A	0	I/P	<u>p.281</u>
		protection	LU33 CHIK	10 Input open phase						
06	0h1B06	Input voltage range during open-phase	IPO V Band	1-100(V)		15	X/A	Ο	I/P	p.281
07	0h1B07	Deceleration time at fault trip	Trip Dec Time	0.0-6	00.0(s)	3.0	O/A	0	I/P	-
		Selection of	RST	0 No						
08	0h1B08	startup on trip reset	Restart	1 Yes		0:No	O/A	0	I/P	<u>p.238</u>
09	0h1B09	Number of automatic restarts	Retry Number	0-10		0	O/A	Ο	I/P	p.238

 $^{^{62}}$ The initial value 10 will be displayed on the keypad as $^{\Box}$ $^{\Box}$ $^{\Box}$.



Code Pr	Comm. Address	Name	LCD Display	Setting Range		Initial Value	Property*	V/F	SL	Ref.
10 ⁶³	0h1B0A	Automatic restart delay time	Retry Delay	0.0-60.0(s) 0 None		1.0	O/A	0	I/P	<u>p.238</u>
				0	None					
		Motion		1	Free-Run					
12	0h1B0C	at speed	Lost Cmd	2	Dec	0:None	O/A	0	I/P	p.284
12	OTTIBOC	command	Mode	3	Hold Input	U.NOHE	OTA		1/1	<i>p.204</i>
		loss		4	Hold Output					
				5	Lost Preset					
13 ⁶⁴	0h1B0D	Time to decide speed command loss	Lost Cmd Time	0.1-120(s)		1.0	O/A	0	I/P	p.284
14 ⁶⁴	0h1B0E	Operation frequency at speed command loss	Lost Preset F	Start frequency- Maximum frequency(Hz)		0.00	O/A	Ο	I/P	<u>p.284</u>
15 ⁶⁴	0h1B0F	Analog input loss decision	Al Lost	0	Half x1	0:Half of	O/A	0	I/P	p.284
		level	Level	1	Below x1	x1				,
		Overload	OL Warn	0	No					
17	0h1B11	warning selection	Select	1	Yes	0:No	O/A	Ο	I/P	<u>p.276</u>
18	0h1B12	Overload alarm level	OL Warn Level	30-18	80(%)	150	O/A	Ο	I/P	<u>p.276</u>
19	0h1B13	Overload warning time	OL Warn Time	0.0-30.0(s)		10.0	O/A	0	I/P	<u>p.276</u>
		Motion at	OL T-1	0 None		1				
20	0h1B14	overload	OL Trip Select	1 Free-Run		1:Free- Run	O/A	0	I/P	<u>p.276</u>
		fault	301001	2 Dec		INGII				
21	0h1B15	Overload fault level	OL Trip Level	30-200(%)		180	O/A	Ο	I/P	<u>p.276</u>
22	0h1B16	Overload	OL Trip	0.0-6	0.0(s)	60.0	O/A	Ο	I/P	<u>p.276</u>

⁶³ Displayed when Pr.09 is set higher than 0.

⁶⁴ Displayed when Pr.12 is not set to 0 (NONE).





Code Pr	Comm. Address	Name	LCD Display	Setting Range		Initial Value	Property*	V/F	SL	Ref.
		fault time	Time							
25	0h1B19	Underload warning selection	UL Warn Sel	0	No Yes	0:No	O/A	0	I/P	<u>p.287</u>
26	0h1B1A	Underload warning time	UL Warn Time	0.0-6	000.0(s)	10.0	O/A	0	I/P	<u>p.287</u>
27	0h1B1B	Underload fault selection	UL Trip Sel	0 1 2	None Free-Run Dec	0:None	O/A	Ο	I/P	<u>p.287</u>
28	0h1B1C	Underload fault time	ULTrip Time	0.0-6	00.0(s)	30.0	O/A	0	I/P	<u>p.287</u>
29	0h1B1D	Underload lower limit level	UL LF Level	10-3	0(%)	30	O/A	0	I/P	<u>p.287</u>
30	0h1B1E	Underload upper limit level	UL BF Level	30-1	00(%)	30	O/A	0	I/P	<u>p.287</u>
0.1	01.4545	No motor	No Motor	0	None		0.44			004
31	0h1B1F	motion at detection	Trip	1	Free-Run	0:None	O/A	0	I/P	<u>p.294</u>
32	0h1B20	No motor detection current level	No Motor Level	1-10	0(%)	5	O/A	0	I	<u>p.294</u>
33	0h1B21	No motor detection delay	No Motor Time	0.1-1	0.0(s)	3.0	O/A	0	I	<u>p.294</u>
		Electronic	ETH Trip	0	None					
40	0h1B28	thermal fault selection	Sel	1	Free-Run	0:None	O/A	Ο	I/P	<u>p.274</u>
				2	Dec					
41	0h1B29	Motor cooling fan	Motor	0	Self-cool	0:Self-	O/A	0	I/P	p.274
71	OTTIBE	type	Cooling	1	Forced-cool	cool			1/1	<u>p.271</u>
42	0h1B2A	Electronic thermal 1 minute rating	ETH 1min	120-	200(%)	150	O/A	0	I/P	p.274
43	0h1B2B	Electronic thermal continuous	ETH Cont	50-1	50(%)	120	O/A	О	I/P	<u>p.274</u>



Code Pr	Comm. Address	Name	LCD Display	Setting Range		Initial Value	Property*	V/F	SL	Ref.
		rating		0 Free-Run						
45	0h1B2D	BX trip mode	BX Mode	0	Free-Run Dec	0	X/A	Ο	I/P	-
				bit	0000-1111					
		Stall		0001	Accelerating					
50	0h1B32	prevention motion and flux braking	Stall Prevent	0010 At constant speed		0000	X/A	0	Х	<u>p.277</u>
		Than braining		0100 At deceleration						
				1000 FluxBraking						
51	0h1B33	Stall frequency1	Stall Freq 1	Stall	requency- ency2(Hz)	50.00	O/A	0	Χ	<u>p.277</u>
52	0h1B34	Stall level1	Stall Level 1	30-25	0(%)	180	X/A	О	Χ	<u>p.277</u>
53	0h1B35	Stall frequency2	Stall Freq 2	Stall	requency1- ency3(Hz)	50.00	O/A	0	Χ	<u>p.277</u>
54	0h1B36	Stall level2	Stall Level 2	30-25		180	X/A	Ο	Χ	<u>p.277</u>
55	0h1B37	Stall frequency3	Stall Freq 3	Stall	requency2- ency4(Hz)	50.00	O/A	Ο	Χ	<u>p.277</u>
56	0h1B38	Stall level3	Stall Level 3	30-25	0(%)	180	X/A	Ο	Χ	<u>p.277</u>
57	0h1B39	Stall frequency4	Stall Freq 4	Stall frequency3- Maximum frequency(Hz)		50.00	O/A	0	Х	<u>p.277</u>
58	0h1B3A	Stall level4	Stall Level 4	30-25	0(%)	180	X/A	Ο	Χ	<u>p.277</u>
59	0h1B3B	Flux braking gain	Flux Brake Kp	0 ~ 150[%]		0	O/A	0	I	-
60	0h1B3C	CAP diagnosis level	CAP. Diag Perc	10 ~ 100[%]		0	O/A	Ο	I/P	-





Code Pr	Comm. Address	Name	LCD Display	Setting Range O None		Initial Value	Property*	V/F	SL	Ref.
		CAD		0	None					
61 ⁶⁵	0h1B3D	CAP diagnosis	CAP. Diag	1	Ref Diag	0	X/A	0	I/P	
Οï	OTTIDOD	mode	CAL Diag	2	Pre Diag		MA	O	1/1	_
				3	Init Diag					
62 ⁶⁵	0h1B3E	CAP Exchange Level	CAP Exchange Level	50.0	~ 95.0[%]	0	X/A	0	I/P	-
63 ⁶⁵	0h1B3F	CAP Diag Level	CAP Diag Level	0.0~	100.0[%]	0.0	-/A	Ο	I/P	-
66	0h1B42	DB resistor warning level	DB Warn %ED	0-30)(%)	0	O/A	Ο	I/P	<u>p.286</u>
		Speed	Speed	0	No					
73	0h1B22	deviation trip	Dev Trip	1	Yes	0:No	O/A	0	I/P	
74 ⁶⁶	0h1B23	Speed deviation band	Speed Dev Band	1 ~ :	20	5	O/A	0	I/P	
75 ⁶⁶	0h1B24	Speed deviation time	Speed Dev Time	0 ~	120	60	O/A	0	I/P	
		Cooling fan	FAN Trip	0	Trip	1:				
79	0h1B4F	fault selection	Mode	1	Warning	Warning	O/A	Ο	I/P	<u>p.289</u>
		Motion	Opt Trip	0	None	1:Free-				
80	0h1B50	selection	Mode	1	Free-Run	Run	O/A	0	I/P	<u>p.293</u>
		at option trip		2	Dec					
81	0h1B51	Low voltage fault decision delay time	LVT Delay	0.0-0	60.0(s)	0.0	X/A	0	I/P	<u>p.289</u>
82	0h1B52	LV2 Selection	LV2 Enable	0	No Yes	0	X/A	О	I/P	-
86	0h1B56	Accumulated percent of fan usage	Fan Time Perc		100.0[%]	0.0	-/A	Ο	I/P	-

 $^{^{65}\,}$ The Pr.61-63 codes are displayed when the Pr.60(CAP.DiagPrec) is set to more than 0.

⁶⁶ Displayed when Pr.73 is set to 1(YES)



Code Pr	Comm. Address	Name	LCD Display	Setting Range		Initial Value	Property*	V/F	SL	Ref.
87	0h1B57	Fan exchange warning level	Fan Exchange Ievel	0.0~	100.0[%]	90.0	O/A	0	I/P	-
88 ⁶⁷	0h1B58	Fan reset time	Fan Time Rst	0	No Yes	0	X/A	0	I/P	-
		time	NSt.	Bit	00~10					
89	0h1B59	CAP, FAN	CAP, FAN	00 -		0	-/A	0	I/P	
09	0111039	Status	State	01 CAP Warning		0	-/ A		1/ 1/	-
				10	FAN Warning					
90 ⁶⁷	0h1B5A	Warning information	-	-		-	-/7	0	I/P	-
91 ⁶⁷	0h1B5B	Fault history 1	-	-		-	-/7	О	I/P	-
92 ⁶⁷	0h1B5C	Fault history 2	-	-		-	-/7	Ο	I/P	-
93 ⁶⁷	0h1B5D	Fault history 3	-	-		-	-/7	0	О	-
94 ⁶⁷	0h1B5E	Fault history 4	-	-		-	-/7	0	Ο	-
95 ⁶⁷	0h1B5F	Fault history 5	-	-		-	-/7	Ο	Ο	-
96 ⁶⁷	0h1B60	Fault history	-	0 No		0:No	-/7	0	0	-
		deletion		1 Yes						

8.11 2nd Motor Function group (PAR→M2)

The 2nd Motor function group will be displayed if any of In.65-71 in IP20 models, In.65-69 in IP66 models are set to 26 (2nd MOTOR). In the following table, the data shaded in grey will be displayed when a related code has been selected.

SL: Sensorless vector control (dr.09) , I – IM Sensorless, P – PM Sensorless

*O/X: Write-enabled during operation, 7/L/A: Keypad/LCD keypad/Common

Code M2	Comm. Addr	Name	LCD Display	Setting Range	Initial Value	Property*	V/F	SL	Ref.
00	-	Jump Code	Jump Code	1-99	14	O/A	0	1	p.72
04	0h1C04	Acceleration	M2-Acc	0.0-600.0(s)	20.0	O/A	0	1	p.241

⁶⁷ Will not be displayed when an LCD keypad is in use.





Code M2	Comm. Addr	Name	LCD Display	Setting Range		Initial Value	Property*	V/F	SL	Ref.
		time	Time							
05	0h1C05	Deceleration time	M2-Dec Time	0.0	-600.0(s)	30.0	O/A	Ο	I	<u>p.241</u>
06	0h1C06	Motor capacity	M2- Capacity		22.0 kW 30.0 kW	-	X/A	0	T	p.241
07	0h1C07	Base frequency	M2-Base Freq	400 [V/ Col 40. 120 [IM Ser 30. 180 [PN Ser	nsorless] 00- 0.00(Hz) 1 nsorless]	50.00	X/A	Ο	I	p.241
08	0h1C08	Control mode	M2-Ctrl Mode	0246	V/F Slip Compen IM Sensorless PM Sensorless	O:V/F	X/A	0	I	p.241
10	0h1C0A	Number of motor poles	M2-Pole Num	2-4	.8	4	X/A	О	l	<u>p.241</u>
11	0h1C0B	Rated slip speed	M2-Rated Slip	0-3	3000(rpm)	Dependent on motor	X/A	Ο	I	<u>p.241</u>



Code M2	Comm. Addr	Name	LCD Display	Se ⁻	tting Range	Initial Value	Property*	V/F	SL	Ref.
12	0h1C0C	Motor rated current	M2-Rated Curr	1.0	-1000.0(A)	settings	X/A	0	I	<u>p.241</u>
13	0h1C0D	Motor no- load current	M2-Noload Curr	0.5	-1000.0(A)		X/A	0	I	<u>p.241</u>
14	0h1C0E	Motor rated voltage	M2-Rated Volt	0, 1	170-480(V)		X/A	0	1	<u>p.241</u>
15	0h1C0F	Motor efficiency	M2- Efficiency	64-	100(%)		X/A	0	-	<u>p.241</u>
16	0h1C10	Load inertia rate	M2-Inertia Rt	8-0	}		X/A	0	I	<u>p.241</u>
17	0h1C11 [R/O]	Stator resistance	M2-Rs	_			X/A	0	I	<u>p.241</u>
18	0h1C12 [R/O]	Leakage inductance	M2-Lsigma	on	pendent motor		X/A	0	-	<u>p.241</u>
19	0h1C13 [R/O]	Stator inductance	M2-Ls	set	tings		X/A	О	I	<u>p.241</u>
20 ⁶⁸	0h1C14 [R/O]	Rotor time constant	M2-Tr	25-	5000(ms)		X/A	0	1	<u>p.241</u>
				0	Linear					
25	0h1C19	V/F pattern	M2-V/F Patt	1	Square	0: Linear	X/A	0	I	<u>p.241</u>
				2	User V/F					
26	0h1C1A	Forward Torque boost	M2-Fwd Boost	0.0	-15.0(%)	2.0	X/A	О	I	<u>p.241</u>
27	0h1C1B	Reverse Torque boost	M2-Rev Boost	0.0	-15.0(%)	12.0	X/A	0	I	<u>p.241</u>
28	0h1C1C	Stall prevention level	M2-Stall Lev	30-	150(%)	150	X/A	0		<u>p.241</u>
29	0h1C1D	Electronic thermal 1 minute rating	M2-ETH 1min	100	0-200(%)	150	X/A	0	I	<u>p.241</u>
30	Oh1C1E	Electronic thermal continuous rating	M2-ETH Cont	50-150(%)		100	X/A	0	I	p.241
40	0h1C28	Rotation count speed gain	Load Spd Gain	0~6000.0[%]		100.0	O/A	Ο		-

 $^{^{68}}$ Displayed when M2.08 is set to 4 (IM Sensorless).



Code M2	Comm. Addr	Name	LCD Display	Setting Range		Initial Value	Property*	V/F	SL	Ref.
				0	x 1					
		Rotation	Lood Cod	1	x 0.1					
41	0h1C29	count speed	Load Spd Scale	2	x 0.01	0: x 1	O/A	Ο		-
		scale		3	x 0.001					
				4	x 0.0001					
		Rotation	Load Spd	0	Rpm					
42 0	0h1C2A	count speed unit	Unit		mpm	0: rpm	O/A	0	_	-

8.12 User Sequence group (US)

This group appears when AP.02 is set to 1 (Yes) or CM.95 is set to 2 (P2P Master). The parameter cannot be changed while the user sequence is running.

SL: Sensorless vector control function (dr.09) , I – IM Sensorless, P – PM Sensorless *O/X: Write-enabled during operation, 7/L/A: keypad/LCD keypad/common

Code US	Comm. Add	Name	LCD Display	Setting Range	Initial Value	Proper ty*	V/F	SL	Ref.
00	-	Jump code	Jump Code	1-99	31	O/A	0	I/P	<u>p.72</u>
01	0h1D01	User sequence	User Seq Con	0 Stop	0:Stop	X/A	Ο	I/P	<u>p.168</u>
		operation		1 Run					
		command		2 Digital In					
				Run					
02	0h1D02	User sequence	US Loop	0 0.01s	1:0.02s	X/A	0	I/P	<u>p.168</u>
		operation loop	Time	1 0.02s					
		time		2 0.05s					
				3 0.1s					
				4 0.5s					
				5 1s					
11	0h1D0B	Output address	Link	0-0xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
		link1	UserOut1						
12	0h1D0C	Output address	Link	0-0xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
4.0	01.4000	link2	UserOut2	0.0 5555	0	>//A	0	1/0	110
13	0h1D0D	Output address	Link	0-0xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
1.4	01.4505	link3	UserOut3	0.0 5555	0	\//A	0	L/D	1/0
14	0h1D0E	Output address	Link	0-0xFFFF	0	X/A	О	I/P	<u>p.168</u>
1 [0h1D0F	link4	UserOut4	0.075555	0	V//A		L/D	1/0
15	0h1D0F	Output address	Link	0-0xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
16	0h1D10	link5	UserOut5	0-0xFFFF	0	X/A	0	I/D	n 1/0
10	טוטווט	Output address link6	Link LicarOut4	U-UXFFFF	U	X/A	U	I/P	<u>p.168</u>
17	0h1D11		UserOut6	0.075555	0	V/A		L/D	n 1/0
17	0h1D11	Output address	Link	0-0xFFFF	0	X/A	0	I/P	<u>p.168</u>



Code US	Comm. Add	Name	LCD Display	Setting Range	Initial Value	Proper ty*	V/F	SL	Ref.
		link7	UserOut7	J					
18	0h1D12	Output address	Link	0-0xFFFF	0	X/A	0	I/P	p.168
		link8	UserOut8						
19	0h1D13	Output address	Link	0-0xFFFF	0	X/A	0	I/P	p.168
		link9	UserOut9						
20	0h1D14	Output address	Link	0-0xFFFF	0	X/A	0	I/P	<u>p.168</u>
		link10	UserOut10						
21	0h1D15	Output address	Link	0-0xFFFF	0	X/A	0	I/P	<u>p.168</u>
		link11	UserOut11						
22	0h1D16	Output address	Link	0-0xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
		link12	UserOut12						
23	0h1D17	Output address	Link	0-0xFFFF	0	X/A	0	I/P	<u>p.168</u>
		link13	UserOut13						
24	0h1D18	Output address	Link	0-0xFFFF	0	X/A	0	I/P	<u>p.168</u>
		link14	UserOut14						
25	0h1D19	Output address	Link	0-0xFFFF	0	X/A	0	I/P	<u>p.168</u>
		link15	UserOut15						
26	0h1D1A	Output address	Link	0-0xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
		link16	UserOut16						
27	0h1D1B	Output address	Link	0-0xFFFF	0	X/A	0	I/P	<u>p.168</u>
		link17	UserOut17						
28	0h1D1C	Output address	Link	0-0xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
		link18	UserOut18		_				
31	0h1D1F	Input constant	Void Para1	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
	01.4500	setting1	\	0000 0000		>// 4		1.75	
32	0h1D20	Input constant	Void Para2	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
	01.4504	setting2		0000 0000		>// 6	_	1.75	
33	0h1D21	Input constant	Void Para3	-9999-9999	0	X/A	О	I/P	<u>p.168</u>
0.4	01.4500	setting3	V - 1 - D - 4	0000 0000	0	>// A	_	L/D	110
34	0h1D22	Input constant	Void Para4	-9999-9999	0	X/A	Ο	I/P	<u>p.168</u>
25	0-1000	setting4	\/a ! al Dana E	0000 0000	0	\/ / A	0	L/D	110
35	0h1D23	Input constant	Void Para5	-9999-9999	0	X/A	Ο	I/P	<u>p.168</u>
0.4	01.1004	setting5	Malal David	0000 0000	0)//A		L/D	110
36	0h1D24	Input constant	Void Para6	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
0.7	01.4505	setting6	\/-!-I D7	0000 0000	0)//A		L/D	110
37	0h1D25	Input constant	Void Para7	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
20	0-100/	setting7	\/a ! al Dana 0	0000 0000	0	\/ / A	0	L/D	110
38	0h1D26	Input constant	Void Para8	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
20	061007	setting8	Void Dans	0000 0000		\/ / A		L/D	110
39	0h1D27	Input constant	Void Para9	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
10	061000	setting9	Vold Dereit	0000 0000	0	V//A		L/D	- 1/0
40	0h1D28	Input constant	Void Para10	-9999-9999	0	X/A	Ο	I/P	<u>p.168</u>
		setting10							<u> </u>





Code US	Comm. Add	Name	LCD Display	Setting Range	Initial Value	Proper ty*	V/F	SL	Ref.
41	0h1D29	Input constant setting11	Void Para11	-9999-9999	0	X/A	0	I/P	p.168
42	0h1D2A	Input constant setting12	Void Para12	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
43	0h1D2B	Input constant setting13	Void Para13	-9999-9999	0	X/A	Ο	I/P	<u>p.168</u>
44	0h1D2C	Input constant setting14	Void Para14	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
45	0h1D2D	Input constant setting15	Void Para15	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
46	0h1D2E	Input constant setting16	Void Para16	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
47	0h1D2F	Input constant setting17	Void Para17	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
48	0h1D30	Input constant setting18	Void Para18	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
49	0h1D31	Input constant setting19	Void Para19	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
50	0h1D32	Input constant setting20	Void Para20	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
51	0h1D33	Input constant setting21	Void Para21	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
52	0h1D34	Input constant setting22	Void Para22	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
53	0h1D35	Input constant setting23	Void Para23	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
54	0h1D36	Input constant setting24	Void Para24	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
55	0h1D37	Input constant setting25	Void Para25	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
56	0h1D38	Input constant setting26	Void Para26	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
57	0h1D39	Input constant setting27	Void Para27	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
58	0h1D3A	Input constant setting28	Void Para28	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
59	0h1D3B	Input constant setting29	Void Para29	-9999-9999	0	X/A	0	I/P	<u>p.168</u>
60	0h1D3C	Input constant setting30	Void Para30	-9999-9999	0	X/A	Ο	I/P	<u>p.168</u>
80	0h1D50S	Analog input 1	P2P In V1	0-12,000		-/A	0	I/P	<u>p.168</u>
81	0h1D51	Analog input2	P2P In I2	-12,000-		-/A	0	I/P	<u>p.168</u>



Code US	Comm. Add	Name	LCD Display	Setting Range	Initial Value	Proper ty*	V/F	SL	Ref.
				12,000					
82	0h1D52	Digital input	P2P In DI	0-0x7F		-/A	0	I/P	p.168
85	0h1D55	Analog output	P2P OutAO1	0-10,000	0	X/A	0	I/P	p.168
88	0h1D58	Digital output	P2P OutDO	0-0x03	0	X/A	0	I/P	p.168

8.13 User Sequence Function group(UF)

This group appears when AP.02 is set to 1 (Yes) or CM.95 is set to 2 (P2P Master). The parameter cannot be changed while the user sequence is running.

SL: Sensorless vector control function (dr.09)

*O/X: Write-enabled during operation, 7/L/A: keypad/LCD keypad/common

Code Comm. Name LCD Setting Range In	nitial	Property*	V/F	SL	Ref.
	/alue	rroperty	V/I	JL	IXEI.
00 - Jump code Jump 1-99 41 Code		O/A	0	I/P	<u>p.72</u>
	:NOP	X/A	0	I/P	p.168
Func1 1 ADD					
2 SUB					
3 ADDSUB					
4 MIN					
5 MAX					
6 ABS					
7 NEGATE					
8 MPYDIV					
9 REMAINDER					
10 COMPARE-GT					
11 COMPARE-GEQ					
12 COMPARE-					
EQUAL 13 COMPARE					
13 COMPARE- NEQUAL					
14 TIMER					
15 LIMIT					
16 AND					
17 OR					
18 XOR					
19 ANDOR					
20 SWITCH					





Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
			, ,	21	BITTEST					
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
02	0h1E02	User function input1-A	User Input1-A	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
03	0h1E03	User function	User	0-0)xFFFF	0	X/A	0	I/P	p.168
		input1-B	Input1-B							,
04	0h1E04	User function	User	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
05	0h1E05	input1-C User function	Input1-C User	20	2767-32767	0	-/A	0	I/P	p.168
03	OTTLOS	output1	Output1	-32	1707-32707	U	-/ A		1/1	<u>p. 100</u>
06	0h1E06	User function 2	User	0	NOP	0:NOP	X/A	Ο	I/P	p.168
			Func2	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12	COMPARE-					
				1.0	EQUAL					
				13	COMPARE- NEQUAL					
				14	TIMER					
					LIMIT					
					AND					
					OR					
					XOR					
				10	//OIL			<u> </u>		



Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
07	0h1E07	User function	User	0-0	XFFFF	0	X/A	Ο	I/P	p.168
		input2-A	Input2-A							
80	0h1E08	User function input2-B	User Input2-B	0-0	XFFFF	0	X/A	Ο	I/P	<u>p.168</u>
09	0h1E09		User	0-0	xFFFF	0	X/A	0	I/P	p.168
10	01.1504	input2-C	Input2-C	20	7/7 007/7	0	/ ^		1/0	1/0
10	0h1E0A	User function output2	User Output2	-32	767-32767	0	-/A	Ο	I/P	<u>p.168</u>
11	0h1E0B	User function3	User	0	NOP	0:NOP	X/A	Ο	I/P	<u>p.168</u>
			Func3	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12	COMPARE-					
				1.0	EQUAL					
				13	COMPARE- NEQUAL					
				14	TIMER					
					LIMIT					
										1





Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
			1 3	17	OR					
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
					PI_PROCESS					
				27						
					DOWNCOUNT					
12	0h1E0C	User function	User		xFFFF	0	X/A	0	I/P	p.168
		input3-A	Input3-A							
13	0h1E0D		User	0-0	xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
1.4	0-1505	input3-B	Input3-B	0.0		0	\/ / A	0	L/D	1/0
14	Oh1E0E	User function input3-C	User Input3-C	0-0	xFFFF	0	X/A	0	I/P	<u>p.168</u>
15	0h1F0F	User function	User	-32	767-32767	0	-/A	0	I/P	p.168
	0h1E0F	output3	Output3							
16	0h1E10	User function4	User	0	NOP	0:NOP	X/A	0	I/P	<u>p.168</u>
			Func4	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12	COMPARE-					
					EQUAL					
				13	COMPARE-					
					NEQUAL					
				14	TIMER					



Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
			, , , , , , , , , , , , , , , , , , ,	15	LIMIT					
				16	AND					
				17	OR					
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
17	0h1E11	User function input4-A	User Input4-A	0-0)xFFFF	0	X/A	0	I/P	<u>p.168</u>
18	01.4540	User function	User	0-0)xFFFF	0	X/A	0	I/P	p.168
	0h1E12	input4-B	Input4-B							
19	0h1E13	User function	User	0-0)xFFFF	0	X/A	Ο	I/P	p.168
20		input4-C User function	Input4-C User	2.2	2767-32767	0	-/A	0	I/P	p.168
20	0h1E14	output4	Output4	-32	.707-32707	U	-/A		1/ [<u>p. 100</u>
21	0h1E15	User function5	User	0	NOP	0:NOP	X/A	0	I/P	<u>p.168</u>
			Func5	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX ABS					
				6						
				7	NEGATE MPYDIV					
				9	REMAINDER					
				10						
					COMPARE-GEQ					
					COMPARE-GEQ					
				-	EQUAL					
				13	COMPARE-					
					NEQUAL					
				14	TIMER					





Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
				15	LIMIT					
				16	AND					
				17	OR					
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
22	0h1E16	User function input5-A	User Input5-A	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
23	0h1E17	User function input5-B	User Input5-B	0-0	xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
24	0h1E18	User function input5-C	User Input5-C	0-0	xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
25	0h1E19	User function output5	User Output5	-32	767-32767	0	-/A	Ο	I/P	<u>p.168</u>
26	0h1E1A	· •	User	0	NOP	0:NOP	X/A	0	I/P	p.168
			Func6	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11						
				12	COMPARE- EQUAL					



Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
				13	COMPARE-					
					NEQUAL					
				14						
				15						
				16	AND					
				17	OR					
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
27	0h1E1B	User function input6-A	User Input6-A	0-0	xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
28	0h1E1C	User function	User	0-0	xFFFF	0	X/A	0	I/P	<u>p.168</u>
29		input6-B User function	Input6-B User	0-0	xFFFF	0	X/A	0	I/P	p.168
27	0h1E1D	input6-C	Input6-C	0-0	ALLIT	O	N/A		1/ 1	<u>p. 100</u>
30	0h1E1E	User function	User	-32	767-32767	0	-/A	Ο	I/P	<u>p.168</u>
31		output6 User function7	Output6 User	0	NOP	0:NOP	X/A	0	I/P	p.168
			Func7	1	ADD		. ,			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
				2	SUB					
				3	ADDSUB					
				4	MIN					
	0h1E1F			5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10						
				IU	COIVIPARE-G1					





11 COMPARE-GEQ 12 COMPARE-GEQ 12 COMPARE-GUAL 13 COMPARE-GUAL 13 COMPARE-GUAL 14 TIMER 15 LIMIT 16 AND 17 OR 18 XOR 19 ANDOR 20 SWITCH 21 BITTEST 22 BITSET 23 BITCLEAR 24 LOWPASSFILTER 25 PI_CONTORL 26 PI_PROCESS 27 UPCOUNT 28 DOWNCOUNT 28 DOWNC	L Ref.	SL	V/F	Property*	Initial Value	Setting Range		LCD Display	Name	Comm. Address	Code UF
EQUAL 13 COMPARE-						COMPARE-GEQ	11				
13 COMPARE- 14 TIMER 15 LIMIT 16 AND 17 OR 18 XOR 19 ANDOR 20 SWITCH 21 BITTEST 22 BITSET 23 BITCLEAR 24 LOWPASSFILTER 25 PI_CONTORL 26 PI_PROCESS 27 UPCOUNT 28 DOWNCOUNT 28 DOWNCOUNT 28 DOWNCOUNT 28 DOWNCOUNT 28 DOWNCOUNT 29 DOWNCOUNT 29 DOWNCOUNT 20 DO						COMPARE-	12				
14 TIMER 15 LIMIT 16 AND 17 OR 18 XOR 19 ANDOR 20 SWITCH 21 BITTEST 22 BITSET 23 BITCLEAR 24 LOWPASSFILTER 25 PL_CONTORL 26 PL_PROCESS 27 UPCOUNT 28 DOWNCOUNT 29 DOWNCOU							1.0				
15 LIMIT											
16 AND 17 OR 18 XOR 19 ANDOR 20 SWITCH 21 BITTEST 22 BITSET 23 BITCLEAR 24 LOWPASSFILTER 25 PL_CONTORL 26 PL_PROCESS 27 UPCOUNT 28 DOWNCOUNT 28 DOWNCOUNT											
17 OR 18 XOR 19 ANDOR 20 SWITCH 21 BITTEST 22 BITSET 23 BITCLEAR 24 LOWPASSFILTER 25 PL_CONTORL 26 PL_PROCESS 27 UPCOUNT 28 DOWNCOUNT 29 DOWNCOUNT 29 DOWNCOUNT 20 DOWNCOUN											
18 XOR 19 ANDOR 20 SWITCH 21 BITTEST 22 BITSET 23 BITCLEAR 24 LOWPASSFILTER 25 PL_CONTORL 26 PL_PROCESS 27 UPCOUNT 28 DOWNCOUNT 29 DOWNCOUNT 20 DOWNCOUNT 20											
19 ANDOR 20 SWITCH 21 BITTEST 22 BITSET 23 BITCLEAR 24 LOWPASSFILTER 25 PL_CONTORL 26 PL_PROCESS 27 UPCOUNT 28 DOWNCOUNT											
20 SWITCH 21 BITTEST 22 BITSET 23 BITCLEAR 24 LOWPASSFILTER 25 PI_CONTORL 26 PI_PROCESS 27 UPCOUNT 28 DOWNCOUNT 28 DOWNCO											
21 BITTEST 22 BITSET 23 BITCLEAR 24 LOWPASSFILTER 25 PL_CONTORL 26 PL_PROCESS 27 UPCOUNT 28 DOWNCOUNT 28 DOW											
22 BITSET 23 BITCLEAR 24 LOWPASSFILTER 25 PL_CONTORL 26 PL_PROCESS 27 UPCOUNT 28 DOWNCOUNT 28 D											
23 BITCLEAR 24 LOWPASSFILTER 25 PI_CONTORL 26 PI_PROCESS 27 UPCOUNT 28 DOWNCOUNT DOWNC											
24 LOWPASSFILTER											
25 PI_CONTORL 26 PI_PROCESS 27 UPCOUNT 28 DOWNCOUNT 29 DOWNCOUNT 29 DOWNCOUNT 29 DOWNCOUNT 29 DOWNCOUNT 29 DOWNCOUNT 20											
26 PI_PROCESS											
27 UPCOUNT											
28 DOWNCOUNT											
32											
33	1/0	1/5		>// A	0						0.0
34							'-A	Input7-A	input7-A	0h1E20	
0h1E22 input7-C <	p.168	I/P	Ο	X/A	0)xFFFF				0h1E21	33
35	p.168	I/P	0	X/A	0)xFFFF	0-0	User	User function	061500	34
OITTE23 output7 Output7 ONOP O:NOP X/A O I/P 36 User function8 User Func8 0 NOP 0:NOP X/A O I/P 2 SUB 3 ADDSUB ADDSUB O I/P							'-C	Input7-C	input7-C	UNIEZZ	
36	p.168	I/P	Ο	-/A	0	2767-32767				0h1E23	35
2 SUB 3 ADDSUB	p.168	I/P	0	X/A	0:NOP	NOP		User			36
3 ADDSUB						ADD	1	Func8			
						SUB	2				
						ADDSUB	3				
0h1E24 4 MIN						MIN	4			0h1E24	
5 MAX						MAX	5				
6 ABS						ABS	6				
7 NEGATE						NEGATE	7				
8 MPYDIV						MPYDIV	8				



Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12	COMPARE-					
					EQUAL					
				13						
				14	NEQUAL TIMER					
					LIMIT					
					AND					
				17	OR					
					XOR					
				19	ANDOR					
				20						
				21	BITTEST	1				
				22	BITSET					
				23	BITCLEAR	-				
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
37	0h1E25	User function input8-A	User Input8-A	0-0)xFFFF	0	X/A	0	I/P	<u>p.168</u>
38	061507	User function	User	0-0)xFFFF	0	X/A	0	I/P	p.168
	0h1E26	input8-B	Input8-B							
39	0h1E27	User function input8-C	User Input8-C	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
40	0h1E28	User function output8	User Output8	-32	2767-32767	0	-/A	Ο	I/P	<u>p.168</u>
41		User function9	User	0	NOP	0:NOP	X/A	0	I/P	<u>p.168</u>
			Func9	1	ADD					
				2	SUB					
	0h1E29			3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					





Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12	COMPARE- EQUAL					
				13						
				14						
				15	LIMIT					
				16	AND					
				17	OR					
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
42	0h1E2A	User function input9-A	User Input9-A	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
43	0h1E2B	User function input9-B	User Input9-B)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
44	0h1E2C	User function input9-C	User Input9-C	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
45	0h1E2D	User function output9	User Output9	-32	2767-32767	0	-/A	Ο	I/P	<u>p.168</u>
46		User	User	0	NOP	0:NOP	X/A	Ο	I/P	p.168
		function10	Func10	1	ADD					
	0h1E2E			2	SUB					
				3	ADDSUB					
				4	MIN					



Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12						
					EQUAL					
				13						
				14	NEQUAL TIMER					
					LIMIT					
					AND					
				17	OR					
					XOR					
					ANDOR					
					SWITCH					
				21						
				22						
					BITCLEAR					
					LOWPASSFILTER					
				25	PI_CONTORL					
					PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
47	0h1E2F	User function input10-A	User Input10- A	0-0	xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
48		User function	User	0-0	xFFFF	0	X/A	0	I/P	p.168
	0h1E30	input10-B	Input10- B							
49	01:4504	User function	User	0-0	xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
	0h1E31	input10-C	Input10- C							
50	0h1E32	User function output10	User Output10	-32	767-32767	0	-/A	Ο	I/P	<u>p.168</u>
51	0h1E33	User	User	0	NOP	0:NOP	X/A	Ο	I/P	<u>p.168</u>





Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
		function11	Func11	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12	COMPARE-					
					EQUAL					
				13	COMPARE-					
				14	NEQUAL TIMER					
					LIMIT					
				16						
				17						
					XOR					
					ANDOR					
					SWITCH					
				21						
				22						
					BITCLEAR					
					LOWPASSFILTER					
					PI_CONTORL					
					PI_PROCESS					
				27						
		Harris Constitution	11		DOWNCOUNT	0	\/ / A	0	L/D	. 1/0
52	0h1E34	User function input11-A	User Input11- A	0-0	xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
53	0h1E35	User function input11-B	User Input11- B	0-0	xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
54	0h1E36	User function	User	0-0	xFFFF	0	X/A	О	I/P	<u>p.168</u>
	1	l	<u> </u>	1						L



Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
		input11-C	Input11- C							
55	0h1E37	User function output11	User Output11	-32	767-32767	0	-/A	Ο	I/P	<u>p.168</u>
56	0h1E38	User	User	0	NOP	0:NOP	X/A	0	I/P	<u>p.168</u>
		function12	Func12	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12	COMPARE-					
					EQUAL					
				13	COMPARE- NEQUAL					
				14	TIMER					
				15	LIMIT					
				16	AND					
				17	OR					
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT	1				
				28	DOWNCOUNT					
57	0h1E39	User function	User	0-0)xFFFF	0	X/A	Ο	I/P	p.168
	UIIILJ9	input12-A	Input12-							





Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
			А							
58	0h1E3A	'	User Input12- B	0-0	xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
59	Oh1E3B	User function input12-C	User Input12- C	0-0	xFFFF	0	X/A	0	I/P	<u>p.168</u>
60	0h1E3C	User function output12	User Output12	-32	767-32767	0	-/A	Ο	I/P	<u>p.168</u>
61	0h1E3D		User	0	NOP	0:NOP	X/A	0	I/P	p.168
		function13	Func13	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12	COMPARE- EQUAL					
				13	COMPARE- NEQUAL					
				14	TIMER					
				15	LIMIT					
				16	AND					
				17	OR					
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET	1				
				23	BITCLEAR					
				24	LOWPASSFILTER	1				
				25	PI_CONTORL	1				



Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
			2	26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT	-				
62		User function	User	0-0)xFFFF	0	X/A	0	I/P	p.168
	0h1E3E	input13-A	Input13-							
63		User function	A User	0.0)xFFFF	0	X/A	0	I/P	p.168
03	0h1E3F	input13-B	Input13-	0-0)	U	///A		1/1	<u>p. 100</u>
			В							
64		User function	User	0-0)xFFFF	0	X/A	0	I/P	<u>p.168</u>
	0h1E40	input13-C	Input13-							
65		User function	C User	-32	2767-32767	0	-/A	0	I/P	p.168
00	0h1E41	output13	Output13	02	1707 02707		// \		"'	<u>p. 100</u>
66	0h1E42	User	User	0	NOP	0:NOP	X/A	0	I/P	p.168
		function14	Func14	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12						
					EQUAL					
				13	COMPARE- NEQUAL					
				14	TIMER					
					LIMIT					
					AND	-				
					OR	1				
					XOR	1				
					ANDOR					
				20						
					BITTEST					
		<u> </u>	<u> </u>		1	1	<u> </u>	<u> </u>		<u> </u>





Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
67	0h1E43	User function input14-A	User Input14- A	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
68	0h1E44	User function input14-B	User Input14- B	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
69	0h1E45	User function input14-C	User Input14- C	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
70	0h1E46	User function output14	User Output14	-32	2767-32767	0	-/A	Ο	I/P	<u>p.168</u>
71	0h1E47	User	User	0	NOP	0:NOP	X/A	Ο	I/P	<u>p.168</u>
		function15	Func15	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
					COMPARE- EQUAL					
					COMPARE- NEQUAL					
				14	TIMER					
					LIMIT					
				16	AND					
				17	OR					



Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
72	0h1E48	User function input15-A	User Input15- A	0-0) XFFFF	0	X/A	Ο	I/P	<u>p.168</u>
73	0h1E49	User function input15-B	User Input15- B	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
74	0h1E4A	User function input15-C	User Input15- C	0-0)xFFFF	0	X/A	Ο	I/P	<u>p.168</u>
75	0h1E4B	User function output15	User Output15	-32	2767-32767	0	-/A	Ο	I/P	<u>p.168</u>
76	0h1E4C	User function	User	0	NOP	0:NOP	X/A	0	I/P	<u>p.168</u>
		16	Func16	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12						
				10	EQUAL					
				13	COMPARE- NEQUAL					
				<u> </u>	INLUUAL					L





Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
				14	TIMER					
				15	LIMIT					
				16	AND					
				17	OR					
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET		ļ			
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
77	0h1E4D	User function input16-A	User Input16- A	0-0xFFFF		0	X/A	Ο	I/P	<u>p.168</u>
78	Oh1E4E	User function input16-B	User Input16- B	0-0xFFFF		0	X/A	Ο	I/P	<u>p.168</u>
79	0h1E4F	User function input16-C	User Input16- C	0-0xFFFF		0	X/A	Ο	I/P	p.168
80	0h1E50	User function output16	User Output16	-32767-32767		0	-/A	Ο	I/P	<u>p.168</u>
81	0h1E51	User function	User	0	NOP	0:NOP	X/A	Ο	I/P	<u>p.168</u>
		17	Func17	1	ADD					
				2	SUB					
				3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					
				7	NEGATE					
				8	MPYDIV					
	l	1	1	0	DELAMINIDED	1	l	ĺ	l	Ī
				9	REMAINDER					



Code	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
0.	7 (4.4. 666		Biopias	11	COMPARE-GEQ	74.46				
				12	COMPARE- EQUAL					
				13	COMPARE- NEQUAL					
				14	TIMER					
				15						
				16	AND					
				17	OR					
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET					
				23						
				24						
				25	PI_CONTORL					
					PI_PROCESS					
				27	UPCOUNT					
					DOWNCOUNT					
82	0h1E52	User function input17-A	User Input17- A	0-0	xFFFF	0	X/A	0	I/P	<u>p.168</u>
83	0h1E53	User function input17-B	User Input17- B	0-0xFFFF		0	X/A	Ο	I/P	<u>p.168</u>
84	0h1E54	User function input17-C	User Input17- C	0-0xFFFF		0	X/A	Ο	I/P	<u>p.168</u>
85	0h1E55	User function output17	User Output17	-32767-32767		0	-/A	Ο	I/P	<u>p.168</u>
86		User function	User	0 NOP		0:NOP	X/A	Ο	I/P	<u>p.168</u>
		18 F	Func18	1	ADD					
				2	SUB					
	0h1E56			3	ADDSUB					
				4	MIN					
				5	MAX					
				6	ABS					





Code UF	Comm. Address	Name	LCD Display		Setting Range	Initial Value	Property*	V/F	SL	Ref.
				7	NEGATE					
				8	MPYDIV					
				9	REMAINDER					
				10	COMPARE-GT					
				11	COMPARE-GEQ					
				12						
				13	EQUAL COMPARE-					
				13	NEQUAL					
				14	TIMER					
				15	LIMIT					
				16	AND					
				17	OR					
				18	XOR					
				19	ANDOR					
				20	SWITCH					
				21	BITTEST					
				22	BITSET					
				23	BITCLEAR					
				24	LOWPASSFILTER					
				25	PI_CONTORL					
				26	PI_PROCESS					
				27	UPCOUNT					
				28	DOWNCOUNT					
87	0h1E57	User function input18-A	User Input18- A	0-0xFFFF		0	X/A	0	I/P	<u>p.168</u>
88	0h1E58	User function input18-B	User Input18- B	0-0xFFFF		0	X/A	Ο	I/P	<u>p.168</u>
89	0h1E59	User function input18-C	User Input18- C	0-0xFFFF		0	X/A	Ο	I/P	<u>p.168</u>
90	0h1E5A	User function output18	User Output18	-32	767-32767	0	-/A	0	I/P	<u>p.168</u>



8.14 Groups for LCD Keypad Only

8.14.1 Trip Mode (TRP Last-x)

Code	Name	LCD Display	(Setting Range	Initial Value	Ref.
00	Trip type display	Trip Name(x)	-		-	-
01	Frequency reference at trip	Output Freq	-		-	-
02	Output current at trip	Output Current	-		-	-
03	Acceleration/Deceleration state at trip	Inverter State	-		-	-
04	DC section state	DCLink Voltage	-		-	-
05	NTC temperature	Temperature	-		-	-
06	Input terminal state	DI Status	-		0000 0000	-
07	Output terminal state	DO Status	-		000	-
08	Trip time after Power on	Trip On Time	-		0/00/00 00:00	-
09 10	Trip time after operation start	Trip Run Time	-		0/00/00 00:00	-
10	Delete trip history	Trip Delete?	0	No Yes		

8.14.2 Config Mode (CNF)

Code	Name	LCD Display	Setting Range	Initial Value	Ref.
00	Jump code	Jump Code	1-99	42	<u>p.72</u>
01	Keypad language selection	Language Sel	0 : English	0 : English	<u>p.269</u>
02	LCD constrast adjustment	LCD Contrast	-	-	<u>p.252</u>
03	Multi keypad ID	Multi KPD ID	3-99	3	p.167
10	Inverter S/W version	Inv S/W Ver	-	-	<u>p.252</u>
11	LCD keypad S/W version	Keypad S/W Ver	-	-	<u>p.252</u>
12	LCD keypad title version	KPD Title Ver	-	-	<u>p.252</u>





Code	Name	LCD Display	Se	tting Range	Initial Value	Ref.
20	Status window display item	Anytime Para	0	Frequency	0: Frequency	<u>p.270</u>
21	Monitor mode display item1	Monitor Line-1	1	Speed	0: Frequency	<u>p.270</u>
22	Monitor mode display item2	Monitor Line-2	2	Output Current	2:Output Current	<u>p.270</u>
			3	Output		
			4	Output		
			5	WHour		
			6	DCLink		
			7	DI State		
			8	DO State		p.270
			9	V1		
		Monitor Line-3	10	V1		
23	Monitor mode display item3		13	V2	3:Output Voltage	
			14	V2		
			15	12		
			16	` '		
			17	'		
			18			
			19	PID Fdb Value		
			20	Torque		
			21	Torque Limit		
			23	Speed Limit		
24	Monitor mode	Mon Mode Init	0	No	0:No	<u>p.270</u>
	initialization	Wierr Wiede in int	1	Yes	0.110	<i>p.270</i>
30	Option slot 1 type display	Option-1 Type	0	None	0:None	<u>p.252</u>
31	Option slot 2 type display	Option-2 Type	6	Ethernet	0:None	<u>p.252</u>
32	Option slot 3 type display	Option-3 Type	9	CANopen	0:None	<u>p.252</u>
			0	No		
			1	All Grp		<u>p.246</u>
40	Parameter initialization	Parameter Init	2	DRV Grp		
				BAS Grp		
			4	ADV Grp		



Table of Functions

Code	Name	LCD Display	Se	tting Range	Initial Value	Ref.
			5	CON Grp		
			6	IN Grp		
			7	OUT Grp		
			8	COM Grp		
			9	APP Grp]	
			12	PRT Grp		
			13	M2 Grp		
41	Display changed	Changed Para	0	View All	0:View All	p.249
	Parameter	Changeurara	1	View	U.VIEW AII	<u>p.247</u>
			0	None		
			1	JOG Key		
42	Multi key item	Multi Key Sel	2	Local/Remote	0:None	p.249
42	42 Multi key item	Multi Key Sei	3	UserGrp SelKey	U.NOME	<u>p.247</u>
			4	Multi KPD		
43	Macro function item	Macro Select	0	None	0:None	-
4.4	Trip history deletion	Erase All Trip	0	No	O.N.o.	<u>p.252</u>
44			1	Yes	0:No	
4 -	User registration code	HeerCro AllDel	0	No	0:No	n 240
45	deletion	UserGrp AllDel	1	Yes	U:NO	<u>p.249</u>
46	Dood parameters	Parameter Read	0	No	0:No	n 245
40	Read parameters	Parameter Read	1	Yes	U.INO	<u>p.245</u>
47	Write parameters	Parameter	0	No	0: No	245
4 /	Write parameters	Write	1	Yes	U. NO	<u>p.245</u>
40	Cava paramatara	Parameter Save	0	No	0:No	n 245
48	Save parameters	Parameter Save	1	Yes	U.INO	<u>p.245</u>
50	Hide parameter mode	View Lock Set	0-9	999	Un-locked	p.247
51	Password for hiding parameter mode	View Lock Pw	0-9	9999	Password	<u>p.247</u>
52	Lock parameter edit	Key Lock Set	0-9	999	Un-locked	p.248
53	Password for locking parameter edit	Key Lock Pw	0-9	999	Password	<u>p.248</u>
60	Additional title update	Add Title Up	0	No	0:No	p.252
	Additional title apaate	Add Title Up	1	Yes	UINU	p.zuz
61	Simple parameter	Easy Start On	0	No	1:Yes	p.249
ΟI	setting	Lasy Start Off	1	Yes	1.103	P.247





Code	Name	LCD Display	Se ⁻	tting Range	Initial Value	Ref.
62	Power consumption initialization	WHCount Reset	0	No Yes	0:No	<u>p.252</u>
70	Accumulated inverter motion time	On-time		ar/month/day ur:minute	-	<u>p.272</u>
71	Accumulated inverter operation time	Run-time	Year/month/day hour:minute		-	<u>p.272</u>
'	Accumulated inverter		0	No	0:No	
72	operation time initialization	Time Reset	1	Yes		<u>p.272</u>
74	Accumulated cooling fan operation time	Fan Time		ar/month/day ur:minute	-	<u>p.272</u>
75	Reset of accumulated cooling fan operation time	Fan Time Rst	1	No Yes	0:No	<u>p.272</u>



This chapter explains how to troubleshoot a problem when inverter protective functions, fault trips, warning signals, or a fault occurs. If the inverter does not work normally after following the suggested troubleshooting steps, please contact the Enertronica Santerno S.p.A. customer service center.

9.1 Trips and Warnings

When the inverter detects a fault, it stops the operation (trips) or sends out a warning signal. When a trip or warning occurs, the keypad displays the information briefly. If the LCD keypad is used, detailed information is shown on the LCD display. Users can read the warning message at Pr.90. When more than 2 trips occur at roughly the same time, the keypad (basic keypad with 7-segment display) displays the higher priority fault trip information, while the LCD keypad shows the information for the fault trip that occurred first.

The fault conditions can be categorized as follows:

- Level: When the fault is corrected, the trip or warning signal disappears and the fault is not saved in the fault history.
- Latch: When the fault is corrected and a reset input signal is provided, the trip 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 the inverter is still in a fault condition after powering it on again, please contact the supplier or the Enertronica Santerno S.p.A. customer service center.

9.1.1 Fault Trips

Protection Functions for Output Current and Input Voltage

Keypad Display	LCD Display	Туре	Description
	Over Load		Displayed when the motor overload trip is activated and the actual load level exceeds the set level. Operates when Pr.20 is set to a value other than 0.



Keypad Display	LCD Display	Туре	Description
	Under Load	Latch	Displayed when the motor underload trip is activated and the actual load level is less than the set level. Operates when Pr.27 is set to a value other than 0.
	Over Current1	Latch	Displayed when inverter output current exceeds 200% of the rated current.
	Over Voltage	Latch	Displayed when internal DC circuit voltage exceeds the specified value.
	Low Voltage	Level	Displayed when internal DC circuit voltage is less than the specified value.
	Low Voltage2	Latch	Displayed when internal DC circuit voltage is less than the specified value during inverter operation.
	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 inverter capacity.
	E-Thermal	Latch	Displayed based on inverse time-limit thermal characteristics to prevent motor overheating. Operates when Pr.40 is set to a 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 Pr.05 is set to 1.
	In Phase Open	Latch	Displayed when a 3-phase inverter input has one or more phases in an open circuit condition. Operates only when bit 2 of Pr.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 inverter rated capacity, and may vary depending on the device's capacity.
(Pil	No Motor Trip	Latch	Displayed when the motor is not connected during inverter operation. Operates when Pr.31 is set to 1.

^{*} Sinus H inverters rated for 4.0kW or less (models 0007 and below) do not support the ground fault trip (GFT) feature. Therefore, an over current trip (OCT) or over voltage trip (OVT) may occur when there is a low-resistance ground fault.

Protection Functions Using Abnormal Internal Circuit Conditions and External Signals

Keypad Display	LCD Display	Туре	Description
	Over Heat		Displayed when the tempertature of the inverter heat sink exceeds the specified value.



Keypad Display	LCD Display	Туре	Description
	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.65-71 in IP20 models, In.65-69 in IP66 models to 4 (External Trip) to enable external trip.
	BX	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 in IP20 models, In.65-69 in IP66 models to 5 (BX) to enable 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 keypad or memory (EEPRom) fault.
			ADC Off Set: An error in the current sensing circuit (U/V/W terminal, current sensor, etc.).
	NTC Open	Latch	Displayed when an error is detected in the temperature sensor of the Insulated Gate Bipolar Transistor (IGBT).
(FAn)	Fan Trip	Latch	Displayed when an error is detected in the cooling fan. Set Pr.79 to 0 to activate fan trip (for models below 22kW capacity).
Fid	Pre-PID Fail	Latch	Displayed when pre-PID is operating with functions set at AP.34–AP.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	Operates when the external brake signal is provided by the multi-function terminal. Occurs when the inverter output starting current remains below the set value at Ad.41. Set either OU.31 or OU.32 to 35 (BR Control).
558	Safety A(B) Err	Level	Displayed when at least one of the two safety input signals is off.



Protection Functions for Communication Options

Keypad Display	LCD Display	Туре	Description
	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). Activate by setting Pr.12 to any value other than 0.
	IO Board Trip	Latch	Displayed when the I/O board or external communication card is not connected to the inverter or there is a bad connection.
			Displayed when the error code continues for more than 5 sec. ('Errc' -> '-rrc' -> E-rc' -> 'Er-c' -> 'Err-' -> 'rc' -> 'Er' -> '' -> 'Errc' ->)
	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.
	Option Trip- 1	Latch	Displayed when a communication error is detected between the inverter and the communication board. Occurs when the communication option card is installed.

9.1.2 Warning Messages

Keypad	LCD Display	Description
Display		
	Over Load	Displayed when the motor is overloaded. Operates when Pr.17 is set to 1. To operate, select 5. Set the digital output terminal or relay (OU.31 or OU.33) to 5 (Over Load) to receive overload warning output signals.
	Under Load	Displayed when the motor is underloaded. Operates when Pr.25 is set to 1. Set the digital output terminal or relay (OU.31 or OU.33) to 7 (Under Load) to receive underload warning output signals.
	INV Over Load	Displayed when the overload time equivalent to 60% of the inverter overheat protection (inverter IOLT) level, is accumulated. Set the digital output terminal or relay (OU.31 or OU.33) to 6 (IOL)



	to receive inverter overload warning output signals.
Lost	Lost command warning alarm occurs even with Pr.12 set to 0. The
Command	warning alarm occurs based on the condition set at Pr.13-15. Set
	the digital output terminal or relay (OU.31 or OU.33) to 13 (Lost Command) to receive lost command warning output signals. If the
	communication settings and status are not suitable for P2P, a Lost
	Command alarm occurs.
Fan Warning	Displayed when an error is detected from the cooling fan while
	Pr.79 is set to 1. Set the digital output terminal or relay (OU.31 or
	OU.33) to 8 (Fan Warning) to receive fan warning output signals
	An alarm occurs when the value set at PRT-86 is less than the value
Fan	set at PRT-87. To receive fan exchange output signals, set the
Exchange	digital output terminal or relay (OUT-31 or OUT-33) to 38 (Fan
	Exchange).
	An alarm occurs when the value set at PRT-63 is less than the value
CAP	set at PRT-62 (the value set at PRT-61 must be 2 (Pre Diag)). To
Exchange	receive CAP exchange signals, set the digital output terminal or
55111	relay (OUT-31 or OUT-33) to 36 (CAP Exchange).
DB Warn	Displayed when the DB resistor usage rate exceeds the set value.
%ED	Set the detection level at Pr.66.
Retry Tr	Tr tune error warning alarm is activated when Dr.9 is set to 4. The
Tune	warning alarm occurs when the motor's rotor time constant (Tr) is
	either too low or too high.

9.2 Troubleshooting Fault Trips

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

Туре	Cause	Remedy
Over Load	The load is greater than the motor's	Ensure that the motor and inverter
	rated capacity.	have appropriate capacity ratings.
	The set value for the overload trip level	Increase the set value for the overload
	(Pr.21) is too low.	trip level.
Under Load	There is a motor-load connection	Replace the motor and inverter with
	problem.	models with lower capacity.
	The set value for underload level (Pr.29,	Reduce the set value for the
	Pr.30) is less than the system's minimum	underload level.
	load.	
Over	Acc/Dec time is too short, compared to	Increase Acc/Dec time.
Current1	load inertia (GD2).	
	The inverter load is greater than the	Replace the inverter with a model that



Туре	Cause	Remedy
туре	rated capacity.	has increased capacity.
	The inverter supplied an output while	Operate the inverter after the motor
	the motor was idling.	has stopped or use the speed search
	the motor was fulling.	function (Cn.60).
	The mechanical brake of the motor is	Check the mechanical brake.
	operating too fast.	Check the mechanical brake.
Over Voltage	Deceleration time is too short for the	Increase the acceleration time.
3	load inertia (GD2).	
	A generative load occurs at the inverter output.	Use the braking unit.
	The input voltage is too high.	Determine if the input voltage is
		above the specified value.
Low Voltage	The input voltage is too low.	Determine if the input voltage is
		below the specificed value.
	A load greater than the power capacity is	Increase the power capacity.
	connected to the system (e.g., a welder,	
	direct motor connection, etc.)	
	The magnetic contactor connected to	Replace the magnetic contactor.
	the power source has a faulty	
	connection.	
Low Voltage2	The input voltage has decreased during	Determine if the input voltage is
	the operation.	above the specified value.
	An input phase-loss has occurred.	Check the input wiring.
	The power supply magnetic contactor is	Replace the magnetic contractor.
Construct Tales	faulty.	
Ground Trip	A ground fault has occurred in the	Check the output wiring.
	inverter output wiring.	Dealers the meeter
E-Thermal	The motor insulation is damaged. The motor has overheated.	Replace the motor.
E-mermai	The motor has overneated.	Reduce the load or operation
	The inverter lead is greater than the	frequency. Replace the inverter with a model that
	The inverter load is greater than the rated capacity.	has increased capacity.
	The set value for electronic thermal	Set an appropriate electronic thermal
	protection is too low.	level.
	The inverter has been operated at low	Replace the motor with a model that
	speed for an extended duration.	supplies extra power to the cooling
	speculion arresteriaca daration.	fan.
Output Phase	The magnetic contactor on the output	Check the magnetic contactor on the
Open	side has a connection fault.	output side.
1	The output wiring is faulty.	Check the output wiring.
Input Phase	The magnetic contactor on the input	Check the magnetic contactor on the
Open	side has a connection fault.	input side.
•	The input wiring is faulty.	Check the input wiring.
	The DC link capacitor needs to be	Replace the DC link capacitor. Contact
	· · · · · · · · · · · · · · · · · · ·	· '



Туре	Cause	Remedy
	replaced.	the retailer or the Enertronica
		Santerno S.p.A. customer service
		center.
Inverter OLT	The load is greater than the rated motor	Replace the motor and inverter with
	capacity.	models that have increased capacity.
	The torque boost level is too high.	Reduce the torque boost level.
Over Heat	There is a problem with the cooling	Determine if a foreign object is
	system.	obstructing the air inlet, outlet, or
		vent.
	The inverter cooling fan has been	Replace the cooling fan.
	operated for an extended period.	
	The ambient temperature is too high.	Keep the ambient temperature below
		50°C.
Over	Output wiring is short-circuited.	Check the output wiring.
Current2	There is a fault with the electronic	Do not operate the inverter. Contact
	semiconductor (IGBT).	the retailer or the Enertronica
		Santerno S.p.A. customer service
		center.
NTC Open	The ambient temperature is too low.	Keep the ambient temperature above
		-10°C.
	There is a fault with the internal	Contact the retailer or the Enertronica
	temperature sensor.	Santerno S.p.A. customer service
		center.
FAN Lock	A foreign object is obstructing the fan's	Remove the foreign object from the
	air vent.	air inlet or outlet.
	The cooling fan needs to be replaced.	Replace the cooling fan.
IP54 FAN Trip	The fan connector is not connected.	Connect the fan connector.
	The fan connector needs to be replaced.	Replace the fan connector.

9.3 Troubleshooting Other Faults

When a fault other than those identified as fault trips or warnings occurs, refer to the following table for possible causes and remedies.

Туре	Cause	Remedy
Parameters cannot be set.	The inverter is in operation (driving mode).	Stop the inverter to change to program mode and set the parameter.
	The parameter access is incorrect.	Check the correct parameter access level and set the parameter.



Туре	Cause	Remedy
. , , , ,	The password is incorrect.	Check the password, disable the
		parameter lock and set the
		parameter.
	Low voltage is detected.	Check the power input to resolve the
		low voltage and set the parameter.
The motor does	The frequency command source is set	Check the frequency command
not rotate.	incorrectly.	source setting.
	The operation command source is set	Check the operation command
	incorrectly.	source setting.
	Power is not supplied to the terminal	Check the terminal connections R/S/T
	R/S/T.	and U/V/W.
	The charge lamp is turned off.	Turn on the inverter.
	The operation command is off.	Turn on the operation command
		(RUN).
	The motor is locked.	Unlock the motor or lower the load
		level.
	The load is too high.	Operate the motor independently.
	An emergency stop signal is input.	Reset the emergency stop signal.
	The wiring for the control circuit	Check the wiring for the control
	terminal is incorrect.	circuit terminal.
	The input option for the frequency	Check the input option for the
	command is incorrect.	frequency command.
	The input voltage or current for the	Check the input voltage or current
	frequency command is incorrect.	for the frequency command.
	The PNP/NPN mode is selected	Check the PNP/NPN mode setting.
	incorrectly.	
	The frequency command value is too	Check the frequency command and
	low.	input a value above the minimum
	TI (OTOD/DECETI)	frequency.
	The [STOP/RESET] key is pressed.	Check that the stoppage is normal, if
	Matartagas is to a law	so resume operation normally.
	Motor torque is too low.	Change the operation modes (V/F,
		IM, and Sensorless). If the fault
		remains, replace the inverter with a
The motor	The wiring for the motor output cable	model with increased capacity.
rotates in the	is incorrect.	Determine if the cable on the output side is wired correctly to the phase
opposite	is incorrect.	(U/V/W) of the motor.
direction to the	The signal connection between the	Check the forward/reverse rotation
command.	control circuit terminal	wiring.
communa.	(forward/reverse rotation) of the	wiinig.
	inverter and the forward/reverse	
	rotation signal on the control panel	
	side is incorrect.	
	5.40 15 11 10011 000.	



Туре	Cause	Remedy
The motor only	Reverse rotation prevention is selected.	Remove the reverse rotation
rotates in one	The verse retation provention is selected.	prevention.
direction.	The reverse rotation signal is not	Check the input signal associated
	provided, even when a 3-wire	with the 3-wire operation and adjust
	sequence is selected.	as necessary.
The motor is	The load is too heavy.	Reduce the load.
overheating.	The read is tee rieary.	Increase the Acc/Dec time.
over rearing.		Check the motor parameters and set
		the correct values.
		Replace the motor and the inverter
		with models with appropriate
		capacity for the load.
	The ambient temperature of the motor	Lower the ambient temperature of
	is too high.	the motor.
	The phase-to-phase voltage of the	Use a motor that can withstand
	motor is insufficient.	phase-to-phase voltages surges
	Thotor is insumerent.	greater than the maximum surge
		voltage.
		Only use motors suitable for
		apllications with inverters.
		Connect the AC reactor to the
		inverter output (set the carrier
		frequency to 2 kHz).
	The motor fan has stopped or the fan is	Check the motor fan and remove any
	obstructed with debris.	foreign objects.
The motor stops	The load is too high.	Reduce the load.
during	The load is too riight.	Replace the motor and the inverter
acceleration or		with models with capacity
when		appropriate for the load.
connected to		appropriate for the load.
load.		
The motor does	The frequency command value is low.	Set an appropriate value.
not accelerate.	The load is too high.	Reduce the load and increase the
/The	The read to too ring	acceleration time. Check the
acceleration		mechanical brake status.
time is too long.	The acceleration time is too long.	Change the acceleration time.
<i>y y y y y y y y y y</i>	The combined values of the motor	Change the motor related
	properties and the inverter parameter	parameters.
	are incorrect.	parameters.
	The stall prevention level during	Change the stall prevention level.
	acceleration is low.	S. a go tho stan provention level.
	The stall prevention level during	Change the stall prevention level.
	operation is low.	Sharige the stan prevention level.
	Starting torque is insufficient.	Change to vector control operation
	Jotal ting torque is insufficient.	onange to vector control operation



Туре	Cause	Remedy
		mode. If the fault is still not
		corrected, replace the inverter with a
		model with increased capacity.
Motor speed	There is a high variance in load.	Replace the motor and inverter with
varies during		models with increased capacity.
operation.	The input voltage varies.	Reduce input voltage variation.
· ·	Motor speed variations occur at a	Adjust the output frequency to avoid
	specific frequency.	a resonance area.
The motor	The V/F pattern is set incorrectly.	Set a V/F pattern that is suitable for
rotation is		the motor specification.
different from		
the setting.		
The motor	The deceleration time is set too long.	Change the setting accordingly.
deceleration	The motor torque is insufficient.	If motor parameters are normal, it is
time is too long		likely to be a motor capacity fault.
even with		Replace the motor with a model with
Dynamic		increased capacity.
Braking (DB)	The load is higher than the internal	Replace the inverter with a model
resistor	torque limit determined by the rated	with increased capacity.
connected.	current of the inverter.	, ,
Operation is	The carrier frequency is too high.	Reduce the carrier frequency.
difficult in	Over-excitation has occurred due to an	Reduce the torque boost value to
underload	inaccurate V/F setting at low speed.	avoid over-excitation.
applications.		
While the	Noise occurs due to switching inside	Change the carrier frequency to the
inverter is in	the inverter.	minimum value.
operation, a		Install a micro surge filter in the
control unit		inverter output.
malfunctions or		'
noise occurs.		
When the	An earth leakage breaker will interrupt	Connect the inverter to a ground
inverter is	the supply if current flows to ground	terminal.
operating, the	during inverter operation.	Check that the ground resistance is
earth leakage		less than 100Ω for 2S/T inverters and
breaker is		less than 10Ω for 4T inverters.
activated.		Check the capacity of the earth
		leakage breaker and make the
		appropriate connection, based on
		the rated current of the inverter.
		Lower the carrier frequency.
		Make the cable length between the
		inverter and the motor as short as



Туре	Cause	Remedy
		possible.
The motor	Phase-to-phase voltage of 3-phase	Check the input voltage and balance
vibrates	power source is not balanced.	the voltage.
severely and		Check and test the motor's
does not rotate		insulation.
normally.		
The motor	Resonance occurs between the motor's	Slightly increase or decrease the
makes	natural frequency and the carrier	carrier frequency.
humming, or	frequency.	, ,
loud noises.	Resonance occurs between the motor's	Slightly increase or decrease the
	natural frequency and the inverter's	carrier frequency.
	output frequency.	Use the frequency jump function to
		avoid the frequency band where
		resonance occurs.
The motor	The frequency input command is an	In situations of noise inflow on the
vibrates/hunts.	external, analog command.	analog input side that results in
		command interference, change the
		input filter time constant (In.07).
	The wiring length between the inverter	Ensure that the total cable length
	and the motor is too long.	between the inverter and the motor
		is less than 200m (50m for motors
		rated 2.2kW or lower).
The motor does	It is difficult to decelerate sufficiently,	Adjust the DC braking parameter.
not come to a	because DC braking is not operating	Increase the set value for the DC
complete stop	normally.	braking current.
when the		Increase the set value for the DC
inverter output		braking stopping time.
stops.		
The output	The frequency reference is within the	Set the frequency reference higher
frequency does	jump frequency range.	than the jump frequency range.
not increase to	The frequency reference is exceeding	Set the upper limit of the frequency
the frequency	the upper limit of the frequency	command higher than the frequency
reference.	command.	reference.
	Because the load is too heavy, the stall	Replace the inverter with a model
	prevention function is working.	with increased capacity.
The cooling fan	The control parameter for the cooling	Check the control parameter setting
does not rotate.	fan is set incorrectly.	for the cooling fan.



10 Maintenance

This chapter explains how to replace the cooling fan, the regular inspections to complete, and how to store and dispose of the product. An inverter is vulnerable to environmental conditions and faults also occur due to component wear and tear. To prevent breakdowns, please follow the maintenance recommendations in this section.

① Caution

- Before you inspect the product, read all safety instructions contained in this manual.
- Before you clean the product, ensure that the power is off.
- Clean the inverter with a dry cloth. Cleaning with wet cloths, water, solvents, or detergents may result in electric shock or damage to the product.

10.1 Regular Inspection Lists

10.1.1 Daily Inspections

Inspection area	Inspection item	Inspection details	Inspection method	Judgment standard	Inspection equipment
All	Ambient environment	Is the ambient temperature and humidity within the design range, and is there any dust or foreign objects present?	refer to <u>1.3</u> <u>Part Names for</u> IP66 <u>o</u> n page <u>21</u> .	No icing (ambient temperature: - 10 - +40) and no condensation (ambient humidity below 50%)	Thermometer, hygrometer, recorder
	Inverter	Is there any abnormal vibration or noise?	Visual inspection	No abnormality	
	Power voltage	Are the input and output voltages normal?	Measure voltages between R/S/ T-phases in. the inverter terminal block.	refer to <u>11.1</u> <u>Input and</u> <u>Output</u> <u>Specification</u> on page <u>417</u> .	Digital multimeter tester



Maintenance

Inspection area	Inspection item	Inspection details	Inspection method	Judgment standard	Inspection equipment
Input/Output circuit	Smoothing capacitor	Is there any leakage from the inside? Is the capacitor swollen?	Visual inspection	No abnormality	-
Cooling system	Cooling fan	Is there any abnormal vibration or noise?	Turn off the system and check operation by rotating the fan manually.	Fan rotates smoothly	-
Display	Measuring device	Is the display value normal?	Check the display value on the panel.	Check and manage specified values.	Voltmeter, ammeter, etc.
Motor	All	Is there any abnormal vibration or noise?	Visual inspection	No abnormality	-
		Is there any abnormal smell?	Check for overheating or damage.		

10.1.2 Annual Inspections

Inspection area	Inspection item	Inspection details	Inspection method	Judgement standard	Inspection equipment
Input/Output circuit	All	Megger test (between input/output terminals and and earth terminal)	Disconnect inverter and short R/S/T/U/V/W terminals, and then measure from each terminal to the ground terminal using a Megger.	Must be abo ve 5 MΩ	DC 500 V Megger
		Is there anything loose in the	Tighten up all screws.	No abnormality	





Inspection area	Inspection item	Inspection details	Inspection method	Judgement standard	Inspection equipment
		device?			
		Is there any evidence of parts overheating?	Visual inspection		
	Cable connections	Are there any corroded cables? Is there any damage to cable insulation?	Visual inspection	No abnormality	-
	Terminal block	Is there any damage?	Visual inspection	No abnormality	-
	Smoothing condenser	Measure electrostatic capacity.	Measure with capacity meter.	Rated capacity over 85%	Capacity meter
	Relay	Is there any chattering noise during operation?	Visual inspection	No abnormality	-
		Is there any damage to the contacts?	Visual inspection		
	Braking resistor	Is there any damage from resistance?	Visual inspection	No abnormality	Digital multimeter / analog tester
		Check for disconnection.	Disconnect one side and measure with a tester.	Must be within ±10% of the rated value of the resistor.	
Control circuit Protection circuit	Operation check	Check for output voltage imbalance while the inverter is in operation.	Measure voltage between the inverter output terminal U/V/ W.	Balance the voltage between phases: within 4V for 2S/T series and within 8V for 4T series.	Digital multimeter or DC voltmeter



Maintenance

Inspection area	Inspection item	Inspection details	Inspection method	Judgement standard	Inspection equipment
		Is there an error in the display circuit after the sequence protection test?	Test the inverter ouput protection in both short and open circuit conditions.	The circuit must work according to the sequence.	
Cooling system	Cooling fan	Are any of the fan parts loose?	Check all connected parts and tighten all screws.	No abnormality	-
Display	Display device	Is the display value normal?	Check the command value on the display device.	Specified and managed values must match.	Voltmeter, Ammeter, etc.

10.1.3 Bi-annual Inspections

Inspection area	Inspection item		- C	Inspection equipment
Motor	resistance	(between the input, output	Must be above 5 MΩ	DC 500 V Megger

① Caution

Do not run an insulation resistance test (Megger) on the control circuit as it may result in damage to the product.



10.2 Storage and Disposal

10.2.1 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>1.3 Part Names for IP66</u> on page <u>21</u>).
- When storing the product for a period longer than 3 months, store it between 10°C and 30°C, to prevent depletion of the electrolytic capacitor.
- Do not expose the inverter to snow, rain, fog, or dust.
- Package the inverter in a way that prevents contact with moisture. Keep the moisture level below 70% in the package by including a desiccant, such as silica gel.

10.2.2 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. Although plastic can also be recycled, it can be incinerated under contolled conditions in some regions.

① Caution

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



11 Technical Specification

11.1 Input and Output Specification

Sinus H 2S IP20

Model SINU:	SHxxxx2s-		0001	0002	0003	0005		
Applied	Heavy load	HP	0.5	1.0	2.0	3.0		
motor		kW	0.4	0.75	1.5	2.2		
	Normal load	HP	1.0	2.0	3.0	5.0		
		kW	0.75	1.5	2.2	3.7		
Rated output	Rated capacity (kVA)	Heavy load	1.0	1.9	3.0	4.2		
·		Normal load	1.2	2.3	3.8	4.6		
	Rated current (A)	Heavy load	2.5	5.0	8.0	11.0		
		Normal load	3.1	6.0	9.6	12.0		
	Output frequer	ncy	0-400 Hz (IM Sensorless: 0-120 Hz; PM Sensorless: 0-180 Hz)					
	Output voltage	e (V)	3-phase 200-240 V					
Rated input	Working voltag	je (V)	Single phase 200-240 V AC (-15% to +10%)					
	Input frequenc	У	50-60 Hz (±5%	%)				
	Rated current (A)	Heavy load	4.4	9.3	15.6	21.7		
		Normal load	5.8	11.7	19.7	24.0		
Weight (lb/k	g)		2.5/1.14	3.9/1.76	3.9/1.76	4.9/2.22		

- The standard motor capacity is based on a standard 4-pole motor.
- The rated output current is limited based on the carrier frequency set at Cn.04 and on the input supply voltage. See Continuous Rated Current Derating.



Sinus H 2T (0.4-4kW) IP20

Model SIN	IUS H xxxx 2T-		0001	0002	0003	0005	0007			
Applied	Heavy load	HP	0.5	1.0	2.0	3.0	5.4			
motor		kW	0.4	0.75	1.5	2.2	4.0			
	Normal load	HP	1.0	2.0	3.0	5.0	7.5			
		kW	0.75	1.5	2.2	3.7	5.5			
Rated output	Rated capacity (kVA)	Heavy load	1.0	1.9	3.0	4.2	6.5			
		Normal load	1.2	2.3	3.8	4.6	6.9			
	Rated current (A)	Heavy load	2.5	5.0	8.0	11.0	17.0			
		Normal load	3.1	6.0	9.6	12.0	18.0			
	Output frequer	Output frequency			0-400 Hz (IM Sensorless: 0-120 Hz; PM Sensorless: 0-180 Hz)					
	Output voltage	: (V)	3-phase 200-240 V							
Rated	Working voltag	e (V)	3-phase 200-240 VAC (-15% to +10%)							
input	Input frequency	У	50-60 Hz (±5%)							
	Rated current (A)	Heavy load	2.2	4.9	8.4	11.8	18.5			
		Normal load	3.0	6.3	10.8	13.1	19.4			
Weight (lb	/kg)		2/0.9	2/0.9	2.86/1.3	3.3/1.5	4.4/2.0			

- The standard motor capacity is based on a standard 4-pole motor.
- The rated output current is limited based on the carrier frequency set at Cn.04 and on the input supply voltage. See Continuous Rated Current Derating.





Sinus H 2T (5.5-15kW) IP20

Model SIN	IUS H xxxx 2t-		0011	0014	0017	0020			
Applied motor	Heavy load	HP	7.5	10	15	20			
HIOTOI		kW	5.5	7.5	11	15			
	Normal load	HP	10	15	20	25			
		kW	7.5	11	15	18.5			
Rated output	Rated capacity	Heavy load	9.1	12.2	17.5	22.9			
	(kVA)	Normal load	11.4	15.2	21.3	26.3			
	Rated current (A)	Heavy load	24.0	32.0	46.0	60.0			
		Normal load	30.0	40.0	56.0	69.0			
	Output freque	Output frequency		0-400 Hz (IM Sensorless: 0-120 Hz; PM Sensorless: 0-180 Hz)					
	Output voltaç	ge (V)	3 phase 200-240V						
Rated	Working volta	age (V)	3 phase 200-240VAC (-15% to +10%)						
input	Input frequer	псу	50-60 Hz (±5%	%)					
	Rated current (A)	Heavy load	25.8	34.9	50.8	66.7			
		Normal load	32.7	44.2	62.3	77.2			
Weight (Ib	/kg)		7.3/3.3	7.3/3.3	10/4.6	16/7.1			

- The standard motor capacity is based on a standard 4-pole motor
- The rated output current is limited based on the carrier frequency set at Cn.04 and on the input supply voltage. See Continuous Rated Current Derating.



Sinus H 4T (0.4-4kW) IP20

Model SIN	NUS H xxxx 4T-		0001	0002	0003	0005	0007			
Applied	Heavy load	HP	0.5	1.0	2.0	3.0	5.4			
motor		kW	0.4	0.75	1.5	2.2	4.0			
	Normal load	HP	1.0	2.0	3.0	5.0	7.5			
		kW	0.75	1.5	2.2	3.7	5.5			
Rated output	Rated capacity	Heavy load	1.0	1.9	3.0	4.2	6.5			
	(kVA)	Normal load	1.5	2.4	3.9	5.3	7.6			
	Rated current (A)	Heavy load	1.3	2.5	4.0	5.5	9.0			
		Normal load	2.0	3.1	5.1	6.9	10.0			
	Output freque	Output frequency		0-400 Hz (IM Sensorless: 0-120 Hz; PM Sensorless: 0-180						
	Output voltaç	ge (V)	3-phase 380-480V							
Rated	Working volta	age (V)	3-phase	3-phase 380-480VAC (-15% to +10%)						
input	Input frequer	псу	50-60 Hz	50-60 Hz (±5%)						
	Rated current (A)	Heavy load	1.1	2.4	4.2	5.9	9.8			
		Normal load	2.0	3.3	5.5	7.5	10.8			
Weight (lb	/kg)		2.6/1.18	2.6/1.18	3.9/1.77	4/1.80	4.9/2.23			

- The standard motor capacity is based on a standard 4-pole motor.
- The rated output current is limited based on the carrier frequency set at Cn.04 and on the input supply voltage. See Continuous Rated Current Derating.





Sinus H 4T (5.5-22kW) IP20

Model SIN	US H xxxx 4T-		0011	0014	0017	0020	0025	0030		
Applied	Heavy load	HP	7.5	10	15	20	25	30		
motor		kW	5.5	7.5	11	15	18.5	22		
	Normal load	HP	10	15	20	25	30	40		
		kW	7.5	11	15	18.5	22	30		
Rated output	Rated capacity	Heavy load	9.1	12.2	18.3	22.9	29.7	34.3		
	(kVA)	Normal load	12.2	17.5	22.9	29.0	33.5	44.2		
	Rated current (A)	Heavy load	12.0	16.0	24.0	30.0	39.0	45.0		
		Normal load	16.0	23.0	30.0	38.0	44.0	58.0		
	Output freque	Output frequency		0-400 Hz (IM Sensorless: 0-120 Hz; PM Sensorless: 0-180 Hz)						
	Output voltag	e (V)	3-phase 380-480V							
Rated	Working volta	ge (V)	3-phase 380-480VAC (-15% to +10%)							
input	Input frequence	СУ	50-60 Hz	50-60 Hz (±5%)						
	Rated current (A)	Heavy load	12.9	17.5	26.5	33.4	43.6	50.7		
		Normal load	17.5	25.4	33.4	42.5	49.5	65.7		
Weight (Ib	/kg)		7.3/3.3	7.5/3.4	10.1/4.6	10.5/4.8	16.5/7.5	16.5/7.5		

- The standard motor capacity is based on a standard 4-pole motor.
- The rated output current is limited based on the carrier frequency set at Cn.04 and on the input supply voltage. See Continuous Rated Current Derating.



Sinus H 4T (30kW) IP20

Model SIN	NUS H xxxx 4T-		0034						
	Hoovy load	HP	40						
Applied	Heavy load	kW	30						
motor	Normal load	HP	50						
	NOTHALIOAU	kW	37						
	Rated	Heavy load	46						
	capacity (kVA)	Normal load	55						
Rated	Rated current (A)	Heavy load	61						
output		Normal load	75						
o ar p ar	Output freque	Output frequency		0-400 Hz (IM Sensorless: 0-120 Hz; PM Sensorless: 0-180 Hz)					
	Output voltage	e (V)	3-phase 380-480 V						
	Working voltag	ge (V)	3-phase 3	380-480 VA	.C (-15% to	+10%)			
Rated	Input frequence	cy .	50-60 Hz	50-60 Hz (±5%)					
input	Rated current	Heavy load	56						
	(A)	Normal load	69						
Weight (lb	/kg)		26/11.8						

^{*}Sinus H inverter rated at 30kW (model 0034) does not support I/O extensions or IP66 certification.

- The standard motor capacity is based on a standard 4-pole motor.
- The rated output current is limited based on the carrier frequency set at Cn.04 and on the input supply voltage. See Continuous Rated Current Derating.





SINUS H 2T Sizes IP66_A, IP66_B

Model SIN	IUS H xxxx 2T-		0001	0002	0003	0005	0007			
Applied motor	Heavy load	HP	0.5	1.0	2.0	3.0	5.4			
motor		kW	0.4	0.75	1.5	2.2	4.0			
Rated output	Rated capacity (kVA)	Heavy Ioad	1.0	1.9	3.0	4.2	6.5			
	Rated current (A)	Heavy load	2.5	5.0	8.0	11.0	17.0			
_	Output frequency		0-400 Hz (IM Sensorless: 0-120 Hz; PM Sensorless: 0-180 Hz)							
	Output voltage	Output voltage (V)			3-phase 200-240 V					
Rated	Working voltag	e (V)	3-phase 200-240 VAC (-15% to +10%)							
input	Input frequency	У	50-60 Hz (±5%)							
	Rated current (A)	Heavy load	2.2	4.9	8.4	11.8	18.5			
Weight (lb	/kg)		7.9/3.6	7.9/3.6	11.5/5.2	11.7/5.3	12.3/5.6			

- The standard motor capacity is based on a standard 4-pole motor.
- The rated output current is limited based on the carrier frequency set at Cn.04 and on the input supply voltage. See Continuous Rated Current Derating.



SINUS H 2T Sizes IP66_C, IP66_D, IP66_E

Model SIN	IUS H xxxx 2T-		0011	0014	0017	0020			
Applied	Heavy load	HP	7.5	10	15	20			
motor		kW	5.5	7.5	11	15			
Rated output	Rated capacity (kVA)	Heavy load	9.1	12.2	17.5	22.9			
(Rated current (A)	Heavy load	24.0	32.0	46.0	60.0			
	Output frequer	Output frequency		0-400 Hz (IM Sensorless: 0-120 Hz; PM Sensorless: 0-180 Hz)					
	Output voltage	Output voltage (V)		3 phase 200-240V					
Rated	Working voltag	e (V)	3 phase 200-240VAC (-15% to +10%)						
input	Input frequency	У	50-60 Hz (±5%)						
	Rated current (A)	Heavy load	25.8	34.9	50.8	66.7			
Weight (Ib	/kg)		19.8/9.0	19.8/9.0	21.2/9.6	26.7/12.1			

- The standard motor capacity is based on a standard 4-pole motor.
- The rated output current is limited based on the carrier frequency set at Cn.04 and on the input supply voltage. See Continuous Rated Current Derating.





SINUS H 4T, Sizes IP66_A,IP66_B

Model SINUS H xxxx 4T-			0001	0002	0003	0005	0007		
Applied	Heavy load	HP	0.5	1.0	2.0	3.0	5.4		
motor		kW	0.4	0.75	1.5	2.2	4.0		
Rated output	Rated capacity (kVA)	Heavy load	1.0	1.9	3.0	4.2	6.5		
	Rated current (A)	Heavy load	1.3	2.5	4.0	5.5	9.0		
-	Output frequen	Output frequency		0-400 Hz (IM Sensorless: 0-120 Hz; PM Sensorless: 0-180 Hz)					
	Output voltage	e (V)	3-phase 380-480V						
Rated	Working voltag	ge (V)	3-phase 380-480VAC (-15% to +10%)						
input	Input frequence	У	50-60 Hz (±5%)						
	Rated current (A)	Heavy load	1.1	2.4	4.2	5.9	9.8		
Weight (lb /	/kg)		8.2/3.7	8.2/3.7	11.7/5.3	12.1/5.5	12.3/5.6		

- The standard motor capacity is based on a standard 4-pole motor
- The rated output current is limited based on the carrier frequency set at Cn.04 and on the input supply voltage. See Continuous Rated Current Derating.



SINUS H 4T, Sizes IP66_C, IP66_D, IP66_E

Model SINUS H xxxx 4T-		0011	0014	0017	0020	0025	0025			
Applied	Heavy load	HP	7.5	10	15	20	25	30		
motor		kW	5.5	7.5	11	15	18.5	22		
output	Rated capacity	Heavy load	9.1	12.2	18.3	22.9	29.7	34.3		
	Rated current (A)	Heavy load	12.0	16.0	24.0	30.0	39.0	45.0		
	Output freque	Output frequency		0-400 Hz (IM Sensorless: 0-120 Hz; PM Sensorless: 0-180 Hz)						
	Output voltag	Output voltage (V)		3-phase 380-480V						
Rated	Working volta	ge (V)	3-phase 380-480VAC (-15% to +10%)							
input	Input frequen	су	50-60 Hz	50-60 Hz (±5%)						
	Rated current (A)	Heavy load	12.9	17.5	26.5	33.4	43.6	50.7		
Weight (lb	/kg)		19.4/8.8	19.6/8.9	21.2/9.6	21.6/9.8	27.3/12.4	27.3/12.4		

- The standard motor capacity is based on a standard 4-pole motor.
- The rated output current is limited based on the carrier frequency set at Cn.04 and on the input supply voltage. See Continuous Rated Current Derating.



11.2 Product Specification Details

Items		Description					
Control	Control method	V/F control, slip compensation, sensorless vector					
	Frequency settings power resolution	Digital command: 0.01 Hz Analog command: 0.06 Hz (60 Hz standard)					
	Frequency accuracy	1% of maximum output frequer	<u> </u>				
	V/F pattern	Linear, square reduction, user V/					
	Overload capacity	Heavy load rated current: 150% 1 min, normal load rated current: 120% 1 min, Peak current: 200% 4 sec (0034 model excluded)					
	Torque boost	Manual torque boost, automatic	c torque boost				
Operation	Operation type	Select key pad, terminal strip, or	communication operation				
	Frequency settings	Analog type: -10~10V, 0~10V, 4- Digital type: key pad, pulse train					
	Input Multi function terminal P1-P7 in	 PID control 3-wire operation Frequency limit Second function Anti-forward and reverse direction rotation Commercial transition Speed search Power braking Leakage reduction Select PNP (Source) or NPN (Sink set according to In.65- In.71 cod in IP20 models, to In.65- In.69 cosettings in IP66 models. 	es and parameter settings				
	IP20 models, P1-P5 in IP66 models	 Forward direction operation Reset Emergency stop Multi step speed frequency-high/med/low DC braking during stop Frequency increase 3-wire Local/remote operation mode transition 	 Reverse direction operation External trip Jog operation Multi step acc/dechigh/med/low Second motor selection Frequency reduction Fix analog command 				



Items			Description				
		Pulse train	 Select acc/dec/stop 0-32 kHz, Low Level: 0-0.8 	frequency • Transition from PID to general operation V. High Level: 3.5-12V			
	Output	Multi function open collector terminal Multi function relay terminal Analog	Fault output and inverter operation status output	<u> </u>			
		output Pulse train	voltage, DC terminal volta Maximum 32 kHz, 10-12V				
Protection function	rotection Trip		Over current trip External signal trip ARM short circuit curre trip Over heat trip Input imaging trip Ground trip Motor over heat trip I/O board link trip No motor trip Parameter writing trip Emergency stop trip Command loss trip External memory error CPU watchdog trip Motor normal load trip	 Inverter over heat Option trip Output imaging trip Inverter overload trip Fan trip Pre-PID operation failure External break trip Low voltage trip during operation Low voltage trip Safety A(B) trip 			
	Alarm		Command loss trip alarm, overload alarm, normal load alarm, inverter overload alarm, fan operation alarm, resistance braking rate alarm, number of corrections on rotor tuning error				
	Instantan blackout	eous	Heavy load less than 15 ms (normal load less than 8 ms): continue operation (must be within the rated input voltage and rated output range) Heavy load more than 15 ms (normal load more than 8 ms): auto restart operation				



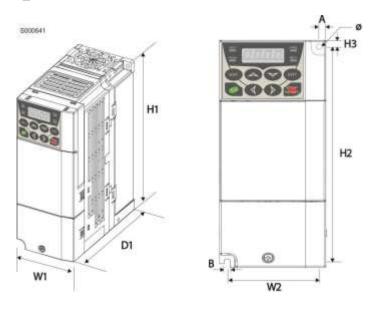
Technical Specification

Items		Description				
Structure/ working	Cooling type	Forced fan cooling structure Forced cooling type				
environment	Protection structure	IP 20 (standard), UL Open & Enclosed Type 1 (standard up to 0030 model, option for 0034 model) (UL Enclosed Type 1 is satisfied by conduit installation option. See 15W0176B100 Sinus H - Conduit Kit and Flange Kit Manual) IP66 (NEMA 4X Indoor Only)				
	Ambient temperature	Heavy load: -10-50°C (14-122°F), normal load: -10-40°C (14-104°F) No ice or frost should be present. Working under normal load at 50°C (122°F), it is recommended that less than 80% load is applied.				
	Ambient humidity	Relative humidity less than 90% RH (to avoid condensation forming)				
	Storage temperature.	-20°C-65°C (-4-149°F)				
	Surrounding environment	Prevent contact with corrosive gases, inflammable gases, oil stains, dust, and other pollutants (Pollution Degree 2 Environment).				
	Operation altitude/oscillation	No higher than 1000m (3280ft). Less than 9.8m/sec ² (1G).				
	Pressure	70-106 kPa				



11.3 External Dimensions (IP 20 Type)

Sizes Eu_A, A1, A2

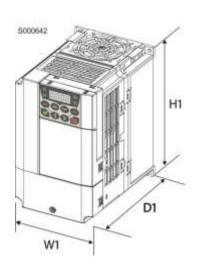


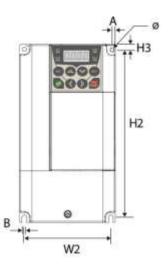
SINUSH	Size	W1	W2	H1	H2	Н3	D1	А	В	Φ
0001 2T	A1	68 (2.68)	61.1 (2.41)	128 (5.04)	119 (4.69)	5 (0.20)	123 (4.84)	3.5 (0.14)	4 (0.16)	4.2 (0.17)
0002 2T	A2	68 (2.68)	61.1 (2.41)	128 (5.04)	119 (4.69)	5 (0.20)	128 (5.04)	3.5 (0.14)	4 (0.16)	4 (0.16)
0001 2S 0001 4T 0002 4T	Eu_A	68 (2.68)	63.5 (2.50)	180 (7.09)	170.5 (6.71)	5 (0.20)	130 (5.12)	4.5 (0.18)	4.5 (0.18)	4.2 (0.17)

Units: mm (inches)



Sizes Eu_B, B1, B2



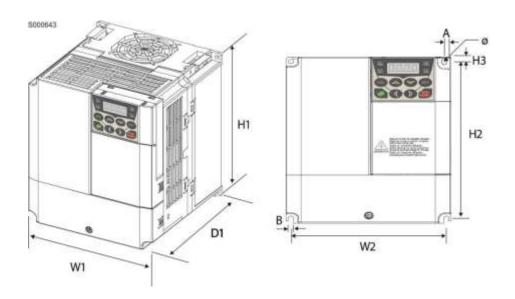


SINUSH	Size	W1	W2	H1	H2	H3	D1	А	В	Φ
0003 2T	B1	100 (3.94)	91 (3.58)	128 (5.04)	120 (4.72)	4.5 (0.18)	130 (5.12)	4.5 (0.18)	4.5 (0.18)	4.5 (0.18)
0005 2T	B2	100 (3.94)	91 (3.58)	128 (5.04)	120 (4.72)	4.5 (0.18)	145 (5.71)	4.5 (0.18)	4.5 (0.18)	4.5 (0.18)
0002 2S 0003 2S 0003 4T 0005 4T	Eu_B	100 (3.94)	91 (3.58)	180 (7.09)	170 (6.69)	5 (0.20)	140 (5.51)	4.5 (0.18)	4.5 (0.18)	4.2 (0.17)

Units: mm (inches)



Sizes C, Eu_C



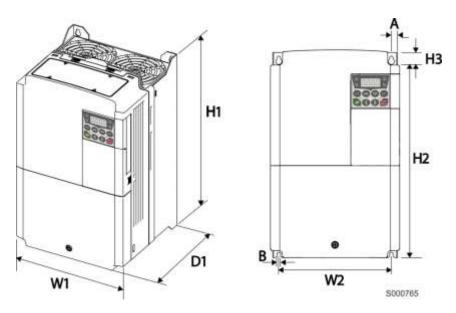
SINUSH	Size	W1	W2	H1	H2	Н3	D1	А	Φ
0007 2T	С		132.2 (5.21)		120.7 (4.75)		145 (5.71)	4.4 (0.17)	4.5 (0.18)
0005 2S 0007 4T	Eu_C					5 (0.20)	140 (5.51)	4 (0.16)	4.2 (0.17)

Units: mm (inches)





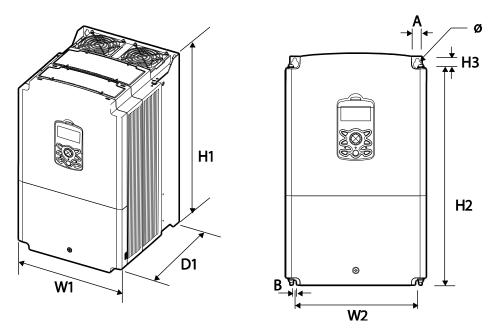
Sizes D, E, F



SINUSH	Size	W1	W2	H1	H2	Н3	D1	А	В
0011 2T 0014 2T 0011 4T 0014 4T	D	160 (6.30)	137 (5.39)	232 (9.13)	216.5 (8.52)	10.5 (0.41)	140 (5.51)	5 (0.20)	5 (0.20)
0017 2T 0017 4T 0020 4T	E	180 (7.09)	157 (6.18)	290 (11.4)	273.7 (10.8)	11.3 (0.44)	163 (6.42)	5 (0.20)	5 (0.20)
0020 2T 0025 4T 0030 4T	F	220 (8.66)	193.8 (7.63)	350 (13.8)	331 (13.0)	13 (0.51)	187 (7.36)	6 (0.24)	6 (0.24)



Size G

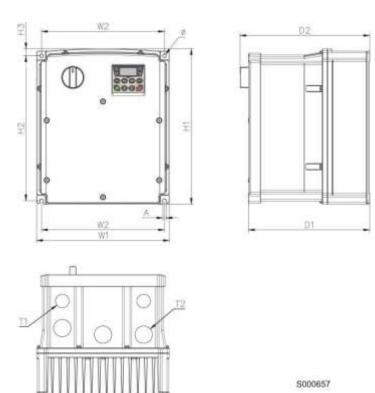


SINUSH	Size	W1	W2	H1	H2	Н3	D1	А	Ф
0034 4T	G	275	232	450	428.5	14	284	7	7
		(10.8)	(9.1)	(17.7)	(16.9)	(0.55)	(11.2)	(0.28)	(0.28)



11.4 External Dimensions (IP 66 Type)

Sizes IP66_A, IP66_B

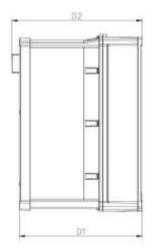


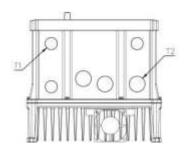
SINUSH	Size	W1	W2	H1	H2	Н3	D1	D2	А	Φ	T1	T2
0001 2T	IP66_A	180	170	256.6	245	8.2	174.2	188.2	4.5	4.5	22.3	-
0002 2T		(7.09)	(6.69)	(10.10)	(9.65)	(0.32)	(6.86)	(7.41)	(0.18)	(0.18)	(0.88)	
0001 4T												
0002 4T												
0003 2T	IP66_B	220	204	258.8	241	11.8	201	215	5.5	5.5	22.3	28.6
0005 2T		(8.66)	(8.03)	(10.19)	(9.49)	(0.46)	(7.91)	(8.46)	(0.22)	(0.22)	(0.88)	(1.13)
0007 2T												
0003 4T												
0005 4T												
0007 4T												



Size IP66_C







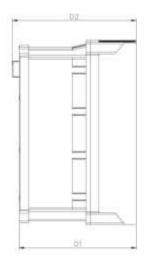
S000658

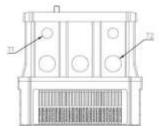
SINUSH	Size	W1	W2	H1	H2	Н3	D1	D2	А	Φ	T1	T2
0011 2T	IP66_C	250	232	328	308	11	227.2	241.2	6	6	22.3	28.6
0014 2T		(9.84)	(9.13)	(12.91)	(12.13)	(0.43)	(8.94)	(9.50)	(0.24)	(0.24)	(0.88)	(1.13)
0011 4T												
0014 4T												



Sizes IP66_D, IP66_E







S000659

SINUS	Size	W1	W2	H1	H2	Н3	D1	D2	А	Φ	T1	T2
0017 2T	IP66_D	260	229	399.6	377	14.6	245.4	259.6	6	-	22.3	34.9
0017 4T		(10.24)	(9.02)	(15.73)	(14.84)	(0.57)	(9.66)	(10.22)	(0.24)		(0.88)	(1.37)
0020 4T												
0020 2T	IP66_E	300	270.8	460	436.5	15.5	250	264	6	-	22.3	44.5
0025 4T		(11.81)	(10.66)	(18.11)	(17.19)	(0.61)	(9.84)	(10.39)	(0.24)		(88.0)	(1.75)
0030 4T												



11.5 Peripheral Devices Specification

Circuit Breaker (MCCB), Leakage Breaker and Magnetic Contactor (MC) recommended features.

Sinus H Mo (Voltage Cl	del ass / Code / k	kW)	Circuit Breaker (MCCB) Current (A)	Leakage Breaker Current (A)	Magnetic Contactor (MC) Current (A)
	0001	0.4	5	5	9
	0002	0.75	10	10	11
	0003	1.5	15	15	18
2S	0005	2.2	20	20	22
	0007	4	30	30	32
2T	0011	5.5	50	50	55
	0014	7.5	60	60	65
	0017	11	100	100	85
	0020	15	125	125	130
	0001	0.4	3	5	7
	0002	0.75	5	5	/
	0003	1.5	10	10	9
	0005	2.2	10	10	12
	0007	4	20	20	18
4T	0011	5.5	30	30	22
41	0014	7.5	30	30	32
	0017	11	50	50	50
	0020	15	60	60	65
	0025	18.5	75	75	75
	0030	22	100	100	85
	0034	30	125	125	105



11.6 Fuse and Reactor Specifications

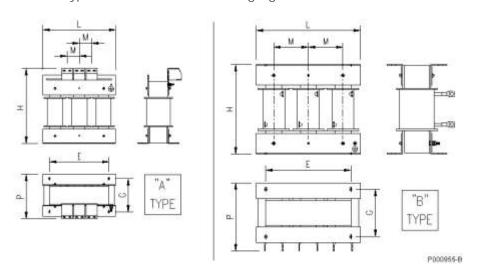
Sinus H			AC Input Fuse		AC Reactor	DC Reactor
(Voltage kW)	e Class / C	ode/	Current (A)	Voltage (V)	Code	Code
2S	0001	0.4	10	600	IM0126002	-
23	0002	0.75			IM0126044	-
	0003	1.5	15		IM0126084	-
	0005	2.2	20			-
2T	0001	0.4	10	600	IM0126000	IM0140054
Z 1	0002	0.75			IM0126002	
	0003	1.5	15		IM0126004	IM0140104
	0005	2.2	20		IM0126044	IM0140154
	0007	4	50		IM0126084	
	0011	5.5				
	0014	7.5	63		IM0126124	IM0140204
	0017	11	80		IM0126144	IM0140254
	0020	15	100		IM0126164	IM0140284
4T	0001	0.4	10	600	IM0126000	-
	0002	0.75				-
	0003	1.5			IM0126002	-
	0005	2.2	15			IM0140054
	0007	4	32		IM0126004	IM0140104
	0011	5.5			IM0126044	
	0014	7.5	35		IM0126084	IM0140154
	0017	11	50		IM0126124	
	0020	15	63			IM0140204
	0025	18.5	70		IM0126144	IM0140254
	0030	22	100			
	0034	30	125		IM0126164	-



AC Reactors

INDUCTANCE MODEL	INDUCTANCE RATINGS		DIMENSIONS					HOLE	WGT	LEAKAGE		
	mH	А	TYPE*	L	Н	Р	М	Е	G	mm	kg	W
IM0126000	4,20	5,25		C	ontac	t Ene	rtro	nica	San	iterno	A.q.2	
IM0126002	2,63	8,4									'	
IM0126004	2.00	11	Α	120	125	75	25	67	55	5	2.9	29
IM0126044	1.27	17	Α	120	125	75	25	67	55	5	3	48
IM0126084	0.70	32	В	150	130	115	50	125	75	7x14	5.5	70
IM0126124	0.51	43	В	150	130	115	50	125	75	7x14	6	96
IM0126144	0.30	68	В	180	160	150	60	150	82	7x14	9	150
IM0126164	0.24	92	В	180	160	150	60	150	82	7x14	9.5	183

Inductance A and B type are defined in the following Figures





DC Reactors

INDUCTANCE	INDUCT RATIN		DIMENSIONS				HOLE	W	/GT	LEAKAGE	
MODEL	mH	А	Г	Н	Р	Е	G	mm	k	G>	W
IM0140054	8	10.5	Contact Enortropics Contorns C n A								
IM0140104	5.1	17	Contact Enertronica Santerno S.p.A.								
IM0140154	2.8	32.5	160	140	120	100	100	7x10	8		50
IM0140204	2	47	160	210	160	97	120	7x14	13		80
IM0140254	1.2	69	160	210	160	97	120	7x14	13.5		90
IM0140274	0.96	94	Contact Enertronica Santerno S.p.A.								
IM0140284	0.96	100									

① Caution

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



11.7 Terminal Screw Specification

Input/Output Terminal Screw Specification

Sinus H Mode (Voltage / Cod			Terminal Screw Size	Screw Torque (Nm / kfg·cm)				
2S	0001	0.4	M3.5	0.2-0.6				
20	0002	0.75		(2.1~6.1)				
	0003	1.5						
	0005	2.2	M4					
2T	0001	0.4	M3.5					
Z I	0002	0.75						
	0003	1.5						
	0005	2.2						
	0007 4 0011 5.5 0014 7.5		M4					
	0017	11	M5	0.4-1.0				
	0020	15		(4.0~10.2)				
4T	0001	0.4	M3.5	0.2-0.6				
	0002	0.75		(2.1~6.1)				
	0003	1.5						
	0005	2.2						
	0007	4	M4					
	0011	5.5						
	0014	7.5	N 45	0.4.1.0				
	0017	11	M5	0.4-1.0				
	0020	15		(4.0~10.2)				
	0025	18.5						
	0030	22						
	0034	30	M8	6.1-9.2 (62~94)				

Control Circuit Terminal Screw Specification

Terminal	Terminal Screw Size	Screw Torque (Nm / kfg·cm)
P1-P7*/CM/VR/V1/I2/AO/AO2	M2	0.22-0.25
[0034 model only]/		(2.2~26)
Q1/EG/24/TI/TO*		
/SA,SB,SC/S+,S-,SG		
A1/C1/B1,	M2.6	0.4
A2/C2 [0034 model only]		(4)





* IP66 models do not support P6/P7/TI/TO terminal. Refer to Step 4 Control Terminal Wiring on page 47.

① Caution

Apply the rated torque when tightening terminal screws. Loose screws may cause short circuits and malfunctions. Overtightening terminal screws may damage the terminals and cause short circuits and malfunctions. Use copper conductors only, rated at 600V, 75°C for power terminal wiring, and rated at 300V, 75°C for control terminal wiring.

11.8 Braking Resistor Specification

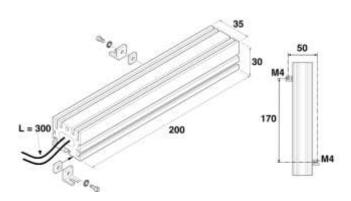
	Sinus H Model (Voltage / Code / kW)		Enertronica Santerno S.p.A. P/N	Resistance (Ω)	Rated Capacity (W)	IP Rating
2S	0001	0.4	RE2644200	200	350	55
	0002	0.75	RE2644150	150	350	55
2T	0003	1.5	RE2643560	56	350	55
	0005	2.2	RE3063500	50	550	33
	0007	4	RE3063330	33	550	33
	0011	5.5	RE3083200	20	1,100	55
	0014	7.5	RE3083150	15	1,100	55
	0017	11	RE3113100	10	2,200	54
	0020	15	RE3113100	10	2,200	54
4T	0001	0.4	RE2644400	400	350	55
• •	0002	0.75	RE2644400	400	350	55
	0003	1.5	RE2644250	250	350	55
	0005	2.2	RE3064200	200	550	33
	0007	4	RE3064100	100	550	33
	0011	5.5	RE3083820	82	1,100	55
	0014	7.5	RE3083500	50	1,100	55
	0017	11	RE3113400	40	2,200	54
	0020	15	RE3113330	33	2,200	54
	0025	18.5	RE3483200	20	4,000	20
	0030	22	RE3483200	20	4,000	20
	0034	30	RE3763120	12	8,000	20



- The standard for braking torque is 150% and the working rate (%ED) is 5%. If the working rate is 10%, the rated capacity for braking resistance must be calculated at twice the standard.
- Braking Resistors with higher IP degrees may be available. Please Contact Enertronica Santerno S.p.A..

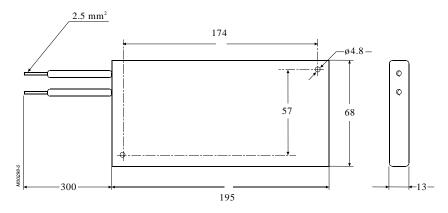
Dimensions

Model 350W - IP55



Overall Dimensions, Resistor 350W - IP55

Model 550W - IP33

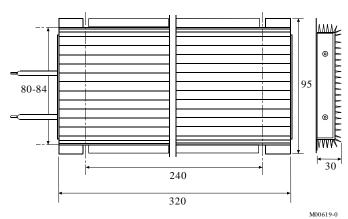


Overall Dimensions.

Resistor 550W - IP33

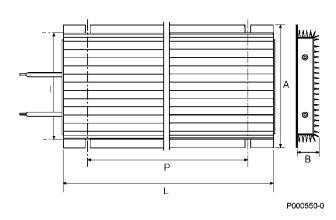


Model 1100W - IP55



Overall Dimensions, Resistor 1100W – IP55

Model 2200W - IP54

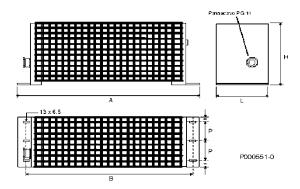


A (mm)	B (mm)	L (mm)	I (mm)	P (mm)
190	67	380	177-182	300

Overall Dimensions, Resistor 2200W - IP54



Model 4000/8000W - IP20



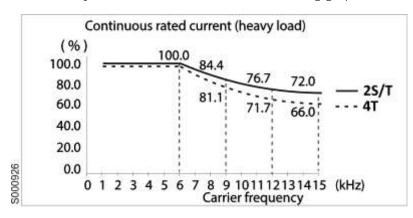
Power (W)	A (mm)	B (mm)	L (mm)	H (mm)	P (mm)
4000	620	600	100	250	40
8000	620	600	160	250	40

Overall Dimensions, Resistor 4000/8000W - IP20

11.9 Continuous Rated Current Derating

Derating by Carrier Frequency (up to 0030 model)

The continuous rated current of the inverter is limited based on the carrier frequency and on the heavy or normal load. Refer to the following graphs.

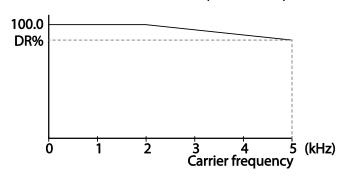






2S / 2T		4T			
Carrier Frequency (kHz)	Constant-rated Current (%)		Constant-rated Current (%)		
1-6	100	1-6	100		
9	84.4	9	81.1		
12	76.7	12	71.7		
15	72.0	15	66.0		

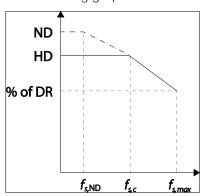
Continuous rated current (normal load)



2S / 2T	-		4T	4T			
Model	(Code/	DR (%)	Mode	(Code/	DR (%)		
kV	V)		kV	V)			
0011	5.5	85	0011	5.5	81.3		
0014	7.5	85	0014	7.5	77.2		
0017	11	86.6	0017	11	85		
0020	15	90.2	0020	15	84.2		
			0025	18.5	91.5		
			0030	22	83.2		

Derating by Carrier Frequency (0034 model)

The continuous rated current of the inverter is limited based on the carrier frequency. Refer to the following graph.

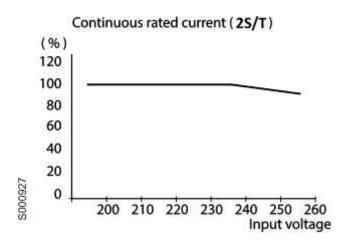


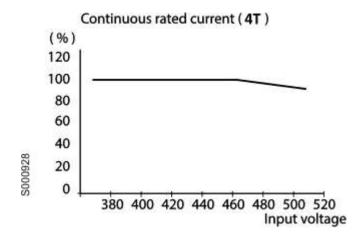
Item	Unit	
f _{s, ND}		2
f _{s, c}	[kHz]	6
f _{s, max}		10
% of DR	[%]	70



Derating by Input Voltage

The continuous rated current of the inverter is limited based on the input voltage. Refer to the following graphs.



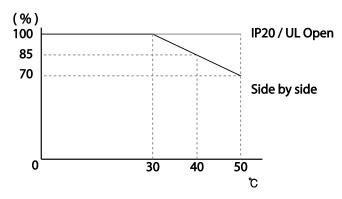




Derating by Ambient Temperature and Installation Type (IP20 models only)

The constant-rated current of the inverter is limited based on the ambient temperature and installation type. Refer to the following graph.

Continuous rated current (400V)



11.10 Heat Emission

The following table shows the inverters' heat emission characteristics (by product capacity).

Heat emission data is based on operations with default carrier frequency settings, under normal operating conditions. For detailed information on carrier frequency, refer to <u>5.17</u> <u>Operational Noise Settings (carrier frequency settings)</u> on page <u>240</u>.

[Test Condition]

Operation at 50Hz

Load 100% (M-G Set load, Corresponding motor to drive)

Operation at room temperature

Carrier Frequency (Default value: 3 kHz HD, 2 kHz ND)

[Definition]

Total losses = Internal losses + Heat losses

Internal losses: based on design standard such as SMPS Rated Capacity, Fan and

so forth

Heat losses: depending on the Output Current

1Wh = 3600 J; 1kcal = 4186 J



		Dotod	Heavy Duty (HD) Normal Duty (ND)							
Code	Voltage	Rated Power	Rated	Total	Internal	Heat	Rated	Total	Internal	Heat
oouc	Class	(kW)	Output	Losses	Losses	Losses	Output	Losses	Losses	Losses
		(****)	Current(A)	(W)	(W)	(kcal)	Current(A)	(W)	(W)	(kcal)
0001	2S	0.4	2.5	16	13	3	3.1	18	13	5
0002	2S	0.75	5	41	13	25	6	42	13	26
0003	2S	1.5	8	54	13	36	9.6	64	13	45
0005	2S	2.2	11	74	13	53	12	81	13	59
0001	2T	0.4	2.5	24	13	10	3.1	25	13	8
0002	2T	0.75	5	24	13	9	6	26	13	12
0003	2T	1.5	8	56	17	34	9.6	60	17	37
0005	2T	2.2	11	59	17	36	12	62	17	39
0007	2T	4	17	108	19	77	18	110	19	74
0011	2T	5.5	24	176	39	118	30	208	39	146
0014	2T	7.5	32	188	39	128	40	236	39	170
0017	2T	11	46	230	39	164	56	272	39	201
0020	2T	15	60	340	39	260	69	428	39	335
0001	4T	0.4	1.3	21	13	7	2	22	13	8
0002	4T	0.75	2.5	17	13	4	3.1	19	13	5
0003	4T	1.5	4	45	17	24	5.1	55	17	27
0005	4T	2.2	5.5	64	17	22	6.9	76	17	27
0007	4T	4	9	68	21	40	10	131	21	41
0011	4T	5.5	12	138	43	82	16	163	43	103
0014	4T	7.5	16	131	43	75	23	179	43	117
0017	4T	11	24	197	43	133	30	207	43	141
0020	4T	15	30	212	43	145	38	232	43	162
0025	4T	18.5	39	320	43	238	44	353	43	267
0030	4T	22	45	330	43	247	58	425	43	329
0034	4T	30	61	432	107	280	75	505	107	343



12 Applying 2T and 4T Drives to Single-Phase Input Application

12.1 Introduction

Sinus H 2T and 4T is a three-phase standard variable frequency drive(VFD). When applying single-phase power to a three-phase VFD, there are several constraints that need to be considered. Standard Pulse-Width-Modulated (PWM) VFDs use a 6-pulse diode rectifier. The 6-pulse rectification results in 300 Hz DC bus ripple when used with a three-phase 50 Hz supply.

However, under single-phase use, the DC bus ripple becomes 100 Hz and the VFDs DC bus circuit is subject to higher stress in order to deliver equivalent power.

Additionally, input currents and harmonics increase beyond those encountered with three-phase input.

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, single-phase use requires the three-phase VFD power rating be reduced (derated) to avoid over stressing the rectifier and DC link components.

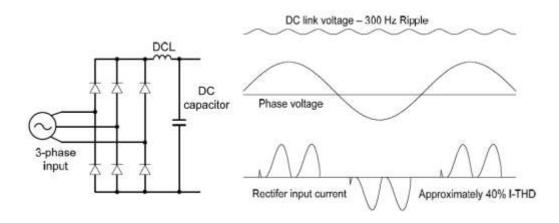


Figure-1 Typical Three-Phase Configuration



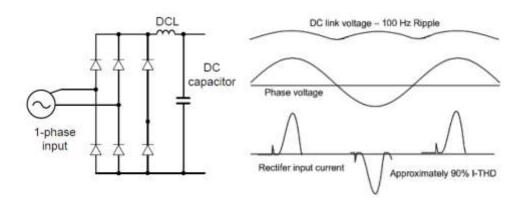


Figure-2 Typical Single-Phase Configuration

12.2 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 because of 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 beyond that with a three-phase supply 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.

When using a motor that is selected by the three-phase drive rating criteria when using single-phase input, it may result in poor performance or premature drive failure. The selected drive of single-phase current ratings must meet or exceed the motor current rating.



12.3 Input Frequency and Voltage Tolerance

The single-phase current ratings are valid for 50Hz input only. The AC supply voltage must be within the required voltage range of 240/480Vac +10% to -5% to maximize motor power production. Standard product with three-phase voltage input has an allowable range of +10% to -15%. Therefore, 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 228Vac for 240 volt models and 456Vac for 480 volt models, to ensure motor voltage production of 207Vac and 415Vac, respectively.

Thus, if full motor torque must be developed near 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. 208Vac motor with a 240Vac supply), will also minimize the effect of voltage deprivation. (240Vac Input \rightarrow 208V motor, 480Vac Input \rightarrow 400V motor).

Note

Enertronica Santerno S.p.A. is not responsible for the use of Sinus H 2T and 4T drives with a single-phase supply.



13 Marking

13.1 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.

13.2 CE mark



The CE mark indicates that the products carrying this mark comply with European safety and environmental regulations. European standards include the Machinery Directive for machine manufacturers, the Low Voltage Directive for electronics manufacturers and the EMC guidelines for safe noise control.

13.2.1 Low Voltage Directive

We have confirmed that our products comply with the Low Voltage Directive (EN 61800-5-1).

13.2.2 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.



FMI / RFI POWER LINE FILTERS

THE ES RANGE OF POWER LINE FILTERS <u>FFM (Footprint) AND FV</u> SERIES, HAVE BEEN SPECIFICALLY DESIGNED WITH HIGH FREQUENCY <u>ES INVERTERS</u>. THE USE OF ES FILTERS, WITH THE INSTALLATION ADVICE OVERLEAF HELP ENSURE TROUBLE FREE USE ALONG SIDE SENSITIVE DEVICES AND COMPLIANCE TO CONDUCTED EMISSION AND IMMUNITY STANDARDS EN61800-3.

∴ CAUTION

IN CASE OF LEAKAGE CURRENT, A PROTECTIVE DEVICE IS USED ON POWER SUPPLY, THAT COULD BE DAMAGED WHEN POWERING ON/OFF THE DEVICE. TO AVOID THIS, THE SENSE CURRENT OF THE PROTECTIVE DEVICE SHOULD BE LARGER THAN THE VALUE OF THE LEAKAGE CURRENT. SEE TABLE BELOW.

RECOMMENDED INSTALLATION INSTRUCTIONS

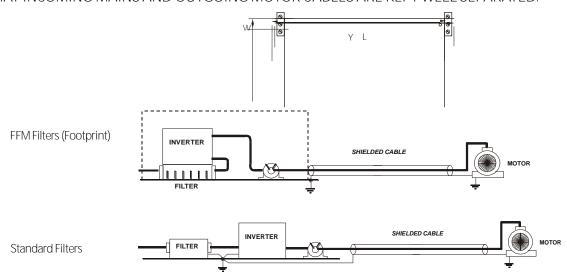
To conform to the EMC directive, it is necessary that these instructions be followed as closely as possible. Follow the usual safety procedures when working with electrical equipment. All electrical connections to the filter, inverter and motor must be made by a qualified electrical technician.

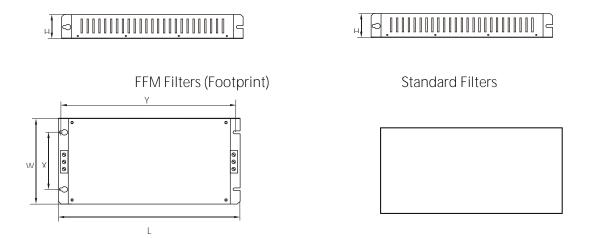
- 1-) Check the filter rating label to ensure that the current, voltage rating and part number are correct.
- 2-) For best results the filter should be fitted as closely as possible to the incoming mains supply of the wiring enclosure, usually directly after the enclosures circuit breaker or supply switch.
- 3-) The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Care should be taken to remove any paint etc... from the mounting holes and face area of the panel to ensure the best possible earth connection 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 <u>ferrite core</u> (output ferrite ring) as close to the inverter as possible. Armoured or screened cable should be used with the 3 phase conductors only threaded twice through the center of the ferrite core. The earth conductor should be securely earthed at both inverter and motor ends. The screen should be connected to the enclosure body via and earthed cable gland.
- 7-) Connect any control cables as instructed in the inverter instructions manual.

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







					FFM	Filters (I	ootprint)				
(Vol	Sinus tage/(kW)		Enertronica Santerno S.p.A. P/N	CURRENT (A)	VOLTAGE (V)	LEAKAGE CURRENT (mA)	DIMENSIONS	MOUNTING Y X (cm)	WEIGHT	MOUNT	OUTPUT FERRITE (*)
						Nom					
2T	0001	0.4	AC1710122	10		0.3-18	176x71.5x45	162x50	1.6	M4	AC1810302
	0003	1.5	AC1710236	20	200- 480	0.3-18	176x103.5x4	162x82	1.6	M4	AC1810302
	0005	2.2	AC1710342	30		0.3-27	176x143.5x4	162x122	1.8	M4	AC1810302
	0007	5.5	AC1710342	30		0.5-27	T PONT TOTON T	102/12/2	1.0	1014	7.0.0.0002
	0014	7.5									
	0017	11				Not avail	able (see Stand	lard Filters)			
	0020	15									
						Nom					
4T (**)	0001	0.4	AC1710120	6		0.3-18	176x71.5x45	162x50	1.6	M4	
	0002	1.5	AC1710122	10	_	0.3-18	176x71.5x45	162x50	1.6	M4	
	0005	2.2	AC1710122	16	200-480	0.3-18	176x103.5x4	162x82	1.6	M4	AC1810302
	0007	4	AC1710236	20		0.3-27	176x103.5x4 5	162x122	1.8	M4	
	0011	5.5	l l			I.	<u>l</u>	<u> </u>		<u> </u>	
	0014	7.5									
	0017	11					Not available				
	0020	15					not available				
	0025	18.5									
	0030	22									

Domestic and industrial environment EN55011 Group 1 Class A = EN 61800-3 C2

^(*) Output Ferrite required for models with built-in filters as well.

^(**) In order to add this filter A1=C2 to a 4T (already internally A2=C3) you need to disconnect the internal filter as per the procedure described under the heading Step 6 Disabling the EMC Filter for Power Sources with Asymmetrical Grounding.



	STANDARD Filters										
Sinus H (Voltage / Code / kW)		ge/	Enertronic a Santerno S.p.A. P/N	CURREN T (A)	VOLTAG E (V)	LEAKAGE CURREN T (mA)	DIMENSIONS L H W (cm)	MOUNTIN G Y X (cm)	WEIGH T	MOUN T	OUTPUT FERRITE (*)
						Nom					
2T	000	0.4	AC1710123	10		0.5-27	255x50x126	25 x 240	1.1		
	000	1.5 2.2	AC1710237	20		0.5-27	335x60x150	35 x 320	1.8		AC181030 2
	000	4.0	AC1710343	30		0.5-27	335x60x150	35 x 320	1.8		
	0011	5.5	AC1710511	42	250	0.5-27	330x70x185	45 x 314	2.8	-	AC181040
	001	7.5	AC1710601	55		0.5-27	330x80x185	55 x 314	3.1	-	2
	001	11	AC1710810	75		0.5-27	330x80x220	55 x 314	4.0	-	
	002	15	AC1711006	100		0.5-27	380x90x220	65 x 364	5.5	-	AC181060
	002	18. 22	AC1711410	130		0.5-27	440x110x24 0	80 x 414	7.5	1	3

Domestic and industrial environment EN55011 Group 2 Class A = EN61800-3 C3

^(*) Output Ferrite required for models with built-in filters as well.



[4
[DOWN] key88	4
ESC] key88	4-pole standard motor416; 419; 420; 421; 422; 425
[HAND] key88	
[LEFT] key88	7
[MODE] key88	•
[MULTI] key88	7-segment display68
OFF] key88	letters68
[PROG / Ent] key88	numbers68
[RIGHT] key88	
STOP/RESET] key88	A
[UP] key88	
	A terminal (Normally Open)165
1	AC power input terminalrefer to R/S/T terminal
1	Acc/Dec pattern114; 147
1-phase 2S IP20416	linear pattern147
	S-curve pattern147
2	Acc/Dec reference143
2	Delta Freq142
2 square reduction115	Max Freq142
24 terminal54; 56	Acc/Dec reference frequency141
2nd Motor Function grouprefer to M2 (2nd Motor	Ramp T Mode141
Function group) group	Acc/Dec stop149
2nd Motor grouprefer to M2(2nd Motor) group	Acc/Dec time141
2nd motor operation240	Acc/Dec time switch frequency146
2nd operation mode163	configuration via multi-function terminal144
2 nd command source164	maximum frequency141
shared command (main source)164	operation frequency143
	accumulated electric energy initialize251
3	Ad (Expanded function group)333
•	Ad(Advanced) group70
3-phase 2T IP20 (0.4~4 kW)417	add user group
3-phase 2T IP20 (5.5~15 kW)418	UserGrp SelKey249
3-phase 2T IP66 (0.4~4 kW)422	advanced features group95
3-phase 2T IP66 (5.5~15 kW)423	Advanced function grouprefer to ADV (advanced)
3-phase 4T IP20 (0.4~4 kW)419; 448	function group
3-phase 4T IP20 (30 kW)421	Advanced grouprefer to Ad(Advanced) group
3-phase 4T IP20 (5.5~22 kW)420	analog frequency hold130
3-phase 4T IP66 (0.4~4 kW)424	Analog Hold130
3-phase 4T IP66 (5.5~22 kW)425	Analog Holdrefer to analog frequency hold
3-Wire operation189	analog input52; 70; 95
	12 current innut 124





12 voltage input	125	multi-function input setting	165
TI Pulse input	127	multi-function output setting	267
V1 voltage input	118	speed search setting	235
analog input selection switch(SW2)	49; 125	stall prevention	277
analog output		bootlace ferrule	55
AO terminal	53	brake control	253
AO2 terminal	53	BR control	253
pulse output	260	brake engage sequence	254
voltage and current output		brake release sequence	
analog output selection switch(SW3)		brake resistor	
AO terminal		brake unit	256
analog output selection switch(SW3).	49	braking resistance	
AO2 terminal		braking torque	443
AP(Application Function group)		braking resistors	
AP(Application group)		BU200	
Application grouprefer to AP(App		built-in communication	
ARM short current fault triprefer to		BX	
asymmetric ground power			
asymmetric ground structure		С	
EMC filter	58	C	
asynchronous communications system		cable28; 38;	40: 41: 42: 43: 47
auto restart settings		ground specifications	
auto torque boost		power I/O cable specifications	
auto tuning		selection28; 38;	
auto tuning		shielded twisted pair	
all(rotating)		signal(control) cable specifications	
all(static)		cable tie	
Tr(static)		carrier frequency	
auxiliary frequency		derating	
auxiliary frequency reference configur		factory default	
auxiliary reference		charge indicator	
auxiliary reference gain		charge lamp	
ŭ ŭ		cleaning	
configurationfinal command frequency calculation		CM terminal	
main reference		CM(Communication Function group)	
maimelerence	179	CM(Communication group)	
D		Cn (Control Function group)	
В		Cn(Control) group	
B terminal (Normally Closed)	145	CNF (configuration mode)	
oA(Basic function group)		code number input	
oA(Basic group)		command	
Basic grouprefer to <i>BAS (Basic function</i>		Cmd Source	
=	group), refer to		
bA(Basic) group	/7	configuration	133
oasic operation	0/	command source	104
oit 165	4/5	fwd/rev command terminal	
bit (Off)		keypad	
bit (On)		RS-485	
bit settina	165	run command/rotational direction of	contiguiration 135



commercial power source transition	242	DB Warn %EDrefer t	o DB Warn %ED
common terminal refer to <i>EG te</i>	rminal	DC braking after start	156
communication	297	DC braking after stop	157
command loss protective operation	301	DC braking frequency	157
communication address	305	DC link voltage	178; 227
communication line connection	298	delta wiring	58
communication parameters	299	derating	240
communication speed	299	digital output	262
communication standards	297	digital source	137
memory map	303	display	
PLC	297	display mode table	
protocol	305	display modes	93
saving parameters defined by communication	302	disposal	411; 415
setting virtual multi-function input	302	dr(Drive group)	70; 323
Communication function grouprefer to	COM	draw operation	178
(communication function group)		Drive group refer to DRV (Drive group);	refer to <i>dr(Drive)</i>
Communication group <i>CM (</i> refer to <i>Communic</i>	cation)	group	
group		Dwell operation	192
config (CNF) mode	251	Acc/Dec dwell frequency	192
Considerations for the installation		acceleration dwell	192
Air Pressure	23	deceleration dwell	192
Altitude/Vibration	23		
Ambient Humidity	23	E	
Ambient Temperature	23	_	
Environmental Factors	23	earth leakage breaker	
contact		EEP Rom Empty	
A contact	282	EG terminal	
B contact	282	electronic thermal overheating protection	
Control grouprefer to <i>CON (Control Function g</i>	group);	EMC filter	
refer to <i>Cn(Control) group</i>		asymmetric power	58
control terminal board wiring41; 4	7; 452	disable	
cooling fan	243	disabling	
fan control	243	enable	
fan operation accumulated time	271	enabling	59
fan operation accumulated time initialization	271	emergency stop fault trip	
cooling fan malfunction	288	energy buffering operation	
CPU Watch Dog fault trip	295	energy saving operation	
cursor keys	88	automatic energy saving operation	232
[DOWN] key	88	manual energy saving operation	232
[LEFT] key	88	ESC key	69
[RIGHT] key	88	[ESC] key configuration	187
[UP] key	88	[ESC] key setup	136
		cancel input	69
D		Jog key	74
2		local/remote switching	137
DB resistor		multi-function key	136
braking resistor circuit		remote/local operation switching	
DB Warn %ED	285	ETH refer to electronic thermal overhe	eating protection





(ETH)		frequency setting (pulse train) terminal	refer to <i>T</i>
E-Thermal	295	terminal	
excitation current	210	frequency setting(voltage) terminal refer	to V1 termina
external 24V power terminal refer	to 24 terminal	fuse	440
external dimensions			
0.8~1.5kW(Single Phase), 1.5~2.2kW(3 F	Phase)430;	G	
435; 436			
External Trip	295; 402	ground	
external trip signal	281	class 3 ground	
		ground terminal	
F		ground cable specifications	
		ground fault triprefer	
factory default		Ground Trip	
fan trip		ground fault trip	401
Fan Trip			
fan warning		H	
Fan Warning			
fatal	400	half duplex system	
fault	294	Heavy Duty	
fatal		heavy load	
fault/warning list	294	hunting	214; 224
latch	400		
level	400	I	
major fault	295		50.40
fault monitoring		12	
multiple fault trips	110	analog input selection switch(SW2)	
fault trip mode	94	frequency setting (current/voltage) ten	
Ferrite		In Phase Open	
fieldbus116; 133; re		In(Input Terminal Block Function group)	
communication option		In(Input Terminal) group	/0
filter time constant		input and output specification	44.
filter time constant number		applied motor	
flux braking		rated input	
ree run stop		rated output	
requency jump		input open-phase fault triprefer to	In Phase Open
requency limit		input phase open	004
frequency jump		input open-phase protection	
frequency upper and lower limit value.		input power frequency	
maximum/start frequency		input power voltage	
requency reference		input terminal	
requency setting		CM terminal	
I2 current input	124	I2 terminal	
I2 voltage input		P1–P5 terminal	
keypad		P1–P7 terminal	
RS-485	129	SA terminal	
TI Pulse input		SB terminal	
V1 voltage input	118	SC terminal	
variable resistor	81	TI terminal	52



V1 terminal	52	selecting a display mode	96
VR terminal		keypad key	
Input terminal function group .refer to		[♣ /[▼ /[◄]/[▶] key	
function group)	(/	[ESC] key	
Input Terminal grouprefer to <i>In(inpu</i>	ıt terminal) aroun	[RUN] key	
inspection	it terrimal) group	[STOP/RESET] key	
annual inspection	<i>4</i> 12	[313171L3L1] Ney	
bi-annual inspection)		т	
installation		L	
installation flowchart		latch	400
mounting the inverter		LCD display	
wiring		LCD keypad4	
installation considerations		LCD brightness/contrast adjustmen	
ii istaliatioi i coi isiaci atioi is	23	operation keys	
т		wiring length	
J		leakage breaker	
Jog operation	184	level	
FWD Jog		lifetime diagnosis of components	
Jog frequency		lifetime diagnosis for fans	290
keypad		lift-type load1	
Jog Operation		linear pattern	
[ESC] key configuration	74	linear V/F pattern operation	
jump frequency		base frequency	
jurily frequency	102	start frequency	
K		local operation	
\mathbf{r}		[ESC] key	
keypad	67	Local/Remote mode switching	
[ESC] key		remote peration	
[HAND] key		locating the installation site	
[MODE] key		location	
[MULTI] key		loop	
[OFF] key		loop time	
[PROG / Ent] key		Lost Command	
[STOP/RESET] key		command loss fault trip warning	
configuration mode		command loss trip	
cursor keys		low voltage	
display		low voltage fault trip	
display		low voltage trip 2	
display mode		LowLeakage PWM	
keypad language		LOWLedikage F WWF	207
monitor mode		M	
navigating between groups		M	
parameter mode		M2(2nd Motor Function group)	370
S/W version		M2(2nd Motor) group	
trip mode		magnetic contactor	
keypad display		maintenance	
keypad features		manual torque boost	
fault monitoring	109	master	
.aart 11101 Ittorii 19	107		270





master inverter	167
master unit	166
MCCB	v; 437
megger test	412
micro surge filter	46
momentary power interruption227; 22	35; 237
monitor	
operation state monitor	269
operation time monitor	
monitoring	
monitor mode	94
monitor mode display	90
motor output voltage adjustment	
motor protection	
motor rotational direction	
motor thermal protection(ETH)	
ETH trip	273
E-Thermal	
mounting bolt	
mounting bracket	
multi function input terminal	
In.65~71	349
Px terminal function setting	
multi function input terminal	
Px Define	3/10
multi keypad	54 /
multi KPD	167
multi keypad(multi-keypad)	107
slave parameter	167
Multi-drop Link System	
Multi-function (open collector) output terminal	291
	255
Multi-function output item1(Q1 Define)	
Multi-function relay 1 item(Relay 1)	
multi-function input terminal	
factory default	
multi-function input terminal off filter	
multi-function input terminal On filter	
1 1 1 0	
P1–P7	
multi-function input terminal control	
multi-function key	
[ESC] key	
Multi Key Sel	
multi-function key options	398
multi-function output terminal	055
multi-function output on/off control	
multi-function output terminal and relay setti	-
	262

multi-function output terminal delay time settings267
trip output by multi-function output terminal and relay266
multi-function(open collector) output terminal refer to Q1 terminal
multi-keypad167
master parameter167
setting167
multi-step frequency Speed-L/Speed-M/Speed-H132
N
- ·
N- terminal(- DC link terminal)46
no motor trip293; 295; 401
noise58; 121
Normal Duty23
normal load240; 416
Normal PWM239
NPN mode(Sink)57
O
open-phase protection
operation frequencyrefer to frequency setting
operation group
operation noise239
carrier frequency239
frequency jump162
operation time271
operation accumulated time271
operation accumulated time initialization271
option trip293; refer to Option Trip-x
Option Trip-x295
option trip295
OU(Output Terminal Block Function group)352
OU(Output Terminal) group70
Out Phase Open295; 401
output block by multi-function terminal291
output open-phase fault triprefer to Out Phase Open
output terminalrefer to R/S/T terminal
Output terminal function grouprefer to $\ensuremath{\textit{OUT}}$ (Output
terminal function group)
Output Terminal grouprefer to <i>OU(output terminal)</i> group
output/communication terminal53
24 terminal



AO terminal	53	basic PID operation	197
AO2 terminal		configuration	
EG terminal		Differential time(PID D-Time)	
Q1 terminal		integral time(PID I-Time)	
S+/S-/SG terminal	54	oscillation	
TO terminal		Pgain	
over current trip		PID feedback	
Over Current1		PID operation sleep mode	
Over Current2		PID output	
Over Heat		PID reference	
over heat fault trip		PID switching	
Over Load		Pre-PID operation	
overload fault trip		PNP mode(Source)	
overload warning		PNP/NPN mode selection switch(
Over Voltage		NPN mode(Sink)	
over voltage trip		PNP mode(Source)	
overload	_	post-installation checklist	
overload overload trip		power consumption	
overload warning		power slot	
overload rate		power terminal	
overload trip		N- terminal	
ο τοι του α α τ. ρ		P2+/B terminal	
Р		U/V/W terminal	
1		power terminal board wiring	
P/lgain	237	power terminals	-
P1+ terminals(+ DC link terminal		R/S/T terminals	46
P2P		power-on runref	
communication function	166	Pr(Protection Function group)	
master parameter		Pr(Protection) group	
setting		pre-exciting time	
slave parameter		press regeneration prevention	
parameter		Pgain/I gain	
display changed parameter		Protection grouprefer	
hide parameters		protocol	
initialization		pulse output terminal	
initializing the parameters		PWM	
parameter lock		frequency modulation	
parameter setting			
password		\circ	
read/write/save	244	Q	
parameter mode	94	Q1 terminal	54
parameter setting mode	95	quantizing	121
parameter view lock		noise	121
part names			
parts illustrated		R	
password		IX.	
phase-to-phase voltage		R/S/T terminal	46; 47; 407
PID control		rated	422





braking resistance rated capaci	ty442	hold time	211
rated input	417; 422	Igain	212
rated output	417; 422	IM sensorless	210
rated torque current	258	Pgain	212
rating		PM synchronous motor settings	219
rated motor current	194	PM synchronous motors	216
rated motor voltage	204	pre-exciting time	211
rated slip frequency	195	sensorless vector control operation guide	214; 215
rated slip speed	194	sequence common terminalrefer to (CM terminal
reactor	31; 440	setting virtual multi-function input	302
regenerated energy	159; 227	Single-Phase Input Application	450
remote operation	137	Sinus H expansion common area parameter	
[ESC] key	137	control area parameter(Read/Write)	316
local operation	137	memory control area parameter(Read/Wr	ite)318
Local/Remote mode switching	136	monitor area parameter (read only)	311
resonance frequency	162	slave	298
carrier frequency		slave inverter	167
frequency jump	162	slave unit	166
RS-485	297	slip	194
communication	298	slip compensation operation	194
converter	298	speed command loss	
integrated communication		speed search operation	
signal terminal		flying start-1	
RS-485 signal input terminal refe		flying start-2	
run prevention		options	
Fwd	138	P/lgain	
Rev	138	speed unit selection (Hz or Rpm)	
		square reduction	
S		square reduction load	151
9		V/F pattern operation	
S/W version	251	stall	
keypad	251	bit on/off	
product	251	stall prevention	276
S+/S-/SG terminal	54	start at power-on	
SA terminal	52	start mode	
Safe operation mode	190	acceleration start	
safety information	iii	start after DC braking	
safety input power terminal	refer to <i>SC terminal</i>	station	
safety inputA terminal	refer to SA terminal	station ID	305
safety inputB terminal	refer to SB terminal	stop mode	157
SB terminal	52	DC braking after stop	
SC terminal	52	deceleration stop	
screw specification		free run stop	
control circuit terminal screw	441	power braking	
S-curve pattern	147	storage	
actual Acc/Dec time		Storing Temperature	
sensorless vector control	207	surge killer	
configuration	210	SW1refer to PNP/NPN mode selection switch(SW1); refer	



to PNP/NPN mode selection switch(SW1) SW2refer to analog input selection	n switch(SW/2)	U	
SW3 refer to analog output selection		U&M mode	249
switch		U/V/W terminal	
analog input selection switch(SW2)		UF 376	
analog output selection switch(SW3)		UF(User Sequence Function) group.	70
PNP/NPN mode selection switch(SW1).		under load , , , , , , , , , , , , , , , , , , ,	
,		under load trip	286
T		under load warning	
1		Under Load	
target frequency		underload trip	295; 400
Cmd Frequency	323	underload warning	
technical specification		underload fault trip	
terminal		update	
A terminal	165; 268	Up-Down operation	
B terminal	165; 268	US 373	
terminal for frequency reference setting	refer to <i>VR</i>	US(User Sequence) group	70
terminal		USB	
test run	65	communication	298
TI terminal	52; 127	user group	248
time scale		delete parameters	249
0.01sec	142	parameter registration	
0.1sec	142	User mode	
1sec	142	user sequence	168
time scale setting	141	function block parameter	
timer	252	setting	168
protection features group <i>PRT (protection fe</i>	atures) group	UF group	168
TO terminal	53; 260	US group	168
torque	46	user function operation conditio	n173
torque control	228	void parameter	
torque reference setting option		User Sequence Function group	
orque boost		Sequence Function) group	
auto torque boost	154	User Sequence grouprefer to <i>US(</i>	user sequence) group
manual torque boost	153	user V/F pattern operation	
overexcitation		using the keypad	
trip	400	groups/codes	7 ²
erase trip history	251	Jog Operation key	74
fault/warning list	294	moving directly to a code	
trip condition monitor		navigating through the codes (fu	
trip mode	94	parameter setting	73; 104
trip status reset	292	switching between groups in pa	rameter display
troubleshooting		mode	
troubleshooting			
other faults		V	
troubleshooting fault trips		·	
- ·		V/F control	150
		linear V/F pattern operation	150
		square reductionV/F pattern ope	eration151





user V/F pattern operation	152	
V1 terminal	52; 118	
V2		
analog input selection switch (SW2)	52	
V2 input	125	
I2 voltage input	125	
variable resistor	81	
variable torque load	151; 228	
voltage drop	46	
voltage/current output terminalrefer to	AO terminal	
VR terminal	52; 118	
W		
warning	400	

fault/warning list	294
veight	416
viring	36
3 core cable	46
control terminal board wiring	41; 47; 452
copper cable	36
cover disassembly	37
ferrite	55
ground	42
power terminal board wiring	43
re-assembling the covers	62
torque	36
wiring length	
8 8	