e-Front runners

REFERENCE MANUAL

FRENIC Lift SERIES

INR-SI47-1068b-E

Designed for Elevating Machinery

FRENIC-Lift

Reference Manual

Preface

This manual provides the roles of function codes available for the FRENIC-Lift series of inverters, their overview lists, and details of each function code. Carefully read this manual for proper use. Incorrect handling of the inverter may prevent the inverter and/or related equipment from operating correctly, shorten their lives, or cause problems.

The table below lists the other materials related to the use of the FRENIC-Lift. Read them in conjunction with this manual as necessary.

Name	Material No.	Description
Instruction Manual	INR-SI47-1038-E	Acceptance inspection, mounting & wiring of the inverter, operation using the keypad, running the motor for a test, troubleshooting, and maintenance and inspection
Multi-function Keypad "TP-G1-CLS" Instruction Manual	INR-SI47-1092-E	Items on acceptance checking, and how to install and wire the multi-function keypad, an operation guide of the keypad, and specifications
FRENIC Loader Instruction Manual	INR-SI47-0903-E	Overview, installation, setting-up, functions, troubleshooting, and specifications of FRENIC Loader

The materials are subject to change without notice. Be sure to obtain the latest editions for use.

How this manual is organized

This manual contains Chapters 1 and 2.

Chapter 1 BLOCK DIAGRAMS FOR CONTROL LOGIC

This chapter describes the main block diagrams for the control logic of the FRENIC-Lift series of inverters.

Chapter 2 FUNCTION CODES

This chapter contains overview lists of seven groups of function codes available for the FRENIC-Lift series of inverters and details of each function code.

Icons

The following icons are used throughout this manual.

This icon indicates information which, if not heeded, can result in the inverter not operating to full efficiency, as well as information concerning incorrect operations and settings which can result in accidents.

This icon indicates information that can prove handy when performing certain settings or operations.

This icon indicates a reference to more detailed information.

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Chapter 1

BLOCK DIAGRAMS FOR CONTROL LOGIC

This chapter describes the main block diagrams for the control logic of the FRENIC-Lift series of inverters.

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FRENIC-Lift series of inverters for lifting machines such as elevators are equipped with a number of function codes to match a variety of motor operations required in your system. Refer to Chapter 2 "FUNCTION CODES" for details of the function codes.

The function codes have functional relationship each other. Several special function codes also work with execution priority each other depending on their functions or data settings.

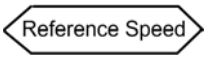
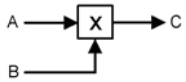
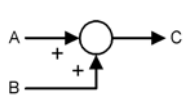
This chapter explains the main block diagrams for control logic in the inverter. You are requested to fully understand the inverter's control logic together with the function codes in order to specify the function code data correctly.

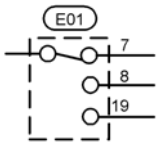
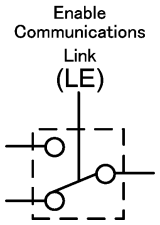
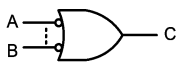
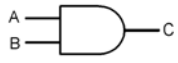
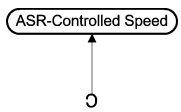
The block diagrams contained in this chapter show only function codes having mutual relationship. For the function codes that work independently and for detailed explanation of each function code, refer to Chapter 2 "FUNCTION CODES."

1.1 Symbols Used in Block Diagrams and their Meanings

Table 1.1 lists symbols commonly used in block diagrams and their meanings with some examples.

Table 1.1 Symbols and Meanings

Symbol	Meaning
[FWD], [Y1] etc.	Input/output signals to/from the inverter's control terminal block.
(FWD), (REV) etc.	Control commands assigned to the control terminal block input signals.
	Low-pass filter: Features appropriate characteristics by changing the time constant through the function code data.
	Internal control command for inverter logic.
	High limiter: Limits the upper value by a constant or data set to a function code.
	Low limiter: Limits the lower value by a constant or data set to a function code.
	Zero limiter: Prevents data from dropping to a negative value.
	Gain multiplier for reference frequencies given by current and/or voltage input or for analog output signals. $C = A \times B$
	Adder for 2 signals or values. $C = A + B$ If B is negative then $C = A - B$ (acting as a subtracter).

Symbol	Meaning
	Function code.
	Switch controlled by a function code. Numbers assigned to the terminals express the function code data.
	Switch controlled by an external control command. In the example shown on the left, the enable communications link command (LE) assigned to one of the digital input terminals from [X1] to [X5] controls the switch.
	OR logic: In normal logic, if any input is ON, then C = ON. Only if all inputs are OFF, then C = OFF.
	NOR (Not-OR) logic: In normal logic, if any input is OFF, then C = ON. If all inputs are ON, C = OFF.
	AND logic: In normal logic, only if A = ON and B = ON, then C = ON. Otherwise, C = OFF.
	Detection point. Shows a detection point for a value indicated in the frame at the checkpoint ↄ.

1.2 Reference Speed (pre-ramp) Command Generator

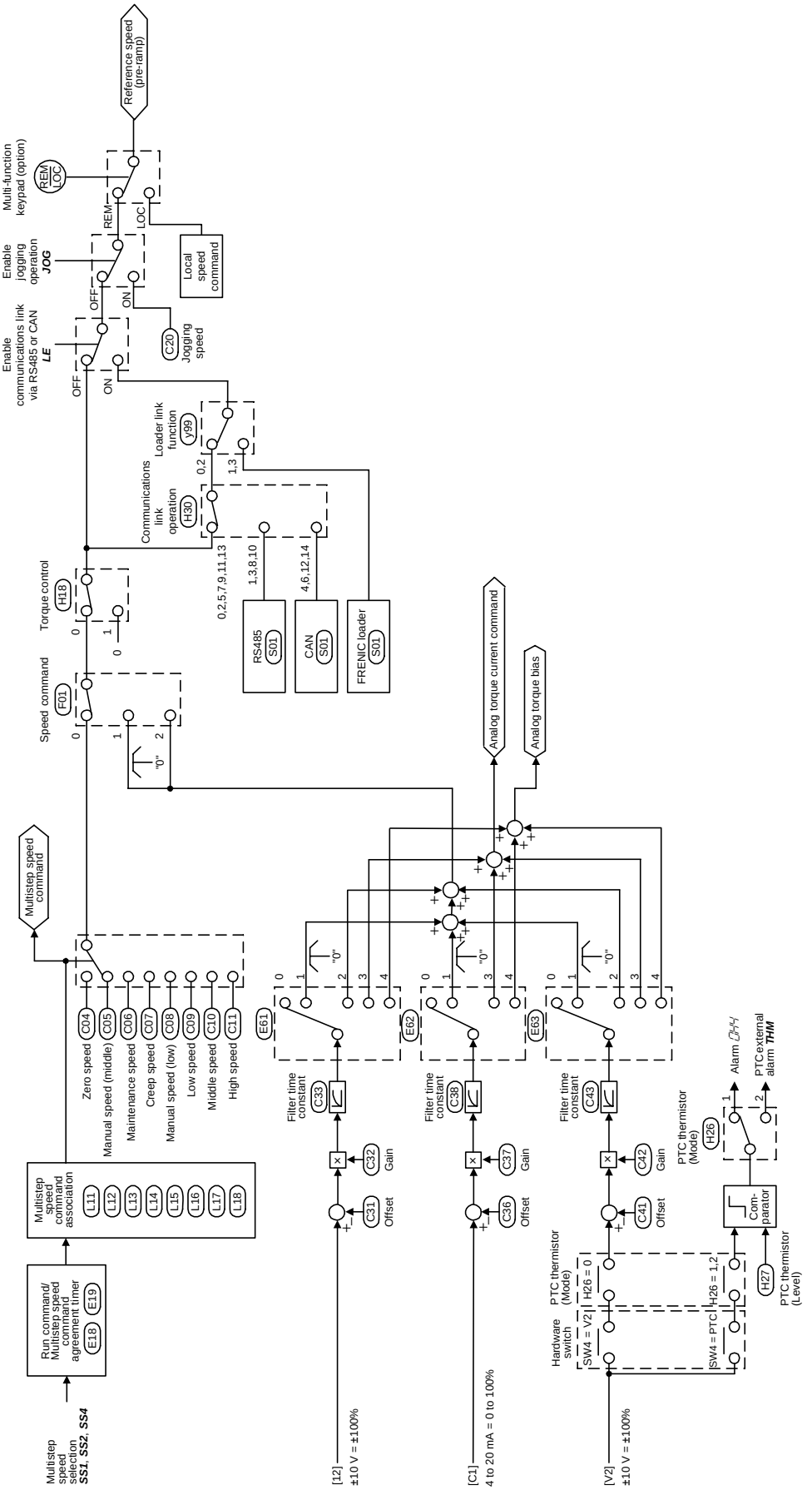


Figure 1.1 Block Diagram of Reference Speed (pre-ramp) Command Generator

1.3 Reference Torque Command Generator

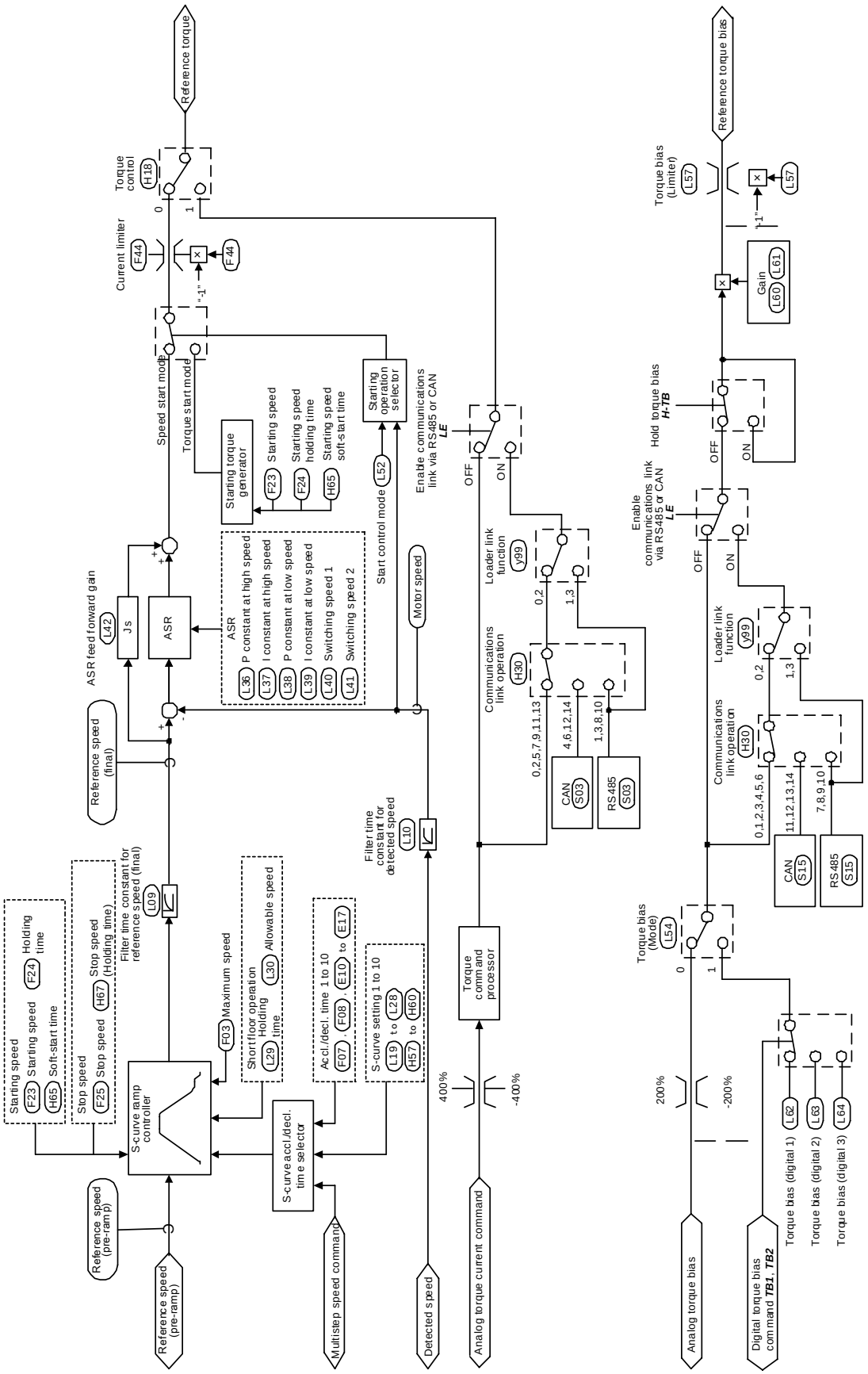


Figure 1.2 Block Diagram of Reference Torque Command Generator

1.4 Drive Command Controller

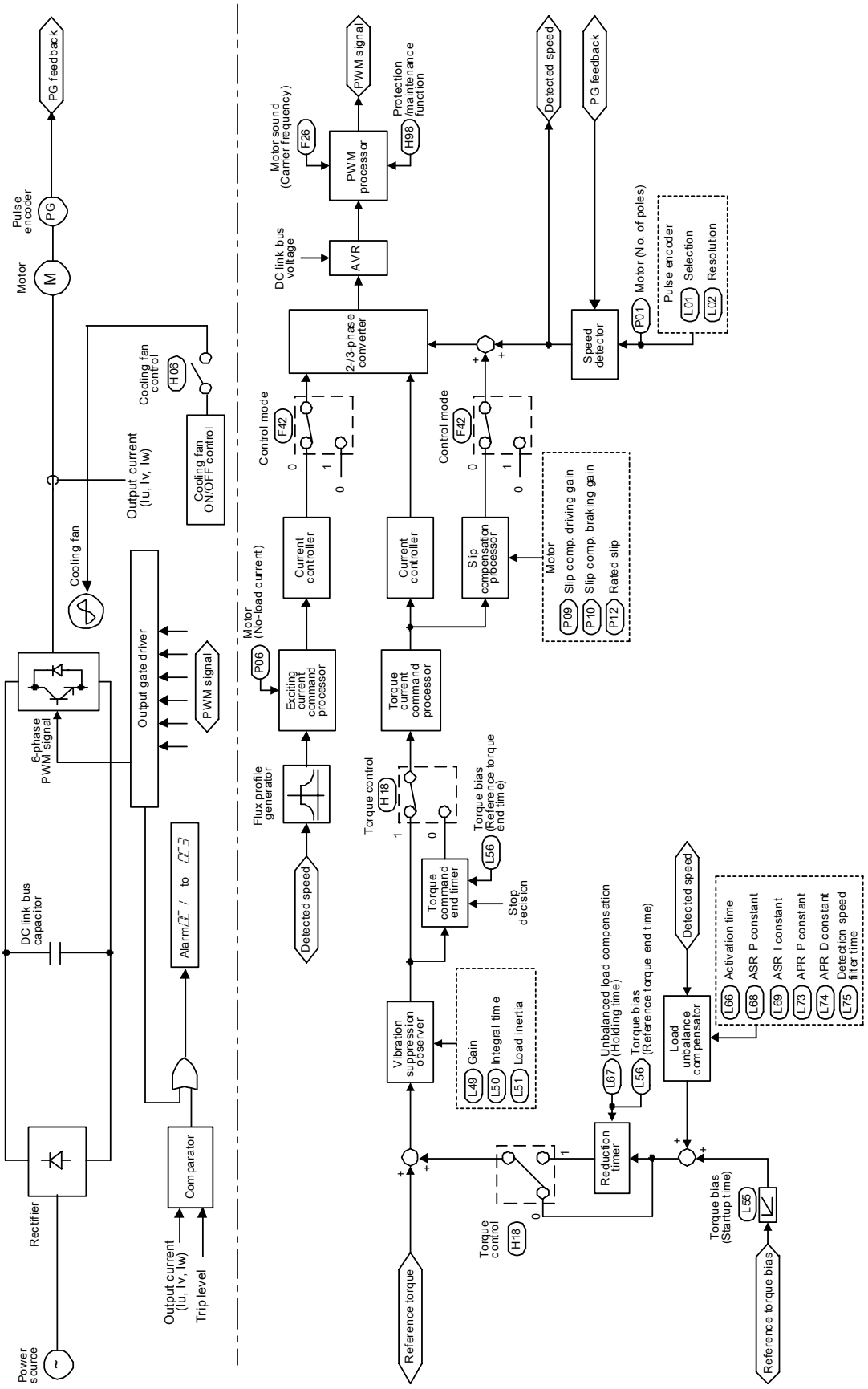


Figure 1.3 Block Diagram of Drive Command Controller

Chapter 2

FUNCTION CODES

This chapter contains overview lists of seven groups of function codes available for the FRENIC-Lift series of inverters and details of each function code.

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2.1 Function Code Tables

Function codes enable the FRENIC-Lift series of inverters to be set up to match your system requirements.

Each function code consists of a 3-letter alphanumeric string. The first letter is an alphabet that identifies its group and the following two letters are numerals that identify each individual code in the group. The function codes are classified into seven groups: Fundamental Functions (F codes), Extension Terminal Functions (E codes), Control Functions (C codes), Motor Parameters (P codes), High Performance Functions (H codes), Link Functions (y codes) and Lift Functions (L codes). To determine the property of each function code, set data to the function code.

The following descriptions supplement those given in the function code tables on page 2-3 and subsequent pages.

■ Changing, validating, and saving function code data when the inverter is running

Function codes are indicated with the following notations based on whether they can be changed or not when the inverter is running:

Notation	Change when running	Validating and saving function code data
Y*	Possible	If the data of the codes marked with Y* is changed with ⌃ and ⌄ keys, the change will immediately take effect; however, the change is not saved into the inverter's memory. To save the change, press the FUNC/DATA key. If you press the PRG/RESET key without pressing the FUNC/DATA key to exit the current state, then the changed data will be discarded and the previous data will take effect for the inverter operation.
Y	Possible	Even if the data of the codes marked with Y is changed with ⌃ and ⌄ keys, the change will not take effect. Pressing the FUNC/DATA key will make the change take effect and save it into the inverter's memory.
N	Impossible	—

■ Copying data

The keypad is capable of copying of the function code data stored in the inverter's memory into the keypad's memory (refer to Menu #7 "Data copying" in Programming mode). With this feature, you can easily transfer the data saved in a source inverter to other destination inverters.

If the specifications of the source and destination inverters differ, some code data may not be copied to ensure safe operation of your power system. Whether data will be copied or not is detailed with the following symbols in the "Data copying" column of the function code tables given later.

Y: Will be copied unconditionally.
Y1: Will not be copied if the rated capacity differs from the source inverter.
Y2: Will not be copied if the rated input voltage differs from the source inverter.
N: Will not be copied. (The function code marked with "N" is not subject to the Verify operation, either.)

If necessary, set up uncopied code data manually and individually.

Note For details of how to set up or edit function codes, refer to the Multi-function Keypad Instruction Manual (INR-SI47-1092-E)

■ Using negative logic for programmable I/O terminals

The negative logic signaling system can be used for the general-purpose input and output terminals by setting the function code data specifying the properties for those terminals. Negative logic refers to the inverted ON/OFF (logical value 1 (true)/0 (false)) state of input or output signal. An active-ON signal (the function takes effect if the terminal is short-circuited.) in the normal logic system is functionally equivalent to active-OFF signal (the function takes effect if the terminal is opened.) in the negative logic system. An active-ON signal can be switched to active-OFF signal, and vice verse, with the function code data setting.

To set the negative logic system for an I/O signal terminal, enter data of 1000s (by adding 1000 to the data for the normal logic) in the corresponding function code and then press the FUNC DATA key.

For example, if the "Enable coast-to-stop" command ***BX*** (data = 7) is assigned to any one of digital input terminals [X1] to [X8] by setting any of function codes E01 through E08, then turning ***BX*** on will make the motor coast to a stop. Similarly, if the ***BX*** (data = 1007) is assigned, turning ***BX*** off will make the motor coast to a stop.

■ Control mode

The FRENIC-Lift series of inverters supports the following control modes.

- Vector control with PG for asynchronous motor
- Vector control with PG for synchronous motor
- V/f control (for asynchronous motor)
- Torque Vector control (without PG for asynchronous motor)

These control modes can be switched by the combination of function codes F42 (Control Mode) and H18 (Torque Control) and terminal command ***PG/Hz*** as listed below.

F42 (Control Mode)	H18 (Torque Control)	***PG/Hz****1	Control Mode Selected
0	0	ON	Vector control with PG (for asynchronous motor), Speed control
0	0	OFF	Torque Vector control (without PG for asynchronous motor), Speed control *3
0	1	ON	Vector control with PG (for asynchronous motor), Torque control
0	1	OFF	Vector control with PG (for asynchronous motor), Torque control
1	0	ON	Vector control with PG (for synchronous motor) *2, Speed control
1	0	OFF	V/f control (for asynchronous motor), Speed control
1	1	ON	Vector control with PG (for synchronous motor) *2, Torque control
1	1	OFF	Vector control with PG (for synchronous motor) *2, Torque control
2	0/1	ON/OFF	Torque Vector control (without PG for asynchronous motor), Speed control

*1 The ON/OFF states in this table are expressed in the normal logic. No assignment of ***PG/Hz*** to any terminal is treated as ON.

*2 An option card is needed. For details, refer to the instruction manual of the option card.

*3 When the version that the torque vector control doesn't work is used, it becomes V/f control (asynchronous motor)/speed control.

⚠CAUTION

V/f control should apply to a test run only. Applying V/f control to elevator operation is dangerous. With this setting, the inverter may not run in sufficient performance. Torque Vector control is a control mode that doesn't use the encoder. The accuracy of the speed control is inferior to that of the vector control with PG. Use it after doing the initial evaluation.

An accident or physical injury may result.

⚠CAUTION
The torque vector control is a control mode of the limitation from 4kW to 22kW of 400V series. Do not operate it in other capacity. **An accident or physical injury may result.**

In the torque control, some function codes are invalid. Whether a function code is valid or invalid is indicated with the following notations in the "Torque control" column of the function code tables given below.

Y: Valid. (The function code data affects the inverter operations.)

N: Invalid. (The function code data does not affect the inverter operations.)

In the torque vector control, some function codes are invalid. Whether a function code is valid or invalid is indicated with the following notations in the Torque vector control column of the function code tables given below.

Y: Valid. (The function code data affects the inverter operations.)

N: Invalid. (The function code data does not affect the inverter operations.)

■ Corresponding software version

From next page, function code list for corresponding software version indicates the additional software version. The blank of software version shows the functions in being from the first.

The software version can be confirmed by the following steps.

- The maintenance of the menu is selected, and ROM is confirmed with the ⌃ and ⌄ key.
- Confirming M25 of function code.

The following tables list the function codes available for the FRENIC-Lift series of inverters.

■ F codes: Fundamental Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
F00	Data Protection	0000_H: Disable data protection (Function code data can be edited) 0001_H: Enable data protection Note: This setting is effective if H99 = 0000_H.	-	-	Y	N	0000_H	1	Y	Y	
	(Password entry)	0001_H to $FFFF_H$ Note: This setting is effective if H99 = other than 0000_H. Data of H99 is your password									
F01	Speed Command	0: Multistep speed command (***SS1***, ***SS2***, ***SS4***) 1: Analog speed command (Not reversible) 2: Analog speed command (Reversible)	-	-	N	Y	0	1	N	Y	
F03	Maximum Speed	150.0 to 3600 *1	Variable	r/min	N	Y	1800 *2	37	Y	Y	
F04	Rated Speed	150.0 to 3600 *1	Variable	*3	N	Y	1500	37	Y	Y	
F05	Rated Voltage	80 to 240 (200V series)	1	V	N	Y2	190	1	Y	Y	
		160 to 500 (400V series)					380				
F05	Rated Voltage	160 to 500 V	1	V	N	Y2	380	1	Y	Y	
F07	Acceleration/Deceleration Time 1	0.00 to 99.9 Note: Acceleration/Deceleration time is ignored at 0.00.	Variable	s	Y	Y	6.00	12	N	Y	
F09	Torque boost	0.0 to 5.0	0.1	-	Y	Y	0.0	3	N	Y*8	From 1200
F08	Acceleration/Deceleration Time 2		Variable	s	Y	Y	6.00	12	N	Y	
F10	Electronic Thermal Overload Protection for Motor (Select motor characteristics)	1: For general-purpose motors with built-in self-cooling fan 2: For inverter-driven motors or high-speed motors with forced-ventilation fan	-	-	Y	Y	2	1	Y	Y	
F11	(Overload detection level)	0.00 (Disable) 1 to 200% of the rated current (allowable continuous drive current) of the inverter	Variable	A	Y	Y1 Y2	Refer to default table	24	Y	Y	
F12	(Thermal time constant)	0.5 to 75.0	0.1	min	Y	Y	5.0 (22kW or below) 10.0 (30kW or above)	3	Y	Y	
F20	DC Braking (Starting Speed)	0.00 to 150.0 *1	Variable	*3	N	Y	0.0	37	N	Y*8	From 1200
F21	(Braking Level)	0 to 100%	1	%	N	Y	0	1	N	Y*8	From 1200
F22	(Braking Time)	0.00 (Disable) 0.01 to 30.00	0.01	s	N	Y	0.00	5	N	Y*8	From 1200
F23	Starting Speed	0.00 to 150.0 *1	Variable	*3	N	Y	6.00	37	N	Y	
F24	(Holding time)	0.00 to 10.00	0.01	s	N	Y	0.00	5	N	Y	
F25	Stop Speed	0.00 to 150.0 *1	Variable	*3	N	Y	3.00	37	N	Y	
F26	Motor Sound (Carrier frequency)	5 to 16	1	kHz	N	Y	15	1	Y	Y	
F30	Reserved *4	-	-	-	Y	Y	0	1	-	-	
F42	Control Mode	0: Vector control with PG for asynchronous motor 1: Vector control with PG for synchronous motor 2: Torque vector control (without PG for asynchronous motor)	-	-	N	Y	0	1	*9	Y	
F44	Current Limiter (Level)	100 to 230 (Percentage to the rated current of the inverter) 999: The maximum current of each inverter automatically applies.	1	%	Y	Y	999	1	N	N	

*1 The data setting range is variable. Refer to p. 2-14.
*2 The factory default setting varies depending on the shipping destination.
*3 The unit changes depending on the setting of C21.
*4 Reserved for particular manufacturers. Do not access this function code.
*8 This function code is only for the torque vector control.
*9 Refer to p. 2-2 for the control mode.

■ E codes: Extension Terminal Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
E01	Command Assignment to: [X1]	Selecting function code data assigns the corresponding function to terminals [X1] to [X8] as listed below.	-	-	N	Y	0	1	-	-	
E02	[X2]	Setting the value of 1000s in parentheses( ) shown below assigns a negative logic input to a terminal.	-	-	N	Y	1	1	-	-	
E03	[X3]		-	-	N	Y	2	1	-	-	
E04	[X4]		-	-	N	Y	8	1	-	-	
E05	[X5]		-	-	N	Y	60	1	-	-	
E06	[X6]		-	-	N	Y	61	1	-	-	
E07	[X7]		-	-	N	Y	62	1	-	-	
E08	[X8]		-	-	N	Y	63	1	-	-	
		0 (1000): Select multistep speed 1 ***SS1***							N	Y	
		1 (1001): Select multistep speed 2 ***SS2***							N	Y	
		2 (1002): Select multistep speed 4 ***SS4***							N	Y	
		7 (1007): Enable coast-to-stop ***BX***							Y	Y	
		8 (1008): Reset alarm ***RST***							Y	Y	
		9 (1009): Enable external alarm trip ***THR***							Y	Y	
		10 (1010): Enable jogging operation ***JOG***							N	Y	
		24 (1024): Enable communications link via RS485 or CAN ***LE***							Y	Y	
		25 (1025): Universal DI ***U-DI***							Y	Y	
		27 (1027): Enable PG vector control ***PG/Hz***							N	-	
		60 (1060): Select torque bias 1 ***TB1***							Y	N	
		61 (1061): Select torque bias 2 ***TB2***							Y	N	
		62 (1062): Hold torque bias ***H-TB***							Y	N	
		63 (1063): Enable battery operation ***BATRY***							Y	Y	
		64 (1064): Start creepless operation ***CRPLS***							N	Y	
		65 (1065): Check brake control ***BRKE***							N	Y	
		66 (1066): Force to decelerate ***DRS***							Y	Y	
		67 (1067): Start unbalance load compensation ***UNBL***							Y	N	
		68 (1068): Reserved for particular manufacturers ***DBTrBR***							-	-	-
		69 : Start magnetic pole position offset tunir ***PPT***							Y	N	From 0900
		101 (1101): Enable external alarm trip 2 ***THR2***							Y	Y	From 1000
		102 (1102): Start reference torque decreasing ***RTDEC***							Y	N	From 1000
		103 (1103): Check status MC control ***CS-MC***							Y	Y	From 1100
		Note: In the case of ***THR***, ***DRS***, ***THR2***, data (1009), (1066), (1101) are for normal logic, and "9", "66", "101" are for negative logic, respectively.									
E10	Acceleration/Deceleration Time 3	0.00 to 99.9 Acceleration/Deceleration time is ignored at 0.00.	Variable	s	Y	Y	6.00	12	N	Y	
E11	Acceleration/Deceleration Time 4		Variable	s	Y	Y	6.00	12	N	Y	
E12	Acceleration/Deceleration Time 5		Variable	s	Y	Y	6.00	12	N	Y	
E13	Acceleration/Deceleration Time 6		Variable	s	Y	Y	6.00	12	N	Y	
E14	Acceleration/Deceleration Time 7		Variable	s	Y	Y	6.00	12	N	Y	
E15	Acceleration/Deceleration Time 8		Variable	s	Y	Y	6.00	12	N	Y	
E16	Acceleration/Deceleration Time 9		Variable	s	Y	Y	6.00	12	N	Y	
E17	Acceleration/Deceleration Time 10		Variable	s	Y	Y	6.00	12	N	Y	
E18	Run Command/ Multistep Speed Command Assignment to: Agreement (Mode)		-	-	N	Y	2	1	-	-	
		0: None							Y	Y	
		1: ***FWD***, ***REV***							Y	Y	
		2: ***SS1***, ***SS2***, ***SS4***							N	Y	
		3: ***FWD***, ***REV*** / ***SS1***, ***SS2***, ***SS4***							Y	Y	
E19	Timer (Time)	0.000 to 0.100	0.001	s	N	Y	0.005	7	Y	Y	

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
E20	Signal Assignment to: (Transistor signal) [Y1]	Selecting function code data assigns the corresponding function to terminals [Y1] to [Y4], [Y5A/C], and [30A/B/C] as listed below. Setting the value of 1000s in parentheses ( ) shown below assigns a negative logic output to a terminal.	-	-	N	Y	0	1	-	-	
E21	[Y2]		-	-	N	Y	71	1	-	-	
E22	[Y3]		-	-	N	Y	57	1	-	-	
E23	[Y4]		-	-	N	Y	73	1	-	-	
E24	(Relay contact signal) [Y5A/C]		-	-	N	Y	74	1	-	-	
E27	[30A/B/C]		-	-	N	Y	99	1	-	-	
		0 (1000): Inverter running ***RUN***							Y	Y	
		1 (1001): Speed arrival ***FAR***							N	Y	
		2 (1002): Speed detected ***FDT***							Y	Y	
		3 (1003): Undervoltage detected (Inverter stopped) ***LU***							Y	Y	
		10 (1010): Inverter ready to run ***RDY***							Y	Y	
		12 (1012): MC control ***SW52-2***							Y	Y	
		25 (1025): Cooling fan in operation ***FAN***							Y	Y	
		26 (1026): Auto-resetting ***TRY***							Y	Y	
		27 (1027): Universal DO ***U-DO***							Y	Y	
		28 (1028): Overheat early warning ***OH***							Y	Y	
		30 (1030): Service life alarm ***LIFE***							Y	Y	
		35 (1035): Inverter output on ***RUN2***							Y	Y	
		37 (1037): Current detected ***ID***							Y	Y	
		38 (1038): Current detected 2 ***ID2***							Y	Y	
		55 (1055): Run command activated ***AX2***							Y	Y	
		56 (1056): Motor overheat detected (PTC) ***THM***							Y	Y	
		57 (1057): Brake control ***BRKS***							N	Y	
		70 (1070): Speed existence ***DNZS***							Y	N	
		71 (1071): Speed agreement ***DSAG***							N	N	
		72 (1072): Speed arrival 3 ***FAR3***							N	Y	
		73 (1073): During acceleration ***DACC***							N	Y	
		74 (1074): During deceleration ***DDEC***							N	Y	
		75 (1075): During zero speed ***DZR***							N	N	
		76 (1076): PG abnormal ***PG-ABN***							N	N	
		78 (1078): Door control ***DOPEN***							N	Y	
		99 (1099): Alarm output (for any alarm) ***ALM***							Y	Y	
		101 (1101): EN detection circuit fault ***DECF***							Y	Y	
		102 (1102): EN terminal off ***ENOFF***							Y	Y	
		103 (1103): Reserved for particular manufacturers ***ISW***							-	-	
		104 (1104): Low voltage detected ***LVD***							Y	Y	
		105 (1105): Electrical angle cycle ***EAC***							Y	N	From 0600
		106 (1106): Reserved for particular manufacturers ***DTBW***							-	-	-
		107 (1107): During magnetic pole position offset tuning ***DTUNE***							Y	N	From 0900
		108 (1108): Reserved for particular manufacturers ***RRD-D***							-	-	-
		109 (1109): Recommended running direction ***RRD***							N	N	From 1000
		110 (1110): Drive continuance alarm output ***ALM2***							Y	Y	From 1000
		111 (1111): Shutdown confirmation ***SD***							Y	Y	From 1000
		112 (1112): Input power limitation ***IPL***							Y	Y	From 1220
E30	Speed Arrival (FAR) (Hysteresis)	0.00 to 3600 *1	Variable	*3	Y	Y	10	37	N	Y	
E31	Speed Detection (FDT) (Detection level)	0.00 to 3600 *1	Variable	*3	Y	Y	1800 *2	37	Y	Y	
E32	(Hysteresis)	0.00 to 900.0 *1	Variable	*3	Y	Y	20	37	Y	Y	
E34	Current Detection 1 (ID) (Level 1)	When you set 1 to L98:bit0, E34 and E35 are effective over torque current alarm (出荷). 0.00: (Disable) Current value of 1 to 200% of the inverter rated current	Variable	A	Y	Y1 Y2	Refer to default table	24	Y	Y	
E35	(Time)	0.01 to 600.00	0.01	s	Y	Y	10.00	5	Y	Y	
E37	Current Detection 2 (ID2) (Level 2)	0.00: (Disable) Current value of 1 to 200% of the inverter rated current	Variable	A	Y	Y1 Y2	Refer to default table	24	Y	Y	
E39	Recommended running direction (RRD) (Detection level)	0 to 100	1	%	N	Y	0	1	N	N	From 1100

*1 The data setting range is variable. Refer to p. 2-14.
*2 The factory default setting varies depending on the shipping destination.
*3 The unit changes depending on the setting of C21.

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
E43	LED Monitor	0: Speed monitor (Select by E48)	-	-	Y	Y	0	1	Y	-	
		3: Output current								Y	
		4: Output voltage								Y	
		8: Calculated torque								Y	
		9: Input power								Y	
		18: Reference torque								N	
		19: Torque bias balance adjustment (Offset) (BTBB)								N	
		20: Torque bias gain adjustment (BTBG)								N	
E45	LCD Monitor (Display mode)	0: Running status, rotational direction and operation guide 1: Bar charts for reference speed(final), output current and reference torque	-	-	Y	Y	0	1	Y	Y	
E46	(Language selection)	0: Chinese 1: English 2: Japanese 3: German 4: French 5: Spanish 6: Italian Note: When the connected multi-function keypad (option) doesn't support the selected language, it is displayed in English.	-	-	Y	Y	1 *2	1	Y	Y	
E47	(Contrast control)	0 (Low) to 10 (High)	1	-	Y*	Y	5	1	Y	Y	
E48	LED Monitor (Speed monitor item)		-	-	Y	Y	0	1	-	-	
		0: Reference speed (final)							N	Y	
		2: Reference speed (pre-ramp)							Y	Y	
		3: Motor speed							Y	N*7	
		5: Elevator speed							Y	N*7	
E61	Analog Input for: (Extension function selection) [12]	Selecting function code data assigns the corresponding function to terminals [12], [C1] and [V2] as listed below.	-	-	N	Y	0	1	-	-	
E62	[C1]		-	-	N	Y	0	1	-	-	
E63	[V2]		-	-	N	Y	0	1	-	-	
		0: None							Y	Y	
		1: Speed command (Not reversible operation with polarity)							N	Y	
		2: Speed command (Reversible operation with polarity) (Nothing for [C1])							N	Y	
		3: Torque current command							Y	N	
		4: Torque bias command							Y	N	
E98	Command Assignment to: [FWD]	Selecting function code data assigns the corresponding function to terminals [FWD] and [REV] as listed below. Setting the value of 1000s in parentheses ( ) shown below assigns a negative logic input to a terminal.	-	-	N	Y	98	1	-	-	
E99	[REV]		-	-	N	Y	99	1	-	-	
		0 (1000): Select multistep speed 1 ***SS1***							N	Y	
		1 (1001): Select multistep speed 2 ***SS2***							N	Y	
		2 (1002): Select multistep speed 4 ***SS4***							N	Y	
		7 (1007): Enable coast-to-stop ***BX***							Y	Y	
		8 (1008): Reset alarm ***RST***							Y	Y	
		9 (1009): Enable external alarm trip ***THR***							Y	Y	
		10 (1010): Enable jogging operation ***JOG***							N	Y	
		24 (1024): Enable communications link via RS485 or CAN ***LE***							Y	Y	
		25 (1025): Universal DI ***U-DI***							Y	Y	
		27 (1027): Enable PG vector control ***PG/Hz***							N	-	
		60 (1060): Select torque bias 1 ***TB1***							Y	N	
		61 (1061): Select torque bias 2 ***TB2***							Y	N	
		62 (1062): Hold torque bias ***H-TB***							Y	N	
		63 (1063): Enable battery operation ***BATRY***							Y	Y	
		64 (1064): Start creepless operation ***CRPLS***							N	Y	
		65 (1065): Check brake control ***BRKE***							N	Y	
		66 (1066): Force to decelerate ***DRS***							Y	Y	
		67 (1067): Start unbalance load compensation ***UNBL***							Y	N	
		68 (1068): Reserved for particular manufacturers ***DBTrBR***							-	-	-
		69 : Start magnetic pole position offset tunir ***PPT***							Y	N	From 0900
		98 : Run forward ***FWD***							Y	Y	
		99 : Run reverse ***REV***							Y	Y	
		101 (1101): Enable external alarm trip 2 ***THR2***							Y	Y	From 1000
		102 (1102): Start reference torque decreasing ***RTDEC***							Y	N	From 1000
		103 (1103): Check status MC control ***CS-MC***							Y	Y	From 1100
		Note: In the case of ***THR***, ***DRS***, ***THR2***, data (1009), (1066), (1101) are for normal logic, and "9", "66", "101" are for negative logic, respectively.									

*2 The factory default setting varies depending on the shipping destination.
*7 If the speed detection is effective, it operates.

■ C codes: Control Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
C01	Battery Operation (Torque limit level for drive side)	0 to 100 999: Torque limit level is F44.	1	%	Y	Y	999	1	Y	Y*8	From 1220
C02	(Torque limit time)	0.0: C01 is effective during battery operation. 0.1 to 30.0	0.1	s	Y	Y	0.0	3	Y	Y*8	From 1220
C03	Battery Operation Speed	0.00 to 3600 *1	Variable	*3	Y	Y	0.00	37	N	Y	
C04	Multistep Speed Zero Speed	0.00 to 3600 *1	Variable	*3	Y	Y	0.00	37	N	Y	
C05	Manual Speed (Middle)		Variable	*3	Y	Y	0.00	37	N	Y	
C06	Maintenance Speed		Variable	*3	Y	Y	0.00	37	N	Y	
C07	Creep Speed		Variable	*3	Y	Y	0.00	37	N	Y	
C08	Manual Speed (Low)		Variable	*3	Y	Y	0.00	37	N	Y	
C09	Low Speed		Variable	*3	Y	Y	0.00	37	N	Y	
C10	Middle Speed		Variable	*3	Y	Y	0.00	37	N	Y	
C11	High Speed		Variable	*3	Y	Y	0.00	37	N	Y	
C20	Jogging Operation Speed	0.00 to 3600 *1	Variable	*3	Y	Y	150.0	37	N	Y	
C21	Speed Command Unit	0: r/min 1: m/min 2: Hz	-	-	Y	Y	0	1	Y	Y	
C31	Analog Input Adjustment for [12] (Offset)	-100.0 to +100.0	0.1	%	Y*	Y	0.0	4	Y	Y	
C32	(Gain)	0.00 to 200.00	0.01	%	Y*	Y	100.00	5	Y	Y	
C33	(Filter time constant)	0.000 to 5.000	0.001	s	Y	Y	0.050	7	Y	Y	
C36	Analog Input Adjustment for [C1] (Offset)	-100.0 to +100.0	0.1	%	Y*	Y	0.0	4	Y	Y	
C37	(Gain)	0.00 to 200.00	0.01	%	Y*	Y	100.00	5	Y	Y	
C38	(Filter time constant)	0.000 to 5.000	0.001	s	Y	Y	0.050	7	Y	Y	
C41	Analog Input Adjustment for [V2] (Offset)	-100.0 to +100.0	0.1	%	Y*	Y	0.0	4	Y	Y	
C42	(Gain)	0.00 to 200.00	0.01	%	Y*	Y	100.00	5	Y	Y	
C43	(Filter time constant)	0.000 to 5.000	0.001	s	Y	Y	0.050	7	Y	Y	

*1 The data setting range is variable. Refer to p. 2-14.
*3 The unit changes depending on the setting of C21.
*8 This function code is only for the torque vector control.

■ P codes: Motor Parameters

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
P01	Motor (Number. of poles)	2 to 100	2	Poles	N	Y1 Y2	4	1	Y	Y	
P02	(Rated capacity)	0.01 to 55.00	0.01	kW	N	Y1 Y2	Refer to default table	11	Y	Y	
P03	(Rated current)	0.00 to 500.0	Variable	A	N	Y1 Y2	Refer to default table	24	Y	Y	
P04	(Auto-tuning)	0: Disable 1: Enable (Tune %R1 and %X while the motor is stopped.) 2: Enable (Tune %R1, %X, no-load current, and rated slip while the motor is stopped.)	-	-	N	N	0	21	Y	Y	
P06	(No-load current)	0.00 to 500.0	Variable	A	N	Y1 Y2	Refer to default table	24	Y	Y	
P07	(%R1)	0.00 to 50.00	0.01	%	Y	Y1 Y2	Refer to default table	5	Y	Y	
P08	(%X)	0.00 to 50.00	0.01	%	Y	Y1 Y2	Refer to default table	5	Y	Y	
P09	(Slip comp. driving gain)	0.0 to 200.0	0.1	%	Y	Y	100.0	3	Y	Y	
P10	(Slip comp. braking gain)	0.0 to 200.0	0.1	%	Y	Y	100.0	3	Y	Y	
P11	(Slip comp. response time)	0.05 to 1.00	0.01	s	Y	Y	1.00*5	5	Y	Y*8	From 1200
P12	(Rated slip)	0.00: Rated slip of Fuji standard motor 0.01 to 15.00	0.01	Hz	Y	Y1 Y2	0.00	5	Y	Y	

*5 The default setting is different in inverter ROM version.
*8 This function code is only for the torque vector control.

■ H codes: High Performance Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
H03	Data Initialization	0: Disable initialization 1: Initialize all function code data to the factory defaults	-	-	N	N	0	1	Y	Y	
H04	Auto-resetting (Times)	0: Disable 1 to 10	1	Times	Y	Y	0	1	Y	Y	
H05	(Reset interval)	0.5 to 20.0	0.1	s	Y	Y	2.0	3	Y	Y	
H06	Cooling Fan Control	0.0: Automatic ON/OFF depending upon temperature 0.5 to 10.0 min: OFF by timer 999: Disable (Always ON)	0.1	min	Y	Y	999	3	Y	Y	
H18	Torque Control	0: Disable (Speed control) 1: Enable (Torque control)	-	-	N	Y	0	1	Y	N	
H26	PTC Thermistor (Mode)	0: Disable 1: Enable (Upon detection of (PTC), the inverter immediately trips and stops with *0H4* displayed.) 2: Enable (Upon detection of (PTC), the inveter continues running while outputting alarm signal ***TMH***.)	-	-	Y	Y	0	1	Y	Y	
H27	(Level)	0.00 to 5.00	0.01	V	Y	Y	1.60	5	Y	Y	
H30	Communications Link Operation	Speed command / Run command / Torque bias command 0: F01 / Terminal / L54 1: RS485 / Terminal / L54 2: F01 / RS485 / L54 3: RS485 / RS485 / L54 4: CAN / Terminal / L54 5: F01 / CAN / L54 6: CAN / CAN / L54 7: F01 / Terminal / RS485 8: RS485 / Terminal / RS485 9: F01 / RS485 / RS485 10: RS485 / RS485 / RS485 11: F01 / Terminal / CAN 12: CAN / Terminal / CAN 13: F01 / CAN / CAN 14: CAN / CAN / CAN Note: 4, 5, 6, 11, 12, 13, and 14 can set only the version equipped with CAN. (for models of FRN__LM1S-2C, -2E, -2J, -2A, -4C, -4E, -4J, -4A)	-	-	Y	Y	0	1	Y	Y	
H42	Capacitance of DC Link Bus Capacitor	0 to 65535: Indication for replacing DC link bus capacitor	-	-	N	N	-	1	Y	Y	
H43	Cumulative Run Time of Cooling Fan	0 to 65535: Indication of cumulative run time of cooling fan for replacement	-	-	N	N	-	1	Y	Y	
H47	Initial Capacitance of DC Link Bus Capacitor	0 to 65535: Indication for replacing DC link bus capacitor	-	-	N	N	Set at factory shipping	1	Y	Y	
H48	Cumulative Run Time of Capacitors on Printed Circuit Board	0 to 65535: Indication for replacing capacitors on printed circuit boards	-	-	N	N	-	1	Y	Y	
H54	Acceleration Time (Jogging)	0.00 to 99.9	Variable	s	Y	Y	6.00	12	N	Y	
H55	Deceleration Time (Jogging)	0.00 to 99.9	Variable	s	Y	Y	6.00	12	N	Y	
H56	Deceleration Time for Forced to Decelerate	0.00 to 99.9	Variable	s	Y	Y	6.00	12	N	Y	
H57	S-curve Setting 11	0 to 50% of max. speed	1	%	Y	Y	0	1	N	Y	From 1210
H58	S-curve Setting 12		1	%	Y	Y	0	1	N	Y	From 1210
H59	S-curve Setting 13		1	%	Y	Y	0	1	N	Y	From 1210
H60	S-curve Setting 14		1	%	Y	Y	0	1	N	Y	From 1210
H64	Zero Speed Holding Time	0.00 to 10.00	0.01	s	N	Y	0.00	5	N	Y	From 1000
H65	Starting Speed (Soft start time)	0.0 to 60.0	0.1	s	N	Y	0.0	3	N	Y	
H66	Stop Speed (Detection method)	0: Use detected speed 1: Use reference speed (final)	-	-	N	Y	0	1	N	N	
H67	(Holding time)	0.00 to 10.00	0.01	s	N	Y	0.00	5	N	Y	
H74	Speed Agreement (Hysteresis)	0.00 to 3600 *1	Variable	*3	Y	Y	10.00	37	N	N	
H75	(OFF delay time)	0.00 to 1.00	0.01	s	Y	Y	0.20	5	N	N	
H76	PG Error Detection for Mode 3 (Detection level)	0 to 50	1	%	Y	Y	10	1	N	N	From 1000
H77	(Detection time)	0.0 to 10.0	0.1	s	Y	Y	0.5	3	N	N	From 1000
H80	Output Current Fluctuation Dar	0.00 to 0.40	0.01	-	Y	Y	0.20	5	N	Y*8	From 1200
H94	Cumulative Run Time of Motor	0 to 65535: Change or reset the cumulative data	-	-	N	N	0	1	Y	Y	
H97	Clear Alarm Data	If H97= 1, its data returns to zero after clearing alarm data.	-	-	Y	N	0	1	Y	Y	
H98	Protection/Maintenance Function	00000000_b to 11111111_b (Displayed on the keypad's LCD in decimal format. In each bit, "0" for disabled, "1" for enabled.)	-	-	Y	Y	81	1	-	-	
		Bit 0: Lower the carrier frequency automatically							Y	Y	
		Bit 1: Detect input phase loss							Y	Y	
		Bit 2: Reserved							-	-	
		Bit 3: Select life judgment criteria of DC link bus capacitor							Y	Y	
		Bit 4: Judge the life of DC link bus capacitor							Y	Y	
		Bit 5: Detect DC fan lock							Y	Y	From 1100
		Bit 6: Detect a short-circuit at startup							Y	Y	
		Bit 7: Detect thermistor disconnect for heat sink							Y	Y	From 1100
		Note: Bit 5 and Bit 7 are effective only for models of 30kW or above (200V series) or 37kW or above (400V series).									
H99	Password Protection	0000_H to $FFFF_H$ 0000_H: Disable password protection 0001_H to $FFFF_H$: Enable password protection	-	-	Y	N	0000_H	1	Y	Y	

*1 The data setting range is variable. Refer to p. 2-14.
*3 The unit changes depending on the setting of C21.
*8 This function code is only for the torque vector control.

■ y codes: Link Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
y01	RS485 Communication (Station address)	1 to 255	1	-	N	Y	1	1	Y	Y	
y02	(Communications error processing)	0: Immediately trip with alarm Er8 1: Trip with alarm Er8 after running for the period specified by timer y03 2: Retry during the period specified by timer y03. If retry fails, trip with alarm Er8. If it succeeds, continue to run. 3: Continue to run	-	-	Y	Y	0	1	Y	Y	
y03	(Error processing time)	0.0 to 60.0	0.1	s	Y	Y	2.0	3	Y	Y	
y04	(Baud rate)	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps	-	-	Y	Y	3	1	Y	Y	
y05	(Data length)	0: 8 bits 1: 7 bits	-	-	Y	Y	0	1	Y	Y	
y06	(Parity check)	0: None (Stop bit 2) 1: Even parity 2: Odd parity 3: None (Stop bit 1)	-	-	Y	Y	0	1	Y	Y	
y07	(Stop bits)	0: 2 bits 1: 1 bit	-	-	Y	Y	0	1	Y	Y	
y08	(No-response error detection time)	0: (No detection) 1 to 60	1	s	Y	Y	0	1	Y	Y	
y09	(Response latency time)	0.00 to 1.00	0.01	s	Y	Y	0.01	5	Y	Y	
y10	(Protocol selection)	0: Modbus RTU protocol 1: SX protocol (FRENIC Loader protocol) 2: Reserved for particular manufacturers	-	-	Y	Y	1	1	Y	Y	
y21	CAN Communication *6 (Station address)	1 to 127	1	-	N	Y	1	1	Y	Y	
y24	(Baud rate)	0: 10 kbps 1: 20 kbps 2: 50 kbps 3: 125 kbps 4: 250 kbps	-	-	N	Y	3	1	Y	Y	
y25	(User-defined I/O parameter 1)	0000_H to $FFFF_H$	-	-	N	Y	0000_H	1	Y	Y	
y26	(User-defined I/O parameter 2)		-	-	N	Y	0000_H	1	Y	Y	
y27	(User-defined I/O parameter 3)		-	-	N	Y	0000_H	1	Y	Y	
y28	(User-defined I/O parameter 4)		-	-	N	Y	0000_H	1	Y	Y	
y29	(User-defined I/O parameter 5)		-	-	N	Y	0000_H	1	Y	Y	
y30	(User-defined I/O parameter 6)		-	-	N	Y	0000_H	1	Y	Y	
y31	(User-defined I/O parameter 7)		-	-	N	Y	0000_H	1	Y	Y	
y32	(User-defined I/O parameter 8)		-	-	N	Y	0000_H	1	Y	Y	
y33	(Operation)	0: Disable 1: Enable	-	-	N	Y	0	1	Y	Y	
y41	Reserved *4	-	-	-	N	Y	0	1	N	-	
y99	Loader Link Function (Mode)	Control command / Run command 0: Follow H30 / Follow H30 1: Via Loader / Follow H30 2: Follow H30 / Via Loader 3: Via Loader / Via Loader Note: Control commands include Speed command, Torque current command, and Torque bias command.	-	-	Y	N	0	1	Y	Y	

*4 Reserved for particular manufacturers. Do not access this function code.
*6 These are able to set only the version equipped with CAN. (for models of FRN LM1S-2C, -2E, -2J, -2A, -4C, -4E, -4J, -4A)

■ L codes: Lift Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
L01	Pulse Encoder (Selection)	· A/B phase · ABS signal	-	-	N	Y	0	1	-	N*7	
		0: 12/15 V - Complementary - Open collector 5 V Line driver / None							Y		
		1: 12/15 V - Complementary - Open collector 5 V Line driver / Z							Y		From 0900
		2: 5 V Line driver / 3-bit code							Y		
		3: 5 V Line driver / 4-bit gray code							Y		
		4: Sinusoidal differential voltage (1 V p-p) / EnDat 2.1 (ECN1313 compatible)							Y		
		5: Sinusoidal differential voltage (1 V p-p) / SIN/COS (ERN1387 compatible)							Y		From 1100
L02	(Resolution)	360 to 60000	1	P/R	N	Y	1024	1	Y	N*7	
L03	Magnetic Pole Position Offset		-	-	N	N	0	21	-	N	
	(Tuning)	0: Disable							Y		
		1: Enable							Y		
		2: Enable (with miss wiring detection)							Y		
		3: Enable (with checking accuracy)							Y		
		4: Enable (for SPM)							Y		
		5: Enable (motor rotated)							N		From 0900
		Note: This setting is effective if F42 = 1. 1 to 4 : It is a recommended condition that the brake is a close. 5 : It is necessary condition that the brake is a release and without load.									
L04	(Offset angle)	0.00 to 360.00 (Return value of L03) Note: This setting is effective if F42 = 1.	0.01	deg	N	Y	0.00	5	Y	N	
L05	ACR (synchronous motor) (P constant)	0.0 to 10.0	0.1	-	Y	Y	1.5*5	3	Y	N	From 1000
L06	(I constant)	0.50 to 5.00	0.01	ms	Y	Y	0.80	5	Y	N	From 1000
L08	Divide frequency ratio	0: 1/1 1: 1/2 2: 1/4 3: 1/8 4: 1/16 5: 1/32 6: 1/64	-	-	N	Y	0	1	Y	Y	From 0600
L09	Filter Time Constant for Reference Speed (Final)	0.000 to 0.100	0.001	s	Y	Y	0.000	7	N	Y	
L10	Filter Time Constant for Detected Speed	0.000 to 0.100	0.001	s	Y	Y	0.005	7	Y	N*7	
L11	Multistep Speed Command Combination Zero Speed	00000000_b to 00000111_b (0 to 7)	1	-	N	Y	0	1	N	Y	
L12	Manual Speed (Middle)	Note: If a binary value within the range from 00000000_b to	1	-	N	Y	1	1	N	Y	
L13	Maintenance Speed	00000111_b is double-assigned, the inverter trips with alarm Er5.	1	-	N	Y	2	1	N	Y	
L14	Creep Speed		1	-	N	Y	3	1	N	Y	
L15	Manual Speed (Low)		1	-	N	Y	4	1	N	Y	
L16	Low Speed		1	-	N	Y	5	1	N	Y	
L17	Middle Speed		1	-	N	Y	6	1	N	Y	
L18	High Speed		1	-	N	Y	7	1	N	Y	
L19	S-curve Setting 1	0 to 50% of max. speed	1	%	Y	Y	0	1	N	Y	
L20	S-curve Setting 2		1	%	Y	Y	0	1	N	Y	
L21	S-curve Setting 3		1	%	Y	Y	0	1	N	Y	
L22	S-curve Setting 4		1	%	Y	Y	0	1	N	Y	
L23	S-curve Setting 5		1	%	Y	Y	0	1	N	Y	
L24	S-curve Setting 6		1	%	Y	Y	0	1	N	Y	
L25	S-curve Setting 7		1	%	Y	Y	0	1	N	Y	
L26	S-curve Setting 8		1	%	Y	Y	0	1	N	Y	
L27	S-curve Setting 9		1	%	Y	Y	0	1	N	Y	
L28	S-curve Setting 10		1	%	Y	Y	0	1	N	Y	
L29	Short Floor Operation (Holding time)	0.00 to 10.00	0.01	s	N	Y	0.00	5	N	Y	
L30	(Allowable speed)	0.00 to 3600 *1	Variable	*3	N	Y	0.00	37	N	Y	
L31	Elevator Parameter (Speed)	0.01 to 240.00 (Elevator speed at maximum speed of the motor)	0.01	m/min	N	Y	60.00	5	Y	Y	
L32	(Over speed level)	50 to 120	1	%	N	Y	120	1	Y	N	From 1000
L34	(Moving distance in creepless operation)	0.0 to 6553.5	0.1	mm	N	Y	0.0	3	N	Y	

*1 The data setting range is variable. Refer to p. 2-14.
*3 The unit changes depending on the setting of C21.
*4 Reserved for particular manufacturers. Do not access this function code.
*5 The default setting is different in inverter ROM version.
*7 If the speed detection is effective, it operates.

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
L36	ASR (P constant at high speed)	0.01 to 200.00	0.01	-	Y	Y	40.00	5	N	N	
L37	(I constant at high speed)	0.001 to 1.000	0.001	s	Y	Y	0.100	7	N	N	
L38	(P constant at low speed)	0.01 to 200.00	0.01	-	Y	Y	40.00	5	N	N	
L39	(I constant at low speed)	0.001 to 1.000	0.001	s	Y	Y	0.100	7	N	N	
L40	(Switching speed 1)	0.00 to 3600 *1	Variable	*3	Y	Y	150.0	37	N	N	
L41	(Switching speed 2)	0.00 to 3600 *1	Variable	*3	Y	Y	300.0	37	N	N	
L42	(Feed forward gain)	0.000 to 10.000	0.001	s	Y	Y	0.000	7	N	N	
L43	Reserved *4	-	-	-	Y	Y	10	1	-	-	
L44	Reserved *4	-	-	-	Y	Y	0	1	-	-	
L45	Reserved *4	-	-	-	Y	Y	10	1	-	-	
L46	Reserved *4	-	-	-	Y	Y	0	1	-	-	
L47	Reserved *4	-	-	-	Y	Y	10	1	-	-	
L48	Reserved *4	-	-	-	Y	Y	0	1	-	-	
L49	Vibration Suppression Observer (Gain)	0.00: Disable 0.01 to 1.00	0.01	-	Y	Y	0.00	5	Y	N	
L50	(Integral time)	0.005 to 1.000	0.001	s	Y	Y	0.100	7	Y	N	
L51	(Load inertia)	0.01 to 655.35	0.01	kgm^2	Y	Y	0.01	5	Y	N	
L52	Start Control Mode	0: Enable speed start mode 1: Enable torque start mode Note: This setting is effective if H18 = 0.	1	-	Y	Y	0	1	N	N	
L54	Torque Bias (Mode)		-	-	N	Y	0	1	Y	N	
		0: Analog									
		1: Digital									
		2: PI control									From 0600
L55	(Startup time)	0.00 to 1.00	0.01	s	Y	Y	0.20	5	Y	N	
L56	(Reference torque end time)	0.00: Disable 0.01 to 20.00	0.01	s	Y	Y	0.00	5	Y	N	
L57	(Limiter)	0 to 200	1	%	Y	Y	100	1	Y	N	
L58	(P constant)	0.01 to 10.00	0.01	-	Y	Y	1.00	5	Y	N	From 0600
L59	(I constant)	0.00 to 1.00	0.01	s	Y	Y	1.00	5	Y	N	From 0600
L60	(Driving gain)	-1000.0 to 1000.0	0.1	%	Y*	Y	100.0	4	Y	N	
L61	(Braking gain)	-1000.0 to 1000.0	0.1	%	Y*	Y	100.0	4	Y	N	
L62	(Digital 1)	-200 to 200	1	%	Y	Y	0	2	Y	N	
L63	(Digital 2)	-200 to 200	1	%	Y	Y	0	2	Y	N	
L64	(Digital 3)	-200 to 200	1	%	Y	Y	0	2	Y	N	
L65	Unbalanced Load Compensation (Operation)	0: Disable 1: Enable	-	-	N	Y	0	1	Y	N	
L66	(Activation time)	0.00 to 2.00	0.01	s	N	Y	0.50	5	Y	N	
L67	(Holding time)	0.01 to 20.00	0.01	s	N	Y	0.50	5	Y	N	
L68	(ASR P constant)	0.00 to 200.00	0.01	-	Y	Y	40.00	5	Y	N	
L69	(ASR I constant)	0.001 to 1.000	0.001	s	Y	Y	0.100	7	Y	N	
L73	(APR P constant)	0.00 to 10.00	0.01	-	Y	Y	0.00	5	Y	N	From 1100
L74	(APR D constant)	0.0 to 10.0	0.1	-	Y	Y	0.0	3	Y	N	From 1220
L75	(Filter Time Constant for Detected Speed)	0.000 to 0.100	0.001	s	Y	Y	0.000	7	Y	N	From 1220

*1 The data setting range is variable. Refer to p. 2-14.
*3 The unit changes depending on the setting of C21.
*4 Reserved for particular manufacturers. Do not access this function code.

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Data format No.	Torque Control	Torque vector control	Software version which can be used
L80	Brake Control										
	(Mode)	1: Brake control by time 2: Brake control by output current	-	-	N	Y	1	1	N	Y	
L81	(Operation level)	0 to 200	1	%	N	Y	100	1	N	Y	
L82	(ON delay time)	0.00 to 10.00	0.01	s	N	Y	0.00	5	N	Y	
L83	(OFF delay time)	0.00 to 100.00	0.01	s	N	Y	0.00	5	N	Y	
L84	(Brake check time)	0.00 to 10.00	0.01	s	N	Y	0.00	5	N	Y	
L85	MC Control										
	(Startup delay time)	0.00 to 10.00	0.01	s	N	Y	0.00	5	Y	Y	
L86	(MC OFF delay time)	0.00 to 10.00	0.01	s	N	Y	0.00	5	Y	Y	
L87	Door Control										
	(Door open starting speed)	0.00 to 3600 *1	Variable	*3	N	Y	100.0	37	N	Y	
L88	(Door open delay time)	0.0 to 10.0	0.1	s	N	Y	1.0	3	N	Y	
L89	(Door open period)	0.1 to 30.0	0.1	s	N	Y	5.0	3	N	Y	
L90	PG Error Detection		-	-	N	Y	1	1	-	N	
	(Mode)	0: Continue to run							N		
		1: Trip at alarm mode 1 with alarm Er-E							N		
		2: Trip at alarm mode 2 with alarm Er-E							N		
		3: Trip at alarm mode 3 with alarm Er-E							N		From 1000
L91	(Detection level)	0 to 50	1	%	Y	Y	10	1	N	N	
L92	(Detection time)	0.0 to 10.0	0.1	s	Y	Y	0.5	3	N	N	
L93	Overheat Early Warning Level	1 to 20	1	deg	Y	Y	5	1	Y	Y	
L95	Reserved *4	-	-	-	N	Y	999	3	-	-	From 0600
L96	Reserved *4	-	-	-	N	Y	30	1	-	-	From 0600
L97	Reserved *4	-	-	-	N	Y	20	5	-	-	From 0900
L98	Protection2	00000000_b to 00000011_b (In each bit, "0" for disabled, "1" for enabled.)	-	-	N	Y	0	1	-	-	
		Bit0: Over torque alarm (oL)							Y	N	From 1100
		Bit1: Drive continuance mode when specific alarm							Y	Y	From 1000
L99	Control Switch	00000000_b to 00011111_b (In each bit, "0" for disabled, "1" for enabled.)	-	-	N	Y	0	1	-	-	
		Bit0: Current confirmation when starting (for synchronous motor)							Y	N	From 0600
		Bit1: Rewrite magnetic pole position offset angle (tuning by PPT)							Y	N	From 0900
		Bit2: Torque bias operation with offset							N	N	From 1000
		Bit3: Select short floor operation mode							N	Y	From 1100
		Bit4:Reserved							-	-	-
		Note: Bit 1 is effective only for tuning by PPT.									

*1 The data setting range is variable. Refer to p. 2-14.
*3 The unit changes depending on the setting of C21.
*4 Reserved for particular manufacturers. Do not access this function code.

Default Table

Type	P02	F11,E34,E37,P03	P06	P07	P08
FRN5.5LM1S-2__	5.50[kW]	27.00[A]	16.80[A]	4.05[%]	11.72[%]
FRN7.5LM1S-2__	7.50[kW]	37.00[A]	19.70[A]	4.23[%]	13.01[%]
FRN11LM1S-2__	11.00[kW]	49.00[A]	27.70[A]	3.22[%]	12.27[%]
FRN15LM1S-2__	15.00[kW]	63.00[A]	35.80[A]	2.55[%]	11.47[%]
FRN18.5LM1S-2__	18.50[kW]	74.00[A]	32.50[A]	1.98[%]	11.97[%]
FRN22LM1S-2__	22.00[kW]	90.00[A]	38.10[A]	2.11[%]	12.35[%]
FRN4.0LM1S-4__	3.70[kW]	9.00[A]	5.70[A]	5.54[%]	8.33[%]
FRN5.5LM1S-4__	5.50[kW]	13.50[A]	8.40[A]	4.05[%]	11.72[%]
FRN7.5LM1S-4__	7.50[kW]	18.50[A]	9.80[A]	4.23[%]	13.01[%]
FRN11LM1S-4__	11.00[kW]	24.50[A]	13.90[A]	3.22[%]	12.27[%]
FRN15LM1S-4__	15.00[kW]	32.00[A]	17.90[A]	2.55[%]	11.47[%]
FRN18.5LM1S-4__	18.50[kW]	37.00[A]	16.20[A]	1.98[%]	11.97[%]
FRN22LM1S-4__	22.00[kW]	45.00[A]	19.00[A]	2.11[%]	12.35[%]
FRN30LM1S-4__	30.00[kW]	58.00[A]	21.40[A]	2.14[%]	14.62[%]
FRN37LM1S-4__	37.00[kW]	72.00[A]	30.80[A]	1.86[%]	11.99[%]
FRN45LM1S-4__	45.00[kW]	85.00[A]	31.10[A]	1.96[%]	13.40[%]

2.2 Before setting the function code

⚠CAUTION

Set the function code in following order. Otherwise, a different value might be set.

1. C21 (Speed Command Unit) should be set. The speed can be specified by the corresponding unit.

C21 data	Speed Command Unit	Referred function code
0	r/min	P01
1	m/min	P01, F03, L31
2	Hz	None

2. P01 (Motor, Number. of poles) should be set.
3. F03 (Maximum Speed) and L31 (Elevator Parameter, Speed) should be set.

Tip F03 (maximum speed) depends on P01 (motor, number of poles). Set the date of F03 again when you change P01. For details, refer to the descriptions of function codes F03.

Changing any data of C21, P01, F03 and L31 requires modifying the data of the function codes listed below again.

Function code(Name)	Inverter internal value [Hz]	Function code(Name)	Inverter internal value [Hz]
F04(Rated Speed)	10.00 to 120.0	C04(Zero Speed) to C11(High Speed)	0.00 to 120.0
F20(DCB Starting Speed)	0.00 to 5.00	C20(Jogging Operation Speed)	0.00 to 120.0
F23(Starting Speed)	0.00 to 5.00	H74((Speed Agreement, Hysteresis)	0.00 to 120.0
F25(Stop Speed)	0.00 to 5.00	L30((Short Floor Operation, Allowable speed)	0.00 to 120.0
E30(Speed Arrival, Hysteresis)	0.00 to 120.0	L40(ASR, Switching speed 1)	0.00 to 120.0
E31(Speed Detection Detection level))	0.00 to 120.0	L41(ASR, Switching speed 2)	0.00 to 120.0
E32(Speed Detection, Hysteresis)	0.00 to 30.00	L87((Door Control, Door open starting speed))	0.00 to 120.0
C03 Battery Operation Speed)	0.00 to 120.0		

Relational expression of r/min and Hz	$[\text{r/min}] = 120 \times \frac{[\text{Hz}]}{\text{Pe}}$
Relational expression of m/min and Hz	$[\text{m/min}] = \frac{\text{Vmax}}{\text{Nmax}} \times 120 \times \frac{[\text{Hz}]}{\text{Pe}}$

Definition of sign

Pe : P01(Motor, No. of poles) (pole)

Nmax : F03 (Maximum Speed) (r/min)

Vmax : L31 (Elevator Speed) (m/min)

2.3 Overview of Function Codes

This section provides a detailed description of the function codes available for the FRENIC-Lift series of inverters. In each code group, its function codes are arranged in an ascending order of the identifying numbers for ease of access. Note that function codes closely related each other for the implementation of an inverter's operation are detailed in the description of the function code having the lowest identifying number. Those related function codes are indicated in the right end of the title bar as shown below.

F00	Data Protection	H99 (Data Protection)

2.3.1 F codes (Fundamental functions)

F00	Data Protection	H99 (Password Protection)

■ Data protection (F00)

F00 specifies whether to protect function code data from getting changed accidentally.

When the multi-function keypad is connected, simultaneous keying of STOP + ∧ or STOP + ∨ switches the data protection from disable to enable or vice versa, respectively.

- Data setting range: 0000H (Disable data protection)
  0001H (Enable data protection)

■ Password protection (H99)

H99 specifies a password, which enables the password protection.

To change password-protected function code data, enter the specified password to F00 to disable the password protection *temporarily*. With that state, setting H99 to 0000 *permanently* disables the password protection.

When the multi-function keypad is connected, simultaneous keying of STOP + ∧ or STOP + ∨ switches the password protection from disable to enable or vice versa, respectively.

- Data setting range: 0000H (Disable password protection)
  0001H to FFFFH (Enable password protection)

Function code data (Specified state)		Changing function code data	Checking function code data	Initialization of function code data (H03)
H99 = 0000	F00 = 0000 (Data protection disabled)	Y	Y	Y
	F00 = 0001 (Data protection enabled)	N (Y)*1	Y	N (Y)*1
H99 ≠ 0000	F00 ≠ H99 (Password protection enabled)	N	N	Y*2
	F00 = H99 (Password protection *temporarily* disabled)	Y	Y	Y

*1 Using a communications link can change or initialize function code data even if the data protection is enabled. However, it cannot if the password protection is enabled.

*2 Even if the password protection is enabled, using H03 can initialize all function code data including password to the factory defaults. This is useful when the user forgot his/her password.

Note Neither F00 data nor H99 data can be changed via a communications link

F01	Speed Command	F07, F08 (Acceleration/Deceleration Time 1, 2) E10 to E17 (Acceleration/Deceleration Time 3 to 10) E61 to E63 (Analog Input for [12], [C1] and [V2]) C04 to C11 (Multistep Speed) L11 to L18 (Multistep Speed Command Combination) L19 to L28 and H57 to H60 (S-curve Setting 1 to 14) L29 (Short Floor Operation)

F01 selects the source that specifies a motor speed.

Data for F01	Function	
0	Enable multistep speed command with S-curve acceleration/deceleration	
1	Enable analog speed command (Setting "1" or "2" enables analog input--voltage input to terminals [12] and [V2] and current input to terminal [C1].)	Not reversible
2		Reversible

In the case of "Reference speed (pre-ramp) < Stop speed" and "Reference speed (pre-ramp) < Starting speed," the inverter runs with the reference speed (pre-ramp) of 0.00 r/min.

■ Multistep speed command with S-curve acceleration/deceleration (L11 to L18 and C04 to C11)

The FRENIC-Lift series of inverters can configure a multistep speed command with eight speeds--Zero Speed, Manual Speed (Middle), Maintenance Speed, Creep Speed, Manual Speed (Low), Low Speed, Middle Speed and High Speed provided for operation purposes.

To configure the multistep speed command, specify L11 to L18 data that combine general-purpose input terminal commands ***SS1***, ***SS2*** and ***SS4*** with eight reference speeds (pre-ramp) defined by C04 to C11.

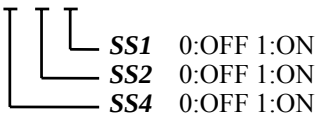
The setting ranges of the acceleration/deceleration times and S-curve zones are determined according to the switching of reference speeds (pre-ramp) as described later.

Combining *SS1*, *SS2* and *SS4* with reference speeds (pre-ramp)

Function Code	Reference Speed Commands	Setting Range	Factory Default	Description
L11	Zero Speed Command	00000000_b to 00000111_b	00000000_b	Enable the zero speed defined by C04, combining with the states of terminal commands ***SS1***, ***SS2*** and ***SS4***.
L12	Manual Speed (Middle) Command		00000001_b	Enable the manual speed (middle) defined by C05, combining with the states of terminal commands ***SS1***, ***SS2*** and ***SS4***.
L13	Maintenance Speed Command		00000010_b	Enable the maintenance speed defined by C06, combining with the states of terminal commands ***SS1***, ***SS2*** and ***SS4***.
L14	Creep Speed Command		00000011_b	Enable the creep speed defined by C07, combining with the states of terminal commands ***SS1***, ***SS2*** and ***SS4***.
L15	Manual Speed (Low) Command		00000100_b	Enable the manual speed (low) defined by C08, combining with the states of terminal commands ***SS1***, ***SS2*** and ***SS4***.
L16	Low Speed Command		00000101_b	Enable the low speed defined by C09, combining with the states of terminal commands ***SS1***, ***SS2*** and ***SS4***.
L17	Middle Speed Command		00000110_b	Enable the middle speed defined by C10, combining with the states of terminal commands ***SS1***, ***SS2*** and ***SS4***.
L18	High Speed Command		00000111_b	Enable the high speed defined by C11, combining with the states of terminal commands ***SS1***, ***SS2*** and ***SS4***.

Definition of Setting Value for L11 to L18

0 0 0 0 0 1 1 1 b



0:Inactive 1:Active	
Active logic	Negative logic
Terminal ON:1	Terminal ON:0
Terminal OFF:0	Terminal OFF:1

Factory default combination of *SS1*, *SS2* and *SS4* states with reference speeds (pre-ramp)

SS4	***SS2***	***SS1***	L11 to L18	Reference speed (pre-ramp) selected
OFF	OFF	OFF	L11 = 00000000_b	Zero speed defined by C04
OFF	OFF	ON	L12 = 00000001_b	Manual speed (middle) defined by C05
OFF	ON	OFF	L13 = 00000010_b	Maintenance speed defined by C06
OFF	ON	ON	L14 = 00000011_b	Creep speed defined by C07
ON	OFF	OFF	L15 = 00000100_b	Manual speed (low) defined by C08
ON	OFF	ON	L16 = 00000101_b	Low speed defined by C09
ON	ON	OFF	L17 = 00000110_b	Middle speed defined by C10
ON	ON	ON	L18 = 00000111_b	High speed defined by C11

Sample combination of *SS1*, *SS2* and *SS4* states with reference speeds (pre-ramp)

To select zero speed by turning on ***SS1***, for example, configure a multistep speed command by setting ***SS1***, ***SS2*** and ***SS4*** and L11 to L18 as listed below.

SS4	***SS2***	***SS1***	L11 to L18	Reference speed (pre-ramp) selected
OFF	OFF	ON	L11 = 00000001_b	Zero speed defined by C04
OFF	OFF	OFF	L12 = 00000000_b	Manual speed (middle) defined by C05
OFF	ON	OFF	L13 = 00000010_b	Maintenance speed defined by C06
OFF	ON	ON	L14 = 00000011_b	Creep speed defined by C07
ON	OFF	OFF	L15 = 00000100_b	Manual speed (low) defined by C08
ON	OFF	ON	L16 = 00000101_b	Low speed defined by C09
ON	ON	OFF	L17 = 00000110_b	Middle speed defined by C10
ON	ON	ON	L18 = 00000111_b	High speed defined by C11

Note Do not double assign the same data to L11 (Zero Speed) to L18 (High Speed). Eight values are available, ranging from "00000000" to "00000111." Double assignment results in a trip with alarm Er-5 the moment a run command is entered.

Tip It is recommended that zero speed to high speed be used for operations named for original purposes. To use any of them for different purposes, confirm the setting ranges of its acceleration/deceleration time and S-curve acceleration/deceleration time.

Acceleration/deceleration times to be applied when the reference speed (pre-ramp) is changed after the reference speed (final) reaches the speed (pre-ramp)

The table below lists the acceleration/deceleration times to be applied when the reference speed (pre-ramp) is changed after the reference speed (final) reaches the previously commanded reference speed (pre-ramp). Those times are specified by function codes F07, F08, and E10 to E17.

In the table below, "Stop" refers to a run command being off. F07/F08 indicates that F07 and F08 apply during acceleration and deceleration, respectively.

After change / Before change	Stop	Zero speed	Manual speed (middle)	Maintenance speed	Creep speed	Manual speed (low)	Low speed	Middle speed	High speed
Stop	-/F08	F07	F07	F07	F07	F07	F07	F07	F07
Zero speed	E16	F07/F08	E10	F07	F07/F08	F07	F07	E10	E12
Manual speed (middle)	E16	E11	F07/F08	F07/F08	E11	F07/F08	F07/F08	F07/F08	F07/F08
Maintenance speed	E16	F08	F07/F08	F07/F08	F07/F08	F07/F08	F07/F08	F07/F08	F07/F08
Creep speed	E15	E14	F07/F08	F07/F08	F07/F08	F07/F08	F07/F08	F07/F08	F07/F08
Manual speed (low)	E16	F08	F07/F08	F07/F08	F08	F07/F08	F07/F08	F07/F08	F07/F08
Low speed	E16	F08	F07/F08	F07/F08	F08	F07/F08	F07/F08	F07/F08	F07/F08
Middle speed	E16	E11	F07/F08	F07/F08	E11	F07/F08	E11	F07/F08	F07/F08
High speed	E16	E13	F07/F08	F07/F08	E13	F07/F08	E13	F07/F08	F07/F08

S-curve starting/ending zones to be applied when the reference speed (pre-ramp) is changed after the reference speed (final) reaches the speed (pre-ramp)

The table below lists the S-curve starting/ending zones to be applied when the reference speed (pre-ramp) is changed after the reference speed (final) reaches the speed (pre-ramp). They are specified by function codes L19 to L28 and H57 to H60.

In the table below, for example, L19/L22 indicates that L19 and L22 apply at the starting and ending zones, respectively.

When two different creep speeds are applied, set the low speed for the higher creep one.

After change / Before change	Stop	Zero speed	Manual speed (middle)	Maintenance speed	Creep speed	Manual speed (low)	Low speed	Middle speed	High speed
Stop	-/-	H57/H58	H57/H58	-/-	H57/H58	H57/H58	H57/H58	H57/H58	H57/H58
Zero speed	H59/ H60	-/-	L19/L22	-/-	H57/H58	L19/L20	L19/L20	L19/L22	L19/L24
Manual speed (middle)	H59/ H60	L23/L28	-/-	-/-	L23/L26	H59/H60	H59/H60	H59/H60	H59/H60
Maintenance speed	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
Creep speed	L27	L28	H57/H58	-/-	-/-	H57/H58	H57/H58	H57/H58	H57/H58
Manual speed (low)	H59/ H60	L21/L28	H57/H58	-/-	L21/L26	-/-	H57/H58	H57/H58	H57/H58
Low speed	H59/ H60	L21/L28	H57/H58	-/-	L21/L26	H59/H60	-/-	H57/H58	H57/H58
Middle speed	H59/ H60	L23/L28	H59/H60	-/-	L23/L26	H59/H60	L23/L26	-/-	H57/H58
High speed	H59/ H60	L25/L28	H59/H60	-/-	L25/L26	H59/H60	L25/L26	H59/H60	-/-

When the reference speed (pre-ramp) is changed before the reference speed (final) reaches that speed (pre-ramp) (during acceleration/deceleration)

The inverter immediately aims at the newly changed reference speed (pre-ramp), applying the acceleration/deceleration times and S-curve acceleration/deceleration zones defined on the previous page, just as when the reference speed (pre-ramp) is changed after the reference speed (final) reaches the previously commanded reference speed (pre-ramp).

The differences between operations before and after the reference speed (final) reaches the speed (pre-ramp) are as described below.

When the reference speed (pre-ramp) change yields deceleration during acceleration (Reference speed (final) at the time of change > Reference speed (pre-ramp)), the inverter performs a short floor operation.

Refer to the description of function code L29 for a short floor operation.

On the contrary, when the speed change yields acceleration during deceleration, the inverter immediately starts S-curve acceleration, which may make an impact on the load.

Acceleration/deceleration times in S-curve operation

In an S-curve operation, the acceleration/deceleration time "t" can be calculated by the following formulae.

- If the speed deviation exceeds the S-curve zone: $|N2-N1| \geq N\max \times \frac{S1+S2}{100}$

$$t = \left(\frac{N2-N1}{N\max} + \frac{S1+S2}{100} \right) \times T$$

- If the speed deviation is within the S-curve zone: $|N1-N2| < N\max \times \frac{S1+S2}{100}$

$$t = 2\sqrt{\frac{|N2-N1|}{N\max} \times \frac{100}{S1+S2}} \times \left(\frac{S1+S2}{100} \right) \times T$$

Where,

Nmax : Maximum speed (r/min)

N1 : Speed before the start of acceleration/deceleration (r/min)

N2 : Speed after the end of acceleration/deceleration (r/min)

S1 : S-curve zone (% of the maximum speed) at the start of acceleration (at the end of deceleration)

S2 : S-curve zone (% of the maximum speed) at the end of acceleration (at the start of deceleration)

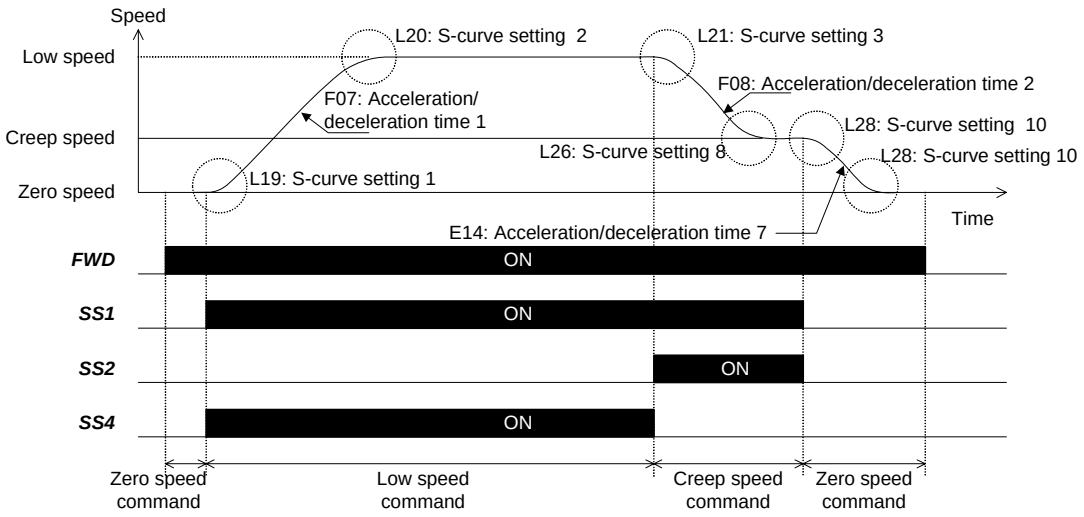
T : Acceleration period (s) required from 0.00 r/min to the maximum speed
or
Deceleration period (s) required from the maximum speed to 0.00 r/min

t : Acceleration/deceleration period (s) required from N1 to N2

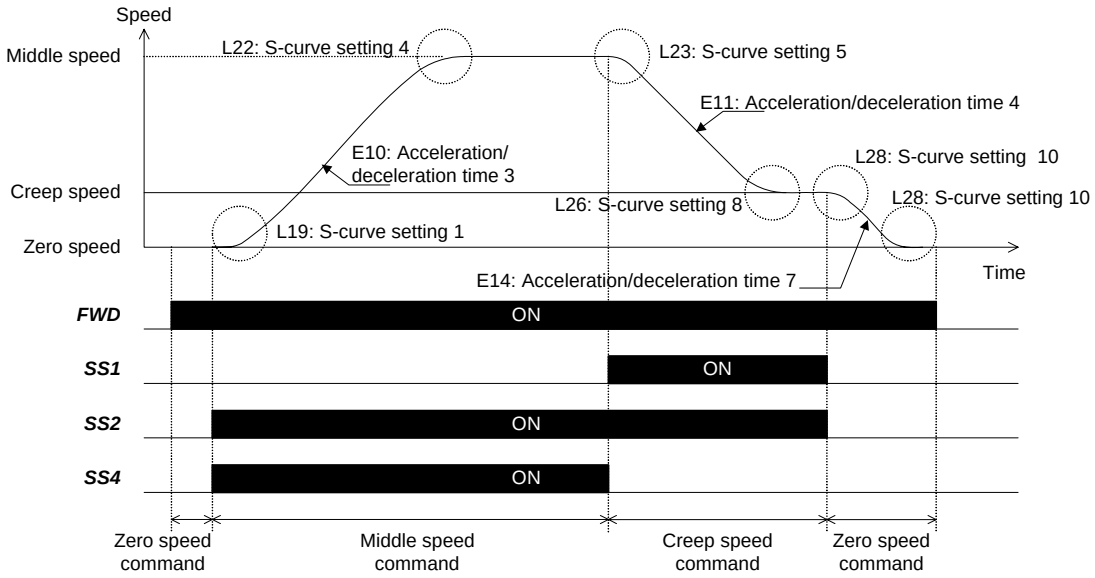
Operation samples

The following diagrams show operation samples given when the inverter runs by factory defaults of function codes L11 to L18. Changing those code data makes the relationship between terminal commands ***SS1, SS2*** and ***SS4*** and the reference speed (pre-ramp) selected different from the following diagrams.

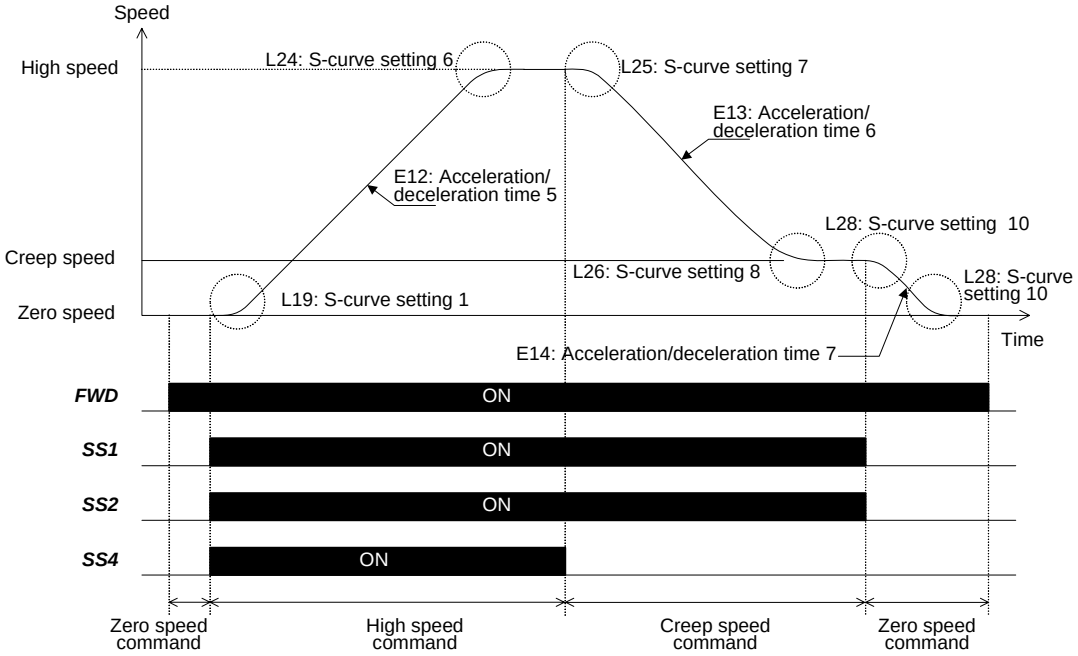
Low speed



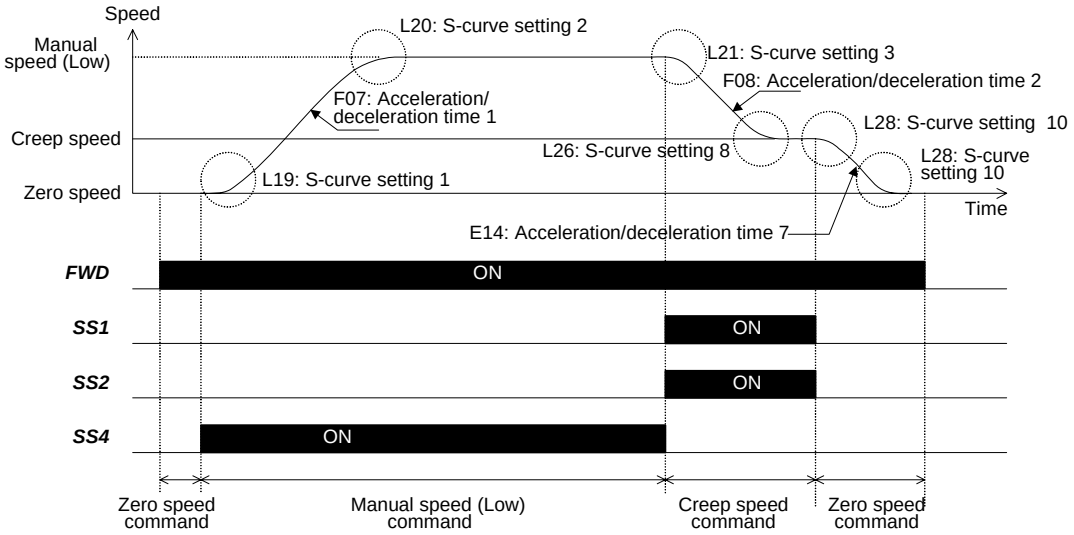
Middle speed



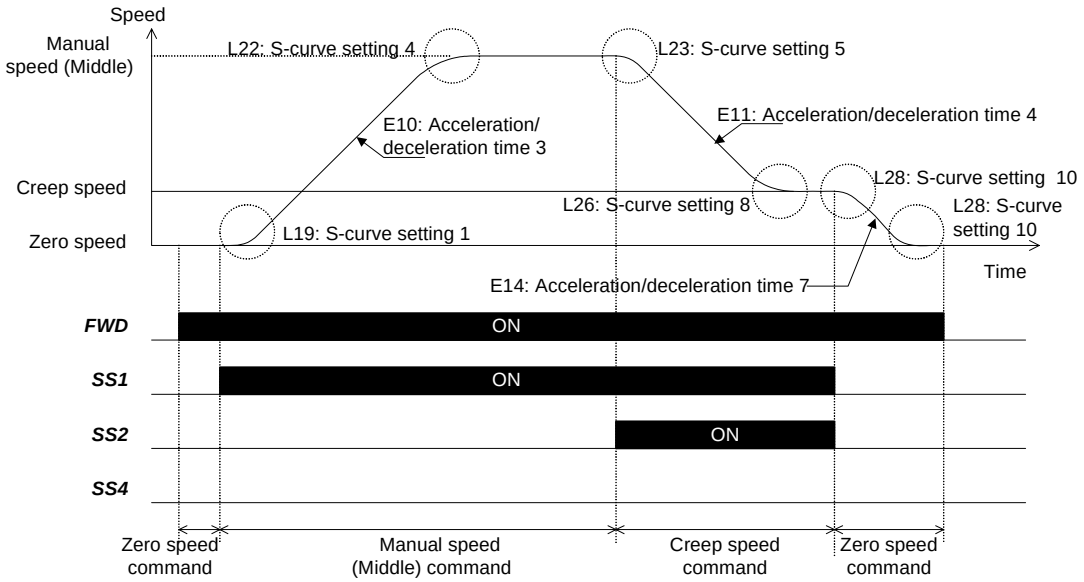
High speed



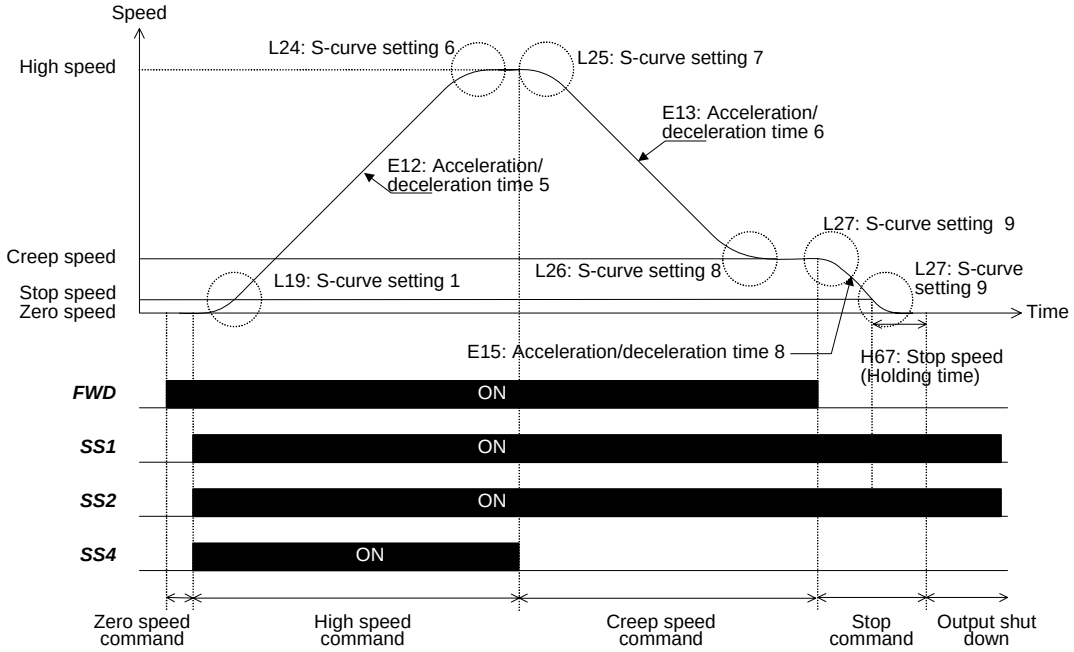
Manual speed (Low)



Manual speed (Middle)



Creep speed to stop

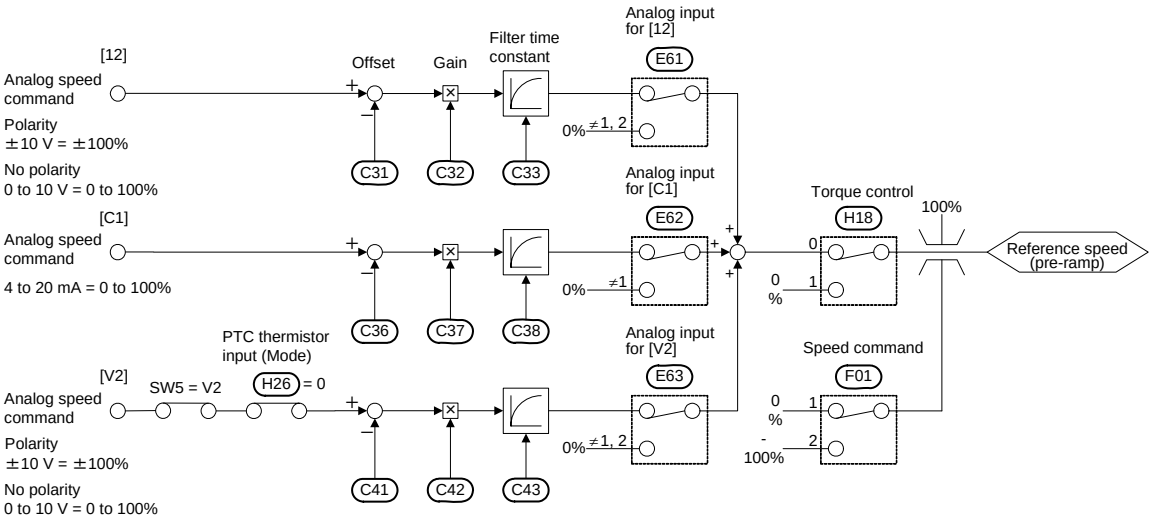


■ Analog speed command

Enabling an analog speed command (F01 = 1 or 2) and assigning a speed command to terminal [12] (E61 = 1 or 2) or [V2] (E63 = 1 or 2) run the inverter by analog voltage. Enabling an analog speed command (F01 = 1 or 2) and assigning a speed command to terminal [C1] (E62 = 1) run the inverter by analog current. These inputs are added. Refer to the block diagram below.

Selecting an analog speed command cannot invoke an S-curve operation. It disables a multistep speed command. When "Reference speed (pre-ramp) < Stop speed" or "F01 = 1," the reference speed (pre-ramp) of 0.00 r/min or below will be regarded as 0.00 r/min. The acceleration/deceleration times specified by F07 and F08 apply, respectively. The inverter will linearly decelerate, however, in accordance with the time specified by E16 when a run command is turned off during running. Exception is linear deceleration for the time specified by E16 when a run command is turned off during running.

Refer to the description of function code F23 for the timing chart to be applied when an analog speed command is selected.



Tip Offset, gain and filter time constant can be specified for analog input--voltage input to terminals [12] and [V2] and current input to terminal [C1]. Refer to C31 to C33, C36 to C38, and C41 to C43.

F03 Maximum Speed

F03 specifies the maximum speed to limit a reference speed (pre-ramp). Specifying the maximum speed exceeding the rating of the equipment driven by the inverter may cause damage or a dangerous situation. Make sure that the maximum speed setting matches the equipment rating.

- Data setting range: $\frac{120\times 5}{P01}$ to $\frac{120\times 120}{P01}$ (r/min)

Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

In case of induction motor, the recommended value of F03 is the rated speed (speed at rated torque), not the synchronous speed.

⚠WARNING

The inverter can easily accept high-speed operation. When changing the settings, carefully check the specifications of motors or equipment beforehand.

Otherwise injuries could occur.

Note Any function codes may be modified by changing maximum speed. Refer to page 2-14.

F04	Rated Speed
F05	Rated Voltage

F04 and F05 specify the rated speed and voltage of the motor that the inverter drives.

■ Rated speed (F04)

Set the rated speed of the motor. In the case of an induction motor, please set the synchronous speed of the motor. If the speed command units are r/min (Speed Command Unit function C21 equals 0), the value of F04 can be obtained from the following expression:

$$F04 = \frac{120 \times f_r\,(\mathrm{Hz})}{P01}$$

Where f_r is the rated frequency of the motor, in Hz.

Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

■ Rated voltage (F05)

Set the rated voltage printed on the nameplate labeled on the motor.

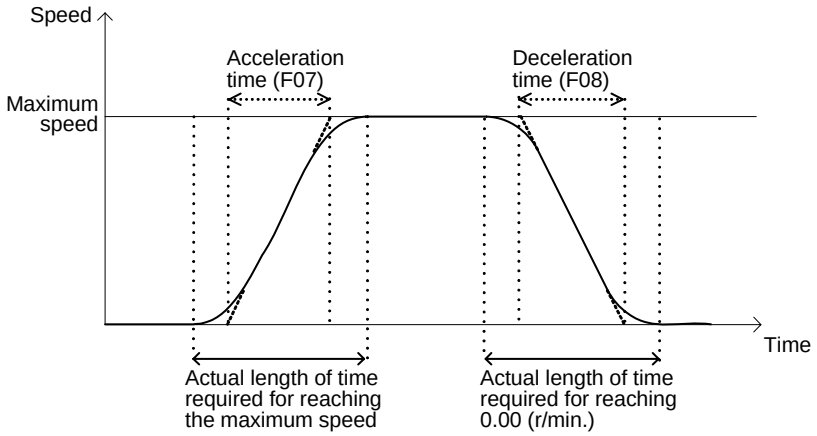
Note that the inverter cannot output the voltage exceeding the inverter's input voltage.

- Data setting range: 80 to 240 (V) 200V series
  : 160 to 500 (V) 400V series

F07, F08	Acceleration/Deceleration Time 1, 2	E10 to E17 (Acceleration/Deceleration Time 3 to 10)

F07 and F08 specify the acceleration or deceleration time in linear acceleration/deceleration zones excluding S-curve zones. The acceleration/deceleration time is the length of time required for the speed to linearly increase from 0.00 r/min to the maximum speed (F03) or decrease from the maximum speed to 0.00 r/min, respectively.

- Data setting range: 0.00 to 99.9 (s)



Tip When the inverter runs by an analog speed command, the acceleration and deceleration times specified by F07 and F08 apply. To generate acceleration/deceleration patterns with the host controller, modify F07 and F08 data.

Also in local mode, the acceleration and deceleration times specified by F07 and F08 apply.

F09	Torque boost

Determines the torque boost for torque vector control. Basically, there is no need to modify the default setting. If you need more torque, please change the value. However, as too much setting of F09 may cause larger current, do not modify the default setting unless it is necessary.

- Data setting range: 0.0 to 5.0

Note It is a special code of the torque vector control.
Refer to page 2-2 for the control mode of the inverter.

F10	Electronic Thermal Overload Protection for Motor (Select motor characteristics)
F11	Electronic Thermal Overload Protection for Motor (Overload detection level)
F12	Electronic Thermal Overload Protection for Motor (Thermal time constant)

F10 through F12 specify the thermal characteristics of the motor for its electronic thermal overload protection that is used to detect overload conditions of the motor inside the inverter.

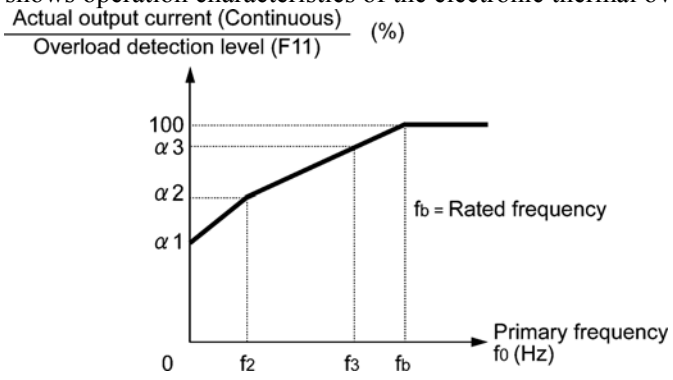
■ Select motor characteristics (F10)

F10 specifies the cooling mechanism of the motor--built-in cooling fan or externally powered forced-ventilation fan.

Data for F10	Function
1	For general-purpose motors with built-in self-cooling fan (The cooling effect will decrease in low speed operation.)
2	For inverter-driven motors or high-speed motors with forced-ventilation fan (The cooling effect will be kept constant regardless of the output speed.)

About F10=1.

The figure below shows operation characteristics of the electronic thermal overload protection.



Cooling Characteristics of Motor Equipped with a Self-cooling Fan

Applicable motor rating (kW)	Thermal time constant (Factory default)	Switching frequency for motor characteristic factor		Characteristic factor (%)		
		f2	f3	α1	α2	α3
5.5 to 11 kW	5 min	5 Hz	6 Hz	90	95	100
15 kW			7 Hz	85	85	100
18.5, 22 kW			5 Hz	92	100	100
30kW to 45kW	10 min	Base frequency ×33%	Base frequency ×83%	54	85	95
55kW	10min	Base frequency ×33%	Base frequency ×83%	51	95	95

■ Overload detection level (F11)

F11 specifies the level at which the electronic thermal overload protection becomes activated.

- Data setting range: 0.00 (Disable)
  1 to 200% of the rated current (allowable continuous drive current) of the inverter.

In general, set F11 to the allowable continuous drive current of the motor when driven at the rated speed (i.e. 1.0 to 1.1 multiple of the rated current of the motor). To disable the electronic thermal overload protection, set F11 to "0.00."

■ Thermal time constant (F12)

F12 specifies the thermal time constant of the motor. The time constant refers to the time required for the electronic thermal overload protection to detect a motor overload when the current of 150% of the overload detection level specified by F11 has flown continuously.

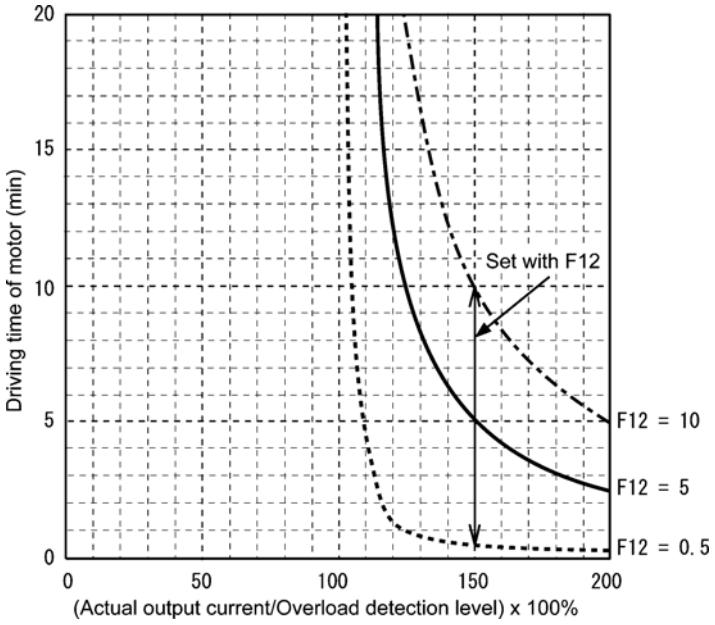
- Data setting range: 0.5 to 75.0 (min)

(Example) When F12 is set at "5.0" (5 minutes)

As shown below, the electronic thermal overload protection is activated to detect an alarm condition (Alarm $\overline{OL}$ 1) when the output current of 150% of the overload detection level (specified by F11) flows for 5 minutes.

The actual activation time required for issuing a motor overload alarm tends to be shorter than the one specified by F12 since it takes into account the time period from when the output current exceeds the rated current (100%) until it reaches 150% of the overload detection level.

Example of Operating Characteristics



F20	**DC Braking(Starting Speed)**
F21	**DC Braking(Operation Level)**
F22	**DC Braking(Operation Time)** **H64(Zero speed control time)**

The starting speed, the operation level, and the operation time of the DC braking are set. The DC braking doesn't operate when using it by the vector control with PG.

■ DC Braking (Starting Speed)(F20)

The starting speed of the DC braking is set.

📖 Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

■ DC Braking (Operation Level)(F21)

Output current that DC braking operates is set.

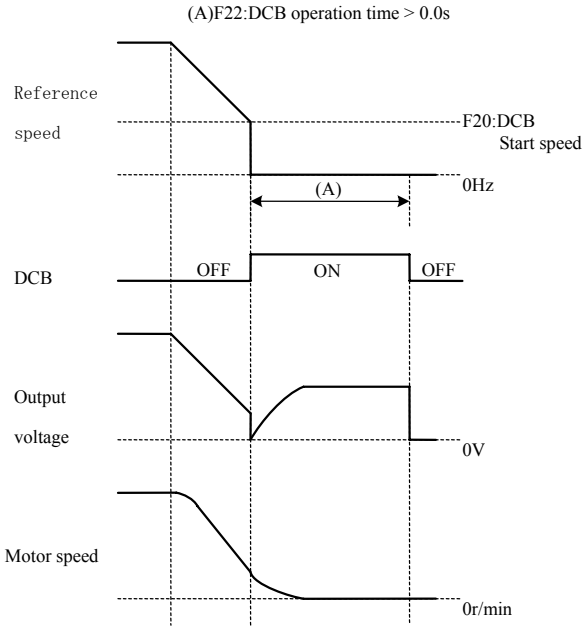
- Data setting range: 0 to 50 (%)

■ DC Braking (Operation Time)(F22)

The operation time of the DC braking is set. The stop speed operation is carried out when set to 0.00s.

- Data setting range: 0.00 to 30.00 (s)

Timing diagram



Note DC braking operates at the stop speed when the stop speed (F25) is more than DCB starting speed (F20).

There are special code of torque vector control.

F23	Starting Speed	H65 (Starting Speed, Soft start time) L52 (Start Control Mode)
F24	Starting Speed (Holding time)	

F23, F24, H65 and L52 specify the starting speed, its holding time, soft start time, and start control mode, respectively, to reduce an impact to the load at the start of running.

■ Starting speed (F23)

F23 specifies the starting speed for the inverter.

- Data setting range: 0.00 to 150.0 (r/min)

📖 Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

■ Holding time (F24)

F24 specifies the holding time of running at the starting speed. Accelerating after running at the starting speed for that duration can reduce an impact to the load at the start of running.

- Data setting range: 0.00 to 10.00 (s)

■ Zero speed control time (H64)

In case of Vector control with PG

After the inverter operates, the time that operates at zero speeds is set. A soft start or the start continuance operates after this function ends. This function doesn't operate when a set value is 0.00s.

In case of Torque Vector control

After the inverter operates, time that the DC braking operates is set. A soft start or the start continuance operates after this function ends. This function doesn't operate when a set value is 0.00s.

- Data setting range: 0.00 to 10.00 (s).

📖 Refer to page 2-2 for the control mode of the inverter.

■ Soft start time (H65)

H65 specifies the period of a soft start operation at the startup of the inverter. The soft start can reduce an impact to the load at the start of running.

- Data setting range: 0.0 to 60.0 (s)

■ Start control mode (L52)

The soft start is available in two start control modes--Speed start and torque start modes. L52 selects either start control mode.

Start control mode (L52)	Multistep speed command *1 (F01 = 0)	Analog speed command (Not reversible) (F01 = 1)	Analog speed command (Reversible) *2 (F01 = 2)
Speed start mode (L52 = 0)	Y	Y	N *4
Torque start mode (L52 = 1)	Y	N *3	N *4

*1 Including keypad command operations and jogging operation

*2 Including commands entered via a communications link

*3 Functionally equivalent to the operation with L52 = 0.

*4 Soft start to the starting speed is disabled.

Note Once the inverter speed decreases to less than the stop speed, increasing the reference speed (pre-ramp) with a run command being ON does not activate a soft start to the starting speed. To soft start the motor up to the starting speed, turn the run command OFF once.

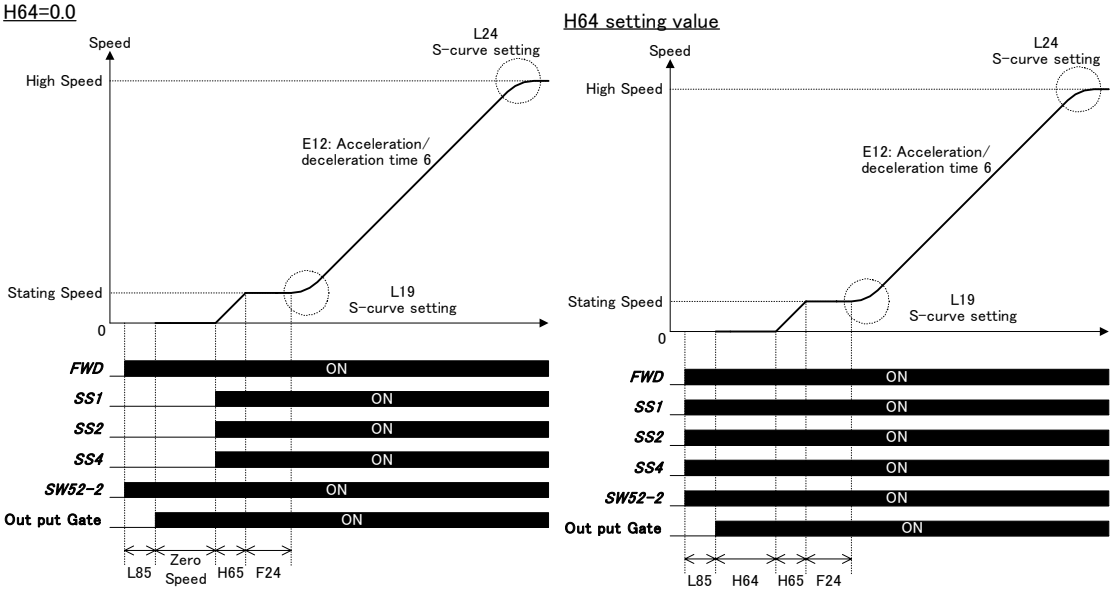
■ In case of Vector control with PG

Speed start mode

Setting L52 data to "0" enables the speed start mode.

(i) When a multistep speed command with S-curve acceleration/deceleration is enabled (F01 = 0)

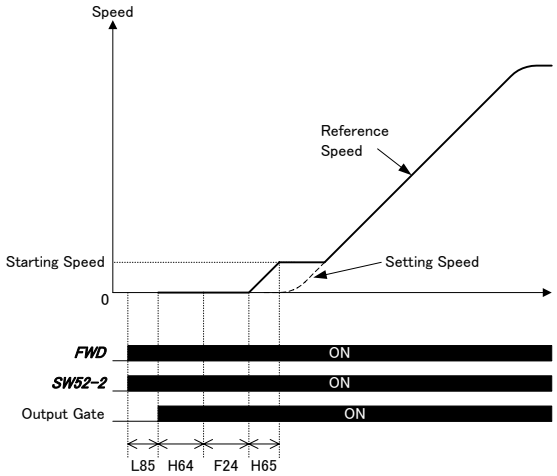
If the reference speed (pre-ramp) exceeds the starting speed, the inverter activates a soft start to the starting speed. After the holding time of running at the starting speed (specified by F24), the inverter accelerates up to the reference speed (pre-ramp).



Note If the stop speed is specified exceeding the starting speed, the inverter does not activate a soft start as long as the reference speed (pre-ramp) does not exceed the stop speed.

(ii) When an analog speed command (Not reversible) is enabled (F01 = 1)

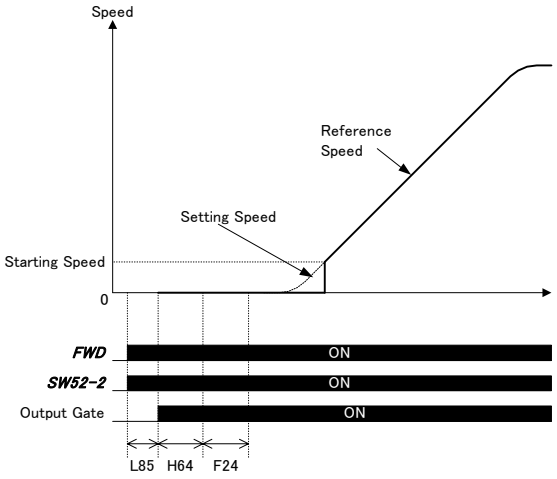
Turning a run command ON activates a soft start. When the speed reaches the starting one, the inverter stands by. When the reference speed (pre-ramp) exceeds the starting speed, the inverter immediately accelerates from the current speed up to the reference speed (pre-ramp).



Note If the stop speed is specified exceeding the starting speed, the inverter does not start acceleration to the reference speed (pre-ramp) as long as the reference speed (pre-ramp) does not exceed the stop speed.

(iii) When an analog speed command (Reversible) is enabled (F01 = 2)

The inverter does not activate a soft start to the starting speed. When the reference speed (pre-ramp) exceeds the starting speed, the inverter starts acceleration to the reference speed (pre-ramp).



Note If the stop speed is specified exceeding the starting speed, the inverter does not start acceleration to the reference speed (pre-ramp) as long as the reference speed (pre-ramp) does not exceed the stop speed.

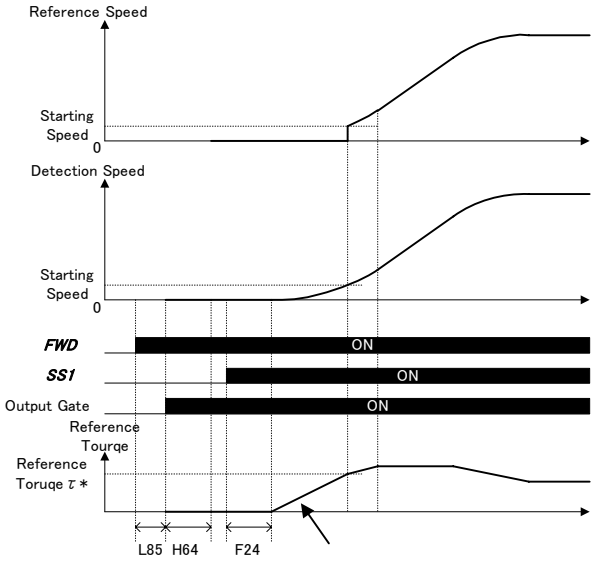
Torque start mode

Setting L52 data to "1" enables the torque start mode.

In this mode, the inverter increases the output voltage to generate torque along the slope specified by the time (F24) in the rotation direction specified by a run command. When the detected speed exceeds the starting speed (F23), the inverter starts the speed control to accelerate smoothly.

When F23 = 0.00, this mode is disabled.

Note In the torque start mode, a PG error may occur or the ***DSAG*** command on the general-purpose output terminal may go OFF depending upon the starting speed setting.

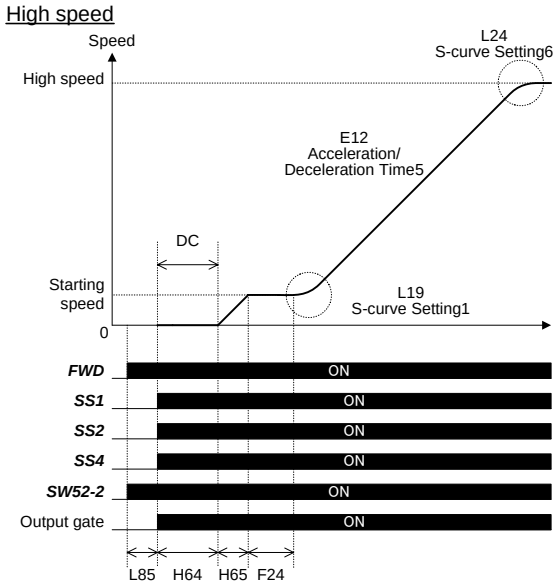


$$\frac{\Delta\tau^*}{\Delta t} = \frac{100}{\text{H65}}\,(\%/\text{s})$$

■ In case of Torque Vector control

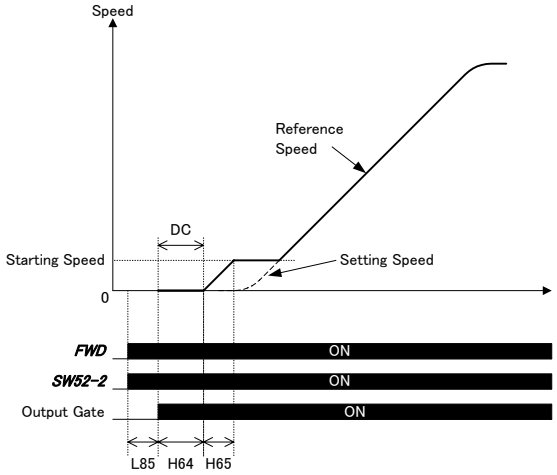
(i) When a multistep speed command with S-curve acceleration/deceleration is enabled (F01 = 0)

If the reference speed (pre-ramp) exceeds the starting speed, the inverter activates the DC braking operation. After the DC braking operation, the inverter activates a soft start to the starting speed. After the holding time of running at the starting speed (specified by F24), the inverter accelerates up to the reference speed (pre-ramp).



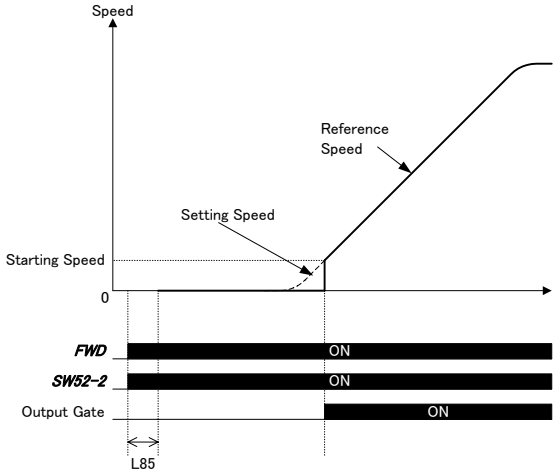
(ii) When an analog speed command (Not reversible) is enabled (F01 = 1)

Turning a run command ON activates the DC braking operation. After the DC braking operation, the inverter activates a soft start to the starting speed. When the speed reaches the starting one, the inverter stands by. When the reference speed (pre-ramp) exceeds the starting speed, the inverter immediately accelerates from the current speed up to the reference speed (pre-ramp).



(iii) When an analog speed command (Reversible) is enabled (F01 = 2)

The inverter does not activate a soft start to the starting speed. When the reference speed (pre-ramp) exceeds the starting speed, the inverter starts acceleration to the reference speed (pre-ramp).



F25	Stop Speed	H66 (Stop Speed, Detection method) H67 (Stop Speed, Holding time)

F25, H66, and H67 specify the stop speed, its detection method, and its holding time, respectively, to reduce an impact to the load at the end of running.

■ Stop speed (F25)

F25 specifies the stop speed for the inverter. If the reference speed (pre-ramp) is specified below the stop speed, it will be regarded as 0.00 (r/min).

- Data setting range: 0.00 to 150.0 (r/min)

📖 Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

■ Detection method (H66)

H66 selects whether to use the detected speed or reference speed (final) for detecting the stop speed.

Data for H66	Function
0	Use detected speed
1	Use reference speed (final)

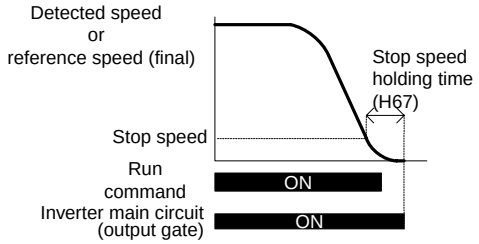
■ Holding time (H67)

H67 specifies the holding time of continuous running after the detection of the stop speed even with a run command being OFF.

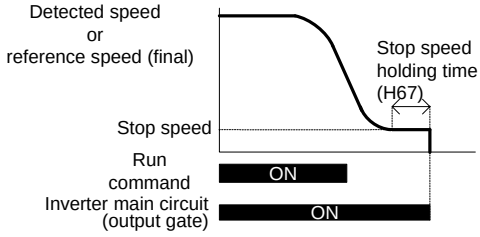
If H67 data is set to 0.00 (s), turning the run command OFF and detecting the stop speed shut down the inverter output.

- Data setting range: 0.00 to 10.00 (s)

In case of Vector control with PG



In case of Torque Vector control



F26 Motor Sound (Carrier frequency) H98 (Protection/Maintenance Function)

F26 controls the carrier frequency so as to reduce an audible noise generated by the motor or inverter itself, and to decrease a leakage current from the main output (secondary) wirings.

Carrier frequency	5 kHz ↔ 16 kHz
Motor sound noise emission	High ↔ Low
Motor temperature (due to harmonics components)	High ↔ Low
Ripples in output current waveform	Large ↔ Small
Leakage current	Low ↔ High
Electromagnetic noise emission	Low ↔ High
Inverter loss	Low ↔ High

Note Specifying a too low carrier frequency will cause the output current waveform to have a large amount of ripples (many harmonics components). As a result, the motor loss increases, causing the motor temperature to rise. Furthermore, the large amount of ripples tends to cause a current limiting alarm.

When a high carrier frequency is specified, the temperature of the inverter may rise due to an ambient temperature rise or an increase of the load. If it happens, the inverter automatically decreases the carrier frequency to prevent the inverter overheat alarm 0H3 or inverter overload alarm 0L1 . With consideration for motor noise, the automatic reduction of carrier frequency can be disabled (see function code H98).

F42 Control Mode

F42 selects the control mode.

Data for F42	Function
0	Vector control with PG for asynchronous motor
1	Vector control with PG for synchronous motor
2	Torque Vector control without PG for asynchronous motor

Refer to page 2-2 for the control mode of the inverter.

F44 Current Limiter (Level)

F44 specifies the activation level of the current limiter.

When the output current of the inverter exceeds the level specified by F44, the current limiter works to manage the output current and reduce the motor torque.

When the output current drops below the level specified by F44, the inverter returns to the normal operation.

- Data setting range: 100 to 230 (%) (Percentage to the rated current of the inverter)
  999 (The maximum current of each inverter automatically applies.)

Note Since the current limit operation with F44 is performed by software, it may cause a delay in control.

Data setting range is different by Software version.

2.3.2 E codes (Extension terminal functions)

E01 to E08	Command Assignment to [X1] to [X8]	E98 and E99 (Command Assignment to [FWD] and [REV])

E01 to E08, E98 and E99 allow you to assign commands to terminals [X1] to [X8], [FWD], and [REV] which are general-purpose, programmable input terminals.

These function codes may also switch the logic system between normal and negative to define how the inverter logic interprets either ON or OFF status of each terminal. The default setting is normal logic system "Active ON." Following table show the commands that can be assigned with the general-purpose programmable input terminals [X1] to [X8], [FWD], and [REV]. Explanations for the commands that follow are given in normal logic system "Active ON."

⚠CAUTION

To the general-purpose programmable input terminals, you can assign commands to the switching means for the run command and its operation, the reference speed (pre-ramp) and the motor drive power.

Be aware of that switching of any of such signals may cause a sudden start (running) or an abrupt change in speed.

An accident or physical injury may result.

Function code data		Terminal commands assigned	Symbol
Active ON	Active OFF		
0	1000	Select multistep speed 1	***SS1***
1	1001	Select multistep speed 2	***SS2***
2	1002	Select multistep speed 4	***SS4***
7	1007	Enable coast-to-stop	***BX***
8	1008	Reset alarm	***RST***
1009	9	Enable external alarm trip	***THR***
10	1010	Enable jogging operation	***JOG***
24	1024	Enable communications link via RS485 or CAN	***LE***
25	1025	Universal DI	***U-DI***
27	1027	Enable PG vector control	***PG/Hz***
60	1060	Select torque bias 1	***TB1***
61	1061	Select torque bias 2	***TB2***
62	1062	Hold torque bias	***H-TB***
63	1063	Enable battery operation	***BATRY***
64	1064	Start creepless operation	***CRPLS***
65	1065	Check brake control	***BRKE***
1066	66	Force to decelerate	***DRS***
67	1067	Start unbalance load compensation	***UNBL***
69	-	Magnetic pole position offset tuning command	***PPT***
98	-	Run forward (Exclusively assigned to [FWD] and [REV] terminals by E98 and E99)	***FWD***
99	-	Run reverse (Exclusively assigned to [FWD] and [REV] terminals by E98 and E99)	***REV***
101	1101	External alarm 2	***THR2***
102	1102	Start reference torque decreasing	***RTDEC***
103	1103	Inverter Output MC confirmation	***CS-MC***

Note Any negative logic (Active OFF) command cannot be assigned to the functions marked with "－" in the "Active OFF" column.

The "Enable external alarm trip" and "Force to decelerate" are fail-safe terminal commands. For example, when data = "9" in "Enable external alarm trip," Active OFF (alarm is triggered when OFF); when data = 1009, "Active ON" (alarm is triggered when ON).

Terminal function assignment and data setting

■ Select multistep speed -- *SS1*, *SS2*, and *SS4* (Function code data = 0, 1, and 2)

The combination of ON/OFF states of digital input signals ***SS1***, ***SS2***, and ***SS4*** selects one of eight different speed commands.

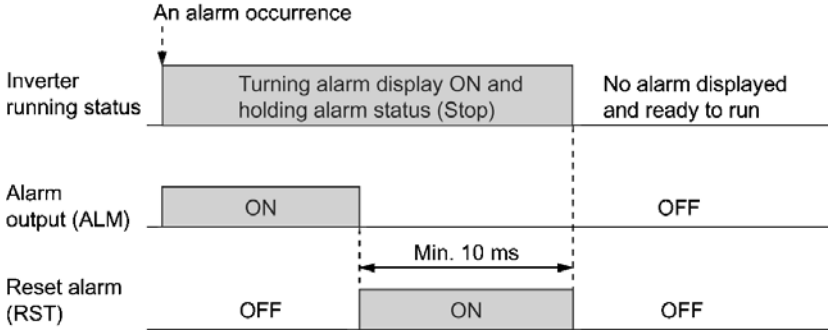
For details, refer to the description of function code F01 (Speed Command).

■ Coast to a stop -- *BX* (Function code data = 7)

Turning this terminal command ON immediately stops the inverter output so that the motor coasts to a stop without issuing any alarm. Turning it OFF restarts the inverter.

■ Reset alarm -- *RST* (Function code data = 8)

Turning this terminal command ON clears the ***ALM*** state--alarm output (for any alarm). Turning it OFF erases the alarm display and clears the alarm hold state. When you turn the ***RST*** command ON, keep it ON for 10 ms or more. This command should be kept OFF for the normal inverter operation.



■ Enable external alarm trip -- *THR* (Function code data = 9)

Turning this terminal command OFF immediately shuts down the inverter output (so that the motor coasts to a stop), displays the alarm "OH2", and outputs the alarm relay (for any alarm) ***ALM***. The ***THR*** is self-held, and is reset when an alarm reset takes place.

Tip Use a trip command from external equipment when you have to immediately shut down the inverter output in the event of an abnormal situation in a peripheral equipment.

■ Enable jogging operation -- *JOG* (Function code data = 10)

Turning this terminal command ON enables jogging operation.

For details, refer to the description of function code C20 (Jogging Speed).

■ Enable communications link via RS485 or CAN -- *LE* (Function code data = 24)

Turning this terminal command ON runs the motor according to the frequency commands or run commands received via the communications link selected with function code H30 (RS485 or CAN).

No ***LE*** assignment is functionally equivalent to the ***LE*** being ON.

For details, refer to the description of function code H30 (Communications Link Operation).

■ **Universal DI -- *U-DI***
(Function code data = 25)

Using ***U-DI*** enables the inverter to monitor digital signals sent from the peripheral equipment via an RS485 or CAN communications link by feeding those signals to the digital input terminals. Signals assigned to the universal DI are simply monitored and do not operate the inverter.


For an access to universal DI via the RS485 or CAN communications link, refer to their respective Instruction Manuals.

■ **Enable PG vector control -- *PG/Hz***
(Function code data = 27)

Turning this terminal command OFF cancels the PG vector control and switches to the V/f control. The ON/OFF switching when the inverter is in operation will not be validated; it will be after the inverter stops. Whenever this terminal command is not assigned, the PG vector control is effective by default. Enabling the torque control (H18 = 1) disables this terminal command.

■ **Torque Bias 1 and 2 -- *TB1* and *TB2***
(Function code data = 60 and 61)

Selecting ***TB1*** or ***TB2*** allows you to set digital torque bias.


For details, refer to the description of function code L54 (Torque Bias, Mode).

■ **Hold torque bias -- *H-TB***
(Function code data = 62)

Turning this terminal command ON holds torque bias setting. Turning it OFF release the hold status.


For details, refer to the description of function code L55 (Torque Bias, Startup time).

■ **Enable battery operation -- *BATRY***
(Function code data = 63)

Turning this terminal command ON selects operation by batteries.


For details, refer to the description of function code C03 (Battery Operation Speed).

■ **Start creepless operation -- *CRPLS***
(Function code data = 64)

Turning this terminal command ON starts creepless operation.


For details, refer to the description of function code L34 (Elevator Parameter, Moving distance in creepless operation).

■ **Check brake control -- *BRKE***
(Function code data = 65)

This terminal command is used to check whether or not the actual brake is working normally, using the ***BRKS*** output from the inverter. Configure an external circuit that turns this command ON or OFF when the brake is released or activated, respectively.

For details, refer to the descriptions of function codes L80 to L84 (Brake Control).

■ **Force to decelerate -- *DRS***
(Function code data = 66)

In normal inverter operation, this terminal command should be ON. If this terminal command is OFF, the motor will be forced to decelerate with deceleration time specified by function code H56.


For details, refer to the description of function code H56 (Deceleration Time for Forced to Decelerate).

■ **Start unbalance load compensation -- *UNBL***
(Function code data = 67)

Turning this terminal command ON starts unbalance load compensation. Synchronize brake control signal from the user controller. When this terminal command is OFF, unbalance load compensation will be started after run command is ON.

📖 For details, refer to the descriptions of function codes L65 to L69 (Unbalanced Load Compensation).

■ **Magnetic pole position offset tuning command -- *PPT***
(Function code data = 69)

PPT is a function for the ABZ encoder. The ABZ encoder doesn't have angle information.
The motor cannot be driven because there is no means to know the magnetic pole position at this time

In case of L99 bit1 = 0
When magnetic pole position offset tuning is done, magnetic pole position offset value (L04) is not changed.

In case of L99 bit1 = 1
When magnetic pole position offset tuning is done, magnetic pole position offset value (L04) is changed. At this time, it is necessary to rotate the motor.more than one rotation.

You should carry out the tuning with L99 bit=1 when you begin to use the motor or chang the encoder. After the trial run ends, the setting of L99 bit1 = 0 is recommended.

📖 For details, refer to the descriptions of function codes L99.

■ **External alarm 2 -- *THR2***

(Function code data = 101)

Before the alarm will happen, if inverter keeps driving for ten seconds. When the inverter shut down the output within ten seconds, alarm will happen.

📖 For details, refer to the descriptions of function codes L99

■ **Start reference torque decreasing -- *RTDEC***

(Function code data = 102)

The inverter decreases reference torque to initial torque bias, when turning RTDEC command OFF.

📖 For details, refer to the descriptions of function codes L99.

■ **Output MC confirmation -- *CS-MC***

(Function code data = 103)

The operation of output Magnetic contactor can be confirmed by SW52-2.

📖 For details, refer to the descriptions of function codes L85 to L86.

Tip

( ) above **No.1000** are logical inversion signals.(active OFF), except the followings.
THR 1009:active ON, 9 :active OFF
DRS 1066:active ON, 66 :active OFF
THR2 1101:active ON, 101 :active OFF

E10 to E17	Acceleration/Deceleration Time 3 to 10	F07 and F08 (Acceleration/Deceleration Time 1 and 2)

E10 to E17 specify the acceleration or deceleration time in linear acceleration/deceleration zones excluding S-curve zones.

📖 For details, refer to the descriptions of function codes F07 to F08 (Acceleration/Deceleration Time 1, 2).

E18	Run Command/Multistep Speed Command Agreement Timer (Mode)
E19	Run Command/Multistep Speed Command Agreement Timer (Time)

E18 and E19 set the run command/multistep speed command agreement timer for eliminating chattering.

■ Mode (E18)

E18 specifies applicable commands for the agreement timer.

Data for E18	Applicable commands	
	FWD, ***REV***	***SS1***, ***SS2***, ***SS4***
0	--	--
1	√	--
2	--	√
3	√	√

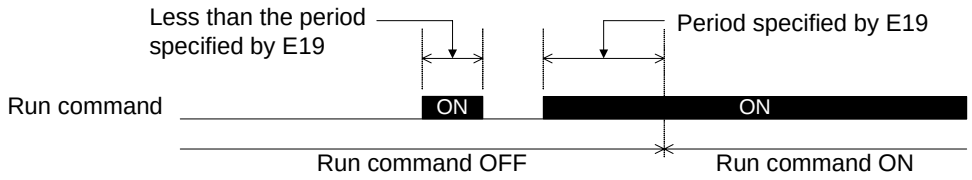
■ Time (E19)

E19 specifies the period to confirm whether the terminal command ***FWD***/***REV*** or ***SS1***/***SS2***/***SS4*** is kept ON or OFF after the command is switched on or off. If the command is kept ON during the specified period, for example, the inverter recognizes the command being ON.

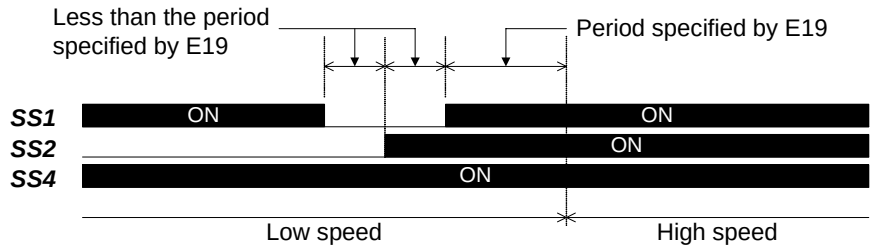
- Data setting range: 0.000 to 0.100 (s)

Application of the agreement timer

- Confirmation for run command



- Confirmation for multistep speed command



E20 to E23 E24, E27	**Signal Assignment to [Y1] to [Y4] (Transistor signal)** **Signal Assignment to [Y5A/C] and [30A/B/C] (Relay contact signal)**

E20 to E24 and E27 assign output signals (listed on the next page) to general-purpose, programmable output terminals [Y1] through [Y4], [Y5A/C], and [30A/B/C]. These function codes can also switch the logic system between normal and negative to define the property of those output terminals so that the inverter logic can interpret either the ON or OFF status of each terminal as active. The factory default settings are "Active ON."

Terminals [Y1] through [Y4] are transistor outputs and terminals, [Y5A/C] and [30A/B/C] are relay contact outputs. In normal logic, if an alarm occurs, the relay will be energized so that [30A] and [30C] will be closed, and [30B] and [30C] opened. In negative logic, the relay will be deenergized so that [30A] and [30C] will be opened, and [30B] and [30C] closed. This may be useful for the implementation of failsafe power systems.

Note

- When a negative logic is employed, all output signals are active (e.g. an alarm would be recognized) while the inverter is powered OFF. To avoid causing system malfunctions by this, interlock these signals to keep them ON using an external power source. Furthermore, the validity of these output signals is not guaranteed for approximately 3 seconds after power-on, so introduce such a mechanism that masks them during the transient period.
- Terminals [Y5A/C] and [30A/B/C]) use mechanical contacts that cannot stand frequent ON/OFF switching. Where a frequent ON/OFF switching is anticipated, use transistor outputs [Y1] through [Y4]. The service life of a relay is approximately 200,000 times if it is switched on and off at one-second intervals.

The table on the following page lists functions that can be assigned to terminals [Y1] through [Y4], [Y5A/C], and [30A/B/C].

To make the explanation simpler, the examples shown below are all written for the normal logic (Active ON).

Function code data		Functions assigned	Symbol
Active ON	Active OFF		
0	1000	Inverter running	***RUN***
1	1001	Speed arrival	***FAR***
2	1002	Speed detected	***FDT***
3	1003	Undervoltage detected	***LU***
10	1010	Inverter ready to run	***RDY***
12	1012	MC control	***SW52-2***
25	1025	Cooling fan in operation	***FAN***
26	1026	Auto-resetting	***TRY***
27	1027	Universal DO	***U-DO***
28	1028	Overheat early warning	***OH***
30	1030	Service life alarm	***LIFE***
35	1035	Inverter output on	***RUN2***
37	1037	Current detected	***ID***
38	1038	Current detected 2	***ID2***
55	1055	Run command activated	***AX2***
56	1056	Motor overheat detected (PTC)	***THM***
57	1057	Brake control	***BRKS***
70	1070	Speed existence	***DNZS***
71	1071	Speed agreement	***DSAG***
72	1072	Speed arrival 3	***FAR3***
73	1073	During acceleration	***DACC***
74	1074	During deceleration	***DDEC***
75	1075	During zero speed	***DZR***
76	1076	PG abnormal	***PG-ABN***
78	1078	Door control	***DOPEN***
99	1099	Alarm output (for any alarm)	***ALM***
101	1101	EN detection circuit fault	***DECF***
102	1102	EN terminal off	***ENOFF***
104	1104	Low voltage detected	***LVD***
105	1105	Electric angle cycle	***EAC***
107	1107	Magnetic pole position offset tuning	***DTUNE***
109	1109	Recommended running direction in battery operation	***RRD***
110	1110	Drive continuance alarm	***ALM2***
111	1111	Shutdown confirmation	***SD***
112	1112	Input power limitation	***IPL***

■ **Inverter running -- *RUN***
(Function code data = 0)

This output signal is used to tell the external equipment whether the inverter is running. Turning the inverter main circuit (output gate) ON or OFF switches the ***RUN*** signal ON or OFF, respectively. This signal is also OFF when the motor is being tuned.

If this signal is assigned in negative logic (Active OFF), it can be used as a signal indicating "inverter being stopped."

■ **Speed arrival -- *FAR***
(Function code data = 1)

This output signal comes ON when the difference between the detected speed and reference speed (pre-ramp) comes within the allowable error zone (specified by E30).

When the run command for the inverter is OFF, this output signal also comes OFF.

For details, refer to the description of function code E30 (Speed Arrival).

■ **Speed detected -- *FDT***
(Function code data = 2)

This output signal comes ON when the detected speed exceeds the speed detection level specified by E31, and it goes OFF when the detected speed drops below the "Detection level (E31) - Hysteresis band width (E32)." This output signal is not affected by a run command.

For details, refer to the description of function codes E31 and E32 (Speed Detection).

■ **Undervoltage detected -- *LU***
(Function code data = 3)

This output signal comes ON when the DC link bus voltage of the inverter drops below the specified undervoltage level, and it goes OFF when the voltage exceeds the level.

This signal is ON also when the undervoltage protective function is activated so that the motor is in an abnormal stop state (e.g., tripped).

■ **Inverter ready to run -- *RDY***
(Function code data = 10)

This output signal comes ON when the inverter becomes ready to run by satisfying all of the following conditions.

- Terminal [EN] ON
- ***BX*** OFF
- No alarm detected
- DC link bus voltage higher than the specified undervoltage level
- Initialization of options completed

Note that the entry of a ***BATRY*** command always turns the ***RDY*** signal OFF.

■ **MC control -- *SW52-2***
(Function code data = 12)

This output signal is used for MC control.

For details, refer to the descriptions of function codes L85 and L86 (MC Control).

■ **Cooling fan in operation -- *FAN***
(Function code data = 25)

This output signal is ON when the cooling fan is in operation, and OFF when it is stopped. This signal can be used to make the cooling system of peripheral equipment interlocked for an ON/OFF control.

■ Auto-resetting -- *TRY* (Function code data = 26)

This output signal comes ON when auto-resetting is in progress.

📖 The auto-resetting is specified by H04 and H05. Refer to the descriptions of function codes H04 and H05 for details about the number of resetting times and reset interval.

■ Universal DO -- *U-DO* (Function code data = 27)

Assigning this output signal to an inverter's output terminal and connecting the terminal to a digital input terminal of peripheral equipment via the communications link RS485 or CAN, allows the inverter to send commands to the peripheral equipment.

The universal DO can be used as an output signal independent of the inverter operation.

📖 For the procedure for access to Universal DO via the communications link RS485 or CAN, refer to the respective instruction manual.

■ Overheat early warning -- *OH* (Function code data = 28)

This output signal issues an overheat early warning before an overheat trip actually occurs due to the temperature on the inverter's heat sink (OH1) or inside the inverter (OH3) or due to an inverter overload (OLU).

If this signal is turned ON, take any appropriate measures such as stop of the inverter operation and enhancement of external cooling.

📖 For details, refer to the description of L93 (Overheat Early Warning Level).

■ Service life alarm -- *LIFE* (Function code data = 30)

This output signal comes ON when it is judged that the service life of any capacitors (reservoir capacitor in the DC link bus and electrolytic capacitors on the printed circuit boards) and cooling fan has expired.

This signal should be used as a guide for replacement of the capacitors and cooling fan. If this signal comes ON, use the specified maintenance procedure to check the service life of these parts and determine whether the parts should be replaced or not.

📖 For details, refer to the FRENIC-Lift Instruction Manual (INR-SI47-1038-E), Section 7.3, Table 7.3 "Criteria for Issuing a Lifetime Alarm."

■ Inverter output on -- *RUN2* (Function code data = 35)

This output signal comes ON when the inverter turns on its main circuit (output gate).

It also comes ON when the motor is being tuned.

■ Current detected and Current detected 2 -- *ID* and *ID2* (Function code data = 37 and 38)

The ***ID*** or ***ID2*** signal comes ON when the output current of the inverter exceeds the level specified by E34 or E37 (Current Detection, Level) for the time longer than the one specified by E35 (Current Detection, Time), provided that "37" or "38" is assigned to any general-purpose input terminal, respectively. The minimum ON-duration is 100 ms.

It goes OFF when the output current drops below 90% of the rated operation level.

📖 For details, refer to the descriptions of function codes E34, E35 and E37.

■ Run command activated -- *AX2* (Function code data = 55)

This output signal comes ON by satisfying all of the following conditions.

- Run command ON
- ***LU*** is OFF
- No alarm (***ALM*** is OFF)

This output signal comes OFF by satisfying either of the following conditions.

- Run command OFF
- ***LU*** is ON
- Alarm (***ALM*** is ON)

■ Motor overheat detected (PTC) -- *THM* (Function code data = 56)

This output signal indicates that a temperature alarm condition has been detected by a PTC (Positive Temperature Coefficient) thermistor on the motor.

With this output signal assigned, setting function code H26 (PTC Thermistor) to "2" enables the inverter to continue running instead of stopping with the alarm 0H4 even if a temperature alarm condition has been detected.

For details of the PTC thermistor, refer to the descriptions of function codes H26 and H27 (PTC Thermistor, Mode and Level).

■ Brake control -- *BRKS* (Function code data = 57)

This signal outputs a brake control command.

For details, refer to the descriptions of function codes L80 to L84 (Brake Control).

■ Speed existence -- *DNZS* (Function code data = 70)

This output signal comes ON when the detected speed is equal to or higher than the stop speed. It is not affected by any run command to the inverter.

■ Speed agreement -- *DSAG* (Function code data = 71)

This output signal comes ON when the difference between reference speed (final) and detected speed is within the range specified by H74 and it goes OFF when the difference is out of the allowable band for the time longer than the one specified by H75. It is not affected by any run command to the inverter.

For details, refer to the description of function codes H74 and H75 (Speed Agreement).

■ Speed arrival 3 -- *FAR3* (Function code data = 72)

This output signal comes ON when the difference between the detected speed and reference speed (pre-ramp) comes within the allowable error zone (specified by E30).

It is not affected by any run command to the inverter.

For details, refer to the description of function code E30 (Speed Arrival).

■ During acceleration and During deceleration -- *DACC* and *DDEC* (Function code data = 73 and 74)

The output signal ***DACC*** or ***DDEC*** come ON depending on whether the motor is accelerating or decelerating by comparing the reference speed (pre-ramp) with the detected speed. These output signals are not affected by any run command to the inverter.

For details, refer to the description of function code E30 (Speed Arrival).

■ **During zero speed -- *DZR***
(Function code data = 75)

This output signal comes ON when the main circuit (output gate) of the inverter is ON and the detected speed is lower than the stop speed specified by function code F25.

■ **PG abnormal -- *PG-ABN***
(Function code data = 76)

This output signal comes ON when any PG error is detected.

📖 For details, refer to the description of function codes L90 to L92 (PG Error Detection).

■ **Door control -- *DOPEN***
(Function code data = 78)

This output signal controls the elevator door.

📖 For details, refer to the description of function codes L87 to L89 (Door Control).

■ **Alarm output (for any alarm) -- *ALM***
(Function code data = 99)

This output signal comes ON when any alarms occur.

■ **EN detection circuit fault -- *DECF***
(Function code data = 101)

This output signal comes ON when the [EN] status detection circuit is defective. It can be outputted separately from the relay alarm output.

■ **EN terminal off -- *ENOFF***
(Function code data = 102)

This is a status output signal that comes ON when the [EN] terminal is not available. It goes OFF when the output signal ***DECF*** is ON.

■ **Low voltage detected -- *LVD***
(Function code data = 104)

This output signal comes ON when a low voltage is detected.

■ **Electric angle cycle -- *EAC***
(Function code data = 105)

When Magnetic pole position offset value of a synchronous motor is set by manual tuning.ower, ***EAC*** is used. If $90^\circ \leqq$ electric angle $\theta < 270^\circ$, ***EAC*** is ON.

■ **Magnetic pole position offset tuning -- *DTUNE***
(Function code data = 107)

DTUNE is turned ON while Magnetic pole position offset tuning is operating. The end of the magnetic pole position tuning done by ***PPT*** can be confirmed.

■ **Recommended running direction at battery operation -- *RRD***
(Function code data = 109)

The inverter recommends the direction that should operate during the battery operation by using digital outputs ***RRD***.
RRD indicates the direction of the braking operation. These signals are saved when the power supply to the inverter is shut off, and keep until the next operation begins.

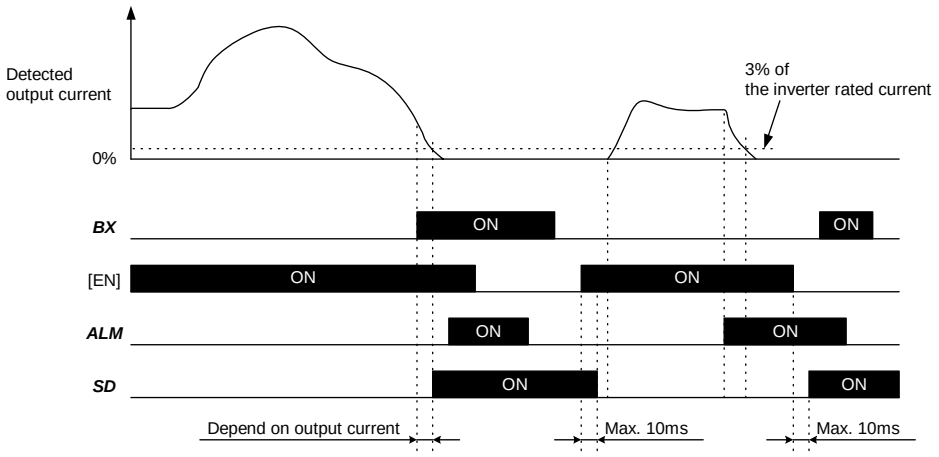
■ Drive continuance alarm -- *ALM2* (Function code data = 110)

When some special alarm happens, the inverter keeps driving the motor for ten seconds. At the same time, drive continuance alarm comes ON. Moreover, the drive continuance alarm keeps the same condition without resetting.

■ Shutdown confirmation -- *SD* (Function code data = 111)

Shutdown confirmation comes ON when the output current of the inverter equals the 3% of the inverter rated current by satisfying following condition.

- Terminal [EN] OFF
- ***BX*** ON



■ Input power limitation -- *IPL* (Function code data = 112)

At the battery operation when the input power has exceeded the level specified C01 and the input power continues longer than the period specified by C02 (Limit time) the inverter stops automatically and *IPL* comes ON. It turns OFF when FWD or REV command turns OFF.

For details, refer to the descriptions of function codes C01 to C02.

Note ( ) above **No.1000** are logical inversion signals.(active OFF),

E30	Speed Arrival (Hysteresis)	H75 (Speed Agreement, Delay time)

E30 specifies the detection range of the speed arrival signal.

- Data setting range: 0.00 to 3600 (r/min)

Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

■ Output signals "Speed arrival *FAR*", "Speed arrival 3 *FAR3*", "During acceleration *DACC*" and "During deceleration *DDEC*"

The output signal ***FAR*** can be assigned to a general-purpose, programmable output terminal by setting "1" (E20 to E24 and E27). The ***FAR*** comes ON when the detected speed against the reference speed (pre-ramp) is within the specified range. However, if the run command is OFF or the reference speed (pre-ramp) is less than 0.00 (r/min) (less than the stop speed), it will not come ON.

The output signal ***FAR3*** can be also assigned by setting "72." The ***FAR3*** comes ON when the detected speed against the reference speed (pre-ramp) is within the specified range. This output signal is not affected by any run command.

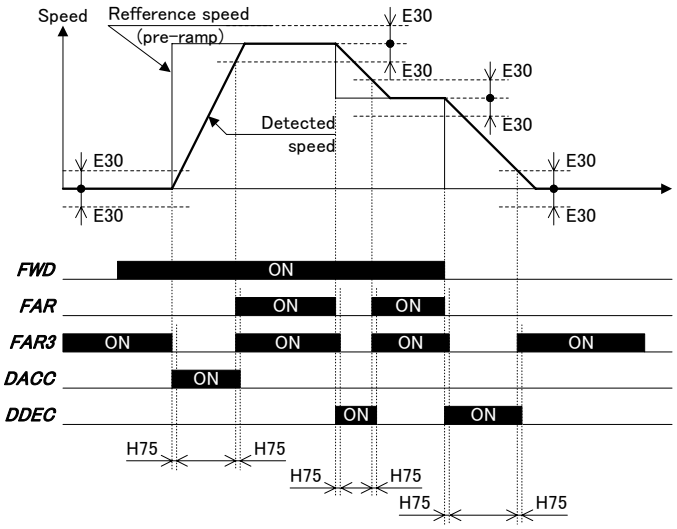
The output signals ***DACC*** and ***DDEC*** can be also assigned by setting "73" and "74," respectively. The ***DACC*** or ***DDEC*** comes ON depending on whether the motor is accelerating or decelerating by comparing the reference speed (pre-ramp) with the detected speed. These output signals during accelerating and decelerating are turned OFF according to the level of the speed arrival hysteresis specified by E30.

When the inverter is under torque control, none of these output signals ***FAR***, ***FAR3***, ***DACC*** and ***DDEC*** comes ON.

Tip When the output signals ***FAR***, ***DACC*** and ***DDEC*** are assigned, the ON-to-OFF delay time can be specified by function code H75 in order to prevent chattering. H75 can be used for the output signal ***DSAG***.

Note When the torque vector control is selected reference speed (final) is used instead of detection speed.

Following is a timing chart for these output signals.



E31	Speed Detection (FDT) (Detection level)
E32	Speed Detection (FDT) (Hysteresis)

E31 and E32 specify the speed detection level and hysteresis band width for the output signal ***FDT*** assigned to a general-purpose programmable output terminal by any of E20 to E24 and E27.

■ Speed detection level (E31)

The output signal ***FDT*** is turned ON when the detected speed has exceeded the speed detection level specified by E31.

- Data setting range: 0.00 to 3600 (r/min)

Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

■ Speed detection hysteresis (E32)

The ***FDT*** is turned OFF when the detected speed has lowered below the "Detection level (E31) - Hysteresis band width (E32)."

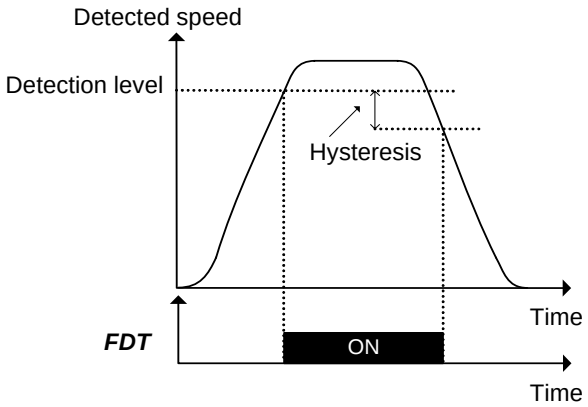
- Data setting range: 0.00 to 900 (r/min)

Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

■ Speed detection

Setting any of E20 to E24 and E27 data to "2" assigns the output signal ***FDT*** to the specified general-purpose, programmable output terminal. The ***FDT*** comes ON when the detected speed has exceeded the speed detection level (E31). It goes OFF when the detected speed has lowered below the "Detection level (E31) - Hysteresis band width (E32).

Note Reference speed is used for detection speed to change when the torque vector is control is used.



E34	Current Detection 1 (Level 1)
E35	Current Detection 1 (Time)
E37	Current Detection 2 (Level 2)

Function code E34, E35 and E37 specify current detection level and timer.

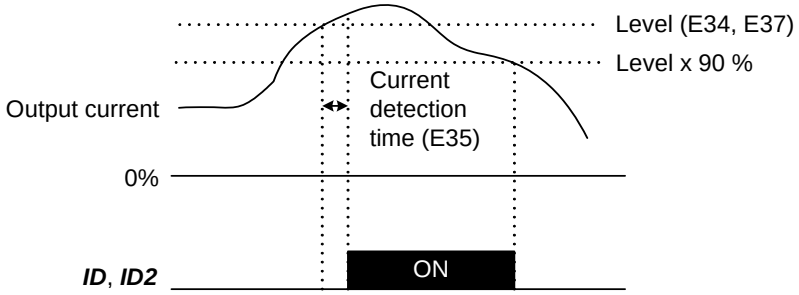
- Data setting range (E34 and E37): Current value of 1 to 200% of the inverter rated current in units of amperes. (0.00: disable)
- Data setting range (E35): 0.01 to 600.00 (s)

E34, E35 are set for over torque current detection (OL) when setting L98 bit 0 with 1.

For details, refer to the description of function codes L98.

■ Current detection

Setting any of E20 to E24 and E27 data to "37" or "38" assigns the output signal "Current detected 1, ***ID***" or "Current detected 2, ***ID2***" to the general-purpose programmable input terminals respectively. The ***ID*** or ***ID2*** comes ON when the output current of the inverter has exceeded the level specified (by E34 for ***ID*** or by E37 for ***ID2***) and the output current continues longer than the period specified by E35 (Current detection time). It turns OFF when the output current drops below 90% of the rated operation level. (Minimum width of the output signal: 100 ms)



E39	RRD Detection Level

The detection level of the recommended running direction at battery operation is set.

- Data setting range: 0 to 100 (%) (operation level)

■ Judgment of recommended running direction

When the weight variation between car and counter weight is small it might be impossible to detect correct direction because of the low efficiency gear that is like worm gear. In this case, please set this level to detect ***RRD*** correctly.

Tip Please follow the following procedure.

a) With balance load, run the elevator up and observe the torque command at the constant speed.

b) Run the elevator down and observe the torque command at constant speed with same condition.

c) Please set larger torque commnd to E39.

E43 LED Monitor (Item selection) E48 (LED Monitor, Speed monitor item)

E43 specifies the monitoring item to be displayed on the LED monitor.

■ LED monitor (Item selection) (E43)

Data for E43	Function (Item to be displayed)	Description
0	Speed monitor	Selected by the sub item of function code E48
3	Output current	Inverter output current expressed in RMS (A)
4	Output voltage	Inverter output voltage expressed in RMS (V)
8	Calculated torque	Reference torque (%) based on the motor rated torque *1
9	Input power	Inverter's input power (kW)
18	Reference torque	Reference torque (%) based on the motor rated torque
19	Torque bias balance adjustment (Offset) (BTBB) *2	For adjustment of analog torque bias
20	Torque bias gain adjustment (BTBG) *2	

*1 In vector control with PG, this item shows the reference torque.

*2 For the multi-function keypad with ROM version 8510, press the FUNC/DATA key in Running mode and switch to monitor page 14 or 15 for BTBB or BTBG, respectively.

Specifying the speed monitor (E43 = 0) provides a choice of speed monitor items specified with E48 (LED Monitor, Speed monitor item).

Define the speed-monitoring format on the LED monitor as listed below.

■ LED monitor (Speed monitor item) (E48)

Data for E48	Display format of the sub item	
0	Reference speed (final)	Expressed in units selected by C21
2	Reference speed (pre-ramp)	Expressed in units selected by C21
3	Motor speed	Expressed in r/min
5	Elevator speed	Expressed in m/min

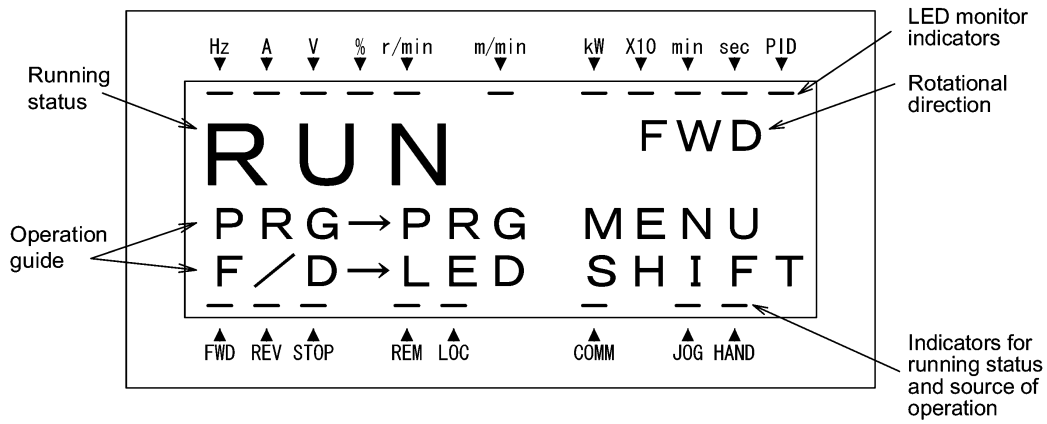
* For the display format on the LED monitor, refer to the Multi-function Keypad Instruction Manual (INR-SI47-1092-E), Chapter 3, Section 3.3.3, Table 3.4 "Monitor Items."

E45 LCD Monitor (Display mode)

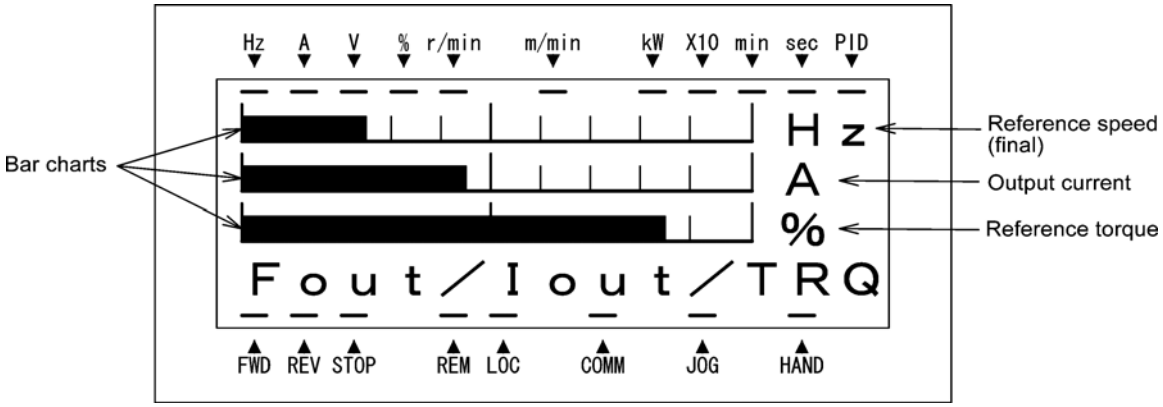
E45 specifies the LCD monitor display mode to be applied when the inverter using the multi-function keypad is in Running mode.

Data for E45	Function
0	Running status, rotational direction and operation guide
1	Bar charts for reference speed (final), output current and reference torque

Example of display for E45 = 0 (during running)



Example of display for E45 = 1 (during running)



Full-scale values on bar charts

Item displayed	Full scale
Reference speed (final)	Maximum speed (F03)
Output current	Inverter rated current × 200%
Reference torque	Motor rated torque × 200%

E46 LCD Monitor (Language selection)

E46 specifies the language to display on the multi-function keypad as follows:

Data for E46	Language
0	Chinese
1	English
2	Japanese
3	German
4	French
5	Spanish
6	Italian

Note If the langue for touch panel which connect with inverter is not belong to above range, English will be indicated.

E47	LCD Monitor (Contrast control)

Adjusts the contrast of the LCD monitor on the multi-function keypad as follows:

Data for E47	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Contrast	Low ⟷ High

E48	LED Monitor (Speed monitor item)	E43 (LED Monitor, Item selection)

E48 specifies speed mode to be displayed on the LED speed monitor when the speed monitor is selected by E43.

For details, refer to the description of function code E43.

E61	**Analog Input for [12] (Extension function selection)** **C31 (Analog Input Adjustment for [12], Offset)** **C32 (Analog Input Adjustment for [12], Gain)** **C33 (Analog Input Adjustment for [12], Filter time constant)**
E62	**Analog Input for [C1] (Extension function selection)** **C36 (Analog Input Adjustment for [C1], Offset)** **C37 (Analog Input Adjustment for [C1], Gain)** **C38 (Analog Input Adjustment for [C1], Filter time constant)**
E63	**Analog Input for [V2] (Extension function selection)** **C41 (Analog Input Adjustment for [V2], Offset)** **C42 (Analog Input Adjustment for [V2], Gain)** **C43 (Analog Input Adjustment for [V2], Filter time constant)**

E61, E62, and E63 define the functions of terminals [12], [C1], and [V2], respectively.
Terminals [12] and [V2] are voltage input terminals, and terminal [C1] is the current input terminal.

Data for E61, E62, or E63	Input assigned to [12], [C1] and [V2]	Description
0	None	--
1	Speed command (Not reversible operation without polarity)	Input an analog speed command to terminal [12] or [V2] by 0 to 10 VDC, and [C1] by 4 to 20 mADC for 0 to 100% of the maximum speed.
2	Speed command (Reversible operation with polarity)	Input an analog speed command to terminal [12] or [V2] by -10 to 10 VDC for -100 to 100% of the maximum speed. Do not assign this data for the terminal [C1].
3	Torque current command	Input an analog rated torque current command to terminal [12] or [V2] by -10 to 10 VDC for -400 to 400% of the inverter rated current. Input an analog rated torque current command to terminal [C1] by 4 to 20 mADC for 0 to 400% of the inverter rated current.
4	Torque bias command	Input an analog torque bias to terminal [12] or [V2] by -10 to 10 VDC for -100 to 100% of the rated torque in analog command value. Input an analog torque bias to terminal [C1] by 4 to 20 mADC for 0 to 100% of the rated torque in analog command value.

Refer to the descriptions of function codes F01, H18 and L54 for analog speed commands, torque current command and analog torque bias, respectively. Offset, gain, and filter time constant can be specified for individual terminals by function codes C31 to C33, C36 to C38 and C41 to C43.

Note If these terminals have been set up by function codes to have the same data, the specified values will be added up.

The terminal [V2] is shared with the PTC thermistor input specified by function code H26. It will be defined as a terminal with "no input assignment" (E63 = 0) when the function code data H26 ≠ 0.

E98	**Command Assignment to [FWD]** **E01 to E08 (Command Assignment to [X1] to [X8])**
E99	**Command Assignment to [REV]** **E01 to E08 (Command Assignment to [X1] to [X8])**

Function codes E98 and E99 specify functions to assign to terminals [FWD] and [REV].

For details, refer to the descriptions of function codes E01 to E08 (Command Assignment to [X1] to [X8]).

2.3.3 C codes (Control functions)

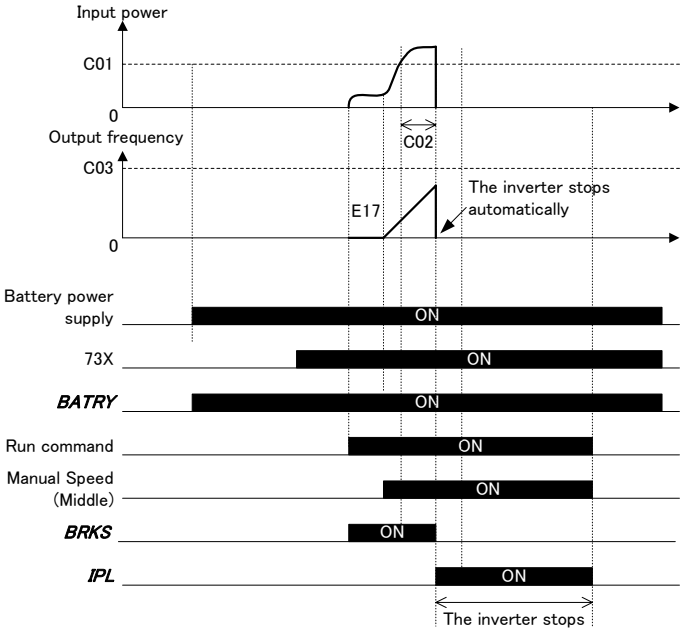
C01	**Battery Operation (Limit level)**
C02	**Battery Operation (Limit time)**

C01 and C02 specify the input power limitation level and detection time for battery operation.

- Data setting range(C01): 0 to 100 (%) (The meaning of 100% is 10kW)
  999 (no operation)
- Data setting range(C02): 0.0 to 30.0 (s)

■ Input power limitation

When the input power has exceeded the level specified C01 and the input power continues longer than the period specified by C02 (Limit time) the inverter stops automatically and ***IPL*** comes ON. It turns OFF when FWD or REV command turns OFF.



Note This function is available only for open loop control.

C03	Battery Operation Speed

C03 specifies the battery operation speed that applies when the manual speed (middle) defined by C05 is selected.

- Data setting range: 0.00 to 3600 (r/min)

📖 Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

■ Battery operation

The battery operation enables the undervoltage inverter to run the elevator with a battery for moving the cage to the nearest floor. It rescues the passengers from the cage stopped halfway due to a power failure.

■ Requirements for battery operation

(1) The ***BATRY*** (data = 63) is assigned to any digital input terminal.

(2) A DC voltage is supplied from the battery to the main circuit (R-T or S-T). The voltage level differs depending upon the operation speed and load.

(3) A regulated voltage is supplied to the auxiliary power supply (R0-T0).

(4) The ***BATRY*** is turned on.

■ **Specifications**

(1) The undervoltage protective function (LL) is deactivated.

(2) The inverter can run the elevator even in the undervoltage state.

(3) The ***RDY*** ("Inverter ready to run" signal) is forced to go OFF.

(4) The close of charging resistor delays from ***BATRY*** ON delayed for certain, the MC in the secondary circuit will turn ON with a start control delay of 0.1 (s).

The closes of changing register delay time from ***BATRY***

200V serise	22kW or less	-
400V serise	30kW or less	37kW or more
Re-power ON after the control power supply is turned off, it starts.	100ms	500ms
Mainta cunrertion on power supply.	205ms	

(5) During the battery operation, selecting manual speed (middle) defined by C05 (if the L11 through L18 defaults are retained, ***SS1***=ON, ***SS2***=OFF and ***SS4***=OFF) runs the elevator at the speed specified by C03.

When the inverter runs by analog speed command, selecting the manual speed (middle) via general-purpose digital input terminals also runs the elevator at the speed specified by C03.

When the multistep speed other than the manual speed (middle) is selected or in torque control, the inverter runs the elevator at the speed specified by the corresponding function code.

(6) In battery operation, the acceleration/deceleration time specified by E17 applies. The S-curve acceleration/deceleration is disabled.

When the inverter runs by analog speed command in battery operation, the acceleration and deceleration times specified by E10 and E11 apply, respectively.

(7) The battery operation speed should be calculated by the following formula, based on the battery voltage. The battery voltage should be 48 V (200V inverter operating on DC:24V) or above.

$$\text{Reference speed (pre - ramp) during battery operation} \leq \frac{\text{Batter voltage} - 5[V]}{\sqrt{2} \times \text{Rated voltage}} \times \text{Rated speed} \times \text{ k}$$

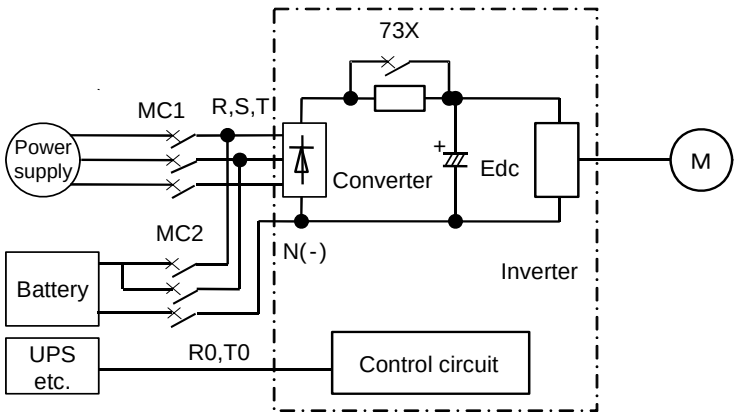
Reference speed (pre-ramp) during battery operation :
C03 in the multistep speed operation (when the manual speed (middle) is selected)

Rated speed : F04

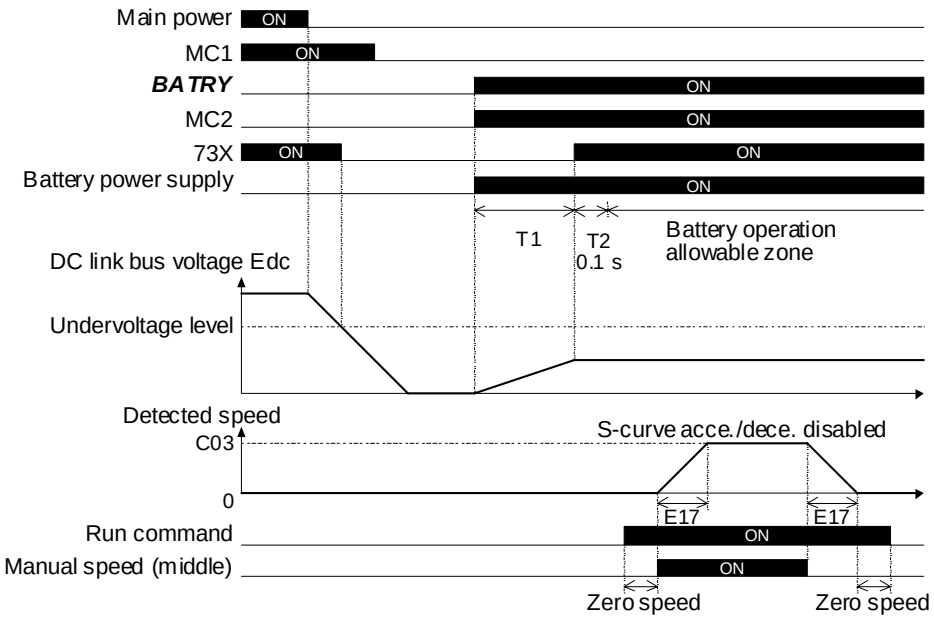
Rated voltage : F05 (motor rated voltage (V))

k: Safety coefficient (less than 1 and may be about 0.8)

■ **Block diagram**



■ Operation Scheme



The time of T1 changes depending on the voltage and capacity. Refer to the delay time of specification (4).

■ Precautions

(1) The battery power supply is connected before ***BATRY*** is turned ON. Or connect the battery power supply at the same time as turning ON ***BATRY***.

(2) As shown above, inverter operation is possible within the battery operation allowable zone. There is a delay of the "T1 + T2" period between when the ***BATRY***, MC, and battery power supply are turned ON and when the inverter becomes ready to run.

(3) The ***BATRY*** should not be turned ON as long as the voltage level is higher than the specified undervoltage level (that is, before the ⊿⊿ appears after a power failure). Doing so blocks 73X to go OFF.

(4) During battery operation, avoid driving with a heavy load and run the elevator with a balanced or braking load. Low battery voltage cannot generate sufficient torque, causing the motor to stall.

(5) These precautions are given for an inverter operation with an extremely low voltage that prevents normal operation. For battery operation with a high voltage (such as 600 V for 400 V class series inverter), do not use the ***BATRY*** but run the inverter in a normal manner at a low speed and be careful with the battery capacity,

(6) Turning the main power supply ON needs the ***BATRY*** OFF. Turning it ON with ***BATRY*** being ON could damage the rectifier diode due to 73X ON.

C04 to C11	Multistep Speed	F01 (Speed Command)

C04 through C11 specify zero speed to high speed for multistep speed change. Turning ***SS1***, ***SS2*** and ***SS4*** assigned to digital input terminals ON and OFF changes the speed.

- Data setting range: 0.00 to 3600 (r/min)

Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

For details, refer to function code F01.

C20	Jogging Operation Speed	H54 (Acceleration time, Jogging) H55 (Deceleration time, Jogging)

C20 specifies the jogging operation speed.

- Data setting range: 0.00 to 3600 (r/min)

Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

■ Jogging operation

The terminal command ***JOG*** can be assigned to a programmable input terminal by setting "10." With the ***JOG*** being ON, turning ***FWD*** or ***REV*** ON starts the jogging operation regardless of the F01 setting.

In jogging operation, the acceleration and deceleration times specified by H54 and H55 apply, respectively.

The torque control disables this function even with ***JOG*** being ON.

Note Turning the ***JOG*** ON when the inverter is running in ordinary operation cannot switch the inverter to jogging operation. Stop the inverter once and switch to jogging operation.

A run command (e.g., ***FWD***) and ***JOG*** command should be entered within 100 ms. Note that if the input of a run command precedes that of the ***JOG*** command, the inverter runs in ordinary operation until the input of the ***JOG*** command.

C21 Speed Command Unit

C21 specifies units for setting the speed.

Data for C21 and the specified units are as follows.

Data for C21	Speed command unit
0	r/min
1	m/min
2	Hz

Changing C21 data converts previously specified function code data into a newly specified unit for display. It also modifies the setting range automatically.

Note Changing the C21 data requires modifying the data of some function codes. For details, refer to page 2-14.

Relational equations between (Hz) and other units

1. (r/min) and (Hz)

$$[r/\min] = 120 \times \frac{[Hz]}{Pe}$$

2. (m/min) and (Hz)

$$[m/\min] = \frac{V\max}{N\max} \times 120 \times \frac{[Hz]}{Pe}$$

Where,

Pe	: Motor, No. of poles (P01) (poles)
N max	: Maximum speed (F03) (r/min)
V max	: Elevator speed (L31) (m/min)

Note As shown in the above equations, changing the data of any of function codes P01, F03, and L31 automatically modifies the inverter's speed settings specified in r/min or m/min.

C31 to C33	**Analog Input Adjustment for [12] (Offset) (Gain) (Filter time constant)**
C36 to C38	**Analog Input Adjustment for [C1] (Offset) (Gain) (Filter time constant)**
C41 to C43	**Analog Input Adjustment for [V2] (Offset) (Gain) (Filter time constant)**

These function codes specify the gain, offset, and filter time constant for analog input terminals.

■ Offset (C31, C36, and C41)

These function codes specify the offset adjustment for analog input voltage or current.

- Data setting range: -100.0 to 100.0 (%)

■ Gain (C32, C37, and C42)

These function codes specify the gain adjustment for analog input voltage or current.

- Data setting range: 0.00 to 200.00 (%)

■ Command values

The following formula indicates the relationship between the command value, gain (%), offset (%), and analog input (%).

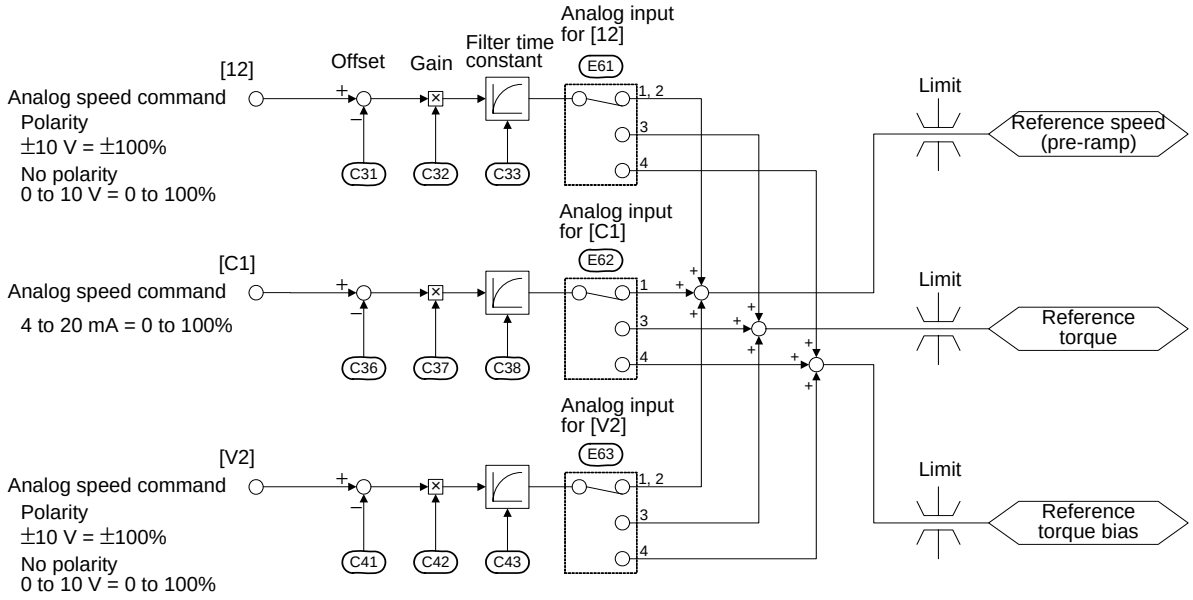
Command value = (Analog input - Offset) × Gain × Reference value

Where, the analog input -100 to 100% corresponds to -10 to 10 V in voltage input, and 0 to 100%, to 4 to 20 mA in current input.

The table below lists the reference values and limits.

Commands	Reference values	Limits
Reference speed (pre-ramp)	Maximum speed	Maximum speed × -100 to 100%
Reference torque current	Inverter rated current × 400%	Inverter rated current × -400 to 400%
Reference torque bias	100% of motor rated torque	Motor rated torque × -200 to 200%

Setting F01 to "1: Analog speed command (Not reversible)" limits the reference speed (pre-ramp) at 0% or 100% of the maximum speed.

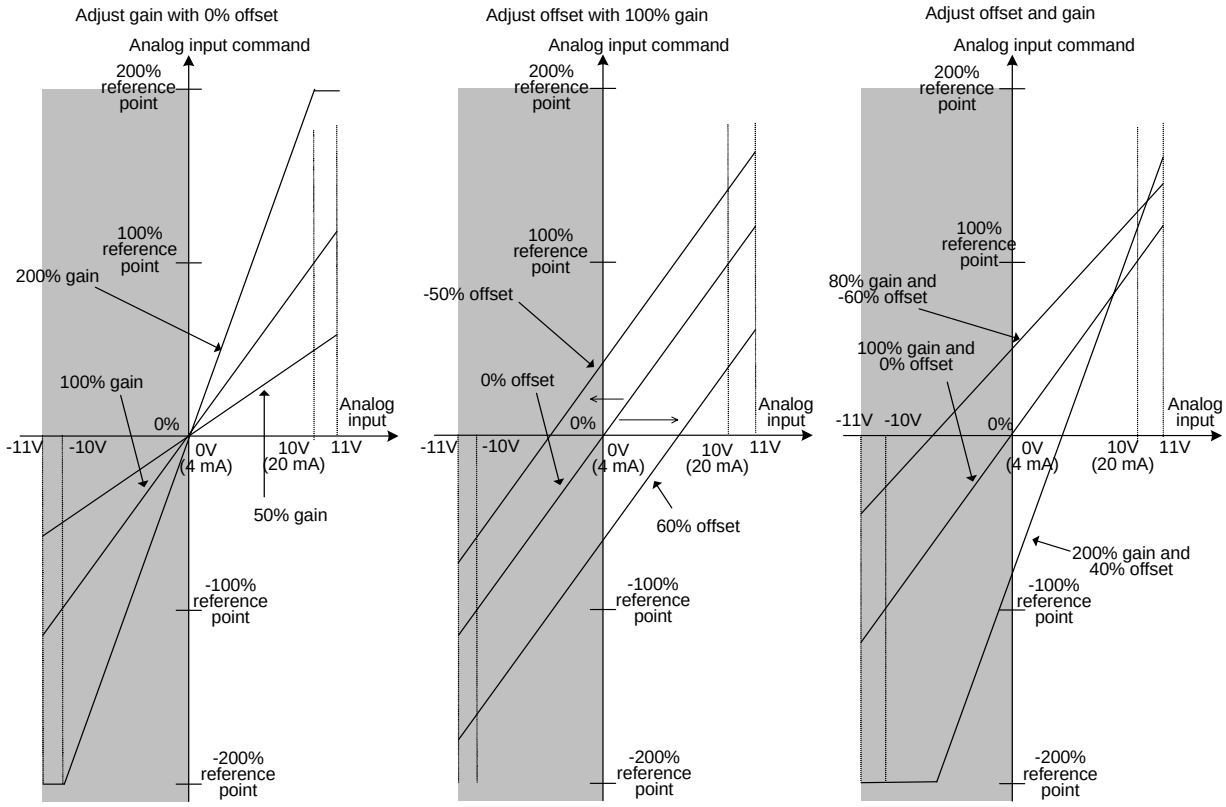


Simplified Block Diagram of Analog Inputs

■ Operation examples

The following graphs show operation examples using the gain and offset effects.

Current input or non-polar voltage input makes shaded areas invalid (as 0 V or 4 mA), and polar voltage input makes the shaded areas valid.



■ Filter time constant (C33, C38, and C43)

These function codes specify the filter time constant for analog input voltage or current on terminals [12], [C1] and [V2]. Increasing the filter time constant delays the response from machinery or equipment, and that is, the time constant should be specified with considering response speed. If the input voltage fluctuates due to noise, large filter time constant releases it.

- Data setting range: 0.000 to 5.000 (s)

2.3.4 P codes (Motor parameters)

P01	Motor (No. of poles)

P01 specifies the number of poles of the motor. The following formula is used for the conversion.

$$\text{Motor speed (r/min)} = \frac{120}{\text{No. of poles}} \times \text{Frequency (Hz)}$$

- Data setting range: 2 to 100 (poles)

Note Changing the P01 data requires modifying the data of some function codes. For details, refer to page 2-14.

P02	Motor (Rated capacity)

P02 specifies the rated capacity of the motor. Enter the rated value shown on the nameplate of the motor.

- Data setting range: 0.01 to 55.00 (kW)

P03	Motor (Rated current)

P03 specifies the rated current of the motor. Enter the rated value shown on the nameplate of the motor.

- Data setting range: 0.00 to 500.0 (A)

P04	Motor (Auto-tuning)

This function automatically detects the motor parameters and saves them in the inverter's internal memory. Basically, you do not need to perform tuning if you use a Fuji standard motor with a standard connection with the inverter.

P04 is only for asynchronous motors. For synchronous motors, the magnetic pole position offset tuning (L03) applies.

In any of the following cases, perform auto-tuning. This is because you may not obtain the best performance under the PG vector control since the motor parameters are different from that of Fuji standard motors.

- The motor to be driven is made by other manufacturer or is a non-standard motor.
- Cabling between the motor and the inverter is long.
- A reactor is inserted between the motor and the inverter.

For details of auto tuning, refer to the FRENIC-Lift Instruction Manual (INR-SI47-1038-E), Section 4.1.3 "Preparation before running the motor for a test -- Setting function code data."

P06	**Motor (No-load current)**
P07	**Motor (%R1)**
P08	**Motor (%X)**

These function codes specify no-load current, %R1, and %X. Obtain the appropriate values from the test report of the motor or by calling the manufacturer of the motor. If you perform auto tuning, these parameters are automatically set as well.

■ No-load current (P06)

Enter the value obtained from the motor manufacturer.

- Data setting range: 0.00 to 500.0 (A)

■ %R1 (P07)

Enter the value calculated by the following formula.

$$\%R1 = \frac{R1 + \text{Cable } R1}{V / (\sqrt{3} \times I)} \times 100\,(\%)$$

where,

R1: Primary resistance of the motor (Ω)

Cable R1: Resistance of the output cable (Ω)

V: Rated voltage of the motor (V)

I: Rated current of the motor (A)

- Data setting range: 0.00 to 50.00 (%)

■ %X (P08)

Enter the value calculated by the following formula.

$$\%X = \frac{X1 + X2 \times XM / (X2 + XM) + \text{Cable } X}{V / (\sqrt{3} \times I)} \times 100\,(\%)$$

X1: Primary leakage reactance of the motor (Ω)

X2: Secondary leakage reactance of the motor (converted to primary) (Ω)

XM: Exciting reactance of the motor (Ω)

Cable X: Reactance of the output cable (Ω)

V: Rated voltage of the motor (V)

I: Rated current of the motor (A)

- Data setting range: 0.00 to 50.00 (%)

Note For reactance, choose the value at the rated speed (F04).

P09	Motor (Slip comp. driving gain)
P10	Motor (Slip comp. braking gain)

P09 and P10 specify the slip compensation gain in percentage to the rated slip (P12) at the driving and braking sides, respectively.

- Data setting range: (P09, P10): 0.0 to 200.0 (%)

P11	Motor (Slip comp. response time)

Determines the response time for slip compensation. Basically, there is no need to modify the default setting.

- Data setting range: 0.05 to 1.00 (s)

Note It is a special code of the torque vector control.

Refer to page 2-2 for the control mode of the inverter.

P12	Motor (Rated slip)

P12 specifies the rated slip frequency of the motor.

- Data setting range: 0.00 to 15.00 (Hz)

The rated slip frequency is calculated with the following formula.

$$\text{Rated slip frequency (Hz)} = \text{Rated frequency (Hz)} \times \frac{\text{Synchronous speed (r/min)} - \text{Rated speed (r/min)}}{\text{Synchronous speed (r/min)}}$$

When the P12 is setted 0.00, operation will fllowed by Fuji standard motor rated slip frequency.

Motor capacity (P02)	Control data of P12=0.00
3.7kW	1.57 Hz
5.5kW	1.18 Hz
7.5kW	1.28 Hz
11kW	0.95 Hz
15kW	0.90 Hz
18.5kW	0.72 Hz
22kW	0.72 Hz
30kW	0.91 Hz
37kW	0.64 Hz
45kW	0.72 Hz

2.3.5 H codes (High performance functions)

H03	Data Initialization

H03 initializes the current function code settings to the factory defaults.

To change the H03 data with the keypad, it is necessary to press STOP and ▲ keys or STOP and ▼ keys simultaneously.

Data for H03	Function
0	Disable initialization. (Settings manually made by the user will be retained.)
1	Initialize all function code data to the factory defaults.

Tip Upon completion of the initialization, the data of function code H03 is reset to "0" (default setting).

H04	Auto-resetting (Times)
H05	Auto-resetting (Reset interval)

H04 and H05 specify the auto-resetting function. Trip is released according to driving instruction OFF.

Listed below are the recoverable alarm statuses of the inverter.

Alarm status	Alarm on LED monitor	Alarm status	Alarm on LED monitor
Instantaneous overcurrent protection	OC 1, OC2, OC3	Motor overheated	OH4
Overvoltage protection	OU 1, OU2, OU3	Motor overloaded	OL 1
Heat sink overheated	OH 1	Inverter overloaded	OLU
Inverter overheated	OH3	Undervoltage detected	LU

■ Number of auto-resetting times (H04)

H04 specifies the number of auto-resetting times for automatically escaping the tripped state. If the protective function is activated more than the specified auto-resetting times, the inverter issues an alarm (for any faults) and does not attempt to escape the tripped state.

- Data setting range: 0 (disable)
  1 to 10 (times)

■ Reset interval (H05)

H05 specifies the interval time to attempt performing auto-resetting the tripped state. Refer to the timing scheme diagram below.

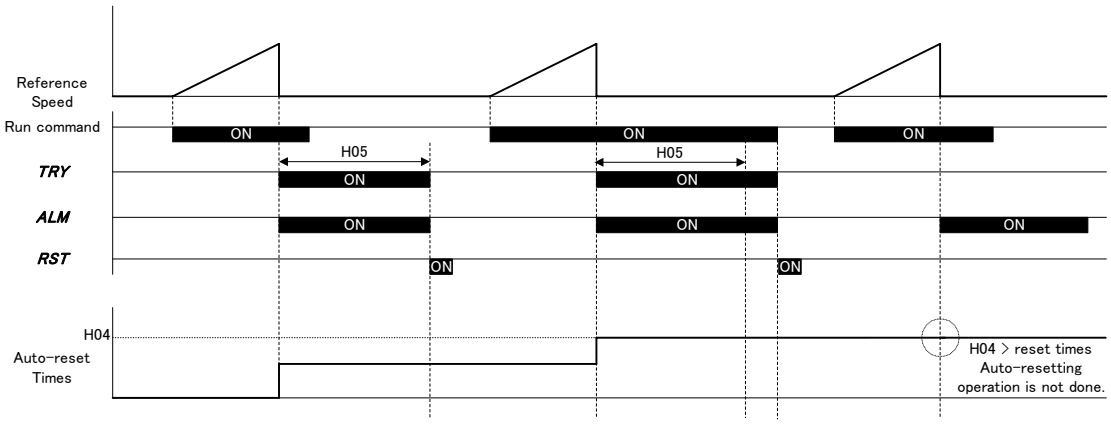
- Data setting range: 0.5 to 20.0 (s)

⚠CAUTION

If ROM version is 1000 or less, the inverter stops without outputting ***ALM*** if recoverable alarm is generated. It starts again according to the retry function automatically after H05 passes, and the motor rotates.
Design the machinery so that human body and peripheral equipment safety is ensured even when the auto-resetting succeeds.

Otherwise an accident could occur.

Operation timing scheme



The auto-resetting operates by satisfying all of the following conditions.

- The time of reset interval (H05) passed after having generated the alarm.
- The run command is OFF.
- The auto-resetting times are set value of Number of auto-resetting times (H04) or less.

The auto-resetting times is reset by satisfying either of the following conditions.

- The alarm was reset by manual operation.
- The alarm was not generated within 24 hours.

Tip The auto-resetting state can be monitored from the external equipment via a digital output terminal to which the ***TRY*** is assigned by setting "26" with E20 to E24 and E27.

Note The auto-resetting function is disabling while auto-tuning or pole position offset tuning.

H06 Cooling Fan Control

H06 specifies the ON-duration of the cooling fan. To prolong the life of the cooling fan and reduce fan noise during running, the cooling fan stops when the temperature inside the inverter drops below a certain level.

Setting the H06 data to 0.0 automatically turns the cooling fan ON/OFF depending upon the temperature even when the inverter is running.

The cooling fan does not restart for 10 seconds after stopping.

- Data setting range: 0.0 (Auto ON/OFF depending upon temperature)
  0.5 to 10.0 (min.)
  999 (Disable. Always ON)

Tip The cooling fan state can be monitored via a digital output terminal to which the ***FAN*** is assigned by setting "25."

H18	Torque Control	F42 (Control Mode)

H18 specifies control modes. Speed control mode and torque control mode are available.

Data for H18	Function
0	Disable: Speed control mode
1	Enable: Torque control mode

■ Analog torque control

Analog input to input terminal [12], [C1] or [V2] specifies the torque current command when the command is assigned to the input terminal by setting any of E61 to E63 data to "3."

In torque control, the torque current command and motor load determine the speed and rotational direction.

Tip Analog input (input voltage to terminals [12] and [V2] and input current to terminal [C1]) is set by offset, gain and filter. For details, refer to function codes C31 to C33, C36 to C38 and C41 to C43.

H26	PTC Thermistor (Mode)
H27	PTC Thermistor (Level)

These function codes protect the motor from overheating or output an alarm signal using the PTC (Positive Temperature Coefficient) thermistor embedded in the motor.

■ PTC thermistor (Mode) (H26)

Selects the function operation mode (protection or alarm) for the PTC thermistor as shown below.

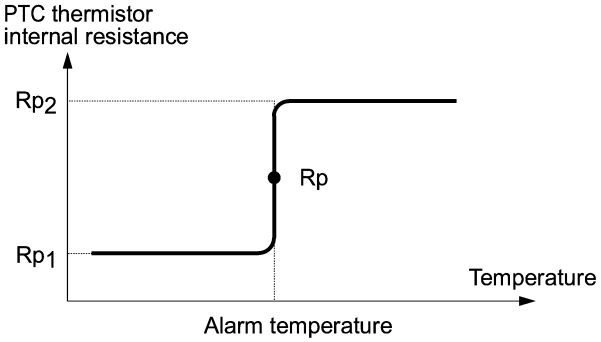
Data for H26	Action
0	Disable
1	Enable When the voltage sensed by the PTC thermistor exceeds the detection level, the motor protective function (alarm 0H4) is triggered, causing the inverter to enter an alarm stop state.
2	Enable When the voltage sensed by the PTC thermistor exceeds the detection level, a motor alarm signal is output but the inverter continues running. You need to assign the motor overheat protection ***THM*** to one of the digital output terminals beforehand, by which a temperature alarm condition can be detected by the thermistor (PTC) (function code data = 56).

■ PTC thermistor (Level) (H27)

Specifies the detection level for the temperature (expressed in voltage) sensed by PTC thermistor.

- Data setting range: 0.00 to 5.00 (V)

The temperature at which the overheating protection is to be activated depends on the characteristics of the PTC thermistor. The internal resistance of the thermistor will significantly change at the alarm temperature. The detection level (voltage) is specified based on the change of internal resistance.

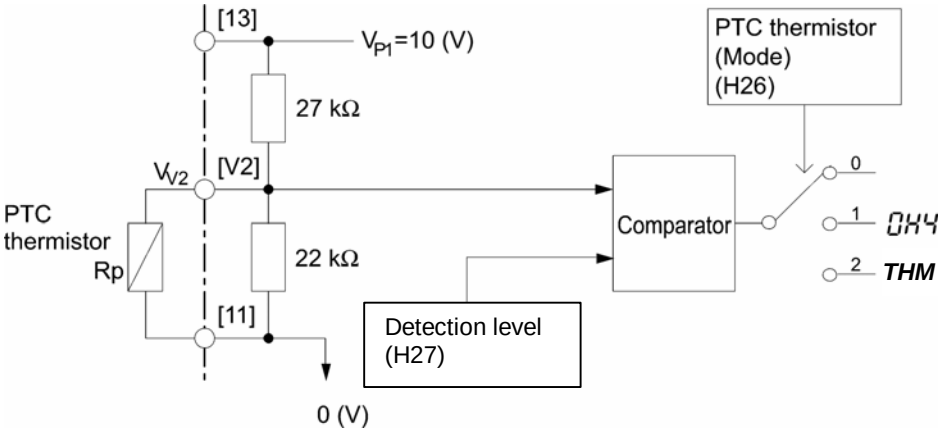


Suppose that the resistance of PTC thermistor at alarm temperature Rp, the detection (voltage) level V_{v2} is calculated by the equation below. Set the result V_{v2} to function code H27.

Substitute the internal resistance of the PTC thermistor at the alarm temperature with Rp to obtain V_{v2}.

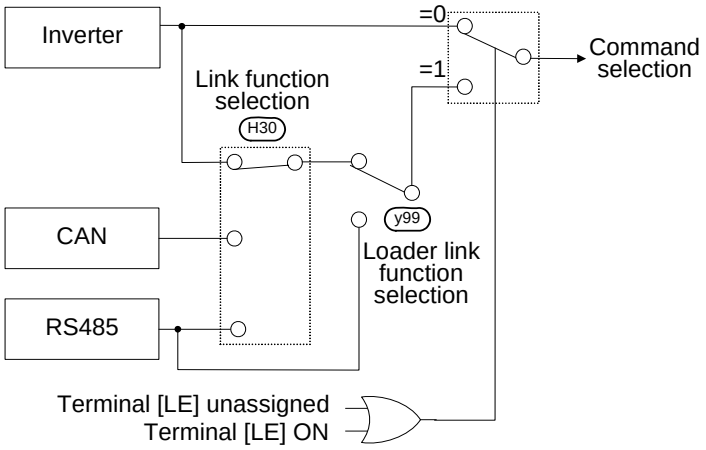
$$V_{v2} = \frac{\frac{22k \times R_p}{22k + R_p}}{27k + \frac{22k \times R_p}{22k + R_p}} \times 10\,(V)$$

Connect the PTC thermistor as shown below. The voltage that is obtained by dividing the input voltage to the terminal [V2] with a set of internal resistors is compared with the preset detection level voltage (H27).



H30 Communications Link Operation

H30 specifies the sources of a speed command and run command--"inverter itself" and "computers or PLCs via the RS485 communications link or the CAN communications link," and setting means of speed command and run command.



Command sources selectable

Command sources	Description
Inverter itself	Command sources except RS485 communications link and CAN communications link Speed command：Source specified by F01 (e.g., multistep speed command) Run command: Via the keypad or digital input terminals
RS485 communications link	Via the standard RJ-45 port used for connecting keypad
CAN communications link	Via CAN communications link (Only the CAN model)

■ **Command sources specified by H30**

Data for H30	Speed command	Run command	Reference torque bias
0	Inverter itself	Inverter itself	Inverter itself
1	Via RS485 communications link	Inverter itself	Inverter itself
2	Inverter itself	Via RS485 communications link	Inverter itself
3	Via RS485 communications link	Via RS485 communications link	Inverter itself
4*[1]	Via CAN communications link	Inverter itself	Inverter itself
5*[1]	Inverter itself	Via CAN communications link	Inverter itself
6*[1]	Via CAN communications link	Via CAN communications link	Inverter itself
7	Inverter itself	Inverter itself	Via RS485 communications link
8	Via RS485 communications link	Inverter itself	Via RS485 communications link
9	Inverter itself	Via RS485 communications link	Via RS485 communications link
10	Via RS485 communications link	Via RS485 communications link	Via RS485 communications link
11*[1]	Inverter itself	Inverter itself	Via CAN communications link
12*[1]	Via CAN communications link	Inverter itself	Via CAN communications link
13*[1]	Inverter itself	Via CAN communications link	Via CAN communications link
14*[1]	Via CAN communications link	Via CAN communications link	Via CAN communications link

*[1]) It is available only for the CAN model.

For details, refer to Chapter 1 "BLOCK DIAGRAMS FOR CONTROL LOGIC" and the RS485 Communication User's Manual or CAN Communication User's Manual.

Note When the ***LE*** terminal command is assigned to a digital input terminal and the terminal is ON, the settings of function code H30 is effective. When the terminal is OFF, the settings of the code are ineffective, and both speed commands and run commands specified from the inverter itself take control.

H42 Capacitance of DC Link Bus Capacitor

H42 displays the measured capacitance of the DC link bus capacitor (reservoir capacitor).

- Data setting range: 0 to 65535

H43 Cumulative Run Time of Cooling Fan

H43 displays the cumulative run time of the cooling fan.

- Data setting range: 0 to 65535

H47 Initial Capacitance of DC Link Bus Capacitor

H47 displays the initial value of the capacitance of the DC link bus capacitor (reservoir capacitor).

- Data setting range: 0 to 65535

H48 Cumulative Run Time of Capacitors on Printed Circuit Board

H48 displays the cumulative run time of capacitors on the printed circuit boards.

- Data setting range: 0 to 65535

H54 Acceleration Time (Jogging)

H55 Deceleration Time (Jogging)

H54 and H55 specify the acceleration and deceleration times for jogging operation, respectively. The acceleration time is the one required for accelerating from 0.00 to the maximum speed (r/min) and the deceleration time, for decelerating from the maximum speed to 0.00 (r/min).

- Data setting range: 0.00 to 99.9 (s)

For details, refer to function code C20.

H56 Deceleration Time for Forced to Decelerate

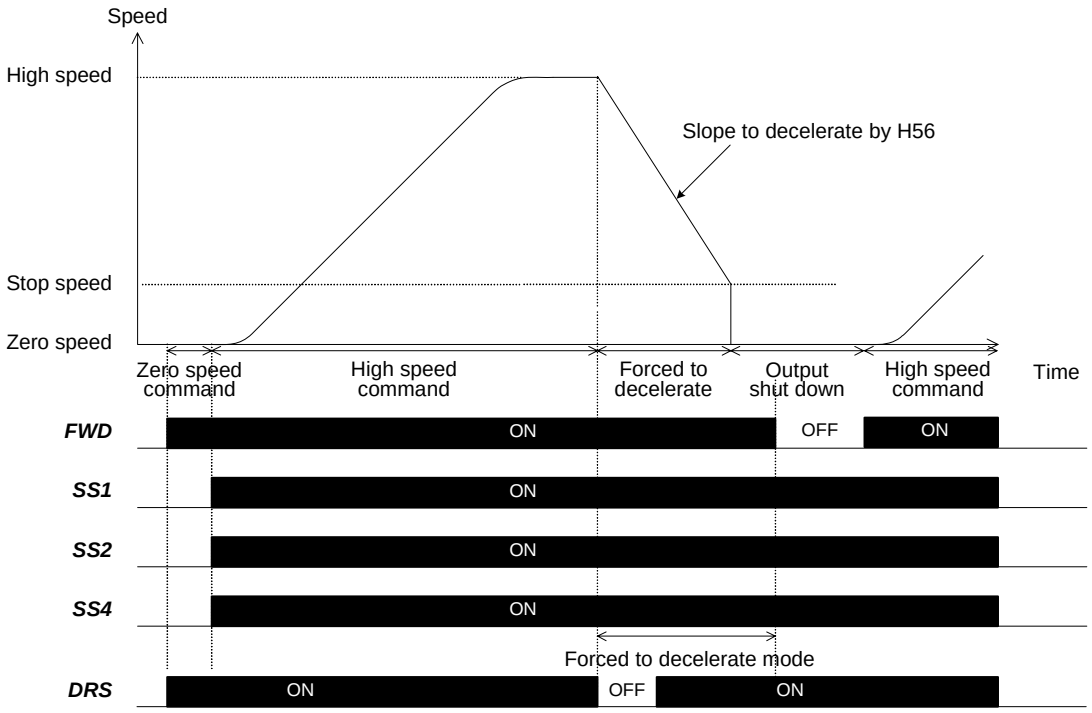
H56 specifies the deceleration time for forced deceleration. The deceleration time is the one required for decelerating from the maximum speed to 0.00 (r/min).

- Data setting range: 0.00 to 99.9 (s)

■ Forced to decelerate

The ***DRS*** command can be assigned to a general-purpose, programmable input terminal by setting "66." The ***DRS*** should be ON when the inverter is running. Turning the ***DRS*** OFF decelerates the speed during the time specified by H56 and then shuts down the inverter output upon detection of a stop speed.

Once the ***DRS*** goes OFF, the inverter no longer runs (that is, the forced-to-decelerate mode will no longer be canceled) until the run command goes OFF and the inverter output is shut down. The operation scheme is shown below.



H57 to H60	S-curve Setting 10 to 14	F01 (Speed Command)

L19 to L28 specify S-curve zones to be applied to operations driven by multistep speed commands with S-curve acceleration/deceleration.

The setting values are indicated in percentage to the maximum speed.

- Data setting range: 0 to 50 (%)

Refer to the description of function code F01 for details.

H64	Zero speed control time	F23, F24 (Starting Speed)

Setting zero speed control time. Keeping zero speed from the moment that gate comes ON until setting time.

- Data setting range: 0.00 to 10.00 (s)

For details, refer to function code F23, F24.

H65	Starting Speed (Soft start time)	F23 (Starting Speed)

H65 specifies the acceleration time until the speed reaches the starting speed. The specified time is the one required for accelerating from 0.00 to the starting speed (r/min).

- Data setting range: 0.0 to 60.0 (s)

For details, refer to function code F23.

H66	Stop Speed (Detection method)	F25 (Stop Speed)

H66 specifies the stop speed detection method.

Data for H66	Detection method
0	Use the detected speed.
1	Use the reference speed (final).

For details, refer to the description of function code F25.

H67	Stop Speed (Holding time)	F25 (Stop Speed)

H67 specifies the holding time of the stop speed.

- Data setting range: 0.00 to 10.00 (s)

For details, refer to function code F25.

H74	Speed Agreement (Hysteresis)
H75	Speed Agreement (OFF delay time)

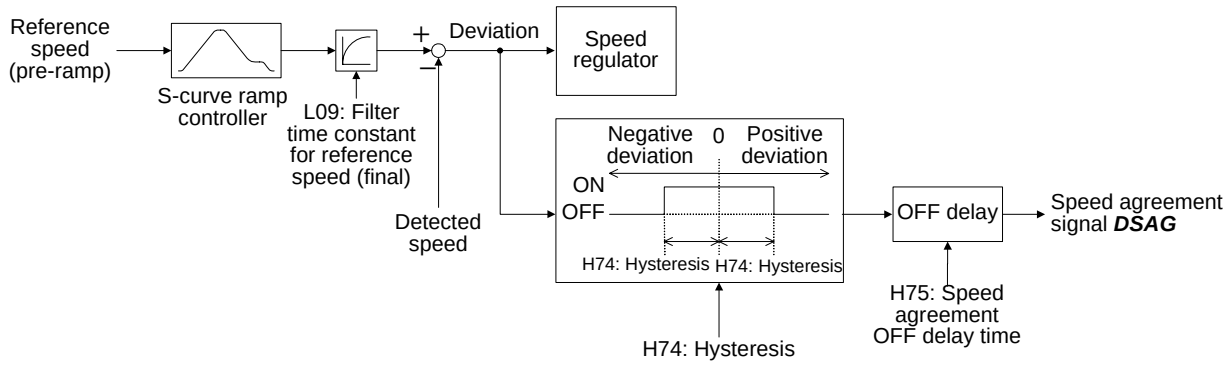
The ***DSAG*** signal can be assigned to a general-purpose, programmable output terminal by setting "71."

The ***DSAG*** comes ON regardless of the status of a run command when the difference between the commanded and detected speeds is within the hysteresis band specified by H74. The ON-to-OFF delay circuit is available for chattering prevention. If the difference is larger than the allowable band specified by H74 continuously for the time specified by H75, then the ***DSAG*** signal goes OFF. No OFF-to-ON delay function is available.

Selecting the torque control disables this function.

- Data setting range (H74): 0.00 to 3600 (r/min)
- Data setting range (H75): 0.00 to 1.00 (s)

Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.



H76	PG Error Detection for Mode3(Detecting level) PG abnormal (operation choice) PG Error Detection (Detection level) PG Error Detection (Detection time)
H77	PG Error Detection for mode 3 (Detecting time)

Setting detecting range and time when using PG abnormal mode 3.

- Data setting range (H76): 0 to 50 (%)
- Data setting range (H77): 0.0 to 10.0 (s)

For details, refer to function code L90～L92

H80	Output Current Fluctuation Damping Gain

The inverter output current driving the motor may fluctuate due to the motor characteristics and/or backlash in the machine. Modifying the H80 data adjusts the controls in order to suppress such fluctuation. However, as incorrect setting of this gain may cause larger current fluctuation, do not modify the default setting unless it is necessary.

- Data setting range (H80):0.00 to 0.40

Note It is a special code of the torque vector control. Refer to page 2-2 for the control mode of the inverter.

H94 Cumulative Run Time of Motor

H94 displays the cumulative run time of the motor. This feature is useful for management and maintenance of the mechanical system. With this function code (H94), you can set the cumulative run time of the motor to any value you choose. For example, by specifying "0," you can clear the cumulative run time of the motor.

- Data setting range: 0 to 65535

H97 Clear Alarm Data

H97 deletes the information such as alarm history and data at the time of alarm occurrence, including alarms that have occurred during the check-up or adjustment of the machinery. Data is then brought back to a normal state without an alarm.

Deleting the alarm information requires simultaneous keying of STOP and ^ keys.

Data for H97	Function
0	Disable
1	Clear all (This data clears all alarm data stored and returns H97 to "0.")

H98 Protection/Maintenance Function F26 (Motor Sound, Carrier frequency)

H98 specifies whether to enable or disable automatic lowering of the carrier frequency, protection against input phase loss, judgment on the DC link bus capacitor life, and the change of judgment criteria on the DC link bus capacitor life, and the selection of short-circuit detection, in a style of combination.

To set data of the function code H98, assign functions to each bit (total 8 bits). The table below lists functions assigned to each bit.

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	Cancel detecting of thermistor cut line	Detect a short-circuit at startup	Cancel detection of DC fan lock	Judge the life of DC link bus capacitor	Select life judgment criteria of DC link bus capacitor	Not assigned	Detect input phase loss	Lower the carrier frequency automati-cally
Data=0	Disable	Disable	Disable	Disable	Factory default setting	-	Disable	Disable
Data=1	Enable	Enable	Enable	Enable	User's setting	-	Enable	Enable
Default	0	1	0	1	0	0	0	1

Set the unassigned data to 0.

■ Lower the carrier frequency automatically (Bit 0)

Even if the inverter is in heat sink overheating or overload state due to an excessive load, abnormal ambient temperature, or trouble in the cooling system, with this function enabled, the inverter lowers the carrier frequency to avoid tripping (OH1, OH3, or OLU). Note that if this feature is enabled, the motor noise increases. If an overload state kept for a long time transcends the inverter capacity, the inverter trips.

■ Detect input phase loss (Lin) (Bit 1)

Upon detecting an excessive stress inflicted on the apparatus connected to the main circuit because of phase loss or inter-phase imbalance in the 3-phase power supplied to the inverter, this feature stops the inverter and displays an alarm Lin.

Note In configurations where only a light load is driven or a DC reactor is connected, a phase loss or an inter-phase imbalance may not be detected because of the relatively small stress on the apparatus connected to the main circuit.

■ Select life judgment criteria of DC link bus capacitor (Bit 3)

H98 allows you to select the criteria for judging the life of the DC link bus capacitor/s (reservoir capacitor/s) between factory default setting and your own choice.

Note Before specifying the criteria of your own choice, measure and confirm the reference level in advance. For details, refer to the FRENIC-Lift Instruction Manual (INR-SI47-1038-E), Chapter 7 "MAINTENANCE AND INSPECTION."

■ Judge the life of DC link bus capacitor (Bit 4)

Whether the DC link bus capacitor (reservoir capacitor) has reached its life is determined by measuring the length of time for discharging after power off. The discharging time is determined by the capacitance of the DC link bus capacitor and the load inside the inverter. Therefore, if the load inside the inverter fluctuates significantly, the discharging time cannot be accurately measured, and as a result, it may be mistakenly determined that the life has been reached. To avoid such an error, you can disable the judgment on the life of the DC link bus capacitor.

Load may vary significantly in the following cases. Disable the judgment on the life during operation, and either conduct the measurement with the judgment enabled under appropriate conditions during periodical maintenance or conduct the measurement under the actual use conditions.

- Auxiliary input for control power is used
- An option card is used
- Another inverter or equipment such as a PWM converter is connected to the terminals of the DC link bus.

For details, refer to the FRENIC-Lift Instruction Manual (INR-SI47-1038-E), Chapter 7 "MAINTENANCE AND INSPECTION."

■ Cancel DC fan lock alarm detection (Bit 5) (400Vseries: 37kW and above)

There is stir fan inside inverter. When detecting the inside stir fan being out of order, it is impossible to make choice that whether handle it with alarm or go on driving.

H98 bit5=0(Alarm treatment): stop inverter by OH1 alarm.
H98 bit5=1(Driving continuous): keeping driving inverter without alarm.

When DC fan lock is detected, the output signal of transistor (***OH***,***LIFE***) comes ON under all the setting situation.

Note When ON-OFF control for cooling fan is effective, it is possible that make cooling fan stop driving. In this situation, judging the fan lock as normal situation, because of the braking down of inside stir fan, signal ***LIFE*** and ***OH*** come OFF, OH1 alarm is disable possibly.

When inside stir fan breaking down, keep driving for a long time under fan lock situation. that the print board condenser can not be used as long time as usual is dangerous. It is necessary that change fan as soon as possible by confirming the ***LIFE*** signal and so on.

■ **Detect a short-circuit at startup (Bit 6)**

H98 selects whether to enable or disable the short-circuit detection that checks the output wirings for a short-circuit when the inverter main power is turned ON.

Enabling the short-circuit detection may mistakenly detect a short-circuit when the motor impedance is low. If it happens, disable the detection.

■ **Canceling detection of thermistor cut line (400kW series: 37kW and above)**

For the inverter (400V series: 37kW and above), the connection between the thermistor for detecting fan's temperature and detecting circuit of power print board is considered as a harness. When the connection is cut, it is possible that choose whether handle it with alarm or driving continuous.

H98 bit7=0(Alarm treatment): stop inverter by OH1 alarm.
H98 bit7=1(Driving continuous): keeping driving inverter without alarm.

H99	Password Protection	F00 (Data Protection)

H99 specifies a password.

- Data setting range: 0000_H (Disable password protection)
  0001_H to $FFFF_H$ (Enable password protection)

For details, refer to function code F00.

Conversion table (Decimal to/from binary)

Decimal	Binary							Decimal	Binary						
	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0	0	0	32	0	1	0	0	0	0	0
1	0	0	0	0	0	0	1	33	0	1	0	0	0	0	1
2	0	0	0	0	0	1	0	34	0	1	0	0	0	1	0
3	0	0	0	0	0	1	1	35	0	1	0	0	0	1	1
4	0	0	0	0	1	0	0	36	0	1	0	0	1	0	0
5	0	0	0	0	1	0	1	37	0	1	0	0	1	0	1
6	0	0	0	0	1	1	0	38	0	1	0	0	1	1	0
7	0	0	0	0	1	1	1	39	0	1	0	0	1	1	1
8	0	0	0	1	0	0	0	40	0	1	0	1	0	0	0
9	0	0	0	1	0	0	1	41	0	1	0	1	0	0	1
10	0	0	0	1	0	1	0	42	0	1	0	1	0	1	0
11	0	0	0	1	0	1	1	43	0	1	0	1	0	1	1
12	0	0	0	1	1	0	0	44	0	1	0	1	1	0	0
13	0	0	0	1	1	0	1	45	0	1	0	1	1	0	1
14	0	0	0	1	1	1	0	46	0	1	0	1	1	1	0
15	0	0	0	1	1	1	1	47	0	1	0	1	1	1	1
16	0	0	1	0	0	0	0	48	0	1	1	0	0	0	0
17	0	0	1	0	0	0	1	49	0	1	1	0	0	0	1
18	0	0	1	0	0	1	0	50	0	1	1	0	0	1	0
19	0	0	1	0	0	1	1	51	0	1	1	0	0	1	1
20	0	0	1	0	1	0	0	52	0	1	1	0	1	0	0
21	0	0	1	0	1	0	1	53	0	1	1	0	1	0	1
22	0	0	1	0	1	1	0	54	0	1	1	0	1	1	0
23	0	0	1	0	1	1	1	55	0	1	1	0	1	1	1
24	0	0	1	1	0	0	0	56	0	1	1	1	0	0	0
25	0	0	1	1	0	0	1	57	0	1	1	1	0	0	1
26	0	0	1	1	0	1	0	58	0	1	1	1	0	1	0
27	0	0	1	1	0	1	1	59	0	1	1	1	0	1	1
28	0	0	1	1	1	0	0	60	0	1	1	1	1	0	0
29	0	0	1	1	1	0	1	61	0	1	1	1	1	0	1
30	0	0	1	1	1	1	0	62	0	1	1	1	1	1	0
31	0	0	1	1	1	1	1	63	0	1	1	1	1	1	1

Decimal	Binary							Decimal	Binary						
	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
64	1	0	0	0	0	0	0	96	1	1	0	0	0	0	0
65	1	0	0	0	0	0	1	97	1	1	0	0	0	0	1
66	1	0	0	0	0	1	0	98	1	1	0	0	0	1	0
67	1	0	0	0	0	1	1	99	1	1	0	0	0	1	1
68	1	0	0	0	1	0	0	100	1	1	0	0	1	0	0
69	1	0	0	0	1	0	1	101	1	1	0	0	1	0	1
70	1	0	0	0	1	1	0	102	1	1	0	0	1	1	0
71	1	0	0	0	1	1	1	103	1	1	0	0	1	1	1
72	1	0	0	1	0	0	0	104	1	1	0	1	0	0	0
73	1	0	0	1	0	0	1	105	1	1	0	1	0	0	1
74	1	0	0	1	0	1	0	106	1	1	0	1	0	1	0
75	1	0	0	1	0	1	1	107	1	1	0	1	0	1	1
76	1	0	0	1	1	0	0	108	1	1	0	1	1	0	0
77	1	0	0	1	1	0	1	109	1	1	0	1	1	0	1
78	1	0	0	1	1	1	0	110	1	1	0	1	1	1	0
79	1	0	0	1	1	1	1	111	1	1	0	1	1	1	1
80	1	0	1	0	0	0	0	112	1	1	1	0	0	0	0
81	1	0	1	0	0	0	1	113	1	1	1	0	0	0	1
82	1	0	1	0	0	1	0	114	1	1	1	0	0	1	0
83	1	0	1	0	0	1	1	115	1	1	1	0	0	1	1
84	1	0	1	0	1	0	0	116	1	1	1	0	1	0	0
85	1	0	1	0	1	0	1	117	1	1	1	0	1	0	1
86	1	0	1	0	1	1	0	118	1	1	1	0	1	1	0
87	1	0	1	0	1	1	1	119	1	1	1	0	1	1	1
88	1	0	1	1	0	0	0	120	1	1	1	1	0	0	0
89	1	0	1	1	0	0	1	121	1	1	1	1	0	0	1
90	1	0	1	1	0	1	0	122	1	1	1	1	0	1	0
91	1	0	1	1	0	1	1	123	1	1	1	1	0	1	1
92	1	0	1	1	1	0	0	124	1	1	1	1	1	0	0
93	1	0	1	1	1	0	1	125	1	1	1	1	1	0	1
94	1	0	1	1	1	1	0	126	1	1	1	1	1	1	0
95	1	0	1	1	1	1	1	127	1	1	1	1	1	1	1

2.3.6 y codes (Link functions)

Following is the applicable devices and that general information.

(1) Multi-function keypad (option)
The multi-function keypad (option) allows you to run and monitor the inverter.

There is no need to set the y codes.

(2) FRENIC Loader
Using your PC running FRENIC Loader, you can monitor the inverter's running status information, edit function codes, and test-run the inverters.

(3) Host equipment
The inverter can be managed and monitored by connecting host equipment such as a PC and PLC to the inverter. Modbus RTU* is available for communications protocols.

*Modbus RTU is a protocol established by Modicon, Inc.

For details, refer to the RS485 Communication User's Manual.

y01 to y10 **RS485 Communication**

■ Station address (y01)

These function codes specify the station address for the RS485 communications link. The table below lists the protocols and the station address setting ranges.

Protocol	Station address	Broadcast address
Modbus RTU protocol	1 to 247	0
SX protocol (Loader protocol)	1 to 255	None

- If any wrong address beyond the above range is specified, no response is returned since the inverter will be unable to receive any enquiries except the broadcast message.
- To use FRENIC Loader, set the station address that matches the connected PC.

■ Communications error processing (y02)

Set the operation performed when an RS485 communications error has occurred.

RS485 communications errors contain logical errors such as address error, parity error, framing error, and transmission error, and physical errors such as communication break error set by y08. In each case, these are judged as an error only when the inverter is running while the operation command or reference speed (pre-ramp) has been set to the configuration specified through RS485 communication. When neither the operation command nor reference speed (pre-ramp) command is issued through RS485 communication or the inverter is not running, error occurrence is not recognized.

Data for y02	Function
0	Immediately trip after showing an RS485 communications error Er-8. (The inverter stops with alarm issue.)
1	Run during the time set on the error processing timer (y03), display an RS485 communications error Er-8, and then stop operation. (The inverter stops with alarm issue.)
2	Retry transmission during the time set on the error processing timer (y03). If communications link is recovered, continue operation. Otherwise, display an RS485 communications error Er-8 and stop operation. (The inverter stops with alarm issue.)
3	Continue to run even when a communications error or a communication break error occurs.

For details, refer to the RS485 Communication User's Manual.

■ Error processing time (y03)

Function code y03 specifies an error processing time.

When the specified time has elapsed because of no response on other end etc., if a response request was issued, the inverter interprets that an error occurs. See the section of "No-response error detection time (y08)."

- Data setting range: 0.0 to 60.0 (s)

■ Baud rate (y04)

Select the transmission speed for RS485 communication.
Set the same transmission speed as that specified by the connected PC.

Data for y04	Baud rate
0	2,400 bps
1	4,800 bps
2	9,600 bps
3	19,200 bps
4	38,400 bps

■ Data length (y05)

Modbus RTU and SX protocol automatically sets the length in 8 bits.

■ Parity check (y06), Stop bits (y07)

Parity bit and stop bit are set.

In case of Modbus RTU

The stop bit is automatically set by setting parity bit.

In case of SX protocol

Parity check is automatically sets the length in odd parity.

Stop bits is automatically sets the length in 1 bit.

Protocol	Parity bit (y06)	Stop bit (y07)
Modbus RTU	0:None	2 bit
	1:Even parity	1 bit
	2:Odd parity	
	3:None	
SX protocol	Odd parity	

■ No-response error detection time (y08)

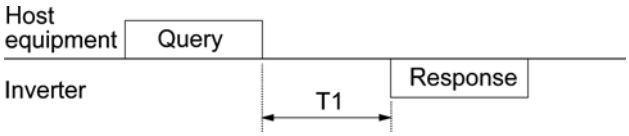
Set the time interval from the inverter detecting no access until it enters communications error alarm mode due to network failure and processes the communications error. This applies to a mechanical system that always accesses its station within a predetermined interval during communications using the RS485 communication link.
For the processing of communications errors, refer to y02.

Data for y08	Function
0	Disable
1 to 60	1 to 60 (s)

■ Response latency time (y09)

Sets the latency time after the end of receiving a query sent from the host equipment (such as a PC or PLC) to the start of sending the response. This function allows using equipment whose response time is slow while a network requires quick response, enabling the equipment to send a response timely by the latency time setting.

- Data setting range: 0.00 to 1.00 (s)



T1 = Latency time + α

Where α is the processing time inside the inverter. This time may vary depending on the processing status and the command processed in the inverter.

For details, refer to the RS485 Communication User's Manual.

Note When setting the inverter with FRENIC Loader, pay sufficient attention to the performance and/or configuration of the PC and protocol converter such as RS485-RS232C communications level converter. Note that some protocol converters monitor the communications status and switch the send/receive of transmission data by a timer.

■ Protocol selection (y10)

Select the communications protocol for the standard RS485 port.
- Specifying FRENIC Loader to connect to the inverter can only be made by y10. Select FRENIC Loader (y10 = 1).

Data for y10	Protocol
0	Modbus RTU protocol
1	SX protocol (FRENIC Loader protocol)
2	Reserved for particular manufacturers

y21	**CAN Communication (Station address)**
y22	**CAN Communication (Communications error processing)**
y23	**CAN Communication (Error processing time)**
y24	**CAN Communication (Baud rate)**
y25 to y32	**CAN Communication (User-defined I/O parameters 1 to 8)**
y33	**CAN Communication (Operation)**

Function code y21 to y33 are used for CAN communications link setting. This function code has only the CAN corresponding model.

For details, refer to the CAN Communication User's Manual.

y99	**Loader Link Function (Mode)**

This is a link switching function for FRENIC Loader. Setting the function code data y99 with the loader enable the loader to issue control commands and/or run commands to the inverter. Since the data setting can be done with the loader, no keypad operation is required.

While the loader is selected as the source for the run command, if the PC runs out of control and cannot be stopped by a stop command sent from the loader, disconnect the RS485 communications cable from the loader's port, connect a keypad instead, and reset the y99 to "0." This makes the function code H30 to issue control and run commands as shown in the following table.

Note that the inverter cannot save the setting of y99. When the inverter is turned off, the data in y99 will back to "0."

Data for y99	Function	
	Control command*	Run command
0	Follow H30	Follow H30
1	Via Loader	Follow H30
2	Follow H30	Via Loader
3	Via Loader	Via Loader

* Control command refers to a speed command, torque current command or reference torque bias.

2.3.7 L codes (Lift functions)

L01 Pulse Encoder (Selection)

L01 specifies the specifications of a pulse encoder system to be used for speed detection.

Data for L01	Applicable encoder specifications		Required option	Applicable motor
	A/B phase output	Absolute signal spec.		
0	12/15V complementary 12/15V open collector	None	Not required.	Asynchronous motor
	5V line driver	None	OPC-LM1-IL	
1	12,15V complement	Z	Not required	Synchronous motor
	5V line driver	Z	OPC-LM1-IL or OPC-LM1-PP	
2	5V line driver	3-bit code (Signal: U, V, W)	OPC-LM1-PP	Synchronous motor
3	5V line driver	4-bit gray code	OPC-LM1-PP	Synchronous motor
4	Sinusoidal differential voltage 1 Vp-p	EnDat2.1 (HEIDENHAIN ECN1313 or its equivalent)	OPC-LM1-PS or OPC-LM1-PS1	Synchronous motor
5	Sinusoidal differential voltage 1 Vp-p	SIN/COS (HEIDENHAIN ERN1387 or its equivalent)	OPC-LM1-PR	Synchronous motor

L02 Pulse Encoder (Resolution)

L02 specifies the resolution of the pulse encoder to be used for speed detection.

Improper setting of the resolution brings the indefinite detection of the speed and magnet pole position, making accurate speed and vector controls impossible.

- Data setting range: 360 to 60000 (P/R)

L03	Magnetic Pole Position Offset (Tuning)
L04	Magnetic Pole Position Offset (Offset angle)

L03 specifies the tuning type of the magnetic pole position offset.

Data for L03	Function
0	Disable tuning
1	Enable tuning
2	Enable tuning with miss wiring detection.
3	Enable tuning with checking accuracy.
4	Reserved for particular manufacturers

Before doing tuning, set up the following function code data.

Function code \ Option		3-bit code (Signal: U, V, W)	4-bit gray code	ECN1313 or its equivalent	ERN1387 or its equivalent
		OPC-LM1-PP		OPC-LM1-PS OPC-LM1-PS1	OPC-LM1-PR
Maximum speed	F03	Set the maximum speed.			
Rated speed	F04	Set the rated speed of the motor.			
Rated voltage	F05	Set the rated voltage of the motor.			
Control mode	F42	Set 1.			
Motor (No. of poles)	P01	Set the number of poles of the motor.			
Motor (Rated capacity)	P02	Set the rated capacity of the motor.			
Motor (Rated current)	P03	Set the rated current of the motor.			
Motor (%R1)	P07	Set 5%.			
Motor (%X)	P08	Unused.			
Pulse encoder (Selection)	L01	Set 2.	Set 3.	Set 4.	Set 5
Pulse encoder (Resolution)	L02	Set the number of pulses per revolution of the PG mounted on the motor.			
Magnetic pole position offset (Offset angle)	L04	Do tuning of the magnetic pole position offset. The tuning result automatically writes onto L04 data.			
ASR (P constant at high speed)	L36	Set 2.00 or less to run the motor by itself.			
ASR (P constant at low speed)	L38	Set 2.00 or less to run the motor by itself.			

When the target motor is of a synchronous motor, complete the wiring between the inverter, motor, and encoder before doing tuning.

Tuning procedure when L03 = "3: Tuning operation with checking accuracy"

(1) Specify the maximum speed (F03), rated speed (F04), rated voltage (F05), control mode (F42), no. of poles (P01), rated capacity (P02), rated current (P03), %R1 (P07), %X (P08), pulse encoder selection (L01), resolution (L02), ASR P constant at high speed (L36) and ASR P constant at low speed (L38) to match the motor and pulse encoder specifications.

(2) Set function code L03 to "3." When a run command is set, tuning starts.

After tuning, the tuning result is written into L04 data. After tuning, the L03 data will be automatically reset to 0.

(3) Enter run forward and run reverse commands to run the motor at the low speed at least one rotation in the forward and reverse directions, respectively. (Note 1)

(4) Turn the power off and then turn it on again to confirm that the motor runs normally. (Note 2)

Note 1: If the motor fails to run normally, the A and B phases of the pulse encoder may be mistakenly connected in wiring. Once shut down the power and correct the wiring of the A and B phases. After parameter-tuning of the motor, do tuning again with the procedure above.

Note 2: If the motor fails to run normally, the wiring of the magnetic pole position detection signals may be wrong. Correct the wiring.

 For details, refer to the instruction manual of the corresponding option card.

L05 ACR P constant

L06 ACR I constant

When a synchronous motor is used, P constant (L05) and I constant (L06) of ACR(Automatic Current Regulator) are set.

- Data setting range (L05): 0.0 to 10.0
- Data setting range (L06): 0.50 to 5.00 (ms)

L08 Divide frequency ratio

Setting Divide frequency ratio of encoder output pulse in order to make sure not over the maximum control.

Data for L08	Divide frequency ratio of FA/FB
0	1/1
1	1/2
2	1/4
3	1/8
4	1/16
5	1/32
6	1/64

 Only when the option card OPC-LM1-ID is installed, this setting is available.

L09 Filter Time Constant for Reference Speed (Final)

L09 specifies the filter time constant for the reference speed (final) to be applied after the S-curve ramp control, which reduces an impact produced at rapid acceleration/deceleration.

- Data setting range: 0.000 to 0.100 (s)

L10	Filter Time Constant for Detected Speed

L10 specifies the filter time constant for a detected speed.

- Data setting range: 0.000 to 0.100 (s)

L11 to L18	Multistep Speed Command Combination (Zero Speed to High Speed) F01 (Speed Command)

L11 to L18 combine commands ***SS1***, ***SS2*** and ***SS4*** assigned to general-purpose input terminals with speed commands--zero speed (C04) to high speed (C11).

- Data setting range: 00000000_b to 00000111_b

📖 Refer to the description of function code F01 for details.

L19 to L28	S-curve Setting 1 to 10 F01 (Speed Command)

L19 to L28 specify S-curve zones to be applied to operations driven by multistep speed commands with S-curve acceleration/deceleration.

The setting values are indicated in percentage to the maximum speed.

- Data setting range: 0 to 50 (%)

📖 Refer to the description of function code F01 for details.

L29	Short Floor Operation (Holding time)
L30	Short Floor Operation (Allowable speed)

L29 and L30 specify a short floor operation that applies when a deceleration command is entered during acceleration in a multistep speed operation in order to keep the current high-speed operation and shorten the creep time.

The short floor operation can be also used for resetting elevators.

There are two kinds of short Floor operation (Mode1: Normal Short Floor Operation and Mode2: Short Floor Operation with location control). The explanation of Mode1 is as follows.

📖 Refer to the description of function code L99 for the method of changing short floor operation and the explanation of Mode2.

■ Short floor operation holding time (L29)

L29 specifies the holding time of A short floor operation. The count of the holding time starts when the speed becomes constant.

- Data setting range: 0.00 to 10.00 (s)

■ Allowable speed (L30)

L30 specifies the allowable speed, below which a short floor operation can be activated.

When the motor is running at the speed less than the one specified by L20 during acceleration in a multistep speed operation, entering a deceleration command activates a short floor operation.

- Data setting range: 0.00 to 3600 (r/min)

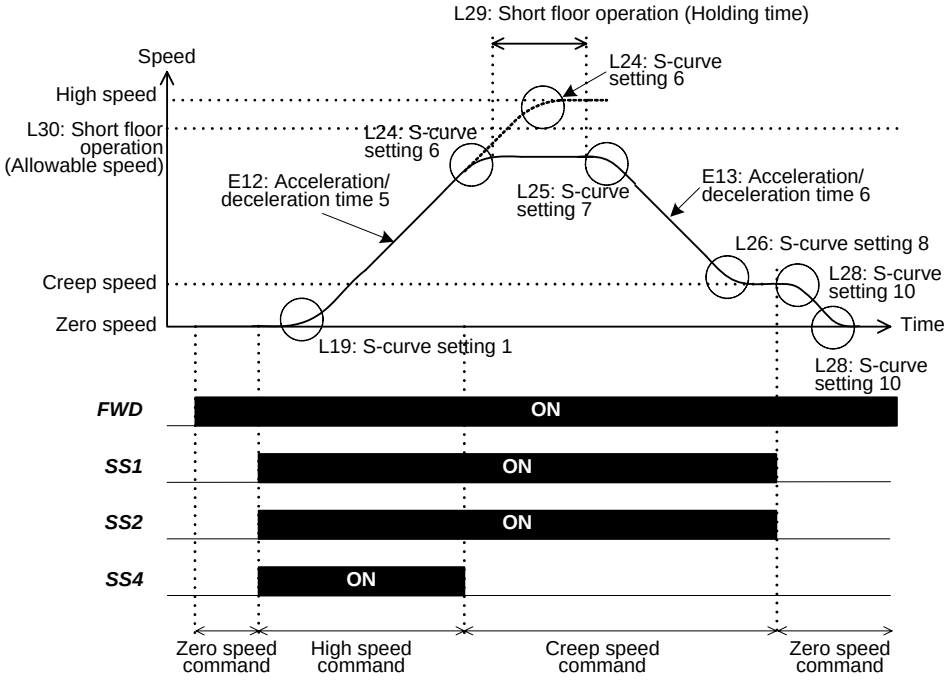
📖 Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

In case of Reference speed (final) ≤ Allowable speed (L30) when a deceleration command is entered

(1) Upon receipt of a deceleration command, an S-curve operation starts for finishing the current acceleration.

(2) After completion of the S-curve operation, the current speed is kept for the short floor operation holding time (L29).

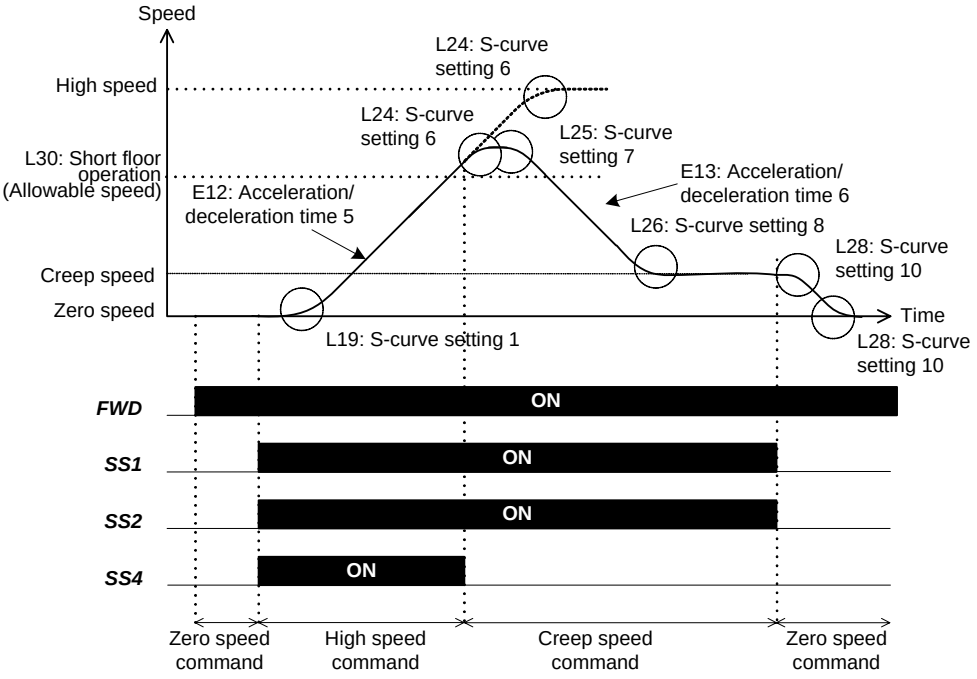
(3) After the holding time, the inverter decelerates in the specified S-curve operation.



In case of Reference speed (final) > Allowable speed (L30) and Holding time (L29) ≠ 0.00 when a deceleration command is entered

(1) Upon receipt of a deceleration command, an S-curve operation starts for finishing the current acceleration.

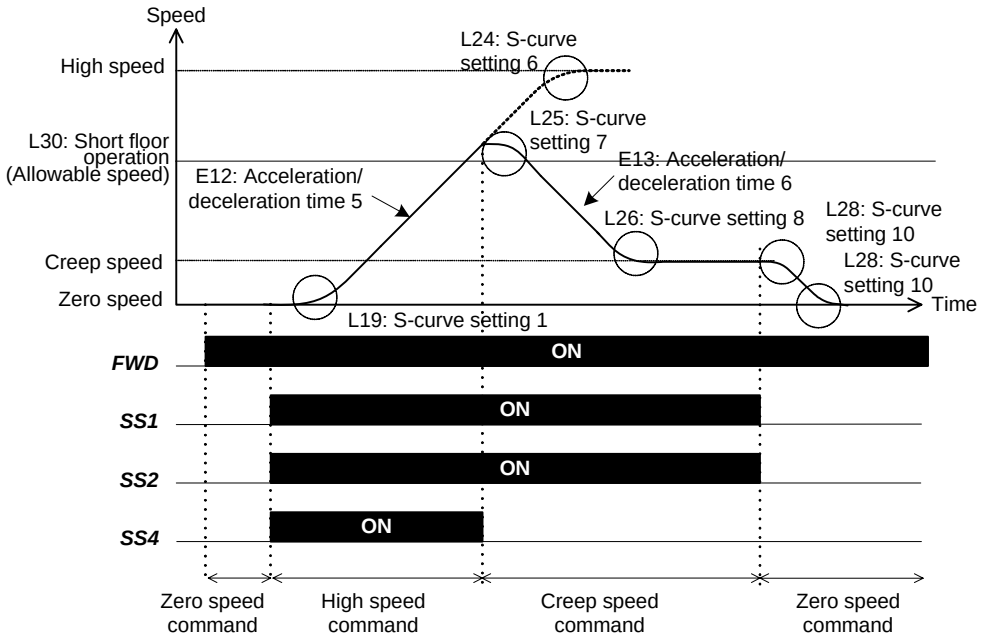
(2) After completion of the S-curve operation, the inverter decelerates in the specified S-curve operation for the creep speed.



In case of Reference speed (final) > Allowable speed (L30) and Holding time (L29) = 0.00 when a deceleration command is entered

(1) Even if a deceleration command is received, no S-curve operation starts for finishing the current acceleration. (If already in an S-curve operation, the inverter cancels the S-curve operation.)

(2) Immediately the inverter decelerates in the specified S-curve operation for the creep speed.



L31 Elevator Parameter (Speed)

L31 specifies the elevator speed (m/min) relative to the inverter's maximum speed (F03).

The elevator speed (L31) can be calculated with the following equation.

L31 = Maximum speed (r/min)/Detected speed (r/min) x Elevator rated speed (m/min)

(Example) If the elevator rated speed is 45 m/min, the detected speed is 1350 r/min, and the maximum speed is 1800 r/min:

L31 = 1800/1350 x 45 = 60 (m/min)

- Data setting range: 0.01 to 240.00 (m/min)

Note Changing the elevator parameter (L31) requires modifying the data of other function codes. Refer to page 2-14.

L32 Elevator Parameter (Over speed protection level)

Setting over speed protection level. If the speed of motor is exceeds the over speed protection level, inverter will stop. When there is no L32, protection level is constant 120%.

- Data setting range: 50 to 120 (%) (100%: setting value of max speed)

L34 Elevator Parameter (Moving distance in creepless operation)

L34 specifies the moving distance of an elevator cage in a creepless operation from its start to end.

- Data setting range: 0.0 to 6553.5 (mm)

Creepless operation

If a creepless operation is selected with the function codes listed below, the inverter receives the position of the elevator cage at landing by an external command and generates a speed command pattern that moves the cage by the distance specified by L34 from the current position to land it.

Accordingly, the creepless operation eliminates a creep required for general elevator control, decreasing the landing time length.

Function code	Name	Data setting range	Unit	Function
E01 to E08	Command assignment to terminals [X1] to [X8]	64: Start creepless operation ***CRPLS***	--	Turning the associated terminal ON starts creepless operation.
L31	Elevator speed	0.01 to 240.00	m/min	This code specifies the elevator speed relative to the inverter's maximum speed.
L34	Moving distance in creepless operation	0.0 to 6553.5	mm	This code specifies the moving distance of an elevator cage in a creepless operation from its start to end.

Requirements for creepless operation

(1) The elevator system should be equipped with a device that accurately detects the position of an elevator cage, or its equivalent device.

(2) The elevator system should be capable of applying signals issued from the detector (stated in (1) above) to the inverter as a "Start creepless operation" command ***CRPLS*** or be capable of modifying speed commands (except zero speed) to zero speed command.

(3) During deceleration, that is, after the start of deceleration, the signal stated in (2) above can be applied to the inverter.

(4) The moving distance from the start of a creepless operation should be 6553.5 mm or less.

(5) The elevator speed calculated for L31 should be 240.00 m/min or below.

(6) A multistep speed command with S-curve operation should apply for speed control.

Deceleration point programming and moving distance

Creepless operation requires accurately programming the position of a deceleration point. Given below is a programming method using the calculation result of the moving distance from the start of deceleration to a stop.

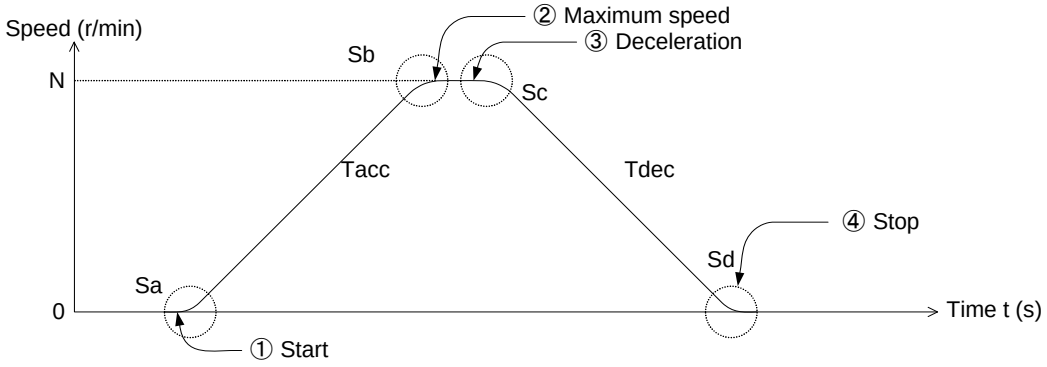
The moving distance from "③ Deceleration" to "④ Stop" in the speed pattern shown below is given by the following equation. Note that N should be equal to or greater than the S-curve zone (N ≥ F03 x (Sc/100 + Sd/100).

$$L = C \times \frac{V\max}{60} \times Tdec \qquad \textbf{Equation 1}$$

$$C = \frac{1}{2} \times \left(\frac{N}{N\max} \right)^2 + \frac{Sc}{100} \times \left(\frac{N}{N\max} \right) + \left(\frac{Sd^2 - Sc^2}{60000} \right) \qquad \textbf{Equation 2}$$

Where

Vmax: Elevator speed (L31) (m/min)
Nmax: Inverter's maximum speed (F03) (r/min)
N: Motor speed at the start of deceleration (r/min)
Tdec: Deceleration period specified (s)
Sc, Sd: S-curve zone specified (%)



The elevator cage moves by distance "L" calculated by equations 1 and 2 when the elevator decelerates from speed "N" during deceleration period "Tdec" within S-curve zone from "Sc" to "Sd," provided that no speed error exists in inverter control. The deceleration point, therefore, should be distance "L" or more before the stop position.

Conditions required for starting a creepless operation

When all of the following three conditions are met, a creepless operation starts.

(1) A creepless operation command is entered.

That is,

- The ***CRPLS*** command is turned ON when the ***CRPLS*** is assigned to a terminal.
- Any speed command (except zero speed) is modified to zero speed when the ***CRPLS*** is not assigned to any terminal.

(2) The reference speed (pre-ramp) is 0.00 r/min.

(3) The remaining moving distance (the internally calculated moving distance from the start of a creepless operation) is nonzero.

Restrictions on creepless operation

(1) The acceleration commanded during a creepless operation will not exceed the specified acceleration.

(2) Do not change the reference speed (pre-ramp) during a creepless operation.

(3) After the end of running (including the end of operation due to the protective function triggered and a coast-to-run command received), turn the ***CRPLS*** command OFF.

(4) In any of the following cases, the creepless operation is forcedly terminated.

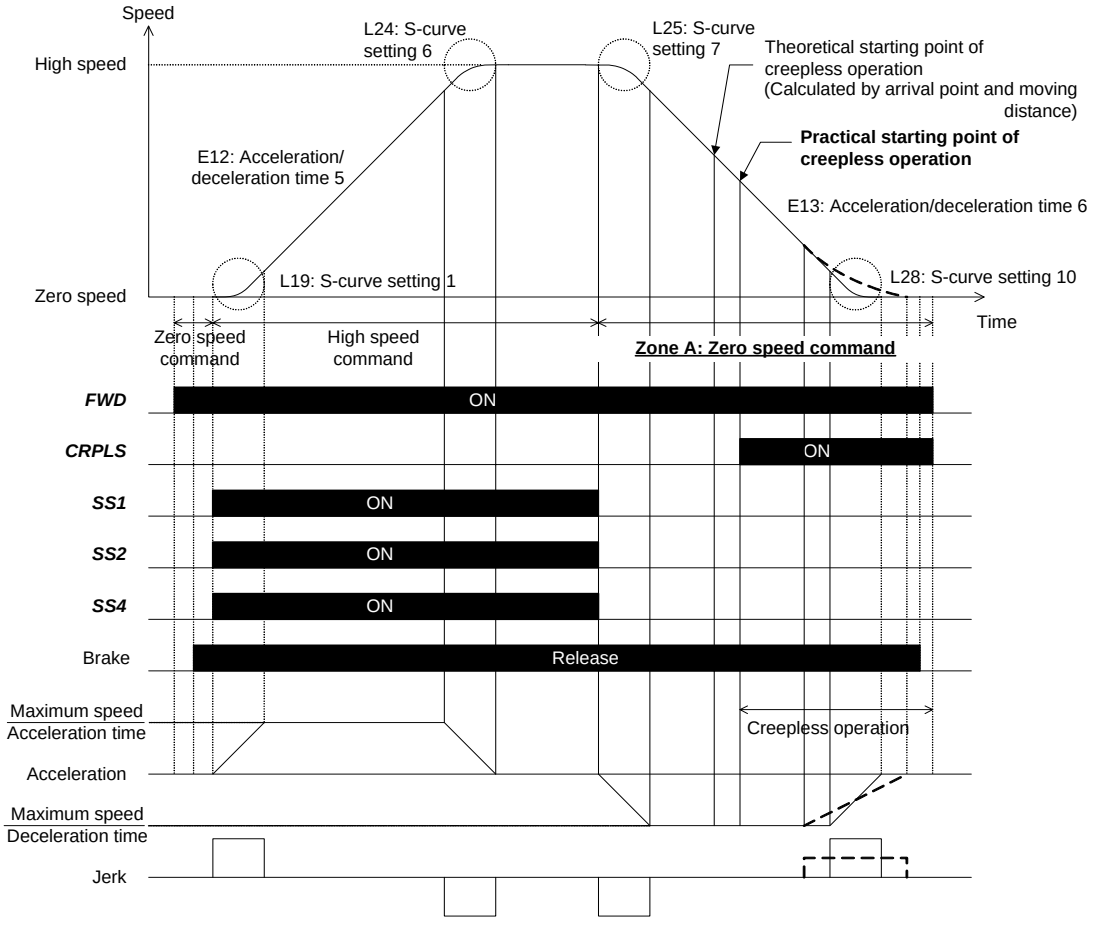
- Such a speed pattern that the speed does not reach 0 after the elevator cage moves the specified moving distance.
- Reference speed (pre-ramp) is nonzero.
- Run command is OFF.

After the forced termination, the inverter continues to run with the speed control not involving a creepless operation. No protective function (trip) works. No creepless operation takes place until the inverter stops.

Input timing of a creepless operation command

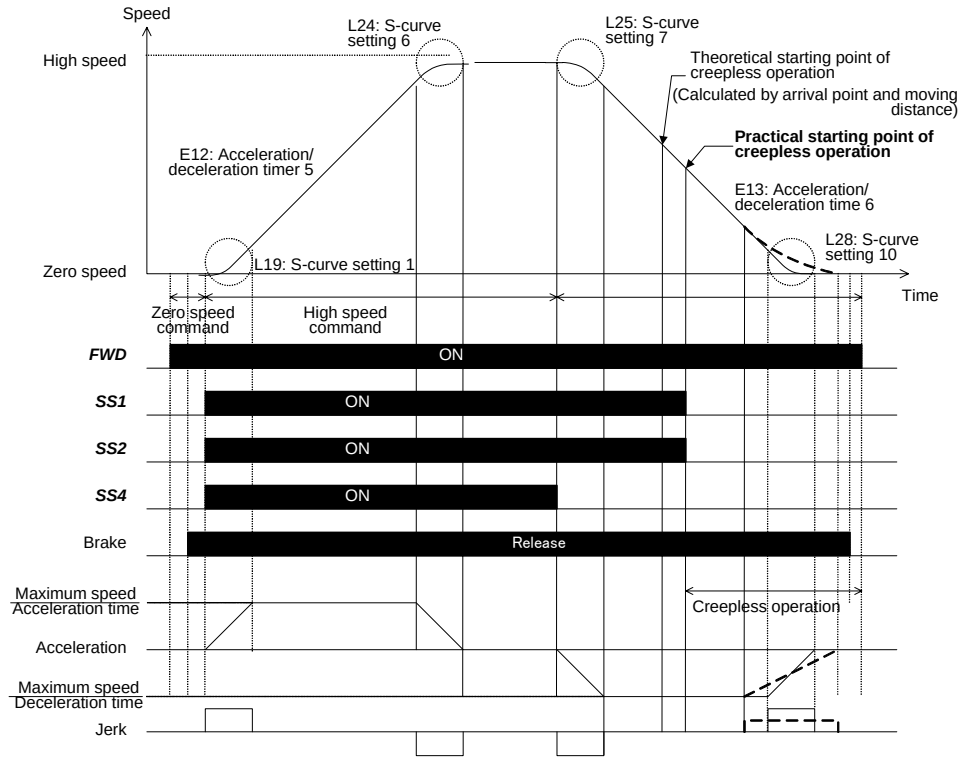
The graph below shows a basic pattern of a creepless operation using the "Start creepless operation" command ***CRPLS***. The ***CRPLS*** command should be given within zone "A" ranging from the end to the start of deceleration.

The following example shows deceleration from high speed to zero speed. The waveforms drawn with broken lines show the speed, acceleration and jerk applied when the ***CRPLS*** command is given earlier than the ones drawn with full lines.



Example of Creepless Operation with ***CRPLS***

The graph below shows a creepless operation applied when no ***CRPLS*** is assigned. Both the creep speed (C07) and zero speed (C04) are 0.00 r/min. To prevent any impact to the load, when the speed changes to zero speed from any other speed, the speed control should be programmed so that the acceleration/deceleration time and S-curve zone will not change.



Example of Creepless Operation with ***CRPLS***

Improving the landing position accuracy in a creepless operation

Observing the following rules improves the landing position accuracy (including the repeatability) in a creepless operation.

(1) When using a multistep speed command to change the reference speed (pre-ramp) to zero speed, lessen the number of terminals which should be switched.

Changing the setting of only a single terminal for changing the reference speed (pre-ramp) can suppress the fluctuation of signals issued from the host controller, improving the stopping accuracy. For that purpose, use L11 (Zero speed) to L18 (High speed).

(2) Use the multistep speed command agreement timer (E19) for multistep speed commands.

(3) Specify the filter time constant for reference speed (final) (L09) as small as possible. It is, however, not necessary to specify the value smaller than the factory default.

Increasing the filter time constant makes the actual moving distance to a stop longer than the one specified by L34 (Moving distance in creepless operation). If such is necessary, therefore, increase the L34 data to adjust the landing position. In this case, it is difficult to calculate the moving distance with Equations 1 and 2 given in "Deceleration point programming and moving distance." Tune-up with the actual elevator is required.

(4) Increase the ASR gain.

In a creepless operation, keeping "Reference speed (final) = Detected speed" is ideal. It is, therefore, necessary to increase the ASR gain to the extent that no hunting occurs, with L36 to L42.

(5) Widen the S-curve zone at the start of deceleration.

With the same reason as stated in (4) above, to suppress the speed difference at the start of deceleration, it is recommended that the S-curve zone be set to 20% or more to the deceleration sequence.

Notes for accurate landing in a creepless operation

(1) Even if a creepless operation is programmed in accordance with the instructions given on the previous pages, the landing position may not be level with a floor. If it happens, use L34 to adjust the moving distance.

(2) The moving distance accuracy in a creepless operation is not guaranteed since it has a relationship with the elevator speed.

The speed control accuracy is the maximum speed -0.01 to 0.01%. Use the accuracy as a guide in programming a creepless operation.

(3) If it is not possible to accurately set the elevator speed (L31) (e.g., elevator specifications having decimal fractions), any error will be produced between the actual moving distance and internally calculated one. If it happens, use L34 to adjust the moving distance so that the landing position comes to be level.

L36	**ASR (P constant at high speed)**
L37	**ASR (I constant at high speed)**
L38	**ASR (P constant at low speed)**
L39	**ASR (I constant at low speed)**
L40	**ASR (Switching speed 1)**
L41	**ASR (Switching speed 2)**

L36 through L39 specify the P and I constants each at high and low speed for the auto speed regulator (ASR). High and low speeds can be switched according to the ASR switching speeds 1 and 2 (L40 and L41).

📖 For details about the ASR switching speed, refer to the descriptions of L40 and L41.

■ ASR P constant (L36 and L38)

The P constant should be specified in proportional to the inertia and machine constant of the load connected to the motor shaft.

If P constant = 1.00, it means that the reference torque comes to be 100% (of the rated torque output of each inverter capacity) when the speed difference (Reference speed (final) - Detected speed) is 100% (equivalent to the maximum speed setting).

- Data setting range: 0.01 to 200.00

Note Increasing the P constant relative to the inertia makes response from machinery or equipment fast but may cause overshooting or hunting in motor. Further, due to resonance of machinery or overamplified noise, machinery or motor may produce vibration noise.

On the contrary, decreasing the P constant excessively delays response and may cause speed fluctuation in a long cycle, taking time to stabilize the speed.

■ ASR I constant (L37 and L39)

The integral constant for the ASR should be specified to the I constant. Since the integration refers to integrating of deviation at the interval of time specified by I constant, setting a small constant shortens the integration interval, making a faster response. On the contrary, setting a large constant lengthens it, having a less effect on the ASR.

To allow overshooting and reach the target speed quickly, specify a small constant.

- Data setting range: 0.001 to 1.000 (s)

Note An integral action refers to a delay component. The integral constant is the gain of the delay component. Making the integral action highly responsive increases the delay component, unstabilizing the control system including the motor and machinery. It takes the form of overshooting or vibration.

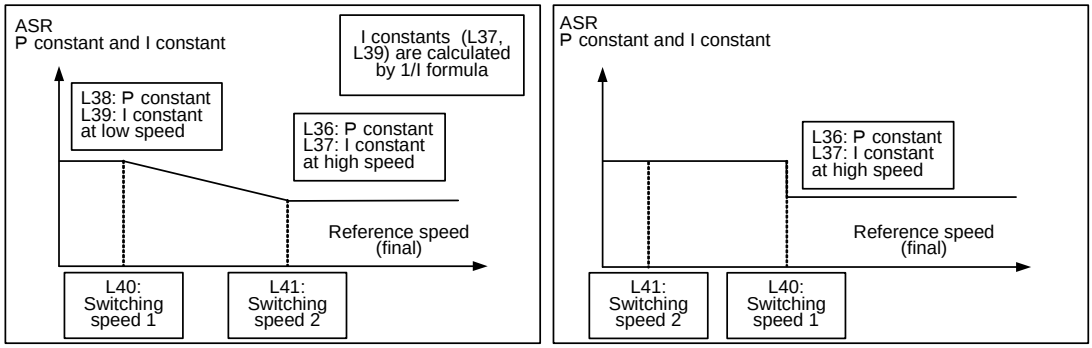
One solution for the resonance of machinery generating abnormal mechanical noise from the motor or gears is to increase the integral constant. If there is any request not to delay response from machinery or equipment, examine the machinery causing the resonance and take any necessary measures at the machinery side.

■ASR switching speeds (L40 and L41)

L40 and L41 specify the speed at which the P and I constants to be applied are switched between the ones for high speed (L36 and L37) and the ones for low speed (L38 and L39). The switching pattern samples are shown below.

Note that if L41 ≤ L40, the P and I constants are switched to the ones for high speed when the switching speed specified by L40 lowers than the reference speed (final).

- Data setting range: 0.00 to 3600 (r/min)



L42 ASR (Feed forward gain)

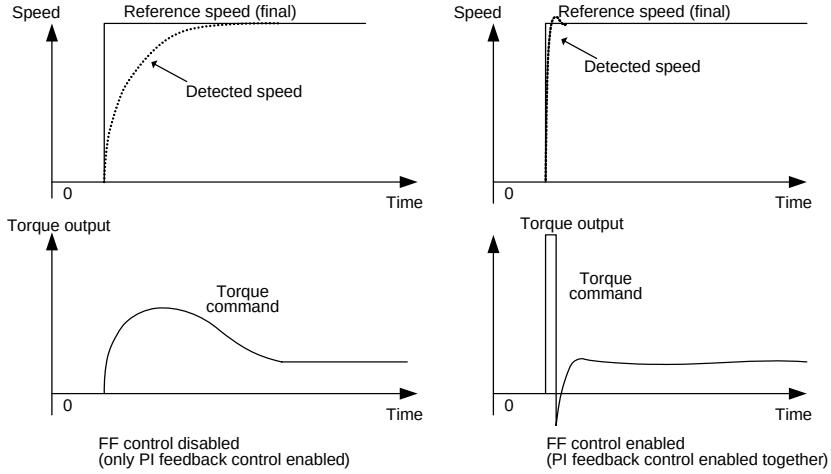
The FRENIC-Lift series of inverters supports the feed forward control that directly adds a torque value determined by deviation in a reference speed (final) to the reference torque.

- Data setting range: 0.000 to 10.000 (s)

The PI control of the ASR is a feedback control. It monitors the result (detected speed) of the target operation and deals with any deviation from the desired operation (reference speed (pre-ramp)) for correction (for following the reference speed (pre-ramp)). The merit of this control is that it can make corrections even for directly unmeasurable factors such as unmeasurable disturbance and uncertainty of the control target. The demerit is that the control makes follow-up corrections after detecting any deviation (reference speed (final) - detected speed) even for foreknown changes.

Since the operation quantity (reference torque) for foreknown factors can be obtained beforehand, adding the quantity to the reference torque directly, that is, the feed forward control can provide a highly responsive control.

When a load inertia is foreknown, the feed forward control is effective. As shown on the next page, the follow-up speed from the detected speed to the reference one is definitely different depending upon whether the feed forward control is disabled and enabled. To get the maximal effect, it is necessary to well balance the feed forward gain (L42) with the P and I constants (L36 to L39) of the ASR.



The effect above can be obtained also by adjusting the P and I constants to speed up the response, but it involves any demerits such as resonance of machinery and vibration noise.

L49	Vibration Suppression Observer (Gain)
L50	Vibration Suppression Observer (Integral time)
L51	Vibration Suppression Observer (Load inertia)

L49 through L51 specify the mechanical inertia for the vibration suppression observer. The observer runs the simulation model inside the inverter, estimates a load torque (that can be a vibration element), and applies it to the reference torque for canceling the load torque. This way the observer quickly attenuates the vibration caused by resonance of machinery.

■ Gain (L49)

L49 specifies the compensation gain for the vibration suppression observer. Specification of 0.00 disables the observer.

Usually set the gain within the range from 0.00 to 0.50.

- Data setting range: 0.00 (Disable)
  0.01 to 1.00

■ Integral time (L50)

L50 specifies the integral time of the observer. No change is required except special cases.

- Data setting range: 0.005 to 1.000 (s)

■ Load inertia (L51)

L51 specifies the moment of inertia of the load. After converting the moment of inertia of the motor and traction machine for the motor shaft, use the value.

- Data setting range: 0.01 to 655.35 (kgm^2)

L52	Start Control Mode	F23 (Starting Speed)

L52 specifies the start control mode.

Data for L52	Function
0	Enable speed start mode.
1	Enable torque start mode.

📖 For details, refer to the description of F23.

L54	Torque Bias (Mode)	L58 (Torque Bias, P constant) L59 (Torque Bias, I constant) L60 (Torque Bias, Driving gain) L61 (Torque Bias, Braking gain) L62 (Torque Bias, Digital 1) L63 (Torque Bias, Digital 2) L64 (Torque Bias, Digital 3)

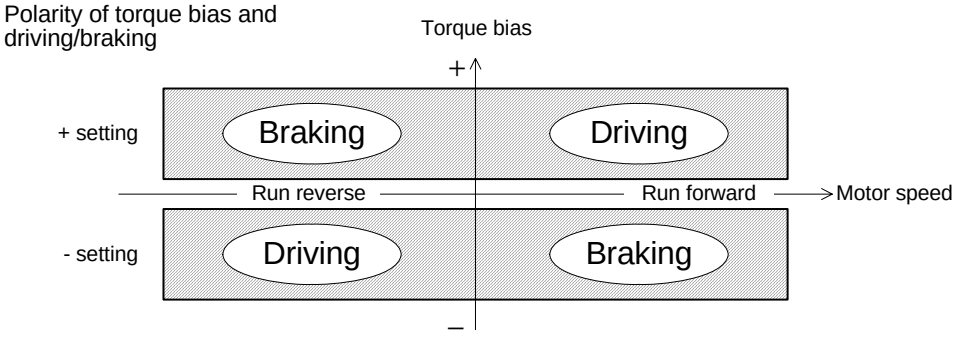
L54 specifies whether to use analog or digital torque bias.

Data for L54	Function
0	Enable analog torque bias.
1	Enable digital torque bias.
2	Enable PI torque bias

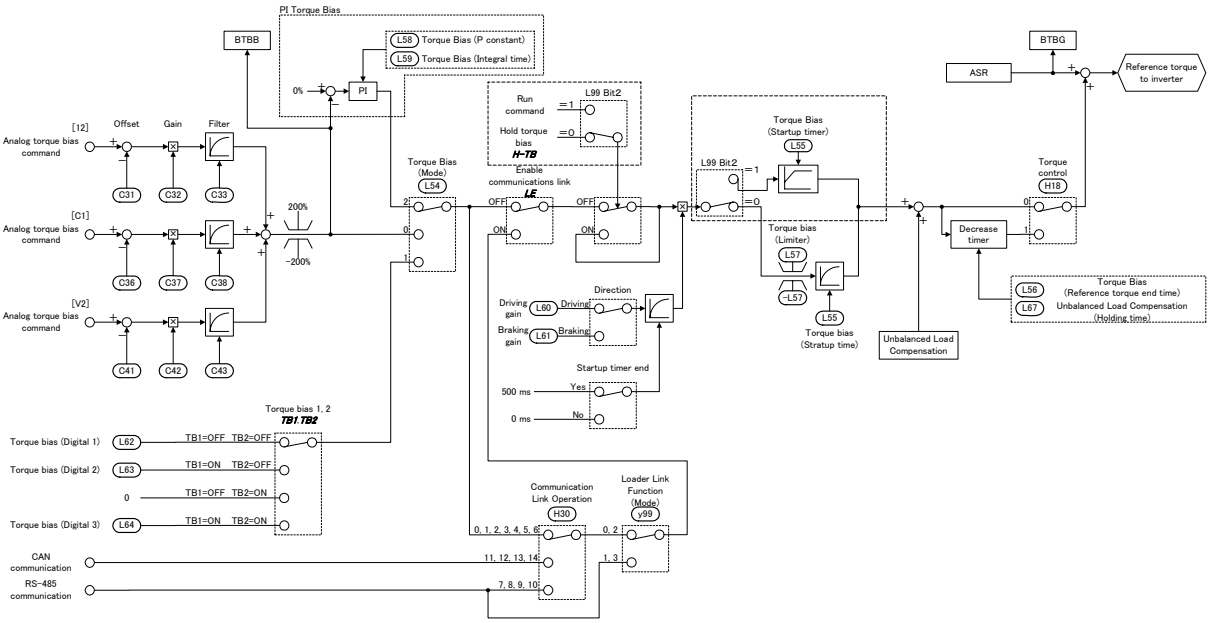
■ Torque Bias (L54)

The torque bias control outputs torque corresponding to load application in advance in order to reduce an impact made when the brake is released.

A torque bias can be specified for compensation either with analog or digital input



In the figure shown above, when viewed from the motor shaft, the counterclockwise rotation means the forward direction, and the clockwise rotation, the reverse direction. The torque bias (+) is a forward direction torque.



Block Diagram of Torque Bias Generator

Analog torque bias (L54 = 0)

Setting L54 data to "0" enables torque bias setting with analog input.

When L54 = 0, assigning a reference torque bias to terminals [12] and [V2] (by function codes E61 and E63) inputs a torque bias with analog voltage input, and assigning it to terminal [C1] (by E62), a torque bias with analog current input. If no reference torque bias is assigned to any of terminals [12], [V2], and [C1], however, the analog torque bias is 0 (%).

Terminal commands ***TB1*** and ***TB2*** assigned to the general-purpose, programmable input terminals (by function codes E01 to E08, E98 and E99) are ignored.

When an analog torque bias is specified, adjust the gain with L60 (Driving gain) and L61 (Braking gain). If L60 (L61) = 100%, analog input voltage -10 to +10 VDC corresponds to -100 to +100% of the motor rated torque and analog input current 4 to 20 mA corresponds to 0 to 100% of the motor rated torque, assuming that gain = 100% and offset = 0%.

- Balancing

With the elevator being loaded with a counterweight, adjust a torque bias amount to 0% relative to the input voltage of the load sensor. This adjustment should be made when the elevator is stationary with a counterweight loaded and the brake being on.

Setting E43 data (LED monitor) to "19" monitors the torque bias balance adjustment value (BTBB) on the LED monitor. For the multi-function keypad with ROM version 8510, press the FUNC/DATA key in Running mode and switch to monitor page 14. Adjust the balance by adjusting analog input with C31 ([12] Offset), C36 ([C1] Offset) or C41 ([V2] Offset) so that the monitored data comes to 0 (%). (The monitored data shows the ratio to the motor rating torque in percentages.)

- Gain adjustment

(1) The gain adjustment should follow the balance adjustment. Before proceeding to the gain adjustment, set analog input with C32 ([12] Gain), C37 ([C1] Gain), or C42 ([V2] Gain) to 100 (%).

(2) According to the table below, determine the initial values of the gains at the driving and braking sides (L60 and L61).

Motor rotational direction when the elevator lifts up	When the load increases, the analog voltage/current input (load sensor) will:	Initial values of L60 and L61 data	Function codes to be set with no load	
			UP	DOWN
Forward	Increase	+100 (%)	L61	L60
	Decrease	-100 (%)		
Reverse	Increase	-100 (%)	L60	L61
	Decrease	+100 (%)		

(3) Setting E43 data (LED monitor) to "20" monitors the torque bias gain adjustment value (BTBG) on the LED monitor. For the multi-function keypad with ROM version 8510, press the FUNC/DATA key in Running mode and switch to monitor page 15.

(4) With no load, run the elevator up at a speed of 2 to 10% of the elevator rated speed. Adjust L61 and L60 data in the forward and reverse direction, respectively, so that the monitored data comes to approximately 0 (%) when the speed is stabilized. (The monitored data shows the ratio to the motor rating torque in percentages.)

(5) With no load, run the elevator down at a speed of 2 to 10% of the elevator rated speed. Adjust L60 and L61 data in the forward and reverse direction, respectively, so that the monitored data comes to approximately 0 (%) when the speed is stabilized.

Note For torque bias setting with current input, the input current on terminal [C1] should be within the range from 4 to 20 mA when the elevator is with no load to the maximum load. The input current from 0 to 4 mA is regarded as 0.

If the current input of 4 mA or below is not avoidable, change the load (the maximum load, for example) and perform steps (4) and (5) above when the current input on [C1] is kept within the range from 4 to 20 mA.

Digital torque bias (L54 = 1)

Setting L54 data to "1" enables torque bias setting with digital input.

When L54 = 1, setting "60" or "61" to any general-purpose, programmable input terminal (by function codes E01 to E08, E98 and E99) assigns command ***TB1*** or ***TB2***, respectively. If neither ***TB1*** nor ***TB2*** is assigned, the torque bias is 0 (%).

The table below shows the relationship between the ***TB1***/***TB2*** command settings and the torque bias value. If only either one of those commands is assigned, the unassigned terminal is regarded as OFF. L60 and L61 specify the gains at the driving and braking sides.

When the inverter is running, a reference torque bias should be held at the host controller side. Chattering of a reference torque bias during running will result in vibration.

If it is difficult to hold a reference torque bias at the host controller side, use a torque bias hold command and startup timer described in the description of L55 (Torque bias startup timer).

TB1	***TB2***	Torque bias value
OFF	OFF	Specified by L62 (Data setting range: -200 to 200 (%) with the forward direction torque as +)
ON	OFF	Specified by L63 (Data setting range: -200 to 200 (%) with the forward direction torque as +)
OFF	ON	0 (%) (No torque bias)
ON	ON	Specified by L64 (Data setting range: -200 to 200 (%) with the forward direction torque as +)

PI torque bias (L54 = 2)

Setting L54 data to "2" enables PI torque bias setting with analog input. Torque sensor is used for measuring braking torque, calculate torque bias by making the output of torque sensor become 0V before releasing brake. It is possible to adjust it by the following function codes.

■ Torque Bias (P constant) (L58)

Specify the P constant to use in PI torque bias calculation.

- Data setting range: 0.01 to 10.00

■ Torque Bias (I constant) (L59)

Specify the I constant to use in PI torque bias calculation.

- Data setting range: 0.00 to 1.00 (s)

L55	Torque Bias (Startup time)

L55 specifies the startup time of a torque bias.

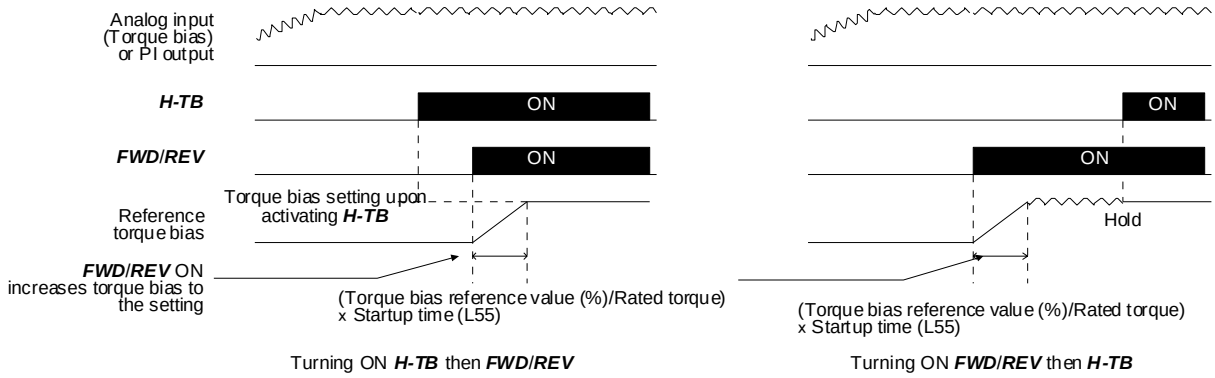
- Data setting range: 0.00 to 1.00 (s)

Terminal command "Hold torque bias" and startup time

Setting "62" to any general-purpose, programmable input terminal (by function codes E01 to E08, E98 and E99) assigns the ***H-TB*** command.

Turning the ***H-TB*** ON holds a reference torque bias; turning it OFF releases the hold.

When a run command ***FWD*** or ***REV*** is turned ON, the inverter increases a reference torque bias value up to the specified torque bias for the time length specified by L55. Once the reference torque bias value reaches the specified one, the bias setting applies. Note that you specify the time length required from the start of running until the torque changes from 0 to 100% of the motor rated torque.



Note When the PI torque bias (L54=2) is set, it is necessary to turn on the ***FWD*** or ***REV*** earlier than ***H-TB***.

L56	Torque Bias (Reference torque end time) L66 (Unbalanced Load Compensation, Activation time) L67 (Unbalanced Load Compensation, Holding time)

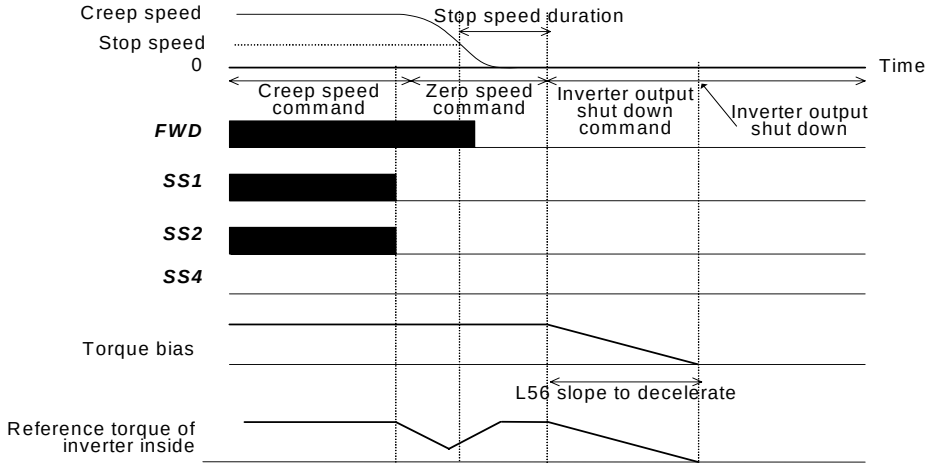
L56 sets up the reference torque end timer whose functional property differs whether in speed control or in torque control.

- Data setting range: 0.00 (Disable)
  0.01 to 20.00 (s)

In speed control

During the shutdown sequence in speed control, the inverter decreases a reference torque value held internally to 0, taking time specified by L56 for deceleration.

Note that you set the time length required to decrease the motor rating torque from 100 to 0% to the reference torque end timer.

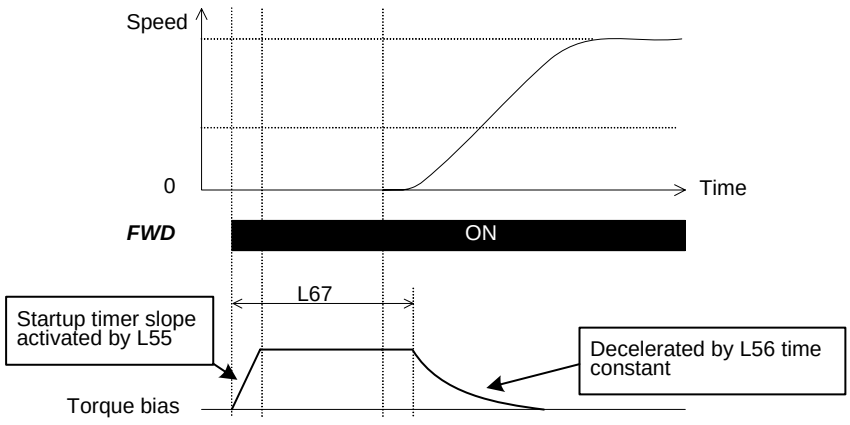


Reference Torque End Sequence in Speed Control

In torque control

During the startup sequence in torque control, the inverter decreases the torque bias amount (Torque bias amount issued from the user controller + Unbalanced load compensation) to 0 using the time constant specified by L56. It is triggered after the time length specified by L67 (Holding time) from when the command ***UNBL*** is turned ON (if the ***UNBL*** command is assigned to any general-purpose, programmable input terminal by setting "67") or when a run command is turned ON (if no ***UNBL*** is assigned).

The activation timer setting (L66) should be less than the holding time (L67). If L66 > L67, the L66 setting automatically applies to the L67 setting inside the inverter.



Reference Torque End Sequence in Torque Control

L57	Torque Bias (Limiter)	

L57 specifies the absolute value of a torque bias amount to be used after the driving or braking gain is applied, as a percentage to the rated torque. It limits a torque bias amount for protection against a load sensor defective and others.

- Data setting range: 0 to 200 (%)

L58	Torque Bias (P constant)	L54 (Torque Bias, Mode)

L58 specifies the P constant to use in PI torque bias.

- Data setting range: 0.01 to 10.00

Refer to the description of function code L54 for details.

L59	Torque Bias (I constant)	L54 (Torque Bias, Mode)

L59 specifies the I constant to use in PI torque bias.

- Data setting range: 0.00 to 1.00 (s)

Refer to the description of function code L54 for details.

L60	Torque Bias (Driving gain)	L54 (Torque Bias, Mode)
L61	Torque Bias (Braking gain)	L54 (Torque Bias, Mode)

L60 and L61 specify the gains of torque biases at the driving and braking sides, respectively, as a percentage to the rated torque.

- Data setting range: -1000.0 to 1000.0 (%)

Refer to the description of function code L54 for details.

L62	Torque Bias (Digital 1)	L54 (Torque Bias, Mode)
L63	Torque Bias (Digital 2)	L54 (Torque Bias, Mode)
L64	Torque Bias (Digital 3)	L54 (Torque Bias, Mode)

L62 to L64 specify digital torque bias amounts with the forward rotation direction torque as a positive value.

- Data setting range: -200 to 200 (%)

Refer to the description of function code L54 for details.

L65	Unbalanced Load Compensation (Operation) L66 (Activation timer) L67 (Holding time) L68 (ASR P constant) L69 (ASR I constant) L73 (APR P constant) L74 (APR D constant) L75 (Filter Time Constant for Detected Speed)

L65 specifies whether to enable or disable the unbalanced load compensation.

Data for L65	Function
0	Disable the unbalanced load compensation.
1	Enable the unbalanced load compensation.

Unbalanced load compensation

This compensation function estimates an unbalanced load and calculates the required torque bias amount inside the inverter.

Setting "67" to any general-purpose, programmable input terminal (by function codes E01 to E08, E98 and E99) assigns the ***UNBL*** command. With the ***UNBL*** being assigned, entering a ***UNBL*** command following a run command starts estimating an unbalanced load. If no ***UNBL*** is assigned, entering a run command starts it.

Just as the torque bias function, this compensation function lightens an impact made when the brake is released even in elevator systems having no load sensors.

The table below lists function codes to be used in unbalanced load compensation.

Function code	Name	Setting required
E01 to E08, E98, and E99	Command assignment to terminals [X1] to [X8] Setting "67" assigns ***UNBL***.	Turn the ***UNBL*** ON to start estimating an unbalanced load (and start L66 and L67 timers). If no ***UNBL*** is assigned, turn a run command ON to start estimating an unbalanced load.
L66	Unbalanced load compensation (Activation timer)	Specify the maximum time length for estimating an unbalanced load.
L67 *1	Unbalanced load compensation (Holding time)	Specify the start time for decreasing the torque bias amount in torque control. L66 < L67
L68	Unbalanced load compensation (ASR P constant)	Specify the ASR P constant to use in unbalanced load calculation. If vibration occurs, decrease the constant.
L69	Unbalanced load compensation (ASR I constant)	Specify the ASR I constant to use in unbalanced load calculation. If vibration occurs, increase the constant.
L73	Unbalance load compensation (APR P constant)	Specify the APR P constant to use in unbalanced load calculation
L74	Unbalance load compensation (APR D constant)	Specify the APR D constant to use in unbalanced load calculation
L75	Unbalance load compensation (Filter Time Constant for Detected Speed)	Specify the Filter time constant for detected speed to use in unbalanced load calculation

*1 Required only in torque control.

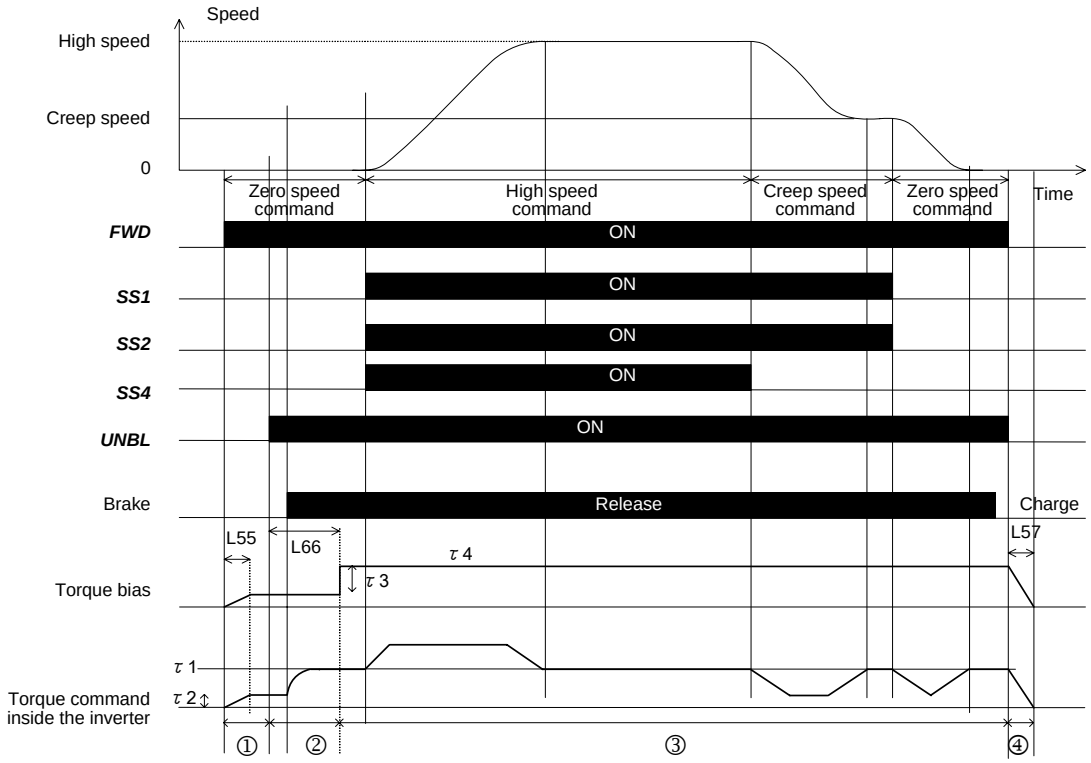
Note When an ***UNBL*** command is assigned to any general-purpose, programmable input terminal, be sure to enter a run command before entry of an ***UNBL*** command. Entry of an ***UNBL*** preceding a run command does not perform unbalanced load compensation.

In speed control

Unbalanced load compensation requires keeping the reference speed (pre-ramp) at 0.00 r/min and releasing the brake during the period from the start of running to the completion of calculation (that is, during the activation timer setting specified by L66).

If the reference speed (pre-ramp) other than 0.00 r/min is entered before the time length specified by L66 elapses, unbalanced load compensation immediately starts.

During the time length (L66) from the start of estimation of an unbalanced load, the inverter holds zero speed with the zero speed control specified when unbalanced load compensation is enabled. After the time length (L66), the current reference torque value inside the inverter will be taken as a torque bias amount. After that, the inverter runs in speed control with the torque bias amount under ASR.



Details

(1) During the period from the entry of a run command to that of an ***UNBL*** command, the inverter runs with "User controller's torque bias amount τ2."

(2) During the time length (L66) from the start of estimation of an unbalanced load, the "Inverter internal reference torque" is equal to "Reference torque at the zero speed hold period in inverter position deviation zero control" plus "User controller's torque bias amount τ2." Finally, the "Inverter internal reference torque" becomes equal to "Load torque τ1."

(3) When the time length (L66) elapses after the start of estimation of an unbalanced load, adding the "Unbalanced load compensation amount τ3" to "User controller's torque bias amount τ2" produces "Torque bias amount τ4." At that point, τ3 = τ1 - τ2. After that, the inverter runs in speed control with the "Torque bias amount τ4" and under normal ASR operation.

(4) During the inverter shutdown sequence, the inverter decreases a reference torque value held in itself to 0, taking time specified by L56, and then shuts itself down.

In torque control

The inverter adds "Unbalanced load compensation amount" to "User controller's reference torque."

The added compensation amount starts decreasing in accordance with the reference torque end time (L56) after the holding time (L67) elapses from the start of unbalanced load compensation calculation.

L66	Unbalanced load compensation (Activation time) L56 (Torque Bias, Reference torque end time) L65 (Unbalanced Load Compensation, Operation)

L66 specifies the calculation time of unbalanced load compensation amount to apply after the ***UNBL*** command is turned ON.

- Data setting range: 0.01 to 2.00 (s)

Refer to the descriptions of function codes L56 and L65 for details.

L67	Unbalanced load compensation (Holding time) L56 (Torque Bias, Reference torque end time) L65 (Unbalanced Load Compensation, Operation)

L67 specifies the starting time for decreasing the torque bias amount in torque control.

- Data setting range: 0.01 to 20.00 (s)

Refer to the descriptions of function codes L56 and L65 for details.

L68	Unbalanced load compensation (ASR P constant)

L68 specifies the ASR(Automatic Speed Regulator) P constant to use in unbalanced load calculation.

Set a larger constant than the one specified in normal operation. If vibration occurs, decrease it.

- Data setting range: 0.00 to 200.00

L69	Unbalanced load compensation (ASR I constant)

L69 specifies the ASR I constant to use in unbalanced load calculation.

Set a smaller constant than the one specified in normal operation. If vibration occurs, increase it.

- Data setting range: 0.001 to 1.000 (s)

L73	Unbalance load compensation (APR P constant)

L73 specifies the APR (Automatic Position Regulator) I constant to use in unbalanced load calculation.

- Data setting range: 0.00 to 10.00

L74	Unbalance load compensation (APR D constant)

L74 specifies the APR D constant to use in unbalanced load calculation.

- Data setting range: 0.0 to 10.0

L75	Unbalance load compensation (Filter Time Constant for Detected Speed)

L75 specifies the APR I constant to use in unbalanced load calculation.

- Data setting range: 0.000 to 0.100 (s)

L80	**Brake Control (Mode)**
L81	**Brake Control (Operation level)**
L82	**Brake Control (ON delay time)**
L83	**Brake Control (OFF delay time)**
L84	**Brake Control (Brake check time)**

L80 to L84 make settings for brake control signals.

■ Brake control mode (L80)

L80 specifies the ***BRKS*** mode as listed below.

Data for L80	ON conditions	OFF conditions	Hold
1	- A run command is ON. AND - The inverter main circuit (output gate) is kept ON during the ON delay period specified by L82.	- After detection of the stop speed, the OFF delay period specified by L83 has elapsed. OR - The inverter output is shut down.	Except conditions given at left
2	- A run command is ON. AND - Output current ≥ Motor no-load current x L81 (%). AND - The inverter main circuit (output gate) is kept ON during the ON delay period specified by L82.		

■ Operation level (L81)

L81 specifies the output current that turns the ***BRKS*** signal ON when L80 = 2.

- Data setting range: 0 to 200 (%) (Motor no-load current reference)

■ ON delay time (L82)

L82 specifies the delay time from when the ***BRKS*** ON conditions are met until the ***BRKS*** signal is actually turned ON.

- Data setting range: 0.00 to 10.00 (s)

■ OFF delay time (L83)

L83 specifies the delay time from when the ***BRKS*** OFF conditions are met until the ***BRKS*** signal is actually turned OFF.

- Data setting range: 0.00 to 100.00 (s)

■ Brake check time (L84)

L84 specifies the allowable time for the ***BRKE*** signal to turn ON (OFF) after the ***BRKS*** signal is turned ON (OFF). If the ON (OFF) state of the ***BRKE*** signal does not match that of the ***BRKS*** signal within the time specified by L84, the inverter trips with alarm *Er-5*. For confirming MC operation, taking use of timer for confirming the condition of ***SW52-2*** and ***CS-MC***.

- Data setting range: 0.00 to 10.00 (s)

Refer to the descriptions of function codes L84 to L86 for details.

Note If the ***BRKE*** signal status changes after it has matched the ***BRKS*** signal status, the inverter trips with alarm *Er-5*.

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Brake control signal *BRKS*

Setting "57" to any of the general-purpose, programmable output terminal (by E20 to E24 and E27) assigns a ***BRKS*** signal to that terminal. The ***BRKS*** signal is available in two modes specified by L80.

The ***BRKS*** signal turns OFF when the time length specified by L83 elapses after the speed (≥ stop speed) drops below the stop speed, independent of a run command. Adjust the braking timing to match the running pattern.

If the ***BRKS*** signal turns OFF with a run command being ON, the ***BRKS*** signal will no longer turn ON again even the ON conditions are met again. To turn the ***BRKS*** signal ON again, turn the run command OFF once.

Brake confirmation signal *BRKE*

Setting "65" to any of the general-purpose, programmable input terminal (by E01 to E08, E98 and E99) assigns a ***BRKE*** signal to that terminal. This signal is used to confirm whether the actual brake works normally with the ***BRKS*** signal issued from the inverter. Configure an external circuit that turns the signal ON or OFF when the brake is actually released or applied, respectively.

If the output status of the ***BRKS*** signal is not identical with the input status of the ***BRKE*** signal, the inverter trips with alarm *Er-5*.

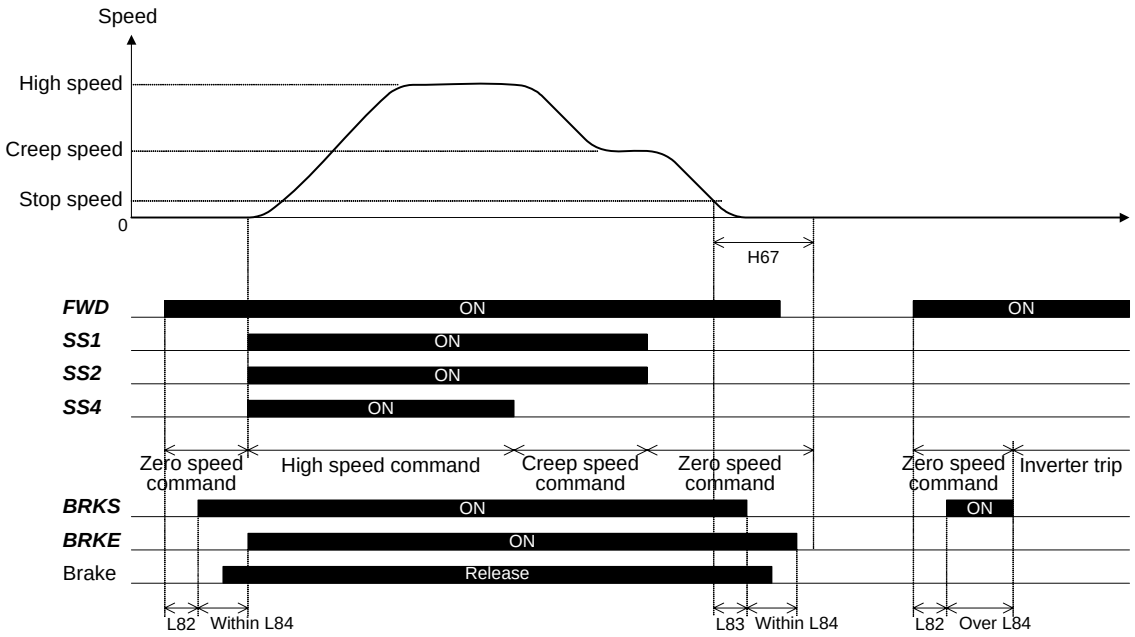
If there is a time lag between the status change of the ***BRKS*** signal and the entry of the ***BRKE*** signal, specify the lag time with L84 (Brake check timer). During the lag time after the ***BRKS*** signal status changes, the discrepancy between the output status of the ***BRKS*** signal and input status of the ***BRKE*** signal does not trigger a trip. Note that the time lag function does not work unless ***BRKS*** or ***BRKE*** is specified.

Make sure that the total time of the brake check time (L84) and the OFF delay time (L83) is less than the stop speed holding time (H67).

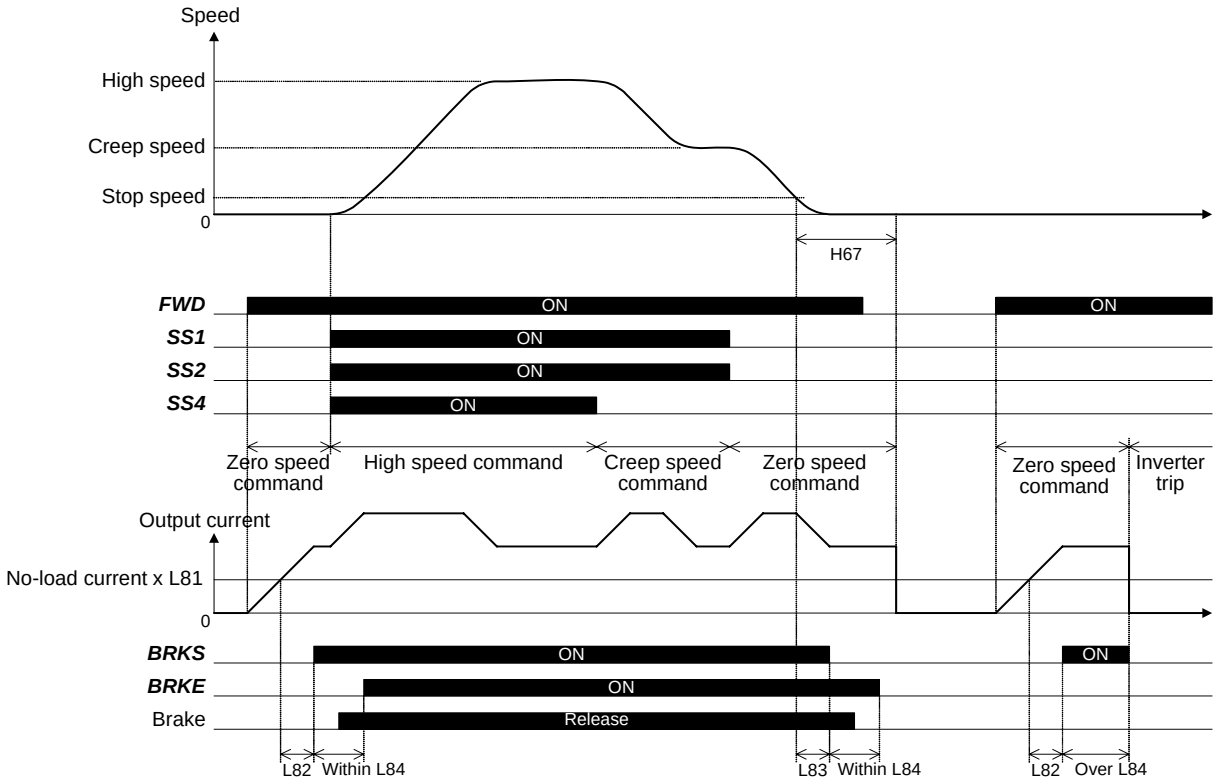
Brake control timing schemes

Given below are brake control timing schemes to be applied when the L80 = 1 and 2.

When L80 = 1



When L80 = 2



L85	MC Control (Startup delay time)
L86	MC Control (MC OFF delay time)

L85 and L86 specify the ON and OFF timings of the MC control signal ***SW52-2*** that is assigned to a general-purpose, programmable output terminal by setting "12" with E20 to E24 and E27. The MC control signal opens or closes the magnetic contactor connected between the inverter and motor.

■ Startup delay time (L85)

L85 specifies the delay time from when the MC control signal ***SW52-2*** turns ON until the main circuit output gate turns ON.

- Data setting range: 0.00 to 10.00 (s)

Note Even if no ***SW52-2*** is assigned to a general-purpose programmable output terminal, turning a run command ON turns the main circuit output gate ON after the delay time specified by L85 elapses.

■ MC OFF delay time (L86)

L86 specifies the delay time from when the main circuit output gate turns OFF until the MC control signal ***SW52-2*** turns OFF.

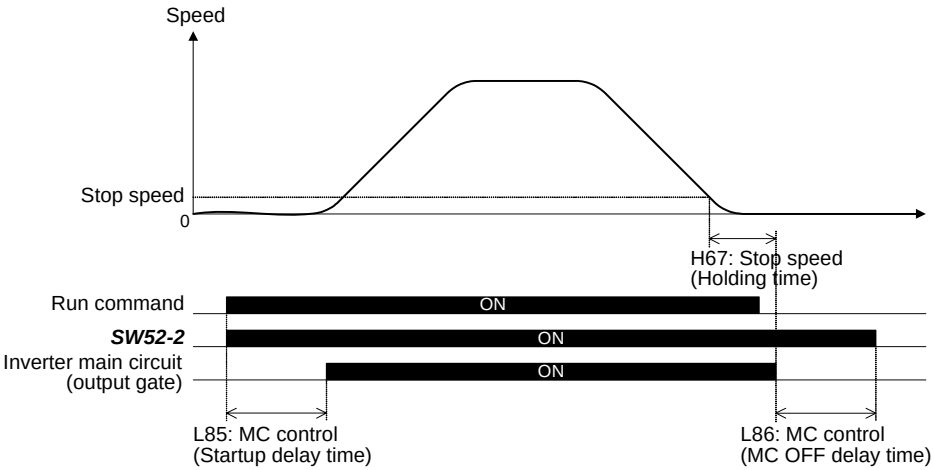
- Data setting range: 0.00 to 10.00 (s)

MC control

The table below lists the inverter running conditions and triggers required for turning the MC control signal ON or OFF. The timing scheme is shown on the next page.

SW52-2 ON	***SW52-2*** OFF	Current status retained
(1) When all of the following conditions are met, turning a run command from OFF to ON turns the MC control signal ON. - "Coast-to-stop" ***BX*** OFF - No trip - Terminal [EN] ON - "Force to decelerate" ***DRS*** OFF (2) Any of the following events with a run command being ON turns the MC control signal ON. - "Coast-to-stop" ***BX*** from ON to OFF. - A trip that occurred is reset. - Terminal [EN] from OFF to ON	Any of the following events with the MC control signal being ON turns the MC control signal OFF after the MC OFF delay time specified by L86. - Inverter main circuit output gate from ON to OFF - Run command from ON to OFF with the inverter main circuit output gate being OFF - "Coast-to-stop" ***BX*** from OFF to ON - A trip occurs. - Terminal [EN] from ON to OFF - "Force to decelerate" ***DRS*** from OFF to ON (below the stop speed).	Except the conditions listed at left

* When the conflicting conditions are present, e.g., from ON to OFF conditions and from OFF to ON conditions, the latter event has priority.
* The ***BX*** and [EN] are in normal logic.
* The "Force to decelerate" state is kept from the entry of a ***DRS*** command until the ***DRS*** is turned ON, and the run command and inverter main circuit output gate are turned OFF.

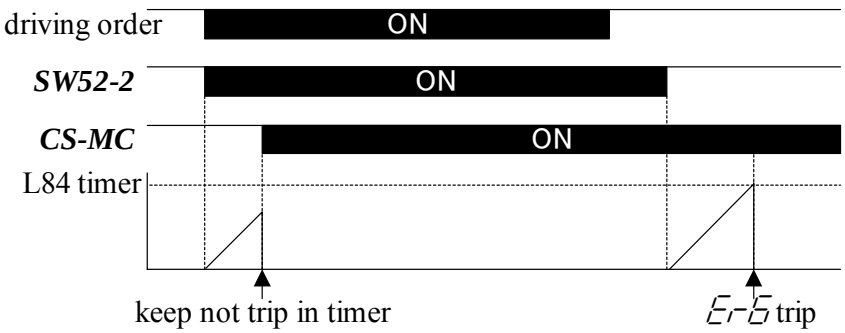


MC Control Signal Timing Scheme

■ MC Operation confomation

Setting general input terminal 103 to come ***CS-MC***. the general input terminal assigns ***CS-MC***, when ***SW52-2*** and ***CS-MC*** are the differernt condition, inverter will be stop by Er-5. moreover, inverter will not stop when ***SW52-2*** and ***CS-MC*** are in different condition (from the time that ***SW52-2*** condition have changed to the time that start stand by (L85)). Also, it is necessary to take use of timer to confirm the condition of ***SW52-2*** and ***CS-MC***. Set L84 in consideration of time from the change of ***SW52-2*** to the change of ***CS-MC***. Er-5 is not generated if it is in the time of L84 after turning on ***SW52-2***.

After gate ON, the confirmation time is continued when brake check time(L84) is longer than startup delay time(L85). When the gate turns on, Er-5 is generated if MC is turning off.



L87	**Door Control (Door open starting speed)**
L88	**Door Control (Door open delay time)**
L89	**Door Control (Door open period)**

L87 to L89 specify the door open parameters relating to the door control signal ***DOPEN*** that is assigned to a general-purpose, programmable output terminal by setting "78" with E20 to E24 and E27.

■ Door open starting speed (L87)

L87 specifies the reference speed (final) at which the door control signal ***DOPEN*** is turned ON. The ***DOPEN*** is turned ON actually after the door open delay time specified by L88.

- Data setting range: 0.00 to 3600 (r/min)

📖 Data setting range changes depending on the number of poles of motor etc. For details, refer to page 2-14.

■ Door open delay time (L88)

L88 specifies the delay time from when the speed drops below the door open starting speed (L87) until the ***DOPEN*** signal is turned ON.

- Data setting range: 0.0 to 10.0 (s)

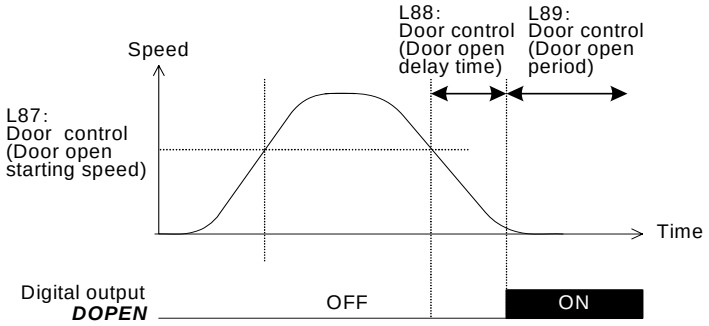
■ Door open period (L89)

L89 specifies the period during which the ***DOPEN*** is kept ON.

- Data setting range: 0.1 to 30.0 (s)

Door control

When the reference speed (final) drops below the door open starting speed (L87) during deceleration and the door open delay time (L88) elapses, the ***DOPEN*** is turned ON and kept ON during the door open period (L89).



Increasing the reference speed (final) above the speed (L87) with the ***DOPEN*** being OFF activates the ***DOPEN*** ON process judgment. If the reference speed (final) does not exceed the speed (L87), the L88 and L89 specifications will be ignored so that the ***DOPEN*** will be kept OFF.

Decreasing the reference speed (final) from the speed exceeding the L87 down to less than the L87 activates the delay timer (L88). After the delay time (L88) elapses, the ***DOPEN*** turns ON during the door open period (L89).

This door control applies to also the battery operation. When the battery operation speed does not reach the door open starting speed (L87), the ***DOPEN*** will be kept OFF.

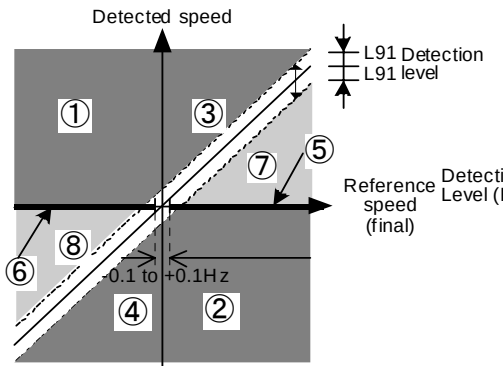
Note: When the L87 = 0.00, the ***DOPEN*** does not work.

L90	**PG abnormal (operation choice)**	**H76 PG abnormal mode 3(detection range)** **H77 PG abnormal mode 3(detection timer)**
L91	**PG Error Detection (Detection level)**	
L92	**PG Error Detection (Detection time)**	

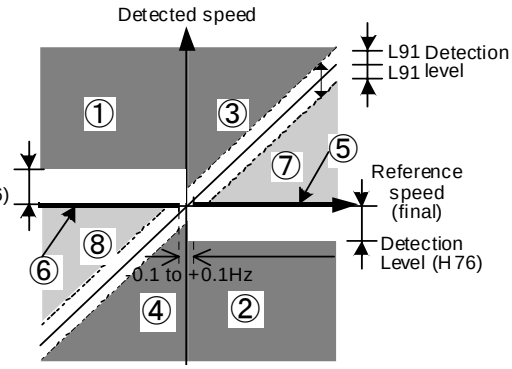
L90 to L92 specify the PG error detection conditions and the inverter operation against the error. If the speed is within a PG error domain specified by L91 during the detection time specified by L92, the inverter regards it as an error and runs or stops with/without an alarm according to the mode specified by L90.

- Data setting range (L91): 0 to 50 (%)
  (L92): 0.0 to 10.0 (s)

The PG error detection does not work in torque control.



L90 = 0,1,2
Figure 1



L90 = 3
Figure 2

In the above figure, ① through ⑧ represent the following states.

①② : The phases A and B of the PG are reversely connected.

③④ : Excessive speed deviation (|Detected speed| > |Reference speed (final)|)

⑤⑥ : PG wires broken (During zero speed operation, that is, at -0.1 to +0.1 Hz, no PG error can be detected.)

⑦⑧ : Excessive speed deviation (|Reference speed (final)| > |Detected speed|)

If L90 = 0

When the speed is within domains ① through ⑥ in the above graph, the inverter regards it as an error. Independent of the PG error detection, the inverter continues to run.

If a PG abnormal signal ***PG-ABN*** is assigned to any general-purpose, programmable output terminal by setting "76" with E20 to E24 and E27, the inverter turns the ***PG-ABN*** ON.

If L90 = 1

When the speed is within domains ① through ⑥ in the above graph, the inverter regards it as an error and stops with an excessive speed deviation error (Er-E).

If L90 = 2

When the speed is within domains ① through ⑧ in the above graph, the inverter regards it as an error and stops with an excessive speed deviation error (Er-E).

If L90 = 3

When the speed is within domains ① through ⑧ in the above graph, and when the speed is within domains ① or ② in the above graph, the inverter regards it as an error and stops with an excessive speed deviation error (Er-E).

The content of the previous page is recorded in the following tables.

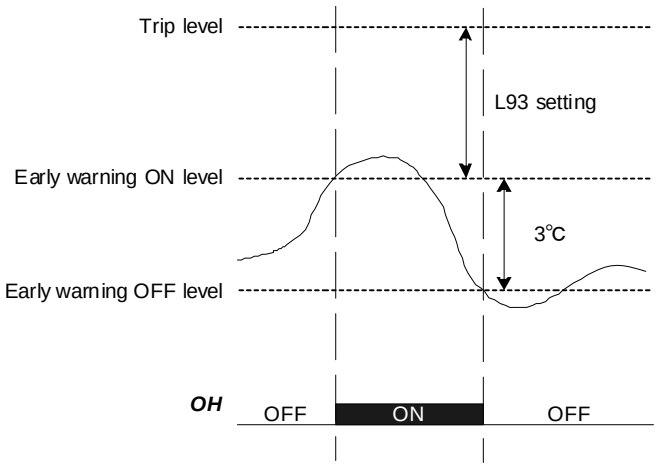
Data for L90 (PG Error Detection Mode)	PG error detection conditions	If a PG error is detected, the inverter:		
		Outputs ***ALM***	Trips with alarm indication	Outputs ***PG-ABN***
0	The speed is within domains ① through ⑥ in the above graph during the detection time (L92).	OFF	---	ON
1		ON	Er-E	OFF
2	The speed is within domains ① through ⑧ in the above graph during the detection time (L92).			
3	The speed is within domains ① or ② in the below graph during the detection time (H77). The speed is within domains ① through ① in the below graph during the detection time (L92).	ON	Er-E	OFF

L93 Overheat Early Warning Level

When the temperature reaches the overheat early warning level that is *n*°C below the trip level, the inverter issues an overheat early warning signal. L93 specifies the *n*°C. The early warning signal ***OH*** is assigned to a general-purpose, programmable output terminal by setting "28" with E20 to E24 and E27.

- Data setting range: 1 to 20 (deg)

ON conditions	OFF conditions	Current status retained
When any of the following conditions is met, the ***OH*** signal is turned ON. - The heat sink temperature is higher than "Heat sink overheat trip temperature - L93 setting." - The inverter inside temperature is higher than "Internal overheat trip temperature - L93 setting." - The IGBT junction temperature is higher than "Inverter overload trip temperature - L93 setting."	When all of the following conditions are met, the ***OH*** signal is turned OFF. - The heat sink temperature is lower than "Heat sink overheat trip temperature - L93 setting - 3°C." - The inverter inside temperature is lower than "Internal overheat trip temperature - L93 setting - 3°C." - The IGBT junction temperature is lower than "Inverter overload trip temperature - L93 setting - 3°C."	Except the conditions listed at left



L98	Protecting operation selection SW	E34 current detection (operation level 1) E35 current detection1 (timer)

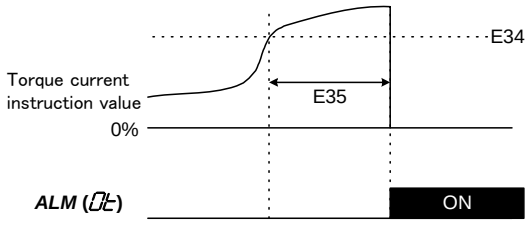
Selecting the protecting function for inverter possibly.

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	Not assigned	Not assigned	Not assigned	Not assigned	Not assigned	Not assigned	Drive continuance alarm	Over torque current protecting operation
Data=0	-	-	-	-	-	-	Disable	Disable
Data=1	-	-	-	-	-	-	Enable	Enable
Default	0	0	0	0	0	0	0	0

Set 0 for an unused function.

■ Over torque current protecting operation (Bit 0)

The inverter is stop when reference torque current of the inverter exceeds the over torque current detection level (E34) and the reference torque current continues longer than the period specified by over torque current detection time (E35). The state is reset when after the inverter stop.



In case of vector control with PG for synchronous motor, the motor torque current is roughly proportional to the output current of the motor. But in case of vector control with PG for asynchronous motor it is not proportional to the output current of the motor.

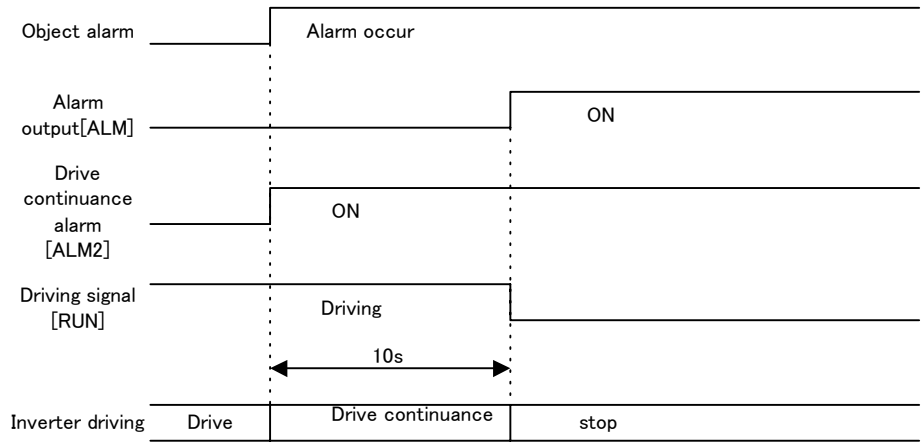
■ Drive continuance alarm (Bit 1)

If the function is enabled, when the following alarms happen, the inverter keeps driving the motor for ten seconds. It is possibe that the driving elevator can be stop safely when alarm happens.

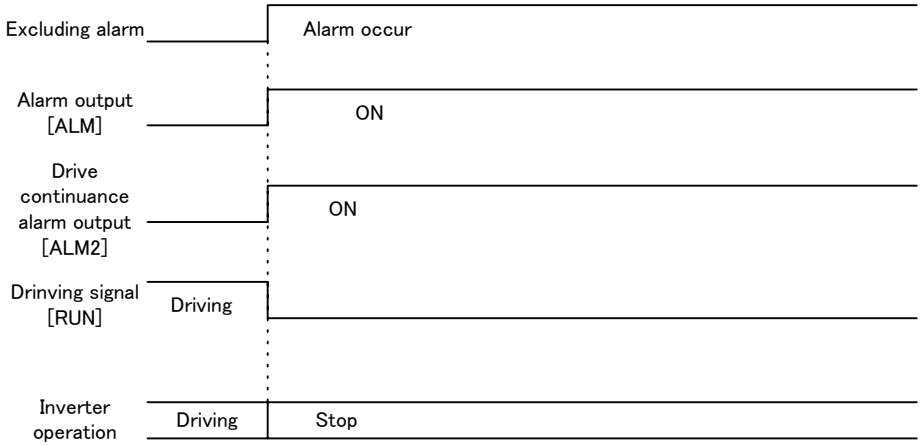
·OH2 (External alarm input 2 ***THR2***)
·OH4 (Motor protection PTC thermistor)
·OL 1 (Motor protection Electronic thermal)
·OLU (inverter unit Overload)
·Er-5 (Reference torque decreasing command error)

When special alarm happens, the inverter keeps driving the motor for ten seconds by drive continuance alarm. After 10 seconds, if the output is shut down, drive continuance alarm will happen and inverter will be stop. Drive continuance alarm will be kept until inverter reset.

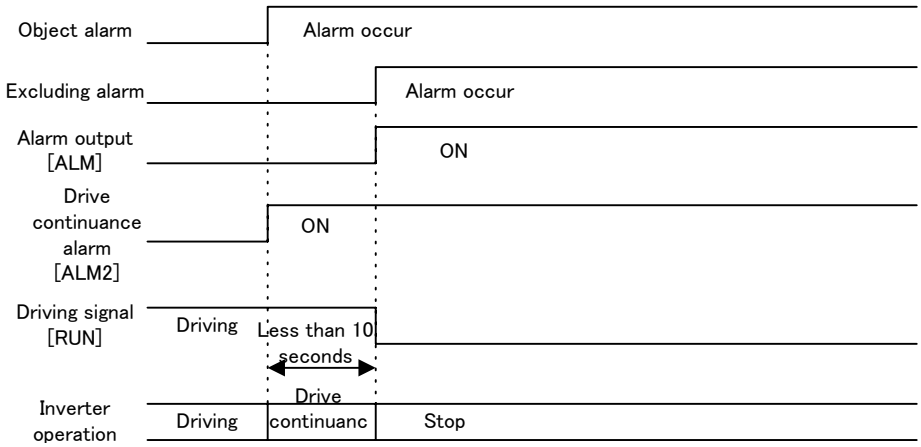
Drive continuance object alarm occur



Excluding drive continuance alarm



Both alarms



L99	Protecting operation selection SW P06 motor unload current L56 torque bias (torque reference finish timer) L57 torque bias (limit) L80 brake control operation selection

Selecting corresponding operations of inverter.

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	Not assigned	Not assigned	Not assigned	Not assigned	Short floor operation using s-curve control driving	Initial torque bias and reference torque decreasing	Magnetic pole position offset	Current confirmation for synchronous motor
Data=0	-	-	-	-	Disable	Disable	Disable	Disable
Data=1	-	-	-	-	Enable	Enable	Enable	Enable
Default	0	0	0	0	0	0	0	0

■ Current confirmation for synchronous motor (Bit 0)

To maintain current more than no-load current this function can be used.

When lift controller uses ***ID*** and ***ID2*** as a brake release condition in case that the inverter control synchronous motor please uses this function.

Tip By using the function, it is possible that do confirmation for the connection between inverter and stopped synchronous motor.

⚠WARNING

Setting 5% of rated current as unload current for below. It is dangerous that setting the value.

Otherwise injuries could occur.

■ Magnetic pole position offset (Bit 1)

The tuning result by ***PPT*** is preserved or read.

Refer to the explanation of ***PPT*** for details.

■ Initial torque bias and reference torque decreasing (Bit 2)

The following functions can be used, when the function is enabling.

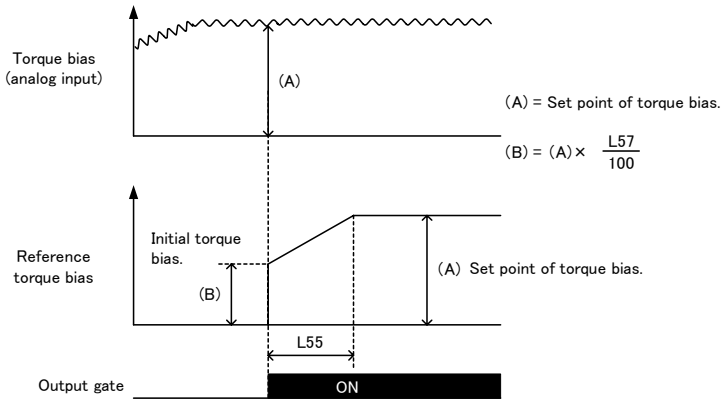
a) Initial torque bias

The operation of initial torque bias is the following.

- Turning the inverter main circuit (output gate) ON to hold a reference torque bias. It is set point of torque bias. It is signed as (A).
- Reference torque bias starts initial torque bias. It is signed as (B) which is calculated as follows.

$$(B) = (A) \times \frac{L57}{100}$$

- The reference torque bias is increased from (B) to (A). The time is a value of L55.

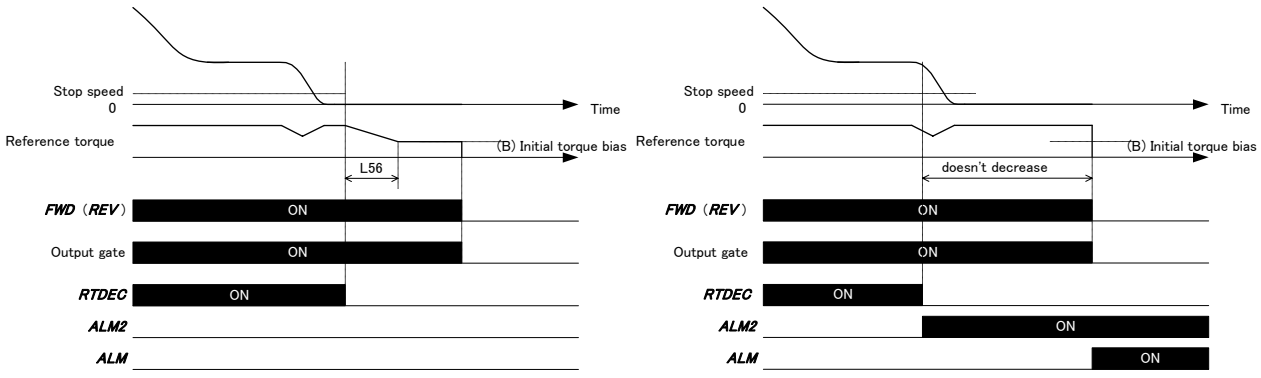


b) Reference torque decreasing

The operation of reference torque decreasing is the following.

1. ***RTDEC*** is changed from OFF to ON within three seconds after the to start operation.
   Or, when the operation is started, ***RTDEC*** is already ON.
2. When ***RTDEC*** is changed from ON to OFF

When all the above-mentioned are satisfied, the inverter decreases the reference torque to initial torque bias. The time until the decrease is completed is L56. In the absolute value, if the reference torque when ***RTDEC*** is turned OFF (A1) is not decreased. Drive continuance alarm (***ALM2***) is output and the inverter stops with Er-6. When ***RTDEC*** is changed from ON to OFF while the inverter is stopping, the inverter trips with Er-6.



Normal operation　　Abnormal operation

■ Short floor operation using S curve (Bit 3)

The operation mode of short floor operation can be selected by this function. Even if Mode 2 is selected, when it doesn't meet the requirement of Mode 2, it operates by Mode 1.

Description of Mode 2

When the deceleration instruction to the creep velocity enters while accelerating, it operates. S-curve setting is automatically adjusted and decelerates. The operation condition of Mode 2 is as follows. When it is not possible to satisfy it, it operates by Mode 1.

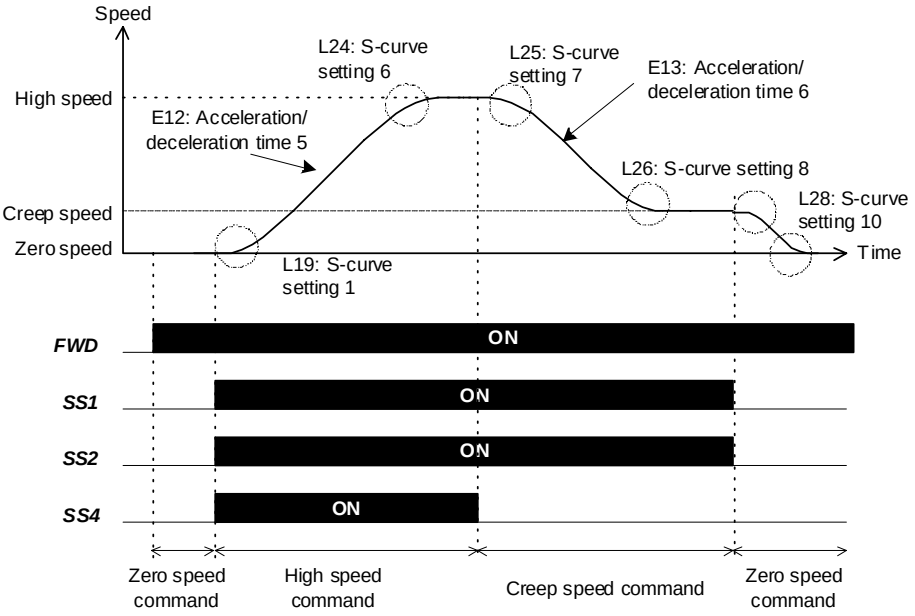
- ·The deceleration instruction to the creep speed (C07) is put while accelerating to Low speed (C09), Middle speed (C10) or High speed (C11) from Zero speed (C04).
- ·S-curve used is 10% or more. (Figure ① to ④)
- ·The range of acceleration time and deceleration time" used is 1 to 10 seconds. (Figure ⑤,⑥)
- ·The difference at a set speed of the attainment speed(C09 to C11) and the creep(C07) velocity is maximum speed (F03) 10% or more.
- ·120Hz or less in frequency conversion. maximum speed (F03).

🕮 Refer to function code L29 for details of Mode 1.

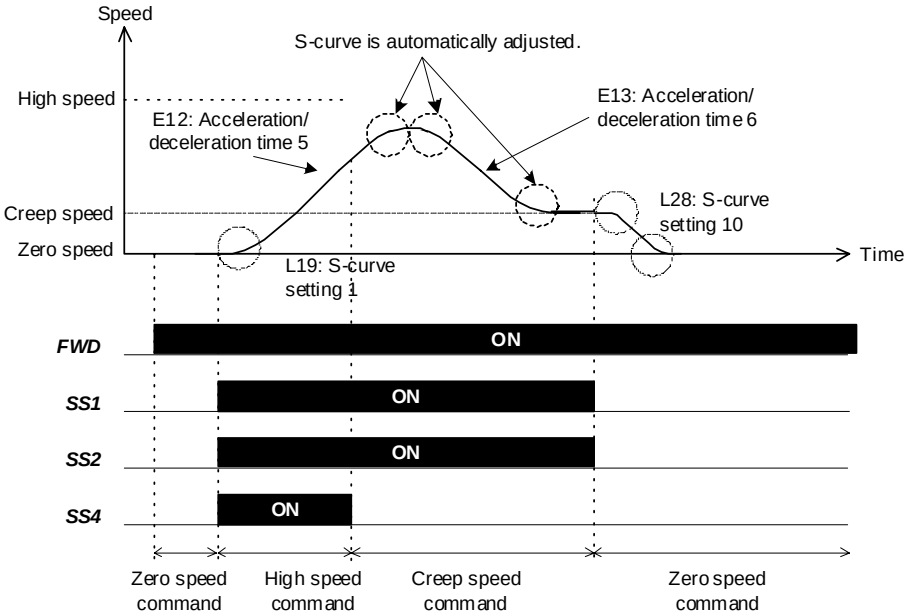
Note Change speed or neither "Addition and subtraction velocity time" or S-curve when you drive with Mode 2.

Note The accuracy of the generated speed pattern is not guaranteed. Operate it as you can absorb the error margin by the creep driving.

When you give the instruction in the creep velocity after acceleration to the high speed ends



When you give the instruction in the creep velocity while accelerating to the high speed.



Designed for Elevating Machinery

FRENIC-Lift

Reference Manual

First Edition, August 2005
Second Edition, March 2006
Third Edition, May 2009
Fuji Electric Systems Co., Ltd.

The purpose of this instruction manual is to provide accurate information in handling, setting up and operating of the FRENIC-Lift series of inverters. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.