Chapter 5 FUNCTION CODES

5.1 Function Code Tables

Function codes enable the FRENIC-Mini 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 eight groups: Fundamental Functions (F codes), Extension Terminal Functions (E codes), Control Functions (C codes), Motor 1 Parameters (P codes), High Performance Functions (H codes), Motor 2 Parameters (A codes), Application Functions (J codes) and Link Functions (y 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 5-3 and subsequent pages.

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

Function codes are indicated by the following 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, the change will immediately take effect; however, the change is not saved into the inverter's memory. To save the change, press the key. If you press the key without pressing the 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	The data of the codes marked with Y can be changed with the and keys regardless of whether the motor is running or not. Pressing the key will make the change effective and save it into the inverter's memory.
N	Impossible	—

■ Copying data

Connecting an optional remote keypad enables you to copy 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 all function code 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. Therefore, you need to set up the uncopied code data individually as necessary. Whether data will be copied or not is detailed with the following symbols in the "Data copy" column of the function code tables given below.

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. (Function codes marked with an "N" are not subject to Verify operation, either.)

It is recommended that you set up those function codes which are not subject to the Copy operation individually using Menu #1 "Data setting" as necessary.

📖 Refer to the Remote Keypad Instruction Manual (INR-SI47-0843-E) for details.

■ Using negative logic for programmable I/O terminals

The negative logic signaling system can be used for digital input terminals and transistor 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 versa, with the function code data setting.

To set the negative logic system for an input or output terminal, enter data of 1000s (by adding 1000 to the data for the normal logic) in the corresponding function code.

Example: "Coast to a stop" command ***BX*** assigned to any of digital input terminals [X1] to [X3] using any of function codes E01 through E03.

Function code data	***BX***
7	Turning ***BX*** ON causes the motor to coast to a stop. (Active ON)
1007	Turning ***BX*** OFF causes the motor to coast to a stop. (Active OFF)

■ Limitation of data displayed on the LED monitor

Only four digits can be displayed on the 4-digit LED monitor. If you enter more than 4 digits of data valid for a function code, any digits after the 4th digit of the set data will not be displayed; however they will be processed correctly.

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

F codes: Fundamental Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
F00	Data Protection	0: Disable both data protection and digital reference protection 1: Enable data protection and disable digital reference protection 2: Disable data protection and enable digital reference protection 3: Enable both data protection and digital reference protection	–	–	Y	Y	0	5-21
F01	Frequency Command 1	0: UP/DOWN keys on keypad 1: Voltage input to terminal [12] (0 to +10 VDC) 2: Current input to terminal [C1] (4 to 20 mA DC) 3: Sum of voltage and current inputs to terminals [12] and [C1] 4: Built-in potentiometer (POT) 7: Terminal command ***UP/DOWN*** control	–	–	N	Y	4	

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
F02	Operation Method	0: RUN/STOP keys on keypad (Motor rotational direction specified by terminal command ***FWD***/***REV***) 1: Terminal command ***FWD*** or ***REV*** 2: RUN/STOP keys on keypad (forward) 3: RUN/STOP keys on keypad (reverse)	–	–	N	Y	2	5-22
F03	Maximum Frequency 1	25.0 to 400.0	0.1	Hz	N	Y	ACU :60.0 E:50.0	5-23
F04	Base Frequency 1	25.0 to 400.0	0.1	Hz	N	Y	AU:60.0 CE:50.0	
F05	Rated Voltage at Base Frequency 1	0: Output a voltage in proportion to input voltage 80 to 240: Output an AVR-controlled voltage (Note 1) 160 to 500: Output an AVR-controlled voltage (Note 2)	1	V	N	Y2	ACE:0 U:230/ 460	
F06	Maximum Output Voltage 1	80 to 240: Output an AVR-controlled voltage (Note 1) 160 to 500: Output an AVR-controlled voltage (Note 2)	1	V	N	Y2	A: 220/ 380 C: 200/ 380 E: 230/ 400 U: 230/ 460	
F07	Acceleration Time 1	0.00 to 3600 Note: Entering 0.00 cancels the acceleration time, requiring external soft-start.	0.01	s	Y	Y	6.00	5-25
F08	Deceleration Time 1	0.00 to 3600 Note: Entering 0.00 cancels the deceleration time, requiring external soft-start.	0.01	s	Y	Y	6.00	
F09	Torque Boost 1	0.0 to 20.0 (percentage with respect to "F05: Rated Voltage at Base Frequency 1") Note: This setting takes effect when F37 = 0, 1, 3, or 4.	0.1	%	Y	Y	See Table A.	5-26
F10	Electronic Thermal Overload Protection for Motor 1 (Motor characteristics)	1: For a general-purpose motor and Fuji standard permanent magnet synchronous motor with shaft-driven cooling fan 2: For an inverter-driven motor with separately powered cooling fan	–	–	Y	Y	1	5-28
F11	(Overload detection level)	0.00: Disable, 0.01 to 100.0 1 to 135% of the rated current (allowable continuous drive current) of the motor	0.01	A	Y	Y1 Y2	See Table A.	
F12	(Thermal time constant)	0.5 to 75.0	0.1	min	Y	Y	5.0	
F14	Restart Mode after Momentary Power Failure (Mode selection)	0: Disable restart (Trip immediately) 1: Disable restart (Trip after a recovery from power failure) 2: Trip after decelerate-to-stop *1 4: Enable restart (Restart at the frequency at which the power failure occurred, for general loads) 5: Enable restart (Restart at the starting frequency)	–	–	Y	Y	AC:1 EU:0	5-31
F15	Frequency Limiter (High)	0.0 to 400.0	0.1	Hz	Y	Y	70.0	5-35
F16	(Low)	0.0 to 400.0	0.1	Hz	Y	Y	0.0	

(Note) Alphabets in the Default setting field denote shipping destination: A (Asia), C (China), E (Europe) and U (USA).

*1 Available in the ROM version 0500 or later.

(Note 1) For the three-phase / single-phase 200 V and single-phase 100 V class series

(Note 2) For the three-phase 400 V class series

(F codes continued)

Code	Name1	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
F18	Bias (Frequency command 1)	-100.00 to 100.00 *2	0.01	%	Y*	Y	0.00	5-36
F20	DC Braking 1 (Braking starting frequency)	0.0 to 60.0	0.1	Hz	Y	Y	0.0	5-37
F21	(Braking level)	0 to 100 *3	1	%	Y	Y	0	
F22	(Braking time)	0.00 (Disable), 0.01 to 30.00	0.01	s	Y	Y	0.00	
F23	Starting Frequency 1	0.1 to 60.0	0.1	Hz	Y	Y	1.0	5-38
F24	(Holding time)	0.00 to 10.00	0.01	s	Y	Y	0.00	
F25	Stop Frequency	0.1 to 60.0	0.1	Hz	Y	Y	0.2	
F26	Motor Sound (Carrier frequency)	0.75 to 16	1	kHz	Y	Y	ACU:2 E:15	5-39
F27	(Tone)	0: Level 0 (Inactive) 1: Level 1 2: Level 2 3: Level 3	–	–	Y	Y	0	
F30	Analog Output [FMA] (Voltage adjustment)	0 to 300	1	%	Y*	Y	100	5-40
F31	(Function)	Select a function to be monitored from the followings. 0: Output frequency 1 (before slip compensation) 1: Output frequency 2 (after slip compensation) 2: Output current *3 3: Output voltage 6: Input power 7: PID feedback amount (PV) 9: DC link bus voltage 14: Calibration 15: PID command (SV) 16: PID output (MV)	–	–	Y	Y	0	
F37	Load Selection/Auto Torque Boost/ Auto Energy Saving Operation 1	0: Variable torque load 1: Constant torque load 2: Auto-torque boost 3: Auto-energy saving operation (Variable torque load during ACC/DEC) 4: Auto-energy saving operation (Constant torque load during ACC/DEC) 5: Auto-energy saving operation (Auto-torque boost during ACC/DEC)	–	–	N	Y	1	5-26
F39	Stop Frequency (Holding Time)	0.00 to 10.00	0.01	s	Y	Y	0.00	5-38

(Note) Alphabets in the Default setting field denote shipping destination: A (Asia), C (China), E (Europe) and U (USA).

*2 When you make settings from the keypad, the incremental unit is restricted by the number of digits that the LED monitor can display.
(Example) If the setting range is from -200.00 to 200.00, the incremental unit is:
"1" for -200 to -100, "0.1" for -99.9 to -10.0 and for 100.0 to 200.0, and "0.01" for -9.99 to -0.01 and for 0.00 to 99.99.

*3 For the single-phase 100 V class series, the percentage is relative to the reference current; for other series, it is relative to the rated output current.

(F codes continued)

Code	Name	Data setting range	Incre-ment	Unit	Change when running	Data copying	Default setting	Refer to page:
F42	Control Mode Selection 1	0: V/f control with slip compensation inactive 1: Dynamic torque vector control 2: V/f control with slip compensation active 11: V/f control for PMSM drive *1	–	–	N	Y	0	5-41
F43	Current Limiter (Mode selection)	0: Disable (No current limiter works.) 1: Enable at constant speed (Disable during ACC/DEC) 2: Enable during ACC/constant speed operation	–	–	Y	Y	2	5-42
F44	(Level)	20 to 180:3.7kW or below 20 to 200:5.57kW or above (The data is interpreted as the rated output current of the inverter for 100%) *3	1	%	Y	Y	160 or 180 *6	
F50	Electronic Thermal Overload Protection for Braking Resistor (Discharging capability)	1 to 900, OFF (Cancel)	1	kWs	Y	Y1 Y2	OFF	
F51	(Allowable average loss)	0.001 to 50.00	0.001	kW	Y	Y1 Y2	0.001	

*1 Available in the ROM version 0500 or later.

*3 For the single-phase 100 V class series, the percentage is relative to the reference current; for other series, it is relative to the rated output current.

*6 160 for inverter of 3.7 kW (5HP) or below; 180 for those of 5.5 kW (7.5HP) or above.

E codes: Extension Terminal Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
E01	Terminal [X1] Function	Selecting function code data assigns the corresponding function to terminals [X1] to [X3] as listed below. 0 (1000): Select multistep frequency (***SS1***) 1 (1001): Select multistep frequency (***SS2***) 2 (1002): Select multistep frequency (***SS4***) 3 (1003): Select multistep frequency (***SS8***) 4 (1004): Select ACC/DEC time (***RT1***) 6 (1006): Enable 3-wire operation (***HLD***) 7 (1007): Coast to a stop (***BX***) 8 (1008): Reset alarm (***RST***) 9 (1009): Enable external alarm trip (***THR***) 10 (1010): Ready for jogging (***JOG***) 11 (1011): Select frequency command 2/1 (***Hz2/Hz1***) 12 (1012): Select motor 2/motor 1 (***M2/M1***) 13: Enable DC braking (***DCBRK***) 17 (1017): UP (Increase output frequency) (***UP***) 18 (1018): DOWN (Decrease output frequency) (***DOWN***) 19 (1019): Enable data change with keypad (***WE-KP***) 20 (1020): Cancel PID control (***Hz/PID***) 21 (1021): Switch normal/inverse operation (***IVS***) 24 (1024): Enable communications link via RS-485 (***LE***) 33 (1033): Reset PID integral and differential components (***PID-RST***) 34 (1034): Hold PID integral component (***PID-HLD***) Setting the value in parentheses ( ) shown above assigns a negative logic input (Active-OFF) to a terminal. Note that, in the case of ***THR***, data "1009" is for normal logic (Active-ON) and "9," for negative logic (Active-OFF). Signals having no value in parentheses ( ) cannot be used for negative logic.	–	–	N	Y	0	5-44
E02	Terminal [X2] Function		–	–	N	Y	7	
E03	Terminal [X3] Function		–	–	N	Y	8	
E10	Acceleration Time 2	0.00 to 3600 Note: Entering 0.00 cancels the acceleration time, requiring external soft-start and -stop.	0.01	s	Y	Y	6.00	5-25
E11	Deceleration Time 2	0.00 to 3600 Note: Entering 0.00 cancels the deceleration time, requiring external soft-start and -stop.	0.01	s	Y	Y	6.00	

(E codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
E20	Terminal [Y1] Function	Selecting function code data assigns the corresponding function to terminals [Y1] and [30A/B/C] as listed below. 0 (1000): Inverter running (***RUN***) 1 (1001): Frequency arrival signal (***FAR***) 2 (1002): Frequency detected (***FDT***) 3 (1003): Undervoltage detected (Inverter stopped) (***LU***) 5 (1005): Inverter output limiting (***IOL***) 6 (1006): Auto-restarting after momentary power failure (***IPF***) 7 (1007): Motor overload early warning (***OL***) 26 (1026): Auto-resetting (***TRY***) 30 (1030): Service lifetime alarm (***LIFE***) 35 (1035): Inverter running 2 (***RUN2***) 36 (1036): Overload prevention control (***OLP***) 37 (1037): Current detected (***ID***) 38 (1038): Current detected 2 (***ID2***) 41 (1041): Low current detected (***IDL***) 43 (1043): Under PID control (***PID-CTL)*** 44 (1044): Motor stopped due to slow flowrate under PID control (***PID-STP)*** 49 (1049): Switched to motor 2 (***SWM2***) 56 (1056): Motor overheat detected by thermistor (***THM***) 57 (1057): Brake signal (***BRKS***) 59 (1059): Terminal [C1] wire break (***C1OFF***) 84 (1084): Maintenance timer (***MNT***) 87 (1087): Frequency arrival detected (***FARFDT***) 99 (1099): Alarm output (for any alarm) (***ALM***) Setting the value in parentheses ( ) shown above assigns a negative logic output to a terminal.	–	–	N	Y	0	5-52
E27	Terminal [30A/B/C] Function		–	–	N	Y	99	
E30	Frequency Arrival (Hysteresis width)	0.0 to 10.0	0.1	Hz	Y	Y	2.5	5-56
E31	Frequency Detection (Detection level)	0.0 to 400.0	0.1	Hz	Y	Y	ACU :60.0 E:50.0	–
E32	(Hysteresis width)	0.0 to 400.0	0.1	Hz	Y	Y	1.0	
E34	Overload Early Warning/ Current Detection/Low Current Detection (Level)	0.00 (Disable), 0.01 to 100.0 Current value of 1 to 200% of the inverter rated current	0.01	A	Y	Y1 Y2	See Table A.	5-57
E35	(Timer)	0.01 to 600.00 *2	0.01	s	Y	Y	10.00	

(Note) Alphabets in the Default setting field denote shipping destination: A (Asia), C (China), E (Europe) and U (USA).

*2 When you make settings from the keypad, the incremental unit is restricted by the number of digits that the LED monitor can display.

(Example) If the setting range is from -200.00 to 200.00, the incremental unit is:
"1" for -200 to -100, "0.1" for -99.9 to -10.0 and for 100.0 to 200.0, and "0.01" for -9.99 to -0.01 and for 0.00 to 99.99.

(E codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
E37	Current Detection 2 (Level)	0.00 (Disable), 0.01 to 100.0 Current value of 1 to 200% of the inverter rated current	0.01	A	Y	Y1 Y2	See Table A.	5-57
E38	(Timer)	0.01 to 600.00 *2	0.01	s	Y	Y	10.00	
E39	Coefficient for Constant Feeding Rate Time	0.000 to 9.999	0.001	–	Y	Y	0.000	5-58
E40	PID Display Coefficient A	-999 to 0.00 to 9990 *4	0.01	–	Y	Y	100	–
E41	PID Display Coefficient B	-999 to 0.00 to 9990 *4	0.01	–	Y	Y	0.00	
E42	LED Display Filter	0.0 to 5.0	0.1	s	Y	Y	0.5	
E43	LED Monitor (Display item)	0: Speed monitor (select by E48) 3: Output current 4: Output voltage 9: Input power 10: PID command 12: PID feedback amount 13: Timer 14: PID output 25: Input watt-hour	–	–	Y	Y	0	
E45	(Note)							
E46								
E47								
E48	LED Monitor (Speed monitor item)	0: Output frequency (Before slip compensation) 1: Output frequency (After slip compensation) 2: Reference frequency 4: Load shaft speed in r/min 5: Line speed in m/min 6: Constant feeding rate time	–	–	Y	Y	0	
E50	Coefficient for Speed Indication	0.01 to 200.00 *2	0.01	–	Y	Y	30.00	5-58
E51	Display Coefficient for Input Watt-hour Data	0.000 (Cancel/reset), 0.001 to 9999	0.001	–	Y	Y	0.010	
E52	Keypad (Menu display mode)	0: Function code data editing mode (Menu #1) 1: Function code data check mode (Menu #2) 2: Full-menu mode (Menus #0 through #6)	–	–	Y	Y	0	5-59

(Note) E45, E46 and E47 appear on the LED monitor, but cannot be used by this inverter.

*2 When you make settings from the keypad, the incremental unit is restricted by the number of digits that the LED monitor can display.
(Example) If the setting range is from -200.00 to 200.00, the incremental unit is:
"1" for -200 to -100, "0.1" for -99.9 to -10.0 and for 100.0 to 200.0, and "0.01" for -9.99 to -0.01 and for 0.00 to 99.99.

*4 The significant figure is in three digits, so the incremental unit changes depending upon the magnitude of absolute values.
(Example) The incremental unit is "10" for 1000 to 9990, "1" for -999 to -100 and for 100 to 999, "0.1" for -99.9 to -10.0 and for 10.0 to 99.9, and "0.01" for -9.99 to 9.99.

(E codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
E60	Built-in Potentiometer (Function selection)	0: None 1: Auxiliary frequency command 1 2: Auxiliary frequency command 2 3: PID process command 1	1	–	N	Y	0	5-59
E61	Terminal [12] Extended Function	Selecting function code data assigns the corresponding function to terminals [12] and [C1] as listed below.	–	–	N	Y	0	
E62	Terminal [C1] Extended Function	0: None 1: Auxiliary frequency command 1 2: Auxiliary frequency command 2 3: PID process command 1 5: PID feedback value	–	–	N	Y	0	
E98	Terminal [FWD] Function	Selecting function code data assigns the corresponding function to terminals [FWD] and [REV] as listed below.	–	–	N	Y	98	5-44
E99	Terminal [REV] Function	0 (1000): Select multistep frequency (***SS1***) 1 (1001): Select multistep frequency (***SS2***) 2 (1002): Select multistep frequency (***SS4***) 3 (1003): Select multistep frequency (***SS8***) 4 (1004): Select ACC/DEC time (***RT1***) 6 (1006): Enable 3-wire operation (***HLD***) 7 (1007): Coast to a stop (***BX***) 8 (1008): Reset alarm (***RST***) 9 (1009): Enable external alarm trip (***THR***) 10 (1010): Ready for jogging (***JOG***) 11 (1011): Select frequency command 2/1 (***Hz2/Hz1***) 12 (1012): Select motor 2/motor 1 (***M2/M1***) 13: Enable DC braking (***DCBRK***) 17 (1017): UP (Increase output frequency) (***UP***) 18 (1018): DOWN (Decrease output frequency) (***DOWN***) 19 (1019): Enable data change with keypad (***WE-KP***) 20 (1020): Cancel PID control (***Hz/PID***) 21 (1021): Switch normal/inverse operation (***IVS***) 24 (1024): Enable communications link via RS-485 (***LE***) 33 (1033): Reset PID integral and differential components (***PID-RST***) 34 (1034): Hold PID integral component (***PID-HLD***) 98: Run forward (***FWD***) 99: Run reverse (***REV***) Setting the value in parentheses ( ) shown above assigns a negative logic input (Active-OFF) to a terminal. Note that, in the case of ***THR***, data "1009" is for normal logic (Active-ON) and "9," for negative logic (Active-OFF). Signals having no value in parentheses ( ) cannot be used for negative logic.	–	–	N	Y	99	

C codes: Control Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
C01	Jump Frequency 1	0.0 to 400.0	0.1	Hz	Y	Y	0.0	–
C02	2				Y	Y	0.0	
C03	3				Y	Y	0.0	
C04	(Hysteresis width)	0.0 to 30.0	0.1	Hz	Y	Y	3.0	
C05	Multistep Frequency 1	0.00 to 400.00 *2	0.01	Hz	Y	Y	0.00	
C06	2				Y	Y	0.00	
C07	3				Y	Y	0.00	
C08	4				Y	Y	0.00	
C09	5				Y	Y	0.00	
C10	6				Y	Y	0.00	
C11	7				Y	Y	0.00	
C12	8				Y	Y	0.00	
C13	9				Y	Y	0.00	
C14	10				Y	Y	0.00	
C15	11				Y	Y	0.00	
C16	12				Y	Y	0.00	
C17	13				Y	Y	0.00	
C18	14				Y	Y	0.00	
C19	15				Y	Y	0.00	
C20	Jogging Frequency	0.00 to 400.00 *2	0.01	Hz	Y	Y	0.00	
C21	Timer Operation	0: Disable 1: Enable	–	–	N	Y	0	5-60
C30	Frequency Command 2	0: UP/DOWN keys on keypad 1: Voltage input to terminal [12] (0 to +10 VDC) 2: Current input to terminal [C1] (4 to 20 mA DC) 3: Sum of voltage and current inputs to terminals [12] and [C1] 4: Built-in potentiometer (POT) 7: Terminal command ***UP***/***DOWN*** control	–	–	N	Y	2	5-21
C32	Analog Input Adjustment for Terminal [12] (Gain)	0.00 to 200.00 *2	0.01	%	Y*	Y	100.0	5-36
C33	(Filter time constant)	0.00 to 5.00	0.01	s	Y	Y	0.05	5-60
C34	(Gain base point)	0.00 to 100.00 *2	0.01	%	Y*	Y	100.00	5-36
C37	Analog Input Adjustment for Terminal [C1] (Gain)	0.00 to 200.00 *2	0.01	%	Y*	Y	100.00	
C38	(Filter time constant)	0.00 to 5.00	0.01	s	Y	Y	0.05	5-60
C39	(Gain base point)	0.00 to 100.00 *2	0.01	%	Y*	Y	100.00	5-36
C40	Terminal [C1] Input Range Selection	0: 4 to 20 mA 1: 0 to 20 mA	–	–	N	Y	0	–
C50	Bias (Frequency command 1) (Bias base point)	0.00 to 100.00 *2	0.01	%	Y*	Y	0.00	5-36
C51	Bias (PID command 1) (Bias value)	-100.00 to 100.00 *2	0.01	%	Y*	Y	0.00	–
C52	(Bias base point)	0.00 to 100.00 *2	0.01	%	Y*	Y	0.00	

*2 When you make settings from the keypad, the incremental unit is restricted by the number of digits that the LED monitor can display.
(Example) If the setting range is from -200.00 to 200.00, the incremental unit is:
"1" for -200 to -100, "0.1" for -99.9 to -10.0 and for 100.0 to 200.0, and "0.01" for -9.99 to -0.01 and for 0.00 to 99.99.

(C codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
C94	Jump Frequency 4 *1	0.0 to 400.0	0.1	Hz	Y	Y	0.0	–
C95	5				Y	Y	0.0	
C96	6				Y	Y	0.0	
C99	Digital Reference Frequency *1	0.00 to 400.00 (cannot change with using the key pad)	0.01	Hz	–	Y	0.00	

P codes: Motor 1 Parameters

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
P02	Motor 1 (Rated capacity)	0.01 to 30.00 (kW when P99 = 0, 3, 4, 20 or 21) 0.01 to 30.00 (HP when P99 = 1)	0.01 0.01	kW HP	N	Y1 Y2	See Table A.	5-61
P03	(Rated current)	0.00 to 100.0	0.01	A	N	Y1 Y2	Rated value of Fuji standard motor	
P04	(Auto-tuning)	0: Disable 1: Tune when the motor stops (%R1, %X) 2: Tune when the motor is rotating under V/f control (%R1, %X, no-load current, slip frequency).	–	–	N	N	0	
P06	(No-load current)	0.00 to 50.00	0.01	A	N	Y1 Y2	Rated value of Fuji standard motor	
P07	(%R1)	0.00 to 50.00	0.01	%	Y	Y1 Y2		
P08	(%X)	0.00 to 50.00	0.01	%	Y	Y1 Y2		
P09	(Slip compensation gain for driving)	0.0 to 200.0	0.1	%	Y*	Y	100.0	5-62
P10	(Slip compensation response time)	0.01 to 10.00	0.01	s	Y	Y1 Y2	1.00	
P11	(Slip compensation gain for braking)	0.0 to 200.0	0.1	%	Y*	Y	100.0	
P12	(Rated slip frequency)	0.00 to 15.00	0.01	Hz	N	Y1 Y2	Rated value of Fuji standard motor	5-61
P60	Permanent magnet synchronous motor *1 (Armature resistance)	0.00 (Disable PMSM), 0.01 to 50.00	0.01	Ω	Y	Y1 Y2	0.00	–
P61	(d-axis inductance)	0.00 (Disable high-efficiency control), 0.01 to 500.0	0.01	mH	Y	Y1 Y2	0.00	
P62	(q-axis inductance)	0.00 (Disable PMSM), 0.01 to 500.0	0.01	mH	Y	Y1 Y2	0.00	

*1 Available in the ROM version 0500 or later.

(P codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
P63	Permanent magnet synchronous motor *1 (Induced voltage)	0 (Disable PMSM), 80 to 240 (Note 1) 160 to 500 (Note 2)	1	V	N	Y2	0	–
P74	(Reference current at starting)	10 to 200	1	%	Y	Y1 Y2	80	
P89	(Control switching level)	10 to 100	1	%	Y	Y1 Y2	10	
P90	(Overcurrent protection level)	0.00 (Disable), 0.01 to 100.0	0.01	A	Y	Y1 Y2	0.00	
P91	(d-axis compensation gain under damping control)	0.00 to 25.00, 999 (Table value)	0.01	–	Y	Y1 Y2	999	
P92	(q-axis compensation gain under damping control)	0.00 to 25.00, 999 (Table value)	0.01	–	Y	Y1 Y2	999	
P93	(Step-out detection current level)	0 to 100, 999 (Table value)	1	%	Y	Y1 Y2	999	
P99	Motor 1 Selection	0: Motor characteristics 0 (Fuji standard IM, 8-series) 1: Motor characteristics 1 (HP rating IM) 3: Motor characteristics 3 (Fuji standard IM, 6-series) 4: Other motors (IM) 20: Other motors (PMSM) 21: Fuji standard PMSM without sensor	–	–	N	Y1 Y2	ACE:0 U:1	5-63

*1 Available in the ROM version 0500 or later.
(Note 1) For the three-phase / single-phase 200 V and single-phase 100 V class series
(Note 2) For the three-phase 400 V class series

H codes: High Performance Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
H03	Data Initialization	0: Disable initialization 1: Initialize all function code data to the factory defaults 2: Initialize motor 1 parameters 3: Initialize motor 2 parameters	–	–	N	N	0	5-64
H04	Auto-reset (Times)	0 (Disable), 1 to 10	1	times	Y	Y	0	5-70
H05	(Reset interval)	0.5 to 20.0	0.1	s	Y	Y	5.0	
H06	Cooling Fan ON/OFF Control	0: Disable (Cooling fan always ON) 1: Enable (ON/OFF control effective)	–	–	Y	Y	0	5-71
H07	Acceleration/ Deceleration Pattern	0: Linear 1: S-curve (Weak) 2: S-curve (Strong) 3: Curvilinear	–	–	Y	Y	0	
H08	Rotational Direction Limitation	0: Disable 1: Enable (Reverse rotation inhibited) 2: Enable (Forward rotation inhibited)	–	–	N	Y	0	–
H11	Deceleration Mode	0: Normal deceleration 1: Coast-to-stop	–	–	Y	Y	0	5-72
H12	Instantaneous Overcurrent Limiting (Mode selection)	0: Disable 1: Enable	–	–	Y	Y	1	5-73
H13	Restart Mode after Momentary Power Failure (Restart time)	0.1 to 10.0	0.1	s	Y	Y1 Y2	See Table A.	5-31
H14	(Frequency fall rate)	0.00 (Deceleration time selected) 0.01 to 100.00 999 (Depends upon current limiter)	0.01	Hz/s	Y	Y	999	
H15	(Continuous running level) *1	200 to 300 (Note 1) 400 to 600 (Note 2)	1	V	Y	Y2	235 470	–
H26	Thermistor for Motor (Mode selection)	0: Disable 1: Enable (With PTC, the inverter immediately trips with  displayed.) 2 Enable (With PTC, the inverter issues output signal ***THM*** and continues to run.	–	–	Y	Y	0	
H27	(Level)	0.00 to 5.00	0.01	V	Y	Y	1.6 *5	
H30	Communications Link Function (Mode selection)	Frequency command / Run command 0: F01/C30 / F02 1: RS-485 / F02 2: F01/C30 / RS-485 3: RS-485 / RS-485	–	–	Y	Y	0	
H42	Capacitance of DC Link Bus Capacitor	Indication for replacement of DC link bus capacitor (0000 to FFFF in hex.)	1	–	Y	N	–	
H43	Cumulative Run Time of Cooling Fan	Indication for replacement of cooling fan (0 to 9999, in units of 10 hours)	1	10h	Y	N	–	
H44	Startup Counter of Motor 1	Indication of cumulative startup count (0000 to FFFF in hex.)	–	–	Y	N	–	
H45	Mock Alarm	0: Disable 1: Enable (Once a mock alarm occurs, the data automatically returns to 0.)	–	–	Y	N	0	5-74
H47	Initial Capacitance of DC Link Bus Capacitor	Indication for replacement of DC link bus capacitor (0000 to FFFF in hex.)	1	–	Y	N	–	–
H48	Cumulative Run Time of Capacitors on Printed Circuit Boards	Indication for replacement of capacitors on printed circuit boards (0 to 9999, in units of 10 hours)	1	10h	Y	N	–	

*1 Available in the ROM version 0500 or later.

*5 In the ROM version 0800 or later, the factory setting is changed from 0.16 to 1.6.

(Note 1) For the three-phase / single-phase 200 V and single-phase 100 V class series

(Note 2) For the three-phase 400 V class series

(H codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
H50	Non-linear V/f Pattern 1 (Frequency)	0.0 (Cancel), 0.1 to 400.0	0.1	Hz	N	Y	0.0	5-23
H51	(Voltage)	0 to 240: Output an AVR-controlled voltage (Note 1) 0 to 500: Output an AVR-controlled voltage (Note 2)	1	V	N	Y2	ACE:0 U:230/460	
H52	Non-linear V/f Pattern 2 (Frequency)	0.0 (Cancel), 0.1 to 400.0	0.1	Hz	N	Y	0.0	
H53	(Voltage)	0 to 240: Output an AVR-controlled voltage (Note 1) 0 to 500: Output an AVR-controlled voltage (Note 2)	1	V	N	Y2	0	
H54	ACC/DEC Time (Jogging operation)	0.00 to 3600	0.01	s	Y	Y	6.00	–
H61	***UP***/***DOWN*** Control (Initial frequency setting)	0: 0.00 1: Last ***UP***/***DOWN*** command value on releasing a run command	–	–	N	Y	1	
H63	Low Limiter (Mode selection)	0: Limit by F16 (Frequency limiter: Low) and continue to run 1: If the output frequency lowers below the one limited by F16 (Frequency limiter: Low), decelerate to stop the motor.	–	–	Y	Y	0	5-35
H64	(Lower limiting frequency)	0.0 (Depends on F16 (Frequency limiter: Low)) 0.1 to 60.0	0.1	Hz	Y	Y	2.0	–
H69	Automatic Deceleration (Anti-regenerative control) (Mode selection)	0: Disable 1: Enable (Lengthen the deceleration time to three times the specified time under voltage limiting control.) (Compatible with the original FRENIC-Mini series FRN□□□C1□-□□) 2: Enable (Torque limit control: Cancel the anti-regenerative control if the actual deceleration time exceeds three times the specified one.) 4: Enable (Torque limit control: Disable force-to-stop processing.)	–	–	Y	Y	0	5-74
H70	Overload Prevention Control	0.00: Follow deceleration time specified by F08/E11 0.01 to 100.0, 999 (Cancel)	0.01	Hz/s	Y	Y	999	5-75
H71	Deceleration Characteristics	0: Disable 1: Enable	–	–	Y	Y	0	
H76	Automatic Deceleration (Frequency increment limit for braking)	0.0 to 400.0	0.1	Hz	Y	Y	5.0	5-74
H78	Maintenance Interval *1	0: Disable, 1 to 9999 (in units of 10 hours)	1	–	Y	N	8760	–
H79	Preset Startup Count for Maintenance *1	0000: Disable, 0001 to FFFF (hex.)	1	–	Y	N	0000	
H80	Output Current Fluctuation Damping Gain for Motor 1	0.00 to 0.40	0.01	–	Y	Y	0.20	

*1 Available in the ROM version 0500 or later.
(Note 1) For the three-phase / single-phase 200 V and single-phase 100 V class series
(Note 2) For the three-phase 400 V class series

(H codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
H89	Electronic Thermal Overload Protection for Motor (Data retention)	0: Disable 1: Enable	–	–	Y	Y	1	–
H91	PID Feedback Wire Break Detection (Terminal [C1])	0.0: Disable alarm detection 0.1 to 60.0: After the specified time, cause alarm	0.1	s	Y	Y	0.0	
H92	Continuity of Running *1 (P)	0.000 to 10.000 times; 999	0.001	times	Y	Y1 Y2	999	
H93	(I)	0.010 to 10.000 s; 999	0.001	s	Y	Y1 Y2	999	
H94	Cumulative Run Time of Motor 1	0 to 9999 (in units of 10 hours)	–	–	N	N	–	5-76
H95	DC Braking (Braking response mode)	0: Slow 1: Quick	–	–	Y	Y	ACU:0 E:1	5-37
H96	STOP Key Priority/Start Check Function	Data: STOP key priority / Start check function 0: Disable / Disable 1: Enable / Disable 2: Disable / Enable 3: Enable / Enable	–	–	Y	Y	ACE:0 U:3	–
H97	Clear Alarm Data	0: Disable 1: Clear alarm data	–	–	Y	N	0	5-74
H98	Protection/Maintenance Function (Mode selection)	0 to 31 (Decimal, Underlined part is the default setting.) Bit 0: Lower the carrier frequency automatically (0: Disable; 1: Enable) Bit 1: Detect input phase loss (0: Disable; 1: Enable) Bit 2: Detect output phase loss (0: Disable; 1: Enable) Bit 3: Select life judgment threshold of DC link bus capacitor (0: Factory default level; 1: User setup level) Bit 4: Judge the life of DC link bus capacitor (0: Disable; 1: Enable)	–	–	Y	Y	19 (Decimal)	5-76

(Note) Alphabets in the Default setting field denote shipping destination: A (Asia), C (China), E (Europe) and U (USA).

*1 Available in the ROM version 0500 or later.

A codes: Motor 2 Parameters

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
A01	Maximum Frequency 2	25.0 to 400.0	0.1	Hz	N	Y	ACU :60.0 E:50.0	–
A02	Base Frequency 2	25.0 to 400.0	0.1	Hz	N	Y	AU:60.0 CE:50.0	
A03	Rated Voltage at Base Frequency 2	0: Output a voltage in proportion to input voltage 80 to 240V: Output an AVR-controlled voltage (Note 1) 160 to 500V: Output an AVR-controlled voltage (Note 2)	1	V	N	Y2	ACE:0 U:230/ 460	
A04	Maximum Output Voltage 2	80 to 240V: Output an AVR-controlled voltage (Note 1) 160 to 500V: Output an AVR-controlled voltage (Note 2)	1	V	N	Y2	A: 220/ 380 C: 200 380 E: 230/ 400 U: 230/ 460	
A05	Torque Boost 2	0.0% to 20.0% (percentage with respect to "A03: Rated Voltage at Base Frequency 2")	0.1	%	Y	Y	See Table A.	
A06	Electronic Thermal Overload Protection for Motor 2 (Motor characteristics)	1: For a general-purpose motor with shaft-driven cooling fan 2: For an inverter-driven motor with separately powered cooling fan	–	–	Y	Y	1	
A07	(Overload detection level)	0.00 (Disable), 0.01 to 100.0 1 to 135% of the rated current (allowable continuous drive current) of the motor	0.01	A	Y	Y1 Y2	See Table A.	
A08	(Thermal time constant)	0.5 to 75.0	0.1	min	Y	Y	5.0	
A09	DC Braking 2 (Braking starting frequency)	0.0 to 60.0	0.1	Hz	Y	Y	0.0	
A10	(Braking level)	0 to 100 *3	1	%	Y	Y	0	
A11	(Braking time)	0.00 : Disable 0.01 to 30.00	0.01	s	Y	Y	0.00	
A12	Starting Frequency 2	0.1 to 60.0	0.1	Hz	Y	Y	1.0	
A13	Load Selection/ Auto Torque Boost/ Auto Energy Saving Operation 2	0: Variable torque load 1: Constant torque load 2: Auto-torque boost 3: Auto-energy saving operation (Variable torque load during ACC/DEC) 4: Auto-energy saving operation (Constant torque load during ACC/DEC) 5: Auto-energy saving operation (Auto-torque boost during ACC/DEC)	–	–	N	Y	1	
A14	Control Mode Selection 2	0: V/f control with slip compensation inactive 1: Dynamic torque vector control 2: V/f control with slip compensation active	–	–	N	Y	0	
A16	Motor 2 (Rated capacity)	0.01 to 30.00 (kW when A39 = 0, 3, or 4) 0.01 to 30.00 (HP when A39 = 1)	0.01 0.01	kW HP	N	Y1 Y2	See Table A.	

(Note) Alphabets in the Default setting field denote shipping destination: A (Asia), C (China), E (Europe) and U (USA).

*3 For the single-phase 100 V class series, the percentage is relative to the reference current; for other series, it is relative to the rated output current.

(Note 1) For the three-phase / single-phase 200 V and single-phase 100 V class series
(Note 2) For the three-phase 400 V class series

(A codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
A17	(Rated current)	0.00 to 100.0	0.01	A	N	Y1 Y2	Rated value of Fuji standard motor	
A18	Motor 2 (Auto-tuning)	0: Disable 1: Tune when the motor stops (%R1 and %X) 2: Tune when the motor is rotating under V/f control (%R1, %X, no-load current, slip freq.)	–	–	N	N	0	–
A20	(No-load current)	0.00 to 50.0	0.01	A	N	Y1 Y2	Rated value of Fuji standard motor	
A21	(%R1)	0.00 to 50.00	0.01	%	Y	Y1 Y2	Rated value of Fuji standard motor	
A22	(%X)	0.00 to 50.00	0.01	%	Y	Y1 Y2	Rated value of Fuji standard motor	
A23	(Slip compensation gain for driving)	0.0 to 200.0	0.1	%	Y*	Y	100.0	
A24	(Slip compensation response time)	0.01 to 10.00	0.01	s	Y	Y1 Y2	1.00	
A25	(Slip compensation gain for braking)	0.0 to 200.0	0.1	%	Y*	Y	100.0	
A26	(Rated slip frequency)	0.00 to 15.00	0.01	Hz	N	Y1 Y2	Rated value of Fuji standard motor	
A39	Motor 2 Selection	0: Motor characteristics 0 (Fuji standard IM, 8-series) 1: Motor characteristics 1 (HP rating IM) 3: Motor characteristics 3 (Fuji standard IM, 6-series) 4: Other motors (IM)	–	–	N	Y1 Y2	ACE:0 U:1	
A41	Output Current Fluctuation Damping Gain for Motor 2	0.00 to 0.40	0.01	–	Y	Y	0.20	
A51	Cumulative Run Time of Motor 2	0 to 9999 (in units of 10 hours)	–	–	N	N	–	
A52	Startup Counter for Motor 2	Indication of cumulative startup count (0000 to FFFF in hex.)	–	–	Y	N	–	

J codes: Application Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Refer to page:
J01	PID Control (Mode selection)	0: Disable 1: Enable (Process control, normal operation) 2: Enable (Process control, inverse operation)	–	–	N	Y	0	–
J02	(Remote command SV)	0: UP/DOWN keys on keypad 1: PID process command 1 (Analog input terminals [12] and [C1]) 3: Terminal command ***UP***/***DOWN*** control 4: Command via communications link	–	–	N	Y	0	
J03	P (Gain)	0.000 to 30.000 *2	0.001	times	Y	Y	0.100	
J04	I (Integral time)	0.0 to 3600.0 *2	0.1	s	Y	Y	0.0	
J05	D (Differential time)	0.00 to 600.00 *2	0.01	s	Y	Y	0.00	
J06	(Feedback filter)	0.0 to 900.0	0.1	s	Y	Y	0.5	
J15	(Operation level for slow flowrate stop)	0.0 (Disable), 1.0 to 400.0	0.1	Hz	Y	Y	0.0	
J16	(Elapsed time from slow flowrate stop)	0 to 3600	1	s	Y	Y	30	
J17	(Initiation frequency)	0.0 to 400.0	0.1	Hz	Y	Y	0.0	
J23	(Initiation deviation level for slow flowrate stop)	0.0 to 100.0	0.1	%	Y	Y	0.0	
J24	(Start latency time for slow flowrate stop)	0 to 3660	1	s	Y	Y	0	
J68	Braking Signal (Brake OFF current)	0 to 200 *3	1	%	Y	Y	100	
J69	(Brake OFF frequency)	0.0 to 25.0	0.1	Hz	Y	Y	1.0	
J70	(Brake OFF timer)	0.0 to 5.0	0.1	s	Y	Y	1.0	
J71	(Brake ON frequency)	0.0 to 25.0	0.1	Hz	Y	Y	1.0	
J72	(Brake ON timer)	0.0 to 5.0	0.1	s	Y	Y	1.0	

*2 When you make settings from the keypad, the incremental unit is restricted by the number of digits that the LED monitor can display.
(Example) If the setting range is from -200.00 to 200.00, the incremental unit is:
"1" for -200 to -100, "0.1" for -99.9 to -10.0 and for 100.0 to 200.0, and "0.01" for -9.99 to -0.01 and for 0.00 to 99.99.

*3 For the single-phase 100 V class series, the percentage is relative to the reference current; for other series, it is relative to the rated output current.

y codes: Link Functions

Code	Name	Data setting range	Incre-ment	Unit	Change when running	Data copying	Default setting	Refer to page:
y01	RS-485 Communication 1 (Station address)	1 to 255	1	–	N	Y	1	–
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 the retry fails, trip with alarm Er8. If it succeeds, continue to run. 3: Continue to run	–	–	Y	Y	0	
y03	(Timer)	0.0 to 60.0	0.1	s	Y	Y	2.0	
y04	(Baud rate)	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps	–	–	Y	Y	3	
y05	(Data length)	0: 8 bits 1: 7 bits	–	–	Y	Y	0	
y06	(Parity check)	0: None (2 stop bits for Modbus RTU) 1: Even parity (1 stop bit for Modbus RTU) 2: Odd parity (1 stop bit for Modbus RTU) 3: None (1 stop bit for Modbus RTU)	–	–	Y	Y	0	
y07	(Stop bits)	0: 2 bits 1: 1 bit	–	–	Y	Y	0	
y08	(No-response error detection time)	0: No detection 1 to 60	1	s	Y	Y	0	
y09	(Response interval)	0.00 to 1.00	0.01	s	Y	Y	0.01	
y10	(Protocol selection)	0: Modbus RTU protocol 1: SX protocol (FRENIC Loader protocol) 2: Fuji general-purpose inverter protocol	–	–	Y	Y	1	
y97	Communication Data Storage Selection *1	0: Save into nonvolatile storage (Rewritable times limited) 1: Write into temporary storage (Rewritable times unlimited) 2: Save all data from temporary storage to nonvolatile one (After saving data, the y97 data automatically reverts to "1.")	–	–	Y	Y	0	
y99	Loader Link Function (Mode selection)	Frequency command / Run command 0: Follow H30 data / Follow H30 data 1: Via RS-485 link (Loader) / Follow H30 data 2: Follow H30 data (Loader) / Via RS-485 link (Loader) 3: Via RS-485 link (Loader) / Via RS-485 link (Loader)	–	–	Y	N	0	

*1 Available in the ROM version 0500 or later.

Table A Fuji Standard Motor Parameters

Power supply voltage	Applicable motor rating kW (HP)	Inverter type	Fuji's standard torque boost (%)	Nominal rated current of Fuji standard motor (A)				Nominal rated capacity of Fuji standard motor (kW)	Restart mode after momentary power failure (Restart time) (s)
			Function code F09/A05	Function codes F11/A07/E34/E37				Function code P02/A16	Function code H13
				Shipping destination (version)					
				Asia	China	Europe	USA		
Three-phase 200 V	0.1 (1/8)	FRN0001C2S-2☐	8.4	0.62	0.68	0.73	0.63	0.10	0.5
	0.2 (1/4)	FRN0002C2S-2☐	8.4	1.18	1.30	1.38	1.21	0.20	
	0.4 (1/2)	FRN0004C2S-2☐	7.1	2.10	2.30	2.36	2.11	0.40	
	0.75 (1)	FRN0006C2S-2☐	6.8	3.29	3.60	3.58	3.27	0.75	
	1.5 (2)	FRN0010C2S-2☐	6.8	5.56	6.10	5.77	5.44	1.50	
	2.2 (3)	FRN0012C2S-2☐	6.8	8.39	9.20	8.80	8.24	2.20	
	3.7 (5)	FRN0020C2S-2☐	5.5	13.67	15.00	14.26	13.40	3.70	
	5.5 (7.5)	FRN0025C2S-2☐	4.9	20.50	22.50	21.25	20.26	5.50	
	7.5 (10)	FRN0033C2S-2☐	4.4	26.41	29.00	26.92	25.72	7.50	
	11 (15)	FRN0047C2S-2☐	3.5	38.24	42.00	38.87	37.21	11.00	1.0
	15 (20)	FRN0060C2S-2☐	2.8	50.05	55.00	50.14	48.50	15.00	
Three-phase 400 V	0.4 (1/2)	FRN0002C2■-4☐	7.1	1.04	1.15	1.15	1.06	0.40	0.5
	0.75 (1)	FRN0004C2■-4☐	6.8	1.72	1.82	1.80	1.63	0.75	
	1.5 (2)	FRN0005C2■-4☐	6.8	3.10	3.20	3.10	2.76	1.50	
	2.2 (3)	FRN0007C2■-4☐	6.8	4.54	4.72	4.60	4.12	2.20	
	3.7 (5)	FRN0011C2■-4☐	5.5	7.43	7.70	7.50	6.70	3.70	
	4.0*	FRN0011C2■-4E	5.5	7.43	7.70	7.50	6.70	3.70	
	5.5 (7.5)	FRN0013C2■-4☐	4.9	11.49	11.84	11.50	10.24	5.50	
	7.5 (10)	FRN0018C2■-4☐	4.4	14.63	15.00	14.50	12.86	7.50	
	11 (15)	FRN0024C2■-4☐	3.5	21.23	21.73	21.00	18.60	11.00	1.0
	15 (20)	FRN0030C2■-4☐	2.8	28.11	28.59	27.50	24.25	15.00	
Single-phase 200 V	0.1 (1/8)	FRN0001C2■-7☐	8.4	0.62	0.68	0.73	0.63	0.10	0.5
	0.2 (1/4)	FRN0002C2■-7☐	8.4	1.18	1.30	1.38	1.21	0.20	
	0.4 (1/2)	FRN0004C2■-7☐	7.1	2.10	2.30	2.36	2.11	0.40	
	0.75 (1)	FRN0006C2■-7☐	6.8	3.29	3.60	3.58	3.27	0.75	
	1.5 (2)	FRN0010C2■-7☐	6.8	5.56	6.10	5.77	5.44	1.50	
	2.2 (3)	FRN0012C2■-7☐	6.8	8.39	9.20	8.80	8.24	2.20	
Single-phase 100 V	0.1 (1/8)	FRN0001C2S-6U	8.4	0.62	0.68	0.73	0.63	0.10	0.5
	0.2 (1/4)	FRN0002C2S-6U	8.4	1.18	1.30	1.38	1.21	0.20	
	0.4 (1/2)	FRN0003C2S-6U	7.1	2.10	2.30	2.36	2.11	0.40	
	0.75 (1)	FRN0005C2S-6U	6.8	3.29	3.60	3.58	3.27	0.75	

Note 1) A box (■) in the above table replaces S (Basic type) or E (EMC filter built-in type) depending on the enclosure

2) A box (☐) in the above table replaces A, C, E, or U depending on the shipping destination.

3) A box (☐) in the above table replaces A or U depending on the shipping destination.

*4.0 kW for the EU. The inverter type is FRN0011C2S-4E.

5.2 Details of Function Codes

This section provides the details of the function codes frequently used for the FRENIC-Mini series of inverters.

📖 For details about the function codes given below and other function codes not given below, refer to the FRENIC-Mini User's Manual (24A7-E-0023), Chapter 9 "FUNCTION CODES."

F00 Data Protection

F00 specifies whether to protect function code data (except F00) and digital reference data (such as frequency command, PID command and timer operation) from accidentally getting changed by pressing the ⌃ / ⌄ keys.

Data for F00	Function
0	Disable both data protection and digital reference protection, allowing you to change both function code data and digital reference data with the ⌃ / ⌄ keys.
1	Enable data protection and disable digital reference protection, allowing you to change digital reference data with the ⌃ / ⌄ keys. But you cannot change function code data (except F00).
2	Disable data protection and enable digital reference protection, allowing you to change function code data with the ⌃ / ⌄ keys. But you cannot change digital reference data.
3	Enable both data protection and digital reference protection, not allowing you to change function code data or digital reference data with the ⌃ / ⌄ keys.

Enabling the protection disables the ⌃ / ⌄ keys to change function code data.

To change F00 data, simultaneous keying of STOP + ⌃ (from 0 to 1) or STOP + ⌄ (from 1 to 0) keys is required.

Tip Even when F00 = 1 or 3, function code data can be changed via the communications link.

For similar purposes, ***WE-KP***, a signal enabling editing of function code data from the keypad is provided as a terminal command for digital input terminals. (Refer to the descriptions of E01 through E03.)

F01, C30 Frequency Command 1, Frequency Command 2

F01 or C30 sets the command source that specifies reference frequency 1 or reference frequency 2, respectively.

Data for F01, C30	Function
0	Enable ⌃ / ⌄ keys on the keypad. (Refer to Chapter 3 "OPERATION USING THE KEYPAD.")
1	Enable the voltage input to terminal [12] (0 to +10 VDC, maximum frequency obtained at +10 VDC).

Data for F01, C30	Function
2	Enable the current input to terminal [C1] (+4 to +20 mA DC or 0 to +20 mA DC, maximum frequency obtained at +20 mA DC). 📖 Using function code C40 expands the input range from "+4 to +20 mA DC" to "0 to +20 mA DC."
3	Enable the sum of voltage (0 to +10 VDC, maximum frequency obtained at +10 VDC) and current inputs (+4 to +20 mA DC or 0 to +20 mA DC, maximum frequency obtained at +20 mA DC) given to terminals [12] and [C1], respectively. 📖 Using function code C40 expands the input range from "+4 to +20 mA DC" to "0 to +20 mA DC." Note: If the sum exceeds the maximum frequency (F03, A01), the maximum frequency will apply.
4	Enable the built-in potentiometer (POT). (Maximum frequency obtained at full scale of the POT)
7	Enable ***UP*** and ***DOWN*** commands assigned to the digital input terminals. The ***UP*** and ***DOWN*** should be assigned to any of digital input terminals [X1] to [X3] beforehand with any of E01 to E03 (data = 17 and 18).

Note In addition to the frequency command sources described above, higher priority command sources including communications link and multistep frequency are provided. For details, refer to the block diagram given in FRENIC-Mini User's Manual (24A7-E-0023), Chapter 4, Section 4.2 "Drive Frequency Command Generator."

Tip
- For frequency settings made by terminals [12] (voltage) and [C1] (current) and by the built-in potentiometer, setting the gain and bias changes the relationship between those frequency settings and the drive frequency. Refer to function code F18 for details.
- For the inputs to terminals [12] (voltage) and [C1] (current), low-pass filters can be enabled.
- Using the terminal command ***Hz2/Hz1*** assigned to one of the digital input terminals switches between frequency command 1 (F01) and frequency command 2 (C30). Refer to function codes E01 to E03.

F02 Operation Method

F02 selects the source that specifies a run command for running the motor.

Data for F02	Run Command Source	Description
0	Keypad (Rotation direction specified by terminal command)	Enable the RUN / STOP keys to run and stop the motor. The rotation direction of the motor is specified by terminal command ***FWD*** or ***REV***.
1	External signals	Enable terminal command ***FWD*** or ***REV*** to run and stop the motor.
2	Keypad (Forward rotation)	Enable RUN / STOP keys to run and stop the motor. Note that this run command enables only the forward rotation. There is no need to specify the rotation direction.

Data for F02	Run Command Source	Description
3	Keypad (Reverse rotation)	Enable RUN / STOP keys to run and stop the motor. Note that this run command enables only the reverse rotation. There is no need to specify the rotation direction.

Note

- When function code F02 = 0 or 1, the "Run forward" ***FWD*** and "Run reverse" ***REV*** terminal commands must be assigned to terminals [FWD] and [REV], respectively.
- When the ***FWD*** or ***REV*** is ON, the F02 data cannot be changed.
- When assigning the ***FWD*** or ***REV*** to terminal [FWD] or [REV] with F02 being set to "1," be sure to turn the target terminal OFF beforehand; otherwise, the motor may unintentionally rotate.
- In addition to the run command sources described above, higher priority command sources including communications link are provided. For details, refer to the FRENIC-Mini User's Manual (24A7-E-0023).

F03 Maximum Frequency 1

F03 specifies the maximum frequency (for motor 1) to limit the output frequency. Specifying the maximum frequency exceeding the rating of the equipment driven by the inverter may cause damage or a dangerous situation. Make sure that the maximum frequency setting matches the equipment rating.

⚠WARNING

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

Otherwise injuries could occur.

Tip Modifying F03 data to allow a higher reference frequency requires also changing F15 data specifying a frequency limiter (high).

F04 Base Frequency 1
F05 Rated Voltage at Base Frequency 1
F06 Maximum Output Voltage 1
H50, H51 Non-linear V/f Pattern 1 (Frequency and Voltage)
H52, H53 Non-linear V/f Pattern 2 (Frequency and Voltage)

These function codes specify the base frequency and the voltage at the base frequency essentially required for running the motor properly. If combined with the related function codes H50 through H53, these function codes may profile the non-linear V/f pattern by specifying increase or decrease in voltage at any point on the V/f pattern.

The following description includes setups required for the non-linear V/f pattern.

At high frequencies, the motor impedance may increase, resulting in an insufficient output voltage and a decrease in output torque. This feature is used to increase the voltage with the maximum output voltage 1 to prevent this problem from happening. Note, however, that you cannot increase the output voltage beyond the voltage of the inverter’s input power.

■ Base Frequency 1 (F04)

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

■ Rated Voltage at Base Frequency (F05)

Set "0" or the rated voltage printed on the nameplate labeled on the motor.

- If "0" is set, the rated voltage at base frequency is determined by the power source of the inverter. The output voltage will vary in line with any variance in input voltage.
- If the data is set to anything other than "0," the inverter automatically keeps the output voltage constant in line with the setting. When any of the auto torque boost settings, auto energy saving or slip compensation is active, the voltage settings should be equal to the rated voltage of the motor.

■ Non-linear V/f Patterns 1 and 2 for Frequency (H50 and H52)

Set the frequency component at an arbitrary point of the non-linear V/f pattern.

(Setting "0.0" to H50 or H52 disables the non-linear V/f pattern operation.)

■ Non-linear V/f Patterns 1 and 2 for Voltage (H51 and H53)

Sets the voltage component at an arbitrary point of the non-linear V/f pattern.

■ Maximum Output Voltage (F06)

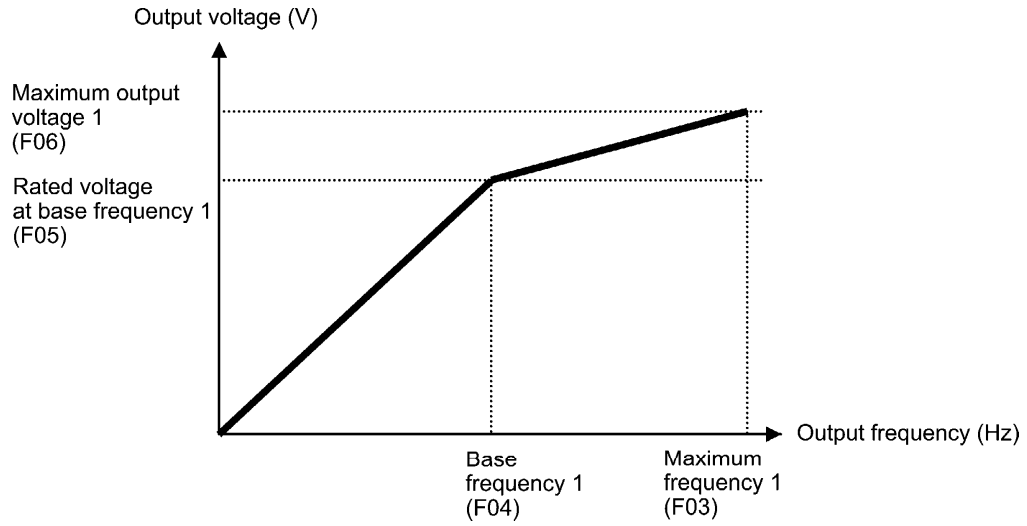
Set the voltage for the maximum frequency 1 (F03).

Note

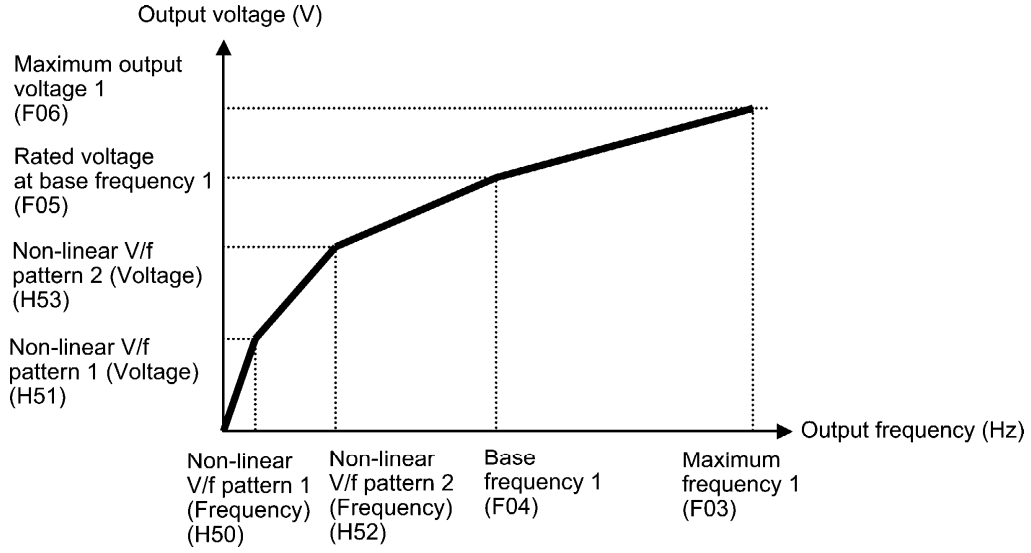
- If F05 (Rated Voltage at Base Frequency 1) is set to "0," settings of H50 through H53 and F06 do not take effect. (When the non-linear point is below the base frequency, the linear V/f pattern applies; when it is above, the output voltage is kept constant.)
- When the auto torque boost (F37) is enabled, the non-linear V/f pattern takes no effect.

Examples:

■ Normal (linear) V/f pattern

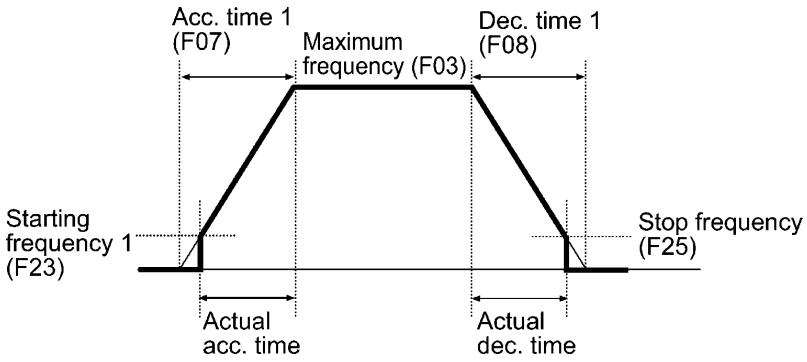


■ V/f pattern with two non-linear points



F07	Acceleration Time 1
F08	Deceleration Time 1
E10	Acceleration Time 2
E11	Deceleration Time 2

F07 specifies the acceleration time, the length of time the frequency increases from 0 Hz to the maximum frequency. F08 specifies the deceleration time, the length of time the frequency decreases from the maximum frequency down to 0 Hz.



Note
- Selecting an S-shaped pattern or curvilinear acceleration/deceleration pattern with function code H07 (Acceleration/deceleration pattern) makes the actual acceleration/deceleration times longer than the specified ones. Refer to the descriptions of function code H07.
- Specifying an improperly short acceleration/deceleration time may activate the current limiter or anti-regenerative control, resulting in a longer acceleration/ deceleration time than the specified one.

Tip Acceleration/deceleration time 1 (F07, F08) and acceleration/deceleration time 2 (E10, E11) are switched by terminal command ***RT1*** assigned to any of the digital input terminals with any of function codes E01 through E03.

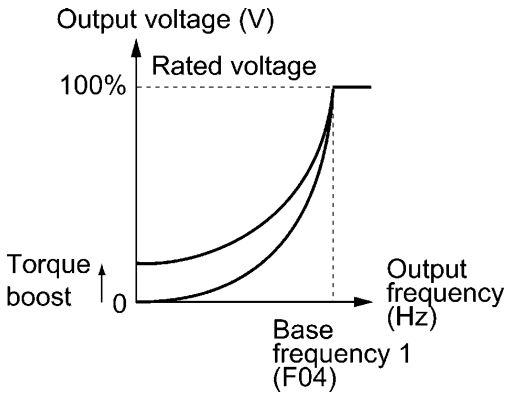
F37 specifies V/f pattern, torque boost type, and auto energy saving operation for optimizing the operation in accordance with the characteristics of the load. F09 specifies the type of torque boost in order to provide sufficient starting torque.

Data for F37	V/f pattern	Torque boost (F09)	Auto energy saving	Applicable load
0	Variable torque V/f pattern	Torque boost specified by F09	Disable	Variable torque load (General purpose fans and pumps)
1	Linear V/f pattern			Constant torque load
2		Auto torque boost		Constant torque load (To be selected if a motor may be over-excited at no load.)
3	Variable torque V/f pattern	Torque boost specified by F09	Enable	Variable torque load (General purpose fans and pumps)
4	Linear V/f pattern			Constant torque load
5		Auto torque boost		Constant torque load (To be selected if a motor may be over-excited at no load.)

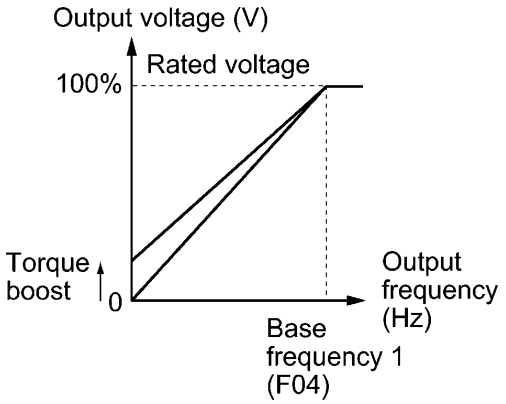
Note: If a required "load torque + acceleration toque" is more than 50% of the rated torque, it is recommended to select the linear V/f pattern (factory default).

■ V/f characteristics

The FRENIC-Mini series of inverters offers a variety of V/f patterns and torque boosts, which include V/f patterns suitable for variable torque load such as general fans and pumps or for special pump load requiring high starting torque. Two types of torque boost are available: manual and automatic.



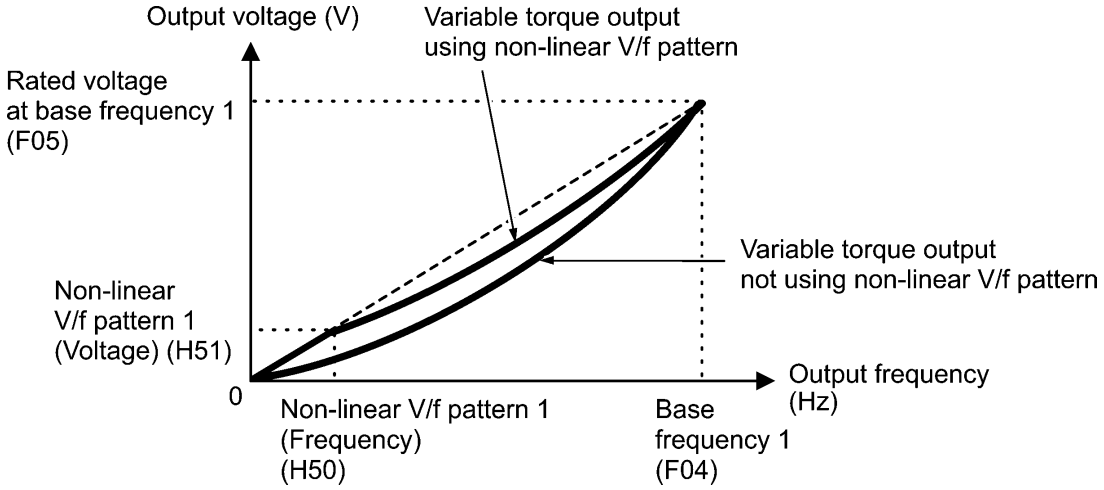
Variable torque V/f pattern (F37 = 0)



Linear V/f pattern (F37 = 1)

Tip When the variable torque V/f pattern is selected (F37 = 0 or 3), the output voltage may be low and insufficient voltage output may result in less output torque of the motor at a low frequency zone, depending on some characteristics of the motor itself and load. In such a case, it is recommended to increase the output voltage at the low frequency zone using the non-linear V/f pattern (H50, H51).

Recommended value: H50 = 1/10 of the base frequency
H51 = 1/10 of the voltage at base frequency



■ Torque boost

• Manual torque boost (F09)

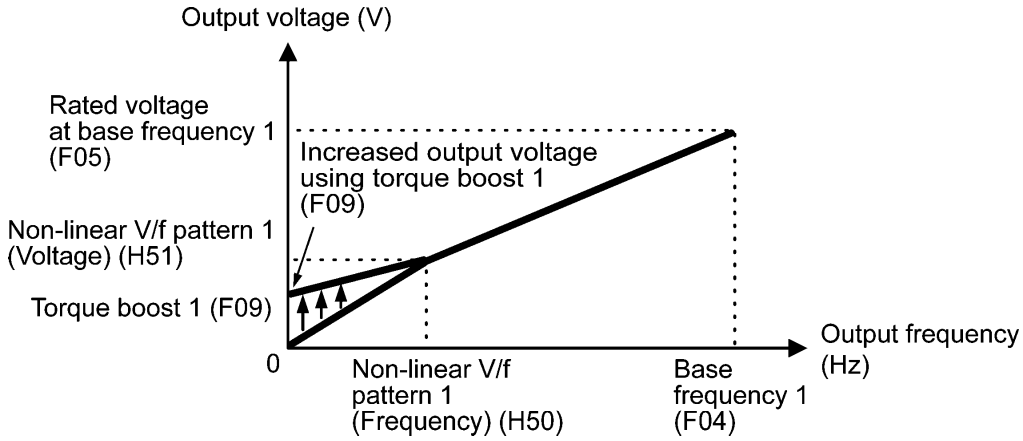
In torque boost using F09, constant voltage is added to the basic V/f pattern, regardless of the load, to give the output voltage. To secure a sufficient starting torque, manually adjust the output voltage to optimally match the motor and its load by using F09. Specify an appropriate level that guarantees smooth start-up and yet does not cause over-excitation with no or light load.

Torque boost per F09 ensures high driving stability since the output voltage remains constant regardless of the load fluctuation.

Specify the F09 data in percentage to the rated voltage at base frequency 1 (F05). At factory shipment, F09 is preset to a level that provides approx. 100% of starting torque.

Note Specifying a high torque boost level will generate a high torque, but may cause overcurrent due to over-excitation at no load. If you continue to drive the motor, it may overheat. To avoid such a situation, adjust torque boost to an appropriate level.

When the non-linear V/f pattern and the torque boost are used together, the torque boost takes effect below the frequency on the non-linear V/f pattern's point.



• Auto torque boost

This function automatically optimizes the output voltage to fit the motor with its load. Under light load, auto torque boost decreases the output voltage to prevent the motor from over-excitation. Under heavy load, it increases the output voltage to increase output torque of the motor.

Note
- Since this function relies also on the characteristics of the motor, set the base frequency 1 (F04), the rated voltage at base frequency 1 (F05), and other pertinent motor parameters (P02, P03 and P06 through P99) in line with the motor capacity and characteristics, or else perform auto-tuning (P04).
- When a special motor is driven or the load does not have sufficient rigidity, the maximum torque might decrease or the motor operation might become unstable. In such cases, do not use auto torque boost but choose manual torque boost per F09 (F37 = 0 or 1).

■ Auto energy saving operation

This feature automatically controls the supply voltage to the motor to minimize the total power loss of motor and inverter. (Note that this feature may not be effective depending upon the motor or load characteristics. Check the advantage of energy saving before actually apply this feature to your power system.)

This feature applies to constant speed operation only. During acceleration/deceleration, the inverter will run with manual torque boost (F09) or auto torque boost, depending on the F37 data. If auto energy saving operation is enabled, the response to a change in motor speed may be slow. Do not use this feature for such a system that requires quick acceleration/ deceleration.

Note
- Use auto energy saving only where the base frequency is 60 Hz or lower. If the base frequency is set at 60 Hz or higher, you may get a little or no energy saving advantage. The auto energy saving operation is designed for use with the frequency lower than the base frequency. If the frequency becomes higher than the base frequency, the auto energy saving operation will be invalid.
- Since this function relies also on the characteristics of the motor, set the base frequency 1 (F04), the rated voltage at base frequency 1 (F05), and other pertinent motor parameters (P02, P03 and P06 through P99) in line with the motor capacity and characteristics, or else perform auto-tuning (P04).

F10	Electronic Thermal Overload Protection for Motor 1 (Select motor characteristics)
F11	Electronic Thermal Overload Protection for Motor 1 (Overload detection level)
F12	Electronic Thermal Overload Protection for Motor 1 (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.

F10 selects the motor cooling mechanism to specify its characteristics, F11 specifies the overload detection current, and F12 specifies the thermal time constant.

Note
Thermal characteristics of the motor specified by F10 and F12 are also used for the overload early warning. Even if you need only the overload early warning, set these characteristics data to these function codes. To disable the electronic thermal overload protection, set function code F11 to "0.00."

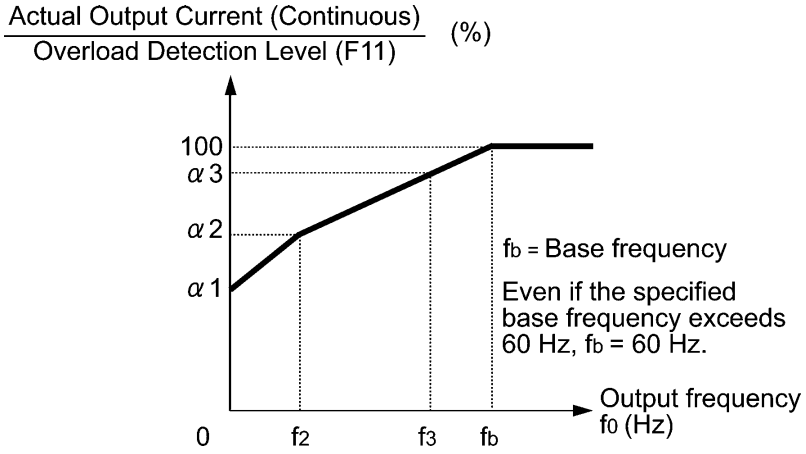
■ Motor characteristics (F10)

F10 selects the cooling mechanism of the motor-- shaft-driven or separately powered cooling fan.

Data for F10	Function
1	For a general-purpose motor and Fuji standard permanent magnet synchronous motor with shaft-driven cooling fan. (The cooling effect will decrease in low frequency operation.)
2	For an inverter-driven motor with separately powered cooling fan. (The cooling effect will be kept constant regardless of the output frequency.)

The figure below shows operating characteristics of the electronic thermal overload protection when F10 = 1. The characteristic factors $\alpha 1$ through $\alpha 3$ as well as their corresponding switching frequencies f_2 and f_3 vary with the characteristics of the motor.

The tables below list the factors determined by the motor capacity (P02) and the motor characteristics (P99).



Cooling Characteristics of Motor with Shaft-driven Cooling Fan

Nominal Applied Motor and Characteristic Factors when P99 (Motor 1 selection) = 0 or 4

Nominal applied motor kW (HP)	Thermal time constant τ (Factory default)	Reference current for setting the thermal time constant (Imax)	Output frequency for motor characteristic factor		Characteristic factor		
			f2	f3	α1	α2	α3
0.1 to 0.75 (1/8 to 1)	5 min	Allowable continuous current × 150%	5 Hz	7 Hz	75%	85%	100%
1.5 to 4.0 (2 to 5)					85%	85%	100%
5.5 to 11 (7.5 to 15)				6 Hz	90%	95%	100%
15 (20)				7 Hz	85%	85%	100%
18.5 (25), 22 (30)				5 Hz	92%	100%	100%
30 (40)	10 min		Base frequency × 33%	Base frequency × 33%	54%	85%	90%

Nominal Applied Motor and Characteristic Factors when P99 (Motor 1 Selection) = 1 or 3

<table>
<tr><th rowspan="2">Nominal applied motor kW (HP)</th><th rowspan="2">Thermal time constant τ (Factory default)</th><th rowspan="2">Reference current for setting the thermal time constant (Imax)</th><th colspan="2">Output frequency for motor characteristic factor</th><th colspan="3">Characteristic factor</th></tr>
<tr><th>f2</th><th>f3</th><th>α1</th><th>α2</th><th>α3</th></tr>
<tr><td>0.1 to 22 (1/8 to 30)</td><td>5 min</td><td rowspan="2">Allowable continuous current × 150%</td><td rowspan="2">Base frequency × 33%</td><td>Base frequency × 33%</td><td>69%</td><td>90%</td><td>90%</td></tr>
<tr><td>30 (40)</td><td>10 min</td><td>Base frequency × 83%</td><td>54%</td><td>85%</td><td>95%</td></tr>
</table>

When F10 = 2, the cooling effect is not decreased by the output frequency so that the overload detection level is a constant value without reduction (F11).

■ Overload detection level (F11)

F11 specifies the detection level (in amperes) at which the electronic thermal overload protection becomes activated.

In general, set F11 to the rated current of motor when driven at the base frequency (i.e. 1.0 to 1.1 multiple of the rated current of motor 1 (P03)). To disable the electronic thermal overload protection, set F11 to "0.00: Disable."

■ Thermal time constant (F12)

F12 specifies the thermal time constant of the motor. If the current of 150% of the overload detection level specified by F11 flows for the time specified by F12, the electronic thermal overload protection becomes activated to detect the motor overload. The thermal time constant for general-purpose motors including Fuji motors is approx. 5 minutes by factory default.

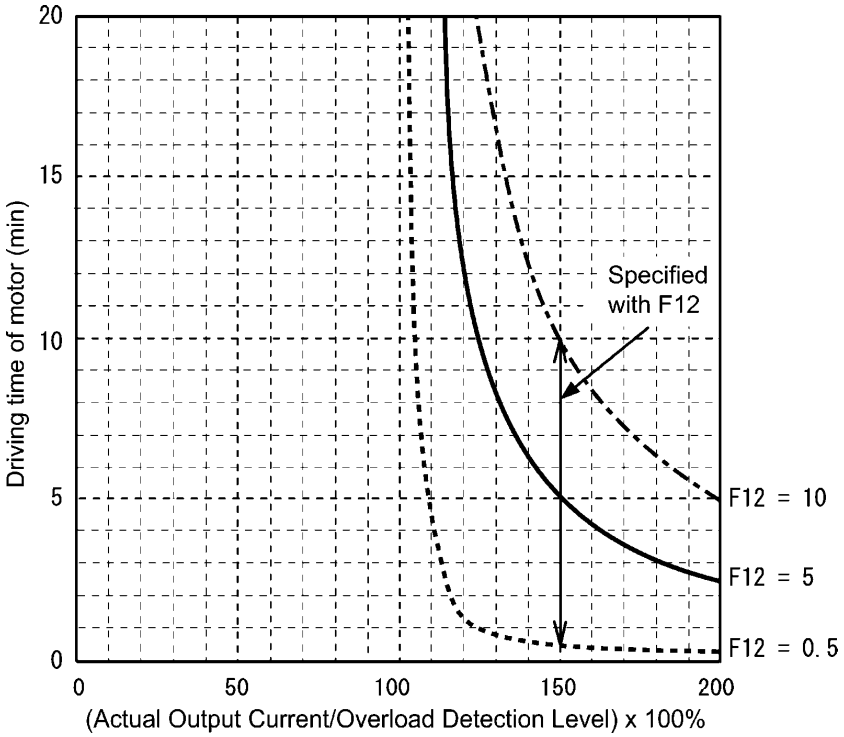
- Data setting range: 0.5 to 75.0 (minutes) in increments of 0.1 (minute)

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

As shown below, the electronic thermal overload protection is activated to detect an alarm condition (alarm code OL1) when the output current of 150% of the overload detection level (specified by F11) flows for 5 minutes, and 120% for approx. 12.5 minutes.

The actual time required for issuing a motor overload alarm tends to be shorter than the specified value, taking into account the time period from when the output current exceeds the allowable continuous drive current (100%) until it reaches 150% of the overload detection level.

Example of Thermal Overload Detection Characteristics



F14	Restart Mode after Momentary Power Failure
H13	Restart Mode after Momentary Power Failure, Restart time
H14	Restart Mode after Momentary Power Failure, Frequency fall rate

F14 specifies the action to be taken by the inverter such as trip and restart in the event of a momentary power failure.

■ Restart mode after momentary power failure (Mode selection) (F14)

Data for F14	Mode	Description
0	Disable restart (Trip immediately)	As soon as the DC link bus voltage drops below the undervoltage detection level due to a momentary power failure, the inverter issues undervoltage alarm LU and shuts down its output so that the motor enters a coast-to-stop state.
1	Disable restart (Trip after recovery from power failure)	As soon as the DC link bus voltage drops below the undervoltage detection level due to a momentary power failure, the inverter shuts down its output so that the motor enters a coast-to-stop state, but it does not enter the undervoltage state or issue undervoltage alarm LU. The moment the power is restored, an undervoltage alarm LU is issued, while the motor remains in a coast-to-stop state.

Data for F14	Mode	Description
2	Trip after decelerate-to-stop	As soon as the DC link bus voltage drops below the continuous running level due to a momentary power failure, decelerate-to-shop control is invoked. Decelerate-to-stop control regenerates kinetic energy from the load's moment of inertia, slowing down the motor and continuing the deceleration operation. After decelerate-to-stop operation, an undervoltage alarm LU is issued. (Available in the ROM version 0500 or later.)
4	Enable restart (Restart at the frequency at which the power failure occurred, for general loads)	As soon as the DC link bus voltage drops below the undervoltage detection level due to a momentary power failure, the inverter saves the output frequency being applied at that time and shuts down the output so that the motor enters a coast-to-stop state. If a run command has been input, restoring power restarts the inverter at the output frequency saved during the last power failure processing. This setting is ideal for applications with a moment of inertia large enough not to slow down the motor quickly, such as fans, even after the motor enters a coast-to-stop state upon occurrence of a momentary power failure.
5	Enable restart (Restart at the starting frequency, for low-inertia load)	After a momentary power failure, restoring power and then entering a run command restarts the inverter at the starting frequency specified by function code F23. This setting is ideal for heavy load applications such as pumps, having a small moment of inertia, in which the motor speed quickly goes down to zero as soon as it enters a coast-to-stop state upon occurrence of a momentary power failure.

⚠WARNING

If you enable the "Restart mode after momentary power failure" (Function code F14 = 4 or 5), the inverter automatically restarts the motor running when the power is restored. Design the machinery or equipment so that human safety is ensured after restarting.

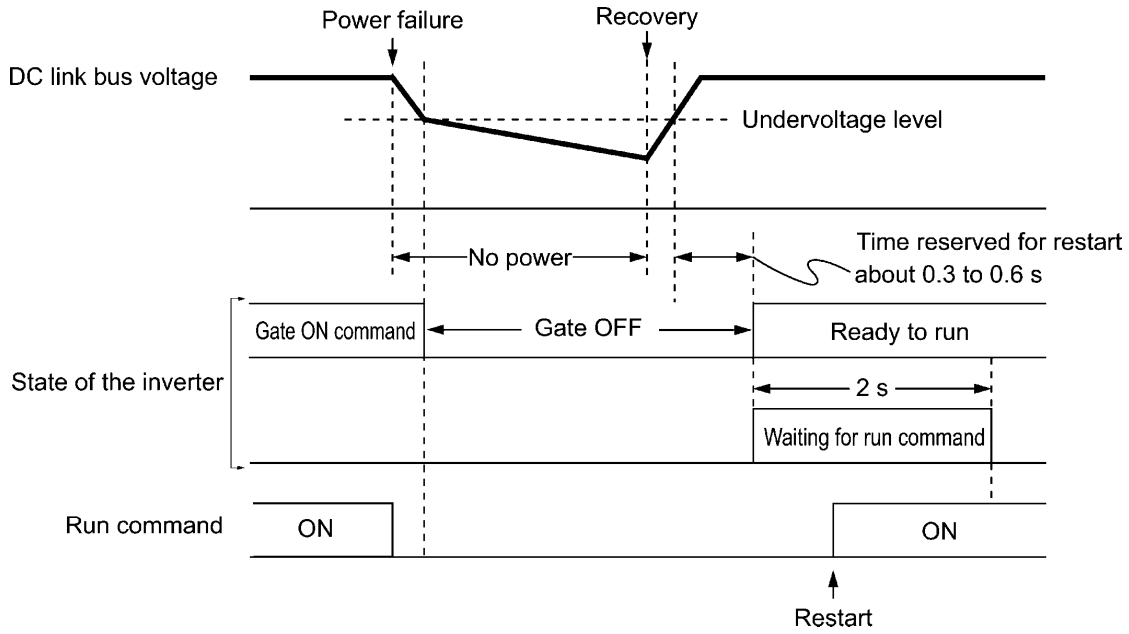
Otherwise an accident could occur.

■ Restart mode after momentary power failure (Basic operation)

The inverter recognizes a momentary power failure upon detecting the condition that DC link bus voltage goes below the undervoltage detection level, while the inverter is running. If the load of the motor is light and the duration of the momentary power failure is extremely short, the voltage drop may not be great enough for a momentary power failure to be recognized, and the motor may continue to run uninterrupted.

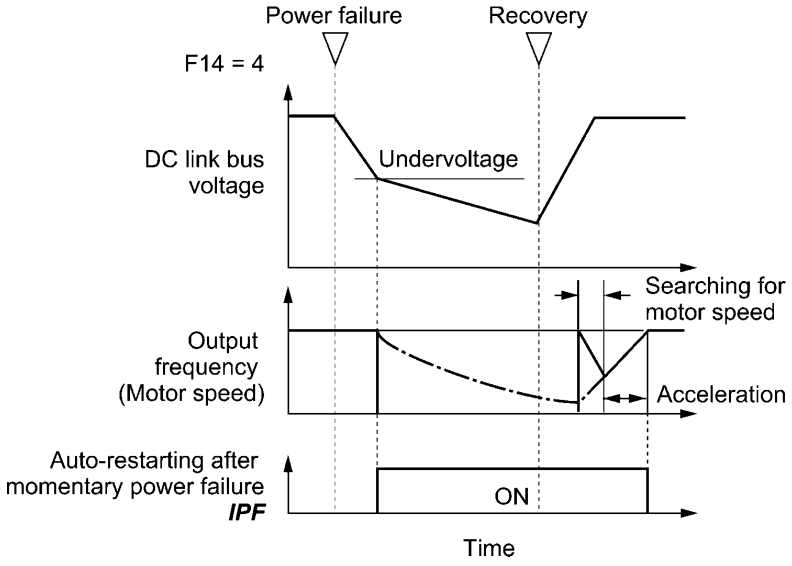
Upon recognizing a momentary power failure, the inverter enters the restart mode (after a recovery from momentary power failure) and prepares for restart. When power is restored, the inverter goes through an initial charging stage and enters the ready-to-run state. When a momentary power failure occurs, the power supply voltage for external circuits such as relay sequence circuits may also drop so as to turn the run command OFF. In consideration of such a situation, the inverter waits 2 seconds for a run command input after the inverter enters a ready-to-run state. If a run command is received within 2 seconds, the inverter begins the restart processing in accordance with the F14 data (Mode selection). If no run command has been received within 2-second wait period, the inverter cancels the restart mode (after a recovery from momentary power failure) and needs to be started again from the ordinary starting frequency. Therefore, ensure that a run command is entered within 2 seconds after a recovery of power, or install a mechanical latch relay.

When run commands are entered via the keypad, the above operation is also necessary for the mode (F02 = 0) in which the rotational direction is determined by the terminal command, ***FWD*** or ***REV***. In the modes where the rotational direction is fixed (F02 = 2 or 3), it is retained inside the inverter so that the restart will begin as soon as the inverter enters the ready-to-run state.



Note If the "Coast to a stop" terminal command ***BX*** is entered during the power failure, the inverter gets out of the restart mode and enters the normal running mode. If a run command is entered with power supply applied, the inverter will start from the normal starting frequency (F23).

During a momentary power failure, the motor slows down. After power is restored, the inverter restarts at the frequency just before the momentary power failure. Then, the current limiting function works and the output frequency of the inverter automatically decreases. When the output frequency matches the motor speed, the motor accelerates up to the original output frequency. See the figure below. In this case, the instantaneous overcurrent limiting must be enabled (H12 = 1).



■ Restart mode after momentary power failure (Restart time) (H13)

H13 specifies the time period from momentary power failure occurrence until the inverter reacts for restarting process.

If the inverter starts the motor while motor's residual voltage is still in a high level, a large inrush current may flow or an overvoltage alarm may occur due to an occurrence of temporary regeneration. For safety, therefore, it is advisable to set H13 to a certain level so that restart will take place only after the residual voltage has dropped to a low level. Note that even when power is restored, restart will not take place until the restart time (H13) has elapsed.

Factory default

By factory default, H13 is set at one of the values shown below according to the inverter capacity. Basically, you do not need to change H13 data. However, if the long restart time causes the flow rate of the pump to overly decrease or causes any other problem, you might as well reduce the setting to about a half of the default value. In such a case, make sure that no alarm occurs.

Inverter capacity kW (HP)	Factory default of H13 (Restart time in seconds)
0.1 to 7.5 (1/8 to 10)	0.5
11 to 15 (15 to 20)	1.0

■ Restart mode after momentary power failure (Frequency fall rate) (H14)

During restart after a momentary power failure, if the inverter output frequency and the idling motor speed cannot be harmonized with each other, an overcurrent will flow, activating the overcurrent limiter. If it happens, the inverter reduces the output frequency to match the idling motor speed according to the reduction rate (Frequency fall rate: Hz/s) specified by H14.

Data for H14	Inverter's action for the output frequency fall
0.00	Follow the selected deceleration time
0.01 to 100.00 (Hz/s)	Follow data specified by H14
999	Follow the setting of the PI processor in the current limiter. (The PI constant is prefixed inside the inverter.)

Note If the frequency fall rate is too high, regeneration may take place at the moment the motor rotation matches the inverter output frequency, causing an overvoltage trip. On the contrary, if the frequency fall rate is too low, the time required for the output frequency to match the motor speed (duration of current limiting action) may be prolonged, triggering the inverter overload prevention control.

F15, F16 Frequency Limiter (High and Low)
H63 Low Limiter (Mode selection)

F15 and F16 specify the upper and lower limits of the output frequency, respectively.

H63 specifies the operation to be carried out when the output frequency drops below the low level specified by F16, as follows:

- When H63 = 0, the output frequency will be held at the low level specified by F16.
- When H63 = 1, the inverter decelerates to stop the motor.

Note
- When you change the frequency limiter (High) (F15) in order to raise the reference frequency, be sure to change the maximum frequency (F03, A01) accordingly.
- Maintain the following relationship among the data for frequency control:

  F15 > F16, F15 > F23(A12), and F15 > F25

  F03/A01 > F16

  where, F23(A12) is of the starting frequency and F25 is of the stop frequency.

  If you specify any wrong data for these function codes, the inverter may not run the motor at the desired speed, or cannot start it normally.

F18	Bias (Frequency command 1)
C50	Bias (for Frequency 1) (Bias base point)
C32, C34	Analog Input Adjustment for [12] (Gain, Gain base point)
C37, C39	Analog Input Adjustment [C1] (Gain, Gain base point)

When any analog input for frequency command 1 (F01) is used, it is possible to define the relationship between the analog input and the reference frequency by multiplying the gain and adding the bias specified by F18.

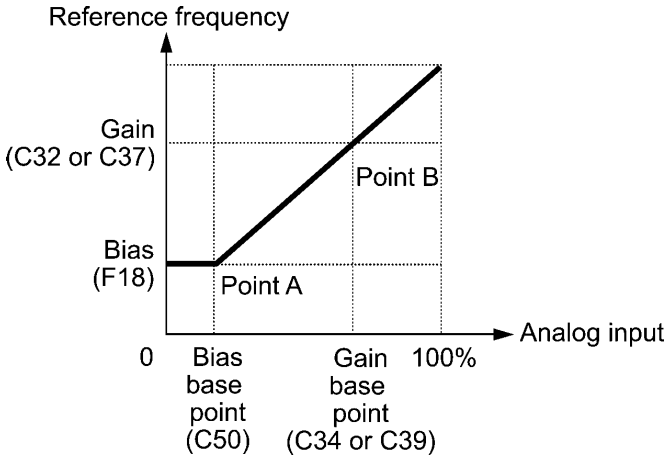
As shown in the graph below, the relationship between the analog input and the reference frequency specified by frequency command 1 is determined by points "A" and "B." Point "A" is defined by the combination of the bias (F18) and its base point (C50); Point "B," by the combination of the gain (C32, C37) and its base point (C34, C39).

The combination of C32 and C34 applies to terminal [12] and that of C37 and C39, to terminal [C1].

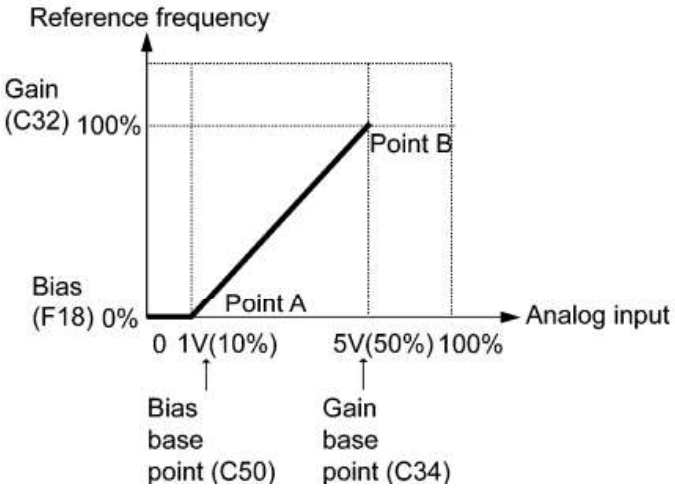
Configure the bias (F18) and gain (C32, C37), assuming the maximum frequency as 100%, and the bias base point (C50) and gain base point (C34, C39), assuming the full scale (10 VDC or 20 mA DC) of analog input as 100%.

Note

- The analog input less than the bias base point (C50) is limited by the bias value (F18).
- Specifying that the data of the bias base point (C50) is equal to or greater than that of each gain base point (C34, C39) will be interpreted as invalid, so the inverter will reset the reference frequency to 0 Hz.



Example: Setting the bias, gain and their base points when the reference frequency 0 to 100% follows the analog input of 1 to 5 VDC to terminal [12] (in frequency command 1).



(Point A)

To set the reference frequency to 0 Hz for an analog input being at 1 V, set the bias to 0% (F18 = 0). Since 1 V is the bias base point and it is equal to 10% of 10 V (full scale), set the bias base point to 10% (C50 = 10).

(Point B)

To make the maximum frequency equal to the reference frequency for an analog input being at 5 V, set the gain to 100% (C32 = 100). Since 5 V is the gain base point and it is equal to 50% of 10 V (full scale), set the gain base point to 50% (C34 = 50).

Note The setting procedure for specifying a gain or bias alone without changing any base points is the same as that of Fuji conventional inverters.

F20 to F22 H95 DC Braking 1 (Braking starting frequency, Braking level, and Braking time) DC Braking (Braking response mode)

F20 through F22 specify the DC braking that prevents motor 1 from running by inertia during decelerate-to-stop operation.

If the motor enters a decelerate-to-stop operation by turning OFF the run command or by decreasing the reference frequency below the stop frequency, the inverter activates the DC braking by flowing a current at the braking level (F21) during the braking time (F22) when the output frequency reaches the DC braking starting frequency (F20).

Setting the braking time (F22) to "0.00" disables the DC braking.

■ Braking starting frequency (F20)

F20 specifies the frequency at which the DC braking starts its operation during motor decelerate-to-stop state.

Note Generally, set the motor rated slip frequency or so to F20. Setting an extremely large value makes the control unstable; according to conditions, it activates an overvoltage protection.

■ Braking level (F21)

F21 specifies the output current level to be applied when the DC braking is activated. The function code data should be set, assuming the rated output current of the inverter as 100%, in increments of 1%.

Note For single-phase 100 V class series

The braking level setting (F21) should be calculated from the DC braking level I_{DB} (A) based on the reference current I_{ref} (A), as shown below.

$$\text{Setting}\,(\%) = \frac{I_{DB}\,(\text{A})}{I_{ref}\,(\text{A})} \times 100$$

(Example) Setting the braking level I_{DB} at 4.2 Amp (A) for 1 HP standard motors

$$\text{Setting}\,(\%) = \frac{4.2\,(\text{A})}{5.0\,(\text{A})} \times 100 = 84$$

Nominal applied motor (HP)	1/8	1/4	1/2	1
Reference current Iref (A)	0.8	1.5	3.0	5.0

■ Braking time (F22)

F22 specifies the braking period that activates DC braking.

■ Braking response mode (H95)

H95 specifies the DC braking response mode.

Data for H95	Characteristics	Note
0	Slow response. Slows the rising edge of the current, thereby preventing reverse rotation at the start of DC braking.	Insufficient braking torque may result at the start of DC braking.
1	Quick response. Quickens the rising edge of the current, thereby accelerating the build-up of the braking torque.	Reverse rotation may result depending on the moment of inertia of the mechanical load and the coupling mechanism.

Tip It is also possible to use an external digital input signal as an "Enable DC braking" terminal command ***DCBRK***.

As long as the ***DCBRK*** command is ON, the inverter performs DC braking, regardless of the braking time specified by F22.

Turning the ***DCBRK*** command ON even when the inverter is in a stopped state activates DC braking. This feature allows the motor to be excited before starting, resulting in smoother acceleration (quicker build-up of acceleration torque).

Note In general, specify data of function code F20 at a value close to the rated slip frequency of motor. If you set it at an extremely high value, control may become unstable and an overvoltage alarm may result in some cases.

⚠CAUTION
The DC brake function of the inverter does not provide any holding mechanism. **Injuries could occur.**

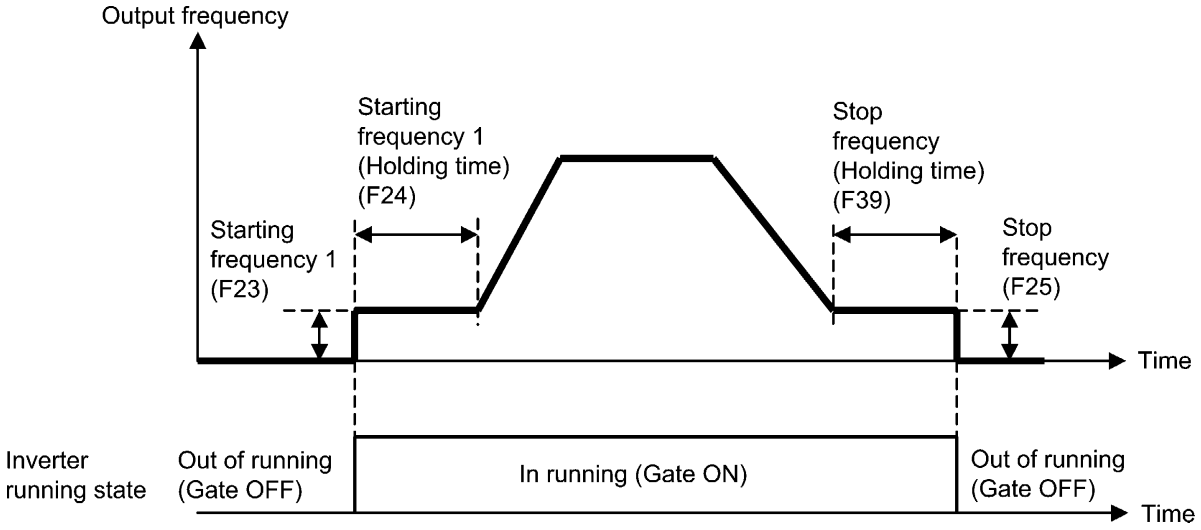
F23	Starting Frequency 1
F24	Starting Frequency 1 (Holding time)
F25	Stop Frequency
F39	Stop Frequency (Holding time)

At the startup of an inverter, the initial output frequency is equal to the starting frequency 1 specified by F23. The inverter stops its output when the output frequency reaches the stop frequency specified by F25.

Set the starting frequency to a level at which the motor can generate enough torque for startup. Generally, set the motor's rated slip frequency as the starting frequency.

In addition, to compensate for the delay time for the establishment of a magnetic flux in the motor, F24 specifies the holding time for the starting frequency. To stabilize the motor speed at the stop of the motor, F39 specifies the holding time for the stop frequency.

Note If the starting frequency is lower than the stop frequency, the inverter will not output any power as long as the reference frequency does not exceed the stop frequency.



F26, F27 Motor Sound (Carrier frequency and tone)

■ Motor sound (Carrier frequency) (F26)

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

Carrier frequency	0.75 to 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. 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 the carrier frequency is set to 1 kHz or below, therefore, reduce the load so that the inverter output current comes to be 80% or less of the rated current.

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 overload alarm OLU. With consideration for motor noise, the automatic reduction of carrier frequency can be disabled. Refer to the description of H98.

■ Motor sound (Tone) (F27)

F27 changes the motor running sound tone. This setting is effective when the carrier frequency set to function code F26 is 7 kHz or lower. Changing the tone level may reduce the high and harsh running noise from the motor.

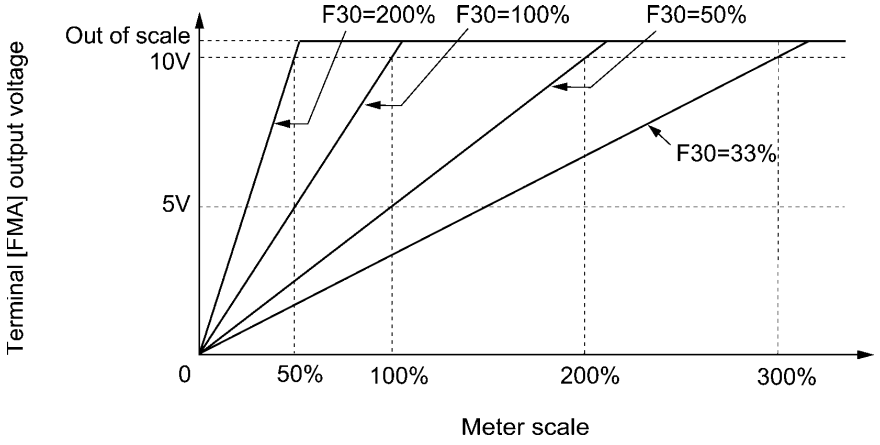
Note If the sound level is set too high, the output current may become unstable, or mechanical vibration and noise may increase. Also, these function codes may not be very effective for certain types of motor.

F30	Analog Output [FMA] (Voltage adjustment)
F31	Analog Output [FMA] (Function)

These function codes allow terminal [FMA] to output monitored data such as the output frequency and the output current in an analog DC voltage. The magnitude of the output voltage is adjustable.

■ Voltage adjustment (F30)

F30 adjusts the output voltage representing the monitored data selected by F31 within the range of 0 to 300%.



■ Function (F31)

F31 specifies what is output to analog output terminal [FMA].

Data for F31	[FM] output	Function (Monitor the following)	Meter scale (Full scale at 100%)
0	Output frequency (before slip compensation)	Output frequency of the inverter (Equivalent to the motor synchronous speed)	Maximum frequency (F03, A01)
1	Output frequency (after slip compensation)	Output frequency of the inverter	Maximum frequency (F03, A01)
2	Output current	Output current (RMS) of the inverter	Twice the inverter rated current
3	Output voltage	Output voltage (RMS) of the inverter	250 V for 200 V class series, 500 V for 400 V class series
6	Input power	Input power of the inverter	Twice the rated output of the inverter
7	PID feedback amount	Feedback amount under PID control	100% of the feedback amount
9	DC link bus voltage	DC link bus voltage of the inverter	500 V for 200 V class series, 1000 V for 400 V class series
14	Calibration	Full scale output of the meter calibration	This always outputs +10 VDC (FMA function).
15	PID command (SV)	Command value under PID control	100% of the PID command value
16	PID output (MV)	Output level of the PID controller under PID control (Frequency command)	Maximum frequency (F03, A01)

Note For single-phase 100 V class series

Outputting the output current to analog output terminal [FMA] as analog output voltage (F31 = 2)

The analog output terminal [FMA] outputs 10 V, that is, 200% of the reference current Iref (A), supposing the output gain (specified by F30) as 100%. Therefore, to adjust the output voltage, you need to set the output gain at terminal [FMA] (F30) based on the conversion result obtained by the following expression:

- Conversion formula for calculating the output gain which is required for outputting the voltage V (V) via terminal [FMA] when current I (A) flows across the inverter

$$\text{Output gain} = 2 \times \frac{\text{Iref (A)}}{\text{I (A)}} \times \frac{\text{V (V)}}{10\text{ (V)}} \times 100$$

Iref (A): Reference current (A)

📖 The reference current is given in the table for F20 to F22.

According to the conversion result, the output voltage to terminal [FMA] can be calculated as shown below.

$$\text{Analog output voltage (V)} = \frac{\text{I (A)}}{2 \times \text{Iref (A)}} \times \frac{\text{Output gain (F30)}}{100} \times 10\text{ (V)}$$

(Example) Outputting analog voltage 8V for 1 HP standard motors when the inverter output current is 4.2A

$$\text{Output gain} = 2 \times \frac{5.0\text{ (A)}}{4.2\text{ (A)}} \times \frac{8\text{ (V)}}{10\text{ (V)}} \times 100 = 190.4$$

$$\text{Analog output voltage (V)} = \frac{4.2\text{ (A)}}{2 \times 5.0\text{ (A)}} \times \frac{190}{100} \times 10\text{ (V)} = 7.98$$

Reference table

To output analog 10 V at 200% of the rated current of any of the single-phase 100 V class series of inverters, set the output gain at terminal [FMA] (F30) as listed below.

Nominal applied motor (HP)	1/8	1/4	1/2	1
Output gain to be set to F30 (%)	114	107	120	119

F42 Control Mode Selection 1

F42 specifies the control mode of the inverter to control a motor.

Data for F42	Control mode
0	V/f control with slip compensation inactive
1	Dynamic torque vector control
2	V/f control with slip compensation active
11	V/f control for PMSM drive

■ V/f control

In this control, the inverter controls a motor by the voltage and frequency according to the V/f pattern specified by function codes.

■ Slip compensation

Applying any load to an induction motor causes a rotational slip due to the motor characteristics, decreasing the motor rotation. The inverter's slip compensation facility first presumes the slip value of the motor based on the motor torque generated and raises the output frequency to compensate for the decrease in motor rotation. This prevents the motor from decreasing the rotation due to the slip.

That is, this facility is effective for improving the motor speed control accuracy.

The compensation value is specified by combination of function codes P12 (Rated slip frequency), P09 (Slip compensation gain for driving)) and P11 (Slip compensation gain for braking).

■ Dynamic torque vector control

To get the maximal torque out of a motor, this control calculates the motor torque for the load applied and uses it to optimize the voltage and current vector output.

Selecting this control automatically enables the auto torque boost and slip compensation function and disables auto energy saving operation.

This control is effective for improving the system response against external disturbances and the motor speed control accuracy.

■ V/f control for PMSM drive

Under this control, the inverter drives a permanent magnet synchronous motor (PMSM). Refer to Section 5.3 "Notes in Driving PMSM" for details.

F43, F44 Current Limiter (Mode selection, Level)

When the output current of the inverter exceeds the level specified by the current limiter (F44), the inverter automatically manages its output frequency to prevent a stall and limit the output current. (Refer to the description of function code H12.)

If F43 = 1, the current limiter is enabled only during constant speed operation. If F43 = 2, the current limiter is enabled during both of acceleration and constant speed operation. Choose F43 = 1 if you need to run the inverter at full capability during acceleration and to limit the output current during constant speed operation.

Note For single-phase 100 V class series

The limiting level setting (F44) should be calculated from the current limiting level I_{limit} (A) based on the reference current I_{ref} (A), as shown below.

$$\text{Setting}\,(\%) = \frac{I_{limit}\,(\text{A})}{I_{ref}\,(\text{A})} \times 100$$

(Example) Setting the current limiting level I_{limit} at 4.2 A for 1 HP standard motors

$$\text{Setting}\,(\%) = \frac{4.2\,(\text{A})}{5.0\,(\text{A})} \times 100 = 84$$

📖 The reference current is given in the table for F20 to F22.

■ Mode selection (F43)

F43 selects the motor running state in which the current limiter will be active.

Data for F43	Running states that enable the current limiter		
	During acceleration	During constant speed	During deceleration
0	Disable	Disable	Disable
1	Disable	Enable	Disable
2	Enable	Enable	Disable

■ Level (F44)

F44 specifies the operation level at which the output current limiter becomes activated, in ratio to the inverter rating.

Note
- Since the current limit operation with F43 and F44 is performed by software, it may cause a delay in control. If you need a quick response, specify a current limit operation by hardware (H12 = 1) at the same time.
- If an excessive load is applied when the current limiter operation level is set extremely low, the inverter will rapidly lower its output frequency. This may cause an overvoltage trip or dangerous turnover of the motor rotation due to undershooting.

F50, F51 Electronic Thermal Overload Protection for Braking Resistor (Discharging capability and Allowable average loss)

A braking resistor can be mounted on inverters of 0.4 kW or above.

These function codes specify the electronic thermal overload protection feature for the braking resistor.

Set F50 and F51 data to the discharging capability and allowable average loss, respectively. Since those values differ depending on the specifications of the braking resistor, refer to the tables given below or calculate them according to the expressions given in the FRENIC-Mini User's Manual (24A7-E-0023), Chapter 9 "FUNCTION CODES."

Note Depending on the thermal marginal characteristics of the braking resistor, the electronic thermal overload protection feature may act so that the inverter issues the overheat protection alarm *dbH* even if the actual temperature rise is not enough. If it happens, review the relationship between the performance index of the braking resistor and settings of related function codes.

The tables below list the discharging capability and allowable average loss of the braking resistor. These values depend upon the inverter and braking resistor models.

■ External Braking Resistors

Standard models

The thermal sensor relay mounted on the braking resistor acts as a thermal protector of the motor for overheat, so assign an "Enable external alarm trip" terminal command ***THR*** to any of digital input terminals [X1] to [X3], [FWD] and [REV] and connect that terminal and its common terminal to braking resistor's terminals 2 and 1.

To protect the motor from overheat without using the thermal sensor relay mounted on the braking resistor, configure the electronic thermal overload protection facility by setting F50 and F51 data to the discharging capability and allowable average loss values listed below, respectively.

Power supply voltage	Inverter type	Braking resistor		Resistance (Ω)	Continuous braking (100% braking torque)		Intermittent braking (Period: 100 s or less)	
		Type	Qty.		Discharging capability (kWs)	Braking time (s)	Allowable average loss (kW)	Duty (%ED)
Three-phase 200 V	FRN0004C2S-2☐	DB0.75-2	1	100	9	45	0.044	22
	FRN0006C2S-2☐				17		0.068	18
	FRN0010C2S-2☐	DB2.2-2		40	34		0.075	10
	FRN0012C2S-2☐				33	30	0.077	7
	FRN0020C2S-2☐	DB3.7-2		33	37	20	0.093	5
	FRN0025C2S-2☐	DB5.5-2		20	55		0.138	
	FRN0033C2S-2☐	DB7.5-2		15	37	10	0.188	
	FRN0047C2S-2☐	DB11-2		10	55		0.275	
	FRN0060C2S-2☐	DB15-2		8.6	75		0.375	
Three-phase 400 V	FRN0002C2■-4☐	DB0.75-4		200	9	45	0.044	22
	FRN0004C2■-4☐				17		0.068	18
	FRN0005C2■-4☐	DB2.2-4		160	34		0.075	10
	FRN0007C2■-4☐				33	30	0.077	7
	FRN0011C2■-4☐	DB3.7-4		130	37	20	0.093	5
	FRN0013C2■-4☐	DB5.5-4		80	55		0.138	
	FRN0018C2■-4☐	DB7.5-4		60	38	10	0.188	
	FRN0024C2■-4☐	DB11-4		40	55		0.275	
	FRN0030C2■-4☐	DB15-4		34.4	75		0.375	
Single-phase 200 V	FRN0004C2■-7☐	DB0.75-2		100	9	45	0.044	22
	FRN0006C2■-7☐				17		0.068	18
	FRN0010C2■-7☐	DB2.2-2		40	34		0.075	10
	FRN0012C2■-7☐				33	30	0.077	7
Single-phase 100 V	FRN0003C2S-6U	DB0.75-2		100	9	45	0.044	22
	FRN0005C2S-6U				17		0.068	18

Note 1) A box (■) in the above table replaces S (Basic type) or E (EMC filter built-in type) depending on the enclosure.

2) A box (☐) in the above table replaces A, C, E, or U depending on the shipping destination.

Compact models

When using the compact models of braking resistor TK80W120Ω or TK80W100Ω, set F50 to "7" and F51 to "0.033."

10% ED models

Power supply voltage	Inverter type	Braking resistor		Resistance (Ω)	Continuous braking (100% braking torque)		Intermittent braking (Period: 100 s or less)	
		Type	Qty.		Discharging capacity (kWs)	Braking time (s)	Allowable average loss (kW)	Duty (%ED)
Three-phase 200 V	FRN0004C2S-2☐	DB0.75-2C	1	100	50	250	0.075	37
	FRN0006C2S-2☐					133		20
	FRN0010C2S-2☐	DB2.2-2C		40	55	73	0.110	14
	FRN0012C2S-2☐					50		10
	FRN0020C2S-2☐	DB3.7-2C		33	140	75	0.185	
	FRN0025C2S-2☐	DB5.5-2C		20	55	20	0.275	
	FRN0033C2S-2☐	DB7.5-2C		15	37	10	0.375	
	FRN0047C2S-2☐	DB11-2C		10	55		0.55	
	FRN0060C2S-2☐	DB15-2C		8.6	75		0.75	
Three-phase 400 V	FRN0002C2■-4☐	DB0.75-4C		200	50	250	0.075	37
	FRN0004C2■-4☐					133		20
	FRN0005C2■-4☐	DB2.2-4C		160	55	73	0.110	14
	FRN0007C2■-4☐					50		10
	FRN0011C2■-4☐	DB3.7-4C		130	140	75	0.185	
	FRN0013C2■-4☐	DB5.5-4C		80	55	20	0.275	
	FRN0018C2■-4☐	DB7.5-4C		60	38	10	0.375	
	FRN0024C2■-4☐	DB11-4C		40	55		0.55	
	FRN0030C2■-4☐	DB15-4C		34.4	75		0.75	
Single-phase 200 V	FRN0004C2■-7☐	DB0.75-2C		100	50	250	0.075	37
	FRN0006C2■-7☐					133		20
	FRN0010C2■-7☐	DB2.2-2C		40	55	73	0.110	14
	FRN0012C2■-7☐					50		10
Single-phase 100 V	FRN0003C2S-6U	DB0.75-2C		100	50	250	0.075	37
	FRN0005C2S-6U					133		20

Note 1) A box (■) in the above table replaces S (Basic type) or E (EMC filter built-in type) depending on the enclosure.

2) A box (☐) in the above table replaces A, C, E, or U depending on the shipping destination.

E01 to E03, E98, E99 Terminal [X1] to [X3] Function
Terminal [FWD] and [REV] Function

Function codes E01 to E03, E98 and E99 allow you to assign commands to terminals [X1] to [X3], [FWD], and [REV] which are general-purpose, programmable, digital 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." So, explanations that follow are given in normal logic system "Active ON."

⚠CAUTION

In the case of digital input, you can assign commands to the switching means for the run command and its operation and the reference frequency (e.g., ***SS1***, ***SS2***, ***SS4***, ***SS8***, ***Hz2/Hz1***, ***Hz/PID***, ***IVS***, and ***LE***). Be aware that switching 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 frequency (0 to 15 steps)	***SS1***
1	1001		***SS2***
2	1002		***SS4***
3	1003		***SS8***
4	1004	Select ACC/DEC time	***RT1***
6	1006	Enable 3-wire operation	***HLD***
7	1007	Coast to a stop	***BX***
8	1008	Reset alarm	***RST***
1009	9	Enable external alarm trip	***THR***
10	1010	Ready for jogging	***JOG***
11	1011	Select frequency command 2/1	***Hz2/Hz1***
12	1012	Select motor 2 / motor 1	***M2/M1***
13	—	Enable DC braking	***DCBRK***
17	1017	UP (Increase output frequency)	***UP***
18	1018	DOWN (Decrease output frequency)	***DOWN***
19	1019	Enable data change with keypad	***WE-KP***
20	1020	Cancel PID control	***Hz/PID***
21	1021	Switch normal/inverse operation	***IVS***
24	1024	Enable communications link via RS-485	***LE***
33	1033	Reset PID integral and differential components	***PID-RST***
34	1034	Hold PID integral component	***PID-HLD***
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***

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 stop" 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 frequency (0 to 15 steps) -- ***SS1***, ***SS2***, ***SS4***, and ***SS8***
(Function code data = 0, 1, 2, and 3)

The combination of the ON/OFF states of digital input signals ***SS1***, ***SS2***, ***SS4*** and ***SS8*** selects one of 16 different frequency commands defined beforehand by 15 function codes C05 to C19 (Multistep frequency 0 to 15). With this, the inverter can drive the motor at 16 different preset frequencies.

The table below lists the frequencies that can be obtained by the combination of switching ***SS1***, ***SS2***, ***SS4*** and ***SS8***. In the "Selected frequency" column, "Other than multistep frequency" represents the reference frequency sourced by frequency command 1 (F01), frequency command 2 (C30), or others.

SS8	***SS4***	***SS2***	***SS1***	Selected frequency
OFF	OFF	OFF	OFF	Other than multistep frequency
OFF	OFF	OFF	ON	C05 (Multistep frequency 1)
OFF	OFF	ON	OFF	C06 (Multistep frequency 2)
OFF	OFF	ON	ON	C07 (Multistep frequency 3)
OFF	ON	OFF	OFF	C08 (Multistep frequency 4)
OFF	ON	OFF	ON	C09 (Multistep frequency 5)
OFF	ON	ON	OFF	C10 (Multistep frequency 6)
OFF	ON	ON	ON	C11 (Multistep frequency 7)
ON	OFF	OFF	OFF	C12 (Multistep frequency 8)
ON	OFF	OFF	ON	C13 (Multistep frequency 9)
ON	OFF	ON	OFF	C14 (Multistep frequency 10)
ON	OFF	ON	ON	C15 (Multistep frequency 11)
ON	ON	OFF	OFF	C16 (Multistep frequency 12)
ON	ON	OFF	ON	C17 (Multistep frequency 13)
ON	ON	ON	OFF	C18 (Multistep frequency 14)
ON	ON	ON	ON	C19 (Multistep frequency 15)

■ Select ACC/DEC time -- ***RT1*** (Function code data = 4)

This terminal command switches between ACC/DEC time 1 (F07, F08) and ACC/DEC time 2 (E10, E11).

If no ***RT1*** command is assigned, ACC/DEC time 1 (F07, F08) takes effect by default.

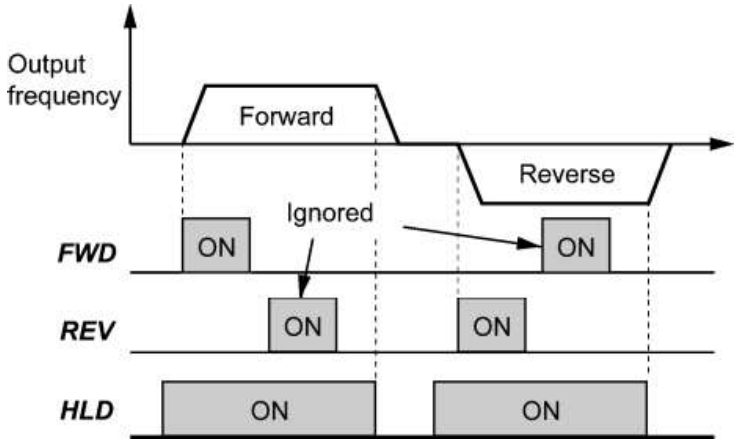
Input terminal command ***RT1***	Acceleration/deceleration time
OFF	Acceleration/deceleration time 1 (F07, F08)
ON	Acceleration/deceleration time 2 (E10, E11)

■ Enable 3-wire operation -- ***HLD*** (Function code data = 6)

Turning this terminal command ON self-holds the forward ***FWD*** or reverse ***REV*** run command issued with it, to enable 3-wire inverter operation.

Short-circuiting the terminals between ***HLD*** and [CM] (i.e., when ***HLD*** is ON) self-holds the first ***FWD*** or ***REV*** command at its leading edge. Turning ***HLD*** OFF releases the self-holding.

When ***HLD*** is not assigned, 2-wire operation involving only ***FWD*** and ***REV*** takes effect.



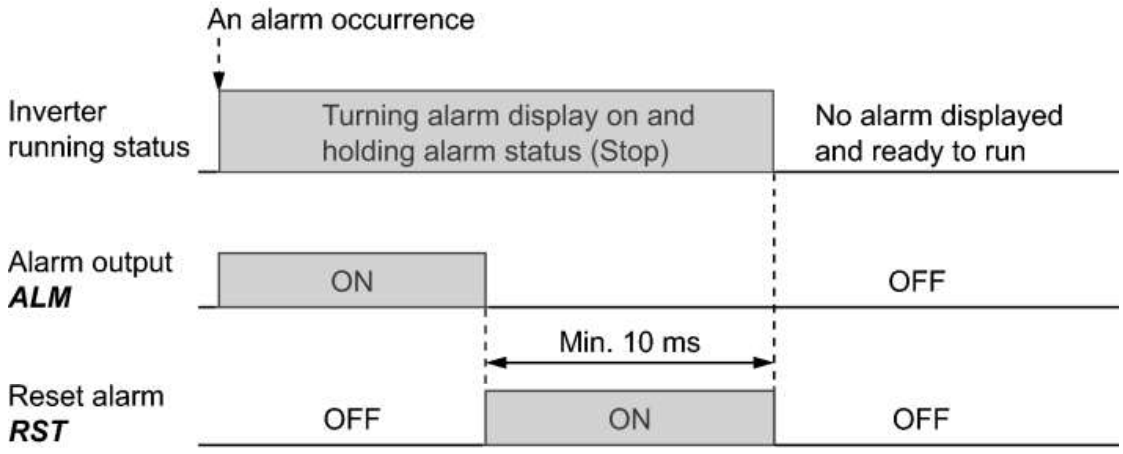
■ Coast to a stop -- ***BX*** (Function code data = 7)

Turning this terminal command ON immediately shuts down the inverter output so that the motor coasts to a stop without issuing any alarms.

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

Turning this terminal command ON clears the ***ALM*** state--alarm output (for any fault). 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 "0H2", and outputs the alarm relay (for any fault) ***ALM***. The ***THR*** command is self-held, and is reset when an alarm reset takes place.

Tip Use this alarm 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.

■ Ready for jogging -- ***JOG*** (Function code data = 10)

This terminal command is used to jog or inch the motor for positioning a work piece.

Turning this command ON makes the inverter ready for jogging.

Simultaneous keying STOP + ∧ keys on the keypad is functionally equivalent to this command; however, it is restricted by the run command source as listed below.

When the run command source is the keypad (F02 = 0, 2 or 3):

Input terminal command ***JOG***	STOP + ∧ keys on the keypad	Inverter running state
ON	—	Ready for jogging
OFF	Pressing these keys toggles between the "normal operation" and "ready for jogging."	Normal operation
		Ready for jogging

When the run command source is digital input (F02 = 1):

Input terminal command ***JOG***	STOP + ∧ keys on the keypad	Inverter running state
ON	Disable	Ready for jogging
OFF		Normal operation

Jogging operation

Pressing the RUN key or turning the ***FWD*** or ***REV*** terminal command ON starts jogging.

For the jogging by the keypad, the inverter jogs only when the RUN key is held down. Releasing the RUN key decelerates to stop.

During jogging, the frequency specified by C20 (Jogging Frequency) and the acceleration/deceleration time specified by H54 (ACC/DEC Time) apply.

Note

- The inverter's status transition between "ready for jogging" and "normal operation" is possible only when the inverter is stopped.
- To start jogging operation by simultaneously entering the ***JOG*** terminal command and a run command (e.g., ***FWD***), the input delay time between the two commands should be within 100 ms. If a run command ***FWD*** is entered first, the inverter does not jog the motor but runs it ordinarily until the next input of the ***JOG***.

■ Select frequency command 2/1 -- ***Hz2***/***Hz1*** (Function code data = 11)

Turning this terminal command ON and OFF switches the frequency command source between frequency command 1 (F01) and frequency command 2 (C30).

If no ***Hz2***/***Hz1*** terminal command is assigned, the frequency sourced by F01 takes effect by default.

Input terminal command ***Hz2***/***Hz1***	Frequency command source
OFF	Follow F01 (Frequency command 1)
ON	Follow C30 (Frequency command 2)

■ Select motor 2 / motor 1 -- ***M2***/***M1*** (Function code data = 12)

Turning this terminal command ON switches from motor 1 to motor 2. Switching is possible only when the inverter is stopped. Upon completion of switching, the digital terminal output "Switched to motor 2" ***SWM2*** (assigned to any of terminals [Y1] and [30A/B/C]) turns ON.

If no ***M2/M1*** terminal command is assigned, motor 1 is selected by default.

Input terminal command ***M2***/***M1***	Selected motor	***SWM2*** status after completion of switching
OFF	Motor 1	OFF
ON	Motor 2	ON

Switching between motors 1 and 2 automatically switches applicable function codes as listed below. The inverter runs the motor with those codes that should be properly configured.

Function code name		For Motor 1	For Motor 2
Maximum Frequency		F03	A01
Base Frequency		F04	A02
Rated voltage at Base Frequency		F05	A03
Maximum Output Voltage		F06	A04
Torque Boost		F09	A05
Electronic Thermal Overload Protection for Motor		F10	A06
	(Select motor characteristics)		
	(Overload detection level)	F11	A07
	(Thermal time constant)	F12	A08
DC Braking	(Braking starting frequency)	F20	A09
	(Braking level)	F21	A10
	(Braking time)	F22	A11
Starting Frequency		F23	A12
Load Selection/Auto Torque Boost/Auto Energy Saving Operation		F37	A13
Control Mode Selection		F42	A14
Motor Parameters	(No. of poles)	P02	A16
	(Rated current)	P03	A17
	(Auto-tuning)	P04	A18
	(No-load current)	P06	A20
	(%R1)	P07	A21
	(%X)	P08	A22
	(Slip compensation gain for driving)	P09	A23
	(Slip compensation response time)	P10	A24
	(Slip compensation gain for braking)	P11	A25
	(Rated slip frequency)	P12	A26
Motor Selection		P99	A39
Output Current Fluctuation Damping Gain for Motor		H80	A41
Cumulative Motor Run Time		H94	A51
Startup Counter of Motor		H44	A52

Motor 2 imposes functional restrictions on the following function codes. Confirm the settings of those function codes before use.

Functions	Restrictions	Related function codes
Non-linear V/f pattern	Disabled. Linear V/f pattern only	H50 to H53
Starting frequency	Starting frequency holding time not supported.	F24
Stop frequency	Stop frequency holding time not supported.	F39
Overload early warning	Disabled.	E34 and E35
UP/***DOWN*** control	Disabled. Fixed at default setting 0.	H61
PID control	Disabled.	J01
Braking signal	Disabled.	J68 to J72
Software current limiter	Disabled.	F43 and F44
Rotation direction limitation	Disabled.	H08

Note To run the 2nd motor with the ***M2/M1*** terminal command and a run command (e.g., ***FWD***), the input of the ***M2/M1*** should not be delayed 10 ms or more from that of the run command. If the delay exceeds 10 ms, the 1st motor will be driven by default.

■ Enable DC braking -- ***DCBRK*** (Function code data = 13)

This terminal command gives the inverter a DC braking command through the inverter's digital input.

(Refer to the descriptions of F20 to F22.)

■ UP (Increase output frequency) and DOWN (Decrease output frequency) commands -- ***UP*** and ***DOWN*** (Function code data = 17, 18)

• Frequency setting

When the ***UP***/***DOWN*** control is selected for frequency setting with a run command ON, turning the ***UP*** or ***DOWN*** terminal command ON causes the output frequency to increase or decrease, respectively, within the range from 0 Hz to the maximum frequency as listed below.

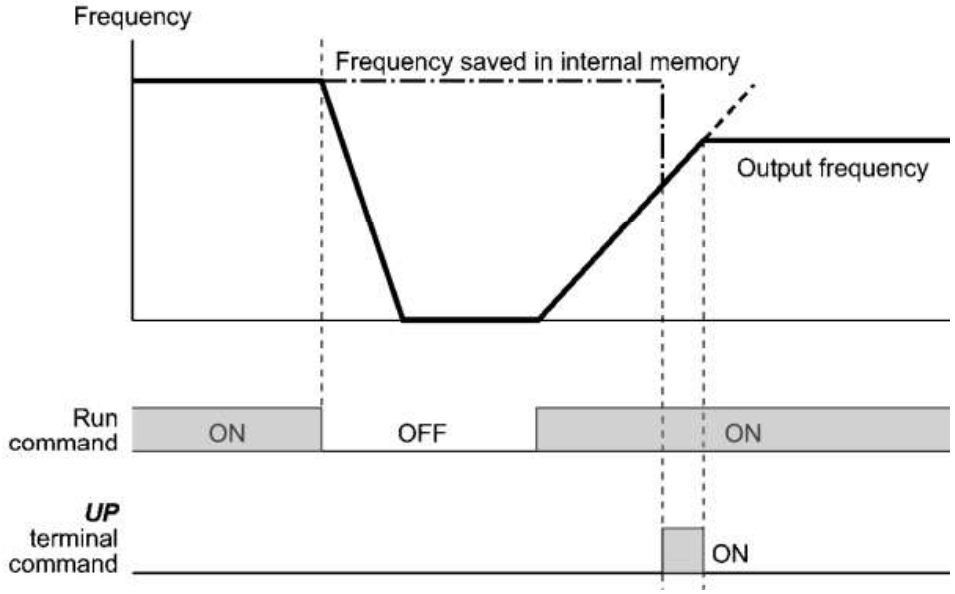
UP	***DOWN***	Function
Data = 17	Data = 18	
OFF	OFF	Keep the current output frequency.
ON	OFF	Increase the output frequency with the acceleration time currently specified.
OFF	ON	Decrease the output frequency with the deceleration time currently specified.
ON	ON	Keep the current output frequency.

The ***UP***/***DOWN*** control is available in two modes--one mode (H61 = 0) in which the initial value of the reference frequency is fixed to "0.00" at the start of the ***UP***/***DOWN*** control and the other mode (H61 = 1) in which the reference frequency applied in the previous ***UP***/***DOWN*** control applies as the initial value.

When H61 = 0, the reference frequency applied by the previous ***UP***/***DOWN*** control has been cleared to "0," so at the next restart (including powering on), use the ***UP*** terminal command to accelerate the speed as needed.

When H61 = 1, the inverter internally holds the current output frequency set by the ***UP***/***DOWN*** control and applies the held frequency at the next restart (including powering on).

Note At the time of restart, if an ***UP*** or ***DOWN*** terminal command is entered before the internal frequency reaches the output frequency saved in the memory, the inverter saves the current output frequency into the memory and starts the ***UP***/***DOWN*** control with the new frequency. The previous frequency held will be overwritten by the current one.



Initial frequency for the ***UP***/***DOWN*** control when the frequency command source is switched

When the frequency command source is switched to the ***UP***/***DOWN*** control from other sources, the initial frequency for the ***UP***/***DOWN*** control is as listed below:

Frequency command source	Switching command	Initial frequency for ***UP***/***DOWN*** control	
		H61 = 0	H61 = 1
Other than ***UP***/***DOWN*** (F01, C30)	Select frequency command 2/1 (***Hz2***/***Hz1***)	Reference frequency given by the frequency command source used just before switching	
PID conditioner	Cancel PID control (***Hz***/***PID***)	Reference frequency given by PID control (PID controller output)	
Multistep frequency	Select multistep frequency (***SS1***, ***SS2***, ***SS4*** and ***SS8***)	Reference frequency given by the frequency command source used just before switching	Reference frequency at the time of previous UP/DOWN control
Communications link	Enable communications link via RS-485 (***LE***)		

Note To enable the ***UP*** and ***DOWN*** terminal commands, you need to set frequency command 1 (F01) or frequency command 2 (C30) to "7" beforehand.

■ Enable communications link via RS-485 -- ***LE***
(Function code data = 24)

Turning this terminal command ON assigns priorities to frequency commands or run commands received via the RS-485 communications link (H30).

No ***LE*** assignment is functionally equivalent to the ***LE*** being ON. (Refer to the description of H30.)

■ Run forward -- ***FWD*** (Function code data = 98)

Turning this terminal command ON runs the motor in the forward direction; turning it OFF decelerates it to stop.

🕮 This terminal command can be assigned only by E98 or E99.

■ Run reverse -- ***REV*** (Function code data = 99)

Turning this terminal command ON runs the motor in the reverse direction; turning it OFF decelerates it to stop.

🕮 This terminal command can be assigned only by E98 or E99.

E20 Terminal [Y1] Function
E27 Terminal [30A/B/C] Function (Relay output)

E20 and E27 assign output signals (listed on the next page) to general-purpose, programmable output terminals [Y1] 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."

Terminal [Y1] is a transistor output and terminals [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 supply. Furthermore, the validity of these output signals is not guaranteed for approximately 1.5 seconds after power-on, so introduce such a mechanism that masks them during the transient period.
- Terminals [30A/B/C] use mechanical contacts that cannot stand frequent ON/OFF switching. Where frequent ON/OFF switching is anticipated (for example, limiting a current by using signals subjected to inverter output limit control such as switching to commercial power line), use transistor output [Y1] instead. The service life of a relay is approximately 200,000 times if it is switched ON and OFF at one-second intervals.

The table below lists functions that can be assigned to terminals [Y1] and [30A/B/C].

To make the explanations 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	Frequency arrival signal	***FAR***
2	1002	Frequency detected	***FDT***
3	1003	Undervoltage detected (Inverter stopped)	***LU***
5	1005	Inverter output limiting	***IOL***
6	1006	Auto-restarting after momentary power failure	***IPF***
7	1007	Motor overload early warning	***OL***
26	1026	Auto-resetting	***TRY***
30	1030	Service lifetime alarm	***LIFE***
35	1035	Inverter running 2	***RUN2***
36	1036	Overload prevention control	***OLP***
37	1037	Current detected	***ID***
38	1038	Current detected 2	***ID2***
41	1041	Low current detected	***IDL***
43	1043	Under PID control	***PID-CTL***
44	1044	Motor stopped due to slow flowrate under PID control	***PID-STP***
49	1049	Switched to motor 2	***SWM2***
56	1056	Motor overheat detected by thermistor (PTC)	***THM***
57	1057	Brake signal	***BRKS***
59	1059	Terminal [C1] wire break	***C1OFF***
84	1084	Maintenance timer	***MNT***
87	1087	Frequency arrival detected	***FARFDT***
99	1099	Alarm output (for any alarm)	***ALM***

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

This output signal tells the external equipment that the inverter is running at a starting frequency or higher. It comes ON when the output frequency exceeds the starting frequency, and it goes OFF when it is less than the stop frequency. It is also OFF when the DC braking is in operation.

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

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

This output signal comes ON when the difference between the output frequency and reference frequency comes within the frequency arrival hysteresis width specified by E30. (Refer to the description of E30.)

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

This output signal comes ON when the output frequency exceeds the frequency detection level specified by E31, and it goes OFF when the output frequency drops below the "Frequency detection level (E31) - Hysteresis width (E32)."

■ 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).

When this signal is ON, a run command is disabled if given.

■ Inverter output limiting -- ***IOL*** (Function code data = 5)

This output signal comes ON when the inverter is limiting the output frequency by activating any of the following actions (minimum width of the output signal: 100 ms).

- Current limiting by software (F43 and F44)
- Instantaneous overcurrent limiting by hardware (H12 = 1)
- Automatic deceleration (Anti-regenerative control) (H69 = 2 or 4)

Note When the ***IOL*** signal is ON, the output frequency may have deviated from the specified frequency because of the limiting function above.

■ Auto-restarting after momentary power failure -- ***IPF*** (Function code data = 6)

This output signal is ON either during continuous running after a momentary power failure or during the period from when the inverter has detected an undervoltage condition and shut down the output until restart has been completed (the output has reached the reference frequency).

To enable this ***IPF*** signal, set F14 (Restart mode after momentary power failure) to "4" (Enable restart (Restart at the frequency at which the power failure occurred)) or "5" (Enable restart (Restart at the starting frequency)) beforehand.

■ Motor overload early warning -- ***OL*** (Function code data = 7)

This output signal is used to issue a motor overload early warning that enables you to take a corrective action before the inverter detects a motor overload alarm  and shuts down its output. (Refer to the description of E34.)

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

This output signal comes ON when it is judged that the service life of any one of capacitors (DC link bus capacitors and electrolytic capacitors on the printed circuit board) 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 about the judgment on service life, refer to Table 7.3 "Criteria for Issuing a Lifetime Alarm" in Chapter 7, Section 7.3 "List of Periodical Replacement Parts."

■ Inverter running 2 -- ***RUN2*** (Function code data = 35)

This signal acts in the same way as ***RUN*** (Function code data = 0) except that ***RUN2*** is ON even when the DC braking is in operation.

■ Overload prevention control -- ***OLP*** (Function code data = 36)

This output signal comes ON when the overload prevention control is activated. The minimum ON-duration is 100 ms. (Refer to the description of H70.)

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

The ***ID*** or ***ID2*** output signal comes ON when the output current of the inverter exceeds the level specified by E34 (Current detection (Level)) or E37 (Current detection 2 (Level)) for the time longer than the one specified by E35 (Current detection (Timer)) or E38 (Current detection 2 (Timer)), respectively. The minimum ON-duration is 100 ms.

The ***ID*** or ***ID2*** goes OFF when the output current drops below 90% of the rated operation level.

These two output signals can be assigned to two different digital output terminals independently if necessary.

Function code E34 is effective for not only the motor overload early warning ***OL***, but also for the operation level of the current detection ***ID***. (Refer to the description of E34.)

■ Low current detected -- ***IDL*** (Function code data = 41)

This output signal comes ON when the inverter output current drops below the low current detection level (E34) and it remains at the low level for the timer period (E35). When the output current exceeds the current detection level (E37) by 5% or more of the inverter rated current, this signal goes OFF. The minimum ON-duration is 100 ms. (Refer to the description of E34.)

■ Under PID control -- ***PID-CTL*** (Function code data = 43)

This output signal comes ON when PID control is enabled ("Cancel PID control" (***Hz/PID***) = OFF) and a run command is ON. (Refer to the description of J01.)

■ Motor stopped due to slow flowrate under PID control -- ***PID-STP*** (Function code data = 44)

This output signal comes ON when the inverter is stopped by the slow flowrate stop function under PID control. (Refer to the descriptions of J15 through J17.)

When PID control is enabled, the inverter may stop due to the slow flowrate stop function or other reasons, with the ***PID-CTL*** signal being ON. As long as the ***PID-CTL*** signal is ON, PID control is effective, so the inverter may abruptly resume its operation, depending on the PID feedback value.

⚠WARNING

When PID control is enabled, even if the inverter stops its output during operation because of sensor signals or other reasons, operation will resume automatically.

Design your machinery so that safety is ensured even in such cases.

Otherwise, an accident could occur.

■ Switched to motor 2 -- ***SWM2*** (Function code data = 49)

This output signal comes ON when motor 2 is selected with the ***M2/M1*** terminal command assigned to a digital input terminal. For details, refer to the descriptions of E01 through E03 (Function code data = 12).

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

When the thermistor is enabled (H26 = 2), this output signal comes ON if the motor temperature rises to the protection trigger level specified by H27.

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

This signal outputs a brake control command that releases or activates the brake.

■ Terminal [C1] wire break -- ***C1OFF*** (Function code data = 59)

When terminal [C1] is used for a feedback signal under PID control, this output signal comes ON if the [C1] wire breaks, thereby enabling it to activate the protection function.

■ Frequency arrival detected -- ***FARFDT*** (Function code data = 87)

The ***FARFDT***, which is an ANDed signal of ***FAR*** and ***FDT***, comes ON when both signal conditions are met.

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

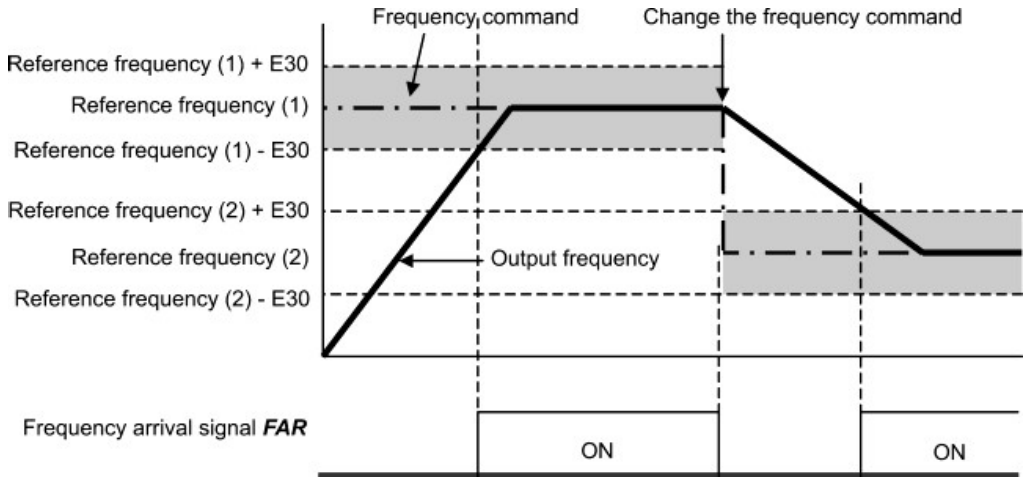
This output signal comes ON if any of the protective functions is activated and the inverter enters Alarm mode.

E30 Frequency Arrival (Hysteresis width for ***FAR***)

E30 specifies the detection level (hysteresis width) for ***FAR*** ("Frequency arrival signal").

The moment the output frequency reaches the zone defined by "Reference frequency ± Hysteresis width specified by E30," the ***FAR*** comes ON.

The operation timings of signals are shown in the graph below.



E34, E35 Overload Early Warning/Low Current Detection (Level and Timer)
E37, E38 Current Detection 2 (Level and Timer)

These function codes define the detection level and timer for the ***OL*** ("Motor overload early warning"), ***ID*** ("Current detected"), ***ID2*** ("Current detected 2") and ***IDL*** ("Low current detected") output signals.

Output signal	Data assigned to output terminal	Detection level	Timer	Motor characteristics	Thermal time constant
		Range: See below	Range: 0.01 to 600.00 s	Range: See below	Range: 0.5 to 75.0 min
OL	7	E34	--	F10	F12
ID	37	E34	E35	--	--
ID2	38	E37	E38		
IDL	41	E34	E35		

- Data setting range

  Operation level: 0.00 (Disable), 1 to 200% of inverter rated current

  Motor characteristics 1: Enable (For a general-purpose motor and Fuji standard permanent magnet synchronous motor with shaft-driven cooling fan)

  2: Enable (For an inverter-driven motor with separately powered cooling fan)

■ Motor overload early warning signal -- ***OL***

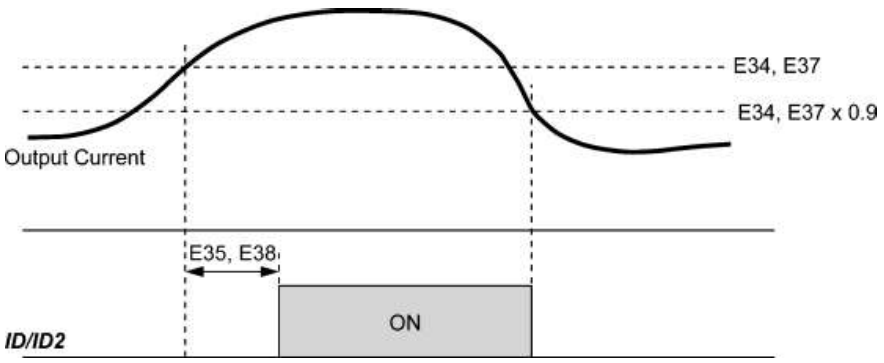
The ***OL*** signal is used to detect a symptom of an overload condition (alarm code $\overline{OL}$ 1) of the motor so that the user can take an appropriate action before the alarm actually happens.

The ***OL*** signal turns ON when the inverter output current has exceeded the level specified by E34. In typical cases, set E34 data to 80 to 90% against F11 data (Electronic thermal overload protection for motor 1, Overload detection level). Specify also the thermal characteristics of the motor with F10 (Select motor characteristics) and F12 (Thermal time constant). To utilize this feature, you need to assign ***OL*** (data = 7) to any of the digital output terminals.

■ Current detected and Current detected 2 signals -- ***ID*** and ***ID2***

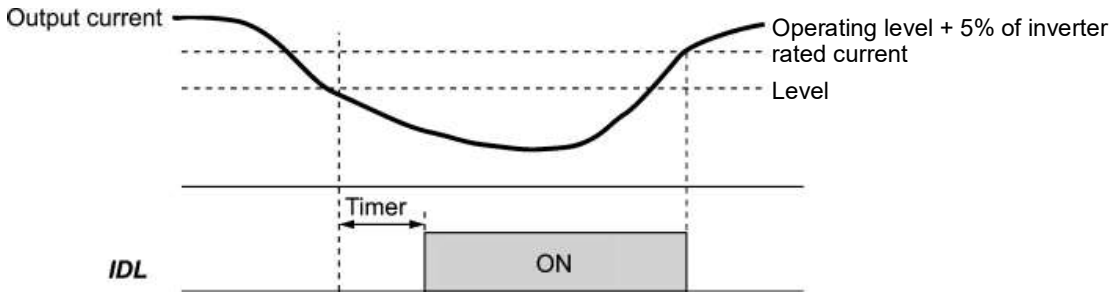
When the inverter output current has exceeded the level specified by E34 or E37 and it continues longer than the period specified by E35 or E38, the ***ID*** or ***ID2*** signal turns ON, respectively. When the output current drops below 90% of the rated operation level, the ***ID*** or ***ID2*** turns OFF. (Minimum width of the output signal: 100 ms)

To utilize this feature, you need to assign ***ID*** (data = 37) or ***ID2*** (data = 38) to any of digital output terminals.



■ Low current detected -- ***IDL***

This signal turns ON when the output current drops below the low current detection level (E34) and remains at the low level for the timer period (E35). When the output current exceeds the "Low current detection level plus 5% of the inverter rated current," it goes OFF. (The minimum ON-duration is 100 ms.)



E39 Coefficient for Constant Feeding Rate Time
E50 Coefficient for Speed Indication

E39 and E50 specify coefficients for determining the constant feeding rate time, load shaft speed, and line speed, as well as for displaying the output status monitored.

Calculation expression

$$\text{Constant feeding rate time (min)} = \frac{\text{Coefficient for speed indication (E50)}}{\text{Frequency} \times \text{Coefficient for constant feeding rate time (E39)}}$$

Load shaft speed = Coefficient for speed indication (E50) × Frequency (Hz)

Line speed = Coefficient for speed indication (E50) × Frequency (Hz)

Where, the "frequency" refers to the "reference frequency" to be applied for settings (constant feeding rate time, load shaft speed, or line speed), or to the "output frequency before slip compensation" to be applied for monitor.

If the constant feeding rate time is 999.9 min. or more or the denominator of the right-hand side is zero (0), "999.9" appears.

E51 Display Coefficient for Input Watt-hour Data

Use this coefficient (multiplication factor) for displaying the input watt-hour data (5_ 17) in a part of maintenance information on the keypad.

Input watt-hour data = Display coefficient (E51 data) × Input watt-hour (kWh)

Note Setting E51 data to 0.000 clears the input watt-hour and its data to "0." After clearing, be sure to restore E51 data to the previous value; otherwise, input watt-hour data will not be accumulated.

E52 Keypad (Menu display mode)

E52 provides a choice of three menu display modes for the keypad as listed below.

Data for E52	Menu display mode	Menus to be displayed
0	Function code data editing mode	Menu #1
1	Function code data check mode	Menu #2
2	Full-menu mode	Menus #1 through #6 *

* Menus #1 through #7 when a remote keypad is connected.

Tip Selecting the full-menu mode (E52 = 2) allows you to cycle through the menus with the ⌃ or ⌄ key and select the desired menu item with the FUNC/DATA key. Once the entire menu has been cycled through, the display returns to the first menu item.

E60 Built-in Potentiometer (Function selection)
E61 Terminal [12] Extended Function
E62 Terminal [C1] Extended Function

E60 through E62 define the property of the built-in potentiometer and terminals [12] and [C1], respectively.

There is no need to set up the potentiometer and terminals if they are to be used for frequency command sources.

Data for E60, E61, or E62	Function	Description
0	None	--
1	Auxiliary frequency command 1	This is an auxiliary analog frequency input to be added to frequency command 1 (F01). It is never added to frequency command 2, multistep frequency command or other frequency commands.
2	Auxiliary frequency command 2	This is an auxiliary analog frequency input to be added to all frequency commands including frequency command 1, frequency command 2 and multistep frequency commands.
3	PID command 1	This input includes temperature, pressure or other commands to apply under the PID control. Function code J02 should be also configured.
5	PID feedback amount	This input includes the feedback of the temperature or pressure under the PID control. (Not available for E60.)

Note If the built-in potentiometer and different terminals have been set up to have the same data, the operation priority is given in the following order:

E60 > E61 > E62

Selecting the ***UP*/*DOWN*** control (F01, C30 = 7) ignores auxiliary frequency command 1 and 2.

C21 Timer Operation

C21 enables or disables a timer operation that is triggered by a run command and continues for the timer count previously specified with the ▲/▼ keys. The operating procedure for the timer operation is given below.

Data for C21	Function
0	Disable timer operation
1	Enable timer operation

Tip

- Pressing the STOP key during timer countdown quits the timer operation.
- Even if C21 = 1, setting the timer to 0 no longer starts the timer operation with the RUN key.
- Applying terminal command ***FWD*** or ***REV*** instead of the key command can also start the timer operation.

Operating procedure for timer operation (example)

Preparation

- To display the timer count on the LED monitor, set E43 (LED Monitor) to "13" (Timer) and set C21 (Timer Operation) to "1" (Enable).
- Specify the reference frequency to apply to timer operation. When the keypad is selected as a frequency command source, press the FUNC/DATA key to shift to the speed monitor and specify the desired reference frequency.

Triggering the timer operation with the RUN key

(1) While watching the timer count displayed on the LED monitor, press the ▲/▼ key to set the timer for the desired count in seconds. Note that the timer count on the LED monitor appears as an integral number without a decimal point.

(2) Press the RUN key. The motor starts running and the timer starts counting down. If the timer counts down, the motor stops without pressing the STOP key. (Even if the LED monitor displays any item except the timer count, the timer operation is possible.)

Note

After the countdown of the timer operation triggered by a terminal command such as ***FWD***, the inverter decelerates to stop and at that moment the LED monitor displays End and any LED monitor item (0 for the timer count) alternately. Turning ***FWD*** OFF returns to the LED monitor item.

C33 Analog Input Adjustment for Terminal [12] (Filter time constant)
C38 Analog Input Adjustment for Terminal [C1] (Filter time constant)

C33 and C38 configure a filter time constant for an analog voltage and current input on terminals [12] and [C1], respectively.

The larger the time constant, the slower the response. Specify the proper filter time constant taking into account the response speed of the machine (load). If the input voltage fluctuates due to line noise, remove the cause of the noise or take an electric circuit related measure. Only when no effect is obtained, increase the time constant.

P02 Motor 1 (Rated capacity)

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

Data for P02	Unit	Remarks
0.01 to 30.00	kW	When P99 = 0, 3, 4, 20 or 21
	HP	When P99 = 1

P03 Motor 1 (Rated current)

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

P04 Motor 1 (Auto-tuning)

The inverter automatically detects the motor parameters and saves them in its internal memory. Basically, it is not necessary to perform tuning when using a Fuji standard motor with a standard connection with the inverter.

In any of the following cases, perform auto-tuning since the motor parameters are different from those of Fuji standard motors so as not to obtain the best performance under each of these controls-- auto torque boost, torque calculation monitoring, auto energy saving operation, automatic deceleration (anti-regenerative control), slip compensation, and torque vector control.

- 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 Chapter 4, Section 4.1.3 "Preparation before a test run--Configuring function code data."

P06, P07 P08, P12 Motor 1 (No-load current, %R1, %X and Motor 1, Rated slip frequency)

P06 through P08 and P12 specify no-load current, %R1, %X, and rated slip frequency, respectively. Obtain the appropriate values from the test report of the motor or by calling the manufacturer of the motor.

Performing auto-tuning automatically sets these parameters.

■ No-load current (P06): Enter the value obtained from the motor manufacturer.

■ %R1 (P07): Enter the value calculated by the following expression.

$$\%R1 = \frac{R1 + CableR1}{V / (\sqrt{3} \times I)} \times 100\ (\%)$$

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)

■ %X (P08): Enter the value calculated by the following expression.

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

where,

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)

■ Rated slip frequency (P12)

Convert the value obtained from the motor manufacturer to Hz using the following expression and enter the converted value. (Note: The motor rating given on the nameplate sometimes shows a larger value.)

$$\text{Rated slip frequency (Hz)} = \frac{\text{(Synchronous speed - Rated speed)}}{\text{Synchronous speed}} \text{ x Base frequency}$$

For reactance, choose the value at the base frequency 1 (F04).

P09	Motor 1 (Slip compensation gain for driving)
P10	(Slip compensation response time)
P11	(Slip compensation gain for braking)

P09 and P11 determine the slip compensation amount in % for driving and braking individually. Specification of 100% fully compensates for the rated slip of the motor. Excessive compensation (P09, P11 > 100%) may cause a system oscillation, so carefully check the operation on the actual machine.

P10 determines the response time for slip compensation. Basically, there is no need to modify the default setting. If you need to modify it, consult your Fuji Electric representatives.

P99 Motor 1 Selection

P99 specifies the type of motor 1 to be used.

Data for P99	Motor type
0	Motor characteristics 0 (Fuji standard IM, 8-series)
1	Motor characteristics 1 (HP rating IM. Typical in North America)
3	Motor characteristics 3 (Fuji standard IM, 6-series)
4	Other motors (IM)
20	Other motors (PMSM)
21	Fuji standard PMSM without sensor (GNB series)

Automatic control (such as auto torque boost and auto energy saving) or electronic thermal overload protection for motor uses the motor parameters and characteristics. To match the property of a control system with that of the motor, select characteristics of the motor and set H03 data (Data Initialization) to "2" to initialize the motor parameters stored in the inverter. The initialization automatically updates the P03 and P06 to P12 data and the constants used inside the inverter.

According to the motor model, set the P99 data as shown below.

- For Fuji standard IM, 8-series (Current standard induction motors), P99 = 0
- For Fuji standard IM, 6-series (Conventional standard induction motors), P99 = 3
- For other manufacturers' IM or model-unknown IM, P99 =4
- For PMSM, P99 = 20 or 21 (to be selected after consultation with motor manufacturers)

- When P99 = 4, the inverter runs following the motor characteristics of Fuji standard IM, 8-series.
- When P99 = 1, the inverter applies to the characteristics of HP rating IM (Typical in North America).

H03 Data Initialization

H03 initializes the current function code data to the factory defaults or initializes the motor parameters.

To change the H03 data, it is necessary to press the STOP + ▲ keys or STOP + ▼ keys (simultaneous keying).

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
2	Initialize motor 1 parameters in accordance with P02 (Rated capacity) and P99 (Motor 1 selection) Function codes subject to initialization: P03, P06 to P12 and constants for internal control (These function codes will be initialized to the values listed in tables on the following pages.)
3	Initialize motor 2 parameters in accordance with A16 (Rated capacity) and A39 (Motor 2 selection) Function codes subject to initialization: A17, A20 to A26 and constants for internal control (These function codes will be initialized to the values listed in tables on the following pages.)

- To initialize the motor parameters, set the related function codes using the following steps.

  1) P02/A16 Motor (Rated capacity) — Set the rated capacity of the motor to be used in kW.
  2) P99/A39 Motor Selection — Select the characteristics of the motor.
  3) H03 Data Initialization — Initialize the motor parameters. (H03 = 2 or 3)
  4) P03/A17 Motor (Rated current) — Set the rated current on the nameplate if the already set data differs from the rated current printed on the nameplate of the motor.

- Upon completion of the initialization, the H03 data reverts to "0" (factory default).
- If the P02 or A16 data is set to a value other than the nominal applied motor rating, data initialization with H03 internally converts the specified value forcedly to the equivalent nominal applied motor rating (see the tables on the next page).
- When a PMSM is selected (P99 = 20 or 21), initializing motor parameters by setting the H03 data to "2" reverts function code data for both IM and PMSM to factory defaults.

■ When Fuji standard 8-series IM (P99 = 0 or A39 = 0) or other motors (P99 = 4 or A39 = 4) are selected, the motor parameters are as listed in the following tables.

200 V class series for Asia version (FRN_ _ _ _C2S-2A, FRN_ _ _ _C2S-7A)

220 V, 60 Hz, rated voltage, base frequency, Fuji standard 8-series

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R (%)	%X (%)	Rated slip frequency (Hz)
P02/A16		P03/A17	P06/A20	P07/A21	P08/A22	P12/A26
0.01 to 0.09	0.06	0.40	0.37	11.40	9.71	1.77
0.10 to 0.19	0.1	0.62	0.50	10.74	10.50	1.77
0.20 to 0.39	0.2	1.18	0.97	10.69	10.66	2.33
0.40 to 0.74	0.4	2.10	1.52	8.47	11.34	2.40
0.75 to 1.49	0.75	3.29	2.11	7.20	8.94	2.33
1.50 to 2.19	1.5	5.56	2.76	5.43	9.29	2.00
2.20 to 3.69	2.2	8.39	4.45	5.37	9.09	1.80
3.70 to 5.49	3.7	13.67	7.03	4.80	9.32	1.93
5.50 to 7.49	5.5	20.50	10.08	4.37	11.85	1.40
7.50 to 10.99	7.5	26.41	11.46	3.73	12.15	1.57
11.00 to 14.99	11	38.24	16.23	3.13	12.49	1.07
15.00 to 18.49	15	50.05	18.33	2.69	13.54	1.13
18.50 to 21.99	18.5	60.96	19.62	2.42	13.71	0.87
22.00 to 29.99	22	70.97	23.01	2.23	13.24	0.90
30.00	30	97.38	35.66	2.18	12.38	0.80

400 V class series for Asia version (FRN_ _ _ _C2S-4A)

380 V, 60 Hz, rated voltage, base frequency, Fuji standard 8-series

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R (%)	%X (%)	Rated slip frequency (Hz)
P02/A16		P03/A17	P06/A20	P07/A21	P08/A22	P12/A26
0.01 to 0.09	0.06	0.19	0.16	12.54	10.68	1.77
0.10 to 0.19	0.10	0.31	0.21	12.08	11.81	1.77
0.20 to 0.39	0.20	0.58	0.42	12.16	12.14	2.33
0.40 to 0.74	0.4	1.07	0.66	9.99	13.38	2.40
0.75 to 1.49	0.75	1.72	0.91	8.72	10.82	2.33
1.50 to 2.19	1.5	3.10	1.20	6.89	11.80	2.00
2.20 to 3.69	2.2	4.54	1.92	6.73	11.40	1.80
3.70 to 5.49	3.7	7.43	3.04	6.04	11.73	1.93
5.50 to 7.49	5.5	11.49	4.35	5.55	15.05	1.40
7.50 to 10.99	7.5	14.63	4.95	4.78	15.59	1.57
11.00 to 14.99	11	21.23	7.01	4.02	16.06	1.07
15.00 to 18.49	15	28.11	7.92	3.50	17.61	1.13
18.50 to 21.99	18.5	35.01	8.47	3.16	17.97	0.87
22.00 to 29.99	22	40.11	9.98	2.92	17.32	0.90
30.00	30	55.21	15.44	2.84	16.10	0.80

200 V class series for China version (FRN_ _ _ _C2■-7C)

200 V, 50 Hz, rated voltage, base frequency, Fuji standard 8-series

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R (%)	%X (%)	Rated slip frequency (Hz)
P02/A16		P03/A17	P06/A20	P07/A21	P08/A22	P12/A26
0.01 to 0.09	0.06	0.44	0.40	13.79	11.75	1.77
0.10 to 0.19	0.1	0.68	0.55	12.96	12.67	1.77
0.20 to 0.39	0.2	1.30	1.06	12.95	12.92	2.33
0.40 to 0.74	0.4	2.30	1.66	10.20	13.66	2.40
0.75 to 1.49	0.75	3.60	2.30	8.67	10.76	2.33
1.50 to 2.19	1.5	6.10	3.01	6.55	11.21	2.00
2.20 to 3.69	2.2	9.20	4.85	6.48	10.97	1.80
3.70 to 5.49	3.7	15.00	7.67	5.79	11.25	1.93
5.50 to 7.49	5.5	22.50	11.00	5.28	14.31	1.40
7.50 to 10.99	7.5	29.00	12.50	4.50	14.68	1.57
11.00 to 14.99	11	42.00	17.70	3.78	15.09	1.07
15.00 to 18.49	15	55.00	20.00	3.25	16.37	1.13
18.50 to 21.99	18.5	67.00	21.40	2.92	16.58	0.87
22.00 to 29.99	22	78.00	25.10	2.70	16.00	0.90
30.00	30	107.0	38.90	2.64	14.96	0.80

400 V class series for China version (FRN_ _ _ _C2■-4C)

380 V, 50 Hz, rated voltage, base frequency, Fuji standard 8-series

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R (%)	%X (%)	Rated slip frequency (Hz)
P02/A16		P03/A17	P06/A20	P07/A21	P08/A22	P12/A26
0.01 to 0.09	0.06	0.21	0.19	13.86	11.81	1.77
0.10 to 0.19	0.10	0.34	0.26	13.25	12.96	1.77
0.20 to 0.39	0.20	0.64	0.50	13.42	13.39	2.33
0.40 to 0.74	0.4	1.15	0.79	10.74	14.38	2.40
0.75 to 1.49	0.75	1.82	1.09	9.23	11.45	2.33
1.50 to 2.19	1.5	3.20	1.43	7.12	12.18	2.00
2.20 to 3.69	2.2	4.72	2.31	7.00	11.85	1.80
3.70 to 5.49	3.7	7.70	3.65	6.26	12.16	1.93
5.50 to 7.49	5.5	11.84	5.23	5.72	15.51	1.40
7.50 to 10.99	7.5	15.00	5.94	4.90	15.98	1.57
11.00 to 14.99	11	21.73	8.41	4.12	16.44	1.07
15.00 to 18.49	15	28.59	9.50	3.56	17.92	1.13
18.50 to 21.99	18.5	35.46	10.17	3.21	18.20	0.87
22.00 to 29.99	22	40.66	11.97	2.96	17.56	0.90
30.00	30	56.15	18.53	2.89	16.37	0.80

A box (■) in the above table replaces S (Basic type) or E (EMC filter built-in type) depending on the enclosure.

200 V class series for Europe version (FRN_ _ _ _C2■-7E)

230 V, 50 Hz, rated voltage, base frequency, Fuji standard 8-series

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R (%)	%X (%)	Rated slip frequency (Hz)
P02/A16		P03/A17	P06/A20	P07/A21	P08/A22	P12/A26
0.01 to 0.09	0.06	0.49	0.46	13.35	11.38	1.77
0.10 to 0.19	0.1	0.73	0.63	12.10	11.83	1.77
0.20 to 0.39	0.2	1.38	1.22	11.95	11.93	2.33
0.40 to 0.74	0.4	2.36	1.91	9.10	12.19	2.40
0.75 to 1.49	0.75	3.58	2.65	7.50	9.30	2.33
1.50 to 2.19	1.5	5.77	3.46	5.39	9.22	2.00
2.20 to 3.69	2.2	8.80	5.58	5.39	9.12	1.80
3.70 to 5.49	3.7	14.26	8.82	4.79	9.30	1.93
5.50 to 7.49	5.5	21.25	12.65	4.34	11.75	1.40
7.50 to 10.99	7.5	26.92	14.38	3.63	11.85	1.57
11.00 to 14.99	11	38.87	20.36	3.04	12.14	1.07
15.00 to 18.49	15	50.14	23.00	2.58	12.98	1.13
18.50 to 21.99	18.5	60.45	24.61	2.29	13.01	0.87
22.00 to 29.99	22	70.40	28.87	2.12	12.56	0.90
30.00	30	97.54	44.74	2.09	11.86	0.80

400 V class series for Europe version (FRN_ _ _ _C2■-4E)

400 V, 50 Hz, rated voltage, base frequency, Fuji standard 8-series

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R (%)	%X (%)	Rated slip frequency (Hz)
P02/A16		P03/A17	P06/A20	P07/A21	P08/A22	P12/A26
0.01 to 0.09	0.06	0.22	0.20	13.79	11.75	1.77
0.10 to 0.19	0.10	0.35	0.27	12.96	12.67	1.77
0.20 to 0.39	0.20	0.65	0.53	12.95	12.92	2.33
0.40 to 0.74	0.4	1.15	0.83	10.20	13.66	2.40
0.75 to 1.49	0.75	1.80	1.15	8.67	10.76	2.33
1.50 to 2.19	1.5	3.10	1.51	6.55	11.21	2.00
2.20 to 3.69	2.2	4.60	2.43	6.48	10.97	1.80
3.70 to 5.49	3.7	7.50	3.84	5.79	11.25	1.93
5.50 to 7.49	5.5	11.50	5.50	5.28	14.31	1.40
7.50 to 10.99	7.5	14.50	6.25	4.50	14.68	1.57
11.00 to 14.99	11	21.00	8.85	3.78	15.09	1.07
15.00 to 18.49	15	27.50	10.00	3.25	16.37	1.13
18.50 to 21.99	18.5	34.00	10.70	2.92	16.58	0.87
22.00 to 29.99	22	39.00	12.60	2.70	16.00	0.90
30.00	30	54.00	19.50	2.64	14.96	0.80

A box (■) in the above table replaces S (Basic type) or E (EMC filter built-in type) depending on the enclosure.

200 V class series, single-phase 100 V series for USA version

(FRN_ _ _ _C2S-2U, FRN_ _ _ _C2S-7U, FRN_ _ _ _C2S-6U)

230 V, 60 Hz, rated voltage, base frequency, Fuji standard 8-series

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R (%)	%X (%)	Rated slip frequency (Hz)
P02/A16		P03/A17	P06/A20	P07/A21	P08/A22	P12/A26
0.01 to 0.09	0.06	0.42	0.38	11.45	9.75	1.77
0.10 to 0.19	0.1	0.63	0.53	10.44	10.21	1.77
0.20 to 0.39	0.2	1.21	1.02	10.48	10.46	2.33
0.40 to 0.74	0.4	2.11	1.59	8.14	10.90	2.40
0.75 to 1.49	0.75	3.27	2.20	6.85	8.50	2.33
1.50 to 2.19	1.5	5.44	2.88	5.08	8.69	2.00
2.20 to 3.69	2.2	8.24	4.65	5.05	8.54	1.80
3.70 to 5.49	3.7	13.40	7.35	4.50	8.74	1.93
5.50 to 7.49	5.5	20.06	10.54	4.09	11.09	1.40
7.50 to 10.99	7.5	25.72	11.98	3.47	11.32	1.57
11.00 to 14.99	11	37.21	16.96	2.91	11.63	1.07
15.00 to 18.49	15	48.50	19.17	2.49	12.55	1.13
18.50 to 21.99	18.5	58.90	20.51	2.23	12.68	0.87
22.00 to 29.99	22	68.57	24.05	2.06	12.23	0.90
30.00	30	94.36	37.28	2.02	11.47	0.80

400 V class series for USA version (FRN_ _ _ _C2S-4U)

460 V, 60 Hz, rated voltage, base frequency, Fuji standard 8-series

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R (%)	%X (%)	Rated slip frequency (Hz)
P02/A16		P03/A17	P06/A20	P07/A21	P08/A22	P12/A26
0.01 to 0.09	0.06	0.21	0.19	11.45	9.75	1.77
0.10 to 0.19	0.10	0.32	0.26	10.30	10.07	1.77
0.20 to 0.39	0.20	0.61	0.51	10.57	10.54	2.33
0.40 to 0.74	0.4	1.06	0.80	8.18	10.95	2.40
0.75 to 1.49	0.75	1.63	1.10	6.83	8.47	2.33
1.50 to 2.19	1.5	2.76	1.45	5.07	8.68	2.00
2.20 to 3.69	2.2	4.12	2.33	5.05	8.54	1.80
3.70 to 5.49	3.7	6.70	3.68	4.50	8.74	1.93
5.50 to 7.49	5.5	10.24	5.27	4.09	11.08	1.40
7.50 to 10.99	7.5	12.86	5.99	3.47	11.32	1.57
11.00 to 14.99	11	18.60	8.48	2.91	11.62	1.07
15.00 to 18.49	15	24.25	9.58	2.49	12.55	1.13
18.50 to 21.99	18.5	29.88	10.25	2.23	12.67	0.87
22.00 to 29.99	22	34.29	12.08	2.06	12.23	0.90
30.00	30	47.61	18.69	2.02	11.47	0.80

■ When HP rating IM (P99 = 1 or A39 = 1) is selected, the motor parameters are as listed in the following tables. (HP refers to horse power that is used mainly in North America as a unit of motor capacity.)

200 V class series for all destinations

230V, 60 Hz, rated voltage, base frequency

Motor capacity (HP)	Nominal applied motor (HP)	Rated current (A)	No-load current (A)	%R (%)	%X (%)	Rated slip frequency (Hz)
P02/A16		P03/A17	P06/A20	P07/A21	P08/A22	P12/A26
0.01 to 0.11	0.10	0.44	0.40	13.79	11.75	2.50
0.12 to 0.24	0.12	0.68	0.55	12.96	12.67	2.50
0.25 to 0.49	0.25	1.40	1.12	11.02	13.84	2.50
0.50 to 0.99	0.5	2.00	1.22	6.15	8.80	2.50
1.00 to 1.99	1	3.00	1.54	3.96	8.86	2.50
2.00 to 2.99	2	5.80	2.80	4.29	7.74	2.50
3.00 to 4.99	3	7.90	3.57	3.15	20.81	1.17
5.00 to 7.49	5	12.60	4.78	3.34	23.57	1.50
7.50 to 9.99	7.5	18.60	6.23	2.65	28.91	1.17
10.00 to 14.99	10	25.30	8.75	2.43	30.78	1.17
15.00 to 19.99	15	37.30	12.70	2.07	29.13	1.00
20.00 to 24.99	20	49.10	9.20	2.09	29.53	1.00
25.00 to 29.99	25	60.00	16.70	1.75	31.49	1.00
30.00 to 39.99	30	72.40	19.80	1.90	32.55	1.00

400 V class series for all destinations

460V, 60 Hz, rated voltage, base frequency

Motor capacity (HP)	Nominal applied motor (HP)	Rated current (A)	No-load current (A)	%R (%)	%X (%)	Rated slip frequency (Hz)
P02/A16		P03/A17	P06/A20	P07/A21	P08/A22	P12/A26
0.01 to 0.11	0.10	0.22	0.20	13.79	11.75	2.50
0.12 to 0.24	0.12	0.34	0.27	12.96	12.67	2.50
0.25 to 0.49	0.25	0.70	0.56	11.02	13.84	2.50
0.50 to 0.99	0.5	1.00	0.61	6.15	8.80	2.50
1.00 to 1.99	1	1.50	0.77	3.96	8.86	2.50
2.00 to 2.99	2	2.90	1.40	4.29	7.74	2.50
3.00 to 4.99	3	4.00	1.79	3.15	20.81	1.17
5.00 to 7.49	5	6.30	2.39	3.34	23.57	1.50
7.50 to 9.99	7.5	9.30	3.12	2.65	28.91	1.17
10.00 to 14.99	10	12.70	4.37	2.43	30.78	1.17
15.00 to 19.99	15	18.70	6.36	2.07	29.13	1.00
20.00 to 24.99	20	24.60	4.60	2.09	29.53	1.00
25.00 to 29.99	25	30.00	8.33	1.75	31.49	1.00
30.00 to 39.99	30	36.20	9.88	1.90	32.55	1.00

H04, H05 Auto-reset (Times and Reset interval)

H04 and H05 specify the auto-reset function that makes the inverter automatically attempt to reset the tripped state and restart without issuing an alarm (for any faults) even if any protective function subject to reset is activated and the inverter enters the forced-to-stop state (tripped state).

If the protective function works in excess of the times specified by H04, the inverter will issue an alarm (for any faults) and not attempt to auto-reset the tripped state.

Listed below are the recoverable alarm statuses to be retried.

Alarm status	LED monitor displays:	Alarm status	LED monitor displays:
Overcurrent protection	OC 1, OC2 or OC3	Motor overheated	OH4
Overvoltage protection	OU 1, OU2 or OU3	Motor overloaded	OL 1 or OL2
Heat sink overheated	OH 1	Inverter overloaded	OLU
Braking resistor overheated	dbH		

■ Number of reset times (H04)

H04 specifies the number of reset times for the inverter to automatically attempt to escape from the tripped state. When H04 = 0, the auto-reset function will not be activated.

⚠WARNING

If the "auto-reset" function has been specified, the inverter may automatically restart and run the motor stopped due to a trip fault, depending on the cause of the tripping.

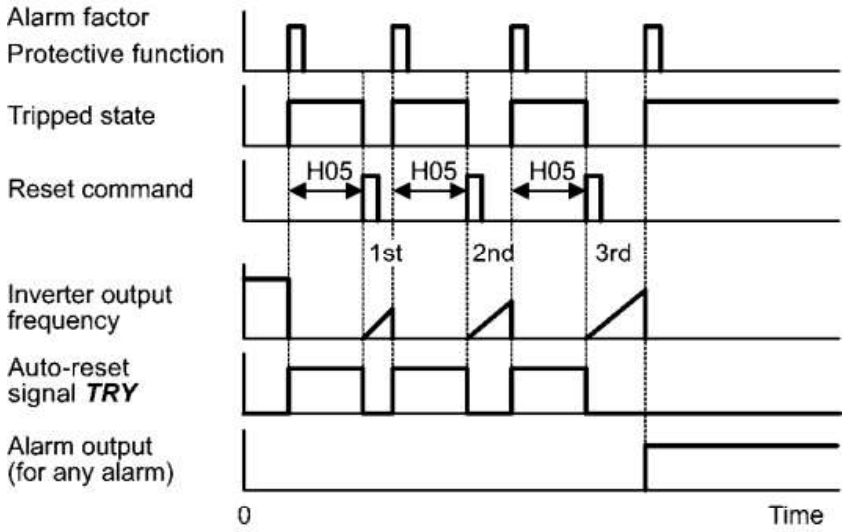
Design the machinery so that human body and peripheral equipment safety is ensured even when the auto-resetting succeeds.

Otherwise an accident could occur.

■ Reset interval (H05)

After the reset interval specified by H05 from when the inverter enters the tripped state, it issues a reset command to auto-reset the tripped state. Refer to the timing scheme diagram below.

<Timing scheme for failed retry (No. of reset times: 3)>



The auto-reset operation can be monitored from the external equipment by assigning the digital output signal TRY to any of the programmable output terminals [Y1] and [30A/B/C] with E20 or E27 (data = 26).

H06 Cooling Fan ON/OFF Control

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 while the inverter stops. However, since frequent switching of the cooling fan shortens its life, the cooling fan is kept running for 10 minutes once it is started.

H06 specifies whether to keep running the cooling fan all the time or to control its ON/OFF.

Data for H06	Cooling fan ON/OFF
0	Disable (Cooling fan always ON)
1	Enable (ON/OFF control effective)

H07 Acceleration/Deceleration Pattern

H07 specifies the acceleration and deceleration patterns (patterns to control output frequency).

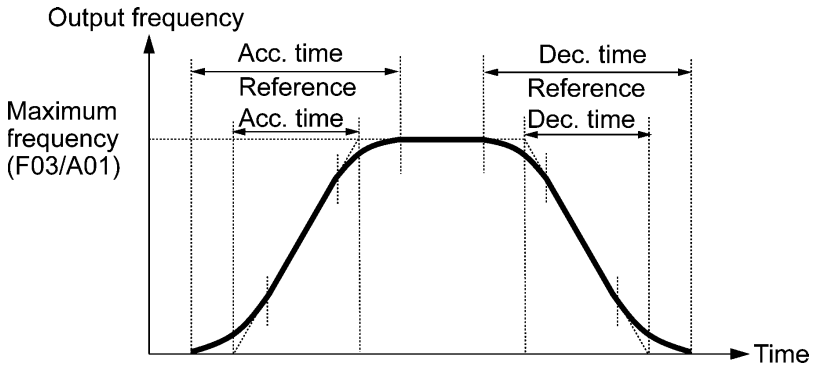
Linear acceleration/deceleration

The inverter runs the motor with the constant acceleration and deceleration.

S-curve acceleration/deceleration

To reduce an impact that acceleration/deceleration would make on the machine (load), the inverter gradually accelerates or decelerates the motor in both starting and ending zones of acceleration/deceleration. Two types of S-curve acceleration/deceleration rates are available; 5% (weak) and 10% (strong) of the maximum frequency, which are shared by the four inflection points.

The acceleration/deceleration time command determines the duration of acceleration/ deceleration in the linear period; hence, the actual acceleration/deceleration time is longer than the reference acceleration/deceleration time.



Acceleration/deceleration time

<S-curve acceleration/deceleration (weak): when the frequency change is 10% or more of the maximum frequency>

Acceleration or deceleration time (s) = (2 x 5/100 + 90/100+ 2 x 5/100) x (reference acceleration or deceleration time)

= 1.1 x (reference acceleration or deceleration time)

<S-curve acceleration/deceleration (strong): when the frequency change is 20% or more of the maximum frequency>

Acceleration or deceleration time (s) = (2 x 10/100 + 80/100 + 2 x 10/100) x (reference acceleration or deceleration time)

= 1.2 x (reference acceleration or deceleration time)

Curvilinear acceleration/deceleration

Acceleration/deceleration is linear below the base frequency (constant torque) but it slows down above the base frequency to maintain a certain level of load factor (constant output).

This acceleration/deceleration pattern allows the motor to accelerate or decelerate with the maximum performance of the motor.

Note Choose an appropriate acceleration/deceleration time, taking into account the machinery's load torque.

H11 Deceleration Mode

H11 specifies the deceleration mode to be applied when a run command is turned OFF.

Data for H11	Function
0	Normal deceleration The inverter decelerates and stops the motor according to deceleration commands specified by H07 (Acceleration/deceleration pattern), F08 (Deceleration time 1), and E11 (Deceleration time 2).
1	Coast-to-stop The inverter immediately shuts down its output, so the motor stops according to the inertia of the motor and machine and their kinetic energy losses.

Note When reducing the reference frequency, the inverter decelerates the motor according to the deceleration commands even if H11 = 1 (Coast-to-stop).

H12 Instantaneous Overcurrent Limiting (Mode selection)

H12 specifies whether the inverter invokes the current limit processing or enters the overcurrent trip when its output current exceeds the instantaneous overcurrent limiting level. Under the current limit processing, the inverter immediately turns OFF its output gate to suppress the further current increase and continues to control the output frequency.

Data for H12	Function
0	Disable An overcurrent trip occurs at the instantaneous overcurrent limiting level.
1	Enable The current limiting operation is effective.

If any problem occurs when the motor torque temporarily drops during current limiting processing, it is necessary to cause an overcurrent trip (H12 = 0) and actuate a mechanical brake at the same time.

Note The similar function is the current limiter specified by F43 and F44. The current limiter (F43, F44) implements the current control by software, so an operation delay occurs. When you have enabled the current limiter (F43, F44), also enable the instantaneous overcurrent limiting with H12 to obtain a quick response current limiting.

Depending on the load, extremely short acceleration time may activate the current limiting to suppress the increase of the inverter output frequency, causing hunting (undesirable oscillation of the system) or activating the inverter overvoltage trip (alarm OL). When specifying the acceleration time, therefore, you need to take into account machinery characteristics and moment of inertia of the load.

⚠CAUTION

When the instantaneous overcurrent limiting is enabled, the motor output torque could drop. For driving elevating machinery which could cause a serious problem with a drop of the motor output torque, therefore, disable the instantaneous overcurrent limiting. Note that disabling it will cause an overcurrent trip when a current exceeding the inverter protection level flows, so secure the protective coordination using a mechanical brake.

An accident could occur.

H45 Mock Alarm
H97 Clear Alarm Data

H45 causes the inverter to generate a mock alarm in order to check whether external sequences function correctly at the time of machine setup.

Setting the H45 data to "1" displays mock alarm Er-1 on the LED monitor. It also issues alarm output ***ALM*** (if assigned to a digital output terminal specified by E20 or E27). (Accessing the H45 data requires simultaneous keying of "STOP key + ∧ key.") After that, the H45 data automatically reverts to "0," allowing you to reset the alarm.

Just as for data (alarm history and relevant information) of those alarms that could occur in running the inverter, the inverter saves mock alarm data, enabling you to confirm the mock alarm status.

To clear the mock alarm data, use H97. (Accessing the H97 data requires simultaneous keying of "STOP key + ∧ key.") H97 data automatically reverts to "0" after clearing the alarm data.

H69 Automatic Deceleration (Anti-regenerative control) (Mode selection)
H76 Automatic Deceleration (Frequency increment limit for braking)

H69 specifies the anti-regenerative control.

In inverters not equipped with a PWM converter or braking resistor, if regenerative energy returned exceeds the inverter's braking capability, an overvoltage trip occurs.

When H69 = 1: The anti-regenerative control is functionally equivalent to that of the original FRENIC-Mini series (FRN□□□C1□-□□). That is, when the DC link bus voltage exceeds the preset voltage limiting level, the inverter lengthens the deceleration time to three times the specified time to decrease the deceleration torque to 1/3. In this way, the inverter reduces the regenerative energy tentatively. This control applies only in deceleration. When the load on the motor results in a braking effect, the control does not have any effect.

When H69 = 2 or 4: The inverter controls the output frequency to keep the braking torque at around 0 N·m in both acceleration/deceleration and constant speed running phases in order to avoid an overvoltage trip.

Since increasing the output frequency too much under anti-regenerative control is dangerous, the inverter has a torque limiter (Frequency increment limit for braking) that can be specified by H76. The torque limiter limits the inverter's output frequency to less than "Reference frequency + H76 setting."

Note that the torque limiter activated restrains the anti-regenerative control, resulting in a trip with an overvoltage alarm in some cases. Increasing the H76 data (0.0 to 400.0 Hz) makes the anti-regenerative control capability high.

In addition, during deceleration triggered by turning the run command OFF, the anti-regenerative control increases the output frequency so that the inverter may not stop the load depending on the load state (huge moment of inertia, for example). To avoid that, H69 provides a choice of cancellation of the anti-regenerative control to apply when three times the specified deceleration time is elapsed, thus decelerating the motor.

Data for H69	Function
0	Disable
1	Enable (Lengthen the deceleration time to three times the specified time under voltage limiting control.) (Compatible with the original FRENIC-Mini series FRN□□□C1□-□□)
2	Enable (Torque limit control: Cancel the anti-regenerative control if the actual deceleration time exceeds three times the specified one.)
4	Enable (Torque limit control: Disable force-to-stop processing.)

Note Enabling the anti-regenerative control may automatically increase the deceleration time.

When a braking resistor is connected, disable the anti-regenerative control.

H70 Overload Prevention Control

H70 specifies the decelerating rate of the output frequency to prevent a trip from occurring due to an overload. This control decreases the output frequency of the inverter before the inverter trips due to a heat sink overheat or inverter overload (with an alarm indication of OH1 or OLU , respectively). It is useful for equipment such as pumps where a decrease in the output frequency leads to a decrease in the load and it is necessary to keep the motor running even when the output frequency drops.

Data for H70	Function
0.00	Decelerate the motor by deceleration time 1 (F08) or 2 (E11)
0.01 to 100.00	Decelerate the motor by deceleration rate from 0.01 to 100.00 (Hz/s)
999	Disable overload prevention control

Note In equipment where a decrease in the output frequency does not lead to a decrease in the load, the overload prevention control is of no use and should not be enabled.

H71 Deceleration Characteristics

Setting the H71 data to "1" (ON) enables forced brake control. If regenerative energy produced during deceleration of the motor and returned to the inverter exceeds the inverter's braking capability, an overvoltage trip will occur. The forced brake control increases the motor energy loss during deceleration, increasing the deceleration torque.

Note This function is aimed at controlling the torque during deceleration; it has no effect if there is braking load.

Enabling the automatic deceleration (anti-regenerative control, H69 = 2 or 4) disables the deceleration characteristics specified by H71.

When replacing the original FRENIC-Mini series (FRN□□□C1□-□□) with the upgraded one (FRN□□□C2□-□□), note the following.

The original FRENIC-Mini series (FRN□□□C1□-□□) does not support H71, but H71 may be set to "1." On the upgraded one, however, it is not necessary to set H71 to "1."

H94 Cumulative Run Time of Motor 1

Operating the keypad can display the cumulative run time of motor 1. This feature is useful for management and maintenance of the machinery. Using H94 can modify the cumulative run time of the motor to the desired value to be used as an arbitrary initial data. Specifying "0" clears the cumulative run time.

H98 Protection/Maintenance Function (Mode selection)

H98 specifies whether to enable or disable (a) automatic lowering of carrier frequency, (b) input phase loss protection, (c) output phase loss protection, and (d) judgment on the life of the DC link bus capacitor, as well as specifying the judgment threshold on the life of the DC link bus capacitor, in a combination of Bit 0 to Bit 4.

Automatic lowering of carrier frequency (Bit 0)

This function should be used for important machinery that requires keeping the inverter running.

Even if a heat sink overheat or overload occurs due to excessive load, abnormal ambient temperature, or cooling system failure, enabling this function lowers the carrier frequency to avoid tripping (OH1 or OLU). Note that enabling this function results in increased motor noise.

Input phase loss protection (LIN) (Bit 1)

Upon detection of an excessive stress inflicted on the apparatus connected to the main circuit due to phase loss or line-to-line voltage unbalance in the three-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, phase loss or line-to-line voltage unbalance may not be detected because of the relatively small stress on the apparatus connected to the main circuit.

Output phase loss protection (OPL) (Bit 2)

Upon detection of phase loss in the output while the inverter is running, this feature stops the inverter and displays an alarm OPL. Where a magnetic contactor is installed in the inverter output circuit, if the magnetic contactor goes OFF during operation, all the phases will be lost. In such a case, this protection feature does not work.

Judgment threshold on the life of DC link bus capacitor (Bit 3)

Bit 3 is used to select the threshold for judging the life of the DC link bus capacitor between factory default setting and your own choice.

Note Before specifying the threshold of your own choice, measure and confirm the reference level in advance. For details, refer to Chapter 7.

Judgment on the life of DC link bus capacitor (Bit 4)

Whether the DC link bus 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.

Since load may vary significantly in the following cases, disable the judgment on the life during operation. Either conduct the measurement with the judgment enabled under appropriate conditions during periodical maintenance or conduct the measurement under the operating conditions matching the actual ones.

- A remote keypad (option) 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 Chapter 7.

To set data of H98, assign functions to each bit (total 5 bits) and set it in decimal format. The table below lists functions assigned to each bit.

Bit number	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	Judge the life of DC link bus capacitor	Select life judgment threshold of DC link bus capacitor	Detect output phase loss	Detect input phase loss	Lower the carrier frequency automatically
Data = 0	Disable	Use the factory default	Disable	Disable	Disable
Data = 1	Enable	Use the user setting	Enable	Enable	Enable
Example of decimal expression (19)	Enable (1)	Use the factory default (0)	Disable (0)	Enable (1)	Enable (1)

Conversion table (Decimal to/from binary)

Decimal	Binary					Decimal	Binary				
	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0	16	1	0	0	0	0
1	0	0	0	0	1	17	1	0	0	0	1
2	0	0	0	1	0	18	1	0	0	1	0
3	0	0	0	1	1	19	1	0	0	1	1
4	0	0	1	0	0	20	1	0	1	0	0
5	0	0	1	0	1	21	1	0	1	0	1
6	0	0	1	1	0	22	1	0	1	1	0
7	0	0	1	1	1	23	1	0	1	1	1
8	0	1	0	0	0	24	1	1	0	0	0
9	0	1	0	0	1	25	1	1	0	0	1
10	0	1	0	1	0	26	1	1	0	1	0
11	0	1	0	1	1	27	1	1	0	1	1
12	0	1	1	0	0	28	1	1	1	0	0
13	0	1	1	0	1	29	1	1	1	0	1
14	0	1	1	1	0	30	1	1	1	1	0
15	0	1	1	1	1	31	1	1	1	1	1

5.3 Notes in Driving PMSM

When driving a permanent magnet synchronous motor (PMSM), observe the following notes. Items not covered in this section are the same as for induction motor (IM) drive.

The PMSM drive is available in the ROM version 0500 or later. (The ROM version can be checked with item 5_ 14 on Menu #5 "Maintenance information" in Programming mode.)

Item	Specifications
Drive by commercial power	A PMSM cannot be driven by commercial power. Be sure to use an inverter. **A failure could occur.**
Wiring	Be sure to match inverter's output terminals (U, V and W) with motor's input terminals (U, V and W).
Control mode	When F42 = 11 (V/f control for PMSM drive) At the start of driving the motor, the inverter flows current equivalent to 80% of the motor rated current (P03) to pull in the magnetic pole position for synchronization. After that, the inverter accelerates the motor to the reference frequency. No magnetic pole position detection function is provided. No auto search for an idling PMSM and restart function are provided. Depending upon the magnetic pole position, the motor may run in the reverse direction slightly at the start of running.
Speed control range	The speed control range is from 10% to 100% of the base frequency (F04). Set the reference frequency to 10% or more of the F04 data.
Motor constants	The following motor parameters are used, so consult the motor manufacturer and configure the correct values. No tuning function is provided. F03: Maximum Frequency 1 (Hz) F04: Base frequency (Hz) F05: Rated voltage at base frequency) (V) (When F05 = 0, the inverter acts as 200/400V setting.) F06: Maximum Output Voltage 1 (V) P03: Motor rated current (A) P60: Armature resistance (Ω) P61: d-axis inductance (mH) P62: q-axis inductance (mH) P63: Induced voltage (V) P90: Overcurrent protection level (A) If any of P60, P62 and P63 is set to "0.00," the inverter does not start. Be sure to set correct values. The factory defaults of P60 to P63 are "0.00." If motor parameters are not correct, the inverter cannot run normally. Set P90 to the value less than the demagnetizing current. **A failure could occur.**
Carrier frequency	The carrier frequency (F26) should be 2 to 16 kHz. Running a PMSM at 0.75 or 1 kHz may result in a failure due to demagnetization. The automatic carrier frequency lowering function at the time of inverter overheat does not work. **A failure could occur.**
2nd motor	A PMSM cannot be driven as the 2nd motor.

Item	Specifications
V/f pattern	Linear V/f pattern only. The load selection value (F37) will be ignored.
Auto energy saving	When driving a PMSM, the high-efficiency control is always ON.
Auto-tuning	A PMSM cannot be tuned.
Instantaneous overcurrent limiter	Not available for a PMSM. The H12 setting will be ignored. Even if H12 = 1, an overcurrent trip occurs due to an overcurrent incident.
Restart mode after momentary power failure	When the F14 data is set to either 4 or 5, the inverter restarts with pull-in by current.
Automatic deceleration (anti-regenerative control),	When H69 = 1, the automatic deceleration is performed only on inverters compatible with the original FRENIC-Mini series (FRN□□□C1□-□□). When H69 = 2 or 4, no automatic deceleration is performed.
Brake signal	Not available for a PMSM. It is always OFF.
Jogging operation	Not available for a PMSM.
DC braking	Not available for a PMSM.
Others	Be sure to consult the motor manufacturers before actual operation. A failure could occur.