11-4. Function table

Function No.	Function Name	Setting range		Minimum unit	Unit	Change during operation	Factory setting	Page
0 0	Data protection	0 : Data changeable 1 : Change inhibited		—	—	×	0	35
0 1	Frequency setting	0 : Using Keypad panel Keys 1 : Using analog signal input		—	—	×	0 (1)[S]	
0 2	Operation method	0 : Using Keypad panel 1 : Terminal operation		0	—	×	0 (1)[S]	36
0 3	Maximum frequency	50 to 400		1	Hz	×	60 (50)[J]	
0 4	Base frequency 1	15 to 400		1	Hz	×	50	
0 5	Rated voltage (Max. output voltage)	0 : AVR function off	80 to 240/200V models	1	V	×	200 (220)[J]	37
			160 to 480/400V models	2			400 (380)[J]	
0 6	Acceleration time 1	0.00 to 3600		0.01 to 10	s	○	6.00	
0 7	Deceleration time 1						6.00	
0 8	Torque boost 1	0 : Automatic torque boost 1 to 31 : Manual torque boost		Code	—	○	0	38
0 9	FMA voltage adjustment	0 (Approx.6.5V) to 99 (Approx.10.3V)		1	—	○	85	
1 0	Motor poles	2 : 2 poles, 4 : 4 poles, 6 : 6 poles, 8 : 8 poles, 10 : 10 poles, 12 : 12 poles		—	—	○	4	
1 1	Speed display coefficient	0.01 to 200.0		0.01, 0.1	—	○	0.01	39
1 2	Motor operating sound adjustment (Carrier frequency)	0 to 15		1	kHz	○	15	
1 3	No. of retries	0 to 10		1	—	×	0	
1 4	Restart after momentary power failure (Operation selection)	0, 1 : Inactive, 2, 3 : Active		1	—	×	1	40
1 5	(Operation selection) Electronic thermal overload relay 1	0 : Inactive 1 : Active (Standard motor) 2 : Active (Fuji FV motor)		1	—	×	1 Rated value of Fuji standard 4-pole motor	
1 6	(Operating level)	0.01 to 99.9		0.01	A	×		
1 7	DC brake (Operation selection)	0 : Inactive, 1 : Active		0.1	—	×	0	41
1 8	DC brake (Starting frequency)	0 to 60 (0.2Hz at 0 setting)		1	Hz	○	0	

( )[S] : without keypad panel model, ( )[J] : JE version

Function No.	Function Name	Setting range	Minimum unit	Unit	Change during operation	Factory setting	Page
19	DC brake (Braking level)	0 to 100	1	%	○	50	41
20	DC brake (Braking time)	0.00 to 30.0	0.01, 0.1	s	○	0.5	
21	Multistep frequency setting 1	0.00 to 99.99 100.0 to 400.0	0.01 0.1	Hz	○	10.00	43
22	Multistep frequency setting 2					20.00	
23	Multistep frequency setting 3					30.00	
24	Multistep frequency setting 4					40.00	
25	Multistep frequency setting 5					50.00	
26	Multistep frequency setting 6					60.00	
27	Multistep frequency setting 7					60.00	
28	S-curve acceleration/ deceleration (Operation selection)	0 : Inactive (linear acceleration/ deceleration) 1 : S-curve acceleration/ deceleration (weak) 2 : S-curve acceleration/ deceleration (strong)	0,1,2	—	×	0	44
29	Protection history	Last 4 protection operations are displayed in order	—	—	○	—	45
30	Starting frequency	0 to 15 (0.2Hz at 0 setting)	1	Hz	×	1	
31	(During acceleration/ deceleration)	0 : No limit 20 to 180 : Torque limit active	1	%	○	0	
32	Torque limit (At constant speed)					0	
33	Braking torque selection	0 : Low (no DB option) 1 : High (with DB option)	0.1	—	×	0	46
34	Bias frequency	−400 to 400	1	Hz	○	0	
35	Gain for frequency setting signal	0.00 to 250.0	0.01,0.1	%	○	100.0	47
36	Frequency limiter (High)	0 to 400	1	Hz	○	70	48
37	Frequency limiter (Low)					0	
38	Motor characteristics	0 to 10	1	—	○	5	
39	Data initialization	0 : Manual setting 1 : Initial values (factory defaults)	1	—	×	0	

Function		Setting range	Minimum unit	Unit	Change during operation	Factory setting	Page
No.	Name						
40	FMA,FMP terminals (Operation selection)	0 : Analog signal output from FMA terminal 1 : Pulse signal output from FMP terminal	—	—	×	0	49
41	FMA terminal (Function selection)	0 : Output frequency 1 : Output current 2 : Output torque 3 : Load factor	1	—	×	0	
42	FMP terminal (Pulse rate multiplier)	10 to 100	1	—	○	24	
43	X4 terminal function	0 : RT1, 1 : X4 2 : VF2, 3 : HLD	1	—	×	0	50
44	Multistep frequency setting 8	0.00 to 99.99 100.0 to 400.0	0.01 0.1	Hz	○	0.00	
45	Multistep frequency setting 9					0.00	
46	Multistep frequency setting 10					0.00	
47	Multistep frequency setting 11					0.00	
48	Multistep frequency setting 12					0.00	
49	Multistep frequency setting 13					0.00	
50	Multistep frequency setting 14					0.00	
51	Multistep frequency setting 15					0.00	
52	Frequency setting signal filter	0.02 to 5.00	0.02	s	○	0.06	51
53	Timer	0 : Inactive, 0.01~3600(s)	0.01~10	s	×	0.00	
54	Y1 terminal (Function selection)	0 : Inverter running mode (RUN) 1 : Frequency level detection (FDT) 2 : Frequency equivalence signal (FAR) 3 : Undervoltage stop mode (LV) 4 : Torque limiting mode (TL) 5 : Auto-restart mode after momentary power loss (IP)	1	—	×	0	52

Function		Setting range	Minimum unit	Unit	Change during operation	Factory setting	Page
No.	Name						
5 5	Frequency level detection (FDT operation level)	0.00 to 400.0	0.01 0.1	Hz	○	0.00	52
5 6	Hysteresis width	0 to 30	1	Hz	○	0	53
5 7	THR terminal (Function selection)	0 : THR function 1 : Edit permit command	1	—	×	0	
5 8	Jump frequency (Hysteresis width)	0 to 30	1	Hz	○	3	54
5 9	Jump frequency 1	0 to 400	1	Hz	○	0	
6 0	Jump frequency 2					0	
6 1	Jump frequency 3					0	
6 2	Base frequency 2	15 to 400	1	Hz	×	50	
6 3	Acceleration time 2	0.00 to 3600	0.01 to 10	s	○	10.0	55
6 4	Deceleration time 2					10.0	
6 5	Torque boost 2	1 to 31 : Manual torque boost	1	—	○	13	
6 6	(Operation selection) Electronic thermal overload relay 2	0 : Inactive 1 : Active(Standard motor) 2 : Active(Fuji FV motor)	1	—	×	0	
6 7	(Operating level)	0.01 to 99.9	0.01	A	×	Rated value of Fuji standard 4-pole motor	
6 8	Slip compensation	0 : Inactive, 0.1 to 5.0	0.1	Hz	○	0.0	56
6 9	Torque vector control	0 : Inactive, 1 : Active	—	—	×	0	
7 0	Motor capacity	0 : 1-frame up capacity 1 : Standard capacity 2 : 1-frame down capacity 3 : 2-frame down capacity	1	—	×	1	
7 1	Motor 1/rated current	0.01 to 99.9	0.01 0.1	A	×	Rated value of Fuji standard 4-pole motor	57
7 2	Motor 1/no-load current						
7 3	Motor 2/rated current						
7 4	Automatic tuning	0 : Inactive, 1 : Active	—	—	×	0	

Function No.	Function Name	Setting range	Minimum unit	Unit	Change during operation	Factory setting	Page
7 5	Motor 1 (%R1 setting)	0.00 to 50.00	0.01	%	×	Rated value of Fuji standard 4-pole motor	57
7 6	Motor 1 (%X setting)						58
7 7	(At constant speed) Torque limiter response (During acceleration/ deceleration)	000 to 999	—	—	○	369	59
7 8						394	
7 9	Option selection	0 : No options 1 : DI , 2 : DI/O, 3 : RS	0~3	—	×	0	

Change during operation [○ : Change possible
× : Change impossible

11-5. Description of functions

This indicates that the data for the function cannot be changed during operation. (Change during operation) appears if the data can be changed.

Indicates the factory default setting.

F 0 0 Data protection

Change during operation

=0

- This setting function protects the setting data from unnecessary changes as a result of errors in operation.
  - 0 : Data changeable
  - 1 : Change inhibited (data protection)

  To change the setting data, simultaneously press the STOP key and either the ∧ or ∨ key.

F 0 1 Frequency setting

Change during operation

=0 : standard, 1 : without keypad panel

- The frequency setting method can be selected from the following.
  - 0 : Using the keypad panel ∧ and ∨ keys
  - 1 : Using analog signal input

    The setting will be the sum of the values at terminal 12 (DC 0 to 10V) and terminal C1 (DC 4 to 20mA).

⚠ CAUTION

●Because it is relatively easy to set the Inverter to high-speed operation, be sure to check the capacity of the motor and the equipment being operated before changing the Inverter function setting.

F 0 2 Operation method

Change during operation

=0 : standard, 1 : without keypad panel

- The input method for operation commands can be selected as follows.

  0 : Operation command input using the keypad panel (RUN and stop commands using the RUN and STOP keys)

  1 : Operation command input by means of external signal terminals (FWD, REV)

Operating mode	F 0 2	Panel Control LED
Keypad panel operation	0	Illuminated
Terminal operation	1	Off

NOTE The data can be changed when the FWD and REV terminals on the terminal board are both OFF (while they are not being held in 3-wire operation).
The FWD and CM terminals are shorted with a shorting bar at the time of shipment. In this condition, the setting for function F02 cannot be changed. Remove the shorting bar while changing the setting.

F 0 3 Max. frequency

Change during operation

= 6 0 Hz: standard, 5 0 Hz: JE version

- The maximum operation frequency can be set within the range 50~400Hz in steps of 1Hz.

⚠ CAUTION

- Because it is relatively easy to set the Inverter to high-speed operation, be sure to check the capacity of the motor and the equipment being operated before changing the Inverter function setting.

F 0 4 Base frequency 1

Change during operation

= 5 0 Hz

- This sets the base frequency.
  Exceeding this frequeucy, output voltage will be constant according to the setting value of Function F05.
  The setting range is 15 to 400Hz in steps of 1Hz. It is normally set to the rated frequency of the motor.

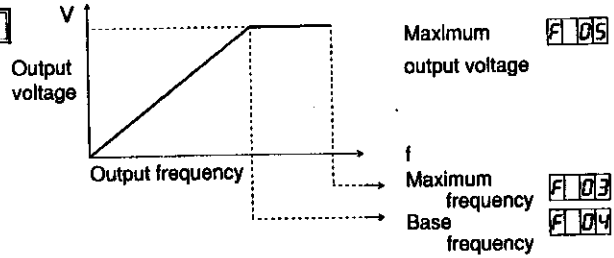
NOTE If the base frequency is greater than the maximum frequency, the output voltage will not rise to the rated voltage. Set so that the ratio between the base frequency and the maximum frequency is less than 1:8.

F 0 5 | Rated voltage (Max. output voltage) | Change during operation | =200V:200V models/400V:400V models / standard 220V:200V models/380V:400V models / JE

- This sets the maximum output voltage for the Inverter steps of 1V.
  Data 0 : AVR function is off (output voltage is proportional to power supply voltage)
  Other : The AVR function operates to control the maximum output voltage of the Inverter to the set voltage.
  [setting range] 200V models: 80 to 240V
  400V models: 160 to 480V

※ The output voltage cannot be higher than the voltage input from the power supply.

NOTE



F 0 6 | Acceleration time 1 | Change during operation | =6.00s
F 0 7 | Deceleration time 1 | Change during operation | =6.00s

- The time from start to maximum frequency (acceleration) and from maximum frequency to stop (deceleration) can be set within the range of 0.01 to 3600 seconds. Set values according to the load characteristics or GD².

Setting range	Setting step
0.00* to 9.99s	0.01s
10.0 to 99.9s	0.1s
100 to 999s	1s
1,000 to 3,600s	10s

* When set to 0 0 0, the time becomes 0.01 seconds.

NOTE This function can be selected when F 4 3 is set to 0 or 2 and X4-CM is off, or when F 4 3 is set to 1 or 3.

F 0 8 Torque boost 1

Change during operation

= 0

- You can switch between automatic torque boost and manual torque boost mode according to the type of load and the motor characteristics, and adjust the torque boost value in manual mode to one of 31 values.

  0 : Torque boost is automatically controlled.

  1 : Squared torque characteristics (for fans and pumps)

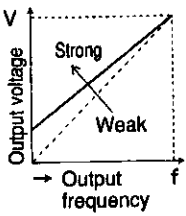
  2 : Proportional torque characteristics

  3 : (Weak)

  :

  31 : (Strong)

  Manual



※ Refer to "11-6-1 Description of torque boost" for details.

NOTE If using a Fuji Inverter motor (FV motor), set to 0 .

F 0 9 FMA (Analog monitor) voltage adjustment

Change during operation

= 8 5

- This function adjusts the voltage level of the analog voltage signal from the FMA terminal.

  0 : Approx.6.5V

  :

  99 : Approx.10.5V

  The value can be adjusted to one of 100 settings within this range.

NOTE This function is only active if F 4 0 (FMA terminal output) is set to 0. If the contents for function F 4 0 have been changed, readjustment is necessary. Select the type of signal output from the FMA terminal by means of function F 4 1 (FMA terminal function selection).

F 1 0 Motor poles

Change during operation

= 4

- This sets the number of poles of the motor being used for synchronized rotation speed display.

  2 : 2 poles, 6 : 6 poles, 10 : 10 poles

  4 : 4 poles, 8 : 8 poles, 12 : 12 poles

  Example: If running a 4-pole motor at 60Hz, the display will be 120 x 60 ÷ 4 = 1800

F 11 | Speed display coefficient | Change during operation | ☞=0.01

- This sets the display coefficient for displaying the line speed [m/min.]
  Display value [m/min.] = Output frequency [Hz] x display coefficient

Display coefficient setting range	Setting step
0.01 to 9.99	0.01
10.0 to 200.0	0.1

F 12 | Motor operating sound adjustment (Carrier frequency) | Change during operation | ☞=15kHz

- This adjusts the carrier frequency of the Inverter within the range of 0.75~15kHz. The acoustic and electromagnetic noise generated by the motor can be reduced by adjusting the carrier frequency.
  If set to [ ][ ]0, the carrier frequency will be set to 0.75kHz.
  The adjustment from 1 to 15kHz can be carried out in 1kHz steps.

F 13 | No. of retries | Change during operation | ☞=0

- This sets the number of times the Inverter automatically tries to restart after a trip caused by overcurrent within the range of 0 to 10 times.
  Retries are only carried out for trips which occur as a result of overcurrent.
  This does not operate for output grounding fault or short circuits.

⚠ WARNING	●**If the retry function has been activated and a trip occurs, the Inverter will restart automatically depending on the cause of the trip.** **Make sure that the system is set up properly so that there will be no danger to personnel when the Inverter starts, otherwise accidents may occur.**

F 14 | Restart after momentary power failure (Operation selection) | Change during operation, = 1

- This sets the operation mode when a momentary power failure occurs and when power is restored.
  - 0 : Inactive (Does not restart and immediate LU trip)
  - 1 : Inactive (Does not restart and LU trip after recovery)
  - 2 : Active (Restarting at frequency at time of power failure)
  - 3 : Active (Restarting at frequency = 0)

NOTE Of the inactive settings, 0 emphasizes protective function, and 1 emphasizes continuous operation.
3 is for loads with low moment of inertia.

⚠ WARNING **●If restarting (data 2 or 3) is selected for the restart after momentary power failure function, the Inverter will restart after power is restored.**

F 15 | Electronic thermal overload relay 1 (Operation selection) | Change during operation , = 1

F 16 | Electronic thermal overload relay 1 (Operation level) | Change during operation , = Rated value for Fuji standerd 4-pole motor

- This sets whether the electronic thermal overload relay (motor overload detection) for protecting the motor from overheating is active or inactive, what kind of motor is being used, and what the operation level is.

[Operation selection]
- 0 : Inactive
- 1 : Active (Standard motor)
- 2 : Active (Fuji FV motor)

[Operation level] This sets the operation level of the electronic thermal overload relay in terms of current [A]. The setting range is within 20 to 105% of the Inverter rating.

F 17	DC brake (Operation selection)	Change during operation	=0
F 18	DC brake (Starting frequency)	Change during operation	=0Hz
F 19	DC brake (Braking level)	Change during operation	=50%
F 20	DC brake (Braking time)	Change during operation	=0.5s

- This sets the whether the DC injection brake is active or inactive, and also sets the operating specifications.

[Operation selection] : This switches the DC brake operation to active or inactive.

□□0 : Inactive (Regenerative braking only)

□□1 : Active (DC braking after regenerative braking)

[Starting frequency] : This sets the frequency at which to start DC injection brake operation during deceleration.

[Braking level] : This sets the braking level (brake output) for the DC injection brake in terms of the DC current calculated from the rated Inverter current.

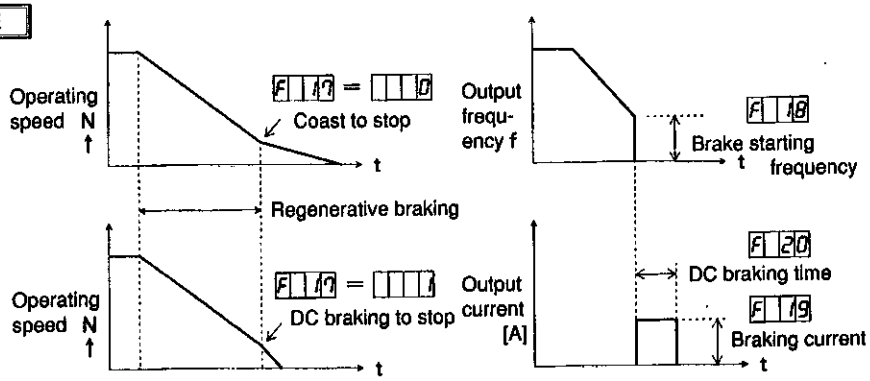
The braking force will vary depending on the characteristics of the motor.

[Braking time] : This sets the operation time for the DC injection brake.

	Setting range	Unit	Setting step
Starting frequency	0[1] to 60	Hz	1Hz
Braking level	0 to 100	%	1%
Braking time	0.00 to 9.99	s	0.01
	10.0 to 30.0		0.1

[1] If the data is set to "0", the frequency will be 0.2Hz.

NOTE



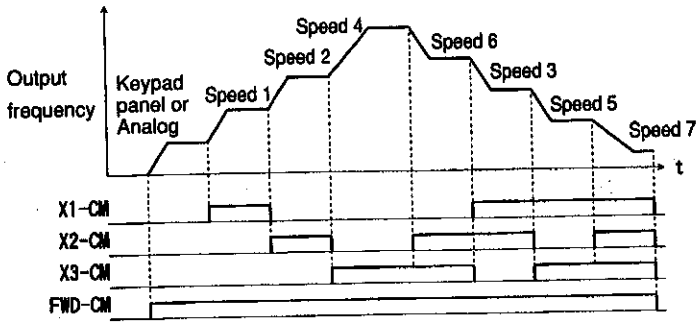
⚠ CAUTION	●The Inverter braking function cannot be substituted for mechanical means. Attempting to do so may result in injury.

F 2 1	Multistep frequency setting 1	Change during operation	=10.00Hz
F 2 2	Multistep frequency setting 2	Change during operation	=20.00Hz
F 2 3	Multistep frequency setting 3	Change during operation	=30.00Hz
F 2 4	Multistep frequency setting 4	Change during operation	=40.00Hz
F 2 5	Multistep frequency setting 5	Change during operation	=50.00Hz
F 2 6	Multistep frequency setting 6	Change during operation	=60.00Hz
F 2 7	Multistep frequency setting 7	Change during operation	=60.00Hz

- This sets the frequencies for multistep frequency operation. The frequencies to set are selected as shown in the table below by setting control terminals X1, X2 and X3 to on.

[Relationship between terminals and multistep frequencies 1 - 7] ● : ON

Function	0 1	2 1	2 2	2 3	2 4	2 5	2 6	2 7
Multistep frequency	Speed 0	Speed 1	Speed 2	Speed 3	Speed 4	Speed 5	Speed 6	Speed 7
X 1 — C M		●		●		●		●
X 2 — C M			●	●			●	●
X 3 — C M					●	●	●	●



(1) Speed 0 (when X1-CM, X2-CM and X3-CM are all off) depends on the frequency setting method selected by means of function F 0 1.
In other words, the setting becomes digital (using the ^ and v keys) or analog ([DC 0 to 10V] + [DC 4 to 20mA]).

(2) The actual operation frequency is limited by the maximum frequency F 0 3 and the frequency limiters F 3 6 and F 3 7 .

F 28

S-curve acceleration/deceleration (Operation selection)

Change during operation

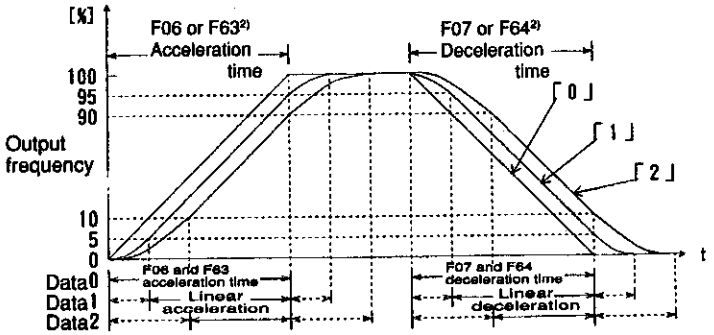
= 0

- This selects whether S-curve acceleration/deceleration is active or inactive, and which of the two S-curve acceleration/deceleration patterns is used.

  0 : Inactive ... linear acceleration and deceleration[1)]

  1 : S-curve acceleration/deceleration (weak)

  2 : S-curve acceleration/deceleration (strong)



NOTE

① Shocks at the start and end of acceleration and deceleration can be softened by selecting a S-curve pattern.

② The maximum gradient in the output frequency when a S-curve pattern is selected is the same as for linear acceleration and deceleration time.

③ The actual acceleration and deceleration times when an S-curve pattern is selected is extended by 10% (when 1 is set) or 20% (when 2 is set) from the times set by F 06 and F 07 or by F 63[2)] and F 64[2)]

[1)] Acceleration and deceleration are carried out at the uniform rate for the time specified by functions F 06 and F 07 or by F 63[2)] and F 64[2)]

[2)] Selected when the terminal X4 function is set so that F 43 = 0 and X4 (RT_1) is ON.

F 29 | Protection history | Change during operation | ☕ = –

- The Last 4 protective operations are displayed in order when the [∨] key is pressed.

— Operation procedure —

	Procedure	Display example	Remarks
1	Call up F 29	F 29	
2	Press the FUNC DATA key.		
3	Press the [∨] key.	0U	Contents of the latest trip are displayed
4	Press the [∨] key. / Press the [∧] key.	0H2	Contents of the second-latest trip are displayed
5	Press the [∨] key. / Press the [∧] key.	0C1	Contents of the third-latest trip are displayed
6	Press the [∨] key. / Press the [∧] key.	- - - -	Contents of the fourth-latest trip are displayed
7	Press the [∧] key.	End	This example shows there is no trip history for this.

※ New trip histories are stored in the "latest trip contents" data area, existing trip histories are moved down one in the order, and the old fourth-latest history is deleted.

F 30 | Starting frequency | Change during operation | ☕ = 1 Hz

- This sets the starting frequency within the range of 0 to 15Hz in 1Hz steps.
  If the data is set to [0], the frequency will be 0.2Hz.

F 31 | Torque limit (During acceleration/deceleration) | Change during operation, | ☕ = 0 %

F 32 | Torque limit (At constant speed) | Change during operation, | ☕ = 0 %

- This sets the torque limit level during acceleration/deceleration and constant-speed operation in steps of 1%.

[0] : No limit
[20] : 20% ┐
: ├ Limit
[180] : 180% ┘

※ Refer to "11-6-2 Description of torque limit" for details.

⚠ WARNING	●If the torque limit function has been selected, the Inverter may start running with differences in the acceleration/deceleration time and speed settings. Make sure that the system is set up properly so that there will be no danger to personnel when the Inverter starts, otherwise accidents may occur.

F 3 3 Braking torque selection

Change during operation

= 0

- This sets the limit level for braking torque in accordance with the brake being used.
  - 0 : Low (no DB option)
  - 1 : High (with DB option)

    Always connect an external braking resistor.

※ Refer to "11-6-3 Description of braking torque selection" for details.

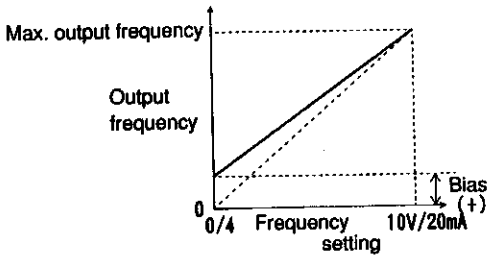
F 3 4 Bias frequency

Change during operation

= 0 Hz

- This function adds the bias frequency to the analog setting frequency to produce the output frequency.

  The setting range is between −400 to +400Hz in steps of 1Hz.



※ The bias frequency is only active when the frequency setting function F 0 1 = 1

⚠ WARNING	●If the bias frequency has been set, the Inverter will operate when an operation command is given, even if the analog frequency is zero.

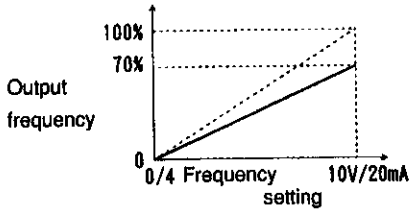
F35

Gain for frequency setting signal

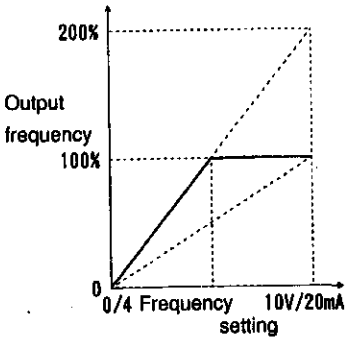
Change during operation

=100.0%

- This sets the size (gradient) of the output frequency corresponding to the analog frequency setting as a percentage of the maximum frequency.



[Example: for 70% gain]



[Example: for 200% gain]

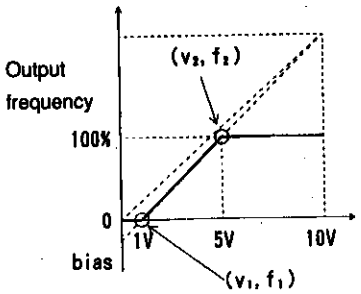
※ The gain setting is only active when F01 = 1

Explanation

If the bias frequency function (F34) and the gain for frequency setting signal function (F35) are used together, the gain for frequency setting signal has priority, and the bias is applied to the frequency with gain already applied.
The bias frequency f_{bias} and setting frequency gain at this time can be calculated by the following formulas.

$$f_{bias} = f_1 - \frac{f_1 - f_2}{v_1 - v_2} \times v_1$$

$$Gain = \frac{1000 \times (f_1 - f_2)}{100 \times (v_1 - v_2) + f_1 \times v_2 - f_2 \times v_1}$$



Example :
If the analog frequency setting voltage is 1 to DC 5V and the output frequency is weighted to 0 to 100%, then:

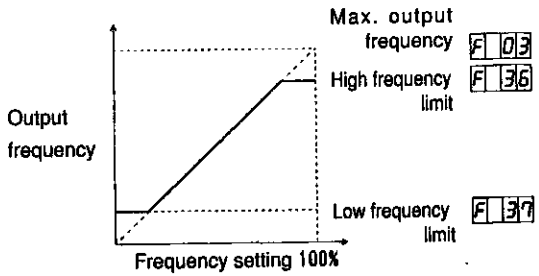
$(v_1, f_1) = (1, 0)$ [V] [%], $(v_2, f_2) = (5, 100)$ [V] [%] so that

$f_{bias} = -25\%$, and Gain=200%

F 36 Frequency limiter (High) — Change during operation — =70Hz

F 37 Frequency limiter (Low) — Change during operation — = 0Hz

- The high and low limits for the output frequency can be set within a range of 0 to 400Hz in steps of 1Hz.



NOTE If the high and low limit settings are reversed, the high limit has priority and the low limit is ignored. In this case, operation covers the whole range with the high limit, regardless of the input signal.

F 38 Motor characteristics — Change during operation — = 5

- This adjusts the output current in cases where there is an irregularity such as current fluctuation. If a current fluctuation occurs, adjust the setting value while referring to the tables below.

No. of motor poles	Many ⟷ 4 ⟷ Few
Setting	0 1 0

Load	High ⟷ Low
Setting	0 1 0

F 39 Data initialization — Change during operation — = 0

- This sets the setting data for all functions to the factory default settings.
  - 0 : Inactive (manual setting)
  - 1 : Initial values (Initialization with factory defaults)

[Operation procedure]
① When 0 is being displayed, press the STOP + ^ keys simultaneously to change the display to 1.
② In this condition, press the FUNC DATA key to reset all data to the factory default settings. The display will then automatically switch to show the frequency setting for STOP mode.

F 40 FMA, FMP terminals (Operation selection)

Change during operation

= 0

- This switches the output destination for the external monitoring signal.

  0 : Analog signals are output from the FMA terminal.
  (The FMP terminal is not used.)
  The type of analog signal output to the FMA terminal is selected by function F 41.

  1 : Pulse signals are output from the FMP terminal.
  (The FMA terminal is not used.)
  Frequency of pulse signal output to the FMP terminal is adjusted by function F 42.

F 41 FMA terminal (Function selection)

Change during operation

= 0

- This sets the type of analog signal which is output to the FMA terminal.

  0 : Output frequency Display 100% = $\frac{\text{Output frequency}}{\text{Maximum frequency}} \times 100$

  1 : Output current Display 100% = $\frac{\text{Output current}}{\text{Rated inverter current} \times 2} \times 100$

  2 : Output torque Display 100% = $\frac{\text{Output torque}}{\text{Rated torque} \times 2} \times 100$

  3 : Load factor Display 100% = $\frac{\text{Inverter output}}{\text{Rated output} \times 2} \times 100$ ($f > f_{base}$)

  $= \frac{\text{Output torque}}{\text{Rated torque} \times 2} \times 100$ ($f \leq f_{base}$)

  f : Output frequency, f_{base} : Base frequency

F 42 FMP terminal (Pulse rate multiplier)

Change during operation

= 24

- This sets the pulse rate multiplier for the pulse signal frequency output to the FMP terminal with respect to the Inverter output frequency. The setting range is 1 to 100.

  [FMP terminal pulse frequency] = [Inverter output frequency] × [Pulse rate multiplier]

※ Set so that the frequency output from the FMP terminal is 6kHz or lower.

F 43 | X4 terminal function | Change during operation | ☞ = 0

- The function for the X4 input terminal can be selected from the following four options.

  0 : Functions as a command input terminal (RT1) for switching to acceleration/deceleration time 2.
  The acceleration time 2 and deceleration time 2 are set by F 63 and F 64.

  1 : Functions as a No. 4 signal (X4) for multistep frequency operation command input.
  When using as this function, operation is possible with a total of 16 frequencies.
  Frequencies 8 to 15 are set by means of F 44 to F 51.

  2 : Functions as a command terminal (VF2) for switching to base frequency 2 when using the second motor, etc.
  When base frequency 2 is selected, acceleration/deceleration time 2, torque boost 2 and electronic thermal overload relay 2 are selected simultaneously.
  Base frequency 2 is set using function F 62, acceleration/deceleration time 2 are set by function F 63 and F 64, torque boost 2 is set by function F 65, and electronic thermal overload relay 2 is set by F 66 and F 67.

  3 : Functions as a hold signal (HLD) for operation commands during 3-wire operation.

F 44	Multistep frequency setting 8	Change during operation,	☞ = 0.00Hz
F 45	Multistep frequency setting 9	Change during operation,	☞ = 0.00Hz
F 46	Multistep frequency setting 10	Change during operation,	☞ = 0.00Hz
F 47	Multistep frequency setting 11	Change during operation,	☞ = 0.00Hz
F 48	Multistep frequency setting 12	Change during operation,	☞ = 0.00Hz
F 49	Multistep frequency setting 13	Change during operation,	☞ = 0.00Hz
F 50	Multistep frequency setting 14	Change during operation,	☞ = 0.00Hz
F 51	Multistep frequency setting 15	Change during operation,	☞ = 0.00Hz

- These set the 8 multistep frequencies from frequency 8 to frequency 15 within the range of 0 to 400Hz.
  The setting step is the same as for functions F21 ~ F27.

[Relationship between terminals and multistep frequencies 8 ~15] ● : ON

Function	44	45	46	47	48	49	50	51
Multistep frequency	Speed 8	Speed 9	Speed 10	Speed 11	Speed 12	Speed 13	Speed 14	Speed 15
X1−CM		●		●		●		●
X2−CM			●	●			●	●
X3−CM					●	●	●	●
X4−CM	●	●	●	●	●	●	●	●

These functions are only active when F 43 has been set to 003 (X4).

F 52 Frequency setting filter

Change during operation

=0.06 s

- This sets the time constant for the input filter in order to reduce the effects of noise included in the analog setting signal (voltage and current input). Settings can be made in steps of 0.02 second.
  If the time constant is set too long, the response to analog commands will become poor.

F 53 Timer

Change during operation

=0.00 s

- This sets whether the timer is active or inactive, and also sets the time from the start of operation until operation automatically stops (when the timer is active).

  000 : Inactive (normal operation)
  001 : Active (0.01 second)
  :
  3600 : Active (3,600 seconds)

Setting range	Setting step	Unit
0.00 to 9.99	0.01	second (s)
10.0 to 99.9	0.1	
100 to 999	1	
1000 to 3600	10	

F 5 4

Y1 terminal (Function selection)

Change during operation

= 0

- This selects the output signal for the Y1 terminal from the following 6 types.

  0 : Inverter running state (RUN)
  This is OFF during direct current braking.

  1 : Frequency level detection (FDT)
  Y1-CM is ON when the frequency detected is identical to the frequency set by function F 5 5.
  The hysteresis is set by function F 5 6.

  2 : Frequency equivalence signal (FAR)
  Y1-CM is ON when the frequency reaches the frequency set by the keypad panel, analog input, multistep frequency setting, etc.
  The hysteresis is set by function F 5 6.

  3 : Undervoltage stop mode (LV)

  4 : Torque limiting mode (TL)

  5 : Auto-restart mode after momentary power failure (IP)

F 5 5

Frequency level detection (FDT operation level)

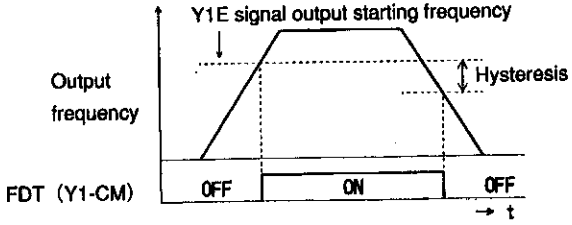
Change during operation

=0.00Hz

- This sets the operation level for FDT signal (frequency detection signal) output within the range of 0.00~400.0Hz.

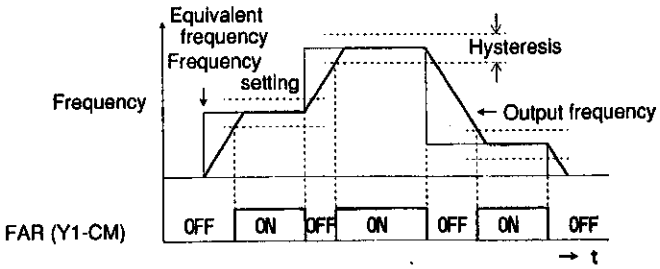
[Setting resolution]

Setting range	Setting step	Unit
0.00 to 99.99	0.01	Hz
100.0 to 400.0	0.1	



F 56 | Hysteresis width | Change during operation | = 0 Hz

- This sets the hysteresis for the frequency detection signal (FDT) and frequency equivalence signal (FAR) within the range of 0~30Hz.
  For the frequency equivalence signal (FAR), the equivalent frequency is in the middle of the hysteresis width.



F 57 | THR terminal (Function selection) | Change during operation | = 0

- This sets the function for the THR input terminal.
  - 0 : Used for THR functions (Trip command functions)
  - 1 : Used for edit permit commands
    - THR-CM off: Function data cannot be changed
    - THR-CM on : Function data can be changed[1)]

1) The relationship between this function and function F 00 (Data protection) is shown in the table below.

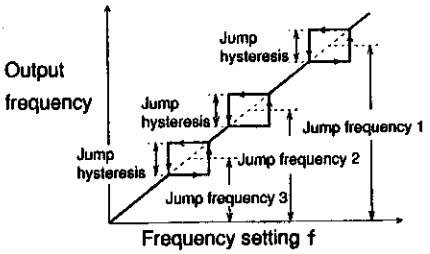
F57: Edit permit command	F00: Data protection	Data changing possible
OFF	0	No
OFF	1	No
ON	0	Yes
ON	1	No

F 58	Jump frequency (Hysteresis)	Change during operation	=3Hz
F 59	Jump frequency 1	Change during operation	=0Hz
F 60	Jump frequency 2	Change during operation	=0Hz
F 61	Jump frequency 3	Change during operation	=0Hz

- This sets the three midpoints and the hysteresis for the jump frequencies which are used to prevent vibration from occurring at certain frequencies due to mechanical resonance between the load and the motor.

  [Jump frequency hysteresis]... The hysteresis for the frequencies to be jumped can be set in steps of 1Hz.

  [Jump frequency 1]
  [Jump frequency 2]
  [Jump frequency 3]
  The midpoints for the frequencies to be jumped can be set in steps of 1Hz. [1)2)]



[1] Even if jump frequencies have been set, they will be omitted during acceleration and deceleration.

[2] If a jump frequency is set to zero, the jump function becomes inactive.

F 62	Base frequency 2	Change during operation = 50 Hz

- This sets base frequency 2 to within the range of 15 to 400Hz in steps of 1Hz. It is used when the terminal X4 has been set to function as a command terminal for switching to base frequency 2 (F 43 = 2).

NOTE If the base frequency is greater than the maximum frequency, the output voltage will not rise to the rated voltage.
Set so that the ratio between the base frequency and the maximum frequency is less than 1:8.

F 63	Acceleration time 2	Change during operation,	=10.0 s
F 64	Deceleration time 2	Change during operation,	=10.0 s

- This sets the acceleration time 2 and deceleration time 2 when terminal X4 has been set to function as a command input terminal for switching to acceleration/deceleration time 2 (RT1: F 143 = 000) or to base frequency 2 (VF2: F 143 = 002).
  Setting details are the same as for function F 006 and F 007.

F 65 | Torque boost 2 | Change during operation | =1 3

- This sets the torque boost 2 to one of 31 patterns 1) when terminal X4 has been set to function as a command input terminal for switching to base frequency 2 (VF2: F 143 = 002).
  Setting details are the same as for function F 008.
  1) For manual torque boost only; no pattern can be selected for automatic torque boost.

※ Refer to "11-6-1 Description of torque boost" for details.

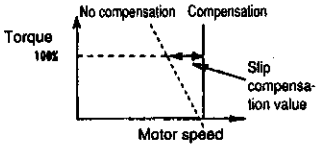
F 66	Electronic thermal overload relay 2 (Operation selection)	Change during operation ,	=0
F 67	Electronic thermal overload relay 2 (Operation level)	Change during operation ,	= Rated value for Fuji standerd 4-pole motor

- When terminal X4 has been set to function as a command input terminal for switching to base frequency 2 (VF2: F 143 = 002), this sets whether the electronic thermal overload relay 2 (motor overload detection) for the second motor is active or inactive, and also sets the operation pattern and the operation level.
  Setting details are the same as for function F 015 and F 016.

NOTE Base frequency 2, torque boost 2 and electronic thermal overload relay 2 are only active when the X4 terminal function has been set to VF2 (F 143 = 002) and X4-CM is ON (close).

F 68 | Slip compensation | Change during operation | ☞=0.0Hz

● Slip compensation (F68) is a function which provides compensation for slippages which occur as a result of the motor load torque in order to control fluctuations in motor speed. (See the graph at right.)



Slip compensation occurs as follows in accordance with the setting for this function.

F68 setting (slip compensation)	Slip compensation operation
0.0	Inactive
Other than 0.0	Compensates in accordance with the slip compensation value which has been set. Obtain the setting value by using the following equation. Slip compensation value = $\frac{(N_{B0}-N_{B1})}{N_{B0}} \times f_B$ f_B : Base frequency 1 (F04) N_{B0} : Synchronized motor speed at base frequency N_{B1} : Motor speed under 100% load at base frequency (value on motor rating plate)

F 69 | Torque vector control | Change during operation | ☞=0

● This selects whether torque vector control is active or not.

0 : Torque vector control inactive
1 : Torque vector control active

※ Refer to "11-6-4 Description of torque vector control" for details.

F 70 | Motor 1 capacity | Change during operation | ☞=1

● This set the capacity of the motor which is connected to the Inverter.

0 : 1-frame up capacity for standard applied motor
1 : Standard capacity for standard applied motor
2 : 1-frame down capacity for standard applied motor
3 : 2-frame down capacity for standard applied motor

F 0 1	Motor 1/rated current	Change during operation	= Rated value for Fuji standard 4-pole motor
F 0 2	Motor 1/no-load current	Change during operation	= Rated value for Fuji standard 4-pole motor

- These set the rated current [A] and no-load current [A] for the motor which is connected to the Inverter.

Explanation The primary resistance (R_1) and leakage reactance (X_1) are automatically rewritten with the rated value of the Fuji standard when motor capacity (F 10), motor 1/rated current F 01 and motor 1/no-load current (F 02) are set.

F 03 **Motor 2/rated current** Change during operation = Rated value for Fuji standard 4-pole motor

- This sets the rated current [A] for the second motor which is selected when base frequency 2 (F 82) is active.

F 04 **Automatic tuning** Change during operation = 0

- This function is used to automatically tune the primary resistance (R_1) and leakage reactance (X_1) of the motor in order to perform the Torque Vector control.
  - 0 : Inactive
  - 1 : Automatic tuning

※ Refer to "11-6-5 Description of automatic tuning procedure" for details.

F 05 **Motor 1 (%R_1 setting)** Change during operation = Rated value for Fuji standard 4-pole motor

- This function displays the primary resistance R1 of the motor in terms of percentage, and manually sets its value.
  The data can be overwritten and changed automatically by automatic tuning using function F 04, or by setting the motor capacity, rated current and no-load current using functions F 10 to F 12.

Calculation formula for %R1

$$\%R1 = \frac{R1 + \text{cable R}}{V/(\sqrt{3}\cdot I)} \times 100\ [\%]$$

R1[1], cable R : Ω
V : Rated voltage of motor
I : Rated current of motor
[1] : Value calculated for star connection

F 7 6 | Motor 1 (%XI setting)

Change during operation

=Rated value for Fuji standard 4-pole motor

- This function displays the leakage reactance XI of the motor in terms of percentage, and manually sets its value.
  The data can be overwritten and changed automatically by automatic tuning using function F 7 4, or by setting the motor capacity, rated current and no-load current using functions F 7 0 to F 7 2.

Calculation formula for %XI

$$\%XI = \frac{X1 + X2 \cdot Xm / (X2 + Xm) + \text{Cable X}}{V / (\sqrt{3} \cdot I)} \times 100 \ [\%]$$

X1[1] : Primary inductance of motor 1[Ω]
X2[1] : Secondary inductance of motor 1[Ω]
Xm[1] : Mutual inductance of motor 1[Ω]
Cable X : [Ω]
V : Rated voltage of motor
I : Rated current of motor
[1] : Value calculated for star connection

⚠ WARNING

●%R1 and %XI should be set to values which are appropriate for the motor being used. The motor may not operate correctly if these values are not set correctly, which could result in accidents.

F 7 7 Torque limiter response (At constant speed) — Change during operation , 🖳 = 3 6 9

F 7 8 Torque limiter response (During acceleration/deceleration) — Change during operation , 🖳 = 3 9 4

- These functions set the response of the torque limiter functions during constant speed operation and during acceleration and deceleration.

000 ~ 999
I ⊔ I ⊔
P I P I

P \ I	(Quick) 0 0	· · ·	(Slow) 9 9
0 (Low)			
•			
•			
9 (High)			

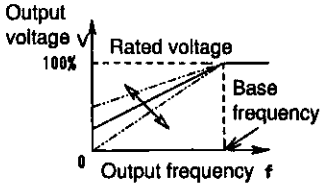
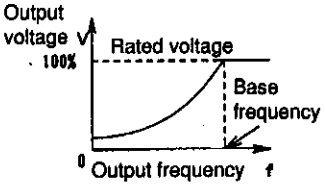
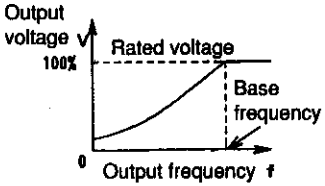
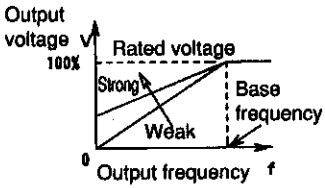
F 7 9 Option selection — Change during operation — 🖳 = 0

- This function sets whether an option is being used or not, and also what type of option is being used if any.
  - 0 : No options
  - 1 : DI option card used
  - 2 : DI/O option card used
  - 3 : RS option card used

※ For details on setting specifications methods when using an option card, refer to the instruction manual which is supplied with the option card.

11-6-1. Description of torque boost

Torque boost is a function which boosts the torque which drops during low-speed operation by compensating for insufficient magnetic flux (torque) in the motor which occurs when the voltage drops in the low-frequency range.

Torque boost classification	Torque boost setting details	Output voltage/output frequency characteristics
Automatic torque boost (*1～*5)	[0] : Automatic torque boost Automatically adjusts the torque boost value for constant torque loads which change in a linear fashion.	
Manual torque boost	[1] : Squared torque characteristics (for fan pump loads)	
	[2] : Proportional torque characteristics (for intermediate loads between squared reduction torque and constant torque)	
	[3] (Weak) ～ [31] (Strong) : Constant torque characteristics	

*1: If using this setting, be sure to set F70, F71, F72, F75 and F76 correctly.
*2: Cannot be selected if F65 is set to "Torque boost 2".
*3: Automatic torque boost cannot be used if more than one motor is being used. Use manual torque boost.
*4: It may not be possible to obtain the full level of performance when using special motors such as high-speed motors. In such cases, use manual torque boost.
*5: Refer to "Conditions for use of torque vector control and automatic torque boost" in "11-6-4. Description of torque vector control" for details of the conditions for using automatic torque boost.

⚠ WARNING	**●If the torque boost value becomes to large when constant torque characteristics have been set, overexcitation will occur. If operation continues in this state, it will cause the motor to overheat. Make the settings correctly in accordance with the characteristics of the motor being used.**

11-6-2. Description of torque limit

Operation during torque limiting

During torque limiting, the frequency is controlled so that the torque does not exceed the torque limit values set by F31 and F32. *1

This operation allows operation to continue while the torque is maintained at the limit value.

However, if the load torque suddenly changes, the torque may momentarily exceed the limit value, or overcurrent or overvoltage protection may be activated.

*1) Actual operation is as follows.

Torque limit conditions	Operation during torque limit
During driving	Output frequency is reduced
During braking	Output frequency is increased (However, the maximum amount of increase is 5Hz.)

Conditions for use of torque limit

Use torque limit under the conditions where automatic torque boost operates *2.

If this is not done, large errors may occur in the torque calculation and torque limiting may not operate correctly.

*2) If not using VF2 when automatic torque boost (F 08 = 0) or torque vector control operation (F 69 = 1) is set

⚠ WARNING	**●When the torque limiting function is being used, operation may occur at acceleration/deceleration times and speeds which are different to those that have been set. Make sure that the system is configured so that safety can be maintained even if this should happen, otherwise an accidents might result.**

11-6-3. Description of braking torque selection

Braking torque selection (F33) is a function which lets you select the braking torque during torque limiting operation with or without external braking resister

i) F 33 = 0

The torque is limited so that it is at or below the allowable braking torque set according to standard specifications.

ii) F 33 = 1

The torque is limited so that it is at or below the allowable braking torque when using an external braking resistor (DB option).

Note that braking torque selection (F33) cannot be used when the following functions have been set.

Function name	Function setting
Torque limit (during acceleration/deceleration)	F 31 = 0 : No limiting
Torque limit (during constant speed)	F 32 = 0 : No limiting

⚠ WARNING	**●If an external braking resistor is not being used, be sure to set braking torque to low (F 33 = 0), otherwise the torque limit function will not operate correctly and overvoltage trips will occur, and an accident may result.**

11-6-4. Description of torque vector control

Caution when using torque vector control

When torque vector control is set to operate (F 6 9 = [ ] [ ] [ ] 1), it operates as follows.

Function name	Function setting	Operation during torque vector control
Rate voltage value (F05)	F 0 5 = [ ] [ ] 0 : AVR function is OFF	The AVR function will be activated at the following settings. ・When 200V series is set to 200V ・When 400V series is set to 400V
	Other than F 0 5 = [ ] [ ] 0 : AVR function is ON	The AVR function will be activated at the F05 setting value.
Torque boost 1 (F08) *1	F 0 8 All data	Operates in automatic torque boost mode.
Slip compensation not operating (F68)*2	F 6 8 = [ ] 0 0 : Slip compensation not operating	Slip compensation will operate at the value for Fuji standard 4P motor.
	Other than F 6 8 = [ ] 0 0	Slip compensation will operate at the value of F68.

●Supplementary description

*1) When using a VF2, torque vector control will not operate even when F 6 9 = [ ] [ ] [ ] 1.

*2) If using a motor other than Fuji standard 4P motor or if manual slip compensation has been set, the slip compensation setting should be F 6 8 = [ ] 0 1 to [ ] 5 0.

Conditions for use of torque vector control and automatic torque boost

If any one of the conditions from ① to ④ cannot be satisfied, set torque vector control so that it does not operate F 6 9 = [ ] [ ] [ ] 0 , and set manual torque boost F 0 8 = [ ] [ ] [ ] 1 to [ ] [ ] 3 1 .

①Data for motor 1 (F70, F71, F72, F75, F76) should be set correctly.

Function code	Factory setting value
F70: Motor capacity	1
F71: Motor 1/Rated current	Rated value of Fuji standard 4P motor
F72: Motor 1/No-load current	
F75: Motor 1/%R1 setting	
F76: Motor 1/%X1 setting	

The data which has been set manually and the data which has been set automatically will be displayed as follows for each usage condition.

No.	Usage condition	Data entered manually	Data set automatically
1	When Fuji standard 4P motor is used	F 7 0	F71, F72, F75, F76
2	When a motor other than No. 1 is used	After entering in the order F70, F71 and F72, automatic tuning using F74.	F75, F76
3	If a reactor is connected between the inverter and the motor		

②The motor rated current should not be less than the inverter rated current.
The appropriate range to be set using F70 (Motor capacity) should be two frames less than the inverter capacity.

③There should be one motor for each inverter.
If more than two motor is connected to an inverter, torque vector control will not operate correctly.

④The cable length between the inverter and the motor should not exceed 50m.
If the cable is too long, the leakage current which flows via the static capacity to ground will affect control and tend to prevent control from being carried out correctly. Furthermore, control may not be carried out correctly even when an output circuit filter (OFL) is used.

11-6-5. Description of automatic tuning procedure

Automatic tuning is a function which automatically detects the motor's primary resistance %R1 (F75) and leakage reactance %X1 (F76).

Use automatic tuning if any one of the following three conditions can be met.

①A motor other than Fuji standard 4P motor is being used, and %R1 and %X1 cannot be ascertained

②The cable between the inverter and the motor is very long

③A reactor has been connected between the inverter and the motor

Automatic tuning procedure

1. Connect the inverter and the motor according to the proper connection procedure.
2. Enter the appropriate data for the following functions in accordance with the characteristics of the motor being used.

Function code	Name	Setting range	Maximum frequency
F 0 3	Maximum frequency	50~400	60
F 0 4	Base frequency 1	15~400	50
F 0 5	Rated voltage (Maximum output voltage)	80~240 (200V series)	200
		160~480 (400V series)	400
F 7 0 *1)	Motor capacity	0~3	1
F 7 1 *1)	Motor 1/Rated current	0.01~9.99	Rated value of Fuji standard 4P motor
F 7 2 *1)	Motor 1/No-load current	0.01~99.9	

*1) Be sure to enter in the order F70 → F71 → F72.

3. After checking that the inverter is stopped, carry out tuning by following steps 3-1 to 3-4 below.
   - 3-1. Set automatic tuning to operate (F04 = 1).
   - 3-2. Press the FUNC DATA key to start automatic tuning.
   - 3-3. The digital monitor on the keypad panel will show as follows during automatic tuning and immediately before and after tuning.

Automatic tuning condition	Digital monitor on keypad panel
Before tuning	1 illuminates
During tuning	1 flashes (for approx. 10 seconds)
After tuning	F75 illuminates

   - 3-4. The results of tuning can be checked using F75: %R1 and F76: %X1.

NOTE

(i)Depending on the setting for F02, emergency stopping may be caused by certain operations which are carried out during automatic tuning. (Er7 will be displayed in the digital monitor on the keypad panel.)

F02 setting	Operation which causes Er7 display
Keypad panel operation : F02 = 0	• STOP key is pressed
	• BX-CM terminals are closed (ON)
Terminal operation : F02 = 1	• STOP key is pressed
	• BX-CM terminals are closed (ON)
	• FWD-CM terminals are closed (ON)
	• REV-CM terminals are closed (ON)

(ii) If multiple motors are connected to a single inverter, or if an output circuit filter (OFL) is being used, automatic tuning calculations will not be carried out correctly. In such cases, set manual torque boost (F08 = 1 to 31).