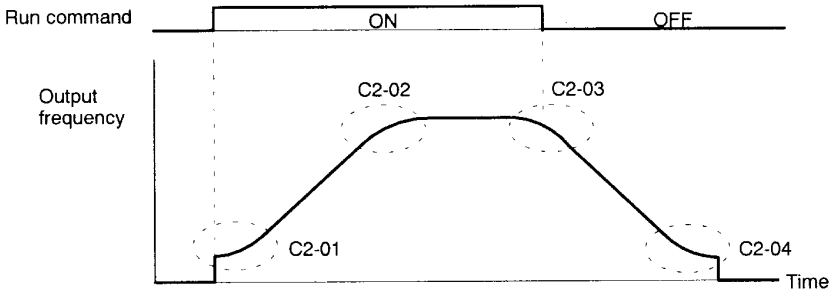
7.5.2 Tuning Constants: C

■ S-Curve Characteristic Function: C2-01 to C2-04

- Using the S-Curve characteristic function for acceleration and deceleration can reduce shock to the machinery when stopping and starting .
- With the Inverter, S-curve characteristic times can be set respectively for beginning acceleration, ending acceleration, beginning deceleration, and ending deceleration.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
C2-01	S-curve characteristic time at acceleration start	X	0.00 to 2.50	s	0.20	A	A	A	A
C2-02	S-curve characteristic time at acceleration end	X	0.00 to 2.50	s	0.20	A	A	A	A
C2-03	S-curve characteristic time at deceleration start	X	0.00 to 2.50	s	0.20	A	A	A	A
C2-04	S-curve characteristic time at deceleration end	X	0.00 to 2.50	s	0.00	A	A	A	A

- The relation between these constants is shown in *Figure 7.24*.



- When the S-curve characteristic time is set, the acceleration and deceleration times will be lengthened as follows:
  - Acceleration time = Selected acceleration time + (S-curve at beginning of acceleration + S-curve at end of acceleration) / 2
  - Deceleration time = Selected deceleration time + (S-curve at beginning of deceleration + S-curve at end of deceleration) / 2

■ Motor Slip Compensation: C3-01 to C3-04

- The motor slip compensation function calculates the motor torque according to the output current, and sets gain to compensate for output frequency.
  - This function is used to improve speed accuracy when operating with a load. It is mainly effective with V/f Control (without PG).

Slip Compensation Gain: C3-01

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
C3-01	Slip compensation gain	❍	0.0 to 2.5	Multiple	1.0 *	B	X	B	B

* When the control method is switched, the factory setting changes as follows: V/f Control: 0.0; V/f with PG: 1.0; Open-Loop Vector 0; Flux Vector: 1.0.

- When “1.0” is set, this function compensates for the rated slip that has been set, by the rated torque output.
- With Flux Vector Control, this becomes the gain to compensate for slip caused by motor temperature variation. (Refer to *7.3.6 Slip Compensation Gain: C3-01*.)

Motor Slip Compensation Gain Adjustment Procedure

1. Correctly set the motor rated slip (constant E2-02) and the motor no-load current (constant E2-03).
   - The motor rated slip can be calculated by means of the following equation, using the numbers that are shown on the motor nameplate.

     Motor rated slip = Motor rated frequency (Hz) – rated speed (RPM) x motor (number of poles) / 120
   - Set the values at the rated voltage and rated frequency for the motor no-load current. With Vector Control, the motor rated slip is automatically set by Auto-Tuning.
2. Set the slip compensation gain (constant C3-01 to "1.0". (If it is set to "0.0", slip compensation will be disabled.)
3. Operate with a load, measure the speed, and adjust the slip compensation gain (in increments of 0.1).
   - If the speed is lower than the target value, increase the slip compensation gain.
   - If the speed is higher than the target value, decrease the slip compensation gain.

Slip Compensation Primary Delay Time: C3-02

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
C3-02	Slip compensation primary delay time	X	0 to 10000	ms	200*	A	X	A	X

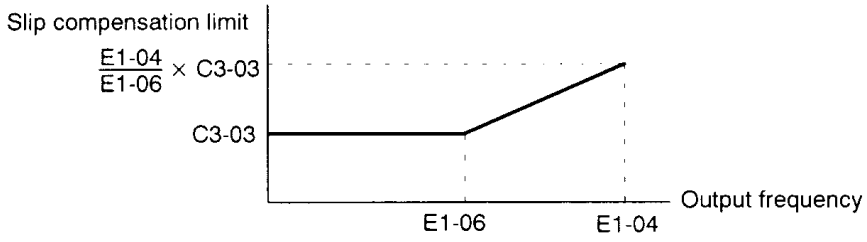
* When the control method is switched, the values change as follows: V/f Control: 2,000; Open-Loop Vector: 200

- This constant does not normally need to be set. Adjust the slip compensation primary delay time if the motor slip compensation responsiveness is low, or if the speeds are unstable.
  - If responsiveness is low, lower the setting.
  - If speeds are unstable, raise the setting.

Slip Compensation Limit: C3-03

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
C3-03	Slip compensation limit	X	0 to 250	%	200	A	X	A	X

- Constant C3-03 sets the slip compensation limit as a percentage for motor rated slip (E2-02), with the motor rated slip taken as 100%.
- If the speed is lower than the target value and does not change even when the slip compensation gain is adjusted, it is possible that the slip compensation limit has been reached. Raise the limit and then check again. Make sure, however, that the value of the sum of the reference frequency and the slip compensation limit does not exceed the speed capacity of the machinery.
- The limit is as shown in *Figure 7.25* in the constant torque and constant output areas.



E1-06: Base frequency
E1-04: Maximum output frequency

Slip Compensation Selection During Regeneration: C3-04

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
C3-04	Slip compensation selection during regeneration	X	0, 1	—	0	A	A	A	X

- Settings

Setting	Contents
0	Slip compensation disabled during regeneration.
1	Slip compensation enabled during regeneration.

- Constant C3-04 enables or disables slip compensation during regeneration.
- The amount of regeneration is momentarily increased when this function is used, so some control option (e.g., Braking Resistor, Braking Resistor Unit, Braking Unit) may be required.

■ Torque Compensation Function: C4-01, C4-02

The torque compensation function detects increases in the motor load, and increases the output torque to compensate.

Torque Compensation Gain: C4-01

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
C4-01	Torque compensation gain	❍	0.00 to 2.50	Multiple	1.00	B	B	B	X

- This constant can be changed during operation, but normally no adjustments are required. Make adjustments in the following cases under the V/f control mode:
  - If the wiring distance between the Inverter and the motor is long, raise the setting.
  - If the motor capacity is less than the Inverter capacity (the maximum application motor capacity), raise the setting.
  - If the motor generates excessive oscillation, lower the setting.
- Set the torque compensation gain so that the output current at low-speed rotation does not exceed 50% of the Inverter's rated output current.
- Do not adjust the setting if this constant is for Open-Loop Vector Control.

Torque Compensation Time Constant: C4-02

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
C4-02	Torque compensation time constant	X	0 to 10000	ms	20 *	A	A	A	X

* When the control method is switched, the factory setting changes as follows: V/f Control: 200; V/f with PG: 200; Open-Loop Vector: 20.

- The torque compensation time constant does not normally need to be adjusted, but make adjustments in the following cases:
  - If the motor generates excessive oscillation, raise the setting.
  - If motor responsiveness is low, lower the setting.

■ Carrier Frequency: C6-01 to C6-03

- The carrier frequency characteristics differ according to the control method.
  - V/f Control and V/f with PG Feedback control: Carrier frequency variable setting possible.
  - Open-Loop Vector Control and Flux Vector: Constant frequency. (Only C6-01 is active.)
- The carrier frequency does not normally need to be adjusted, but make adjustments in the following cases:
  - If the wiring distance between the Inverter and the motor is long, lower the frequency.

Wiring Distance	164 feet maximum	328 feet maximum	Over 328 feet
Carrier Frequency	15 kHz maximum	10 kHz	5 kHz maximum

  - If there are great irregularities in speed or torque, lower the carrier frequency.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
C6-01	Carrier frequency upper limit	X	2.0 to 15.0*1	kHz	15.0*2	B	B	B	B
C6-02	Carrier frequency lower limit	X	0.4 to 15.0	kHz	15.0*2	A	A	X	X
C6-03	Carrier frequency proportional gain	X	00 to 99	Multiple	00	A	A	X	X

*1 The setting range for the carrier frequency upper limit is as follows for the control methods:
- V/f Control (with or without PG): 0.4 to 15.0
- Vector Control (Open-Loop or Flux): 2.0 to 15.0

*2 The setting range and the factory setting vary according to the Inverter capacity. The table shows a value of 200 V class, 0.4 kW. (See Page 258)

- In the Vector Control modes, the carrier frequency is determined by the carrier frequency upper limit (constant C6-01). In the V/f Control modes (both with and without PG), the carrier frequency can be changed in response to the output frequency by setting the carrier frequency lower limit (constant C6-02) and the carrier frequency proportional gain (constant C6-03).

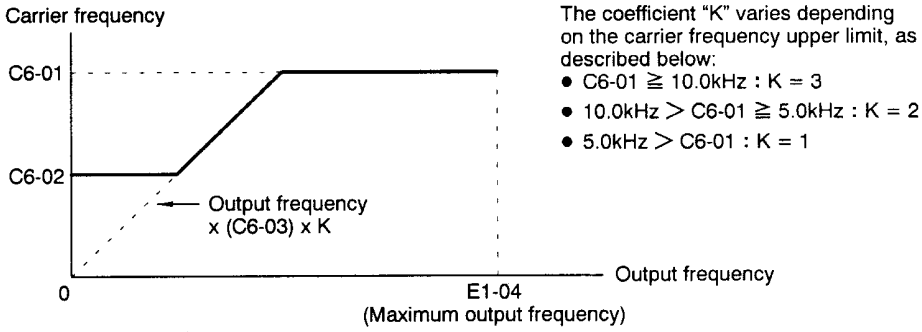


Figure 7.26 Setting the Carrier Frequency

- To make the carrier frequency constant, either set the same value for constants C6-01 and C6-02 or set the carrier frequency proportional gain (constant C6-03) to "0" (i.e., fix at upper limit value). The following settings will generate a constant setting fault (OPE11):
  - Carrier frequency upper limit (C6-01) > 5.0 kHz and carrier frequency lower limit (C6-02) ≤ 5.0 kHz
  - Carrier frequency proportional gain (C6-03) > 6 and C6-01) < (C6-02)
- If the lower limit is set higher than the upper limit, the lower limit will be disregarded and carrier frequency will be fixed at the upper limit.

7.5.3 Reference Constants: d

■ Frequency Reference Function: d2-01, d2-02

- The frequency reference function sets the output frequency upper and lower limits.
- When the frequency reference is zero and a run command is input, the motor operates at the frequency reference lower limit (d2-02). The motor will not operate, however, if the lower limit is set lower than the minimum output frequency (E1-09).

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
d2-01	Frequency reference upper limit	X	0.0 to 110.0	%	100.0	B	B	B	B
d2-02	Frequency reference lower limit	X	0.0 to 109.0	%	0.0	B	B	B	B

- The frequency reference upper and lower limits are set as a percentage of the maximum output frequency (E1-04), in increments of 1%.
- The upper and lower limits of the frequency reference are shown in *Figure 7.27*.

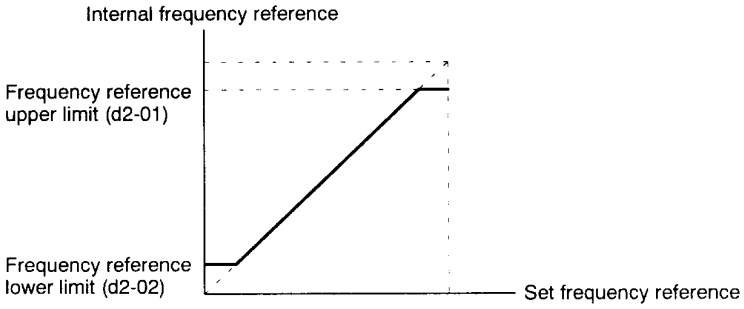


Figure 7.27 Upper and Lower Limits of the Frequency Reference

■ Prohibited Frequencies (Jump Frequencies): d3-01 to d3-04

- This function allows the prohibition or "jumping" of certain frequencies within the Inverter's output frequency range so that the motor can operate without resonant oscillations caused by some machine systems.
- It is also used for deadband control.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
d3-01	Jump frequency 1	X	0.0 to 400.0	Hz	0.0	B	B	B	B
d3-02	Jump frequency 2	X	0.0 to 400.0	Hz	0.0	B	B	B	B
d3-03	Jump frequency 3	X	0.0 to 400.0	Hz	0.0	B	B	B	B
d3-04	Jump frequency width	X	0.0 to 20.0	Hz	1.0	B	B	B	B

- To disable this function, set the jump frequency references (d3-01 to d3-03) to 0.0 Hz.
- For d3-01 to d3-03, set the center values of the frequencies to be jumped. Be sure to set the jump frequency so that d3-03 ≦ d3-02 ≦ d3-01.
- For d3-04, set the jump frequency bandwidth. The jump frequency ± the jump frequency bandwidth becomes the jump frequency range.
- Operation is prohibited within the jump frequency range, but changes during acceleration and deceleration are smooth with no jumps.
- The relation between the internal frequency and the set frequency references is shown in *Figure 7.28*.

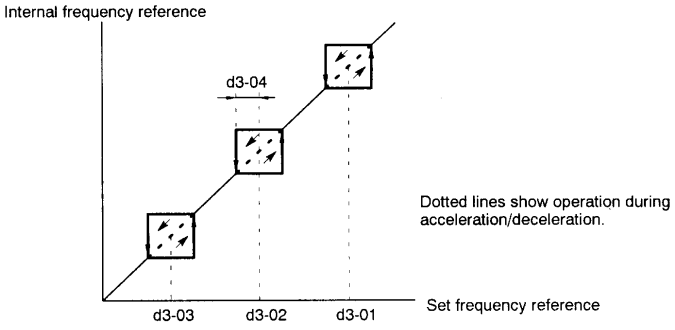


Figure 7.28 Setting Prohibited Frequencies

Hold Reference Memory Selection: d4-01

- Constant d4-01 is enabled by making either of the following settings for the multi-function inputs (H1-01 to H1-06).
  - Acceleration/deceleration ramp hold (Setting A).
  - Up command (Setting 10)/down command (Setting 11).
- When hold status is established by these external signals, specify whether or not the output frequency is to be retained.
- When this function is enabled, operation is re-started after power-up using the frequency reference value that was retained.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
d4-01	Frequency reference hold function selection	X	0, 1	—	0	A	A	A	A

- Settings

Setting	Description
0	Disabled. Restart after operation stoppage or power-up begins at zero.
1	Enabled. Restart after operation stoppage or power-up begins at the held frequency reference.

- For information regarding the acceleration/deceleration stop (hold) command and the up/down command, refer to the description of *Multi-Function Inputs (H1)* under *7.5.5*.

Trim Control Level: d4-02

- The trim control level is valid when the Trim Control increase command (Setting 1C) or Trim Control decrease command (Setting 1D) is set for a multi-function input (H1-01 to H1-06).
- If the Trim Control increase command is ON when a frequency reference is input on the analog input, the Trim Control level will be added to the analog frequency reference and then output as the output frequency. If the Trim Control decrease command is ON, the frequency reference will be decreased by the Trim Control level.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
d4-02	+ - Speed limits	X	0 to 100	%	25	A	A	A	A

- Set the Trim Control level as a percentage of the maximum output frequency.
- If the frequency reference minus the Trim Control level is less than zero, the output frequency will be zero.
- Refer to the description of *Multi-Function Inputs (H1)* under *7.5.5* for details on the Trim Control increase and Trim Control decrease commands.

7.5.4 Option Constants: F

Installing Option Cards

A maximum of three Option Cards can be installed the Inverter. The installation location of each is determined by the type of card. Be sure to install the cards in their correct locations.

Table 7.7 Option Card Specifications

Type of Card	Model	Specifications	Location
Analog Reference Card	AI-14U	14-bit analog, 2 inputs (voltage/current)	C
	AI-14B	14-bits analog, 3 inputs	C
Digital Reference Card	DI-08	8-bit digital input (BCD/binary)	C
	DI-16H2	16-bit digital input (BCD/binary)	C
PG Speed Option Card	PG-A2	Open-collector/complementary, single input	A
	PG-B2	Complementary, A-/B-Phase input	A
	PG-D2	Line-driver, single input	A
	PG-X2	Line-driver, A-/B-Phase input	A
Analog Monitor Card	AO-08	8-bit analog output, 2 channels	D
	AO-12	12-bit analog output, 2 channels	D
Pulse Monitor Card	PO-36F	Pulse frequency output	D

Installation Procedure

1. Turn OFF the Inverter's main-circuit power supply. Wait at least one minute (or at least three minutes for models of 30 kW or more).
2. Remove the Inverter's front cover. Check to be sure that the CHARGE LED is turned OFF.
3. Check the Option Card's installation location (A, C, or D). (See *Figure 7.29*.)
4. Insert the accessory spacer into the spacer mounting hole in the Inverter mounting base.
5. Align the Option Card connector with the connector position on the control board, and then pass the spacer to the spacer mounting hole on the card. Press firmly until the spacer snaps into place.
6. Connect the Option Card's FG connection line to the Inverter ground terminal (Terminal 12).

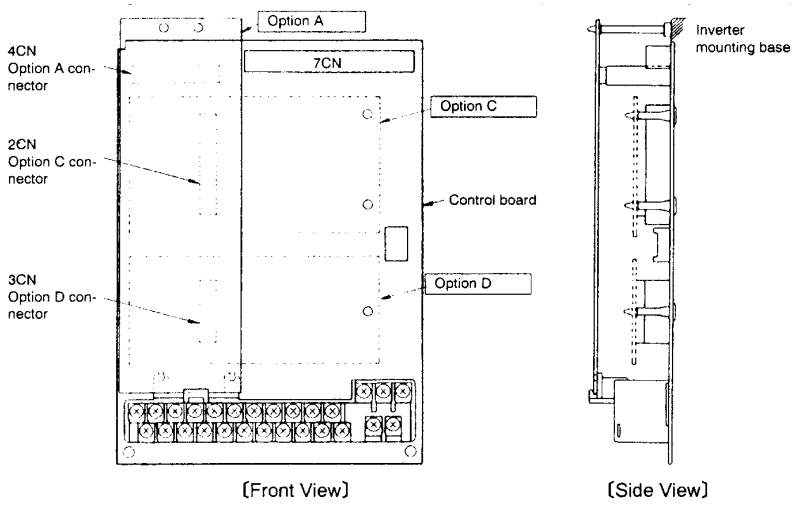


Figure 7.29 Installation Locations for Option Cards

■ Analog Reference Card: F2-01

- When using a AI-14B/AI-14U Analog Reference Card, set constant b1-01 (reference selection) to "3" (option).
- When using a AI-14B, set the function for channels 1 to 3 with constant F2-01. (There are no constants to set for AI-14U.)

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
F2-01	Bi-polar or uni-polar input selection	X	0, 1	—	0	B	B	B	B

- Settings

Setting	Description
0	3-channel individual input (CH1: Terminal 13; CH2: Terminal 14; CH3: Terminal 16) (b1-01 = 1)
1	3-channel additional input (Sum of CH1 to CH3 is used as the frequency reference value.) (b1-01 = 3)

- Constant b1-01 (reference selection) must be set to "1" (external terminal), when 3-channel individual input (Setting 0) is set.
- When using a AI-14B and setting 3-channel individual input, the multi-function inputs cannot be set to the Option/Inverter selection function (Setting 2).

■ Digital Reference Card: F3-01

- When using a DI-08 or DI-16H2 Digital Reference Card, set constant b1-01 (reference selection) to "3" (option) and set the input method with constant F3-01.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
F3-01	Digital input option	X	0 to 7	—	0	B	B	B	B

- Settings

Setting	Description
0	BCD 1% unit
1	BCD 0.1% unit
2	BCD 0.01% unit
3	BCD 1 Hz unit
4	BCD 0.1 Hz unit
5	BCD 0.01 Hz unit
6	BCD special setting (5-digit input) (Only when DI-16H2 is used.)
7	Binary input (Setting is displayed in decimal notation.)

- The maximum frequency (100% speed) reference will be used when the binary input is set (Setting 7) and all bits are "1".
  - DI-08: Maximum output frequency reference (255/100%).
  - DI-16H2: Maximum output frequency reference (16 bits: 30000/100%, 12 bits: 4095/100%).
- Setting 6, BCD special setting (5-digit input), is valid only when the DI-16H2 is used. Using this setting, a frequency from 0.00 to 399.98 Hz can be set in BCD. The data input method is different from that for settings 1 to 5.

Setting: 1 to 5	Sign	8×10^3	4×10^3	2×10^3	1×10^3	...	8×10^0	4×10^0	2×10^0	1×10^0
Setting: 6	2×10^4	1×10^4	8×10^3	4×10^3	2×10^3	...	1×10^1	8×10^0	4×10^0	2×10^0

- The sign bit is used as a data bit, so only positive (plus) data can be set.
- The second digit below the decimal point is set by bits 8×10^0, 4×10^0, and 2×10^0, so the settings are made in units of 0.02 Hz. (If these three bits are "111", "110", and "101", they will be recognized as "9".)

Analog Monitor Card: F4-01 to F4-04

- When using an AO-08 Analog Monitor Card, set the monitor items and gain with the following constants.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
F4-01	Channel 1 monitor selection	X	1 to 35	—	2	B	B	B	B
F4-02	Channel 1 gain	❍	0.00 to 2.50	Multiple	1.00	B	B	B	B
F4-03	Channel 2 monitor selection	X	1 to 35	—	3	B	B	B	B
F4-04	Channel 2 gain	❍	0.00 to 2.50	Multiple	0.50	B	B	B	B

- For the output monitor selections (F4-01, F4-03), set the numbers for the right side of the "U1" constants in *Table 4.3*. The setting range is 1 to 35, but the following numbers cannot be set: 4, 10, 11, 12, 13, 14, 25, and 28 to 35.
- When the AO-12 is used, outputs of 0 to ±10 V are possible. For that, set constant H4-07 (multi-function analog output signal level selection) to "1" (0 to ±10 V outputs). There are some monitor items. However, that can only use outputs of 0 to +10 V even if constant H4-07 is set to"1".
- When the AO-08 is used, only outputs of 0 to +10 V are possible regardless of the constant H4-07 setting.

DO-02 Digital Output Card Settings: F5-01, F5-02

- Set the output selections in the following constants when using a DO-02 Digital Output Card.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
F5-01	Channel 1 output selection	X	00 to 37	—	0	B	B	B	B
F5-02	Channel 2 output selection	X	00 to 37	—	1	B	B	B	B

- Set the values from *Table 7.10*.

DO-08 Digital Output Card Settings: F6-01

- Set the output mode in the following constants when using a DO-08 Digital Output Card.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
F6-01	Output mode selection	X	0, 1	—	0	B	B	B	B

- The items output from the DO-08 will be as follows according to the setting of F6-01.

Setting	Terminal	Output	
0: 8 channels of individual outputs	TD5-TD11	Overcurrent (SC, OC, GF)	
	TD6-TD11	Overvoltage (OV)	
	TD7-TD11	Inverter overload (OL2)	
	TD8-TD11	Fuse blown (PUF)	
	TD9-TD11	Overspeed (OS)	
	TD10-TD11	Inverter overheat (OH1) or motor overload (OL1)	
	TD1-TD2	Zero speed detection	
	TD3-TD4	Speed agree	
1: Binary code output	TD5-TD11	Bit 0	Binary code (see below)
	TD6-TD11	Bit 1	
	TD7-TD11	Bit 2	
	TD8-TD11	Bit 3	
	TD9-TD11	Zero speed detection	
	TD10-TD11	Speed agree	
	TD1-TD2	Running	
	TD3-TD4	Minor fault	

- Coded Outputs

Bit 3210	Meaning	Bit 3210	Meaning
0000	No fault	1000	External fault (EFXX)
0001	Overcurrent (SC, OC, GF)	1001	Controller fault (CPFXX)
0010	Overvoltage (OV)	1010	Motor overload (OL1)
0011	Inverter overload (OL2)	1011	Not used
0100	Inverter overheat (OH, OH1)	1100	Power loss (UV1, UV2, UV3)
0101	Overspeed (OS)	1101	Excessive speed deviation (DEV)
0110	Fuse blown (PUF)	1110	PG disconnected (PGO)
0111	Braking Resistor Unit overheat (RH) Braking Transistor fault (RR)	1111	Not used

Pulse Monitor Card: F7-01

- When using a PO-36F Pulse Monitor Card, set the output pulse in constant F7-01.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
F7-01	Frequency multiple selection	X	0 to 4	—	1	B	B	B	B

- Settings

Setting	Description	
0	1F	1 x Inverter output frequency
1	6F	6 x Inverter output frequency
2	10F	10 x Inverter output frequency
3	12F	12 x Inverter output frequency
4	36F	36 x Inverter output frequency

- "F" indicates the output frequency (Hz). For example, if "0" (1F) is set, when the output frequency is 60 Hz there will be an output of 60 pulses per second. (Duty 50%.)

7.5.5 External Terminal Functions: H

This section describes the settings for the external terminal functions.

■ Multi-Function Input Settings: H1

The settings and functions for the multi-function inputs are listed in *Table 7.8*.

Table 7.8 Multi-Function Input Functions

Setting Value	Function	Control Method			
		V/f	V/f with PG	Open-Loop Vector	Flux Vector
0	3-wire sequence (Forward/Reverse run command)	❍	❍	❍	❍
1	Local/Remote selection (ON: Operator, OFF: Constant setting)	❍	❍	❍	❍
2	Option/Inverter selection (ON: Option card)	❍	❍	❍	❍
3	Multi-step speed reference 1 When H3-05 is set to “0”, this function is combined with “Master/auxiliary speed switch”.	❍	❍	❍	❍
4	Multi-step speed reference 2	❍	❍	❍	❍
5	Multi-step speed reference 3	❍	❍	❍	❍
6	Jog frequency reference (higher priority than multi-step speed reference)	❍	❍	❍	❍
7	Accel/Decel time 1	❍	❍	❍	❍
8	External baseblock NO (NO contact: Baseblock at ON)	❍	❍	❍	❍
9	External baseblock NC (NC contact: Baseblock at OFF)	❍	❍	❍	❍
A	Accel/Decel ramp hold (ON: Accel/decel stopped, frequency on hold)	❍	❍	❍	❍
B	OH2 alarm signal input (ON: OH2 will be displayed)	❍	❍	❍	❍
C	Multi-function analog input selection (ON: Enable)	❍	❍	❍	❍
D	No V/f Control with PG (ON: Speed feedback control disabled) (normal V/f Control)	X	❍	X	X
E	Speed Control integral reset (ON: Integral control disabled)	X	❍	X	❍
F	Not used (Do not input this setting)	—	—	—	—
10	Up command (Always set with the down command)	❍	❍	❍	❍
11	Down command (Always set with the up command)	❍	❍	❍	❍
12	FJOG command (ON: Forward run at jog frequency d1-09)	❍	❍	❍	❍
13	RJOG command (ON: Reverse run at jog frequency d1-09)	❍	❍	❍	❍
14	Fault reset (Reset when turned ON)	❍	❍	❍	❍
15	Emergency stop (ON: Deceleration to stop in emergency stop time C1-09)	❍	❍	❍	❍
16	Motor switch command (Motor 2 selection)	❍	—	❍	—
18	Timer function input (Functions are set with b4-01, b4-02 and the timer function is set at the same time)	❍	❍	❍	❍
19	PID Control disable (ON: PID Control disabled)	❍	❍	❍	❍
1A	Accel/Decel time 2	❍	❍	❍	❍
1B	Constants write enable (ON: All constants can be written-in. OFF: All constants other than frequency monitor are write protected)	❍	❍	❍	❍
1C	Trim Control increase (ON: d4-02 frequencies are added to analog frequency references)	❍	❍	❍	❍
1D	Trim Control decrease (ON: d4-02 frequencies are subtracted from analog frequency references)	❍	❍	❍	❍
1E	Analog frequency reference sample/hold	❍	❍	❍	❍
1F	Frequency reference Terminal 13/14 selection (ON: selects Terminal 14)	❍	❍	❍	❍
20~2F	External fault (Desired settings possible) Input mode: NO contact/NC contact Detection mode: Normal/during operation Stopping method: Deceleration to stop, coast to stop, emergency stop or continue operation	❍	❍	❍	❍
30	PID Control integral reset (ON: Reset)	❍	❍	❍	❍
60	DC Injection Braking command (ON: Performs DC Injection Braking)	❍	❍	❍	❍
61	External speed search command 1: Maximum output frequency (ON: speed search)	❍	X	❍	X
62	External speed search command 2: Set frequency (ON: speed search)	❍	X	❍	X
63	Energy Saving command (ON: Energy Saving Control set for b8-01, b8-02)	❍	❍	X	X
64	External speed search command 3	❍	❍	❍	❍
65	KEB (deceleration at momentary power loss) command (NO contact)	❍	❍	❍	❍
66	KEB (deceleration at momentary power loss) command (NO contact)	❍	❍	❍	❍
71	Speed/Torque Control change (ON: Torque Control)	X	X	X	❍
72	Zero Servo command (ON: Zero Servo)	X	X	X	❍
77	Speed Control (ASR) proportional gain switch (ON: C5-03)	X	X	X	❍

Constant Settings

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vecto r
H1-01	Multi-function input 1 (Terminal 3)	X	0 to 77	—	24	B	B	B	B
H1-02	Multi-function input 2 (Terminal 4)	X	0 to 77	—	14	B	B	B	B
H1-03	Multi-function input 3 (Terminal 5)	X	0 to 77	—	3(0)	B	B	B	B
H1-04	Multi-function input 4 (Terminal 6)	X	0 to 77	—	4(3)	B	B	B	B
H1-05	Multi-function input 5 (Terminal 7)	X	0 to 77	—	6(4)	B	B	B	B
H1-06	Multi-function input 6 (Terminal 8)	X	0 to 77	—	8(6)	B	B	B	B

- The factory settings in parentheses are for when the unit is initialized for 3-wire control.
- The following table shows the settings and section references for some common functions.

Function	Setting	Section
3-Wire Sequence (Forward/Reverse Run Command)	0	6.1.8
Multi-Step Speed References 1 to 3 and Jog Frequency Reference	3 to 6	6.1.8
Accel/Decl Time 1 and 2	7, 1A	6.1.8
Emergency Stop	15	6.1.8
FJOG/RJOG Commands	12, 13	6.1.8
Terminal 13/14 Switch	1F	6.1.8
Timer Function Input	18	7.5.1
Energy Saving Command	63	7.2.1, 7.4.1

Local/Remote Selection (Setting 1)

OFF	Operate with the frequency reference and run command specified in b1-01 (the frequency reference source) and b1-02 (run source).
ON	Operate with the frequency reference and run command set at the Digital Operator.

- With this setting, the multi-function input selects the input method for the frequency reference and run command.
- The input method can be switched only when the Inverter is stopped.
- The Digital Operator LOCAL/REMOTE key is disabled when this function has been set in a multi-function input.

Option Card/Inverter Selection (Setting 2)

OFF	The Inverter frequency reference is enabled.
ON	The Option Card frequency reference is enabled.

- With this setting, the multi-function input enables the frequency reference input from the Inverter itself or the one form Option Card. The frequency reference input can be switched only when the Inverter is stopped.
- Be sure that b1-01 (the frequency reference source selector) has been set to – (Operator) or 1 (external terminal). Only the frequency reference from the Option Card will be enabled if b1-01 is set to 3 (Option PCB).
- Setting 2 cannot be selected if the AI-14B is being used and constant F2-01 (AI-14 Input Selector) is set to 0.

External Baseblock NO (Setting 8)

OFF	Normal operation
ON	Baseblock

External Baseblock NC (Setting 9)

OFF	Baseblock
ON	Normal operation

- With either of these settings, the multi-function input controls baseblock operation.
- Baseblock is an interruption of the Inverter output. The motor coasts while the baseblock command is being input.

- The output frequency is retained internally, so the same frequency will be output again when the baseblock command is cleared. The output frequency will change in a step pattern when the output resumes, so take some safety precaution such as turning OFF the run command – especially if the baseblock command was input when the motor was operating at high speed. (When the run command is turned OFF, the internally retained output frequency is reset to zero.)

- After a baseblock command is cleared, the voltage will be restored in the voltage recovery time set in L2-04.

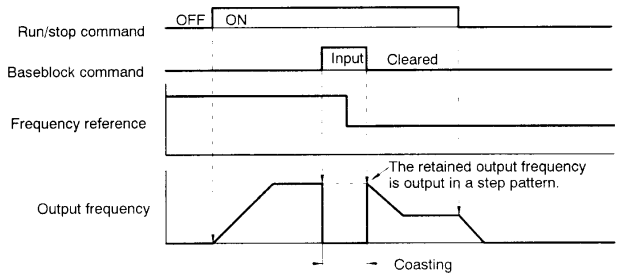


Figure 7.30 Baseblock Command

Acceleration/Deceleration Ramp Hold (Setting A)

OFF	Normal operation or restart acceleration/deceleration.
ON	Pause acceleration/deceleration and maintain the present frequency.

- With this setting, the multi-function input pauses acceleration or deceleration and maintains (holds) the output frequency.

- Acceleration/deceleration is restarted when the acceleration/deceleration ramp hold input is turned OFF.

- The motor will be stopped if a stop command is input while the acceleration/deceleration ramp hold input is ON.

- When constant d4-01 (the frequency reference hold function selector) is set to 1, the held frequency will be stored in memory. This stored frequency will be retained even after a power loss and the motor will be restarted at this frequency when a run command is input again.

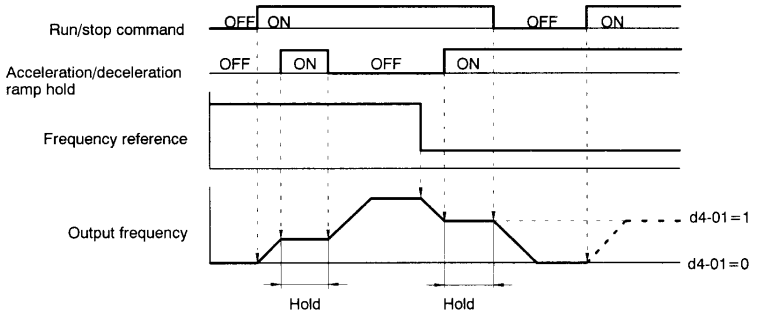


Figure 7.31 Acceleration/Deceleration Ramp Hold

- Then d4-01 is set to 1, the held output frequency will be retained. To operate at this frequency even after the Inverter is stopped, input the run command with the acceleration/deceleration ramp hold input ON.

- When d4-01 is set to 0, the output frequency will be held at zero if the run command is input with the acceleration/deceleration ramp hold input ON.

OH2 Alarm Signal (Setting B)

OFF	Normal operation
ON	Normal operation (The warning message “OH2” will be displayed on the Digital Operator.)

- The message “OH2” will be displayed on the Digital Operator while the multi-function input is ON and the display will revert to its previous status when the input is turned OFF. (It is not necessary to reset the alarm.) The Inverter will continue operation without detecting a fault.

- With this setting, a temperature sensor can be connected to the multi-function input to display a warning message when the temperature rises too high.

Multi-Function Analog Input Selection (Setting C)

OFF	Disables the multi-function analog input (Terminal 16).
ON	Enables the multi-function analog input (Terminal 16).

- With this setting, the multi-function input can be used to enable or disable the multi-function analog input.
- Turning the input OFF has the same effect as setting H3-05 (the multi-function analog input selector for Terminal 16) to 1F.

No V/f Control with PG (Setting D)

OFF	V/f Control with PG Feedback (enables Speed Control with Speed Feedback)
ON	Normal V/f Control (disables Speed Feedback Control)

- With this setting, the multi-function input can be used to switch "V/f Control with PG Feedback" to "Normal V/f Control". It is possible to switch between these control methods during operation.
- Acceleration/deceleration is restarted when the acceleration/deceleration ramp hold input is turned OFF.

Speed Control Integral Reset (Setting E)

OFF	Operates with PI Control Speed Control Loop.
ON	Operates with P Control Speed Control Loop. (The speed control integral values are reset by the integral time constant.)

- This function is valid only for V/f Control with PG Feedback when constant F1-07 is set to 0. (Setting F1-07 to 0 disables integral operation during acceleration/deceleration.)
- It is possible to switch between these Speed Control modes during operation.

Up and Down Commands (Setting 10 and 11)

Up Command	ON	OFF	ON	OFF
Down Command	OFF	ON	ON	OFF
Operation	Acceleration	Deceleration	Hold	Hold

- With these settings, the multi-function inputs can be used to control the Inverter's output frequency.
- When using this function, be sure to set both the up command (Setting 10) and the down command (Setting 11) for 2 multi-function inputs. An OPE03 option fault will occur if only one of these commands is set or if an acceleration/deceleration ramp hold input (Setting A) is set at the same time.
- Be sure to set constant b1-02 (the run command source selector) or 1 (external terminal). The up/down function will not operate with any other b1-02 setting.
- The frequency up/down commands operate according to the normal acceleration/deceleration times in C1-01 to C1-08.
- The upper and lower limits for the output frequency with the up/down commands are determined by the following settings:
  - Upper limit = Maximum output frequency (E1-04) x Reference upper limit (d2-01) / 100
  - Lower limit = Maximum output frequency (E1-04) x Reference lower limit (d2-02) / 100
- When frequency reference (voltage) Terminal 13 or frequency reference (current) Terminal 14 is being used as a frequency reference input, the greatest frequency value becomes the lower limit.
- When the up/down function is being used, the output frequency will be accelerated to the lower limit if a run command is input.
- When the up/down function and jog frequency reference are both assigned to multi-function inputs, an ON jog frequency reference input has the highest priority.
- Multi-step speed references 1 to 8 are all disabled when the up/down function has been set.
- The output frequency held the up/down function will be stored in memory if d4-01 (the frequency reference hold function selector) is set to 1. This output frequency will be retained even after the power loss, and operation will be restarted at this frequency the next time that a run command in input. The stored output frequency will be cleared from memory if the up or down command is turned ON while the run command is OFF (see "Reference Frequency Reset" in *Figure 7.32*).

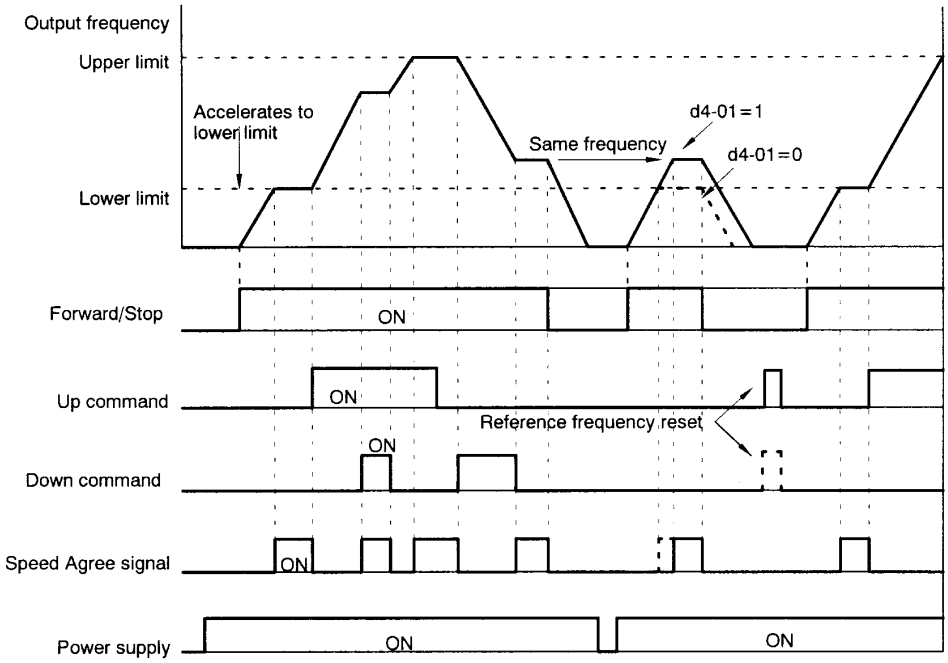


Figure 7.32 Timing Chart for Up and Down Commands

Fault Reset (Setting 14)

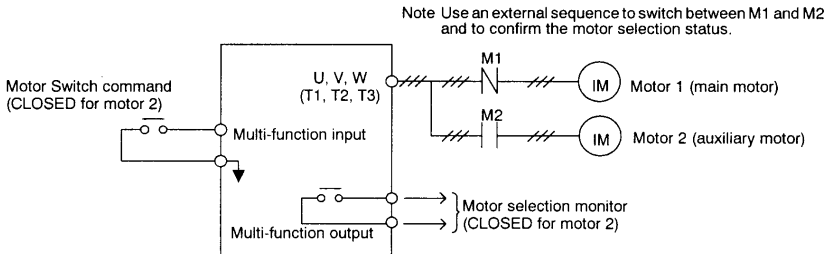
OFF	Normal Operation
ON	Resets faults when input goes from OFF to ON. (Normal operation when no fault has occurred.)

- With this setting, the multi-function input resets faults that have occurred.
- When a fault has occurred, be sure to find out what kind of fault occurred, take steps to correct the cause of the fault, and restart the Inverter. It is possible to damage the Inverter by repeatedly resetting a fault without correcting the cause.
- To resume operation after a fault has occurred, turn the run command OFF, turn the fault reset input from ON to OFF, and then turn the run command ON again. A fault cannot be reset while the run command is ON.
- If a fault has not occurred, turning the fault reset ON and OFF will have no effect on operation.

Motor Switch Command (Motor 2 Selection, Setting 16)

- CLOSED: Motor 2 constants used.

Operation



- The control method, V/f characteristics, and motor constants recorded in the Inverter can be switched by setting “16” (motor switch command) for a constant from H1-01 to 06 (multi-function inputs), and then inputting a signal while the motor is stopped.

- The current motor selection can be monitored at a multi-function output terminal by setting “1C” (motor selection monitor) for a constant from H2-01 to 03 (multi-function outputs).
- Set the Basic (3) or Advanced (4) access level in the Initialize setting A1-01 (access level).
- The constants being used will changed as shown in the following table for the motor switch command.

Motor Switch Command	OPEN (Motor 1)	CLOSED (Motor 2)
Control Method	A1-02 (control method in Initialize settings)	E3-01 (Motor 2 control method)
V/f Characteristics	E1-04 to 13 (V/f characteristics)	E4-01 to 07 (Motor 2 characteristics)
Motor Constants	E2-01 to 09 (Motor constants)	E5-01 to 06 (Motor 2 motor constants)
Motor Selection Monitor	OPEN	CLOSED

- The timing chart for switching between Motor 1 and Motor 2 is shown below.

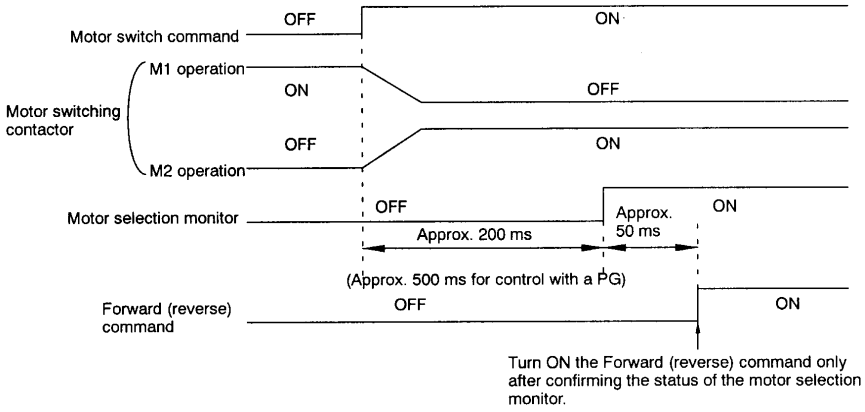


Figure 7.33 Timing Chart for Switching from Motor 1 to Motor 2

PID Control Disable (Setting 19)

OFF	Enables PID Control.
ON	Disables PID Control. (Normal Inverter Control)

- With this setting, the multi-function input switches between PID Control and normal Inverter control. This function can be used to perform trial operation or jog operation with normal Inverter control (Open-Loop Control) and then switch to PID Control (Closed-Loop Control using feedback) after adjusting the system. The PID disable function can also be used to switch to Open-Loop Control when there is a problem with the feedback value.

Constants Write Enable (Setting 1B)

OFF	Write protects all constants except for frequency monitor.
ON	Allows constants specified in Initialize mode to be changed.

- With this setting, the multi-function input can be used to write-protect the Operator constants. When the input is OFF, the Operation mode frequency can be monitored and the frequency can be changed but other changes are prohibited.

Trim Control Increase and Decrease (Settings 1C and 1D)

Trim Control Increase	ON	OFF	ON	OFF
Trim Control Decrease	OFF	ON	ON	OFF
Output Frequency	Reference frequency + Trim Control level (d4-02)	Reference frequency-Trim Control level (d4-02)	Reference frequency	Reference frequency

- The trim increase function adds the level in d4-02 to the analog frequency reference.
- The Trim Control decrease function subtracts the level in d4-02 to the analog frequency reference.
- These functions are effective when the frequency reference is input from an analog input. These functions must both be set at the same time or an OPE03 fault will occur. The analog frequency reference will not be changed when both the Trim Control increase and decrease inputs are ON. The output frequency will be zero when the Trim Control decrease input is ON and the result of the subtraction is less than zero.

Analog Frequency Reference Sample/Hold (Setting 1E)

- The analog input value will become the frequency reference 100 ms after the multi-function input closes.

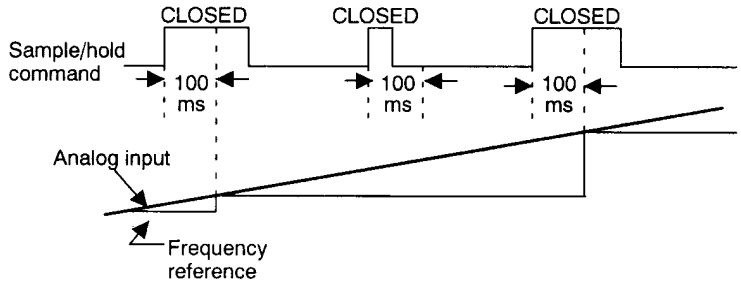


Figure 7.34 Analog Frequency Reference Sample/Hold

- The analog frequency reference sample/hold function is valid only for Terminals 13, 14 and 16 or for the analog inputs from the AI-14U or AI-14B.
- An OPE03 fault will occur if two or more of the following signals turn ON at the same time: acceleration/deceleration ramp hold command (0A), up/down commands (10 or 11), Trim Control increase/decrease commands (1C or 1D), and the analog frequency reference sample/hold command.

External Faults (Setting 20 to 2F)

- With this setting, the multi-function input can be used to stop the Inverter or output an alarm when a malfunction or fault occurs in a peripheral device.
- There are 16 external fault inputs available with all 16 combinations of the following variables. Select the setting with the desired combination.
  - Input Level: Normally open or normally closed
  - Detection Method: Always or during operation only
  - Operation Selection: Deceleration to Stop, Coast to Stop, Emergency Stop or Continue Operation

Table 7.9 External Fault Settings

Setting	Input Level		Detection Method		Operation Selection			
	NO Contact	NC Contact	Always	During Operation	Deceleration to Stop (Fault)	Coast to Stop (Fault)	Emergency Stop (Fault)	Continue Operation (Alarm)
20	❍		❍		❍			
21		❍	❍		❍			
22	❍			❍	❍			
23		❍		❍	❍			
24	❍		❍			❍		
25		❍	❍			❍		
26	❍			❍		❍		
27		❍		❍		❍		
28	❍		❍				❍	
29		❍	❍				❍	
2A	❍			❍			❍	
2B		❍		❍			❍	
2C	❍		❍					❍
2D		❍	❍					❍
2E	❍			❍				❍
2F		❍		❍				❍

- For the input level, select whether you want a fault to be detected when the input signal is ON (normally open input) or OFF (normally closed input).
- For the detection method, select whether you want faults to be detected any time that the Inverter is ON or only during operation.

- For the operation selection, select the processing method that you want to be performed when a fault has been detected.
  - Deceleration to Stop: A fault is output and the output stopped in the selected deceleration time.
  - Coast to Stop; A fault is output and the output stopped in the emergency stop time (C1-09).
  - Continue Operation: An alarm is output and operation continues.
- When an alarm is going to be output externally, be sure to set one of the multi-function outputs (H2-01, 02, and 03) to alarm (Setting 10).
- An external fault setting cannot be set in more than one multi-function input.
- Unlike other constant settings, the external fault settings have an input procedure, as shown in the following diagrams.

Setting Procedure

1. When setting an external fault function, press the Enter key when “External Fault” is displayed to bring up the “Input Level” display.

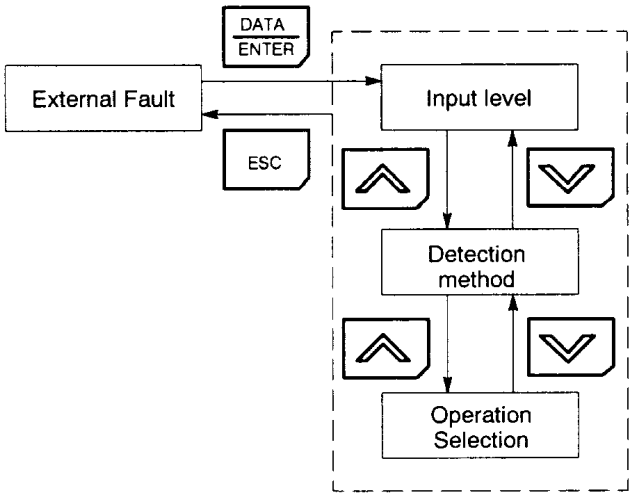


Figure 7.35 Setting Procedure for External Fault Function

2. Press the Increment key to switch displays as follows:
   “Detection Method” ➞ “Operation Selection” ➞ “Input Method”
3. Press the Enter key at the desired constant to select that constant.

   At this point, the Increment and Decrement keys can be pressed to scroll to the available settings for the selected constant. Press the Enter key to select the displayed constant setting. (Press the Escape key to cancel the operation without changing the constant setting.)

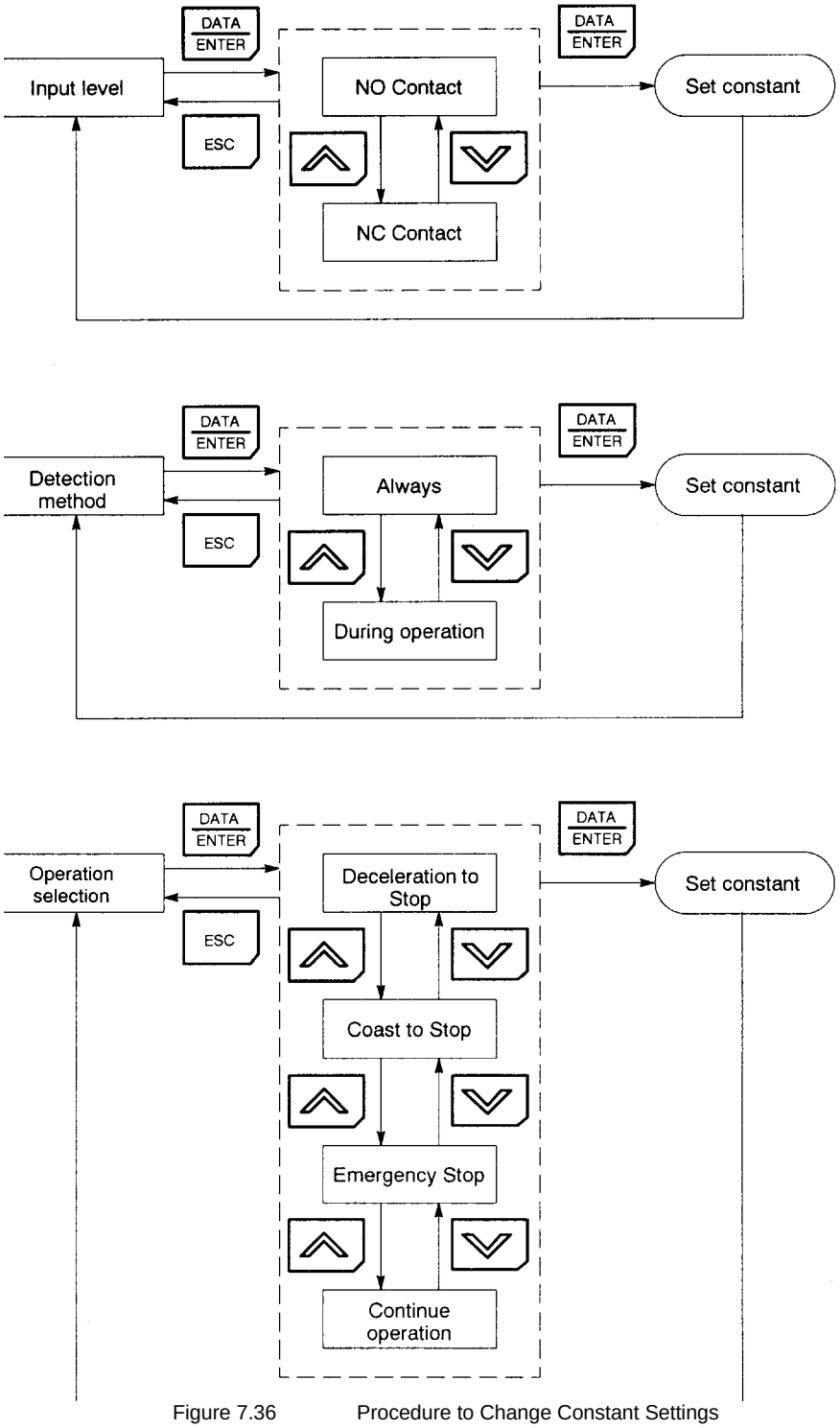


Figure 7.36 Procedure to Change Constant Settings

DC Injection Braking Command (Setting 60)

OFF	Normal operation
ON	Applies DC Injection Braking if the Inverter is stopped. (Applies initial excitation when Flux Vector Control is being used.)

- DC Injection Braking is used to prevent the motor from rotating due to inertia or external forces when the Inverter is stopped.
- DC Injection Braking is performed if the DC Injection Braking input is ON while the Inverter is stopped.
- If a run command or jog command (jog, forward jog, or reverse jog) is input, the DC Injection Braking will be cleared and motor operation will be started.

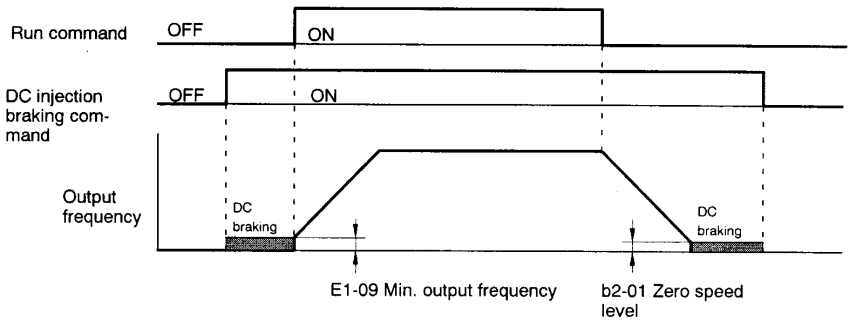


Figure 7.37 Timing Chart for DC Injection Braking Command

External Speed Search 1 (Setting 61)

OFF	Normal Operation
ON	Starts a speed search from the maximum output frequency.

External Speed Search 2 (Setting 62)

OFF	Normal Operation
ON	Starts a speed search from the set frequency (from the current reference frequency when the external search command turn ON).

- Either one of the external search functions can be set, but not both.
- The speed search function can be used to operate the motor without tripping when switching operation from a commercial power supply and the Inverter or starting a coasting motor.
- The speed search will begin after the minimum baseblock time (L2-03) has elapsed when the run command is input after the external search command has been turned ON.

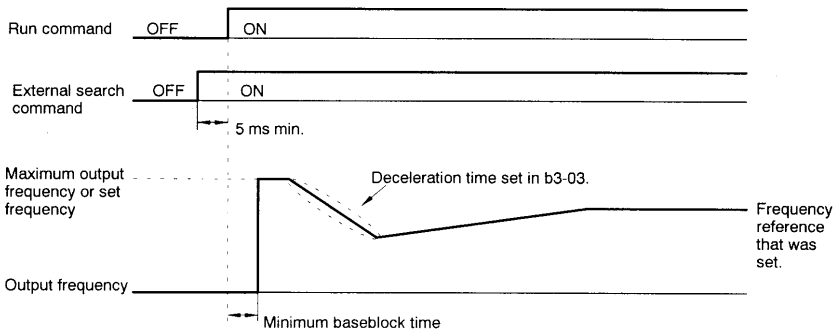


Figure 7.38 Timing Chart for the External Search Command

Speed/Torque Control Change (Setting 71)

OFF	Speed Control
ON	Torque Control

- With this setting, the multi-function input can be used to switch between Speed and Torque Control. Refer to *7.3.4 Speed/Torque Control Switching Function* for more details.

Zero Servo Command (Setting 72)

OFF	Normal Operation
ON	Zero Servo when the frequency (speed) reference falls below the Zero Speed level in b2-01.

- With this setting, the multi-function input controls the Zero Servo function (b9-01 and b9-02).
- When the Zero Servo command is ON, a position control loop is formed and the motor is completely stopped when the frequency (speed) reference falls below the excitation level set in b2-01. Refer to *7.3.2 Zero Servo Function* for more details.

ASR Proportional Gain Switch (Setting 77)

OFF	The gain is set according to the values in C5-01, C5-03, and C5-07.
ON	The gain is set to the value in C5-03 (ASR proportional gain 2).

- With this setting, the multi-function input switches the proportional gain used in ASR.
- Refer to *6.4.4 Speed Control (ASR) Structure* for more details on constants C5-01, C5-03, and C5-07.

■ Multi-Function output Settings: H2

The settings and functions for the multi-function outputs are listed in *Table 7.10* below.

Table 7.10 Multi-Function Output Functions

Setting Value	Function	Control Methods			
		V/f	V/f with PG	Open-Loop Vector	Flux Vector
0	During run (ON: run command is ON or voltage is being output)	❍	❍	❍	❍
1	Zero Speed	❍	❍	❍	❍
2	Frequency agree 1: (Detection width L4-02)	❍	❍	❍	❍
3	Desired frequency agree 1 (ON: output frequency = ± L4-01, detection width in L4-02)	❍	❍	❍	❍
4	Frequency (Four) detection 1 (ON: + L4-01 ≥ - L4-01, detection width in L4-02)	❍	❍	❍	❍
5	Frequency (Four) detection 2 (ON: output frequency ≥ + L4-01 or output frequency ≤ - L4-01, detection width in L4-02)	❍	❍	❍	❍
6	Inverter operation ready READY: After initialization, no faults	❍	❍	❍	❍
7	During DC bus undervoltage (UV) detection	❍	❍	❍	❍
8	During baseblock (ON: during baseblock)	❍	❍	❍	❍
9	Frequency reference selection (ON: Frequency reference from Operator)	❍	❍	❍	❍
A	Run command selection (ON: Run command from Operator)	❍	❍	❍	❍
B	Overtorque detection 1 NO (NO contact: Overtorque detection at ON)	❍	❍	❍	❍
C	Loss of frequency reference (Effective when operation selection is “1” for L4-05 frequency reference missing.)	❍	❍	❍	❍
D	Braking Resistor fault (ON: Resistor overheat or braking transistor fault)	❍	❍	❍	❍
E	Fault (ON: Faults other than CPF00, CPF01 have occurred.)	❍	❍	❍	❍
F	Not used. (Do not set.)	—	—	—	—
10	Minor fault (ON: Alarm displayed)	❍	❍	❍	❍
11	Fault reset command active	❍	❍	❍	❍
12	Timer function output	❍	❍	❍	❍
13	Frequency agree 2 (Detection width: L4-04)	❍	❍	❍	❍
14	Desired frequency agree 2 (ON: Output frequency = L4-03, detection width in L4-04)	❍	❍	❍	❍
15	Frequency detection 3 (ON: Output frequency ≤ - L4-03, detection width in L4-04)	❍	❍	❍	❍
16	Frequency detection 4 (ON: Output frequency ≥ - L4-03, detection width in L4-04)	❍	❍	❍	❍
17	Overtorque detection 1 NC (NC Contact: Torque detection at OFF)	❍	❍	❍	❍
18	Overtorque detection 2 NO (NO contact: Torque detection at ON)	❍	❍	❍	❍
19	Overtorque detection 2 NC (NC Contact: Torque detection at OFF)	❍	❍	❍	❍
1A	During reverse run (ON: During reverse run)	❍	❍	❍	❍
1B	During baseblock 2 (OFF: During baseblock)	❍	❍	❍	❍
1C	Motor selection (Motor under selection)	—	—	—	—
1D	Regenerating (ON: Regenerating)	X	X	X	❍
1E	Restart enabled (ON: Restart enabled)	❍	❍	❍	❍
1F	Motor overload (OL1) pre-alarm (ON: 90% or more of the detection level)	❍	❍	❍	❍
20	Inverter overheat (OH) pre-alarm (ON: Temperature exceeds L8-02 setting)	❍	❍	❍	❍
30	During torque limit (current limit) (ON: During torque limit)	X	X	❍	❍
31	During speed limit (ON: During speed limit)	X	X	X	❍
33	Zero Servo end (ON: Zero Servo function completed)	X	X	X	❍
37	During run 2 (ON: Frequency output, OFF: Baseblock, DC Injection Braking, initial excitation, operation stop.	❍	❍	❍	❍

Constant Settings

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
H2-01	Multi-function output (Terminals 9-10)	X	0 to 37	—	0	B	B	B	B
H2-02	Multi-function output (Terminal 25)	X	0 to 37	—	1	B	B	B	B
H2-03	Multi-function output (Terminal 26)	X	0 to 37	—	2	B	B	B	B

- The following table shows the settings and section references for functions that are described in more detail in this chapter.

Function	Setting	Section
Frequency Agree 1	2	*Frequency Detection Settings: L4-01 to L4-05* in *7.5.6*
Desired Frequency Agree 1	3	
Frequency Detection 1	4	
Frequency Detection 2	5	
Overtorque Detection 1 (NO)	B	*Overtorque Detection Settings: L6-01 to L6-06* in *7.5.6*
Loss of Frequency Reference	C	*Timer Functions: b4-01, b4-02* in *7.5.1*
Timer Function Output	12	
Frequency Agree 2	13	*Frequency Detection Settings: L4-01 to L4-05* in *7.5.6*
Desired Frequency Agree 2	14	
Frequency Detection 3	15	
Frequency Detection 4	16	
Overtorque Detection 1 (NC)	17	*Overtorque Detection Settings: L6-01 to L6-06* in*7.5.6*
Overtorque Detection 2 (NO)	18	
Overtorque Detection 2 (NC)	19	

- Refer to *Table 7.10 Multi-Function Output Functions* for information on the following functions.

Function	Setting
Inverter Operation Ready	6
DC Bus Undervoltage	7
During Baseblock	8
Frequency Reference Selection	9
Run Command Selection	A
Braking Resistor Fault	D
Fault	E
Minor Fault	10
Fault Reset Command Active	11
During Reverse Run	1A
During Baseblock 2	1B
Regenerating	1D
Restart Enabled	1E
During Torque Limit (Current Limit)	30
During Speed Limit	31

During Run (Setting 0)

OFF	The run command is OFF and there is not output voltage
ON	The run command is ON or a voltage is being output.

During Run 2 (Setting 37)

OFF	The Inverter is not outputting a frequency. (Baseblock, DC Injection Braking, initial excitation, or stopped.)
ON	The Inverter is outputting a frequency.

- These outputs can be used to indicate the Inverter's operating status.

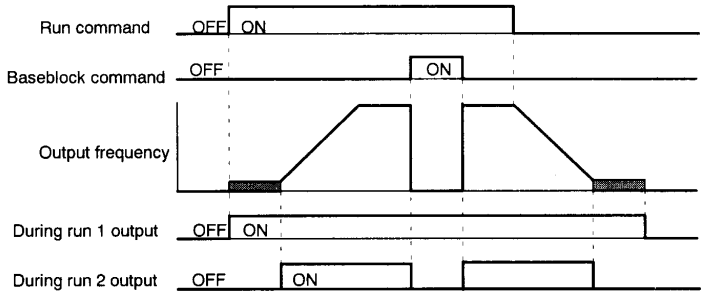


Figure 7.39 Timing Chart for "During RUN" Output

Zero Speed (Setting 1)

OFF	The output frequency is greater than the minimum output frequency (E1-09). (With Flux Vector Control, the output frequency is grater than the Zero Speed level (b2-01).)
ON	The output frequency is less than the minimum output frequency (E1-09). (With Flux Vector Control, the output frequency is less than the Zero Speed level (b2-01).)

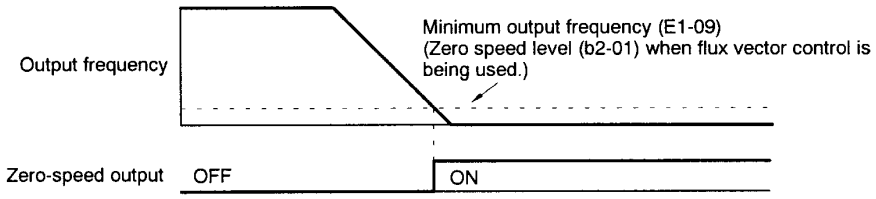


Figure 7.40 Timing Chart for Zero Speed

Motor Overload (OL1) Pre-Alarm (Setting 1F)

OFF	The motor protection function's electronic thermal value is less than 90% of the detection level.
ON	The motor protection function's electronic thermal value is greater than 90% of the detection level.

- This output function is valid when the motor overload protection function is enabled (L1-01 = 1).
- This output can be used to warn off overheating before the protection function itself operates.

Inverter Overheat (OH) Pre-Alarm (Setting 20)

OFF	The cooling fin temperature is less than the "OH Pre-Alarm Level" set in L8-02.
ON	The cooling fin temperature exceeds the "OH Pre-Alarm Level" set in L8-02.

- This output function indicates that the temperature of the cooling fins reaches the temperature set in L8-02 (the Inverter overheating alarm detection level).

Zero Servo End (Setting 33)

OFF	The Zero Servo command is not being input or Zero Servo position control has not been completed.
ON	The position has been brought within the Zero Servo completion width (b9-02) after the Zero Servo command was input.

- This output function indicates that Zero Servo position control has been completed.
- The output is turned ON after the Zero Servo command is input and the difference between the Zero Servo operation starting position and the current position is within the Zero Servo completion width (b9-02).

■ Multi-Function Analog Input/Frequency Reference (Current): H3-05, H3-09

Constant Settings

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
H3-05	Multi-function analog input (Terminal 16)	X	0 to 1F	—	0	B	B	B	B
H3-09	Multi-function analog input (Terminal 14)	X	0 to 1F	—	1F	A	A	A	A

Table 7.11 Multi-Function Input/Frequency Reference (Voltage) Function

Setting	Function	Equivalent of 100% Input (10 V or 20 mA)	Control Methods			
			V/f	V/f with PG	Open-Loop Vector	Flux Vector
0	Auxiliary frequency reference (H3-05)	Maximum output frequency	❍	❍	❍	❍
1	Frequency gain	Frequency reference (voltage) command value	❍	❍	❍	❍
2	Frequency bias	Maximum output frequency (added to H3-03)	❍	❍	❍	❍
4	Voltage bias	Motor rated voltage (E1-05)	❍	❍	X	X
5	Accel/Decl change (reduction coefficient)	Accel/Decl times (C1-01 to C1-08)	❍	❍	❍	❍
6	DC Injection Braking current	Inverter rated output current	❍	❍	❍	X
7	Overtorque detection level	Motor rated torque	❍	❍	❍	❍
8	Stall Prevention level during run	Inverter rated output current	❍	❍	X	X
9	Frequency reference lower limit level	Maximum output frequency	❍	❍	❍	❍
A	Jump frequency	Maximum output frequency	❍	❍	❍	❍
B	PID Feedback	Maximum output frequency	❍	❍	❍	❍
10	Forward side torque limit	Motor rated torque	X	X	❍	❍
11	Reverse side torque limit	Motor rated torque	X	X	❍	❍
12	Regeneration for torque limit	Motor rated torque	X	X	❍	❍
13	Torque reference/torque limit for Speed Control	Motor rated torque	X	X	X	❍
14	Torque compensation bias	Motor rated torque	X	X	X	❍
15	Forward/reverse torque limit	Motor rated torque	X	X	❍	❍
1F	Disable analog input (H3-05)	—	❍	❍	❍	❍
	Frequency reference (H3-09)	Maximum output frequency				

- The analog input signal level, gain, and bias are set with the following constants.

Terminal 16 signal level selector	H3-04 (0 to +10 V or 0 to ±10 V)
Terminal 16 input gain	H3-06
Terminal 16 input bias	H3-07
Terminal 14 signal level selector	H3-08 (0 to +10 V, 0 to ±10 V, or 4 to 20 mA)
Terminal 14 input gain	H3-10
Terminal 14 input bias	H3-11

- When a voltage input is being input to Terminal 14, be sure to disconnect jumper wire J1 on the control PC board.
- The input resistance will be destroyed if a voltage input is used without disconnecting the jumper wire. (Refer to *7.3.3 Torque Reference Settings: H3-04, H3-05, H3-08, H3-09*.)
- Set the time constant in constant H3-12 when adding a primary delay filter to an analog input. This filter time constant applies to all three of the analog inputs.

Analog Input Characteristics

- Analog input characteristics for a gain of 100.0% and a bias of 0.0% are shown for setting examples in *Table 7.12*.
- To set over 100% for a 10 V input (e.g., 300%/10V), set the gain to 300% in H3-06 for Terminal 16 and H3-10 for Terminal 14.

Table 7.12 Analog Input Characteristics

<table>
<tr>
<td>

- Auxiliary Frequency Reference (Setting: 0)
- Frequency Bias (Setting: 2)
- PID Feedback (Setting: B)
- Frequency Reference (H3-09 Setting: 1F)

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<td>

- Frequency Gain (Setting: 1)
- Output Voltage Bias (Setting: 4)
- DC Injection Braking Current (Setting: 6)

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- Acceleration/Deceleration Time Gain (Setting: 5)

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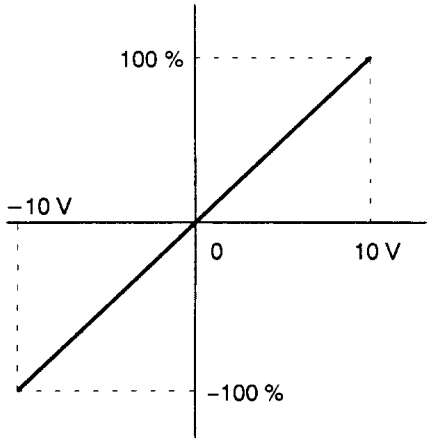
<td> 
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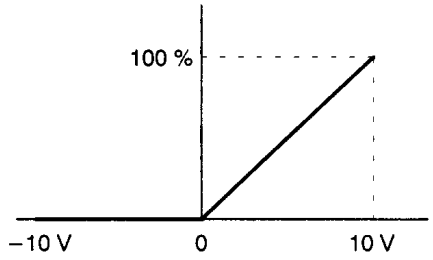
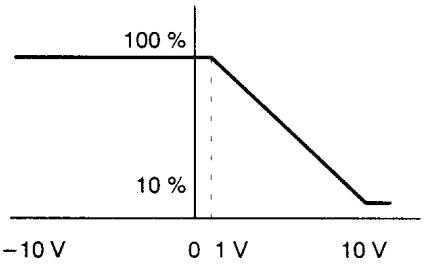
<td> 

When set to “1”, the setting of H3-02 will be added to achieve the final gain.</td>
<td> 
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- DC Injection Braking Current (Setting: 6)
- Overtorque Detection Level (Setting: 7)

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- Stall Prevention Level (Setting: 8)

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- Output Frequency Lower Limit (Setting: 9)
- Jump Frequency (Setting: A)

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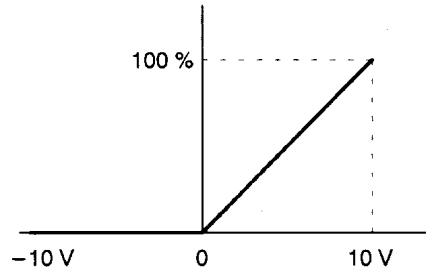
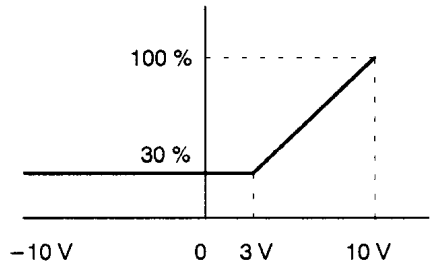
<td> 

Only the overtorque detection 1 output can be used when “7” is set to use overtorque detection for a multi-function output.</td>
<td> 
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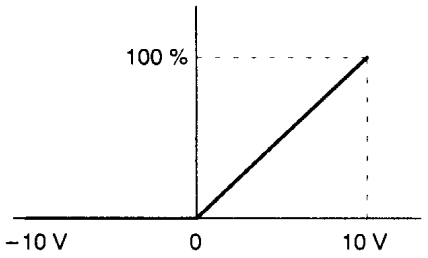
<td> 
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- Torque Reference (Setting: 13)
- Torque Compensation Bias (Setting: 14)

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- Forward Torque Limit (Setting: 10)
- Reverse Torque Limit (Setting: 11)
- Regenerative Torque Limit (Setting: 12)

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- Forward/Reverse Torque (Speed) Limit (Setting: 15)

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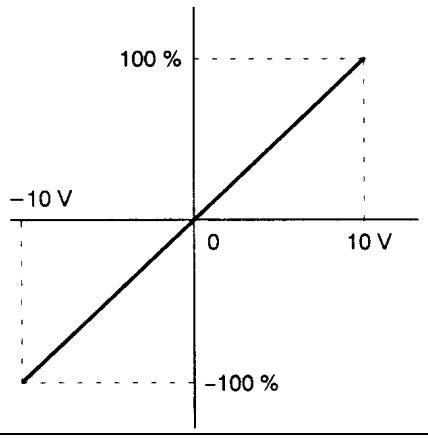
<td> 
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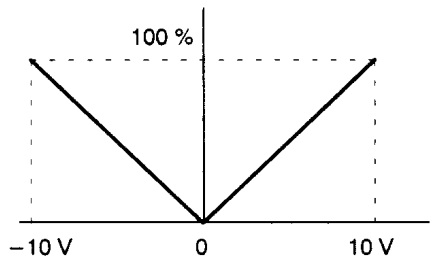
<td> 
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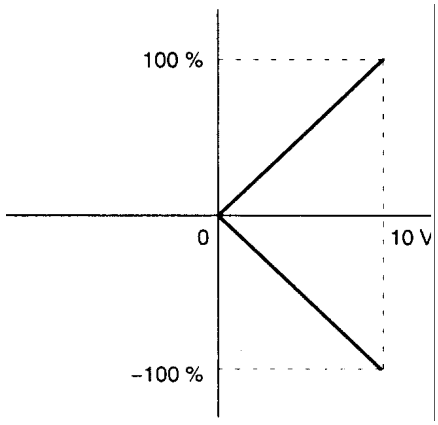
<td> 
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■ Multi-Function Analog Output Settings: H4-01 to H4-07

Function Selection Constants: H4-01, H4-04

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
H4-01	Monitor selection (Terminal 21)	X	1 to 35	—	2	B	B	B	B
H4-04	Monitor selection (Terminal 23)	X	1 to 35	—	3	B	B	B	B

- The multi-function outputs can be set to monitor any of the U1 Inverter status items by setting the last two digits of the constant number (U1-❑❑). Refer to Page 64 for a table listing all of the U1 setting.
- Settings 4, 10, 11, 12, 13, 14, 25, 28 and 34 cannot be set and Settings 29, 30, and 31 are not used.

Adjusting the Monitor Output: H4-02, H4-03, H4-05, H4-06

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
H4-02	Gain (Terminal 21)	❍	0.00 to 2.50	Multiple	1.00	B	B	B	B
H4-03	Bias (Terminal 21)	❍	-10.0 to +10.0	%	0.0	B	B	B	B
H4-05	Gain (Terminal 23)	❍	0.00 to 2.50	Multiple	0.50	B	B	B	B
H4-06	Bias (Terminal 23)	❍	-10.0 to +10.0	%	0.0	B	B	B	B

- For the output gain, set what multiple of 10 V will correspond to a 100% output of the monitored item.
- For the output bias, set the amount that the output characteristics will be shifted vertically. Set this amount as a percentage, with 10 V corresponding to 100%.

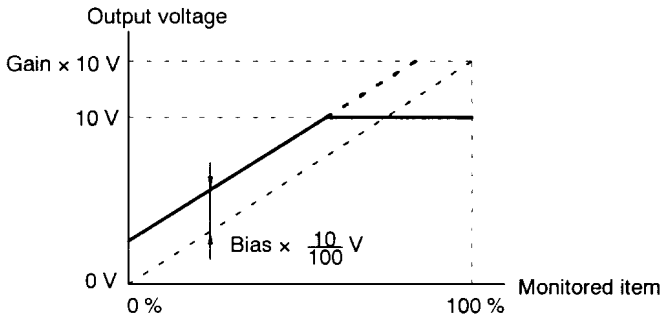


Figure 7.41 Monitor Output Adjustments

Multi-Function Analog Output Signal Level: H4-07

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
H4-07	Analog output signal level selection	X	0, 1	—	0	B	B	B	B

- Settings

Setting	Function
0	0 to +10 V (Absolute value output)
1	0 to ±10 V

- This signal level setting applies to analog outputs 1 and 2 (Terminals 21 and 23).
- When the 0 to ±10 V signal level is used to output speed values (frequency reference, output frequency, or motor speed), positive voltage indicates Inverter output in the forward direction. (Assuming a bias setting of 0.0.)
- There are some monitor items that are limited to the o to +10 V signal range even when the 0 to ±10 V signal level has been selected. Refer to *Table 4.3 Status Monitor Items* for details.

■ MEMOBUS Communications Settings: H5-01 to H5-05

Station Node Address: H5-01

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
H5-01	Station address	X	0 to 20	—	1F	A	A	A	A

Baud Rate: H5-02

- Set the baud rate for MEMOBUS communications.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
H5-02	Communication speed selection	X	0 to 3	—	3	A	A	A	A

- Settings

Setting	Baud Rate
0	1200 bps
1	2400 bps
2	4800 bps
3	9600 bps

Communication Parity: H5-03

- Set the parity for MEMOBUS communications.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
H5-03	Communication parity selection	X	0 to 2	—	0	A	A	A	A

- Settings

Setting	Function
0	No parity
1	Even parity
2	Odd parity

Stopping Method after Communications Error: H5-04

- Set the stopping method to used after a communications error is detected.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
H5-04	Stopping method after communication error	X	0 to 3	—	3	A	A	A	A

- Settings

Setting	Function
0	Deceleration to stop (deceleration time: C1-02)
1	Coast to stop
2	Emergency stop (deceleration time: C1-09)
3	Continue operation (display only)

Communications Error Detection: H5-05

- Set the stopping method to used after a communications error is detected.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
H5-05	Communication error detection selection	X	0, 1	—	1	A	A	A	A

- Settings

Setting	Function
0	Do not detect as communications error.
1	Detect as communications error.

7.5.6 Protective Functions: L

■ Motor Protection Settings: L1-01, L1-02

Motor Protection Selection: L1-01

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L1-01	Motor protection selection	X	0, 1	—	1	B	B	B	B

- Settings

Setting	Function
0	Disabled.
1	Enabled.

- This setting enables or disables the motor overload protection function.
- The rated current setting (E2-01) is used as a basis for overload detection.
- Disable the motor protection function (Setting 0) when two or more motors are connected to a single Inverter. Use another method to provide overload protection separately to each motor, such as connecting a thermal overload relay to the power line of each monitor.
- The motor protection function may not protect a motor when the power supply is turned ON and OFF frequently, because the thermal value is reset each time that the power is turned OFF.
- If the Overload OL1 alarm (1F) is set in one of the multi-function outputs (H2-01 to H2-03), the output will be turned ON when the electronic thermal value reaches 90% of the overload detection level.

Motor Protection Time Constant: L1-02

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L1-02	Motor protection time constant	X	0.1 to 5.0	Minutes	1.0	B	B	B	B

- Normally it is not necessary to change this setting. (The factory setting is a 150%, 1 minute capacity.)
- Set the electronic thermal protection operation time if a 150% overload is applied after operating continuously at the motor's rated current (hot start).
- When the motor's overload capacity level is known, set the hot start overload resistance level for the motor, but be sure to allow some margin for safety.
- Decrease this setting when you want to detect an overload more quickly.

Electronic Thermal Time Characteristics
In this example, L1-02 is set to 1 minute, the motor is operating at 60 Hz, and general-purpose motor characteristics are used.

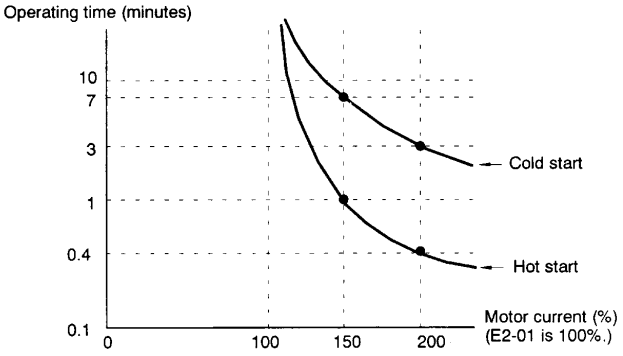


Figure 7.42 Motor Protection Operating Time

■ Momentary Power Loss Settings: L2-01 to L2-05

Momentary Power Loss Detection: L2-01

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L2-01	Momentary power loss detection	X	0 to 2	—	0	B	B	B	B

- Settings

Setting	Function
0	Disabled. (An undervoltage fault is detected when there is a momentary power loss.)
1	Enabled. (Restarts if power is restored within the L2-02 time. An undervoltage fault is detected for a longer power loss.)
2	Enabled during CPU operation. (Restarts if power is restored while the CPU is operating. An undervoltage fault is not detected.)

- This constant specifies the processing that is performed when a momentary power loss occurs.
- When power loss ridethru is enabled (Setting 1 or 2), operation will be restarted after a speed search if the power is restored within the allowed time interval.
- When power loss ridethru is disabled (Setting 0), an undervoltage fault will be detected if power is interrupted for more than 15 ms.

Momentary Power Loss Ridethru Time: L2-02

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L2-02	Momentary power loss ridethru time	X	0.0 to 2.0	s	0.7	B	B	B	B

- The factory setting depends on the Inverter capacity. The factory setting shown in the table above is for a 200V class, 0.4 kW Inverter. (See Page 258)
- This setting is valid only when constant L2-01 is set to 1. Set the power loss ridethru time in seconds.

Minimum Baseblock Time: L2-03

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L2-03	Minimum baseblock time	X	0.0 to 5.0	s	0.5	B	B	B	B

- The factory setting depends on the Inverter capacity. The factory setting shown in the table above is for a 200V class, 0.4 kW Inverter. (See Page 258)
- This setting is used with the speed search and DC Injection Braking functions.
- Set the time required for the leakage voltage to dissipate. Increase the setting if an overcurrent (OC) occurs when the speed search or DC Injection Braking function starts.
- This setting is valid for speed searches performed after a momentary power loss and regular speed searches.

Voltage Recovery Time: L2-04

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L2-04	Voltage recovery time	X	0.0 to 5.0	s	0.3	A	A	A	A

- Set the time allowed for the normal voltage to be restored after completion of the speed search. For a 200 V class Inverter, this is the time in seconds for voltage to be restored from 0 VAC to 200 VAC. For a 400 V class Inverter, this is the time in seconds for voltage to be restored from 0 VAC to 400 VAC.
- This setting is valid for speed searches after a momentary power loss, regular speed searches, the voltage changes with Energy Saving Control, and the voltage changes with baseblock clearing.

Undervoltage Detection Level: L2-05

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L2-05	Undervoltage detection level	X	150 to 210 (300 to 420)	VDC	190 (380)	A	A	A	A

- The values in parentheses are for 400 V class Inverters. (See Page 259)
- Normally it is not necessary to change this setting.
- Use this constant when you want to add an AC Reactor and lower the main circuit undervoltage detection level. Be sure to set a main circuit DC voltage value (V) that will detect a main circuit undervoltage.

KEB Deceleration Rate: L2-06

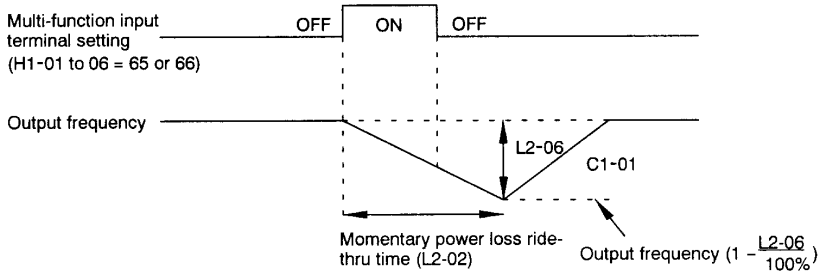
User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L2-06	KEB deceleration rate	X	0.0 to 100.0	0.1	0.0	A	A	A	A

- The KEB function restores the operating conditions for momentary power loss by applying a frequency deceleration to create inertia energy when a power loss occurs, and thus avoid the power loss.
- This function is normally used with film lines and other applications where multiple Inverters are connected to the main DC line. Synchronous deceleration for power loss prevents the line from stopping as the result of speed fluctuations.
- The KEB operation is performed using a KEB command (Setting 65 or 66) for a multi-function input.
- Applicable Capacities
  200 V class Inverters: 0.4 to 1.5 kW
  400 V class Inverters: 0.4 to 18.5 kW

Operation

- L2-06 = 0
  The motor is automatically accelerated based on the emergency stop time (C1-09) so that the DC mainline voltage does not go below the UV level. The momentary power loss ridethru time (L2-02) is not used.

- L2-06 ½ 0
  The motor is decelerated to the KEB frequency level using the momentary power loss ridethru time (L2-02) and then is accelerated to the original frequency reference using acceleration time 1 (C1-01). The KEB frequency level is calculated from the KEB frequency rate using the following equation.
  KEB frequency level = Output frequency before power loss [1 – (setting of L2-06)/100]%



■ Stall Prevention Function Settings: L3-01 to L3-06

- A stall occurs if the rotor cannot keep up with the rotating magnetic field on the motor stator side when a large load is applied to the motor or a sudden acceleration/deceleration is performed.
- In the Inverter, Stall Prevention functions can be set independently for accelerating, running, and decelerating. (Some functions are restricted depending on the control method.)

Stall Prevention Selection During Acceleration: L3-01

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L3-01	Stall Prevention selection during acceleration	X	0 to 2	—	1	B	B	B	X

- Settings

Setting	Function
0	Disabled. (Accelerate according to the settings. Stalls may occur with large loads.)
1	Enabled. (Stop acceleration if L3-02 setting is exceeded. Accelerate again when current recovers.)
2	Optimum acceleration. (Adjust acceleration so that the L3-02 is not exceeded by much. Disregard the acceleration time setting.)

- When Setting 1 (enabled) is selected, acceleration is stopped if the motor current exceeds the acceleration Stall Prevention level. Acceleration is started again when the current falls below this level. The acceleration time can be longer than the setting depending on the load.
- When Setting 2 (Optimum Acceleration) is selected, acceleration is performed using the acceleration Stall Prevention level as a basis. In this case, the acceleration time is disregarded.

Stall Prevention Level During Acceleration: L3-02

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L3-02	Stall Prevention level during acceleration	X	0 to 200	%	150	B	B	B	X

- This setting is valid when L3-01 is set to 1 or 2.
- Normally it is not necessary to change this setting.
- Decrease this setting when the motor capacity is small compared to the Inverter capacity or stalling occurs when the motor is operated with the factory setting. The standard target setting is 2 to 3 times the motor's rated current. (Set this current value as a percentage of the Inverter's rated current, i.e., 100% corresponds to the Inverter's rated current.)

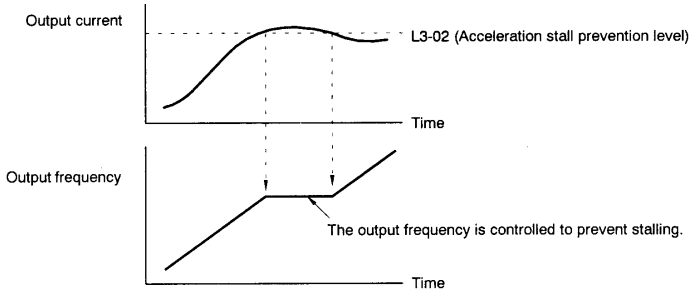
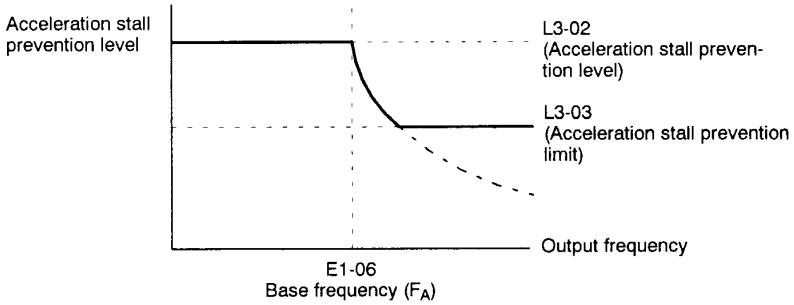


Figure 7.43 Acceleration Stall Prevention Function: L3-01 = 1

Stall Prevention Limit During Acceleration: L3-03

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L3-03	Stall Prevention limit during acceleration	X	0 to 100	%	50	A	A	A	X

- Normally it is no necessary to change this setting.
- Set this constant when a high speed motor is being used in the high speed range (the high frequency range above the base frequency).
- The standard target setting is the motor's rated current. Set this current value as a percentage of the Inverter's rated current, i.e., 100% corresponds to the Inverter's rated current.



Note: When the motor is used in the high-speed range, the acceleration Stall Prevention level is automatically lowered to provide smoother acceleration. The acceleration Stall Prevention limit (L3-03) limits how much the acceleration Stall Prevention level is lowered so that it is not lowered any more than necessary.

Figure 7.44 Stall Prevention Limit During Acceleration

Stall Prevention Selection During Deceleration: L3-04

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L3-04	Stall Prevention selection during deceleration	X	0 to 2	—	1	B	B	B	B

- Settings

Setting	Function
0	Disabled. (Decelerate according to the settings. Main circuit overvoltage may occur if the deceleration time is too short.)
1	Enabled. (Stops deceleration if the main circuit voltage exceeds the overvoltage level. Decelerate again when voltage recovers.)
2	Optimum deceleration. (Decelerate as fast as possible judging from the main circuit voltage. Disregard the deceleration time setting.)

- When Setting 1 (enabled) is selected, deceleration time is extended automatically so that a main circuit overvoltage does not occur.
- Always select Setting 0 when a braking option (Braking Resistor, Braking Resistor Unit, or Braking Unit) is being used. If Setting 1 or 2 is selected, the braking option will not be used and the deceleration time cannot be shortened.
- L3-04 cannot be set to 2 for Vector Control modes.

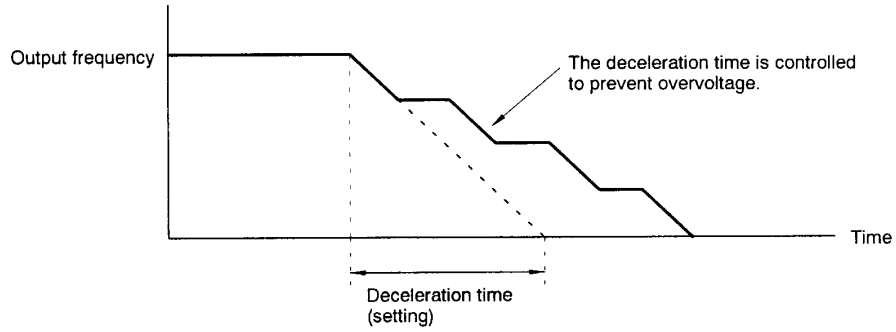


Figure 7.45 Deceleration Stall Prevention Function: L3-04 = 1

Stall Prevention Selection During Running: L3-05

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L3-05	Stall Prevention selection during running	X	0 to 2	—	1	B	B	X	X

- Settings

Setting	Function
0	Disabled. (Run according to the settings. Stalls may occur with large loads.)
1	Enabled - deceleration time 1. (Use deceleration time in C1-02 for Stall Prevention function.)
2	Enabled - deceleration time 2. (Use deceleration time C1-04 for Stall Prevention function.)

- When Setting 1 or 2 (enabled) is selected, deceleration is started if the current of the Stall Prevention level during operation continues for more than 100 ms. The motor is accelerated back to the reference frequency again when the current falls below this level.

Stall Prevention Level During Running: L3-06

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L3-06	Stall Prevention level during running	X	30 to 200	%	160	B	B	X	X

- This setting is valid when L3-05 is set to 1 or 2.
- Normally it is not necessary to change this setting.

- Decrease this setting when the motor capacity is small compared to the Inverter capacity or stalling occurs when the motor is operated with the factory setting. (Set this current value as a percentage of the Inverter's rated current, i.e., 100% corresponds to the Inverter's rated current.)

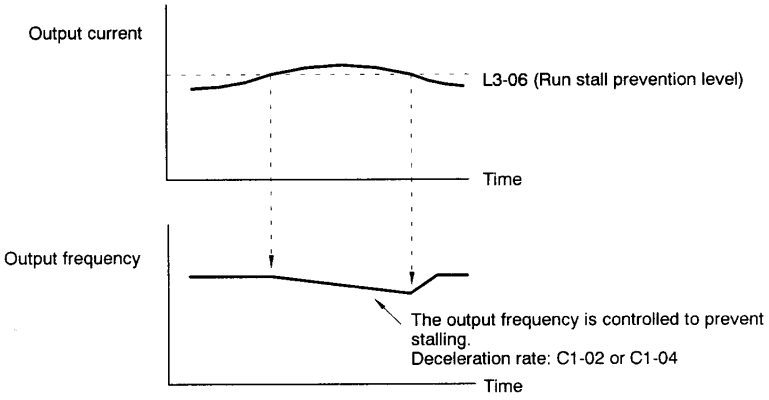


Figure 7.46 Run Stall Prevention Function: L33-05 = 1 or 2

■ Frequency Detection Settings: L4-01 to L4-05

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L4-01	Speed agree detection level	X	0.0 to 400.0	Hz	0.0	B	B	B	B
L4-02	Speed agree detection width	X	0.0 to 20.0	Hz	2.0	B	B	B	B
L4-03	Speed agree detection level (+/-)	X	-400.0 to +400.0	Hz	0.0	A	A	A	A
L4-04	Speed agree detection width (+/-)	X	0.0 to 20.0	Hz	2.0	A	A	A	A

- Set these constants when outputting one of the frequency agree or frequency detection signals from a multi-function output. *Table 7.13* shows the relationship between these constants and the output signals.

Table 7.13 Constants and Output Signals

Constant	Related Output Settings	Constant Function
Speed Agree Level (Absolute value)	Fref/Set Agree 1 Frequency Detection 1 > Frequency Detection 2 <	Set the speed that you want to detect in Hz. The set speed is an absolute value, so the speed is detected in forward or reverse.
Speed Agree Width (Absolute value)	Fref/Fout Agree 1 Fref/Set Agree 1 Frequency Detection 1 > Frequency Detection 2 <	Set the speed detection range in Hz.
Speed Agree Level +/- (Signed value)	Fref/Set Agree 2 Frequency Detection 3 > Frequency Detection 4 <	Set the speed that you want to detect in Hz. Set positive values for forward, negative values for reverse.
Speed Agree Width +/- (Signed value)	Fref/Fout Agree 2 Frequency Detection 3 > Frequency Detection 4 <	Set the speed detection range in Hz.

- Set the corresponding setting in the multi-function output (H2-01, H2-02, or H2-03) to output the desired Fref/Fout Agree signal, Fref/Set Agree signal, or Frequency Detection signal.

Function	Setting
Fref/Fout Agree 1	2
Fref/Set Agree 1	3
Frequency Detection 1 >	4
Frequency Detection 2 <	5
Fref/Fout Agree 2	13
Fref/Set Agree 2	14
Frequency Detection 3 >	15
Frequency Detection 4 <	16

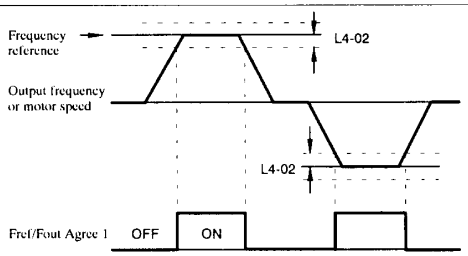
Frequency Detection Operation: L4-05

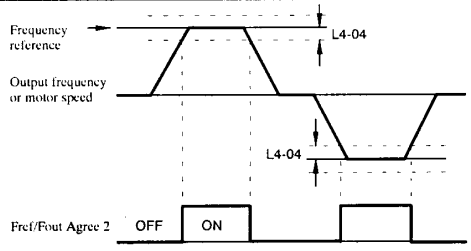
User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L4-05	Operation when frequency reference is missing	X	0, 1	—	0	A	A	A	A

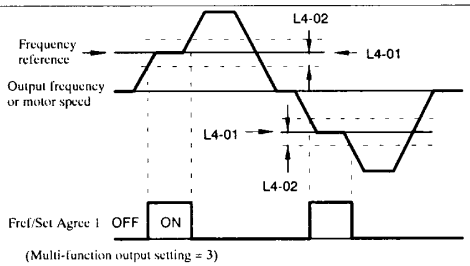
- The frequency reference is considered lost when the frequency reference voltage drops by 90% for more than 400 ms.
- Settings

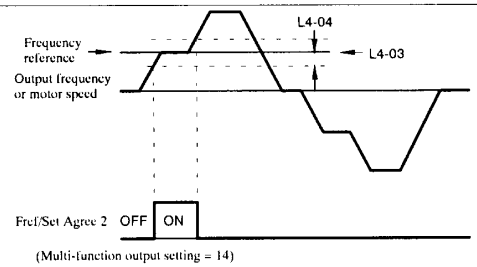
Setting	Function
0	Stop. (Operate according tot he frequency reference value.)
1	Continue operation at 80% speed. (Continue operation with a speed that is 80% of the value when the frequency reference was lost.)

- Timing Chart for Frequency Detection Operation

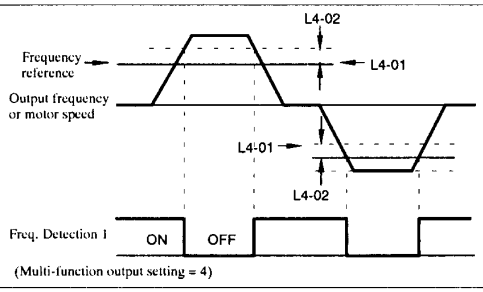
<table>
<tr><td>Related constant</td><td>L4-01: Speed Agree Level
L4-02: Speed Agree Width</td><td>L4-03: Speed Agree Level +/–
L4-04: Speed Agree Width +/–</td></tr>
<tr><td>Fref/Fout Agree</td><td>Fref/Fout Agree 1
 

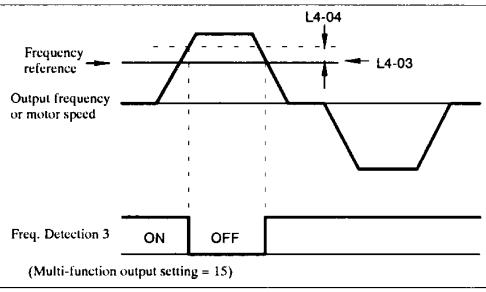
(Multi-function output setting = 2)</td><td>Fref/Fout Agree 2
 

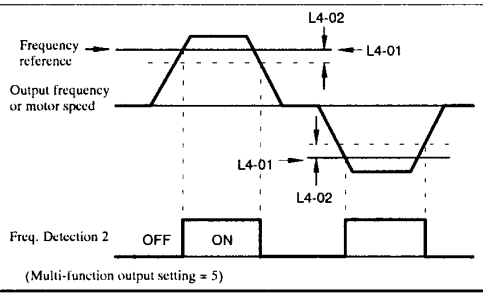
(Multi-function output setting = 13)</td></tr>
<tr><td>Fref/Set Agree</td><td>Fref/Set Agree 1
 

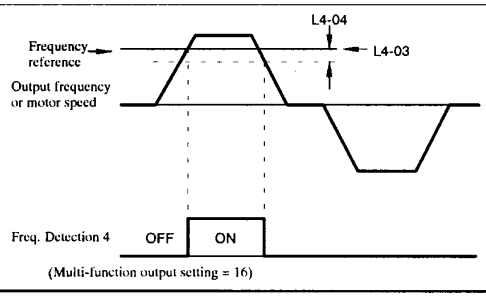
(Multi-function output setting = 3)</td><td>Fref/Set Agree 2
 

(Multi-function output setting = 14)</td></tr>
</table>

<table>
<tr><td>Related constant</td><td>L4-01: Speed Agree Level
L4-02: Speed Agree Width</td><td>L4-03: Speed Agree Level +/–
L4-04: Speed Agree Width +/–</td></tr>
<tr><td rowspan="2">Frequency Detection</td><td>Frequency Detection 1
 

(Multi-function output setting = 4)</td><td>Frequency Detection 3
 

(Multi-function output setting = 15)</td></tr>
<tr><td>Frequency Detection 2
 

(Multi-function output setting = 5)</td><td>Frequency Detection 4
 

(Multi-function output setting = 16)</td></tr>
</table>

■ Fault Restart Settings: L5-01, L5-02

Number of Auto Restart Attempts: L5-01

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L5-01	Number of Auto Restart attempts	X	0 to 10	—	0	B	B	B	B

NOTE:

- The Inverter might be damaged when using the fault restart function too frequently.
- Understanding that the Inverter might be damaged, be sure to take the following precautions:
  Always set up a MCCB. Set up a sequence that will stop peripheral equipment when an Inverter fault occurs.

- The fault restart function automatically restarts the Inverter even when an internal fault occurs during Inverter operation. Use this function only when continuing operation is more important than possibly damaging the Inverter.
- The fault restart function is effective with the following faults With other faults, the protective operations will engage immediately without attempting to restart operation.
  - OC (Overcurrent)
  - GF (Ground fault)
  - PUF (Fuse blown)
  - OV (Main circuit overvoltage)
  - UV1 (Main circuit undervoltage)
  - PF (Main circuit voltage fault)
  - LF (Output open-phase)
  - RF (Braking resistor overheated)
  - RR (Braking transistor fault)
  - OL1 (Motor overload)
  - OL2 (Inverter overload)
  - OL3 (Overtorque)
  - OL4 (Overtorque)
- The fault restart count is cleared in the following cases:
  - When operation is normal for 10 minutes after a fault restart is performed.
  - When the fault reset input is received after the protection operation has been activated and the fault confirmed.
  - When the power is turned OFF and then ON again.

- When one of the multi-function outputs (H2-01, H2-02, or H2-03) is set to 1E (Restart Enabled), the output will be ON while the fault restart function is in progress.

Auto Restart Operation Selection: L5-02

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L5-02	Auto Restart operation selection	X	0, 1	—	0	B	B	B	B

- Settings

Setting	Function
0	Do not output fault restart. (The fault contact does not operate.)
1	Output fault restart. (The fault contact operates.)

■ Overtorque Detection Settings: L6-01 to L6-06

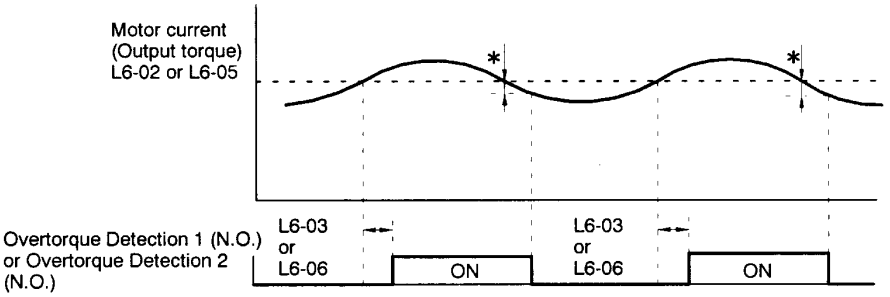
User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L6-01	Torque detection selection 1	X	0 to 4	—	0	B	B	B	B
L6-02	Torque detection level 1	X	0 to 300	%	150	B	B	B	B
L6-03	Torque detection time 1	X	0.0 to 10.0	s	0.1	B	B	B	B
L6-04	Torque detection selection 2	X	0 to 4	—	0	A	A	A	A
L6-05	Torque detection level 2	X	0 to 300	%	150	A	A	A	A
L6-06	Torque detection time 2	X	0.0 to 10.0	s	0.1	A	A	A	A

- The overtorque detection function detects an excessive mechanical load from an increase in the output current (or output torque).
- The settings in the torque detection selection constants (L6-01 and L6-04) determine whether overtorque conditions will be detected and what kind of processing will be performed if an overtorque condition is detected.
- L6-01/L6-04 Settings

Setting	Function	Display	
0	Overtorque detection disabled	Overtorque detection 1	Overtorque output 2
1	Detect only during speed agree. Continue operation eve after detection. (Minor fault)	"OL3" blinks	"OL4" blinks
2	Detect overtorque at any time. Continue operation even after detection. (Minor fault)	"OL3" blinks	"OL4" blinks
3	Detect only during speed agree. Stop output after detection. (Fault)	"OL3" lights	"OL4" lights
4	Detect overtorque at any time. Stop output after detection. (Fault)	"OL3" lights	"OL4" lights

- When overtorque detection is enabled, be sure to set the overtorque detection level (L6-02 or L6-05) and the overtorque detection time (L6-02 or L6-05). An overtorque condition is detected when the current exceeds the overtorque detection level for longer than the overtorque detection time.
- The overtorque detection level settings depend on the control method:
  - Open-Loop or Flux Vector Control: Set as a percentage of the motor rated torque.
  - Normal V/f or V/f with PG Feedback control: Set as a percentage of the Inverter rated current.
- Any of the following functions can be set in a multi-function output (H2-01, H2-02, or H2-03) to indicate the fact that an overtorque condition has been detected.

• Setting B: Overtorque detection 1 (NO)	• Setting 18: Overtorque detection 2 (NO)
• Setting 17: Overtorque detection 1 (NC)	• Setting 19: Overtorque detection 2 (NC)



* The overtorque detection is cleared when the current drops about 5% of the Inverter's rated current (or the motor's rated torque).

Figure 7.47 Timing Chart for Overtorque Detection

■ Hardware Protection Settings: L8-01 to L8-03, L8-05, L8-07

Protection Selection for Internal DB Resistor: L8-01

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L8-01	Protect selection for internal DB resistor	X	0, 1	—	0	B	B	B	B

- Settings

Setting	Function
0	Disabled. (Select 0 when a Braking Resistor is not being used or a Braking Resistor Unit is being used.)
1	Enabled. (Protects the Braking Resistor from overheating.)

Inverter Overheating (OH) Pre-Alarm Settings: L8-02, L8-03

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L8-02	Overheating pre-alarm level	X	50 to 110	°C	95	A	A	A	A
L8-03	Operation selection after overheat pre-alarm	X	0 to 3	—	3	A	A	A	A

- Constant L8-02 specifies that detection temperature in °C for the Inverter overheat (OH) pre-alarm function. An overheat pre-alarm occurs when the temperature of the cooling fins reaches this level.
- Constant L8-03 specifies the processing that will be performed when an overheat pre-alarm occurs. Apart from this setting, cooling fin overheating (OH1) is detected is a protection function at 105°C.
- Settings

Setting	Function
0	Decelerates to a stop in the deceleration time set in C1-09. (Protection operation: Fault contacts operate.)
1	Coast to stop. (Protection operation: Fault contacts operate.)
2	Emergency stop in the emergency stop time set in C1-09. (Protection operation: Fault contacts operate.)
3	Continues operation. (Alarm: Monitor display only.)

Input Open-Phase Protection Selection: L8-05

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L8-05	Input open-phase protection selection	X	0, 1	—	0	A	A	A	A

- This function detects changes in the main circuit DC voltage which indicate a power supply open-phase, large imbalance in the power supply voltage, or deterioration of the main circuit capacitor.

- Settings

Setting	Function
0	Disabled.
1	Enabled. (Detects input power supply open-phase, 3-phase imbalance, or deterioration of the main circuit capacitor.)

Output Open-Phase Protection Selection: L8-07

- This function detects an Inverter output open-phase.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
L8-07	Input open-phase protection selection	X	0, 1	—	0	A	A	A	A

- Settings

Setting	Function
0	Disabled.
1	Enabled. (Detects an output open-phase at under 10% of the Inverter's rated output current.)

- False open-phase detections may occur when the motor capacity is small compared to the Invert capacity. In this case, disable the detection function by setting L8-07 to 0.

7.5.7 Operator Constants: o

■ Operator Display Selection: o1-01 to o1-05

Constant Number Display Selection: o1-01

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o1-01	Constant number display selection	❍	4 to 35	—	6	B	B	B	B

- In operation mode, the frequency reference, output frequency, output current, and output voltage can be monitored immediately if the factory settings are being used. One of these four values, the output voltage, can be changed to a different value.
- When you want to monitor a value other than the output voltage, set that number in constant o1-01.
- Use the last two digits from the "U1 Monitor" list (U1-❑❑) to select a value. Refer to *Table 4.3*.

Monitor Selection After Power UP: o1-02

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o1-02	Monitor selection after power up	❍	1 to 4	—	1	B	B	B	B

- When the power is turned ON, the frequency reference will appear in the unit's data display if the factory settings are being used.
- Any one of the four values monitored at startup (frequency reference, output frequency, output current, or the value set in constant o1-01) can be selected to appear when the power is turned ON.
- Change the setting of constant o1-02 to display an item other than the frequency reference at startup.
- Settings

Setting	Function
1	The frequency reference is displayed at start-up.
2	The output frequency is displayed at start-up.
3	The output current Is displayed at start-up.
4	The value set in constant o1-01 is displayed at start-up.

Frequency Units of Reference Setting and Monitor: o1-03

- This function detects an Inverter output open-phase.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o1-03	Frequency units of reference setting and monitor	X	0 to 39999	—	0	B	B	B	B

- Settings

Setting	Unit
0	0.01 Hz
1	0.01%
2 to 39	r/min (0 to 3999) r/min = 120 x frequency reference (Hz) / o1-03 (number of motor poles)
40 to 39999	Use the 5th digit of o1-03 to specify the decimal point. 5th digit = 0: ❑❑❑❑ 5th digit = 1: ❑❑❑.❑ 5th digit = 2: ❑❑.❑❑ 5th digit = 3: ❑.❑❑❑ The 1st to 4th digits of o1-03 determine the frequency setting Ex 1: To set the 100% speed to 200.0, set o1-03 to 12000. 200.0 will be displayed for 100%, 120 will be displayed for 60%. Ex 2: To set the 100% speed to 65.00, set o1-03 to 26500. 65.00 will be displayed for 100%, 39.00 will be displayed for 60%.

Frequency Units of Constant Setting: o1-04

- This constant can be used to change the setting unit for V/f control constants to r/min.

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o1-04	Frequency units of constant setting	X	0, 1	—	0	X	X	X	B

- Settings

Setting	Unit
0	Unit of setting: Hz
1	Unit of setting: r/min

Constant Number Display Selection: o1-05

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o1-05	Constant number display selection	X	0, 1	—	0	A	A	A	A

- Settings

Setting	Function
0	Display constant number.
1	Display constant number (address) set for MEMOBUS communications.

■ Key Function Settings/Other Settings: o2-01 to o2-08

LOCAL/REMOTE Key Enable/Disable: o2-01

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o2-01	LOCAL/REMOTE key enable/disable	X	0, 1	—	1	B	B	B	B

- This constant enables or disables the LCOAL/REMOTE key (the Operation Mode Selector key) on the Digital Operator.

- Settings

Setting	Function
0	Disabled. (Cannot change between local and remote.)
1	Enabled. (Pressing the LOCAL/REMOTE key switches control of operation between the Operator and the sources specified in constants b1-01 and b1-02.)

STOP Key During Control Circuit Terminal Operation: o2-02

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o2-02	STOP key during control circuit terminal operation	X	0, 1	—	1	B	B	B	B

- This constant enables or disables the STOP on the Digital Operator.

- Settings

Setting	Function
0	Disabled. (The STOP key is disabled when the run command is input from an external terminal.)
1	Enabled. (The STOP key is enabled at all times during operation.)

User Constant Initial Value: o2-03

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o2-03	User constant initial value	X	0, 1, 2	—	0	B	B	B	B

- This constant is used to record or clear the user constant defaults.

- Once the user defaults have been recorded, constant A1-03 can be used to initialize the Inverter constants to these defaults.

- Settings

Setting	Function
0	No change. (Retain current settings.)
1	Record user defaults. (Record the current constant settings as user defaults.)
2	Clear user defaults. (Clear the recorded user defaults.)

- The Digital Operation display will return to 0 after the settings have been made.

kVA Selection: o2-04

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o2-04	kVA selection	X	0 to FF	—	0	B	B	B	B

- This setting range and factory setting depend on the Inverter capacity. The settings shown in the table are for a 200 V class, 0.4 kW Inverter. (See Page 258)

- Do not change this constant setting; it is used by the manufacturer to identify the Inverter model.

- Use this setting only when the control PG board has been replaced.

Frequency Reference Setting Method Selection: o2-05

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o2-05	Frequency reference setting method selection	X	0, 1	—	0	A	A	A	A

- This constant determines whether it is necessary to press the ENTER key when changing the frequency reference with the Digital Operator's frequency reference monitor; it cannot be changed during operation.
- When o2-05 is set to 1 (DATA/ENTER key input not required), the frequency reference changes simultaneously with the Digital Operator's value.
- Settings

Setting	Function
0	DATA/ENTER key input required.
1	DATA/ENTER key input not required.

Operation Selection when Digital Operator is Disconnected: o2-06

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o2-06	Operation selection when the Digital Operator is disconnected	X	0, 1	—	0	A	A	A	A

- This constant specifies whether to stop operation when the Digital Operator is disconnected.
- Settings

Setting	Function
0	Disable Operator detection. (Continue operation when the Digital Operator is disconnected.)
1	Enable Operator detection. (Detect an OPR fault when the Digital Operator is disconnected, stop the Inverter output, and operate the fault contact.)

Cumulative Operation Time Settings: o2-07, o2-08

User Constant Number	Name	Change During Operation	Setting Range	Unit	Factory Setting	Valid Access Levels			
						V/f Control	V/f with PG	Open-Loop Vector	Flux Vector
o2-07	Cumulative operation time setting	X	0 to 65535	h	0	A	A	A	A
o2-08	Cumulative operation time selection	X	0, 1	—	0	A	A	A	A

- Set the initial elapsed time in constant o2-07. The elapsed operating time will start from this value.
- Constant o2-08 determines whether the elapsed operating time is the time that the Inverter is on or the time that the Inverter is running.
- Settings

Setting	Function
0	Inverter power-on time. (Counts the elapsed time from start-up until power is turned OFF.)
1	Inverter running time. (Counts the elapsed time that there is an Inverter output.)