3. CONSTANT DESCRIPTION

B APPLICATION-RELATED CONSTANTS

Constant No.	Name	Description	Remarks
B1-01 B1-02	Reference selection Operation method selection	Frequency reference and run command can be set independently as shown below. Table: Set Value / Description 0 / Run by digital operator reference 1 / Run by control circuit terminal reference 2 / Run by serial communication reference 3 / Run by option reference • By using the digital operator LOCAL/REMOTE key, operation mode can be selected during stop as shown below. LOCAL: Run by frequency reference and run command from digital operator REMOTE: Run by frequency reference and run command set by B1-01 and B1-02, respectively. Note: REMOTE is set when the power supply is turned ON.	When B1-01 is selected, frequency reference is a sum of terminals 13 and 14. (When terminal 14 is selected as a multi-function input, only terminal 13 is input.)
B1-03	Stopping method selection	The stopping method can be set as shown below. 	Only 00 and 01 can be selected when A1-02=3 (flux vector control). Deceleration time is selected among C1-02, C1-04, C1-06 and C1-08.

① B1-03=00 Deceleration to stop

② B1-03=01 Coast to stop

③ B1-03=02 Full-range DC injection braking stop

④ B1-03=03 Coasting to a stop (with timer function)

Constant No.	Name	Description	Remarks
B1-04	Prohibition of reverse operation	<table><tr><td>Selection</td><td>Description</td></tr><tr><td>0</td><td>REV run enabled</td></tr><tr><td>1</td><td>REV run prohibited (REV run command and minus frequency reference are not accepted.)</td></tr></table>	
B1-05	Operation selection for setting of E1-09 (min. frequency reference) or less	When flux vector control is set, select operation mode for frequency reference less than E1-09. <table><tr><td>Selection</td><td>Description</td></tr><tr><td>0</td><td>Run according to frequency reference (E1-09 invalid)</td></tr><tr><td>1</td><td>Baseblock</td></tr><tr><td>2</td><td>Run with min. frequency reference (E1-09)</td></tr><tr><td>3</td><td>Zero-speed operation (Internal speed reference is set to zero.)</td></tr></table>	• This setting is disabled when E1-09=0 (INITIAL VALUE). • When frequency reference is less than the min. frequency reference at A1-02=0, 1 or 2, baseblock is applied.

Time Chart of Inverter internal frequency reference and initial excitation when initial excitation time is set at start and stop

RUN COMMAND CLOSED OPEN

FREQUENCY REFERENCE BY ANALOG INPUT
0
E1-09

INVERTER INTERNAL FREQUENCY REFERENCE (SOFT-START INPUT)

B1-05=0
INITIAL EXCITATION STARTED WHEN MOTOR SPEED BECOMES B2-01 OR LESS AFTER RUN COMMAND IS CLOSED
BB
INITIAL EXCITATION
BB

B1-05=1
INITIAL EXCITATION STARTED WHEN MOTOR SPEED BECOMES B2-01 OR LESS AFTER FREQUENCY REFERENCE BECOMES LOWER THAN E1-09
BB
BB

B1-05=2
INITIAL EXCITATION STARTED WHEN MOTOR SPEED BECOMES B2-01 OR LESS AFTER RUN COMMAND IS CLOSED
BB
BB

B1-05=3
INITIAL EXCITATION STARTED WHEN MOTOR SPEED BECOMES B2-01 OR LESS AFTER RUN COMMAND IS CLOSED
BB
BB

Constant No.	Name	Description	Remarks
B1-06	Read sequence input twice	<table><tr><td>Selection</td><td>Description</td></tr><tr><td>0</td><td>Twice reading of control circuit terminal input signal for 2 msec</td></tr><tr><td>1</td><td>Twice reading of control circuit terminal input signal for 5 msec</td></tr></table>	Set "0" when control circuit terminal response is needed.
B2-01	Zero-speed level (DB starting frequency)	Set frequency which starts DC injection braking (initial excitation for flux vector control) in units of 0. 1Hz when deceleration to stop is selected. When B2-01 <E1-09, DC injection braking is started from E1-09.	
B2-02	DC injection braking current	Sets DC injection braking current in units of 1%. Inverter rated current becomes 100%.	※Note : Initial excitation is performed with current value set in E2-03 when A1-02=3 (flux vector control).
B2-03	DC injection braking time at start	When the motor rotating direction is not defined, DC injection braking at start is used in order to stop the coasting motor temporarily and start it again without tripping. Set the time to perform DC injection braking (initial excitation for flux vector control) at start in units of 0. 1 second.	When the set value is 0, DC injection braking at start is not performed.
B2-04	DC injection braking time at stop	Used to prevent coasting after stop command is input. Set the time to perform DC injection braking (zero speed control for flux vector control) at stop in units of 0. 1 second. E1-09 MIN OUTPUT FREQUENCY B2-01 B2-03 B2-04 DC Injection Braking Time Chart (Initial Excitation)	When the set value is 0, DC injection braking at stop is not performed.
B3-01	Speed search selection at start	<table><tr><td>Set Value</td><td>Description</td></tr><tr><td>0</td><td>When run command is input, the motor accelerates to the set frequency from the min. output frequency</td></tr><tr><td>1</td><td>When run command is input, speed search is performed from the max. output frequency. For a control method with PG, the motor accelerates/decelerates to the frequency from the motor speed.</td></tr></table>	* Factory setting of B3-01 is 01 for control with PG.

Constant No.	Name	Description	Remarks
B3-02	Speed search operating current	Set speed search operating level in the ratio (%) for the inverter rated current.	
B3-03	Speed search deceleration time	Set deceleration time during speed search in units of 0.1 second. O Speed search time chart at start with V/f control When inverter output current is larger than B3-02, the motor decelerates to the set frequency in the set accel/decel time.	.

```
RUN COMMAND        CLOSED
          OPEN                     DECEL TIME SET IN B3-03
MAX. OUTPUT FREQUENCY                                        SET FREQUENCY
                                                             REFERENCE

               ◄──►
          MIN. BASEBLOCK TIME

      B3-02  ·········
                                                             OUTPUT CURRENT
```

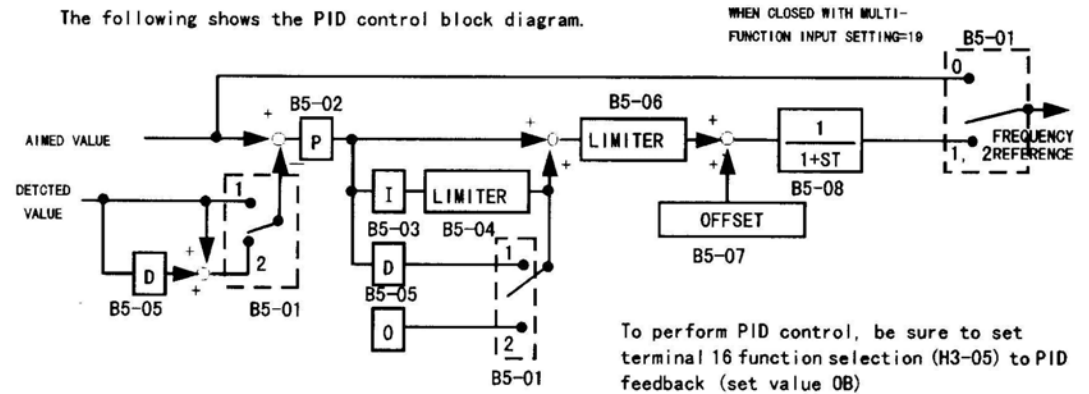| Constant No.	Name	Description	Remarks
		By combining multi-function input terminal input (set value=18) and multi-function output terminal timer output (set value=12), a timer to be mounted on the outside of the inverter can be enclosed in the inverter.	For selection of multi-function input terminal function, refer to H3-04 to H3-12
B4-01	Timer function ON-delay time	Sets ON-delay time in units of 0.1 second.	
B4-02	Timer function OFF-delay time	Sets OFF-delay time in units of 0.1 second.	
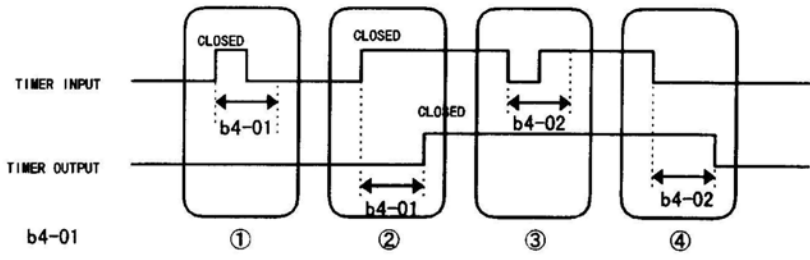
Sequence

① When timer input "CLOSED" time is shorter than b4-01, timer output remains OPEN.

② When timer input is "CLOSED" time output becomes "CLOSED" after the time set to b4-01 elapses.

③ When timer input "OPEN" time is shorter than b4-02, timer output remains "CLOSED".

④ When timer input is "OPEN" time output becomes "OPEN" after the time set to b4-02 elapses.

B5-01	PID control mode selection	• PID process control is enabled in the inverter.	

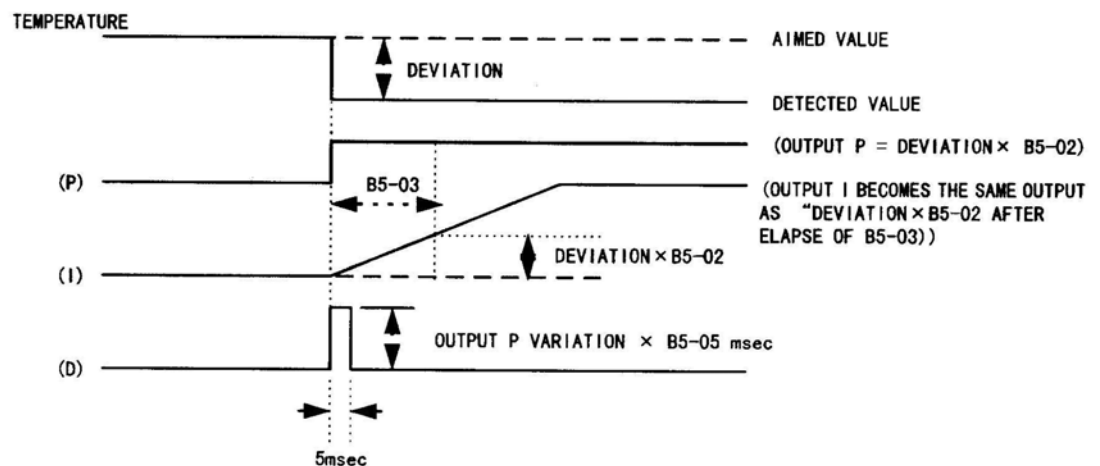| B5-01	PID Control Function
0	PID control disabled
1	PID control enabled (Deviation is D-controlled.)
2	PID control enabled (Feedback value is D-controlled.)

The following shows the PID control block diagram.

To perform PID control, be sure to set terminal 16 function selection (H3-05) to PID feedback (set value 0B)

• Setting of aimed value

Frequency reference selection (B1-01), multi-function input multi-step speed references 1 to 3 and frequency reference selected by jog reference become aimed values.
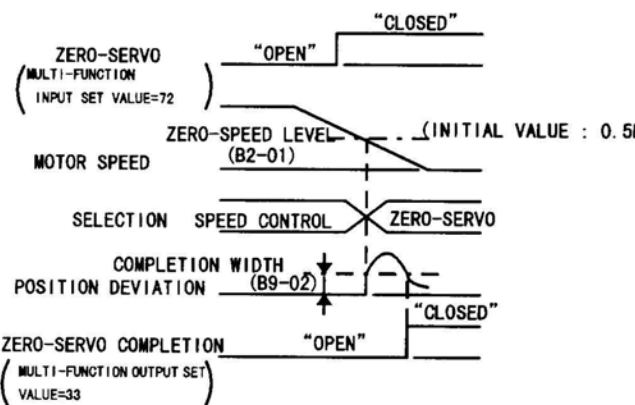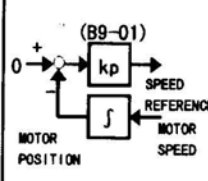
Constant No.	Name	Description	Remarks
B5-02	Proportional gain (P)	Sets P-control proportional gain. Setting to 0.0 does not perform P-control.	For multi-function analog input terminal function, refer to H3-04 to H3-12.
B5-03	Integral (I) time	Sets I-control integral time. Setting to 0.0 does not perform I-control.	
B5-04	Integral (I) limit	Sets integral limit in the ratio for max. frequency (E1-04).	
B5-05	Differential (D) time	Sets D-control differential time. Setting to 0.0 does not perform D-control.	
B5-06	PID limit	Sets PID limit control limiter in the ratio for max. frequency (E1-04).	
B5-07	PID offset adjustment	Sets offset for output after PID control in the ratio for max. frequency.	
B5-08	PID primary delay time constant	Sets primary delay time constant for frequency reference after PID control.	

(When variation is of step form)

- Value I is reset to 0 in the following cases; Stop command is input or operation held.
  For selection of multi-function input PID control, terminal is set to CLOSED and PID control is set to DISABLED.

- The upper limit of value I can be set by B5-04.
  To increase control capability by integration, increase the value of B5-04. If the control system vibrates and it cannot be resolved by adjusting integral time or primary time constant, decrease the value of B5-04.

- By selecting multi-function input PID DISABLED/ENABLED and closing the contact during run, PID control is canceled and the aimed value signal is used as frequency reference without being changed.

Constant No.	Name	Description	Remaks
B6-01	Dwell frequency at start	Dwell (temporary stop) function is used to stop output frequency temporarily and start it again when driving a motor with a heavy starting load. Sets frequency to stop output frequency during acceleration in units of 0.1Hz.	
B6-02	Dwell time at start	Sets time to stop output frequency during acceleration in units of 0.1Hz.	
B6-03	Dwell frequency at stop	Sets frequency to stop output frequency during deceleration in units of 0.1Hz	
B6-04	Dwell time at stop	Sets time to stop output frequency during deceleration in units of 0.1Hz 	
B7-01 B7-02	Droop control gain Droop control delay time	Drooping is a function to provide speed drooping characteristics in proportion to load torque. Sets B7-01 to speed reduction amount in the rated (100%) load status in the ratio (%) for max. frequency (E1-04) By decreasing B7-02, drooping response quicker, however, the motor would hunt more easily.	Function only for A1-02 =3 (flux vector control) (Not available at present time)
B8-01 B8-02	Energy-saving gain Energy-saving frequency	When output does not have to be large after completion of acceleration, by decreasing output voltage, energy-saving operation is enabled. When multi-function input energy-saving command is input, output voltage is decreased during speed agree at energy-saving starting frequency (B8-02) higher. Output voltage during energy-saving, normal V/f (E1-03 to 10) setting × energy-saving gain (E8-01. Output voltage declines and recovers in V-recovery time (L2-04). 	This function is validated only at A1-02 = 1 or 2 (V/f control).

Constant No.	Name	Description	Remarks
B9-01	Zero-servo gain	Zero servo function is to perform position control at a position where the motor speed becomes less than the zero-speed level. Sets zero-servo gain.	
B9-02	Zero-servo completion width	Sets zero-servo completion width in units of one pulse. 	 • For multi-function input terminal function selection, refer to H1-01 to H2-06. • For multi-function output terminal function selection, refer to H2-01 to H2-03. • This function is enabled only at A1-02 = 1 or (V/f control).

C CONSTANTS FOR ADJUSTMENT

Constant No.	Name	Description	Remarks
C1-01 C1-02 C1-03 C1-04 C1-05 C1-06 C1-07 C1-08	Acceleration time 1 Deceleration time 1 Acceleration time 2 Deceleration time 2 Acceleration time 3 Deceleration time 3 Acceleration time 4 Deceleration time 4	Sets acceleration time to accelerate from 0Hz to the max. frequency (E1-04), and deceleration time to decelerate from the max. frequency to 0Hz. By accel/decel time selection commands 1 and 2 of multi-function inputs, accel/decel time can be changed up to 4 steps. (Changeable even during run.) （see table below）	For multi-function input terminal function selection refer to H1-01 to H1-06

Accel/decel Time Selection 2 Multi-function Input Set Value =1A	Accel/decel Time Selection 1 Multi-function Input Set Value =07	Accel Time	Decel Time
Open or not set	Open or not set	C1-01	C1-02
Open or not set	Closed	C1-03	C1-04
Closed	Open or not set	C1-05	C1-06
Closed	Closed	C1-07	C1-08

Constant No.	Name	Description	Remarks
C1-09	Emergency stop time	Emergency stop time becomes valid in the following cases. ○ Multi-function input emergency stop command (set value = 1) is closed. ○ Selection at fault detection is set to emergency stop.	
C1-10	Accel/decel time setting unit	Accel/decel Time Setting Unit （see table below） When C1-10 is changed, the setting unit of accel/decel time (C1-01 to 09) stored in the inverter is changed automatically as follows. When C1-10 is changed from 0 to 1 at C1-01 = 12.4 seconds, 12.4 seconds is automatically set to C1-01. If either of C1-01 to 09 is set to 600.1 seconds or more, C1-10 cannot be changed from 0 to 1.	

Set Value	Description
0	Accel/decel time (C1-01 to 09) setting range is in units of 0.1 second. Setting range : 0 to 6000.0 seconds
1	Accel/decel time (C1-01 to 09) setting range is in units of 0.01 second. Setting range : 0 to 600.0 seconds

Constant No.	Name	Description	Remarks
C1-11	Accel/decel time switching frequency	By using C1-11, accel/decel time can be changed automatically. Run at C1-01 and 02 accel/decel time at output frequency ≧ C1-11. Run at C1-07 and 08 accel/decel time at output frequency < C1-11. OUTPUT FREQUENCY C1-11 ACCEL/DECEL TIME CHANGEOVER C1-07 C1-01 C1-02 C1-08 Multi-function input accel/decel time selection has priority over automatic change of accel/decel.	

Constant No.	Name	Description	Remarks
C2-01	S-curve characteristic time at acceleration start	S-curve characteristic is used to prevent the machine from shock at transfer or stop. As shown below, S-curve characteristic time can be set independently at 4 points : at acceleration start/stop and deceleration start/stop.	Time to accelerate from 0 to the maximum frequency can be calculated as follows : Accelerate time $+ \dfrac{C2\text{-}01 + C2\text{-}02}{2}$
C2-02	S-curve characteristic time at acceleration end		
C2-03	S-curve characteristic time at deceleration start		
C2-04	S-curve characteristic time at deceleration end		
C3-01	Slip compensation gain	Meaning of slip compensation gain differs depending on the control method. ○ PG-less control. PG-less vector control (open loop vector) ○ Calculates motor torque according to output current and sets gain to compensate for output frequency in units of 0.1. Adjusts when speed accuracy is reduced when operating with a load. <table><tr><th>Run Status</th><th>C3-01 Adjustment *</th></tr><tr><td>When actual speed is low</td><td>Increase the set value.</td></tr><tr><td>When actual speed is high</td><td>Decrease the set value.</td></tr></table> * : Adjust the value by 0.1 ○ Vector control with PG (flux vector control) Gain to compensate for slip caused by temperature variation. Normally, this setting does not have to be modified.	
C3-02	Slip compensation primary delay time	Adjusted value when speed is not stabilized or speed response is slow when operating with a load in PG-less V/f control or PG-less vector control. <table><tr><th>Run Status</th><th>C3-02 Adjustment *</th></tr><tr><td>When actual speed is low</td><td>Increase the set value.</td></tr><tr><td>When actual speed is high</td><td>Decrease the set value.</td></tr></table> * : Adjust the value by 10 msec.	
C3-03	Slip compensation limit	Sets slip compensation limit in the ratio (%) for motor rated slip (E2-02). The limit is as shown below in the constant torque and constant output area. 	