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# TOSVERT VF-MB1

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## Functions for lift application

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### **Toshiba Schneider Inverter Corporation**

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# 1. Introduction

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TOSVERT VF-MB1 has some functions for lift application.

This instruction manual explains the light-load high-speed operation function and the braking function of VF-MB1 for crane and hoists applications.

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# 2. Functions

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VF-MB1 has some functions for lift application.

1) Light-load high-speed operation function

The function is used to increase the operating efficiency of the machine by increasing the rotational speed of the motor when it is operated under light load.

The function is useful for constant-torque load applications which repeatedly drive light and heavy loads, such as lifts and transfer equipment.

Since VF-MB1 has the learning function for the light-load high-speed operation, it can be easily adjusted by executing the forward run (raising) or reverse run (falling) operation. (F 3 2 B=3, 4 only)

2) Braking function

To ensure smooth operation, the motor produces enough torque before the brake is released.

Since VF-MB1 has the learning function for the braking function, it can be easily rough set creeping frequency, creeping time and braking release time.

## 3. Light –load high-speed operation function

### 3.1 Related parameters

Title	Communication No.	Function	Adjustment range	Minimum setting unit (Panel/Communication)	Default setting
<i>F328</i>	0328	Light-load high-speed operation selection	0:Disabled 1: High-speed operation speed set automatically (Power running at F command: Increase) 2: High-speed operation speed set automatically (Power running at R command: Increase) 3: High-speed operation speed set with <i>F330</i> (Power running at F command: Increase) 4: High-speed operation speed set with <i>F330</i> (Power running at R command: Increase)	-	0
<i>F329</i>	0329	Light-load high-speed learning function	0:No learning 1:Forward run learning 2:Reverse run learning	-	0
<i>F330</i>	0330	Automatic light-load high-speed operation frequency	30.0 to $\underline{UL}$ Hz	0.1/0.01	(*1)
<i>F331</i>	0331	Light-load high-speed operation switching lower limit frequency	5.0 to $\underline{UL}$ Hz	0.1/0.01	40.0
<i>F332</i>	0332	Light-load high-speed operation load waiting time	0.0 to 10.0 sec.	0.1/0.1	0.5
<i>F333</i>	0333	Light-load high-speed operation load detection time	0.0 to 10.0 sec.	0.1/0.1	1.0
<i>F334</i>	0334	Light-load high-speed operation heavy load detection time	0.0 to 10.0 sec.	0.1/0.1	0.5
<i>F335</i>	0335	Switching load torque during power running	-250 to 250%	1/0.01	50
<i>F336</i>	0336	Heavy-load torque during power running	-250 to 250%	1/0.01	100
<i>F337</i>	0337	Heavy-load torque during constant power running	-250 to 250%	1/0.01	50
<i>F338</i>	0338	Switching load torque during regenerative braking	-250 to 250%	1/0.01	50

(\*1)The values depend on the setup menu setting.

Note: Parameters *F335* to *F338* need adjustment according to the load.

Since VF-MB1 has the learning function for the light-load high-speed operation, it can be easily adjusted by executing the forward/reverse run operation (raising/falling for lift application).  
(*F328*=3, 4 only)

## 3.2 Mode description

The light-load high-speed operation includes the modes below:

Each mode can be set by the light-load high-speed operation selection (*F 3 2 8*).

Title/function	Default setting	Action
<i>F 3 2 8</i> Light-load high-speed operation selection	0: Disabled	Light-load high-speed operation disabled.
	1:High-speed operation speed set automatically (Power running at F command: Increase)	When inverter judges to be light-load, the high-speed operation frequency is automatically set according to a detected torque.
	2:High-speed operation speed set automatically (Power running at R command: Increase)	
	3:High-speed operation speed set with <i>F 3 3 0</i> (Power running at F command: Increase)	When inverter judges to be light-load, the operation is set to the automatic light-load high-speed operation frequency ( <i>F 3 3 0</i> ).
4:High-speed operation speed set with <i>F 3 3 0</i> (Power running at R command: Increase)		

Example: If automatic setting mode of high-speed operation speed is used,  
 set *F 3 2 8* to *1* for F (forward command): Increase  
 set *F 3 2 8* to *2* for R (reverse command): Increase

Note: Light load output and Heavy load output conditions of output terminal functions are different from *F 3 2 8* setting.

1) *F 3 2 8* (Light-load high-speed operation selection) =0

Light load output (Function No. 106/107) ON: Less than <i>F 3 3 5</i>
Heavy load output (Function No. 108/109) ON: <i>F 3 3 7</i> or more

2) *F 3 2 8* (Light-load high-speed operation selection) setting is not 0

Light load output (Function No. 106/107) ON: Less than <i>F 3 3 5</i> or <i>F 3 3 8</i>
Heavy load output (Function No. 108/109) ON: <i>F 3 3 5</i> or <i>F 3 3 8</i> or more

*F 3 3 5*: Switching load torque during power running  
*F 3 3 7*: Heavy-load torque during constant power running  
*F 3 3 8*: Switching load torque during regenerative braking

## 3.2.1 Automatic setting mode of high-speed operation speed (F328=1, 2)

The diagram on the next page (Fig.1) is the timing chart when the automatic setting mode of high-speed operation speed (F328=1) is applied to lift application.

At the operation frequency above the light-load high-speed operation switching lower limit frequency (F331) (point A in the Fig.1), if a detected torque (\*1) after completion of speed reach is the switching load torque during power running (F335 setting value) or less, the inverter judges to be light-load.

For light-load operation, the frequency decided with the formula is determined as a target frequency (high-speed operation frequency) and the operation is accelerated toward the target frequency. (Point B in the Fig.1 Light-load high-speed operation)

$$\text{Target frequency} = (\text{Value set with F335}) \times [\text{Base frequency (UL)}] / (\text{Detection torque})$$

when target frequency  $\leq$  UL ( $\leq$  FH)

(\*1) Average torque during light-load high-speed operation load detection time (F333) after light-load high-speed operation load detection waiting time (F332) (5% or more)

Light-load detection is carried out after speed reach when an operation frequency is above the light-load high-speed operation switching lower limit frequency (F331).

When each of conditions below is reached, the light-load high-speed operation is canceled and the operation is returned to the frequency corresponding to a speed command value.

- 1) The torque is exceeded the heavy-load torque (F335) during acceleration up to the high-speed operation frequency.
- 2) The torque is exceeded the heavy-load torque during constant power running (F337) after reaching the automatic light-load high-speed operation frequency (F330) and after a lapse of the light-load high-speed operation heavy load detection time (F334).
- 3) The speed command value is entered less than the light-load high-speed operation switching lower limit frequency (F331).

《Example of operation》 Light-load high-speed operation selection  
 (F 3 2 8 = 1: High-speed operation speed set automatically): F (Increase)

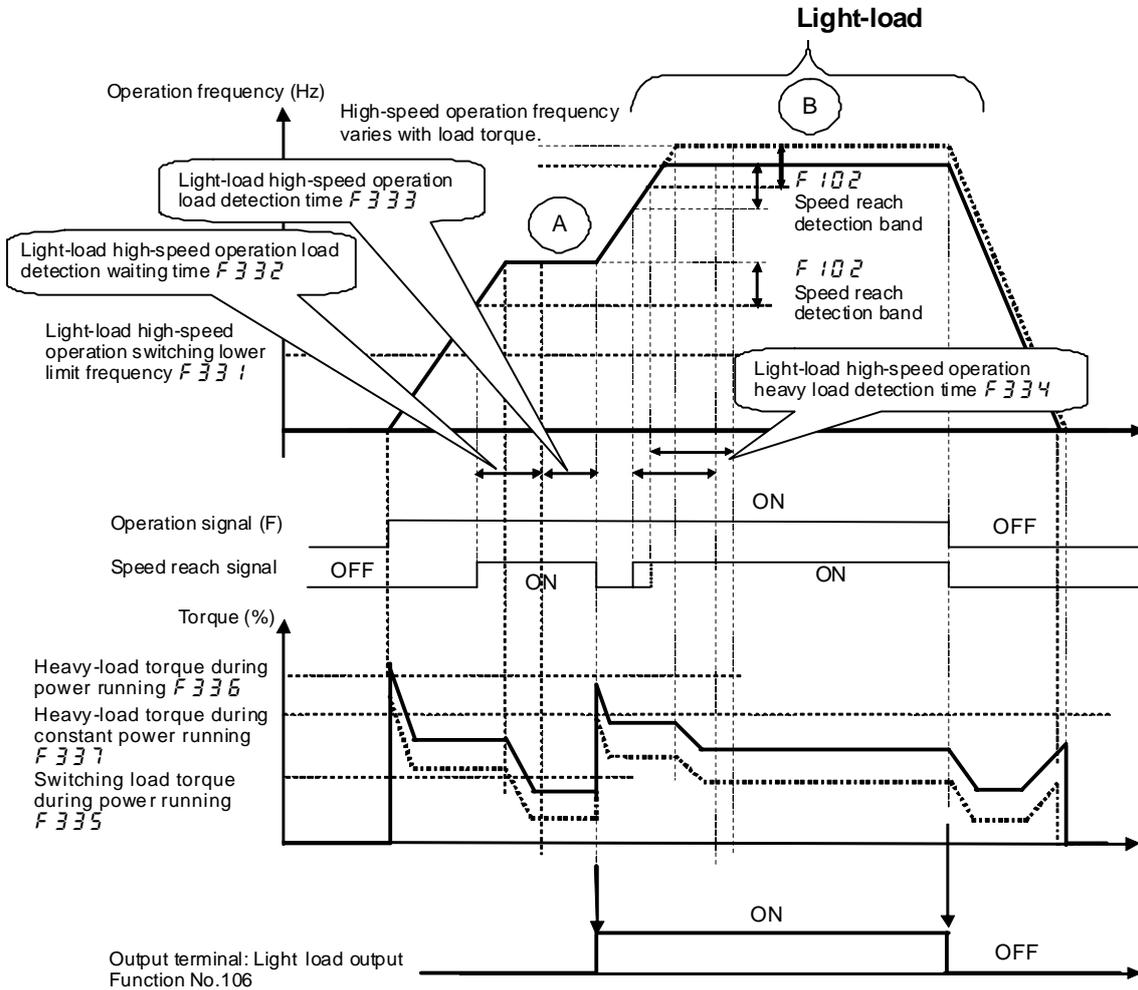


Fig.1

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### 3.2.2 Fixed setting mode of high-speed operation speed (F328=3, 4)

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The diagram on the next page (Fig.2) is the timing chart when fixed setting mode of the high-speed operation speed (F328=3) is applied to lift application.

At the operation frequency more than the light-load high-speed operation switching lower limit frequency (F331) (point A in the Fig.2), if an average torque during the light-load high-speed operation load detection time (F333) after completion of speed reach and after the light-load high-speed operation load detection waiting time (F332) has elapsed is below the switching load torque during power running (F335), the inverter judges to be light-load detection and is more accelerated up to an automatic light-load high-speed operation frequency (F330). (Point B in the Fig.2 Light-load high-speed operation)

Load torque detection is carried out after speed reach when an operation frequency is more than the light-load high-speed operation switching lower limit frequency (F331).

When each of conditions below is reached, the light-load high-speed operation is canceled and the operation is returned to the frequency corresponding to a speed command value.

- 1) The torque is exceeded the heavy-load torque (F336) during acceleration up to the automatic light-load high-speed operation frequency (F330).
- 2) The torque is exceeded the heavy-load torque during constant power running (F337) after reaching the automatic light-load high-speed operation frequency (F330) and after a lapse of the light-load high-speed operation heavy load detection time (F334).
- 3) The speed command value is entered less than the light-load high-speed operation switching lower limit frequency (F331).

《Example of operation》 Light-load high-speed operation selection  
 (F 3 2 8 = 3: High-speed operation set with F 3 3 0): F (Increase)

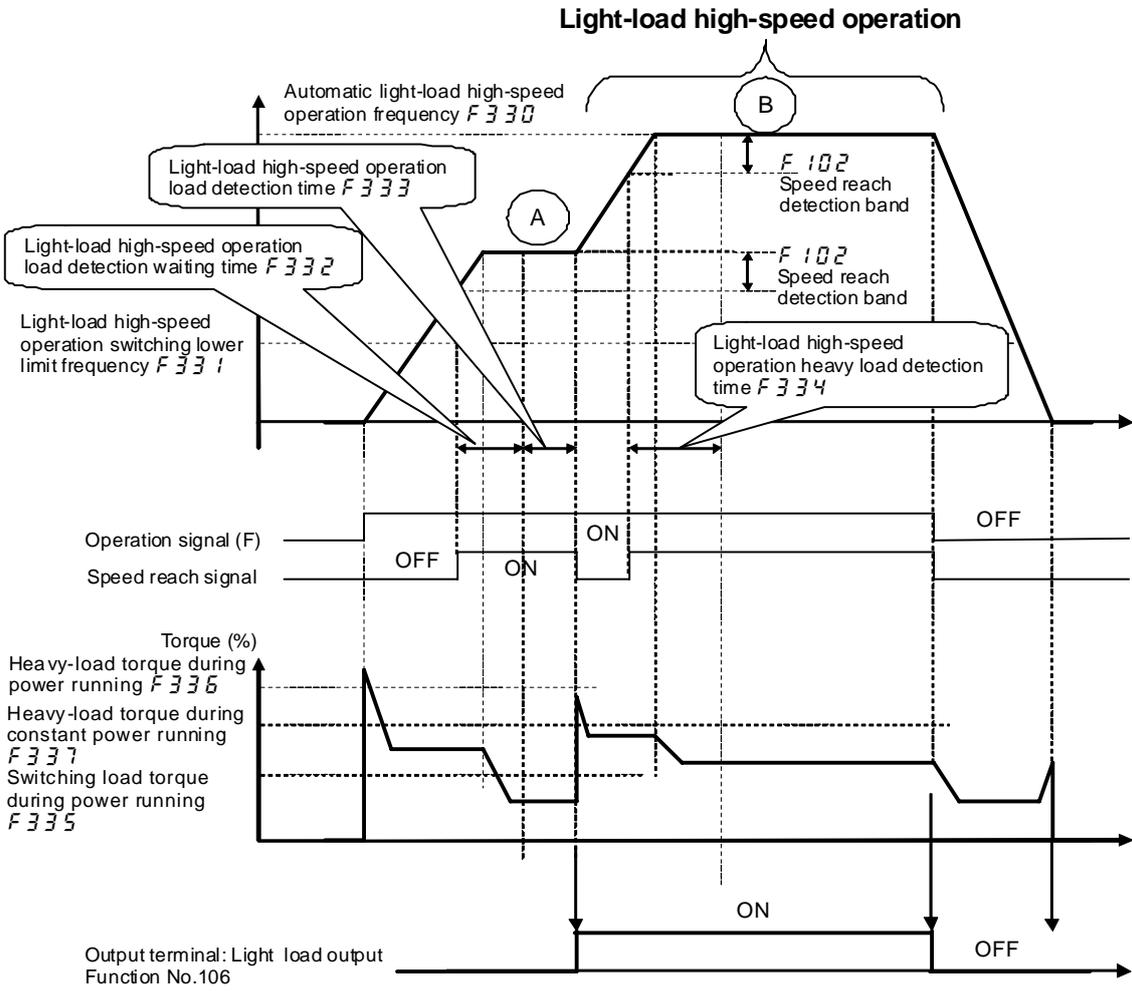


Fig.2

## 3.3 How to adjust parameters

If the light-load high-speed operation is used, it is necessary to always set the motor-related parameters (Motor constants).

Refer to Section 6.21 of VF-MB1 instruction manual (E6581697) to set motor-related parameters.

In addition, for the high-speed operation fixed setting mode ( $F 328=3, 4$ ), the learning action allows the light-load high-speed operation to be adjusted easily.

### 3.3.1 Automatic setting mode of high-speed operation speed ( $F 328=1, 2$ )

《Adjustment method for lift application》

If the light-load high-speed operation is carried out with 60Hz of normal operation, follow the procedure below:

- 1) Set the parameter below at an arbitrary position of the status monitor display selection ( $F 711$  to  $F 718$ ).

Torque monitor	Setting No.7	Ex. of LED display	9 20
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- 2) Set  $F 335=0$  and  $F 338=0$  not to change the light-load high-speed operation.

$F 335$ : Switching load torque during power running

$F 338$ : Switching load torque during regenerative braking

- 3) Check the torque monitor value of the following conditions. And set the value to each parameters after all operation checking.

- (1)Setting of  $F 335$  (Switching load torque during power running)

Carry out the power running operation while hanging 100% load at the  $\omega_L$  (base frequency).

Check the maximum torque monitor value after speed reach and set the value to  $F 335$ .

- (2)Setting of  $F 338$  (Switching load torque during regenerative braking)

Carry out the regenerative braking operation while hanging 100% load at the  $\omega_L$  (base frequency).

Check the maximum torque monitor value after speed reach and set the value to  $F 338$ .

- (3)Setting of  $F 335$  (Heavy-load torque during power running)

Carry out the power running operation while hanging 100% load at the  $\omega_L$  (base frequency).

Check the torque monitor value during acceleration and set the value to  $F 335$ .

- (4)Setting of  $F 337$  (Heavy-load torque during constant power running)

Carry out the power running operation while hanging 100% load at the  $\omega_L$  (base frequency).

Check the torque monitor value during constant power running and set the value to  $F 337$ .

- 4) Carry out the power running operation while hanging a minimum load for which the light-load high-speed operation is not wanted and check that the operation does not change to the light-load high-speed operation (an operation frequency does not change).

If changing to the light-load high-speed operation, reduce the setting value of the switching load torque during power running ( $F 335$ ).

- 5) Similarly, carry out the regenerative braking operation while hanging a minimum load for which the light-load high-speed operation is not wanted and check that the operation does not change to the light-load high-speed operation (an operation frequency does not change).

If changing to the light-load high-speed operation, reduce the setting value of the switching load torque during power running ( $F 338$ ).

Change the *F 335* and *F 338* values step by step.

- 6) When reaching a state where it is possible to switch to the light-load high-speed operation, check that a high-speed operation frequency changes by changing a load.
- 7) Restore the parameter changed in 1) to an initial value if necessary.

## 3.3.2 Fixed setting mode of high-speed operation speed (F328=3, 4)

《Adjustment method using the learning function for lift application》

If the light-load high-speed operation is carried out with 60Hz of normal operation, follow the procedure below:

- 1) Set the automatic light-load high-speed operation frequency (F330). Ex.: F330=90Hz
- 2) Set the light-load high-speed learning function (F329) to 1 (Forward run learning).
- 3) Carry out the 60Hz-forward power running operation while hanging a maximum load for which the light-load high-speed operation can be carried out and check that the operation changes to the light-load high-speed operation (90Hz operation). (Forward run learning)  
During the learning operation,  $\text{L}$  blinks on the left side of the frequency display LED.
- 4) Set the light-load high-speed learning function (F329) to 2 (Reverse run learning).
- 5) Similarly, carry out the 60Hz-reverse regenerative braking operation while hanging a maximum load for which the light-load high-speed operation can be carried out and check that the operation changes to the light-load high-speed operation (90Hz operation).
- 6) The parameters below are automatically adjusted by carrying out operations in 3) and 5).

Title	Function	Default setting
F335	Switching load torque during power running	50
F336	Heavy-load torque during power running	100
F337	Heavy-load torque during constant power running	50
F338	Switching load torque during regenerative braking	50

- 7) Hang a load for which the light-load high-speed operation is not wanted and check that a normal operation does not change for both of power running/regenerative braking operations.
- 8) In case of a dynamic lift off at power running operation, carry out the dynamic lift off after high-speed operation and check that the inverter operates at the normal speed.

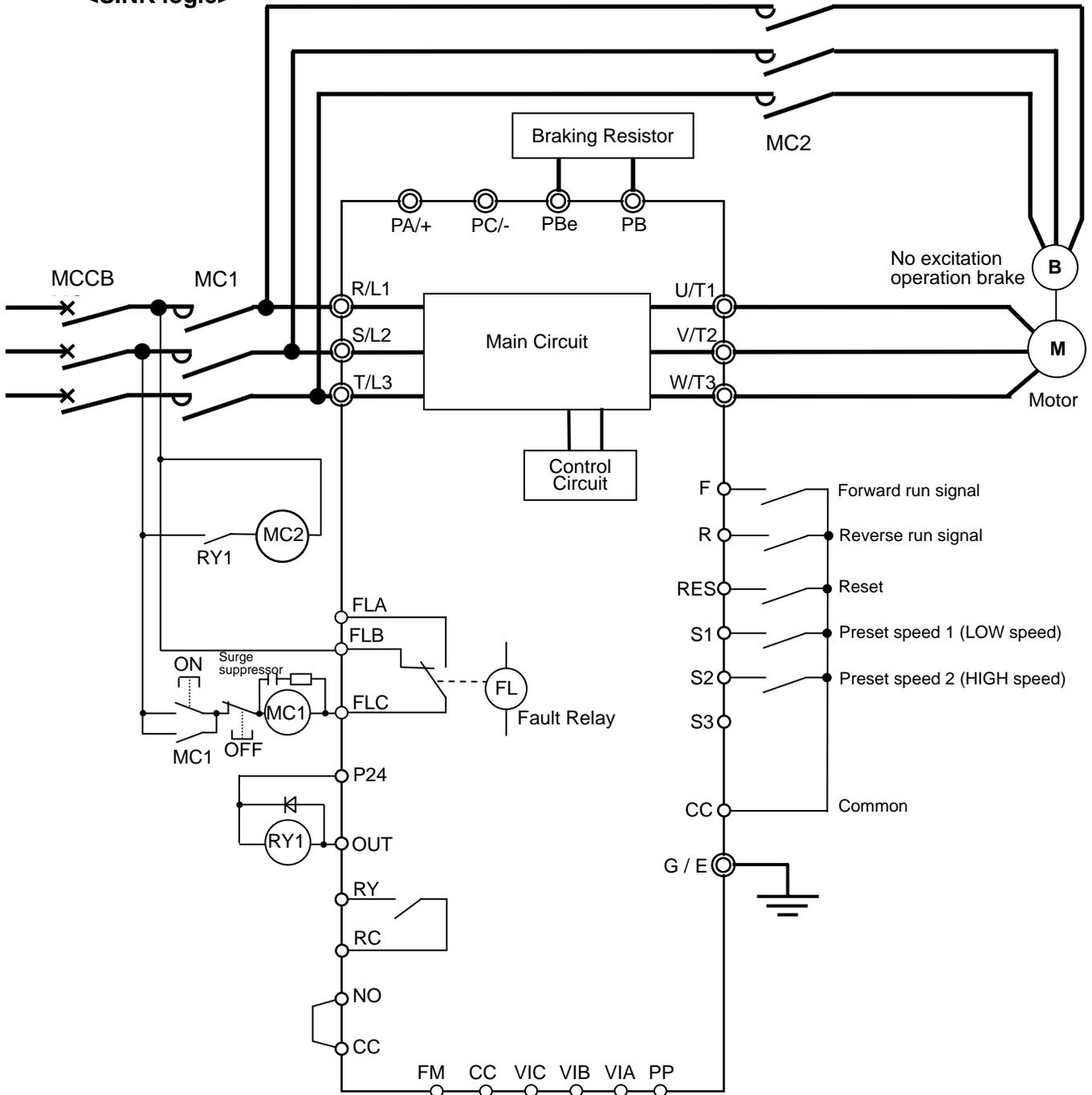
《Cautions》

- If a result of the learning operation is as follows, the learning operation should be completed when it stops without transition to the high-speed operation.  
Switching load torque during power running (F335) is 70% or more  
Switching load torque during regenerative braking (F338) is 70% or more
- If a detected torque exceeds 150% during acceleration of the high-speed operation, the high-speed operation should be stopped and the learning operation should be completed without reflecting the learning data.
- If a detected torque exceeds 100% during constant speed operation after completion of acceleration of the high-speed operation, the high-speed operation should be stopped and the learning operation should be completed without reflecting the learning data.

## 4. Braking functions

### 4.1. Standard connection for lift application

<SINK logic>



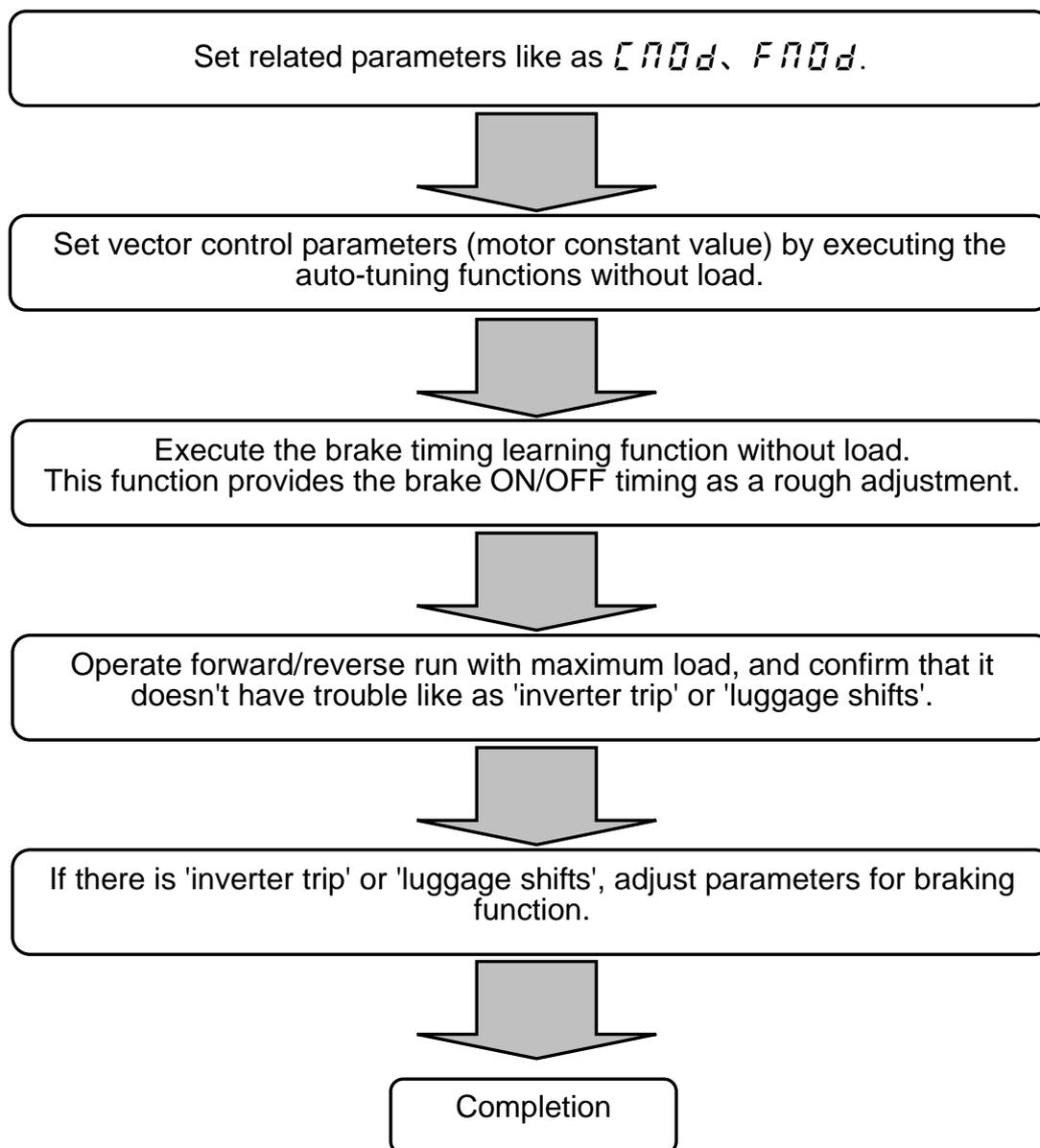
[Operation] By terminal signal

[Speed reference] Preset speed 1 and 2, Operation panel → 3 preset speed

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## 4.2 Parameter adjustment procedure for braking functions

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## 4.3 Setting sample of related parameters

Title	Comm. Number	Functions	Setting range	Minimum setting value (Panel/Comm.)	Default value	Setting sample	Notes
<i>CnOd</i>	0003	Command mode selection	0 ~ 4	-	1	<b>0</b>	0:Terminal input enabled
<i>FnOd</i>	0004	Frequency setting mode selection 1	0 ~ 11	-	0	<b>3</b>	3:Setting dial 2
<i>RtL</i>	0009	Acceleration time 1	0.0 ~ 3600 sec.	0.1/0.1	10.0	<b>1.0</b>	
<i>dEt</i>	0010	Deceleration time 1	0.0 ~ 3600 sec.	0.1/0.1	10.0	<b>1.0</b>	
<i>FH</i>	0011	Maximum frequency	30.0 ~ 500.0Hz	0.1/0.01	80.0	<b>60.0</b>	
<i>UL</i>	0012	Upper limit frequency	0.5~ <i>FH</i> Hz	0.1/0.01	(*1)	<b>60.0</b>	
<i>LL</i>	0013	Lower limit frequency	0.0 ~ <i>UL</i> Hz	0.1/0.01	0.0	<b>6.0</b>	
<i>Pt</i>	0015	V/f control mode selection	0 ~ 7	-	(*1)	<b>3 (*3)</b>	3: Vector control
<i>sr1</i>	0018	Preset speed operation frequency 1	<i>LL</i> ~ <i>UL</i>	0.1/0.01	0.0	<b>10.0</b>	Operation frequency (Low)
<i>sr2</i>	0019	Preset speed operation frequency 2	<i>LL</i> ~ <i>UL</i>	0.1/0.01	0.0	<b>60.0</b>	Operation frequency (High)
<i>F131</i>	0131	Output terminal selection 2A (OUT)	0 ~ 255	-	6	<b>68</b>	68: Brake release signal (*3)
<i>F240</i>	0240	Starting frequency setting	0.1 ~ 10.0 Hz	0.1/0.01	0.5	<b>0.5</b>	
<i>F304</i>	0304	Dynamic braking selection	0 ~ 4	-	0	<b>1</b>	1:Enabled (Resistor overload protection enabled)
<i>F305</i>	0305	Overvoltage limit operation	0 ~ 3	-	2	<b>2 (*4)</b>	1:Disabled 2:Enabled (quick deceleration)
<i>F308</i>	0308	Dynamic braking resistance	1.0 ~ 1000 ohm	0.1/0.1	(*2)	<b>(*5)</b>	
<i>F309</i>	0309	Allowable continuous braking resistance	0.01 ~ 30.00kW	0.01/0.01	(*2)	<b>(*6)</b>	
<i>F340</i>	0340	Creeping time 1	0.00 ~10.00 sec	0.01/0.01	0.00	<b>0</b>	Refer to section 4.4.
<i>F341</i>	0341	Braking mode selection	0 ~ 3	-	0	<b>1</b>	
<i>F342</i>	0342	Load portion torque input selection	0 ~ 4	-	0	<b>4</b>	
<i>F343</i>	0343	Hoisting torque bias input (valid only when <i>F342</i> =4)	-250 ~ 250%	1/0.01	100	<b>100</b>	
<i>F344</i>	0344	Lowering torque bias multiplier	0 ~ 100%	1/0.01	100	<b>60</b>	
<i>F345</i>	0345	Brake release time	0.00 ~ 10.00 sec.	0.01/0.01	0.05	<b>0.05</b>	
<i>F346</i>	0346	Creeping frequency	<i>F240</i> ~ 20.0Hz	0.1/0.01	3.0	<b>3.0</b>	
<i>F347</i>	0347	Creeping time 2	0.00 ~ 10.00 sec.	0.01/0.01	0.10	<b>0.10</b>	
<i>F348</i>	0348	Braking time learning function	0, 1	-	0	<b>1</b>	
<i>F400</i>	0400	Auto-tuning	0 ~ 5	-	0	<b>(*3)</b>	Refer to of the VFMB1 installation manual (E6581697 : section 5.5 or 6.21)
<i>F401</i>	0401	Slip frequency gain	0 ~ 150%	1/1	50		
<i>F402</i>	0402	Automatic torque boost value	0.1 ~ 30.0%	0.1/0.1	(*2)		
<i>F405</i>	0405	Motor rated capacity	0.01 ~ 22.00kW	0.01/0.01	(*2)		
<i>F415</i>	0415	Motor rated current	0.1 ~ 100.0A	0.1/0.1	(*2)		
<i>F417</i>	0417	Motor rated speed	100 ~ 6400min <sup>-1</sup>	1/1	(*1)		
<i>F452</i>	0452	Power running stall continuous trip detection time	0.00 ~ 10.00 sec.	0.01/0.01	0.00	<b>0.5(*7)</b>	

(\*1) The values depend on the setup menu setting.

(\*2) Default setting values depend on inverter's capacity. Refer the installation manual about the default setting values.

(\*3) Select the vector control in case of using braking functions (output terminal functions: 68, 69).  
Set *RU2* (Torque boost setting macro function)=*2* (vector control + auto-tuning), or set motor constant parameters (*F401* ~ *F417*) and *Pt* (V/f control mode selection)=*3* (vector control)

(\*4) *F304* (Dynamic braking selection)=*1*~*4* (Enabled) setting process automatically as same as *F305* (Overvoltage limit operation) = *1* (Disabled).

(\*5) It is impossible to connect the braking resistor smaller than the minimum allowable resistance value.

(\*6) Set this parameter to specifications of connected braking resistor's capacity.

(\*7) This is one of functions to prevent from falling for lift application. The function offers inverter trip by judgment of motor stalling in continuous stall prevention mode. Set the detection time to about 0.5 seconds.

## 4.4 Braking functions

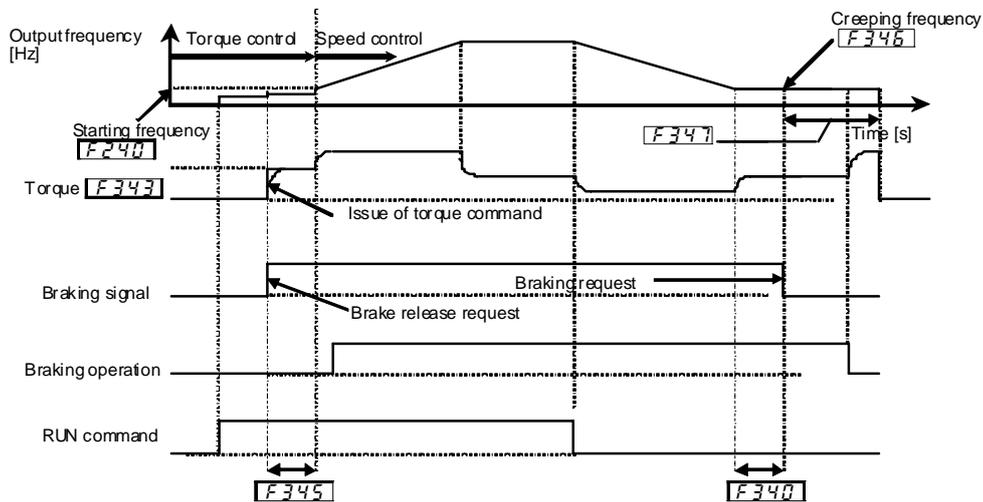
The braking function is to ensure smooth operation with the motor produces enough torque before the brake is released.

### ■ Starting procedure

At the run command, the inverter makes the motor produce the torque specified with parameter  $F343$ . As soon as a torque output command is issued, a brake release request signal is put out through the brake output terminal. Upon expiration of the brake release time set with  $F345$ , the motor starts to accelerate.

### ■ Stopping procedure

At the stop command, the operation frequency is decreased to the creep frequency set with parameter  $F346$ , and put out the braking request after the creep time 1 set with  $F347$ . And then, the creep frequency is maintained for the creep time set with  $F347$ . While the creep frequency is maintained, the brake release signal is put out through the braking signal output terminal to apply the brake.



## 4.4.1 Parameters for braking functions

TITLE	FUNCTIONS	Setting range	Default setting value	Setting sample	Notes
<i>F340</i>	Creeping time 1	0.00 ~ 10.00 sec.	0.00	0	
<i>F341</i>	Braking mode selection	0:Disabled 1:Forward winding up 2:Reverse winding up 3:Horizontal operation	0	1	
<i>F342</i>	Load portion torque input selection	0:Disabled 1:VIA 2:VIB 3:VIC 4: <i>F343</i>	0	4	(*1)
<i>F343</i>	Hoisting torque bias input (valid only when <i>F342</i> =4)	-250 ~ 250%	100	100	(*2)
<i>F344</i>	Lowering torque bias multiplier	0 ~ 100%	100	60	
<i>F345</i>	Brake release time	0.00 ~ 10.00 sec.	0.05	0.05	(*3)
<i>F346</i>	Creeping frequency	<i>F240</i> ~ 20.0Hz	3.0	3.0	(*3)
<i>F347</i>	Creeping time 2	0.00 ~ 10.00 sec.	0.10	0.10	(*3)
<i>F348</i>	Braking time learning function	0:Disabled 1:Learning (0 after adjustment)	0	1	

***F340*** : Creeping time 1

Inverter puts out the braking request after the time with *F340* to wait for being minimize swing of load.

***F341*** : Braking mode selection

This parameter is for selection of operation mode of brake function. Usually, the forward (F terminal) operation is winding up.

***F342*** : Load portion torque input selection

This parameter is to set the brake releasing torque value as same as load torque to prevent load gap (shifts) at brake release.

Usually, set the fixed *F343* (Hoisting torque bias input) value with *F342* = 4.

(\*1) This parameter is set *F342*=4 by "Braking time learning function (*F348*)".

***F343*** : Hoisting torque bias input

This parameter is hoisting torque bias value that is valid only *F342* = 4.

The 100% value depends on *F405* (Motor rated capacity) and *F417* (Motor rated speed).

Usually, set *F343* = 100. In case of some trouble after brake learning, adjust this setting value.

(\*2) This parameter is set *F343*=100 by "Braking time learning function (*F348*)"

***F344*** : Lowering torque bias multiplier

The torque bias value when brake released is set by *F342* (Load portion torque input selection). When winding down, the torque bias value is multiplied this parameter value.

Usually, a necessary torque in winding down is decreased by squaring the mechanical efficiency.

The hoisting torque bias in winding down at 80% machine efficiency is  $0.8 \times 0.8 = 0.64$  (about 60%).

Usually, set *F344* = 60 ~ 70.

**F345** : Brake release time

The brake release demand signal is output at the same time as outputting the set torque after the starting signal turns on.  
After the time set with *F 345* (Brake release time), it accelerates.

(\*3)This parameter is set by "Braking time learning function" as a rough adjustment.

**F346** : Creeping frequency

After the starting signal turns off, it becomes a brake close operation after decelerated to *F 346* (Creep frequency). A standard setting of the creep frequency is about motor rated slips.  
For example, case of 5% slips in 60Hz motor, the creeping frequency is "60Hz\*5%=3Hz".

(\*3)This parameter is set by "Braking time learning function" as a rough adjustment.

**F347** : Creeping time 2

After the starting signal turns off, it becomes a brake close operation after decelerated to *F 346* (Creep frequency). Moreover, inverter's output frequency keeps a creeping frequency while set *F 347* (Creeping time 2).

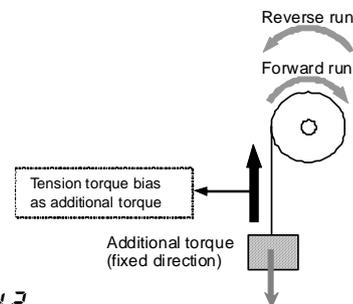
(\*3)This parameter is set by "Braking time learning function" as a rough adjustment.

**F348** : Braking time learning function

The brake learning function is executed by set *F 348* (Braking time learning function) to 1.  
Parameters of *F 345* (Brake release time), *F 346* (Creeping frequency) and *F 347* (Creeping time 2) are set by "Braking time learning function" as a rough adjustment.  
And *F 342* = 4 and *F 343* = 100 are set after adjustment.

■ Torque bias function (*F 342* ~ *F 344*)

Using this function, the load can be started smoothly, by the motor produces enough torque for load portion before the brake is released,



<Selection of external signals>

		<b>F 342</b>	
Voltage signals	—	VIA-CC – 0~10V (0~250%)	1
	—	VIB-CC – 0~±10V (-250~250%)	2
Current signals	—	VIC-CC – 4(0)~20mA (0~250%)	3

## 4.4.2 Execution of "Brake time learning"

The brake function sets automatically the timing (torque establishment when starting) of the preliminary excitation by motor's constants value.  
It is necessary to set related parameter before "brake time learning".

Before executed "brake time learning", the brake timing may not fit a load torque.  
Execute "brake time learning" at light load that is no load, 3% of rated load or less.

### ■ Learning function ( $F348$ )

Using this function, rough settings can be made automatically and also parameters  $F345$ ,  $F346$  and  $F347$  can be set automatically.

After the learning function is set,  $F342$  will be set automatically to 4 and  $F343$  to 100.

If necessary, fine adjust the parameter setting manually.

### ■ Learning operation

Set parameter  $F348$  to 1 and enter an operation command to start learning.

The frequency and "Hz" are displayed alternately.

Parameter  $F343$  (torque) is set, the brake release timing is calculated, and parameter  $F345$  (release time) is set based on the calculation result.  $F346$  is set automatically according to the motor constant calculated. At the stop of operation,  $F347$  (creep time) are set.

Note 1: Learning should be performed under light-load conditions.

Note 2: If a counterweight is provided, a learning error may occur. If so, make an adjustment manually.

Note 3: Brake learning ( $F348=1$ ) should be carried out for forward rotation if  $F341$  is set to 1 (forward winding), or for reverse rotation if  $F341$  is set to 2 (reverse winding).

### 《Notice for braking function》

Note 4: For the braking functions, the pre-excitation time is automatically determined by the inverter from motor-related constants.

When the VFMB1S-2022PL is used in combination with a Toshiba 4P-2.2kW-60Hz-200V standard motor, the pre-excitation time is approximately 0.1 to 0.2 seconds.

Depending on the motor, the pre-excitation time may be prolonged.

Note 5: Select the vector control in case of using braking functions.

Set  $F42$  (Torque boost setting macro function) = 2 (vector control + auto-tuning), or set motor constant parameters ( $F401 \sim F417$ ) and  $P4$  (V/F control mode selection) = 3 (vector control).

Note 6: When the inverter is confirmed operation by braking functions, connect and run the combined motor.

As this function calculate the timing of brake by detecting output current, calculating error is occurred without connecting the motor.

## 4.4.3 Brake timing with maximum load

The brake timing adjustment at no-load (light load) is completed by the previous chapter.

Next confirmation is the brake timing with maximum load.

Please confirm next items.

- Isn't there load gap (shifts) when starting on the winding up, and is the start when the brake is released smooth?
- Isn't there load gap (shifts) when the brake operates?
- Isn't there load gap (shifts) in case of the repetition of the start (run/stop)?
- Does the allophone from the brake when start or stop, or not?
- Does the inverter trip when start or stop, or not?

There is no trouble after confirmation, an adjustment of the brake function is completed.

《Convenient function for adjustment》

When starting, the lift application is necessary to get enough output torque and to adjust brake release timing. When stopping, it is necessary to shutdown the inverter output with being sure brake-ON.

Therefore, the state that the motor is restrained to some degree is generated when start/stop.

In case of a short restrained time, it happens that load shifts. But, in case of long restrained time, the inverter trip is caused by increased motor current.

Please use next parameter when adjustment that can confirm a peak output current.

Usually, a peak output current is about 150% of inverter's rated current.

Title	Function	Setting range	Default setting value	Setting sample	Notes
<i>F709</i>	Standard monitor hold function	0:Real time 1:Peak hold 2:Minimum hold	0	1	-
<i>F710</i>	Initial panel display selection	0 ~ 52	0	1	Output current
<i>F750</i>	EASY key function	0:Easy/standard setting mode switching function 1:Shortcut key 2:Local/remote key 3:Monitor peak minimum hold trigger	0	3	-

The status monitor is changed "Peak hold value of output current" by above parameter settings.

This peak value is changed when the peak value of the output current is updated by start/stop.

When push the "EASY" key, the peak hold value is reset.

## 4.4.4 Abnormal phenomenon and the measures

Abnormal phenomenon and the measures (adjustment item) according to load and operating condition

Load condition	Operating condition	Abnormal phenomenon	Countermeasure (adjustment item)
No-load	At start	When winding down operation, wind down after a little winding up.	<ol style="list-style-type: none"> <li>1. Set <math>F\ 3\ 4\ 5</math> (Brake release time) to short value.</li> <li>2. Set <math>F\ 3\ 4\ 4</math> (Lowering torque bias multiplier) to 5% down.</li> <li>3. Set <math>F\ 3\ 4\ 3</math> (Hoisting torque bias input) to 5 ~ 10% down.</li> </ol>
No-load or load	At start	When winding up operation, it happens a little load gap/shift (a little winding down).	<ol style="list-style-type: none"> <li>1. Set torque bias value of <math>F\ 3\ 4\ 2</math> (Load portion torque input selection) and <math>F\ 3\ 4\ 3</math> (Hoisting torque bias input) to increased 10 ~ 20%.</li> </ol>
No-load or load	At start or stop	When winding up operation with inching, it happens a little load gap/shift (a little winding down).	<ol style="list-style-type: none"> <li>1. Set <math>F\ 3\ 4\ 5</math> (Brake release time) to short value.</li> </ol>

**《Notice of adjustment》**

When adjust  $F\ 3\ 4\ 5$  (Brake release time) and  $F\ 3\ 4\ 7$  (Creeping time 2), these setting value have to be changed step by step.

If these values are too large or small, the load may fall in worst case because of not matched "brake operation" and "generating motor torque" timing.