

6

[Advanced] How to use parameters

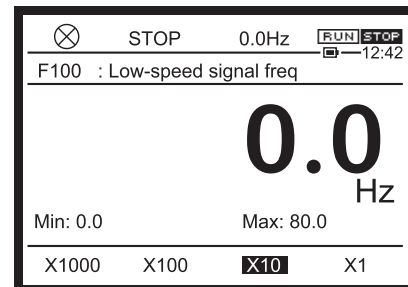
This inverter has basic parameters and other three types of parameters such as extended parameters (with F), advanced parameters, (with A), and communication parameters (with C). These parameters are used for sophisticated operations, detailed settings, special purposes, etc. This chapter explains how to use the parameters that are not mentioned in the previous chapters.

6.1 Output signals from the control terminals

Various signals are output for motor operation.
For details on the output terminal functions, refer to [7. 2. 2].

6.1.1 Output the running signal and the brake signal (output the low-speed signal)

<F100: Low-speed signal output frequency>



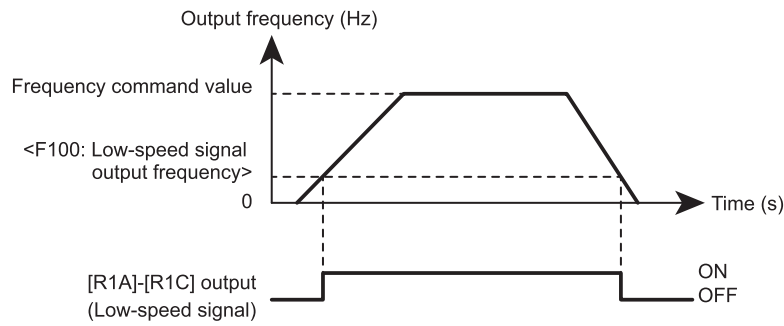
■ Function

When the output frequency becomes over <F100: Low-speed signal output frequency>, the low-speed signal is output from the output terminal.

- When <F100: Low-speed signal output frequency> is set to "0.0", the ON signal is output when the output frequency is over 0.0 Hz. Therefore, this setting can be used as a running signal.
- This signal can be also used as brake/release signal for the electromagnetic brake.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F100	Low-speed signal output frequency	0.0-FH	Hz	0.0



■ **Output terminal parameter setting**

Low-speed signal is the default setting for terminal [R1].

Title	Parameter name	Adjustment range	Default setting
F133	Terminal R1 function 1	0-255 *1	4

*1 For details on the output terminal functions, refer to [7. 2. 2].

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Memo

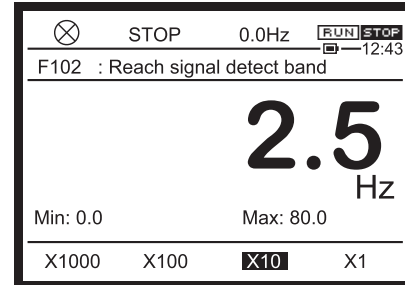
- When you want to output the inversion signal (OFF signal), set "5".
 - The signals can be also output from the other output terminals depending on the parameter setting.
- When you want to output the signals from the relay logic output terminals [FLA]-[FLB]-[FLC], set "4" or "5" for <F132: Terminal FL function>. When you want to output the signals from the terminals [R2A]-[R2C], set "4" or "5" for <F134: Terminal R2 function>. When you want to output the signals from the terminal [FP], set "4" or "5" for <F130: Terminal FP function 1>.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 1. 2 Output a signal when reached to a frequency command (output the Acc/Dec completed signal)

<F102: Reach signal detection band>



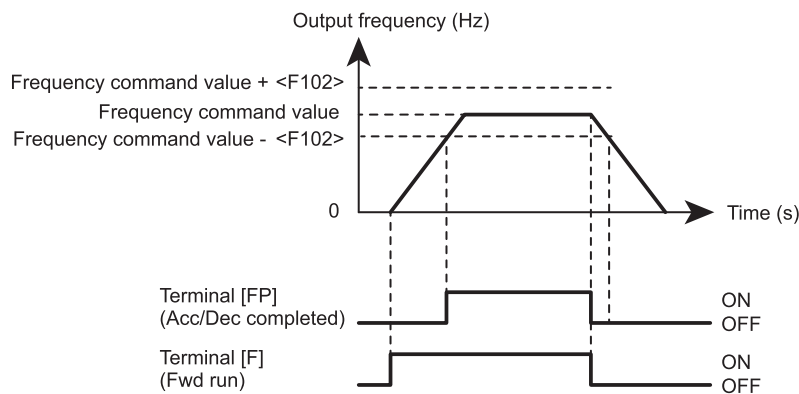
■ Function

When the output frequency becomes the frequency command \pm <F102: Reach signal detection band>, the Acc/Dec completed signal is output from the output terminal.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F102	Reach signal detection band	0.0-FH	Hz	2.5

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■ Output terminal parameter setting

Acc/Dec completed signal is the default setting for output terminal [FP].

Title	Parameter name	Adjustment range	Default setting
F130	Terminal FP function 1	0-255*1	6

*1 For details on the output terminal functions, refer to [7. 2. 2].

Memo

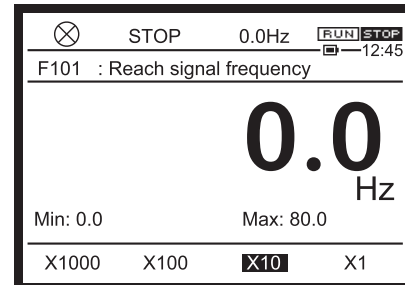
- When you want to output the inversion signal (OFF signal), set "7".
- The signals can be also output from the other output terminals depending on the parameter setting.
When you want to output the signals from the [FLA]-[FLB]-[FLC] relay logic output terminals, set at <F132: Terminal FL function>. When you want to output the signals from the terminals [R1A]-[R1C], set at <F133: Terminal R1 function 1>. When you want to output the signals from the terminals [R2A]-[R2C], set at <F134: Terminal R2 function >.
- When the run command (Fwd signal or Rev signal) is OFF, the Acc/Dec completed signal is also OFF.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 1. 3 Output a signal when reached to a specified frequency (output the specified frequency attainment signal)

<F101: Reach signal specified frequency>
 <F102: Reach signal detection band>



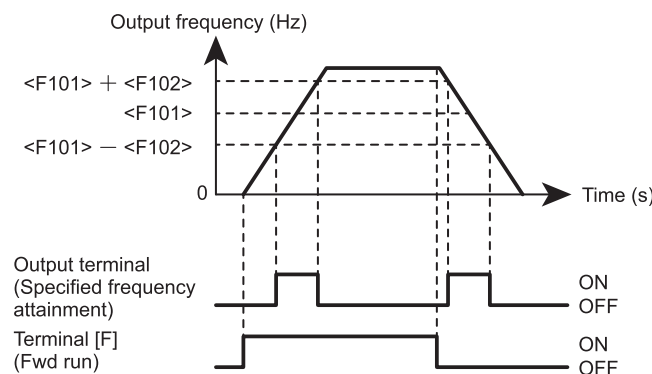
■ **Function**

When the output frequency becomes the frequency that is equal to the value for <F101: Reach signal specified frequency> plus or minus the value for <F102: Reach signal detection band>, the ON signal (specified frequency attainment signal) is output from a specified output terminal.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
F101	Reach signal specified frequency	0.0-FH	Hz	0.0
F102	Reach signal detection band	0.0-FH	Hz	2.5

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■ **Output terminal parameter setting**

When you want to output the specified frequency attainment signal to the output terminal [FP], set "8" for <F130: Terminal FP function 1>.

When you want to output the signal from the relay logic output terminals [FLA]-[FLB]-[FLC], set <F132: Terminal FL function>. When you want to output the signal from the [R1A]-[R1C] terminals, set <F133: Terminal R1 function 1>. When you want to output the signal from the terminals [R2A]-[R2C] set <F134: Terminal R2 function >.

Memo

- When you want to output the inversion signal (OFF signal), set "9".
- When a run command (Fwd signal or Rev signal) is OFF, the specified frequency attainment signal is also OFF.

Reference

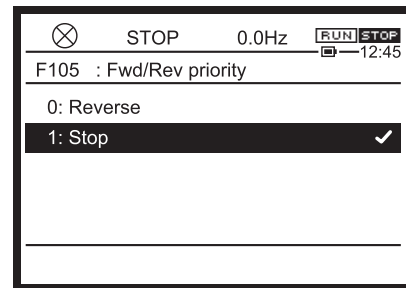
- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6.2 Input signals to the control terminals

Various signals are input to the inverter for motor operation.
For details on the input terminal function, refer to [7. 2. 1].

6.2.1 Selecting operation at simultaneous input of Fwd/Rev commands

<F105: Fwd/Rev priority of both close>



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■ Function

This parameter selects operation performed (reverse run or deceleration stop) when the Fwd and Rev signals are simultaneously input.

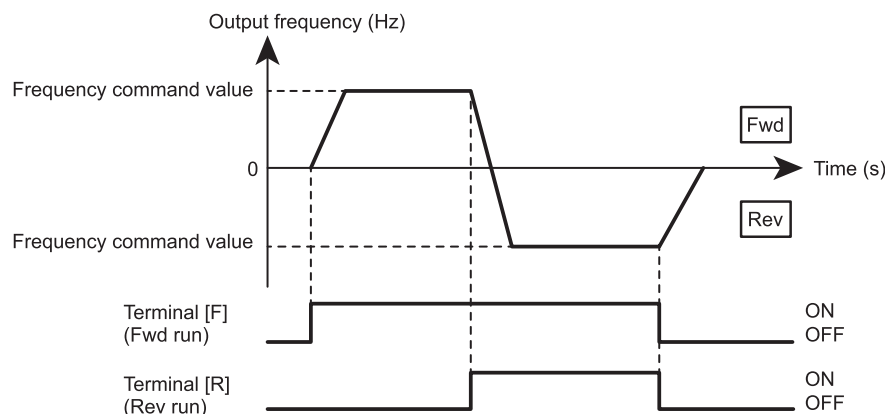
■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F105	Fwd/Rev priority of both close	0: Reverse 1: Stop	1

■ Difference between the settings

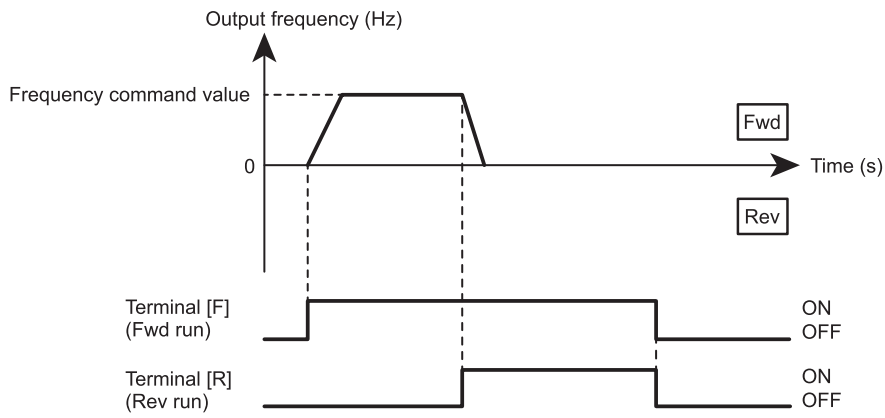
0: Reverse

When the Fwd and Rev signals are simultaneously input, reverse run is performed.



1: Stop

When the Fwd and Rev signals are simultaneously input, deceleration stop is performed.



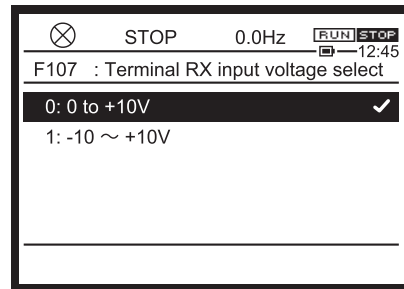
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Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 2. 2 Selecting input voltage of the terminal [RX]

<F107: Terminal RX input voltage select>



■ Function

This parameter selects the input voltage of the terminal [RX].

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F107	Terminal RX input voltage select	0: 0 to +10 V 1: -10 to +10 V	0

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■ Difference between the settings

0: 0 to +10 V

Input 0 to 10 Vdc between the terminals [RX]-[CC].
The resolution is 1/1000 at the maximum at 0 to 10 Vdc.

1: -10 to +10 V

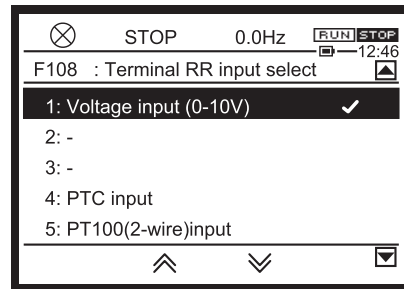
Input -10 to +10 Vdc between the terminals [RX]-[CC].
The resolution is 1/2000 at the maximum at -10 to +10 Vdc.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 2. 3 Selecting input signal of the terminal [RR]

<F108: Terminal RR input select>



■ **Function**

This parameter selects the input signal of the terminal [RR].

■ **Parameter setting**

Title	Parameter name	Adjustment range	Default setting
F108	Terminal RR input select	1: Voltage input (0-10 V) 2, 3: - 4: PTC input 5: PT100 (2-wire) input 6: - 7: PT1000 (2-wire) input 8: - 9: KTY84 input	1

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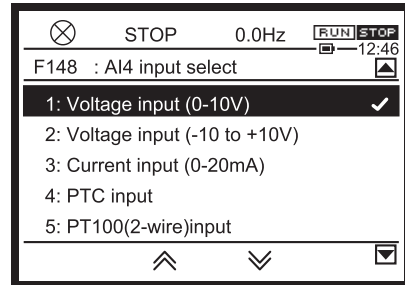
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 2. 4 Selecting input signals of the optional terminals [AI4] and [AI5]

<F148: Terminal AI4 input select>

<F149: Terminal AI5 input select>



■ Function

These parameters select an input signal for the optional terminals [AI4] and [AI5].

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F148	Terminal AI4 input select	1: Voltage input (0-10 V) 2: Voltage input (-10 to +10 V) 3: Current input (0-20 mA) 4: PTC input 5: PT100 (2-wire) input	1
F149	Terminal AI5 input select	6: PT100 (3-wire) input 7: PT1000 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input	1

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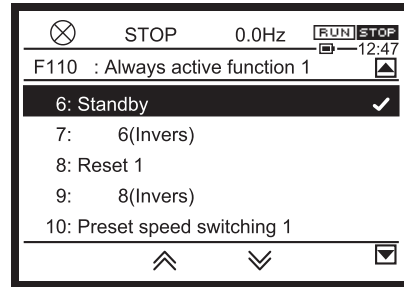
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].

6.3 Selecting terminal functions

6.3.1 Always enabling the input terminal functions (always ON)

- <F110: Always active function 1>
- <F127: Always active function 2>
- <F128: Always active function 3>



■ Function

These parameters select an input terminal function to be always enabled (always ON). You can set three points.

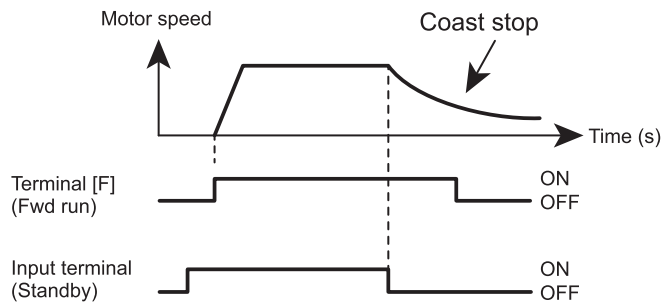
■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F110	Always active function 1	0-177*1	6
F127	Always active function 2		0
F128	Always active function 3		0

*1 For details on the input terminal functions, refer to [7. 2. 1].

Memo

- Coast stop is a stop pattern where the inverter output is turned OFF, and the motor rotation stops spontaneously.
The deceleration stop is performed by default setting (the frequency is decreased to 0 Hz by the inverter deceleration time).
- When "ST" (standby) is turned OFF, the motor performs coast stop.
- "ST"(standby)is always ON by default setting. Therefore, change the setting as shown below:
 - <F110: Always active function 1> = "0: No function"
 - Assign "6: ST" (standby) to an unused input terminal.
- When the terminal where "ST" (standby) is assigned is turned OFF, coast stop will be performed.



Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 3. 2 Changing the input terminal functions

<F111: Terminal F function 1>
<F112: Terminal R function 1>
<F113: Terminal RES function 1>
<F114: Terminal S1 function 1>
<F115: Terminal S2 function>
<F116: Terminal S3 function>
<F117: Terminal S4 function>
<F118: Terminal S5 function>
<F119: Terminal DI11 function>
<F120: Terminal DI12 function>
<F121: Terminal DI13 function>
<F122: Terminal DI14 function>
<F123: Terminal DI15 function>
<F124: Terminal DI16 function>
<F140: Terminal F response time>
<F141: Terminal R response time>
<F142: Terminal RES response time>
<F143: Terminal S1 response time>
<F144: Terminal S2-S5 response time>
<F145: Terminal DI11-DI16 response time>
<F146: Terminal S4 input select>
<F147: Terminal S5 input select>
<F151: Terminal F function 2>
<F152: Terminal R function 2>
<F153: Terminal RES function 2>
<F154: Terminal S1 function 2>
<F155: Terminal F function 3>
<F156: Terminal R function 3>
<F157: Terminal RES function 3>
<F158: Terminal S1 function 3>

For details on the input terminal functions, refer to [7. 2. 1].

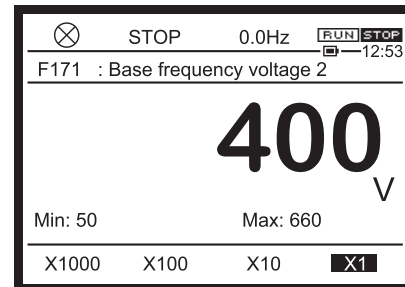
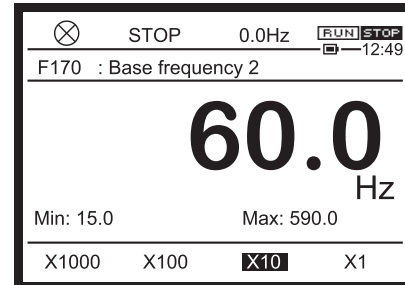
6. 3. 3 Changing the output terminal functions

<F130: Terminal FP function 1>
<F132: Terminal FL function >
<F133: Terminal R1 function 1>
<F134: Terminal R2 function >
<F135: Terminal R1 delay time>
<F136: Terminal R2 delay time>
<F137: Terminal FP function 2>
<F138: Terminal R1 function 2>
<F139: Terminal FP, R1 logic selct>
<F159: Terminal DQ11 function>
<F160: Terminal DQ12 function>
<F161: Terminal R4 function>
<F162: Terminal R5 function>
<F163: Terminal R6 function>

For details on the output terminal functions, refer to [7. 2. 2].

6.4 Switching two to four types of motor characteristics

- <F170: Base frequency 2>
- <F171: Base frequency voltage 2>
- <F172: Manual torque boost 2>
- <F174: Base frequency 3>
- <F175: Base frequency voltage 3>
- <F176: Manual torque boost 3>
- <F178: Base frequency 4>
- <F179: Base frequency voltage 4>
- <F180: Manual torque boost 4>
- <F182: Motor overload protection current 2>
- <F183: Motor overload protection current 3>
- <F184: Motor overload protection current 4>



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■ Function

These parameters are used for setting when you want to switch up to four types of motors for an inverter, or when you want to switch the motor V/f characteristics (four types) according to the purpose or operation method.

V/f1 to V/f4 are switched by the input terminal signals.

Memo

- <Pt: V/f Pattern> is valid only for V/f1.
- When V/f2 to V/f4 are selected, V/f constant control is applied regardless of the setting of <Pt>.
- Do not switch the motors when <Pt: V/f Pattern> is set to "7" or "8".
- For the parameters that are selected when V/f1 to V/f4 are switched, refer to the following table.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F170	Base frequency 2	15.0-590.0	Hz	50.0/60.0 *1
F171	Base frequency voltage 2	240V class: 50-330V 480V class: 50-660V	V	*1
F172	Manual torque boost 2	0.00-30.00	%	*2
F174	Base frequency 3	15.0 - 590.0	Hz	50.0/60.0 *1
F175	Base frequency voltage 3	240V class: 50-330V 480V class: 50-660V	V	*1

Title	Parameter name	Adjustment range	Unit	Default setting
F176	Manual torque boost 3	0.00-30.00	%	*2
F178	Base frequency 4	15.0 - 590.0	Hz	50.0/60.0 *1
F179	Base frequency voltage 4	240V class: 50-330V 480V class: 50-660V	V	*1
F180	Manual torque boost 4	0.00-30.00	%	*2
F182	Motor overload protection current 2	Depending on capacity*2	A*2	*2
F183	Motor overload protection current 3	Depending on capacity*2	A*2	*2
F184	Motor overload protection current 4	Depending on capacity*2	A*2	*2

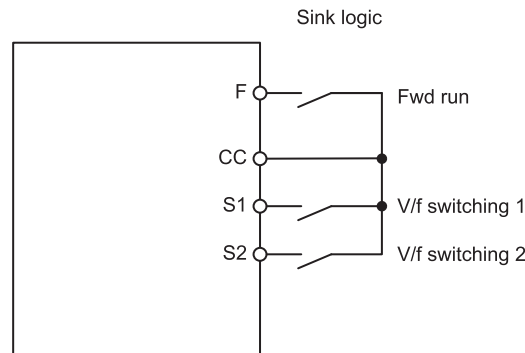
*1 Depending on the setup menu. For details, refer to [5. 3. 10], [11. 10].

*2 Depending on capacity. For details, refer to [11. 6].

■ **Switch terminal setting**

V/f1 to V/f4 switching functions are not assigned to the input terminals by default setting. Thus, assign them to unused input terminals.

Example: When V/f switching 1 function is assigned to the terminal [S1], and V/f switching 2 function to the terminal [S2].



Input terminal		V/f	Parameters selected	Output terminal (function number)	
S1-CC	S2-CC			No.186	No.188
OFF	OFF	1	Base frequency 1: <vL> Base frequency voltage 1: <vLv> Manual torque boost 1: <vb> Motor overload protection current 1: <tHrA>	OFF	OFF
ON	OFF	2	Base frequency 2: <F170> Base frequency voltage 2: <F171> Manual torque boost 2: <F172> Motor overload protection current 2: <F182>	ON	OFF

Input terminal		V/f	Parameters selected	Output terminal (function number)	
S1-CC	S2-CC			No.186	No.188
OFF	ON	3	Base frequency 3: <F174> Base frequency voltage 3: <F175> Manual torque boost 3: <F176> Motor overload protection current 3: <F183>	OFF	ON
ON	ON	4	Base frequency 4: <F178> Base frequency voltage 4: <F179> Manual torque boost 4: <F180> Motor overload protection current 4: <F184>	ON	ON

- Be sure to perform V/f switching in the stop state. Switching is impossible during run. It takes 0.1 second before switching. Therefore, be sure to wait 0.1 second or more after inputting a switching signal, and then start operation.
- When you want to use the vector control and V/f 5-point setting, select V/f1. When V/f2 to V/f4 are selected, V/f constant is obtained, and thus making the vector control impossible.
- When you use an input terminal where a variety of functions can be assigned, you can link the switching of torque limit or acceleration/deceleration time to V/f switching.

For operation panel run, you can also set the acceleration/deceleration time at <F504: Panel Acc/Dec select>. For details, refer to [6. 27. 2].

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Reference	<ul style="list-style-type: none"> • How to operate the operation panel -> Refer to [3. 1. 1]. • How to switch display mode on the operation panel -> Refer to [3. 1. 2]. • Procedure to change parameter setting -> Refer to [4. 2. 3]. • Details on operation by external signals -> Refer to [Chapter 7].
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6.5 V/f 5-point setting

<F190: V/f 5-point VF1 frequency>

<F191: V/f 5-point VF1 voltage>

<F192: V/f 5-point VF2 frequency>

<F193: V/f 5-point VF2 voltage>

<F194: V/f 5-point VF3 frequency>

<F195: V/f 5-point VF3 voltage>

<F196: V/f 5-point VF4 frequency>

<F197: V/f 5-point VF4 voltage>

<F198: V/f 5-point VF5 frequency>

<F199: V/f 5-point VF5 voltage>

Refer to [5. 3. 4].

6.6 Setting the frequency commands

You can set the frequency commands in various methods. Select a frequency command setting method according to operation. You can also switch the frequency commands using signals to the terminals.

6.6.1 Switching two types of frequency commands

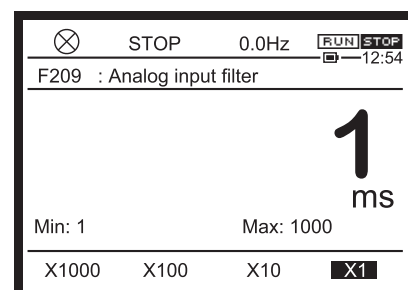
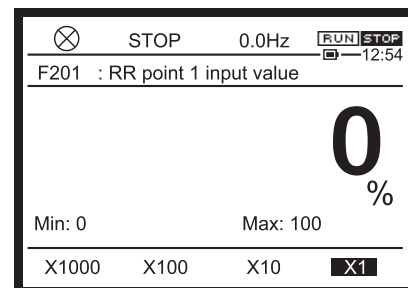
- <F200: Frequency command priority select>
- <FMOd: Frequency command select 1>
- <F207: Frequency command select 2>
- <F208: Frequency command switching frequency>

Refer to [5. 4. 1].

6.6.2 Setting frequency command characteristics by analog signals

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- <F107: Terminal RX input voltage select>
- <F108: Terminal RR input select>
- <F148: Terminal AI4 input select>
- <F149: Terminal AI5 input select>
- <F201: RR point 1 input value>
- <F202: RR point 1 frequency>
- <F203: RR point 2 input value>
- <F204: RR point 2 frequency>
- <F205: RR point 1 rate>
- <F206: RR point 2 rate>
- <F209: Analog input filter>
- <F210: RX point 1 input value>
- <F211: RX point 1 frequency>
- <F212: RX point 2 input value>
- <F213: RX point 2 frequency>
- <F214: RX point 1 rate>
- <F215: RX point 2 rate>
- <F216: II point 1 input value>
- <F217: II point 1 frequency>
- <F218: II point 2 input value>
- <F219: II point 2 frequency>
- <F220: II point 1 rate>
- <F221: II point 2 rate>
- <F222: AI4 point 1 input value>
- <F223: AI4 point 1 frequency>
- <F224: AI4 point 2 input value>
- <F225: AI4 point 2 frequency>
- <F226: AI4 point 1 rate>
- <F227: AI4 point 2 rate>
- <F228: AI5 point 1 input value>



- <F229: AI5 point 1 frequency>
- <F230: AI5 point 2 input value>
- <F231: AI5 point 2 frequency>
- <F810: Communication frequency point select>
- <F811: Communication point 1 input value>
- <F812: Communication point 1 frequency>
- <F813: Communication point 2 input value>
- <F814: Communication point 2 frequency>

■ **Function**

These parameters set the output frequencies for the frequency commands of the analog signals. You can use the following terminals. The terminals [AI4] and [AI5] are optional.

- Voltage input (0 to 10 V) : terminals [RR], [RX], [AI4], and [AI5]
- Voltage input (-10 to +10 V) : terminals [RX], [AI4], and [AI5]
- Curret input (4 to 20 mA) : terminals [II], [AI4], and [AI5]

■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
F107	Terminal RX input voltage select	0: 0 to +10 V 1: -10 to +10 V	-	0
F108	Terminal RR input select	1: Voltage input (0-10 V) 2: - 3: - 4: PTC input 5: PT100 (2-wire) input 6: - 7: PT1000 (2-wire) input 8: - 9: KTY84 input	-	1
F148	Terminal AI4 input select	1: Voltage input (0-10 V) 2: Voltage input (-10 to +10 V) 3: Current input (0-20 mA) 4: PTC input 5: PT100 (2-wire) input 6: PT100 (3-wire) input 7: PT1000 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input	-	1
F149	Terminal AI5 input select			1
F201	RR point 1 input value	0-100	%	0
F202	RR point 1 frequency	0.0-590.0	Hz	0.0
F203	RR point 2 input value	0-100	%	100
F204	RR point 2 frequency	0.0-590.0	Hz	50.0/60.0 *1
F205	RR point 1 rate	0-250	%	0
F206	RR point 2 rate	0-250	%	100
F209	Analog input filter	1: Disabled 2-1000	ms	1

Title	Parameter name	Adjustment range	Unit	Default setting
F210	RX point 1 input value	-100 to +100	%	0
F211	RX point 1 frequency	0.0-590.0	Hz	0.0
F212	RX point 2 input value	-100 to +100	%	100
F213	RX point 2 frequency	0.0-590.0	Hz	50.0/60.0 *1
F214	RX point 1 rate	-250 to +250	%	0
F215	RX point 2 rate	-250 to +250	%	100
F216	II point 1 input value	0-100	%	0
F217	II point 1 frequency	0.0-590.0	Hz	0.0
F218	II point 2 input value	0-100	%	100
F219	II point 2 frequency	0.0-590.0	Hz	50.0/60.0 *1
F220	II point 1 rate	0-250	%	0
F221	II point 2 rate	0-250	%	100
F222	AI4 point 1 input value	-100 to +100	%	0
F223	AI4 point 1 frequency	0.0-590.0	Hz	0.0
F224	AI4 point 2 input value	-100 to +100	%	100
F225	AI4 point 2 frequency	0.0-590.0	Hz	50.0/60.0 *1
F226	AI4 point 1 rate	-250 to +250	%	0
F227	AI4 point 2 rate	-250 to +250	%	100
F228	AI5 point 1 input value	-100 to +100	%	0
F229	AI5 point 1 frequency	0.0-590.0	Hz	0.0
F230	AI5 point 2 input value	-100 to +100	%	100
F231	AI5 point 2 frequency	0.0-590.0	Hz	50.0/60.0 *1
F810	Communication frequency point select	0: Disabled 1: RS485 (1) 2: RS485 (2) 3: Communication option 4: Embedded Ethernet		0
F811	Communication point 1 input value	0-100	%	0
F812	Communication point 1 frequency	0.0-FH	Hz	0.0
F813	Communication point 2 input value	0-100	%	100
F814	Communication point 2 frequency	0.0-FH	Hz	50.0/60.0 *1

*1 Depending on the setup menu. Refer to [11. 10].

■ **Setting method**

Set a frequency command for an analog input amount at two points.

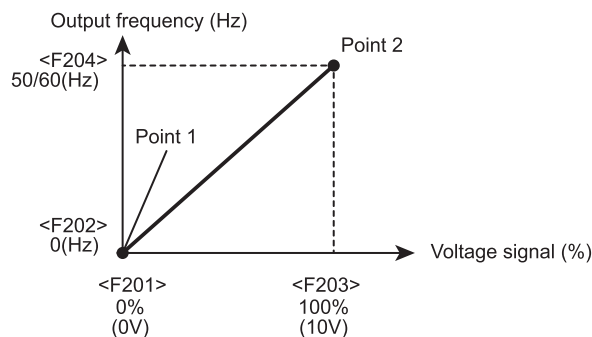
For the corresponding parameters of each terminal and the setting method, refer to the following.

As default setting, the range between the minimum and maximum input amounts is set to 0 to 50.0/60.0 Hz for main analog signal of the terminals. For example, the terminal [RR] is set to 0 to 50.0/60.0 Hz at 0-10 V.

- For the terminal [RX], select the voltage for <F107: Terminal RX input voltage select>.
- For the terminal [AI4], select the analog signal for <F148: Terminal AI4 input select>. For the terminal [AI5], select the analog signal for <F149: Terminal AI5 input select>. The terminals [AI4] and [AI5] are optional.
- If noise disturbs stable operation, increase the value for <F209: Analog input filter>. Doing so eliminates the noise of the frequency setting circuit.
- Do not set the same value for point 1 and point 2. Failure to do so displays "Err1".

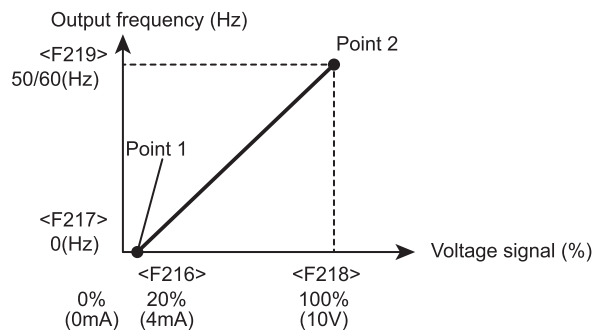
For details on the analog signal setting, refer to [7. 3].

1) For setting the voltage input of 0-10 V (terminals [RR]), refer to the following figure.

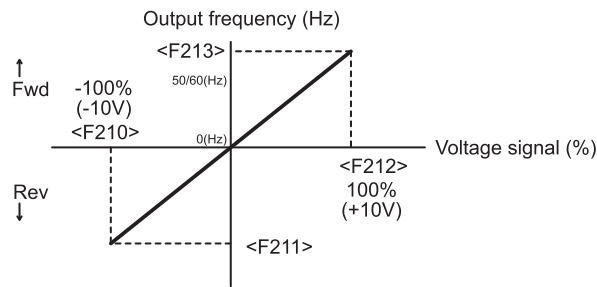


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2) For setting current input of 4-20 mA (terminal [II]), refer to the following figure.



3) For setting voltage input of -10 to +10 V (terminal [RX]), refer to the following figure.



<F107: Terminal RX input voltage select> = "-10 to +10 V"

6

Memo

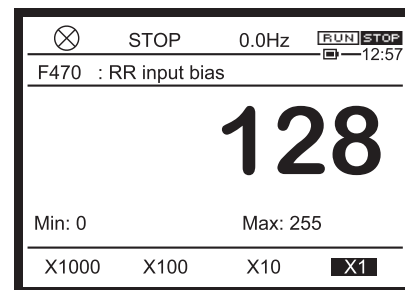
- When you want to fine adjust the frequency command characteristics, adjust the bias and gain of each input terminal at <F470: RR input bias>-<F479: AI5 input gain>. For details, refer to [6. 6. 3].
- When you want to set an analog signal for a frequency command, set at <FMOD: Frequency command select 1> (or <F207: Frequency command select 2>).
 1: Terminal RR
 2: Terminal RX
 3: Terminal II
 4: Terminal AI4 (option)
 5: Terminal AI5 (option)

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 6. 3 Fine adjusting the analog frequency commands

- <F470: RR input bias>
- <F471: RR input gain>
- <F472: RX input bias>
- <F473: RX input gain>
- <F474: II input bias>
- <F475: II input gain>
- <F476: AI4 input bias>
- <F477: AI4 input gain>
- <F478: AI5 input bias>
- <F479: AI5 input gain>



■ Function

These parameters fine adjust the characteristics set in [6. 6. 2] "Setting frequency command characteristics by analog signals".

The allowance is zero setting on default setting.

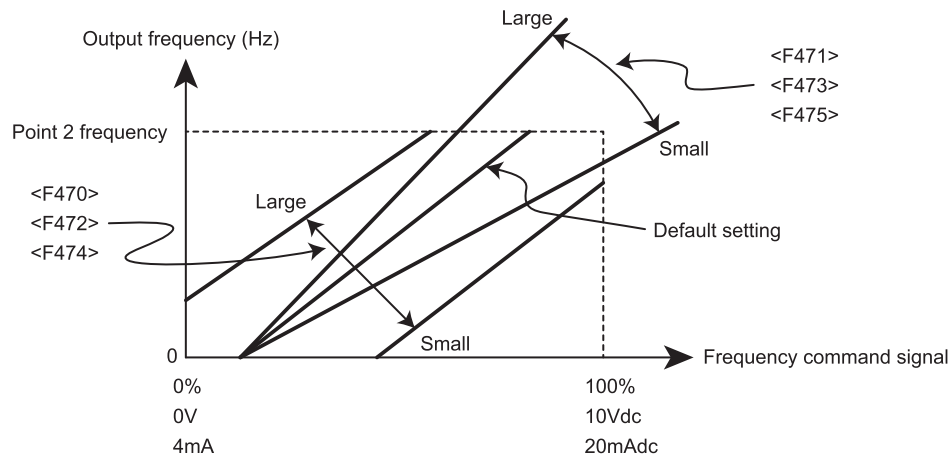
■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting														
F470	RR input bias	0-255	-	128														
F471	RR input gain	0-255	-	128														
F472	RX input bias	0-255	-	128														
F473	RX input gain	0-255	-	128														
F474	II input bias	0-255	-	128														
F475	II input gain	0-255	-	128														
F476	AI4 input bias	0-255	- </tr <tr> <td>F477</td> <td>AI4 input gain</td> <td>0-255</td> <td>-</td> <td>128</td> </tr> <tr> <td>F478</td> <td>AI5 input bias</td> <td>0-255</td> <td>-</td> <td>128</td> </tr> <tr> <td>F479</td> <td>AI5 input gain</td> <td>0-255</td> <td>-</td> <td>128</td> </tr>	F477	AI4 input gain	0-255	-	128	F478	AI5 input bias	0-255	-	128	F479	AI5 input gain	0-255	-	128
F477	AI4 input gain	0-255	-	128														
F478	AI5 input bias	0-255	-	128														
F479	AI5 input gain	0-255	-	128														

■ **Adjustment method**

For the frequency commands to be input to the analog terminals and the output frequency characteristics, refer to the following figure.

6



Analog input terminal bias adjustment (<F470>, <F472>, <F474>, <F476>, and <F478>)

To avoid the influence of noise, there is a tolerance for the minimum input amount so that the inverter starts output after some voltage/current is applied to the analog input terminal by default setting.

To decrease this tolerance value, increase the bias value for a corresponding terminal.

However, if the set value is too large, frequency may be output even when the frequency command is set to 0 (zero).

Analog input terminal gain adjustment (<F471>, <F473>, <F475>, <F477>, and <F479>)

The set maximum frequency is output before voltage/current reach the maximum value to avoid trouble such as voltage drop by default setting.

When you want to output the set maximum frequency at the maximum voltage and current values, decrease the gain value for a corresponding terminal.

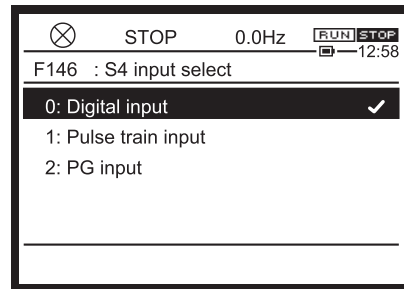
However, if the set value is too small, the maximum frequency may not be output even when voltage and current reach the maximum values.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
 - How to switch display mode on the operation panel -> Refer to [3. 1. 2].
 - Procedure to change parameter setting -> Refer to [4. 2. 3].
 - Details on operation by external signals -> Refer to [Chapter 7].
-

6. 6. 4 Input the frequency commands by pulse trains

- <F146: Terminal S4 input select>
- <F147: Terminal S5 input select>
- <F234: Pulse train input point 1 input value>
- <F235: Pulse train input point 1 frequency>
- <F236: Pulse train input point 2 input value>
- <F237: Pulse train input point 2 frequency>
- <F376: PG phases number select>
- <F378: Pulse train input pulses number>
- <F679: Pulse train input filter>



■ Function

These parameters set the frequency command characteristics by pulse train input.

You can use the terminals [S4] and [S5].

When you want to use pulse train input, set <FM0d: Frequency command select 1> (or <F207: Frequency command select 2>) to "16: Pulse train".

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F146	Terminal S4 input select	0: Digital input 1: Pulse train input 2: PG input		0
F147	Terminal S5 input select	0: Digital input 1: Pulse train input 2: PG input		0
F378	Pulse train input pulses number	1-9999	pps	1000
F679	Pulse train input filter	1-1000	ms	1
F234	Pulse train input point 1 input value	0 - 100	%	0
F235	Pulse train input point 1 frequency	0.0 - 590.0	Hz	0.0
F236	Pulse train input point 2 input value	0 - 100	%	100
F237	Pulse train input point 2 frequency	0.0 - 590.0	Hz	50.0/60.0 *1
F376	PG phases number select	0: PTI (Command) - PTI (FB) 1: PTI (Command) - Digital option (FB) 2 - 5: - 6: Digital option (Command) - Non FB 7 - 9: - 10: PTI (Command) - PTI (FB inversion) 11: PTI (Command) - Digital option (FB inversion) 12 - 15: - 16: Digital option (Command inversion) - Non FB		0

*1 Depending on the setup menu. For details, refer to [5. 3. 10], [11. 10].

■ **Guideline for the setting**

When you want to use the terminal [S4], set <F146: Terminal S4 input select> to "1: Pulse train input". When you want to use the terminal [S5], set <F147: Terminal S5 input select> to "1: Pulse train input".

Set the number of pulses per 1 Hz of output frequency at <F378; Pulse train input pulses number>. The minimum number of pulses that can be input to the terminals [S4] and [S5] is 10 pps, and the maximum number of pulses 30 kpps. The duty is 50 ±10%. The maximum frequency that can be output is 200 Hz.

■ **Setting example**

<F378> setting value	Input signal	Output frequency
25 (pps)	25 (pps)	1.0 (Hz)
	100 (pps)	4.0 (Hz)
	2k (pps)	80.0 (Hz)
50 (pps)	50 (pps)	1.0 (Hz)
	100 (pps)	2.0 (Hz)
	2k (pps)	40.0 (Hz)

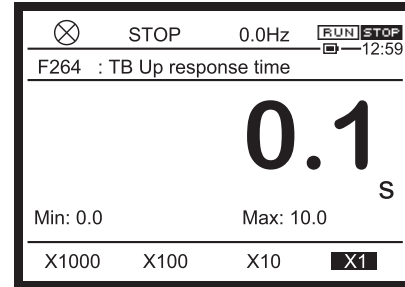
6

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
 - How to switch display mode on the operation panel -> Refer to [3. 1. 2].
 - Procedure to change parameter setting -> Refer to [4. 2. 3].
 - Details on operation by external signals -> Refer to [Chapter 7].
- For use as PG feedback, refer to "Digital Encoder Instruction manual" (E6582148).
- Pulse train must be input after F146 or F147 is set to 1.
- If pulse train is input when F146 or F147 is set to 0 (default value), preset speed works.

6. 6. 5 Changing frequency by the terminal UP and DOWN signal

- <F264: Terminal Up response time>
- <F265: Terminal Up frequency step>
- <F266: Terminal Down response time>
- <F267: Terminal Down frequency step>
- <F268: Initial Up/Down frequency>
- <F269: Up/Down frequency rewrite>



■ Function

These parameters are the frequency commands that input the logic signals to the two input terminals for the UP and DOWN signals. You can input a logic signal either as a continuous signal or as a pulse signal.

Set <FM0d: Frequency command select 1>= "15".

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F264	Terminal Up response time	0.0-10.0	s	0.1
F265	Terminal Up frequency step	0.0-FH	Hz	0.1
F266	Terminal Down response time	0.0-10.0	s	0.1
F267	Terminal Down frequency step	0.0-FH	Hz	0.1
F268	Initial Up/Down frequency	LL-UL	Hz	0.0
F269	Up/Down frequency rewrite	0: F268 is not changed. 1: F268 is changed after power off.		1

■ Input terminal parameter setting

Three input terminals are used.

Two of the three input terminals are used for the UP and DOWN signals. The other input terminal is used for the signal that clears the set frequency command.

Input terminal function		ON	OFF
88	Terminal Up frequency	Frequency setting increase	-
90	Terminal Down frequency	Frequency setting decrease	-
92	Terminal Up, Down frequency clear	OFF → ON: Input terminal up/down frequency command clear	<F268> setting

When the signals are simultaneously input

- When the clear signal, and an UP or a DOWN signal are simultaneously input, the clear signal takes priority.
- When an UP signal and a DOWN signal are simultaneously input, the frequency changes according to the up rate and the down rate.

Memo

- The next number of each function number ("89", "91", or "93") is an inversion signal.
- When <F702: Free unit multiplication factor>="1.00", you can make setting in steps of 0.01 Hz.

■ **Setting example 1: Increase or decrease by the continuous signals**

When you want to increase or decrease the output frequency in proportion to the input time of the UP and DOWN signals, set the parameters as shown below:

UP/DOWN frequency increase inclination=Setting time for <F265>/<F264>

UP/DOWN frequency decrease inclination=Setting time for <F267>/<F266>

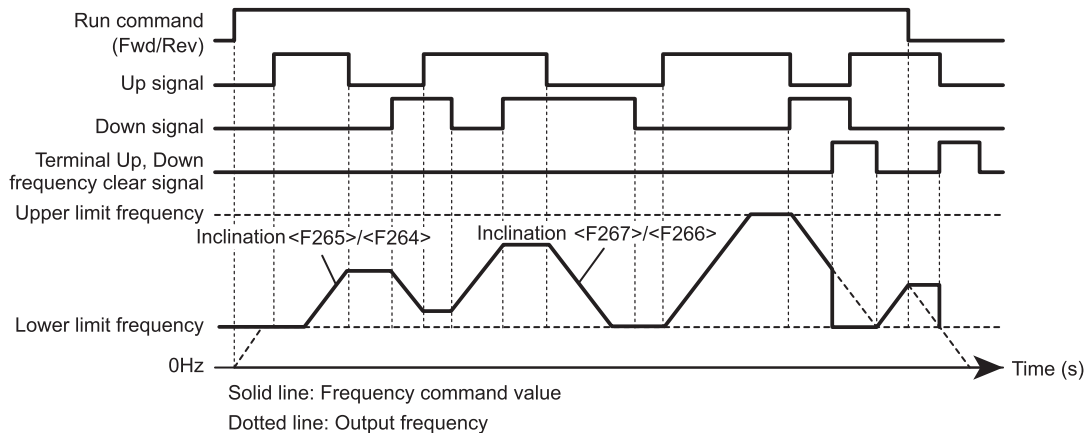
When you want to increase or decrease the output frequency almost in synchronization with the increase or decrease in the UP/DOWN frequency command, set the parameters as shown below:

<F264>=<F266> = "0.1"

<FH>/<ACC> ≥ (Setting time for <F265>/<F264>)

<FH>/<dEC> ≥ (Setting time for <F267>/<F266>)

6



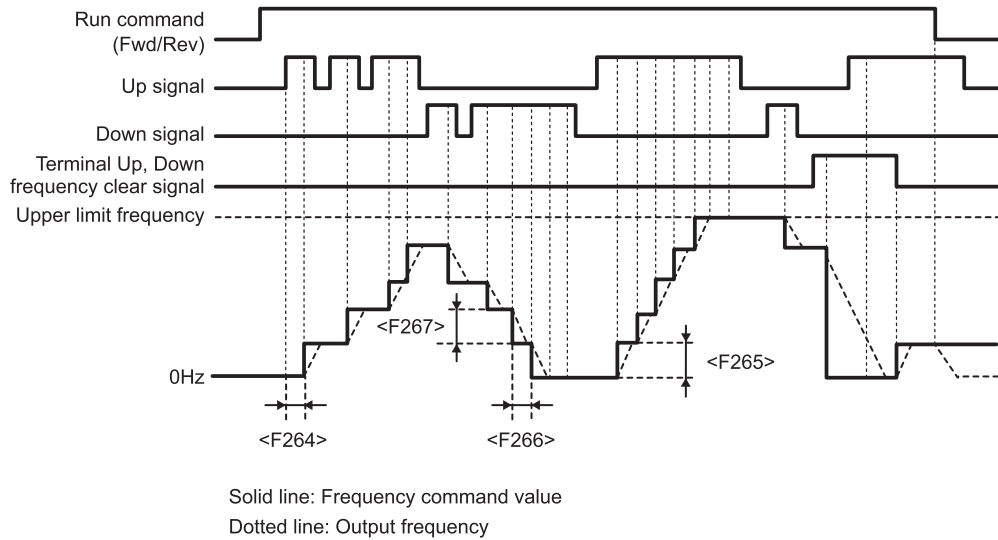
■ **Setting example 2: Increase or decrease by the pulse signals**

When you want to increase or decrease the frequency per pulse stepwise, set the parameters as shown below:

<F264>, <F266> ≤ Pulse ON time

<F265>, <F267> = Frequency that increases or decreases per pulse

However, no response is obtained to the pulse below the time set for <F264> and <F266>. Set 12 ms or more for the clear signal.



■ Initial UP/DOWN frequency setting method

When you want to set a specified frequency other than 0.0 Hz at first after power on, set <F268: Initial Up/Down frequency>.

Also, set <F269: Up/Down frequency rewrite> to "0: F268 is not changed".

Save the frequency before power off. When you want to start at the saved frequency the next time the power is turned ON, set <F269: Up/Down frequency rewrite> to "1: F268 is changed after power off."

Keep in mind that <F268: Initial Up/Down frequency> is changed every time the power is turned OFF.

The adjustment range of <F268: Initial Up/Down frequency> is <LL: Lower limit frequency> to <FH: Maximum frequency>. When Terminal Up, Down frequency clear (function number: "92" or "93") is input, the lower limit frequency is set for the frequency command.

Reference

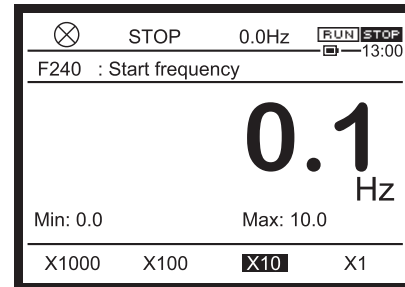
- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6.7 Setting the start and end frequencies

6.7.1 Setting the starting frequency and the end frequency

<F240: Start frequency>

<F243: End frequency>



■ Function

The frequency set for <F240: Start frequency> is instantly output at startup.

This parameter is used when the delayed response of starting torque caused by the acceleration/ deceleration time affects the frequency.

When the output frequency is decreased to the frequency set for <F243: End frequency>, the frequency instantly becomes 0 Hz when stopping.

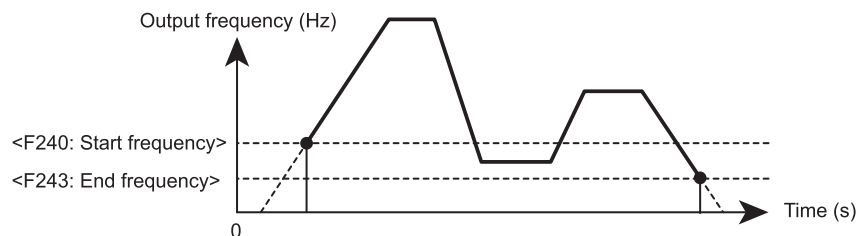
■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F240	Start frequency	0.0-10.0	Hz	0.1
F243	End frequency	0.0-30.0	Hz	0.0

■ Setting method

Use the parameters when the delayed response of starting torque caused by the acceleration/ deceleration time affects the frequency. For the setting values, 0.1-3.0 Hz (5 Hz or less) is recommended. Overcurrent can be reduced by setting the value to the motor rated slippage or less. Set the values so that <F240: Start frequency> is higher than <F243: End frequency>.

When <F240> is lower than <F243>, no operation is performed by any frequency command lower than <F243>.



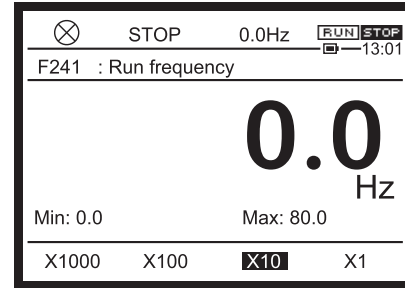
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].

6. 7. 2 Run/stop with a frequency command

<F241: Run frequency>

<F242: Run frequency hysteresis>



■ Function

You can run/stop the motor with only a frequency command when a run command remains ON. When the frequency command reaches the set frequency value, the inverter will start to run. When it becomes below the set value, the inverter will stop.

6

■ Parameter setting

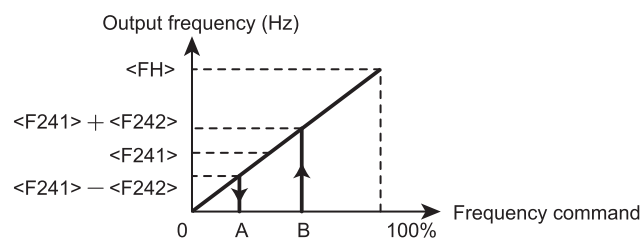
Title	Parameter name	Adjustment range	Unit	Default setting
F241	Run frequency	0.0 - FH	Hz	0.0
F242	Run frequency hysteresis	0.0 - FH	Hz	0.0

■ Setting method

When the frequency command reaches the setting value of <F241: Run frequency>, the inverter will start to run. When the command becomes below the setting value, the inverter will stop.

To prevent the inverter from repeatedly running/stopping around the frequency set with <F241: Run frequency>, use <F242: Run frequency hysteresis> to provide hysteresis.

Set the parameter, referring to the following figure.

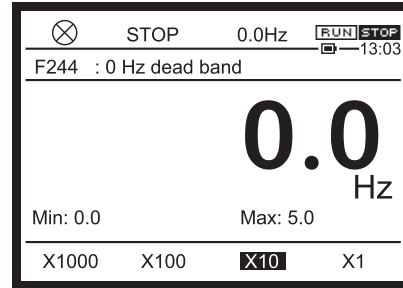


Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 7. 3 Setting a frequency command to 0 Hz securely

<F244: 0 Hz dead band>



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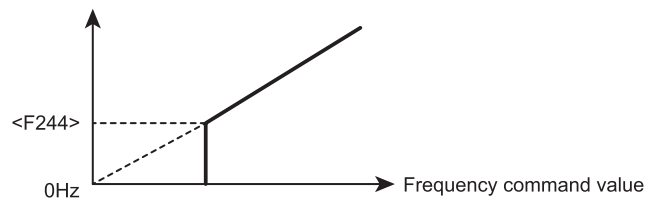
■ **Function**

Set the frequency command to 0 Hz when it is under the setting value of <F244: 0 Hz dead band>. This function is used to securely set the frequency command to 0 Hz in the following case: although an analog signal is set to 0 Hz in order to use the vector control with a sensor to fix the motor shaft, it does not become 0 Hz due to a drift or offset.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
F244	0 Hz dead band	0.0 - 5.0	Hz	0.0

Output value after processing frequency command dead band



Memo

- This function is invalid for a preset speed frequency command.
- It is valid for frequency commands which are prioritized in <FM0d: Frequency command selection 1>, <F207: Frequency command selection 2>, and communications.
- For the override function, values are added or multiplied for frequencies with this function enabled.

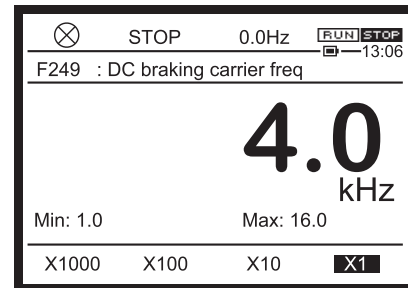
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 8 DC braking

6. 8. 1 Obtaining large torque with DC braking

- <F249: DC braking carrier frequency>
- <F250: DC braking frequency>
- <F251: DC braking amount>
- <F252: DC braking time>
- <F253: Fwd/Rev DC braking priority>



■ Function

Apply direct current to the motor to obtain braking torque. This will stop the motor. It is used, for example, to securely decelerate and stop the motor.

You can set the amount and time of direct current applied to the motor and the start frequency.

■ Parameter setting

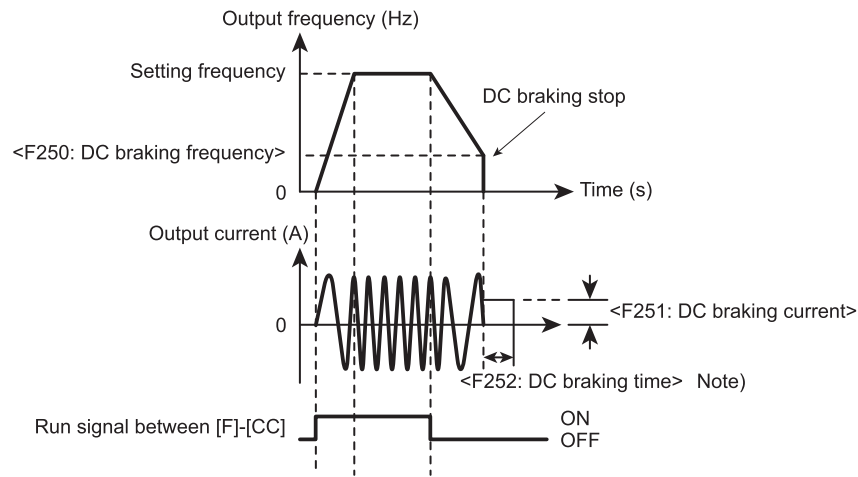
Title	Parameter name	Adjustment range	Unit	Default setting
F249	DC braking carrier frequency	1.0 - 16.0	kHz	*1
F250	DC braking frequency	0.0 - FH	Hz	0.0
F251	DC braking current	0 - 100	%	50
F252	DC braking time	0.0 - 25.5	s	1.0
F253	Fwd/Rev DC braking priority	0: Disabled 1: Enabled		0

*1 Depending on capacity. For details, refer to [11. 6].

- The inverter has high sensitivity for overload protection when DC braking is in progress. It may automatically adjust the DC braking amount to prevent a trip.



Important



Note) Actually it will be longer than the setting value of <F252> because of the reduced voltage operation.

■ DC braking with the set frequency

When the inverter decelerates until the setting value of <F250: DC braking frequency>, it applies DC braking.

Set the DC braking amount with <F251: DC braking current>. Set the amount based on 100% meaning the rated current of the inverter. With <F701: Current, voltage units select> set to "1: A (ampere), V (volt)", specify a current value (A).

■ DC braking with an external signal

A signal input to the terminal can forcibly cause the inverter to apply DC braking.

Assign "22: DC braking" ("23" for inversion) to the input terminal.

DC braking is applied while the terminal is turned ON regardless of the settings of <F250: DC braking frequency> and <F252: DC braking time>.

Even when the terminal is turned OFF, it is applied for the period set with <F252: DC braking time>.

The DC braking amount depends on the setting of <F251: DC braking current>.

Memo

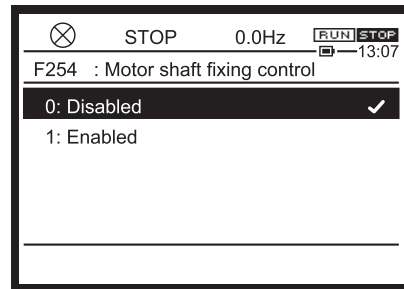
- The carrier frequency when DC braking is in progress is the setting value of either <F249: DC braking carrier frequency> or <F300: Carrier frequency> which is lower.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 8. 2 Fixing the motor shaft with DC braking

<F254: Motor shaft fixing control>



■ Function

Use DC braking to temporarily fix the motor shaft.

This function is used to avoid the free rotation of the motor or to preheat the motor.

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F254	Motor shaft fixing control	0: Disabled 1: Enabled	0

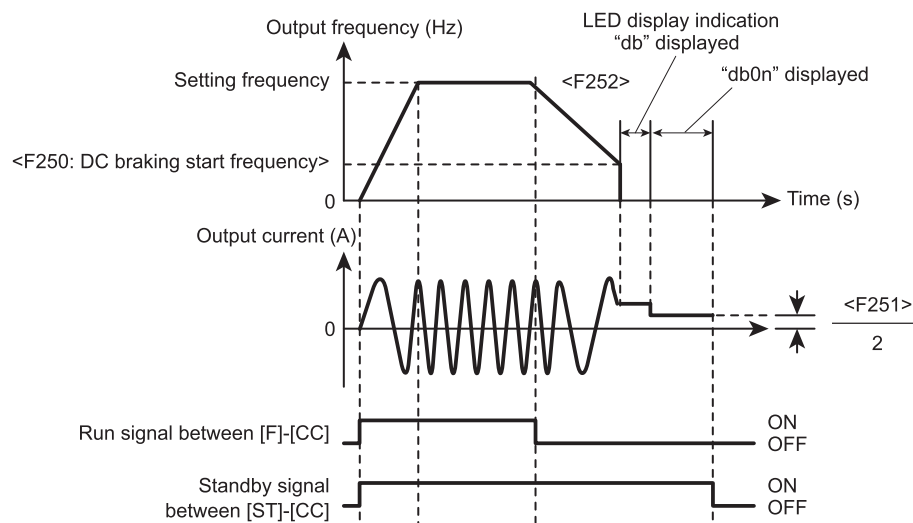
6

■ Selecting a setting value

1: Enabled

Continue to apply DC braking at half the DC braking amount specified with <F251: DC braking current> after the normal DC braking action.

During shaft fixing control, "dbOn" appears on the LCD screen.



■ How to use

To perform motor shaft fixing control, set <F254: Motor shaft fixing control> to 1.

To cancel it, turn OFF standby (ST) signal).

Since standby (ST) is always turned ON in the default setting, you should set values as shown below.

- Set <F110: Always active function 1> to "1: No function".
- Assign "6:ST" (standby) to an unused input terminal.

Cancel motor shaft fixing control if the following problems occur during motor shaft fixing control: the inverter coasts due to power failure, or it is restored with the retry function after a trip.

Even when DC braking is activated with a signal from the input terminal, the almost same motor shaft fixing control can be performed.

Memo

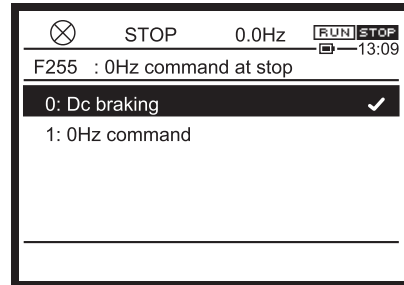
- The carrier frequency during shaft fixing control is the setting value of either <F249: DC braking carrier frequency> or <F300: Carrier frequency> which is lower.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 8. 3 Making the motor standstill with PG feedback control

- <F255: 0Hz command select at stop>
- <F250: DC braking frequency>
- <F252: DC braking time>



■ **Function**

This function works only for the speed control of PG feedback control. Use a way other than DC braking to make the motor standstill.

When this function is set, the inverter outputs a 0 Hz command instead of applying DC braking when stopping to make the motor standstill for the specified time.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
F255	0Hz command select at stop	0: DC braking 1: 0 Hz command		0
F250	DC braking frequency	0.0 - FH	Hz	0.0
F252	DC braking time	0.0 - 25.5	s	1.0

■ **How to select a setting value**

0: DC braking

This function works as the DC braking function described in [6. 8. 1].

1: 0 Hz command

This function works only for the speed control of PG feedback control.

The inverter outputs 0 Hz for the period set with <F252: DC braking time> when the frequency reaches the setting value of <F250: DC braking frequency>.

It does not work when <F250: DC braking frequency> is set to "0.0".

With this function enabled, <F254: Motor shaft fixing control> cannot be used.

■ **How to use**

This function is used for PG feedback control (<Pt: V/f Pattern> = "10", "11").

You should set the terminals [S4] and [S5] or have any option for PG feedback.

The normal DC braking action (the same action set with <F255> = "0") is performed for non-PG feedback control.



Important

- Note that a higher value of <250: DC braking frequency> will cause a command indicating the sudden stop of the motor from a high rotation state. A trip may occur depending on a load condition.

Memo

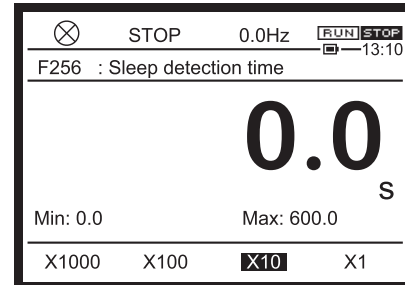
- When <F255: 0Hz command select at stop> is set to "1", the inverter outputs a 0 Hz command instead of applying the following DC braking.
DC braking with a command from the terminal or communication (input terminal function "22"/ "23", communication command)
Emergency DC braking of DC braking emergency stop (<F603: Emergency off stop pattern> = "2") when the DC braking stop of the jog stop pattern is specified (<F261: Jog stop select> = "2")

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Option for PG feedback -> Refer to "Digital Encoder Instruction manual" (E6582148).
- Details on operation by external signals -> Refer to [Chapter 7].

6.9 Automatic stop when run continues at the lower limit frequency (sleep function)

- <F256: Run sleep detection time>
- <F259: Run sleep detection time at startup>
- <F391: Sleep detection hysteresis>
- <F392: Wakeup deviation>
- <F393: Wakeup feedback>



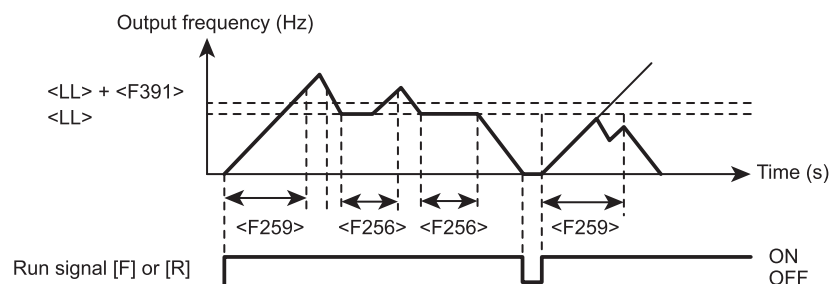
■ Function

This function is used to automatically decelerate and stop the inverter in the following case: the inverter continues to run at the frequency set with <LL: Lower limit frequency>, which has a low workload, for the period specified in <F256: Run sleep detection time> for energy-saving, etc. (sleep function).

The LCD screen displays "LStP" during sleep.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F256	Run sleep detection time	0.0: Disabled 0.1 - 600.0	s	0.0
F259	Run sleep detection time at startup	0.0: Disabled 0.1 - 600.0	s	0.0
F391	Sleep detection hysteresis	0.0 - UL	Hz	0.0
F392	Wakeup deviation	0.0 - UL	Hz	0.0
F393	Wakeup feedback	0.0 - UL	Hz	0.2



■ Guideline for the setting

This function is used to automatically decelerate and stop the inverter when it continues to run at the frequency set with <LL: Low limit frequency>.

Set a duration with <F256: Sleep detection time>.

6

When the inverter starts to run, the sleep function works after the output frequency is over the value of <LL: Lower limit frequency>.

Also, when it starts, this function enables you to automatically stop the inverter after the period set with <F259: Run sleep detection time at startup> if the output frequency does not increase to the value of <LL> due to a load error. However, if the output frequency is over the value of <LL>, the function of <F259> is invalid until the run signal is turned OFF

For non-PID control, this function is canceled when the frequency command value is over the values of <LL: Lower limit frequency> and <F391: Sleep detection hysteresis> (Hz) or when the run command is turned OFF.

For PID control, set values with <F392: Wakeup deviation> and <F393: Wakeup feedback>.
For details, refer to the PID control instruction manual (E6582112).

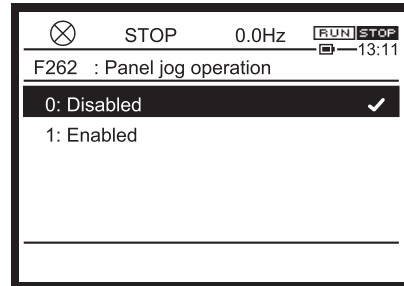
This function is also valid when you switch between forward and reverse run.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 10 Jog run

- <F262: Panel jog run>
- <F260: Jog frequency>
- <F261: Jog stop select>



■ Function

Jog run represents inching the motor.

When you input a jog run signal, the inverter immediately outputs a jog run frequency regardless of the set acceleration time.

You can start/stop jog run even on the operation panel.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F262	Panel jog run	0: Disabled 1: Enabled		0
F260	Jog frequency	F240 - 20.0	Hz	5.0
F261	Jog stop select	0: Deceleration stop 1: Coast stop 2: DC braking stop		0

■ Setting example

Assign "18: jog run" to the unused input terminal.

While that input terminal is turned ON, the inverter can perform jog run.

To use only the panel jog run, you should not assign it to the input terminal.

Example) When it is assigned to the terminal [RES]: <F113: Terminal RES function 1> = "18"

The inverter outputs a low-speed detection signal but does not output an output frequency attainment signal during jog run. Also, PID control is disabled.

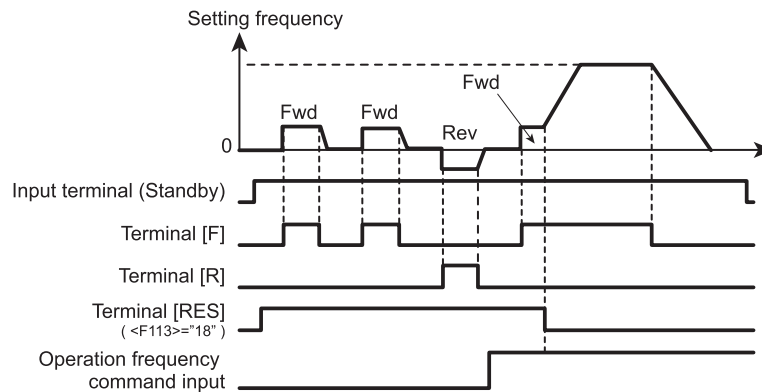
<Example of jog run>

Terminal [RES] (JOG): ON + terminal [F]: Forward jog run when the terminal is turned ON

Terminal [RES] (JOG): ON + terminal [R]: Reverse jog run when the terminal is turned ON

(Frequency command + terminal [F]: Forward run when the terminal is turned ON, terminal [R]:

Reverse run when the terminal is turned ON)



- The terminal [RES] (JOG) is valid when the output frequency is the jog frequency or less. It does not work when the output frequency is higher than the jog frequency.
- The inverter can perform jog run while the terminal [RES] (JOG) is turned ON.
- Jog run is prioritized even if a run command is input on the way.
- Even when <F261: Jog stop select> is set to "0" or "1", DC braking is applied for emergency DC braking (F603: Emergency off stop pattern = "2").
- The jog frequency is not limited by <UL: Upper limit frequency>.

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■ Panel jog run (when <F262: Panel jog run> is set to 1)

Each time you press the [FWD/REV] key, the state of jog run is switched as follows:

- The inverter performs forward jog run while the [F4] key is pressed.
- The inverter performs reverse jog run while the [F4] key is pressed.
- When you press the key for 20 seconds or more, the key failure alarm "A-17" appears.

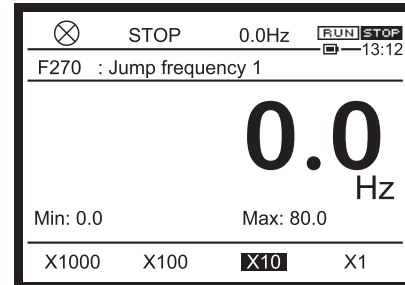
The inverter cannot move to panel jog run while it runs or a run command is input.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 11 Jumping the frequency to avoid the resonant frequency

- <F270: Jump frequency 1>
- <F271: Jump frequency 1 band>
- <F272: Jump frequency 2>
- <F273: Jump frequency 2 band>
- <F274: Jump frequency 3>
- <F275: Jump frequency 3 band>



■ Function

When you want to avoid resonance caused by the natural frequency of the mechanical system to run the inverter, the resonant frequency can be jumped.
This characteristic has hysteresis given to the jump frequency.

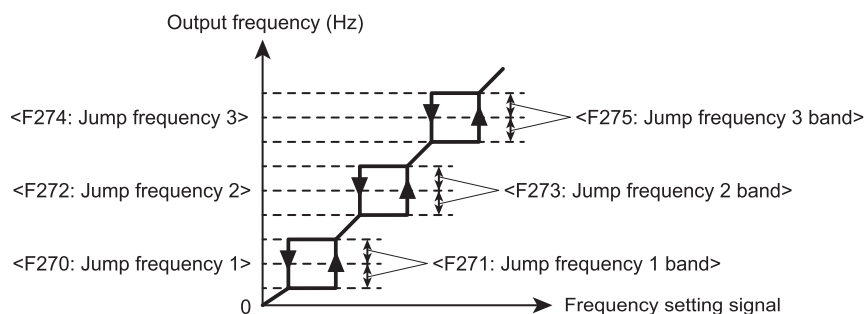
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■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F270	Jump frequency 1	0.0 - FH	Hz	0.0
F271	Jump frequency 1 band	0.0 - 30.0	Hz	0.0
F272	Jump frequency 2	0.0 - FH	Hz	0.0
F273	Jump frequency 2 band	0.0 - 30.0	Hz	0.0
F274	Jump frequency 3	0.0 - FH	Hz	0.0
F275	Jump frequency 3 band	0.0 - 30.0	Hz	0.0

■ Setting method

You can set three jump frequencies. To do that, avoid the overlap of the adjustment range of each jump frequency.
The frequency does not jump during acceleration or deceleration.



Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 12 Setting the preset-speed operation frequency

6. 12. 1 Setting the preset-speed operation frequency

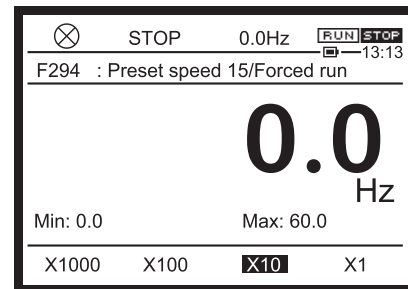
- <F287: Preset speed 8>
- <F288: Preset speed 9>
- <F289: Preset speed 10>
- <F290: Preset speed 11>
- <F291: Preset speed 12>
- <F292: Preset speed 13>
- <F293: Preset speed 14>
- <F294: Preset speed 15 / Forced run speed>
- <F560: Preset speed operation style>
- <F561: Operation function (1-speed)> through <F575: Operation function (15-speed)>
- <F576: Operation function (0-speed)>

For details of preset speed operation, refer to [5. 3. 7].

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6. 12. 2 Forced run in emergency

- <F294: Preset speed 15 / Forced run speed>



■ Function

You can run the inverter at a specified speed (frequency) in emergencies or continue to forcibly run it during slight failure. When the input terminal with the assigned function is turned ON, the inverter runs at the frequency set with <F294: Preset speed 15 / Forced run speed> regardless of run and frequency commands.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F294	Preset speed 15 / Forced run speed	LL - UL	Hz	0.0

■ Guideline for the setting

Assign the function to unused input terminal.

- When the inverter runs at a specified speed in an emergency

Input terminal function "58: Fire speed run"

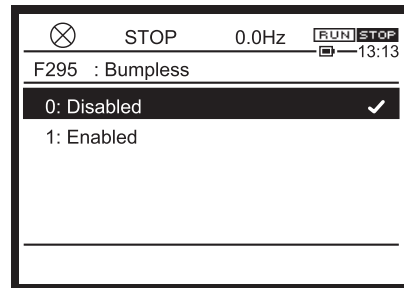
- When the inverter continues to forcibly run even during slight failure

Input terminal function "56: Forced run"

When the input terminal with the assigned function is turned ON, the inverter runs at the frequency set with <F294: Preset speed 15 / Forced run speed>.

6. 13 Bumpless operation

<F295: Bumpless>



■ Function

This function is used to pass on the run/stop state and output frequency under the automatic operation to the manual operation when a switch between the two operation modes is made.

When a switch from the manual to automatic operation is made, the operation status under the manual operation is not passed on to the automatic operation.

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F295	Bumpless	0: Disabled 1: Enabled	0

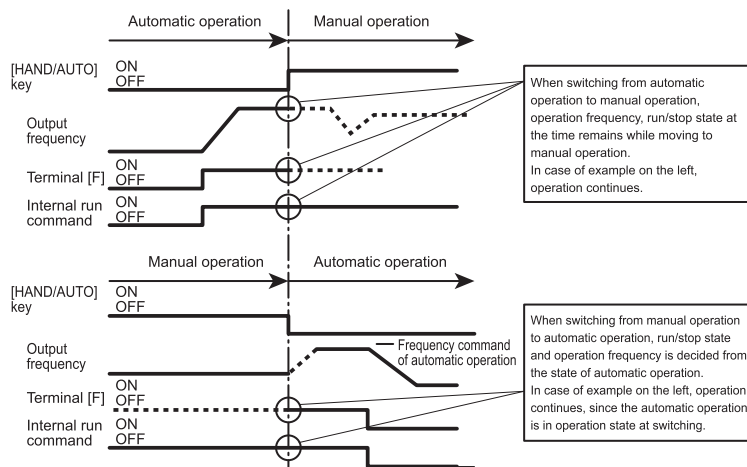
■ How to use

The [HAND/AUTO] key is used to make a switch between the manual and automatic operations.

- [HAND] indicates the panel operation at hand. (Manual operation)
- [AUTO] indicates the operation method selected by <CMOD: Run command select> or <FMOD: Frequency command select 1> (or <F207: Frequency command select 2>). (Automatic operation)

■ Operation example

When <CMOD: Run command select> is "0: Terminal" under the automatic operation



When you do not want to pass on the run/stop state and output frequency under the automatic operation to the manual operation, set <F295> to "0: Disabled".

Reference

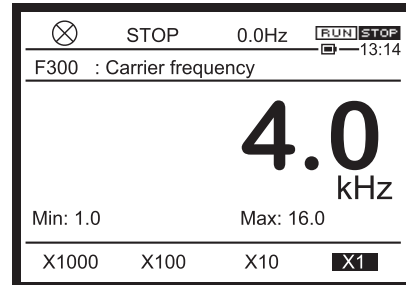
- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 14 Changing carrier frequency to reduce noise and magnetic noise

<F300: Carrier frequency>

<F312: Random switching>

<F316: Carrier frequency control>



■ Function

The inverter noise can be reduced by decreasing the carrier frequency.

You can respond to unpleasant motor acoustic noise by increasing the carrier frequency or changing the tone with the random switching.

Adjustment of carrier frequency is effective when a resonance with a load machine or motor fan cover occurs.

However, note that a low carrier frequency causes the motor acoustic noise to increase, and a high carrier frequency causes the inverter electro-magnetic noise to increase.

■ Parameter setting

■ <F300: Carrier frequency> setting

Some models require current reduction depending on the <F300: Carrier frequency> setting and ambient temperature.

■ <F312: Random switching> setting

When you want to reduce the motor acoustic noise with a low carrier frequency, set <F312: Random switching>. The tone can be changed.

This function works in the low output frequency range producing unpleasant acoustic noise from the motor.

<F312: Random switching> has three different tones: "1", "2" and "3". Select the appropriate setting for the load.

With <F300: Carrier frequency> set to 8.0 kHz or more, the motor acoustic noise decreases, and thus the random switching does not function.

■ <F316: Carrier frequency control> setting as a measure to protect motors against surge voltages

When a 480 V class inverter is used to operate a motor, very high surge voltages may be produced depending on the wire length, wire routing and types of wires used.

Here are some examples of measures against surge voltages.

- Decrease <F300: Carrier frequency>.

- When the wire length between the inverter and motor is long (approx. 20 to 100 m), set <F316: Carrier frequency control> to "2" or "3".
- Turn off power to set <F316: Carrier frequency control> to "2" or "3".
- Install a sinusoidal filter to the output side of inverter. In this case, set <F316: Carrier frequency control> to "4" or "5".
- Use a motor with high insulation strength.



Important

- When no decrease of carrier frequency is selected while a high carrier frequency is set, a trip occurs by Overheat (OH), etc. more easily than the case with automatic decrease.
- With <F316: Carrier frequency control> set to "2" or "3", the carrier frequency is restricted to 4 kHz or less automatically.
- With <F316: Carrier frequency control> set to "4" or "5", the carrier frequency is 4 kHz or more automatically.
- With <Pt: V/f pattern> set to "2" - "6" or "9" - "12", the carrier frequency is 2 kHz or more automatically.

■ Reduction of load current

When the ambient temperature is above 40 or 50°C, reduce the current according to "Instruction manual for load reduction" (E6582116).

An IGBT overload pre-alarm "L" or overheat pre-alarm "H" is displayed when the IGBT overload "OL3" or overheat "OH" protection level nears.

With <F316: Carrier frequency control> set to "1", "3" or "5", carrier frequency is decreased at IGBT overload pre-alarm, or overheat pre-alarm to try to prevent "OL3" or "OH" trip. When the cumulative amount of overload further increases, an "OL3" or "OH" trip will occur. In this case, decrease <F601: Stall prevention level 1> to avoid trips.

Even when <F300: Carrier frequency> is set to a low value, the carrier frequency increases in the high output frequency range to ensure stable operation.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 15 Avoiding trips

Occurrences of trips may be avoided using the appropriate function in consideration of the causes of alarms or trips.

6. 15. 1 Restarting smoothly after momentary power failure (restarting from motor coasting state)

<F301: Auto-restart>

For detailed settings of auto-restart, refer to [5. 4. 2].

6. 15. 2 Selecting operation for momentary power failure

<F302: Regenerative power ride-through>

<F310: Dec time at power failure>

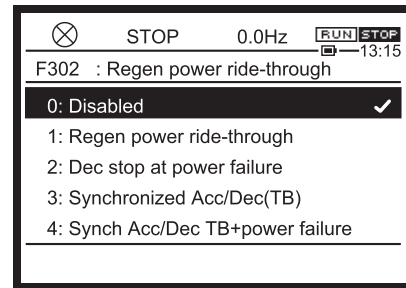
<F313: Ridethrough time>

<F317: Synchronized stop time>

<F318: Synchronized reach time>

<F625: Undervoltage detection level>

<F629: Regenerative power ride-through level>



6

■ Function

Select the reaction to a momentary power failure during operation from regenerative power ride-through, deceleration stop at power failure and synchronized Acc/Dec.

- Regenerative power ride-through: When a momentary power failure occurs, the operation is continued using the regenerative energy of the motor.
- Deceleration stop at power failure: When a momentary power failure occurs, the operation is stopped forcibly and swiftly using the regenerative energy of the motor. The deceleration time varies by the control. "StOP" is displayed on the operation panel during the stop. After the deceleration stop at power failure, the stop state is kept until the run command is turned OFF.
- Synchronized Acc/Dec: For a spindle winder of textile machine or the like, multiple machines are stopped in a lined-up manner or brought to reach the frequency command simultaneously during momentary power failure or restoration of power to prevent thread breakage.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F302	Regenerative power ride-through	0: Disabled 1: Regenerative power ride-through 2: Deceleration stop at power failure 3: Synchronized Acc/Dec (TB) 4: Synchronized Acc/Dec (TB + power failure)		0
F310	Dec time at power failure	0.0 - 320.0	s	2.0

Title	Parameter name	Adjustment range	Unit	Default setting
F313	Ridethrough time	0.0: Continuous 0.1 - 320.0	s	2.0
F317	Synchronized stop time	0.0 - 6000	s	2.0
F318	Synchronized reach time	0.0 - 6000	s	2.0
F625	Undervoltage detection level	50 - 79 80: Auto	%	80
F629	Regenerative power ridethrough level	55 - 100	%	75

■ Selecting the setting value

When using the regenerative power ride-through: <F302: Regenerative power ride-through> = "1"

- Set <F302> to "1: Regenerative power ride-through".
- A motor is controlled according to <F313: Ridethrough time>.

Note that the available time to continue the operation varies by the mechanical inertia or load condition. The motor may enter the coasting state depending on the load condition.
- Set the operation level of regenerative power ride-through with <F629: Regenerative power ride-through level>.

100% reference is 200 V (240V class), 400 V (480V class)

Set it to a value equal to <F625: Undervoltage detection level> decreased by 5%, or more. Or, set it to a value equal to <F629: Regenerative power ridethrough level> increased by 5%. If the setting is inappropriate, the regenerative power ride-through control time may become too short. This is not required when <F625> is "80: Auto".
- When <F303: Retry> is used together, you can restart a motor without stopping it in case a trip occurs.
- To restart a motor smoothly after restoration of power, use <F301: Auto-restart> together.
- This does not function during torque control.

When using the deceleration stop at power failure: <F302: Regenerative power ride-through> = "2"

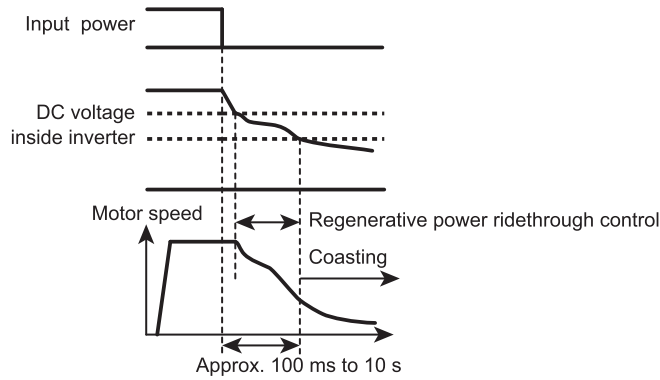
- Set <F302> to "2: Deceleration stop at power failure".
- A motor makes a deceleration stop according to <F310: Dec time at power failure>. The deceleration time is from <FH: Maximum frequency> to 0 Hz. With <F302> set to "2", <F310> cannot be written during run.
- Set the operation level of deceleration stop at power failure with <F626: Overvoltage limit operation level>. 100% reference is 200 V (240V class), 400 V (480V class).
- When the voltage falls to <F625: Undervoltage detection level> or less during a deceleration stop due to power failure, the motor will enter the coasting state.
- "StOP" is displayed on the operation panel during the stop. The stop state is kept until the run command is turned OFF.
- This does not function during torque control.

When using the synchronized Acc/Dec: <F302: Regenerative power ride-through> = "3" or "4"

- Set <F302> to "3: Synchronized Acc/Dec (TB)" or "4: Synchronized Acc/Dec (TB + power failure)".
- The deceleration time set by <F317: Synchronized stop time> and acceleration time set by <F318: Synchronized reach time> are used.
- This does not function during torque control.
- The jog run is disabled while this function is set.

■ Setting example of <F302: Regenerative power ride-through> = "1"

1) When the power supply is shut off



* Available time to continue the operation varies by the mechanical inertia or load condition. Perform verification test when using this function.

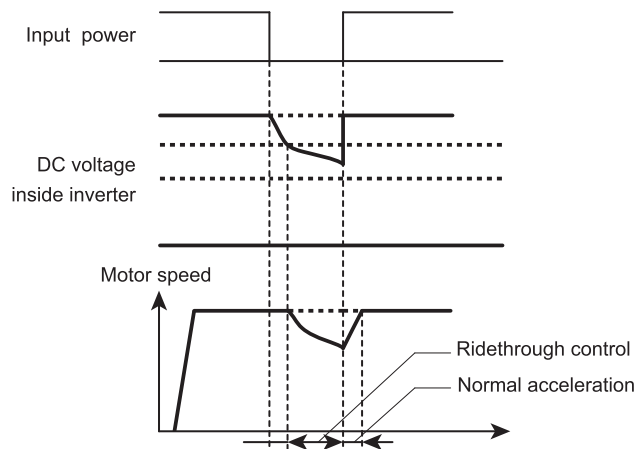
* Using retry function at the same time enables to automatically restart without failure stop. When the power supply is shut off during deceleration stop, deceleration stop corresponding to F302=2 is operated instead of regenerative power ride through.

This function does not work well at high speed in PM control.

Do not set this function in case of PM high speed drive.

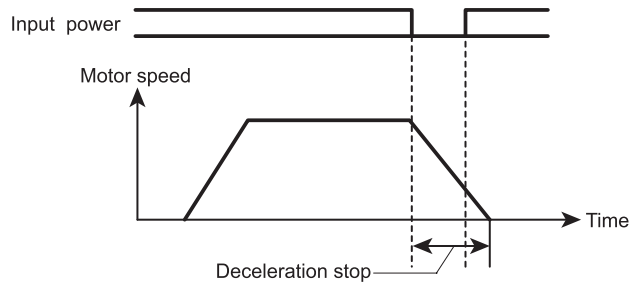
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2) When a momentary power failure occurs



When a momentary power failure occurs during deceleration stop, the regenerative power ride-through does not function.

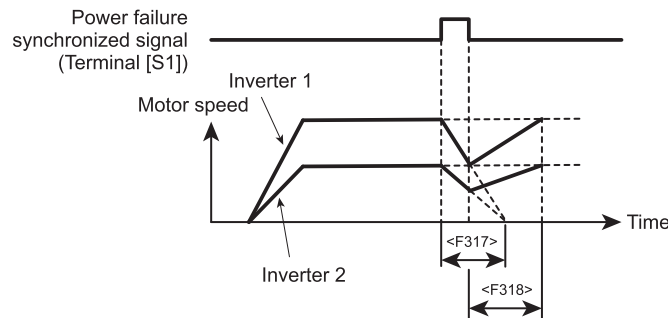
■ Setting example of <F302: Regenerative power ride-through> = "2"



- The motor makes a deceleration stop also when the power is restored. However, when the voltage in power circuit inside the inverter falls to or below a certain value, the control is stopped and the motor enters the coasting state.
- A motor makes a deceleration stop according to <F310: Dec time at power failure>. The deceleration time is from <FH: Maximum frequency> to 0 Hz.
- When the voltage falls to <F625: Undervoltage detection level> or less during a deceleration stop due to power failure, the motor will enter the coasting state. The display shows "StOP", and the motor is kept in the coasting state after power is restored.

■ Setting example of <F302: Regenerative power ride-through> = "3"

When <F114: Terminal S1 function 1> is set to "62: Synchronized Acc/Dec", and a power failure synchronized signal is allocated to the terminal [S1].



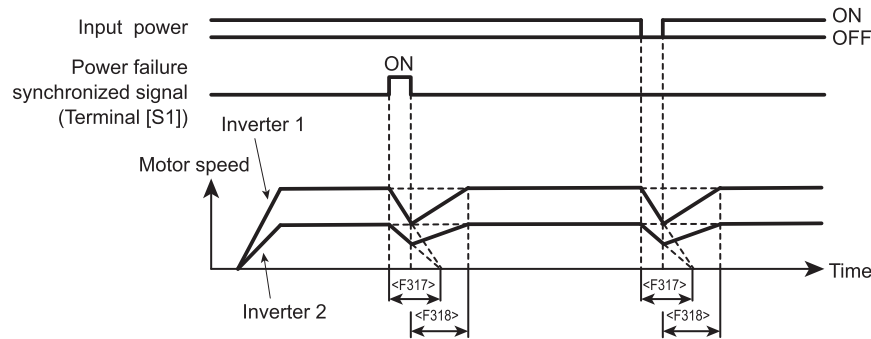
- When the terminal [S1] is turned ON with <F317: Synchronized stop time> and <F318: Synchronized reach time> of acceleration/deceleration set to the same value, multiple motors can be stopped almost at the same time. After power is restored, the motors can reach respective frequency command values almost at the same time.
- When the terminal [S1] is turned ON, linear deceleration is performed for the specified time by <F317> from the output frequency at this point to 0 Hz. The S-pattern deceleration and brake sequence are unavailable. "StOP" is displayed when the stop process is completed.
- When the terminal [S1] is turned OFF during synchronized deceleration, linear acceleration is performed for the specified time by <F318: Synchronized reach time> from the output frequency at this point to the output frequency at which the synchronized deceleration was started or frequency command value, whichever is lower. The S-pattern acceleration, brake sequence and auto-tuning are unavailable. "StOP" disappears when acceleration is started.

- When a Fwd/Rev switching or stop command is input during synchronized deceleration, synchronized acceleration/deceleration stops.
- To operate a motor again after a synchronized deceleration function stop, turn OFF the terminal [S1].
- When using the synchronized deceleration function, check that the overvoltage stall prevention function is not working during deceleration.

■ **Setting example of <F302: Regenerative power ride-through> = "4"**

When <F114: Terminal S1 function 1> is set to "62: Synchronized Acc/Dec", and a power failure synchronized signal is allocated to the terminal [S1].

Synchronized deceleration is performed when the terminal [S1] is ON or power failure occurs, and synchronized acceleration is performed when the terminal [S1] is OFF or restoration of power occurs.



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- When <F302> is set to "1", "2" or "4", the voltage in power circuit inside the inverter is controlled between <F625: Undervoltage detection level> and <F629: Regenerative power ride-through level>.
- When the voltage falls to <F625: Undervoltage detection level> or less, the power circuit undervoltage (MOFF) alarm is displayed and the motor enters the coasting state. If "MOFF" is displayed immediately after a power failure, adjust by decreasing the <F625> setting or slightly increasing the <F629: Regenerative power ride-through level> setting.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

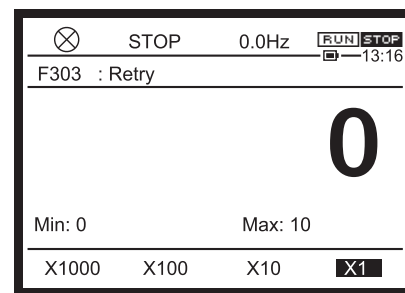
6. 15. 3 Automatic reset at trip (retry function)

CAUTION

Mandatory action

- Do not go near the motor or machine.
- When the retry function is selected, the motor/machine stopped at an occurrence of alarm will be started after a selected period of time (suddenly). Going near the motor/machine may result in unexpected injury.
- Affix the caution label about sudden restart in retry function to the inverter, motor and machine. Take a preventive measure against accidents.

<F303: Retry>



6

■ **Function**

The inverter is reset automatically when a trip occurs.
 During retry, the motor speed search is activated automatically as occasion demands to start a motor smoothly.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
F303	Retry	0: Disabled 1 - 10	Times	0

■ **How to use**

The following table shows the causes of trip and retry processes.

Cause of trip	Retry process	Stop condition
Overcurrent Overvoltage Overload Overheat Step out (PM only)	Consecutive retries up to 10 times 1st time: Approx. 1 second after occurrence of a trip 2nd time: Approx. 2 seconds after occurrence of a trip 3rd time: Approx. 3 seconds after occurrence of a trip ... 10th time: Approx. 10 seconds after occurrence of a trip	A trip other than overcurrent, overvoltage, overload, overheat and step-out detection occurs during retry. Retry fails with the specified number of times.

Followings are the trips of retry targets.
 "OC1" , "OC2" , "OC3" , "OP1" , "OP2" , "OP3" , "OL1" , "OL2" , "OL3" , "OLr" , "OH" , "SOUT"

During retry, "rtry" is displayed on LCD screen.

The retry count is cleared (number of retry: 0) after a specified time without occurrence of trips from a retry success.

A retry success means that the output frequency reaches the frequency command value without tripping.



Important

- A failure signal is not output during retry.
A "10: Failure signal 1" is allocated to the [FLA]-[FLB]-[FLC] terminals in the default setting.
- To output a failure signal during retry, allocate the function "116: Failure signal 4" or "117" to the output terminal.
- The virtual cooling time is provided for the overload trips "OL1", "OL2", and "OLr".
A retry is performed after the virtual cooling time and retry time elapse.
- For the overvoltage trips "OP1", "OP2" and "OP3", a retry is performed after the voltage in the DC section decreases.
- For the overheat trip "OH", a retry is performed after the inverter internal temperature decreases to the operable level.

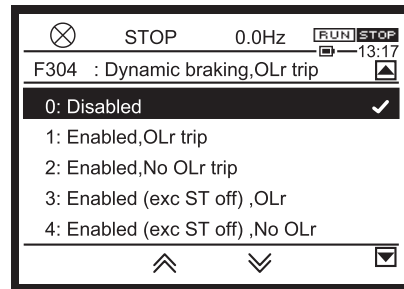
6

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 15. 4 Dynamic braking - Abrupt motor stop

- <F304: Dynamic braking, OLR trip>
- <F308: Braking resistance>
- <F309: Braking resistor capacity>
- <F626: Overvoltage limit operation level>
- <F639: Braking resistor overload time>



■ Function

The dynamic braking function can be enabled by connecting an external braking resistor.

- When an abrupt deceleration is necessary
- When an overvoltage "OP" trip occurs at a deceleration stop
- When the continuous regenerative state, such as moving down of a lifting gear and winding-out operation for tension control, is entered
- When the regenerative state is entered by load fluctuation during constant speed run of a press machine, etc.

6

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F304	Dynamic braking, OLR trip	0: Disabled 1: Enabled, OLR trip 2: Enabled, No OLR trip 3: Enabled (except during ST OFF), OLR trip 4: Enabled (except during ST OFF), No OLR trip 5: Enabled (except during trip), OLR trip 6: Enabled (except during trip), No OLR trip 7: Enabled (except during trip & ST OFF), OLR trip 8: Enabled (except during trip & ST OFF), No OLR trip		0
F308	Braking resistance	0.5 - 1000	Ω	*1
F309	Braking resistor capacity	0.01 - 600.0	kW	*1
F626	Overvoltage limit operation level	100 - 150	%	134
F639	Braking resistor overload time	0.1 - 600.0	s	5.0

*1 Depending on capacity, refer to [11. 6].

■ How to use

To use dynamic braking, set <F304: Dynamic braking, OLR trip> to "1" - "8" (dynamic braking enabled). At this time, the overvoltage limit operation is automatically disabled as in the case of <F305: Overvoltage limit operation> ="1: Disabled", and the regenerative energy of the motor is consumed by a braking resistor. (Refer to [6. 15. 5].)

Set <F308: Braking resistance> and <F309: Braking resistor capacity> according to the braking resistor to be connected.

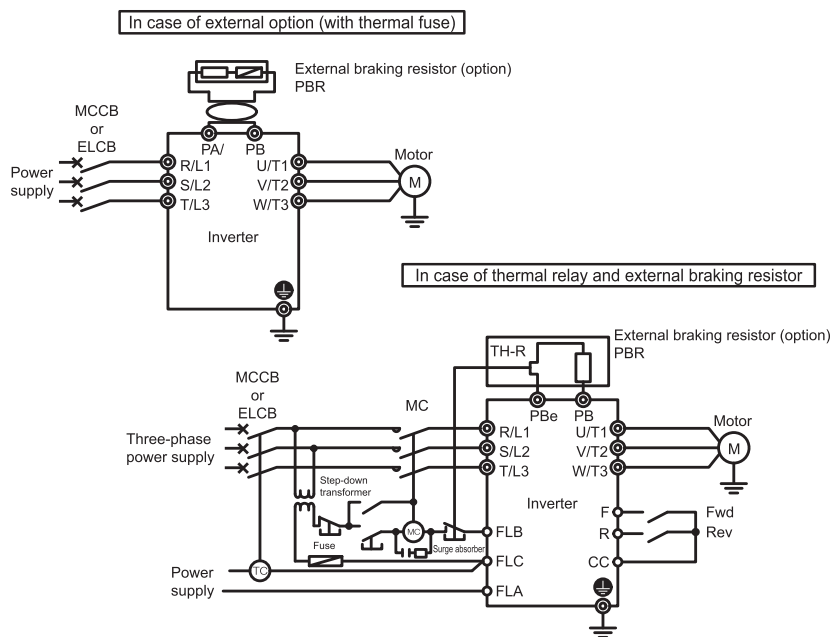
Set the overload time of braking resistor with <F639: Braking resistor overload time>. Set a value so that a trip occurs at a value 10 times the <F309: Braking resistor capacity> setting. The default setting is intended for our recommended braking resistors (DGP600 Series excluded). To use the DGP600 Series, use the characteristic value of overload relay as a guide.

Set the operation level of dynamic braking with <F626: Overvoltage limit operation level>.

To output an overload of braking resistor, allocate the braking resistor overload (OLr) pre-alarm (function number: "30" , "31") to the output terminal.

■ **Setting example**

When using an external braking resistor (option)



The above connection is for the case where MCCB or ELCB with a trip coil is used instead of MC for TC (trip coil).

Prepare a step-down transformer for the 480V class. It is not required for the 240V class.



Important

- Be sure to install a thermal relay (THR) to prevent fire. The inverter is equipped with the functions that protect a braking resistor from overload or overcurrent. A thermal relay needs to be activated when these protective functions become disabled.
- Select the appropriate thermal relay (THR) according to the braking resistor capacity (watt).
- "Thermal overload relay" is recommended, install it for each motor to be protected.
- "Thermal relay with CT" is not available.

For an application that requires the continuous regenerative state, such as moving down of a lifting gear, press and tension control, or when a deceleration stop is performed for a machine with large load inertial moment, increase the braking resistor capacity according to the operation rate.

Connect a braking resistor with a resistance value greater than the minimum allowable resistance value (resultant resistance value). Be sure to set <F308: Braking resistance> and <F309: Braking resistor capacity> for overload protection.

To use a braking resistor without thermal fuse, connect a thermal relay to shut off the power.

■ **Braking resistor option**

Following table shows the optional braking resistors. Operation rate is 3%ED.

Rating shows resultant resistance capacities (watt) and resultant resistance values (ohm).

A braking resistor for frequent regenerative braking is also available. Please contact your Toshiba distributor for information.

The type-form "PBR-" features built-in thermal fuse, and "PBR7-" features built-in thermal fuse and thermal relay.

The default settings of <F308: Braking resistance> and <F309: Braking resistor capacity> are intended for the optional braking resistors.

■ **Minimum resistance of connectable braking resistor**

Following shows the minimum resistance of connectable braking resistor.

Use a braking resistor with a resistance value greater than the minimum allowable resistance value (resultant resistance value).

■ **Minimum resistances of connectable braking resistors**

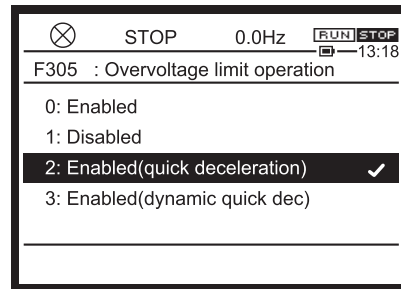
Voltage class	Inverter output capacity (kW at HD)	Minimum allowable resistance (Ω)
3-phase 240V	0.4 to 4.0	7.9
	5.5, 7.5	5.3
	11, 15	5
	18.5	4.5
	22 to 55	1
3-phase 480V	0.4 to 1.5	78
	2.2, 4.0	31.2
	5.5, 7.5	22.3
	11 to 18.5	15.6
	22, 30	12
	37	7.9
	45 to 75	2.5
	90 to 160	1.9
	220 to 280	1

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 15. 5 Avoiding overvoltage trip

- <F305: Overvoltage limit operation>
- <F319: Regenerative over-flux upper limit>
- <F626: Overvoltage limit operation level>



■ Function

These parameters are used to temporarily maintain the output frequency constant or increase the frequency to prevent overvoltage tripping when the voltage in the DC section rises during deceleration or while constant speed run is in progress (overvoltage limit operation).



Important

- During overvoltage limit operation, deceleration time may be longer than the time set.
- During overvoltage limit operation, the overvoltage (OP) pre-alarm is displayed.

6

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F305	Overvoltage limit operation	0: Enabled 1: Disabled 2: Enabled (quick deceleration) 3: Enabled (dynamic quick deceleration)		2
F319	Regenerative over-flux upper limit	100 - 160	%	*1
F626	Overvoltage limit operation level	100 - 150	%	134 *1

*1 Depending on the setup menu. For details, refer to [11. 6].

■ Difference in specific settings

<F305: Overvoltage limit operation> = "2"

This value sets quick deceleration.

When the voltage reaches the overvoltage limit operation level during deceleration, the motor may be decelerated more quickly than normal deceleration by increasing the voltage to be applied to the motor (over-excitation control) to increase the amount of energy consumed by the motor.

<F305: Overvoltage limit operation> = "3"

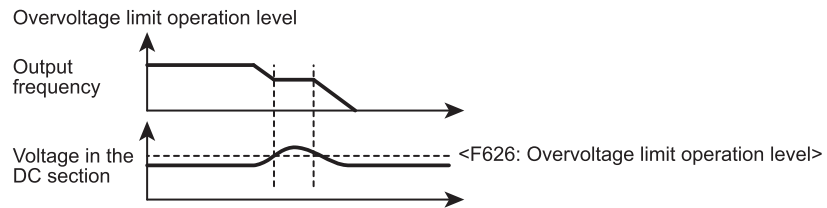
This value sets dynamic quick deceleration.

The motor may be decelerated more quickly than quick deceleration by increasing the voltage to be applied to the motor (over-excitation control) to increase the amount of energy consumed by the motor as soon as the motor starts decelerating.

<F319: Regenerative over-flux upper limit> is enabled when <F305: Overvoltage limit operation> is set to "2" or "3".

This parameter is used to adjust the maximum value of energy the motor consumes during deceleration. Increase this value if overvoltage tripping occurs during deceleration.

<F626: Overvoltage limit operation level> also serves as the parameter to set the dynamic braking level.

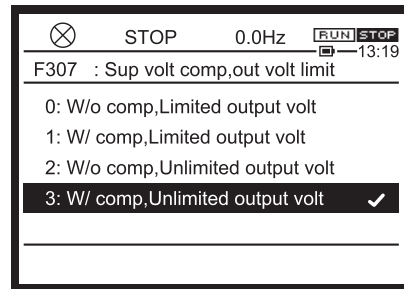


Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 15. 6 Adjusting and limiting output voltage

<F307: Supply voltage compensation, Output voltage limitation>



■ Function

- Supply voltage compensation: maintains a constant V/f ratio even when the input voltage fluctuates to suppress torque reduction in the low-speed range.
- Output voltage limitation: limits the output voltage so that voltage set with <vLv: Base frequency voltage 1> or more will not be output at frequency set with <vL: Base frequency 1> or more. This function is used when operating a special motor with low induced voltage.

6

■ Parameter setting

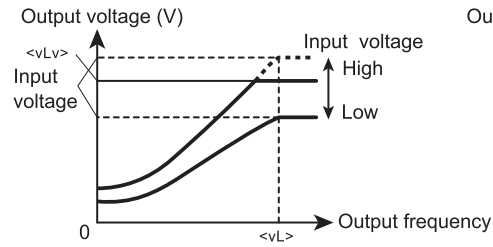
Title	Parameter name	Adjustment range	Default setting
F307	Supply voltage compensation, Output voltage limitation	0: Without supply voltage compensation, Limited output voltage 1: With supply voltage compensation, Limited output voltage 2: Without supply voltage compensation, Unlimited output voltage 3: With supply voltage compensation, Unlimited output voltage	*1

*1 Depending on the setup menu. Refer to [5. 3. 10], [11. 10].

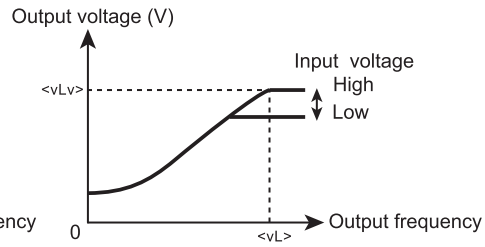
■ Selecting a setting value

- To maintain a constant V/f ratio even when the input voltage fluctuates to suppress torque reduction in the low-speed range, set <F307: Supply voltage compensation, Output voltage limitation> to "1" or "3" (With supply voltage compensation).
When <F307> is set to "0" or "2", output voltage will change in proportion to the input voltage.
- The output voltage can be limited according to the motor rating. When <F307> is set to "0" or "1", the output voltage will be limited to <vLv: Base frequency voltage 1> when operated at frequency set with <vL: Base frequency 1> or more.
- Even if <vLv> is set to the input voltage or more, the output voltage will not exceed the input voltage.
- When <Pt: V/f Pattern> is set to "2" - "6" or "9" - "12", With supply voltage compensation will be set regardless of the <F307> setting.

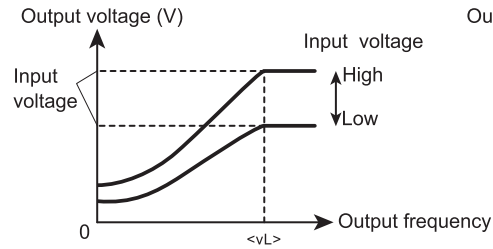
<F307>= "0: Without supply voltage compensation, Limited output power"



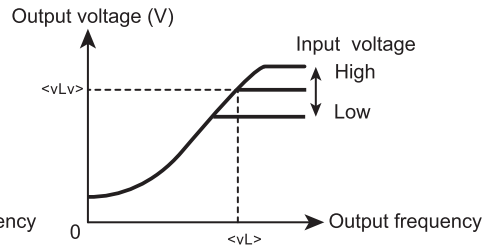
<F307>= "1: With supply voltage compensation, Limited output power"



<F307>= "2: Without supply voltage compensation, Unlimited output power"



<F307>= "3: With supply voltage compensation, Unlimited output power"



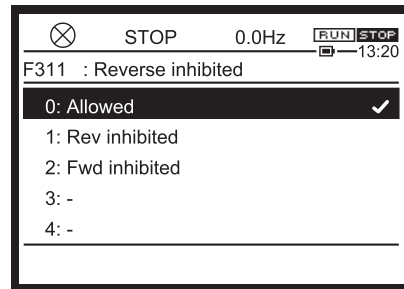
Rated voltages are fixed to values 240 V class: 200 V and 480 V class: 400 V.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 15. 7 Inhibiting Reverse run

<F311: Reverse inhibited>



■ Function

This function limits the direction of rotation when the wrong Fwd or Rev run command is input.

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F311	Reverse inhibited	0: Allowed 1: Rev inhibited 2: Fwd inhibited 3, 4: -	0

6



Important

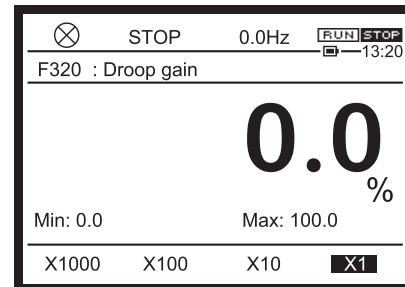
- When the motor is operated in the inhibited direction during operations such as preset speed operation with functions or jog run, the run command will be set to OFF.
- If the motor parameters are not set to the appropriate values when vector control or automatic torque boost is set, the motor may run in the reverse direction at approximately the slip frequency.
Set <F243: End frequency> to approximately the slip frequency.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 16 Single load sharing by multiple inverters (droop control)

- <F320: Droop gain>
- <F321: Frequency at 0% droop gain>
- <F322: Frequency at F320 droop gain>
- <F323: Droop deadband torque>
- <F324: Droop output filter>



■ Function

Droop control is a function that prevents loads from concentrating at a specific motor due to load imbalance when multiple inverters and motors are used to drive a common load. These parameters are used to allow the motor to slip (drooping characteristic) according to the load torque. These parameters are used to adjust the frequency range, deadband torque, and gain.

6

■ Parameter setting

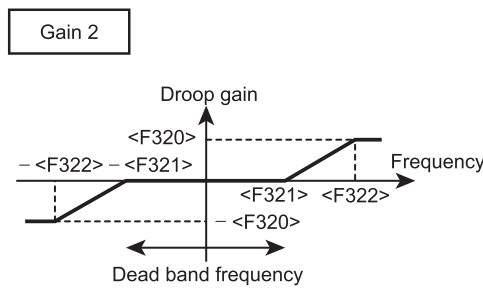
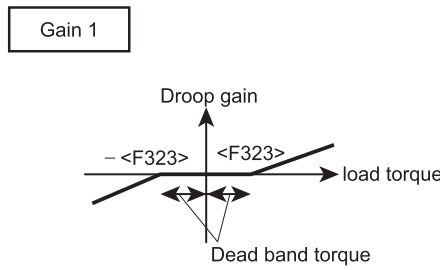
Title	Parameter name	Adjustment range	Unit	Default setting
F320	Droop gain	0.0 - 100.0 *1	%	0.0
F321	Frequency at 0% droop gain	0.0 - 320.0	Hz	10.0
F322	Frequency at F320 droop gain	0.0 - 320.0	Hz	100.0
F323	Droop deadband torque	0 - 100	%	10
F324	Droop output filter	0.1 - 200.0	rad/s	100.0

*1 Range that can be changed during run is 0.1 - 100.0%. Setting or changing to 0.0 (no droop) must be performed after stop.

■ Setting methods

- Droop control is enabled when <Pt: V/f Pattern> is set to "3", "9", "10", or "11".
- When the applied torque is equal to or more than the deadband torque value, output frequency is reduced during power running or increased during regeneration.
- Droop control is enabled at frequency range <F321: Frequency at 0% droop gain> or more.
- The amount of droop will vary depending on the output frequency for frequency ranges <F321: Frequency at 0% droop gain> or more or <F322: Frequency at F320 droop gain> or less.
- For the frequency range over <vL: Base frequency 1>, the amount of error for <F323: Droop deadband torque> will increase. Therefore, we recommend you use this parameter at base frequency or less.
- Output frequency in droop control will not be limited by <FH: Maximum frequency>.

6



■ Calculating formula

The amount of output frequency adjusted by droop control can be calculated with the following formula.

1) Gain based on internal torque command (Gain 1)

- When internal torque command (%) ≥ 0 ,
Gain 1 = (load torque - <F323>)/100
Note that 0 (zero) or a positive number must be set to Gain 1.
- When internal torque command (%) < 0 ,
Gain 1 = (load torque + <F323>)/100
Note that 0 (zero) or a negative number must be set to Gain 1.

2) Gain based on frequency after acceleration (Gain 2)

- When <F321> $< <F322>$
When |frequency after acceleration| $\leq <F321>$,
Gain 2 = 0
When |frequency after acceleration| $> <F322>$,
Gain 2 = <F320>/100
When <F321> $< |frequency after acceleration| \leq <F322>$,
Gain 2 = (<F320>/100) x ((|frequency after acceleration| - <F321>)/(<F322> - <F321>))
- When <F321> $\geq <F322>$
When |frequency after acceleration| $\leq <F321>$,
Gain 2 = 0
When |frequency after acceleration| $> <F321>$,
Gain 2 = <F320>/100

3) Droop frequency

Droop frequency = <vL: Base frequency 1> x Gain 1 x Gain 2

Note that, when <vL: Base frequency 1> is over 100 Hz, this value is calculated as 100 Hz.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 17 High-speed operation with light load on cranes

- <F328: Light-load high-speed operation>
- <F329: Light-load high-speed learning function>
- <F330: Light-load high-speed automatic operation frequency>
- <F331: Light-load high-speed operation switching lower-limit frequency>
- <F332: Light-load high-speed operation load detection wait time>
- <F333: Light-load high-speed operation load detection time>
- <F334: Light-load high-speed operation heavy load detection time>
- <F335: Switching load torque during power running>
- <F336: Heavy-load torque during power running>
- <F337: Heavy-load torque during constant speed power running>
- <F338: Switching load torque during regen>

For details, refer to "Crane Application Function Manual" (E6582104) (light-load high-speed operation, brake sequence, learning).

6. 18 Brake sequence

6. 18. 1 Brake sequence

- <F325: Brake release wait time>
- <F326: Brake release undercurrent threshold>
- <F340: Creep time 1>
- <F341: Brake function>
- <F342: Load torque input select>
- <F343: Hoisting torque bias>
- <F344: Lowering torque bias rate>
- <F345: Brake releasing time>
- <F346: Creep frequency>
- <F347: Creep time 2>
- <F348: Brake learning>
- <F630: Brake answer wait time>

For details, refer to "Crane Application Function Manual" (light-load high-speed operation, brake sequence, learning) (E6582104).

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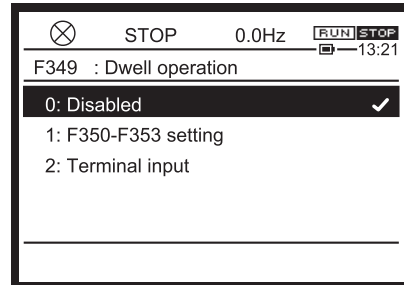
6. 18. 2 Hit and stop control

- <F382: Hit and stop control>
- <F383: Hit and stop frequency>
- <F384: Hit and stop torque limit>
- <F385: Hit and stop detection time>
- <F386: Hit and stop continuation torque limit>

For details, refer to Hit and Stop Function Instruction Manual ([E6582096](#)).

6. 19 Constant speed run with Acc/Dec suspended (dwell operation)

- <F349: Dwell operation>
- <F350: Acc suspended frequency>
- <F351: Acc suspended time>
- <F352: Dec suspended frequency>
- <F353: Dec suspended time>



■ Function

This function suspends acceleration/deceleration temporarily and let the inverter run in constant speed according to the brake delay during run/stop for transportation of heavy load. This will prevent occurrence of overcurrent at startup or slippage when stopping by adjusting the timing with the brake.

There are two ways to set dwell operation: automatic stop by setting the stop frequency and stop time and stop by using signals to the input terminal.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F349	Dwell operation	0: Disabled 1: F350-F353 setting 2: Terminal input		0
F350	Acc suspended frequency	0.0 - FH	Hz	0.0
F351	Acc suspended time	0.0 - 10.0	s	0.0
F352	Dec suspended frequency	0.0 - FH	Hz	0.0
F353	Dec suspended time	0.0 - 10.0	s	0.0

■ Setting method

Select whether to automatically suspend acceleration/deceleration by parameter settings or by signal input to the input terminal. This is set with <F349: Dwell operation>.

- When <F349> is set to "1", you must also set parameters <F350: Acc suspended frequency> through <F353: Dec suspended time>.

<F350: Acc suspended frequency> must be set to a value over <F240: Start frequency>.

<F352: Dec suspended frequency> must be set to a value over <F243: End frequency>.

When the frequency command value is the same as values set for <F350> and <F352> settings, dwell operation will not be enabled.

- When <F349> is set to "2", you must also assign function numbers "60", "61" (dwell operation) to the unused input terminal.



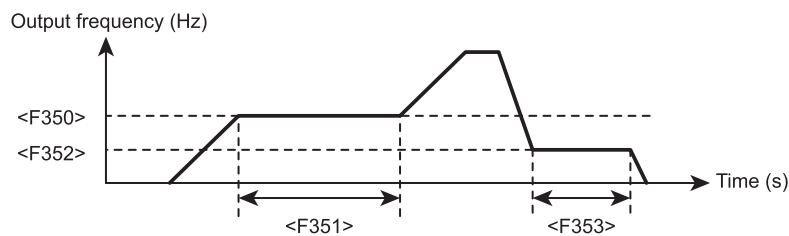
Important

- When output frequency falls due to the stall preventive function, dwell operation may be enabled.

■ **Setting example: for automatic dwell operation**

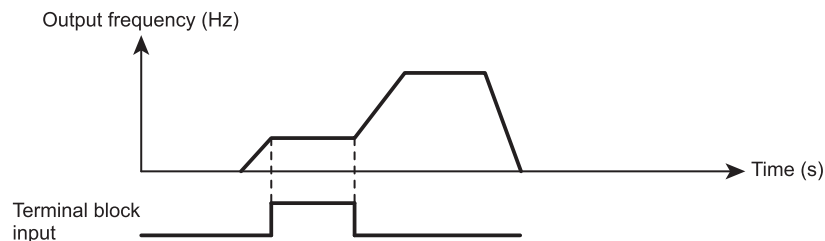
Set <F350: Acc suspended frequency>, <F352: Dec suspended frequency>, <F351: Acc suspended time>, and <F353: Dec suspended time>. Then set <F349: Dwell operation> to "1".

When the output frequency reaches the set frequency, operation will automatically switch to constant speed run (acceleration/deceleration suspended).



■ **Setting example: for dwell operation by external signal input**

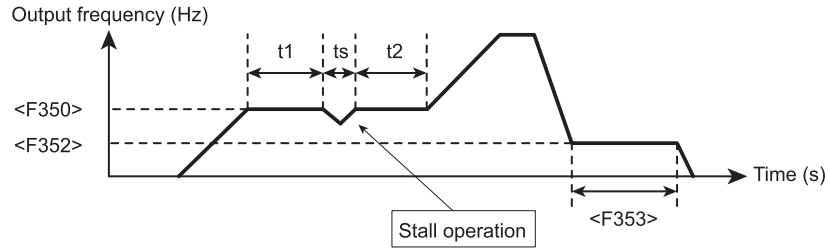
Assign function numbers "60", "61" (dwell operation) to the unused input terminal. Dwell operation will be performed while the input terminal is ON.



When you set run command ON after you set the dwell operation signal ON, operation will start at <F240: Start frequency>.

■ If the stall preventive function is enabled during dwell operation

Duration of any temporary output frequency change due to the stall preventive function will be included in the acceleration/deceleration suspended time.



6

Memo

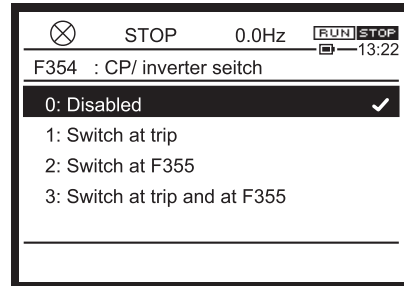
- The stall preventive function automatically changes the output frequency when overcurrent, overload or overvoltage occurs. Specific functions that are set with each parameter are as follows:
 - Overcurrent stall: <F601: Stall prevention level 1>
 - Overload stall: <OLM: Motor overload protection characteristic>
 - Overvoltage stall; <F305: Overvoltage limit operation>

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 20 Switching to commercial power run

- <F354: Commercial power/Inverter switching>
- <F355: Commercial power switching frequency>
- <F356: Inverter switching wait time>
- <F357: Commercial power switching wait time>
- <F358: Commercial power switching frequency continuous time>



■ Function

This function allows output of switching signals to an external sequence (such as MC) so that when tripping occurs, operation will be switched to commercial power run without stopping the motor. For details, refer to Commercial power/Inverter switching (E6582108).

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F354	Commercial power/ Inverter switching	0: Disabled 1: Switch at trip 2: Switch at F355 3: Switch at trip and at F355		0
F355	Commercial power switching frequency	0 - UL	Hz	50.0/60.0 *1
F356	Inverter switching wait time	0.10 - 10.00	s	*2
F357	Commercial power switching wait time	0.10 - 10.00	s	0.62
F358	Commercial power switching frequency continuous time	0.10 - 10.00	s	2.00

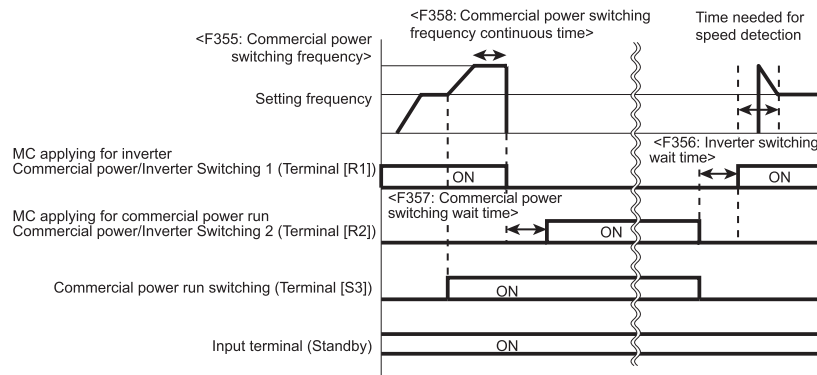
*1 Depending on the setup menu. Refer to [5. 3. 10], [11. 10].

*2 Depending on capacity. For details, refer to [11. 5].

Trips that are automatically switched are those not displayed as "OCL", "E", "EF1", and "EF2".

<F341: Brake function> will not be enabled.

■ Timing chart (setting example)



When function numbers "102", "103" (switch to commercial power run) is set to terminal [S3].

Terminal [S3] ON: commercial power operation

Terminal [S3] OFF: inverter operation

Switching cannot be performed properly if standby function is OFF.

6

Title	Parameter name	Setting example	Unit
F354	Commercial power/ Inverter switching	2: Switch at F355 or 3: Switch at trip and at F355	-
F355	Commercial power switching frequency	Power supply frequency, etc.	Hz
F356	Inverter switching wait time	Depending on capacity *1	s
F357	Commercial power switching wait time	0.62	s
F358	Commercial power switching frequency continuous time	2.00	s
F116	Terminal S3 function	102: Commercial powr run switching	-
F133	Terminal R1 function 1	46: Commercial power/Inverter Switching 1	-
F134	Terminal R2 function	48: Commercial power/Inverter Switching 2	-

*1 Depending on capacity. For details, refer to [11. 6].



Important

- To allow switching to commercial power operation, forward run of the inverter and the direction of rotation of the motor for commercial power operation must match.
- Do not set <F311: Reverse inhibited> to "2: Fwd inhibited". The inverter will not be able to forward run and switching to commercial power cannot be accomplished.
- This function can only be used in induction motors. Do not use this function with PM motors.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 21 PID control

<FPid: PID1 set value>
<F359: PID control 1>
<F360: PID1 feedback input select >
<F361: PID1 filter>
<F362: PID1 proportional gain>
<F363: PID1 integral gain>
<F364: PID1 deviation upper-limit>
<F365: PID1 deviation lower-limit>
<F366: PID1 differential gain>
<F367: PID1 set value upper-limit>
<F368: PID1 set value lower-limit>
<F369: PID1 start wait time>
<F370: PID1 output upper-limit>
<F371: PID1 output lower-limit>
<F372: PID1 set value increase time>
<F373: PID1 set value decrease time>
<F374: PID1 set value agreement detection band>
<F388: PID1 output dead band>
<F389: PID1 set value select>

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For details of PID control, refer to PID Control Instruction Manual (E6582112).
For parameter setting, refer to [5. 3. 8] "Setting PID control" as well.

6. 22 Retaining the stop position

<Pt: V/f Pattern>
<F381: Simple positioning completion range>
<F359: PID control1>
<F362: PID1 proportional gain>
<F369: PID1 start wait time>
<F375: PG pulses number>
<F376: PG phases number select>

For details of stop position retain function, refer to PID Control Instruction Manual (E6582112).

6. 23 Setting of motor parameters

! WARNING



Prohibited

- Do not touch terminals or motor of the inverter while performing auto tuning. Touching the terminals or motor while voltage is applied to the terminals and motor may result in electric shock, even if the motor is stopped. After setting offline auto-tuning (F400 = "2"), execute the auto tuning at first start of the inverter. The auto tuning takes several seconds and the motor is stopped meanwhile, but voltage is applied to the terminals and motor. The motor may also generate a sound during the auto tuning, but this is not malfunction.



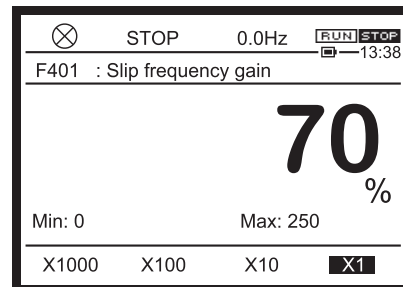
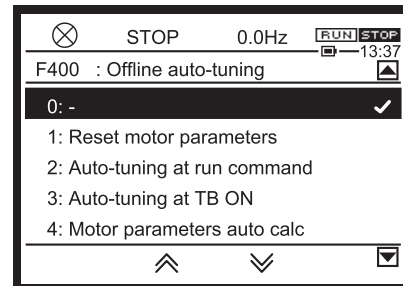
Mandatory action

- Install circuit protection such as the mechanical brake in the crane. If there is no sufficient circuit protection installed in the crane, insufficient motor torque while auto tuning will cause the machine stalling/falling.

6. 23. 1 Setting induction motor parameters

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- <F400: Offline auto-tuning>
- <F401: Slip frequency gain>
- <F402: Automatic torque boost>
- <F403: Online auto-tuning>
- <F405: Motor rated capacity>
- <F412: Leakage inductance>
- <F413: Exciting current coefficient>
- <F414: Stall prevention coefficient>
- <F415: Motor rated current>
- <F416: Motor no load current>
- <F417: Motor rated speed>
- <F459: Load inertia ratio>
- <F462: Speed reference filter coefficient 1>
- <F465: Speed reference filter coefficient 2>



■ Function

To select vector control, automatic torque boost, or automatic energy-saving with <Pt: V/f Pattern>, you must set motor parameters (auto-tuning).

There are four setting methods.

- Use <AU2: Torque boost macro> to set both <Pt> and <F400: Offline auto-tuning>.
- Set <Pt> and <F400> individually.
- Set <Pt> and <F400> individually. Perform an auto-tuning after calculating the motor parameter automatically (available with motor not connected).

- Set <Pt> and set the motor parameter manually.



Important

- Check the motor name plate and set the following parameters first.
The value of 4 pole general purpose motor, with same capacity as the inverter, is set by default setting.
 - <vL: Base frequency 1> (Rated frequency)
 - <vLv: Base frequency voltage 1> (Rated voltage)
 - <F405: Motor rated capacity>
 - <F415: Motor rated current>
 - <F417: Motor rated speed>
- Set other motor parameters as necessary.

■ Setting method 1: Use torque boost macro

This is the simplest setting method. Vector control/automatic torque boost/automatic energy-saving and auto-tuning are all set at once.

Check the motor name plate and set the following parameters first.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Next, set <AU2: Torque boost macro>.

- 1: Automatic torque boost + offline auto-tuning
- 2: Vector control 1 + offline auto-tuning
- 3: Energy savings + offline auto-tuning

For details of setting methods, refer to [5. 3. 5].

■ Setting method 2: Set auto-tuning

Set vector control/automatic torque boost/automatic energy-saving and auto-tuning individually.

First, set <Pt: V/f Pattern>. For details of setting methods, refer to [5. 3. 4].

Next, perform offline auto-tuning.

1) Parameter setting

Title	Parameter name	Adjustment range	Default setting
F400	Offline auto-tuning	0: - 1: Reset motor parameters (0 after execution) 2: Auto-tuning at run command (0 after execution) 3: Auto-tuning at TB ON 4: Motor parameters auto calculation (0 after execution) 5: 4+2 (0 after execution) 6: Auto-tuning at run command during TB ON 7: Auto-tuning F402 only at run command during TB ON	0

2) Selecting auto-tuning setting

1: Reset motor parameters (0 after execution)

Set motor parameters <F402: Automatic torque boost>, <F412: Leakage inductance>, and <F416: Motor no load current> to default setting values (same motor parameter values as a 4 pole general purpose motor with same capacity as the inverter).

2: Auto-tuning at run command (0 after execution)

Perform auto-tuning when the motor starts for the first time after settings are made and automatically set <F402: Automatic torque boost> and <F412: Leakage inductance> while considering the motor wiring.

3: Auto-tuning at TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal.

When the assigned input terminal is ON, make an auto-tuning and automatically set <F402: Automatic torque boost> and <F412: Leakage inductance>.

This setting allows auto-tuning while the motor is stopped; use this function when the motor cannot run following the auto-tuning due to some reason related to the operation of the machinery.

However, if standby signal is OFF, this function will not be enabled.

To make an auto-tuning again, turn input terminal off once, then turn on again.

6: Auto-tuning at run command during TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal.

When the assigned input terminal is ON, always make an auto-tuning and automatically set <F402: Automatic torque boost> and <F412: Leakage inductance> at startup.

7: Auto-tuning F402 only at run command during TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal.

Always make an auto-tuning at startup when the motor starts for the first time after the assigned input terminal is ON and set <F402: Automatic torque boost> only.

3) Cautions during offline auto-tuning

- Offline auto-tuning must be performed with the motor connected but in a completely stopped state.
 - Due to residual voltage, tuning may not be properly executed immediately after running motor is stopped.
- There would be almost no rotation of the motor during offline auto-tuning, but you must keep in mind that voltage is still applied during this time.
- During auto-offline tuning, "Atn" will be displayed on the LCD screen.
- Offline auto-tuning takes a few seconds. If any failure is found, tripping will occur with auto-tuning error "Etn1" or "Etn2", and motor parameters will not be set.
- Offline auto-tuning cannot be performed on special motors such as a high-speed motor or high-slip motor. Calculate the motor parameters using "Setting method 3".
- If offline auto-tuning cannot be executed or auto-tuning error "Etn1" or "Etn2" occurs, perform manual setting using "Setting method 4".

■ Setting method 3: Make auto-tuning of motor parameter after automatic setting.

Make auto-tuning after setting vector control/automatic torque boost/automatic energy-saving and performing motor parameters auto calculation.

Check the motor name plate and set the following parameters first.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Next, set <Pt: V/f Pattern>. For details of setting methods, refer to [5. 3. 4].

Then, select <F400> = "4: Motor parameters auto calculation (0 after execution)" and calculate motor parameters automatically.

Motor parameters <F402: Automatic torque boost>, <F412: Leakage inductance>, and <F416: Motor no load current> will be set automatically.

This setting can be made without connecting the motor since it only calculates.

After automatic setting of motor parameter with <F400> = "4", be sure to set <F400> to "2: Auto-tuning at run command (0 after execution)" and perform an auto-tuning.

You can set <F400> to "4" and "2" collectively by setting <F400> to "5: 4+2 (0 after execution)".

Since calculation is performed based on general trend, the calculation results may not be correct. In this case, set the parameter manually. In case ETN3 trip occurs after set 4 to F400, do not set 4 to F400, and set the parameter manually.

■ **Setting method 4: Manually setting motor parameter**

Set <Pt: V/f Pattern> and set the motor parameter manually.

If tuning error "Etn1" is displayed during auto-tuning setting or when you want to improve vector control characteristics, set motor parameters individually.

4) Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F401	Slip frequency gain	0 - 250	%	70
F402	Automatic torque boost	0.1 - 30.00	%	*1
F405	Motor rated capacity	0.01 - 315.0	kW	*1
F412	Leakage inductance	0.0 - 25.0	%	*1
F413	Exciting current coefficient	100 - 150	%	100
F415	Motor rated current	*1	A *1	*1
F416	Motor no load current	10 - 90	%	*1
F417	Motor rated speed	100 - 64000	min ⁻¹	*2
F459	Load inertia ratio	0.1 - 100.0	Times	1.0
F460	Speed control response 1	0.0 - 25.0	-	0.0
F461	Speed control stabilization coefficient 1	0.50 - 2.50	-	1.00
F462	Speed reference filter coefficient 1	0 - 100	-	35

Title	Parameter name	Adjustment range	Unit	Default setting
F463	Speed control response 2	0.0 - 25.0	-	0.0
F464	Speed control stabilization coefficient 2	0.50 - 2.50	-	1.00
F465	Speed reference filter coefficient 2	0 - 100	-	35
F466	Speed control response switching frequency	0.0 - FH	Hz	0.0

*1 Depending on capacity. For details, refer to [11. 6].

*2 Depending on the setup menu. Refer to [5. 3. 10], [11. 10].

5) Motor parameter setting method (Basic)

<F401: Slip frequency gain>

This parameter sets the compensation gain for motor slip.

Increasing the value will reduce motor slip.

Set <F417: Motor rated speed> and then make fine adjustments to <F401>.

Keep in mind that setting a higher value than necessary will cause unstable operation such as hunting.

<F402: Automatic torque boost>

This parameter adjusts the primary resistive component of the motor.

Increasing this value will prevent torque reduction due to voltage drop during low speed.

Adjust the value according to the actual operation.

Keep in mind that setting a higher value than necessary will increase current at low speed and may cause tripping.

If there is a motor test report, check the stator resistance value per phase.

$$\text{<F402> (\%)} = (\sqrt{3} \times R_s \times \text{<F415>} \times 0.9) / (V_{\text{type}} \times 100)$$

where R_s is the stator resistance value per phase (Ω), V_{type} is 200, 400 V (depends on voltage class).

<F405: Motor rated capacity>

This parameter sets the motor rated capacity.

Check the motor name plate or test report while setting.

<F412: Leakage inductance>

This parameter sets the leakage inductance component of the motor.

Increasing this value will improve torque in the high-speed region.

<F415: Motor rated current>

This parameter sets the motor rated current.

Check the motor name plate or test report while setting.

<F416: Motor no load current>

This parameter sets the ratio of the motor no-load current to the rated current.

This is equivalent to the exciting inductance of the motor.

Check the no-load current value in the motor test report and divide it by the rated current value.

Set the calculated value in %.

Increasing this value will increase the exciting current.
Keep in mind that setting a value too high will cause hunting in the motor.

<F417: Motor rated speed>

This parameter sets the motor rated speed.
Check the motor name plate or test report while setting.

6) Motor parameter setting method (Advanced)

• **How to adjust the moment of inertia of the load**

<F459: Load inertia ratio>

This parameter adjusts the excess response speed.
Increasing this value will reduce the overshoot at the acceleration/deceleration completion point.

Default setting values are set so that the moment of inertia of the load (including the motor shaft) value is set to be appropriate at 100% of the motor shaft. If the moment of inertia of the load is not 100%, set a value appropriate for the actual inertia of the load.

<F460: Speed control response 1>

<F461: Speed control stabilization coefficient 1>

<F462: Speed reference filter coefficient 1>

<F463: Speed control response 2>

<F464: Speed control stabilization coefficient 2>

<F465: Speed reference filter coefficient 2>

<F466: Speed control response switching frequency>

This parameter adjusts the excess response speed.
Increasing this value will reduce the overshoot at the acceleration/deceleration completion point. Set a value appropriate for the actual inertia of the load.
For details, refer to "Current and Speed Control Gain Adjustment Method" manual (E6582136).

- If the torque needs to be increased in low speed range (10Hz or less as a guide)
Perform the basic settings for the motor parameters. Then, if the torque needs to be increased even further, increase <F413: Exciting current coefficient> to a maximum of 130%. <F413> is a parameter that increases the magnetic flux of the motor at low speeds, so specifying a higher value for <F413> increases the no-load current. If the no-load current exceeds the rated current, do not adjust this parameter.
- If the motor stalls when operated at frequencies over the base frequency
Adjust <F414: Stall prevention coefficient>.
If a heavy load is applied momentarily (transiently), the motor may stall before the load current reaches the stall prevention level (<F601>, etc.). In such a case, a motor stall may be avoided by reducing the value of <F414> gradually.

Memo

- To use vector control, the motor capacity must be the same as the inverter rated capacity, or you can use a general purpose squirrel-cage motor with capacity no less than one rank below. Note that the minimum applicable motor capacity is 0.1 kW.

■ **Online auto-tuning setting**

<F403: Online auto-tuning> is a function that automatically adjusts motor parameters by predicting the increase in motor temperature.

- Online auto-tuning must be performed along with <F400: Offline auto-tuning>.
- Perform auto-tuning when the motor has cooled down (same temperature as the ambient temperature).

7) Parameter setting

Title	Parameter name	Adjustment range	Default setting
F403	Online auto-tuning	0: Disabled 1: Self-cooling motor auto-tuning 2: Forced air-cooling motor auto-tuning	0

8) Selecting a setting value

1: Self-cooling motor auto-tuning

Set this value when the motor is equipped with a self-cooling fan (a type in which a fan is directly connected to the motor shaft).

2: Forced air-cooling motor auto-tuning

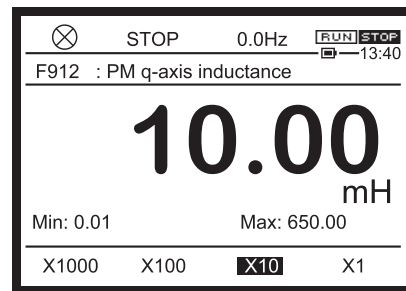
Set this value when the motor is equipped with a fan motor (forced air-cooling).

6

Reference	<ul style="list-style-type: none"> • How to operate the operation panel -> Refer to [3. 1. 1]. • How to switch display mode on the operation panel -> Refer to [3. 1. 2]. • Procedure to change parameter setting -> Refer to [4. 2. 3]
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6. 23. 2 Setting PM motor parameters

- <F400: Offline auto-tuning>
- <F402: Automatic torque boost>
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>
- <F459: Load inertia ratio>
- <F462: Speed reference filter coefficient 1>
- <F465: Speed reference filter coefficient 2>
- <F912: PM q-axis inductance>
- <F913: PM d-axis inductance>
- <F915: PM control method>



■ Function

To select PM motor control with <Pt: V/f Pattern>, you must set motor parameters (auto-tuning). There are three setting methods.

- Set <Pt> and <F400: Offline auto-tuning> individually.
- Set <Pt> and <F400> individually. Perform an auto-tuning after calculating the motor parameter automatically (available with motor not connected).
- Set <Pt> and set the motor parameter manually.

6



Important

- To set <Pt: V/f Pattern> to "6: PM motor control" or "12: PG feedback PM motor control", check the motor name plate and set the following parameters first.
 - <vL: Base frequency 1> (Rated frequency): calculate from back EMF
 - <vLv: Base frequency voltage 1> (Rated voltage): calculate from back EMF
 - <F405: Motor rated capacity>
 - <F415: Motor rated current>
 - <F417: Motor rated speed>
 - <F912: PM q-axis inductance>
 - <F913: PM d-axis inductance>

■ Setting method 1: Set auto-tuning

Set PM motor control and auto-tuning individually.

First, set <Pt: V/f Pattern> to "6: PM motor control". For details of setting methods, refer to [5. 3. 4].

Next, perform offline auto-tuning.

1) Parameter setting

Title	Parameter name	Adjustment range	Default setting
F400	Offline auto-tuning	0: - 1: Reset motor parameters (0 after execution) 2: Auto-tuning at run command (0 after execution) 3: Auto-tuning at TB ON 4: Motor parameters auto calculation (0 after execution) 5: - 6: Auto-tuning at run command during TB ON 7: Auto-tuning F402 only at run command during TB ON	0

2) How to select a setting value

1: Reset motor parameters (0 after execution)

Motor parameters <F402: Automatic torque boost>, <F912: PM q-axis inductance>, and <F913: PM d-axis inductance> are set with default setting values.

2: Auto-tuning at run command (0 after execution)

Perform tuning when the motor starts for the first time after settings are made and automatically set <F402: Automatic torque boost>, <F912: PM q-axis inductance>, and <F913: PM d-axis inductance> while considering the motor wiring.

3: Auto-tuning at TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal. When the assigned input terminal is ON, executed an auto-tuning and automatically set <F402: Automatic torque boost>, <F912: PM q-axis inductance>, and <F913: PM d-axis inductance>. This setting allows auto-tuning while the motor is stopped; use this function when the motor cannot run following the auto-tuning due to some reason related to the operation of the machinery.

However, if standby signal is OFF, this function will not be enabled.

To make an auto-tuning again, tern input terminal off once, then turn on again.

6: Auto-tuning at run command during TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal. When the assigned input terminal is ON, always make an auto-tuning and automatically set <F402: Automatic torque boost>, <F912: PM q-axis inductance>, and <F913: PM d-axis inductance> at startup.

7: Auto-tuning F402 only at run command during TB ON

Assign "66: Offline auto-tuning" (67 is the inversion signal) to the digital input terminal. Always execute an auto-tuning at startup when the motor starts for the first time after the assigned input terminal is ON and set <F402: Automatic torque boost> only.

3) Cautions during offline auto-tuning

- Offline auto-tuning must be performed with the motor connected but in a completely stopped state.

Due to residual voltage, auto-tuning may not be properly performed immediately after running motor is stopped.

- There would be almost no rotation of the motor during offline auto-tuning, but you must keep in mind that voltage is still applied during this time.
- During auto-offline tuning, "Atn" will be displayed on the LCD screen.
- Offline auto-tuning takes a few seconds. If any failure is found, tripping will occur with auto-tuning error "Etn1" or "Etn2", and motor parameters will not be set.
- Offline auto-tuning cannot be performed on special motors. Calculate the motor parameters using "Setting method 2".
- If offline auto-tuning cannot be performed or auto-tuning error "Etn1" or "Etn2" occurs, set manually using "Setting method 3".

■ **Setting method 2: Make auto-tuning of motor parameter after automatic setting.**

Set PM motor control and then perform motor parameters auto calculation.

Check the motor name plate and set the following parameters first.

- <vL: Base frequency 1> (Rated frequency)
- <vLv: Base frequency voltage 1> (Rated voltage)
- <F405: Motor rated capacity>
- <F415: Motor rated current>
- <F417: Motor rated speed>

Next, set <Pt: V/f Pattern> to "6: PM motor control". For details of setting methods, refer to [5. 3. 4]. Then, select <F400> = "4: Motor parameters auto calculation (0 after execution)" and perform <vLv: Base frequency voltage> auto calculation.

This setting can be made without connecting the motor since it only calculates.

After automatic setting of motor parameter with <F400> = "4", be sure to set <F400> to "2: Auto-tuning at run command (0 after execution)" and execute an auto-tuning.

Since calculation is performed based on general trend, the calculation results may not be correct. In this case, set the parameter manually.

■ **Setting method 3: Manually setting motor parameter**

Set <Pt: V/f Pattern> to "6: PM motor control" and set the motor parameter manually.

If tuning error "Etn1" is displayed during auto-tuning setting or when you want to improve PM motor control characteristics, set motor parameters individually. For details of setting methods, refer to [5. 3. 4].

4) Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F402	Automatic torque boost	0.1 - 30.00	%	*1
F405	Motor rated capacity	0.01 - 315.0	kW	*1
F415	Motor rated current	*1	A *1	*1
F417	Motor rated speed	100 - 64000	min ⁻¹	*2
F459	Load inertia ratio	0.1 - 100.0	Times	1.0
F460	Speed control response 1	0.0 - 25.0	-	0.0

Title	Parameter name	Adjustment range	Unit	Default setting
F461	Speed control stabilization coefficient 1	0.50 - 2.50	-	1.00
F462	Speed reference filter coefficient 1	0 - 100	-	35
F463	Speed control response 2	0.0 - 25.0	-	0.0
F464	Speed control stabilization coefficient 2	0.50 - 2.50	-	1.00
F465	Speed reference filter coefficient 2	0 - 100	-	35
F466	Speed control response switching frequency	0.0 - FH	Hz	0.0
F912	PM q-axis inductance	0.01 - 650.00	mH	10.00
F913	PM d-axis inductance	0.01 - 650.00	mH	10.00

*1 Depending on capacity. For details, refer to [11. 6].

*2 Depending on the setup menu. Refer to [5. 3. 10], [11. 10].

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5) Motor parameter setting method

<F402: Automatic torque boost>

This parameter adjusts the primary resistive component of the motor.

Increasing this value will prevent torque reduction due to voltage drop during low speed.

Adjust the value according to the actual operation. Keep in mind that setting a higher value than necessary will increase current at low speed and may cause tripping.

If there is a motor test report, check the stator resistance value per phase.

$$\text{<F402> (\%)} = (\sqrt{3} \times R_s \times \text{<F415>} \times 0.9) / (V_{\text{type}} \times 100)$$

where R_s is the stator resistance value per phase (Ω), V_{type} is 200, 400 V (depends on voltage class).

<F405: Motor rated capacity>

This parameter sets the motor rated capacity.

Check the motor name plate or test report while setting.

<F415: Motor rated current>

This parameter sets the motor rated current.

Check the motor name plate or test report while setting.

<F417: Motor rated speed>

This parameter sets the motor rated speed.

Check the motor name plate or test report while setting.

How to adjust the moment of inertia of the load

<F459: Load inertia ratio>

This parameter adjusts the excess response speed.

Increasing this value will reduce the overshoot at the acceleration/deceleration completion point.

Default setting values are set so that the moment of inertia of the load (including the motor shaft) value is set to be appropriate at 100% of the motor shaft. If the moment of inertia of the load is not 100%, set a value appropriate for the actual moment of inertia of the load.

- <F460: Speed control response 1>
- <F461: Speed control stabilization coefficient 1>
- <F462: Speed reference filter coefficient 1>
- <F463: Speed control response 2>
- <F464: Speed control stabilization coefficient 2>
- <F465: Speed reference filter coefficient 2>
- <F466: Speed control response switching frequency>

This parameter adjusts the excess response speed.
 Increasing this value will reduce the overshoot at the acceleration/deceleration completion point. Set a value appropriate for the actual moment of inertia of the load.
 For details, refer to "Current and Speed Control Gain Adjustment Method" manual (E6582136).

- <F912: PM q-axis inductance>
 - <F913: PM d-axis inductance>
- Set q-axis inductance and d-axis inductance (mH) of PM motor.
 Use <F400: auto-tuning> to set the value.

Memo

- To use PM motor control, the motor capacity must be the same as the inverter rated capacity, or you can use a motor with capacity no less than one rank below.
- If there is a possibility that main power supply is shut down during running, set <F301: Auto-restart> to activate.
 Otherwise, when DC-bus voltage is recovered and inverter start to run again, E-39 or OP trip occurs, because motor is still rotated and back EMF voltage is high.

■ **PM motor control and starting torque optimization setting**

If the PM motor does not start after auto-tuning due to heavy load, set <F915: PM control method> to "4" for starting torque optimization.

6) Parameter setting

Title	Parameter name	Adjustment range	Default setting
F915	PM control method	0: Method 0 1: Method 1 2: Method 2 3: Method 3 4: Method 4	3

7) How to select setting values

0: Method 0

This value sets no initial position estimation control. Reverse run may occur at startup.
 If tripping occurs with PM auto-tuning error "E-39", use this function by setting <F915> to "0".

1: Method 1

This value sets initial position estimation for high saliency motors.

2: Method 2

This value sets initial position estimation and starting torque optimization for high saliency motors.

3: Method 3

This value sets initial position estimation for weak saliency motors.

4: Method 4

This value sets initial position estimation and starting torque optimization for weak saliency motors.

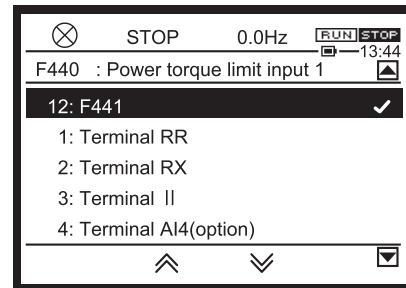
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 24 Torque limits

6. 24. 1 Switching torque limits

- <F440: Power running torque limit input select 1>
- <F441: Power running torque limit level 1>
- <F442: Regenerative torque limit input select 1>
- <F443: Regenerative torque limit level 1>
- <F444: Power running torque limit level 2>
- <F445: Regenerative torque limit level 2>
- <F446: Power running torque limit level 3>
- <F447: Regenerative torque limit level 3>
- <F448: Power running torque limit level 4>
- <F449: Regenerative torque limit level 4>
- <F454: Torque limit in field weakening>



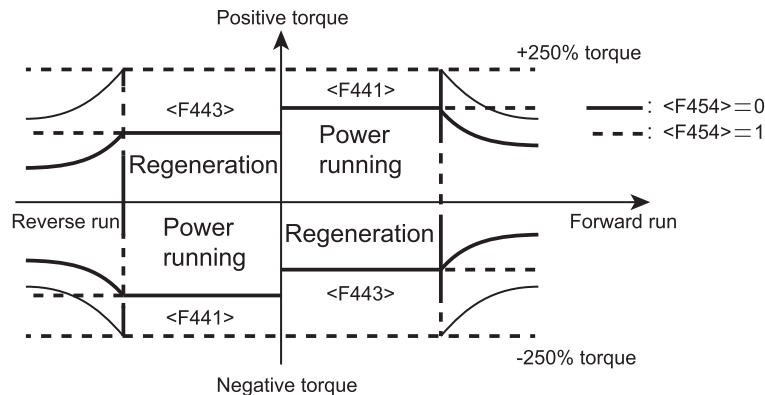
■ Function

When the motor-generated torque reaches a certain level, the inverter reduce the torque by lowering the output frequency.

You can select a constant output limit or a constant torque limit in the constant output zone.

■ Selecting a setting value

1) When torque limits are applied by the parameter setting values



Select from where to input a torque limit value at <F440: Power running torque limit input select 1> and <F442: Regenerative torque limit input select 1>.

As default setting, torque limits are applied by the parameter setting values.

Title	Parameter name	Adjustment range	Default setting
F440	Power running torque limit input select 1	0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal AI4 (option) 5 - 11: - 12: F441	12
F442	Regenerative torque limit input select 1	0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal AI4 (option) 5 - 11: - 12: F443	12

Set the torque limit values for the power running and regenerative torques at <F441: Power running torque limit level 1> and <F443: Regenerative torque limit level 1>.

Set limit treatment of the constant output zone (weak magnetic field) at <F454: Torque limit in field weakening>. You can select either constant output limit <F454> = "0" (default setting) or constant torque limit <F454> ="1".

6

Title	Parameter name	Adjustment range	Unit	Default setting
F441	Power running torque limit level 1	0.0-249.9 250.0: Disabled	%	250.0
F443	Regenerative torque limit level 1	0.0-249.9 250.0: Disabled	%	250.0
F454	Torque limit in field weakening	0: Constant power limit 1: Constant torque limit		0

You can set four patterns each for the power running torque limit or the regenerative torque limit at the parameter settings.

Title	Parameter name	Adjustment range	Unit	Default setting
F444	Power running torque limit level 2	0.0-249.9 250.0: Disabled	%	250.0
F445	Regenerative torque limit level 2		%	250.0
F446	Power running torque limit level 3		%	250.0
F447	Regenerative torque limit level 3		%	250.0
F448	Power running torque limit level 4		%	250.0
F449	Regenerative torque limit level 4		%	250.0

Patterns 1 to 4 can be switched by turning the input terminal ON/OFF.

Assign "32: Stall prevention switching/Torque limit switching 1" and "34: Torque limit switching 2" to the two unused input terminals.

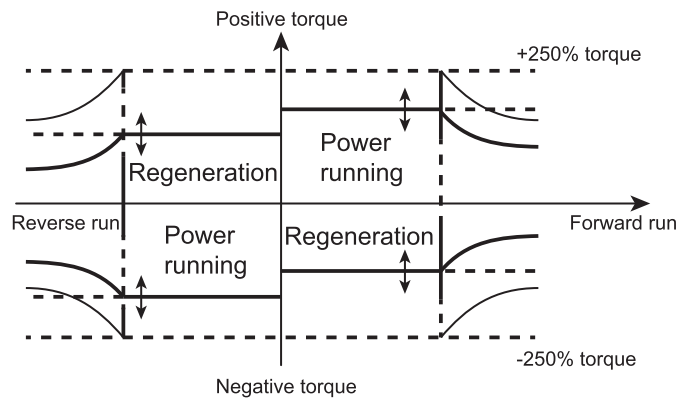
	32: Stall prevention switching/ Torque limit switching 1	34: Torque limit switching 2
Torque limit level 1	OFF	OFF
Torque limit level 2	ON	OFF
Torque limit level 3	OFF	ON
Torque limit level 4	ON	ON

Memo

- Set the torque limit level to "250.0" when disabling this function.
- When <Pt: V/f Pattern>="0", "1", or "7", the torque limit will be disabled.
- When the current value is big, or the setting value of <F601: Stall prevention level 1> is small, the stall preventive function may be active before torque limit and lower the frequency.

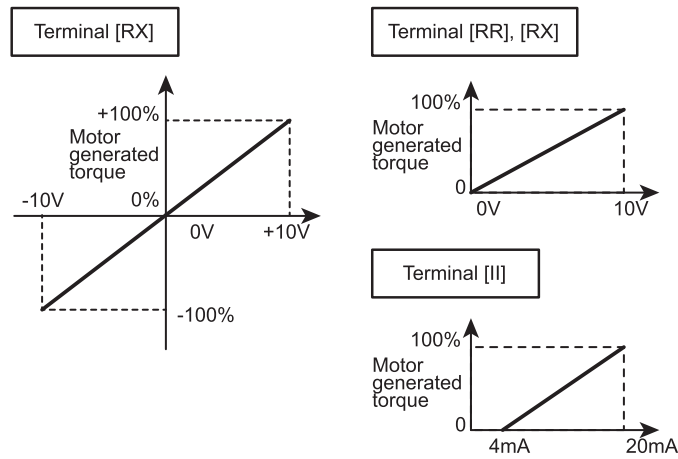
2) When torque limits are applied by external signals

6



Torque limit value can be changed by external signals.

- When setting with input of 0 to 10 Vdc to terminal [RR]
Set "1" for <F440: Power running torque limit input select 1> and <F442: Regenerative torque limit input select 1>.
- When setting with input of -10 to 10 Vdc to terminal [RX]
Set "2" for <F440: Power running torque limit input select 1> and <F442: Regenerative torque limit input select 1>.
- When setting with input of 4 to 20 mAdc to terminal [II]
Set "3" for <F440: Power running torque limit input select 1> and <F442: Regenerative torque limit input select 1>.



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Memo

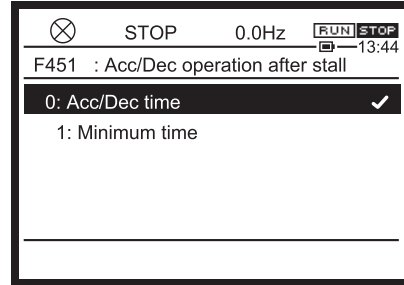
- The torque command values are limited to the torque limit level in torque control.
- When V/f Pattern is "V/f constant", "Variable torque", and "V/f 5-points", the torque limit will be disabled.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 24. 2 Selecting Acc/Dec operation after stall prevention operation

<F451: Acc/Dec operation after stall operation>



■ Function

When you use lifting gear (crane or hoist) in combination with mechanical brakes, and if the output frequency is decreasing due to stall prevention operation before mechanical brake release, accelerate the mechanical brake delay time in the minimum time to prevent load from falling due to torque reduction after mechanical brake release.

This will also improve the response in inching operation, and thus preventing the load from slipping down.

6

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F451	Acc/Dec operation after stall operation	0: Acc/Dec time 1: Minimum time	0

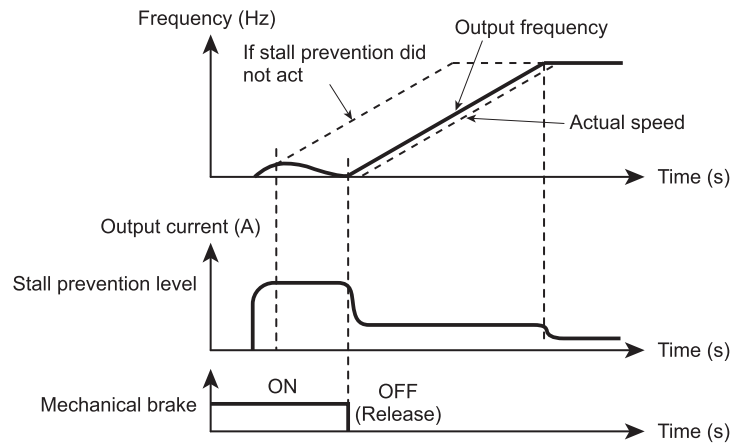
■ Selecting a setting value

0: Acc/Dec time

When stall prevention is active, the output frequency gets low.

If stall prevention was active and the output frequency is decreasing before releasing the machine, even if the mechanical brake is released, the stall prevention remains active during the delay time of the brake operation. After delay time of the brake operation, the output current value gets low, the stall prevention operation is deactivated and the output frequency increases.

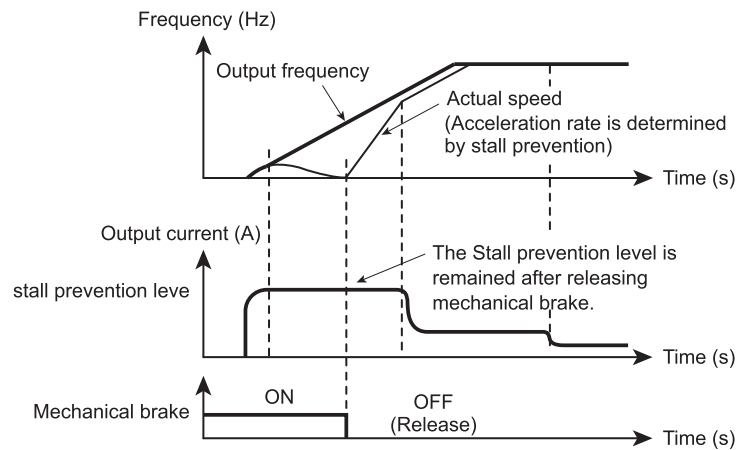
With this setting, the output frequency reaches the frequency command value after brake operation delay time + acceleration time. The actual speed of the machinery changes in sync with the output frequency.



1: Minimum time

With the same situation as in 0, the output frequency precedes and accelerates in minimum time, even when the stall prevention is active. After release of the mechanical brake, the output current is retained, and the actual speed of the machinery changes in sync with the output frequency. This setting can prevent the load from falling, thus improving the response of the inching operation.

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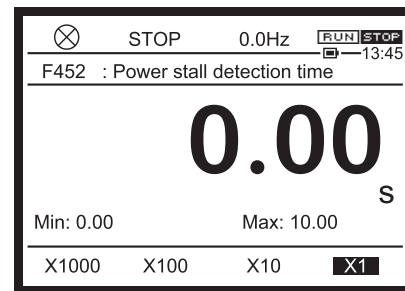


Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 24. 3 Detecting the stall time during power running to trip

- <F452: Stall detection time during power running>
- <F441: Power running torque limit level 1>
- <F601: Stall prevention level 1>



■ Function

This function is one of the functions to prevent lifting gear from falling. If stall prevention operation occurs in succession, this function judges that the motor has stalled to trip it.

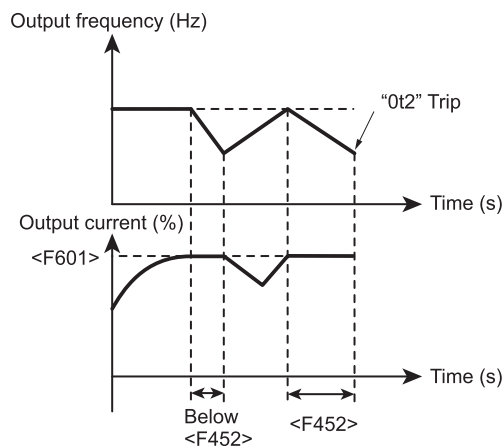
■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F452	Stall detection time during power running	0.00-10.00	s	0.00
F441	Power running torque limit level 1	0.0-249.9 250.0: Disabled	%	250.0
F601	Stall prevention level 1	10-200 (HD) 10-160 (ND)	%	150(HD) 120(ND)

6

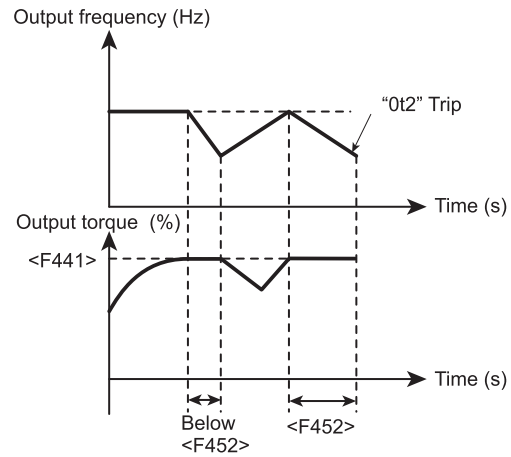
■ Setting method

1) In case of overcurrent stall



If, during power running, the output current reaches the value for <F601: Stall prevention level 1> or more, and continues for the period of time set for <F452: Stall detection time during power running>, the trip "Ot2" will occur.

2) In case of torque limit



If, during power running, the output torque reaches the value for <F441: Power running torque limit level 1> or more, and continues for the period of time set for <F452: Stall detection time during power running>, the trip "Ot2" will occur. In case F452=0, this function is not activated (Ot2 trip does not occur).

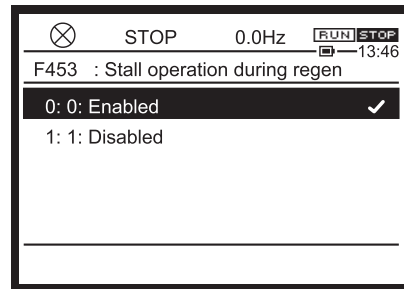
6

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 24. 4 Selecting stall operation during regeneration

<F453: Stall operation during regen>



■ Function

This function is one of the functions to prevent the lifting gear from being displaced at stop. If current stall prevention gets active during regeneration of controlled stop, there may be a mismatch at stop. Set to inhibit only the stall prevention of current.

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F453	Stall operation during regen	0: Enabled 1: Disabled	0

6

■ Selecting a setting value

To inhibit the stall prevention of current during regeneration of controlled stop, set <F453: Stall operation during regen> to "1".

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 25 Torque control

For details of switching to torque control, refer to Torque control (E6582106).

6. 25. 1 Setting external torque commands

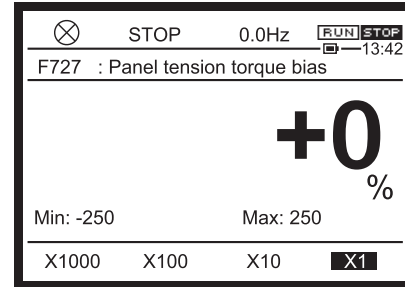
- <F420: Torque command select>
- <F421: Torque command filter>
- <F435: Rotation direction limit during torque control>
- <F455: Torque command polarity at Rev>
- <F725: Panel torque command>

6. 25. 2 Speed limit during torque control

- <F425: Fwd speed limit input>
- <F426: Fwd speed limit level>
- <F427: Rev speed limit input>
- <F428: Rev speed limit level>
- <F430: Speed limit center value input select>
- <F431: Speed limit center value>
- <F432: Speed limit band>

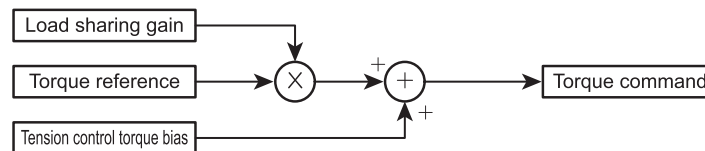
6. 25. 3 Selecting tension control torque bias input and load sharing gain input

- <F423: Tension control torque bias input>
- <F424: Load sharing gain input>
- <F727: Panel tension torque bias>
- <F728: Panel load sharing gain>



■ **Function**

These parameters are used to select tension control torque bias input and load sharing gain input.



■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
F423	Tension control torque bias input	0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal AI4 (option) 5 - 11: - 12: F727 13 - 19: - 20: Embedded Ethernet 21: RS485 communication connector 1 22: RS485 communication connector 2 23: Communication option		0
F424	Load sharing gain input	0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal AI4 (option) 5 - 11: - 12: F728 13 - 19: - 20: Embedded Ethernet 21: RS485 communication connector 1 22: RS485 communication connector 2 23: Communication option		0
F727	Panel tension torque bias	-250 to +250	%	0
F728	Panel load sharing gain	0 - 250	%	100

■ Setting example

Select destination of tension control torque bias input and load sharing gain input.

When setting with input of 0 to 10 Vdc to terminal [RR]

Set <F423: Tension control torque bias input> = "1" or <F424: Load sharing gain input> = "1".

When setting with input of -10 to +10 Vdc to terminal [RX]

Set <F423: Tension control torque bias input> = "2" or <F424: Load sharing gain input> = "2".

When setting with input of 4 to 20 mAdc to terminal [II]

Set <F423: Tension control torque bias input> = "3" or <F424: Load sharing gain input> = "3".

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 26 Adjusting current and speed control gain

6. 26. 1 Setting current and speed control gain

- <F458: Current control response>
- <F459: Load inertia ratio>
- <F460: Speed control response 1>
- <F461: Speed control stabilization coefficient 1>
- <F462: Speed reference filter coefficient 1>
- <F463: Speed control response 2>
- <F464: Speed control stabilization coefficient 2>
- <F465: Speed reference filter coefficient 2>
- <F466: Speed control response switching frequency>

For details, refer to "Current and Speed Control Gain Adjustment Method" manual (E6582136).

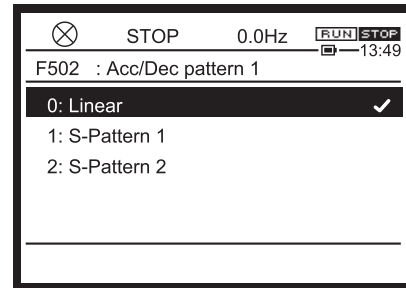
6. 26. 2 Setting the over modulation ratio

- <F495: Over modulation ratio>

6. 27 Switching multiple acceleration/ deceleration

6. 27. 1 Setting Acc/Dec patterns

- <F502: Acc/Dec pattern 1>
- <F506: S-Pattern range at Acc start>
- <F507: S-Pattern range at Acc completion>
- <F508: S-Pattern range at Dec completion>
- <F509: S-Pattern range at Dec start>



■ Function

You can select acceleration/deceleration patterns suitable for the purpose.

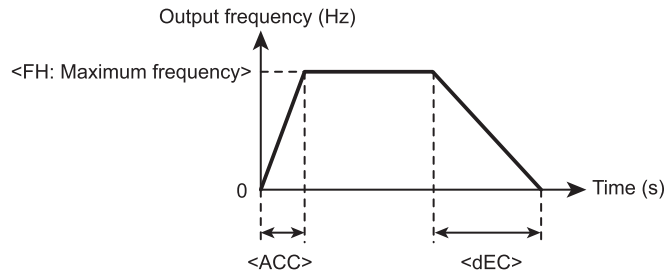
■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F502	Acc/Dec pattern 1	0: Linear 1: S-Pattern 1 2: S-Pattern 2		0
F506	S-Pattern range at Acc start	0-50	%	10
F507	S-Pattern range at Acc completion	0-50	%	10
F508	S-Pattern range at Dec completion	0-50	%	10
F509	S-Pattern range at Dec start	0-50	%	10

■ How to select the setting value for <F502>

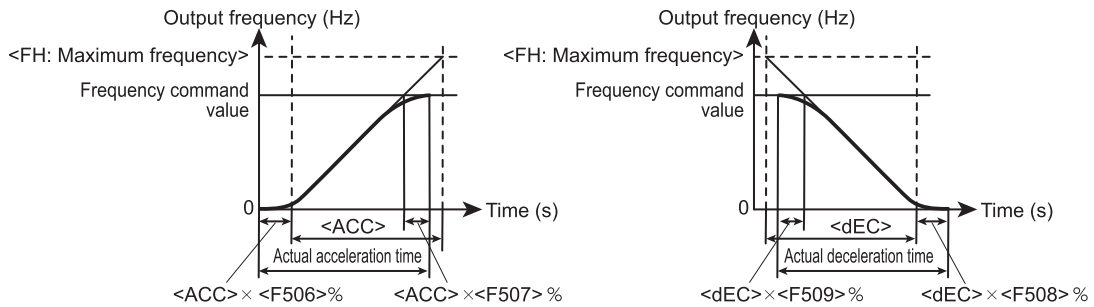
0: Linear pattern

This is linear acceleration and deceleration, and is a normal Acc/Dec pattern. Normally, you can use this setting for operation.



1: S-Pattern 1

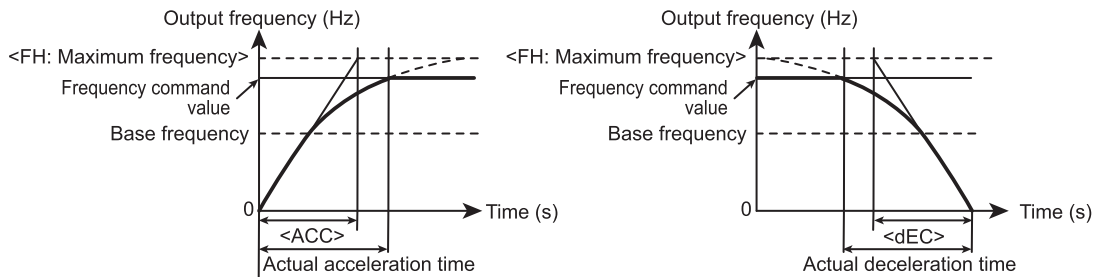
The S-Pattern Acc/Dec 1 is selected to minimize the shock at acceleration/deceleration. This is suitable for pneumatic transport machines, etc.



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2: S-Pattern 2

For the S-Pattern ACC/DEC 2, the motor accelerating torque accelerates in the small demagnetizing region. This is suitable for high-speed spindle operation, etc.

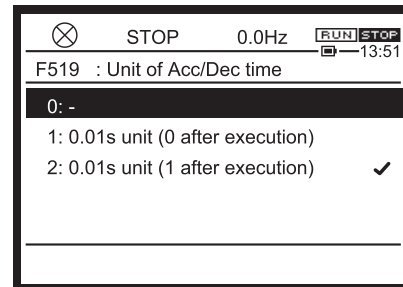
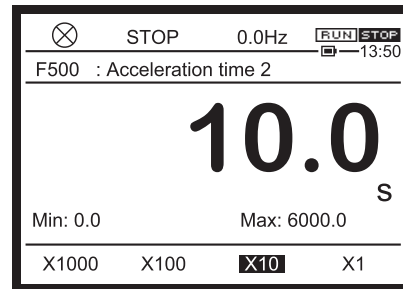


Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 27. 2 Switching four types of acceleration/deceleration

- <F500: Acceleration time 2>
- <F501: Deceleration time 2>
- <F503: Acc/Dec pattern 2>
- <F504: Panel Acc/Dec select>
- <F505: Acc/Dec switching frequency 1>
- <F510: Acceleration time 3>
- <F511: Deceleration time 3>
- <F512: Acc/Dec pattern 3>
- <F513: Acc/Dec switching frequency 2>
- <F514: Acceleration time 4>
- <F515: Deceleration time 4>
- <F516: Acc/Dec pattern 4>
- <F517: Acc/Dec switching frequency 3>
- <F519: Unit of Acc/Dec time>



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■ Function

You can set four types of options for each acceleration and deceleration time. There are three setting methods to choose from four types.

- 1) Selection by the parameters
- 2) Switching by frequencies
- 3) Switching by the terminals

■ Setting of parameters

Title	Parameter name	Adjustment range	Unit	Default setting
ACC	Acceleration time 1	0.0 - 6000 (600.0)	s	*1
dEC	Deceleration time 1	0.0 - 6000 (600.0)	s	*1
F500	Acceleration time 2	0.0 - 6000 (600.0)	s	*1
F501	Deceleration time 2	0.0 - 6000 (600.0)	s	*1
F510	Acceleration time 3	0.0 - 6000 (600.0)	s	*1
F511	Deceleration time 3	0.0 - 6000 (600.0)	s	*1
F514	Acceleration time 4	0.0 - 6000 (600.0)	s	*1
F515	Deceleration time 4	0.0 - 6000 (600.0)	s	*1
F519	Unit of Acc/Dec time	0: - 1: 0.01 s unit (0 after execution) 2: 0.1 s unit (0 after execution)	-	0

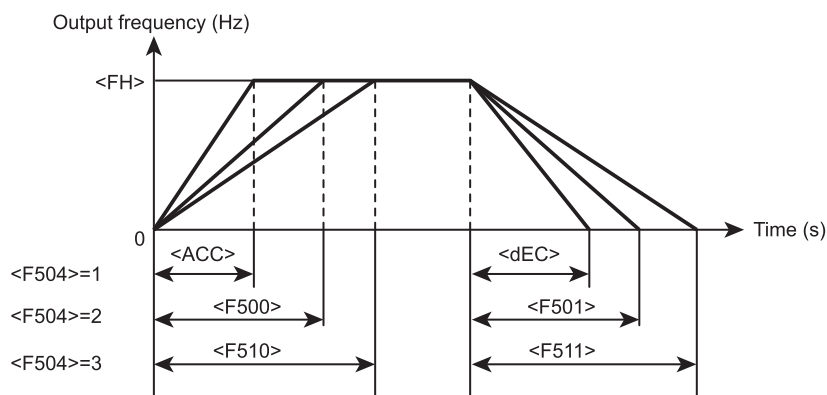
*1 Depending on capacity. For details, refer to [11. 6].

In default setting, the acceleration/deceleration time is set in the increment unit of 0.1 second. When you set <F519: Unit of Acc/Dec time> to "1", you can change the increment unit for the acceleration/deceleration time to 0.01 second. (After setting <F519>, the unit returns to 0.)

■ How to use the parameters

1) Selection by the parameters

Title	Parameter name	Adjustment range	Unit	Default setting
F504	Panel Acc/Dec select	1: Acc/Dec 1 2: Acc/Dec 2 3: Acc/Dec 3 4: Acc/Dec 4		1



Set run command to panel run. Set <CMOd: Run command select> to "1: Operation panel, Extension panel".

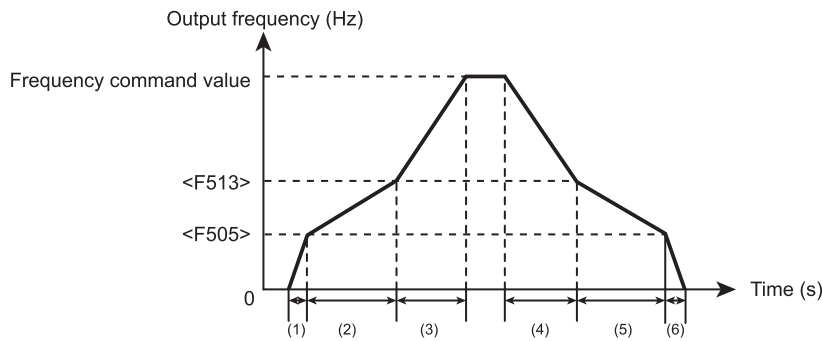
At default setting, "Acc/Dec 1" is set, and <ACC: Acceleration time 1> and <dEC: Deceleration time 1> is enabled.

When using "Acc/Dec 2" to "Acc/Dec 4", set <F504: Panel Acc/Dec select>.

2) Switching by frequencies

Title	Parameter name	Adjustment range	Unit	Default setting
F505	Acc/Dec switching frequency 1	0.0: Disabled 0.1-UL	Hz	0.0
F513	Acc/Dec switching frequency 2	0.0: Disabled 0.1-UL	Hz	0.0
F517	Acc/Dec switching frequency 3	0.0: Disabled 0.1-UL	Hz	0.0

The acceleration/deceleration time is automatically switched according to the set frequency. Even if the order of the switching frequencies is changed, it will be switched between Acc/Dec 1 and 2, Acc/Dec 2 and 3, and then Acc/Dec 3 and 4 in the order of the increasing frequencies. For example, if <F505: Acc/Dec switching frequency 1> is higher than <F513: Acc/Dec switching frequency 2>, Acc/Dec 1 is selected to <F513>, and Acc/Dec 2 to <F505>.

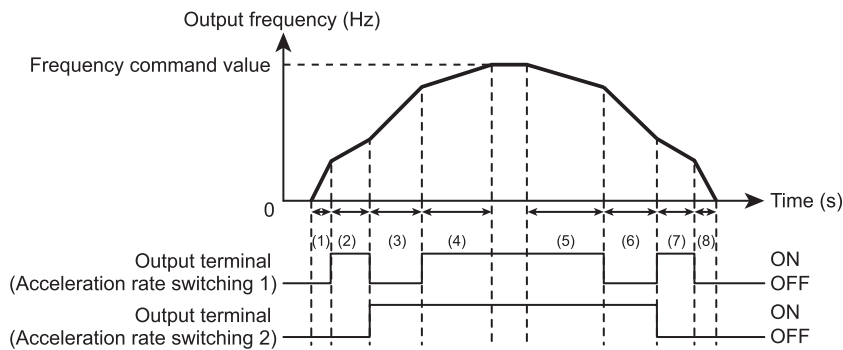


- (1) Accelerate by the inclination of the acceleration time <ACC>
- (2) Accelerate by the inclination of the acceleration time <F500>
- (3) Accelerate by the inclination of the acceleration time <F510>
- (4) Decelerate by the inclination of the deceleration time <F511>
- (5) Decelerate by the inclination of the deceleration time <F501>
- (6) Decelerate by the inclination of the deceleration time <dEC>

3) Switching by the terminals

The acceleration/deceleration time is switched by signals to terminals.

6



- (1) Accelerate by the inclination of the acceleration time <ACC>
- (2) Accelerate by the inclination of the acceleration time <F500>
- (3) Accelerate by the inclination of the acceleration time <F510>
- (4) Accelerate by the inclination of the acceleration time <F514>
- (5) Decelerate by the inclination of the deceleration time <F515>
- (6) Decelerate by the inclination of the deceleration time <F511>
- (7) Decelerate by the inclination of the deceleration time <F501>
- (8) Decelerate by the inclination of the deceleration time <dEC>

Set run command to terminal run. Set <CMOd: Run command select> to "0: Terminal".

Patterns 1 - 4 can be switched by turning the two input terminals ON/OFF.

Assign "32: Stall prevention switching/Torque limit switching 1" and "34: Torque limit switching 2" to the two unused input terminals.

	24: Acc/Dec switching 1	26: Acc/Dec switching 2
Acc/Dec 1	OFF	OFF
Acc/Dec 2	ON	OFF
Acc/Dec 3	OFF	ON
Acc/Dec 4	ON	ON

■ **Acc/Dec patterns**

You can individually select Acc/Dec patterns by selecting Acc/Dec 1, 2, 3 or 4.

Title	Parameter name	Adjustment range	Unit	Default setting
F502	Acc/Dec pattern 1	0: Linear 1: S-Pattern 1 2: S-Pattern 2		0
F503	Acc/Dec pattern 2			0
F512	Acc/Dec pattern 3			0
F516	Acc/Dec pattern 4			0
F506	S-Pattern range at Acc start	0-50	%	10
F507	S-Pattern range at Acc completion	0-50	%	10
F508	S-Pattern range at Dec completion	0-50	%	10
F509	S-Pattern range at Dec start	0-50	%	10

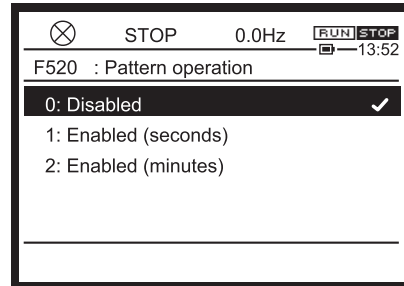
For details on the Acc/Dec patterns, refer to [6. 27. 1].

Parameters to determine S-Pattern ranges of "1: S-Pattern 1", <F506><F507><F508><F509>, is common to Acc/Dec patterns 1 - 4.

Reference	<ul style="list-style-type: none"> • How to operate the operation panel -> Refer to [3. 1. 1]. • How to switch display mode on the operation panel -> Refer to [3. 1. 2]. • Procedure to change parameter setting -> Refer to [4. 2. 3] • Details on operation by external signals -> Refer to [Chapter 7].
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6. 28 Pattern operation

- <F520: Pattern operation>
- <F521: Pattern operation continue select>
- <F522: Pattern 1 repeat number>
- <F523: Pattern 1 select 1> to <F530: Pattern 1 select 8>
- <F531: Pattern 2 repeat number>
- <F532: Pattern 2 select 1> to <F539: Pattern 2 select 8>
- <F540: Operation time (1-speed)> to <F554: Operation time (15-speed)>



■ Function

You can perform terminal run according to up to 30 types (15 types x 2 patterns) of operation frequencies, operation time, and acceleration/deceleration time that were set in advance. Pattern operation switching, and Run/Stop are all input from the terminals.

■ Parameter setting

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Title	Parameter name	Adjustment range	Unit	Default setting
F520	Pattern operation	0: Disabled 1: Enabled (seconds) 2: Enabled (minutes)		0
F521	Pattern operation continue select	0: Reset after stop 1: Continue after stop		0
F522	Pattern 1 repeat number	1-254 255: Continuous	Times	1
F523-F530	Pattern 1 select 1-8	0: Skip 1: Sr1 2: Sr2 3: Sr3 4: Sr4 5: Sr5 6: Sr6 7: Sr7 8: F287 9: F288 10: F289 11: F290 12: F291 13: F292 14: F293 15: F294		0
F531	Pattern 2 repeat number	1-254 255: Continuous	Times	1
F532-F539	Pattern 2 select 1-8	Same as <F523>		0
F540-F554	Operation time (1 to 15-speed)	0.1-5999 6000: Continuous	The unit is set at <F520>.	5.0

Title	Parameter name	Adjustment range	Unit	Default setting
F560	Preset speed operation style	0: Frequency only 1: With function	-	0
F561 - F575	Operation function (1-speed) to Operation function (15-speed)	0: Fwd run +1: Rev run +2: Acc/Dec switching signal 1 +4: Acc/Dec switching signal 2 +8: V/f switching signal 1 +16: V/f switching signal 2 +32: Torque limit switching signal 1 +64: Torque limit switching signal 2		0

When auto-restart after momentary stop is set, time is also added to the pattern operation time during catch on fly. Therefore, the actual operation time may be shorter than the setting time.

■ **How to use the parameters**

The basic operation method is as follows:

- 1) Set <F520: Pattern operation> to "1: Enabled (seconds)" or "2: Enabled (minutes)".**

This parameter is used to select the time unit (seconds/minutes) for <F540: Operation time (1-speed)> to <F554: Operation time (15-speed)>.

- 2) Set the frequency to operate.**

To set the frequencies to be used for pattern operations, do so at the following parameters related to preset-speed frequencies, not at specific parameters.

- <Sr1: Preset speed 1> to <Sr7: Preset speed 7>
- <F287: Preset speed 8> to <F294: Preset speed 15>

- 3) To attach function to the frequency to operate, set <F560: Preset speed operation style> to "1: With function".**

The function can be set to each frequency to operate. Set required functions, e.g. Fwd, Rev, Acc/Dec switching 1, 2, V/f switching 1, 2, to the following parameters.

- <F561: Operation function (1-speed)> through <F575: Operation function (15-speed)>

For details, refer to [5. 3. 7].

- 4) Set the required operation time at <F540: Operation time (1-speed)> to <F554: Operation time (15-speed)> for every frequency to operate. Select the unit (seconds/minutes) at <F520: Acc/Dec switching frequency 1>.**

- 5) Set the order of frequency to operate.**

Three parameter setting methods are provided.

- Select pattern operation mode at <F521: Pattern operation continue select>.

0: Reset after stop

Operation is resumed after the pattern operations are reset by stop or switching operation.

1: Continue after stop

Pattern operations are started by stop or switching operation. After completion of a routine, operation stops or the next routine is started.

- Select pattern groups to set the order of frequencies to operate.
 - <F522: Pattern 1 repeat number>
 - <F523: Pattern 1 select 1> to <F530: Pattern 1 select 8>
 - <F531: Pattern 2 repeat number>
 - <F532: Pattern 2 select 1> to <F539: Pattern 2 select 8>
- You can set parameter groups to operate by turning the input terminal ON/OFF. Assign "38: Pattern operation 1" and "40: Pattern operation 2" to the two unused input terminals. Also, assigning "42: Pattern operation continuation" and "44: Pattern operation start" to other input terminals allows you can select operation method by turning them ON/OFF.

6) Display status of pattern operation in [Monitor mode].

The status of the pattern operation can be checked in [Monitor mode]. Set the monitor numbers shown in the following table to <F711: Monitor mode 1 display> to <F718: Monitor mode 8 display>.

Monitor number	Operation status	Example of display	Example of content
66	Pattern operation group number	P1.0	Indicates Pattern group 1.
67	Pattern operation remaining cycle number	n123	Indicates that the 123rd pattern is being performed.
68	Pattern operation preset speed number	F1	Indicates that 1-speed frequency is used to operate.
69	Pattern operation remaining time	123.4	Indicates that the current pattern will be ended in 123.4 seconds.

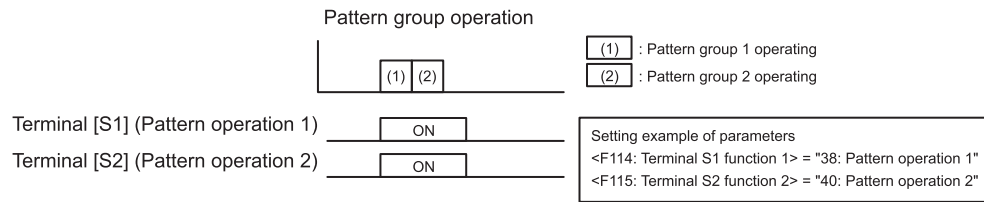
6

■ **Pattern operation switching output**

Signals can be output when all pattern operations are ended.
 Assign "36: Pattern operation switching" to an output terminal.
 Output is turned OFF when run command is off and when the pattern operation selection is changed.

■ **Notes for pattern operation**

- You need to input pattern operation group selection from the terminal.
- When all input terminals with pattern operation assigned are turned OFF, and after pattern operation is ended, normal operation will start.
- When multiple group numbers are simultaneously input, operations will be performed in the order of the increasing group numbers, to automatically change to the next group. In this case, it may take approximately 0.06 second (per pattern) to search the patterns.
- Turn pattern operation 1 or 2 ON, wait for 10 ms or more to elapse, then turn ON the run command. Turning the run command ON early may cause operation with normal output frequency instead of pattern operation.
- <F964: Preset speed 16> to <F979: Preset speed 31> cannot be set to pattern operation.



Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 29 Shock monitoring function

<F590: Shock monitoring>

<F591: Shock monitoring trip>

<F592: Shock monitoring detection>

<F593: Shock monitoring detection level>

<F595: Shock monitoring detection time>

<F596: Shock monitoring detection hysteresis>

<F597: Shock monitoring detection wait time>

<F598: Shock monitoring detection condition>

For details, refer to Shock Monitoring Function Instruction Manual (E6582098).

6. 30 Setting the protection functions

Set the protection functions against electric thermal, current stall prevention operation, input/output phase failure, short circuit, ground fault, overtorque, undervoltage, analog signal disconnection, etc. for safety operation.

6. 30. 1 Setting the motor electronic thermal protection

<F606: Motor overload reduction frequency threshold>

<F607: Motor overload time>


<F631: Inverter overload detection>


<F632: Electronic thermal memory target>

<F657: Overload alarm level>

For details on the motor electronic thermal functions, refer to [5. 2. 5].

6. 30. 2 Setting overcurrent stall


CAUTION

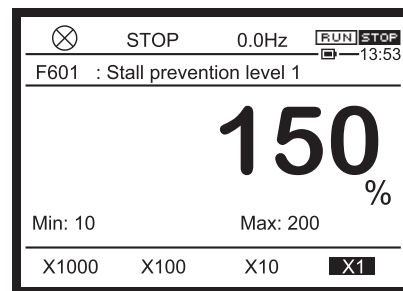


Prohibited

- Do not set the stall prevention level parameters (F601 and F185) extremely low.
- If the stall prevention level parameters (F601 and F185) are set at or below the motor no-load current, the stall preventive function will be always enabled and increase the frequency when it judges that regenerative braking is taking place.
- Do not set the stall prevention level parameters (F601 and F185) at 30% or less under normal use conditions.

<F601: Stall prevention level 1>

<F185: Stall prevention level 2>



6

■ Function

If the current exceeding the level set at Stall prevention level 1 or 2 is flowed, stall prevention operation will be enabled to lower the output frequencies.
 Setting the output frequency low lowers output current of fans and pumps, which prevents overcurrent trip.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F601	Stall prevention level 1	10-200 (HD)	%	*1
F185	Stall prevention level 2	10-160 (ND)		

*1 Depending on capacity. For details, refer to [11. 6].
 In case F601=199, 200(or 159, 160), stall prevention control is not activated.

■ How to set the parameter

100% reference is the inverter rated current.
 To switch <F601: Stall prevention level 1> between <F185: Stall prevention level 2>, use signals to input terminal. Assign "32: Stall prevention switching/Torque limit switching 1" to the unused input terminal.
 For details, refer to [7. 2. 1].

■ Display during the stall prevention operation

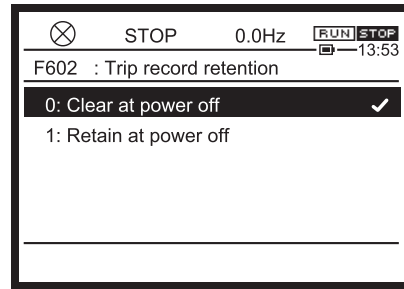
If the current exceeding the stall prevention level is about to flow, the output frequency will change. At this time, the letter "C" will blink.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 30. 3 Retaining trip types

<F602: Trip record retention>



■ Function

Trip can be reset by turning power off, but you can set to retain details about trip occurrence even when power is turned off.

After power off, the saved trip type will be displayed after turning power on again. If trip factor is remaining, however, the trip will occur again.

6

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F602	Trip record retention	0: Clear at power off 1: Retain at power off	0

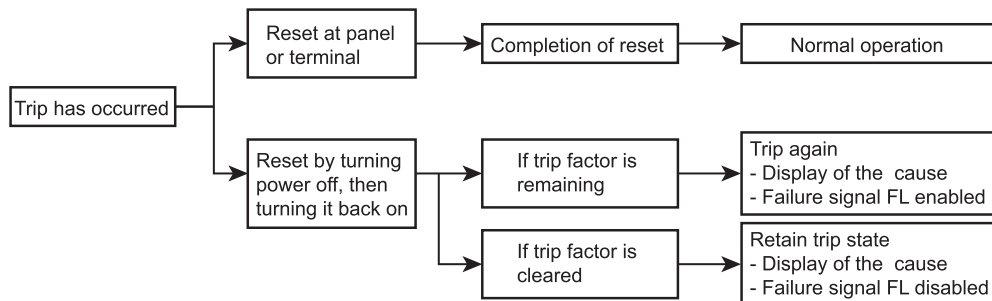
■ Selecting a setting value

0: Clear at power off

Reset the trip at power off. Trip type will not be retained after turning power on again.

1: Retain at power off

The following shows how the inverter operates after power off.



Memo

- The causes of the last eight trips can be displayed in [Monitor mode] even if the trip record retention is set. For details, refer to [8. 1. 1].
- If the power is turned on again, the data at trip in [Monitor mode] will not be retained. Check the data on the details monitor for the past trip history. For details, refer to [8. 1. 2].
- Even if the power is turned ON during retry, a trip record will be retained.

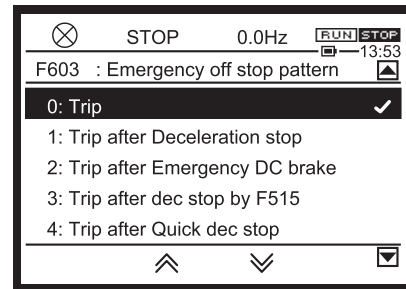
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 30. 4 Emergency off

<F603: Emergency off stop pattern>

<F604: Emergency DC braking time>



■ Function

Set the stop pattern for emergency off

At the time of emergency off, a trip occurs. The trip display is "E".

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F603	Emergency off stop pattern	0: Trip 1: Trip after Deceleration stop 2: Trip after Emergency DC braking 3: Trip after deceleration stop by F515 4: Trip after Quick deceleration stop 5: Trip after Dynamic quick deceleration stop		0
F604	Emergency DC braking time	0.0-20.0	s	1.0
F251	DC braking current	0 - 100	%	50
F515	Deceleration time 4	0.0-6000	s	*1

*1 Depending on capacity. For details, refer to [11. 6].

■ Select the setting value for <F603: Emergency off stop pattern>

0: Trip

A trip occurs by emergency off command. The motor performs coast stop.

1: Trip after Deceleration stop

A trip occurs after deceleration stop is performed for the period of time set for <dEC: Deceleration time 1>.

2: Trip after Emergency DC braking

The inverter stops after emergency DC braking, and a trip occurs.

Set <F251: DC braking current> and <F604: Emergency DC braking time>.

3: Trip after deceleration stop by <F515>

A trip occurs after deceleration stop is performed for the period of time set for <F515: Deceleration time 4>.

Set <F515>.

Use this parameter when you want to set deceleration time for normal operation and emergency off in different time.

4: Trip after Quick deceleration stop

After quick deceleration is performed, a trip occurs after stop.

In quick deceleration stop, the motor can decelerate more quickly than normal deceleration by increasing the voltage to the motor (over-excitation control) to increase the energy consumed by the motor when the voltage reaches the overvoltage limit operation level during deceleration.

5: Trip after Dynamic quick deceleration stop

A trip occurs after Dynamic quick deceleration stop.

In Dynamic quick deceleration, the motor may be decelerated more quickly than quick deceleration control by increasing the voltage to the motor (over-excitation control) to increase the energy consumed by the motor as soon as the motor starts decelerating.

■ How to use

1) Emergency off via external signal

Emergency off can be performed via a signal to a terminal. Assign "20: Emergency off" to the input terminal. Select how to stop the operation in <F603>.

Emergency off from the terminals is always given priority even during panel run.

2) Emergency off from the operation panel

Emergency off can be performed on the operation panel when panel run is not performed.

To perform emergency off, press the [STOP] key on the operation panel twice.

For details on the operation, refer to [3. 2. 3].

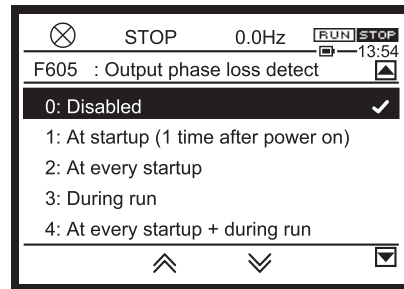
The inverter cannot be reset the trip while the emergency off signal is being input to the input terminal. Reset a trip after releasing the signal.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 5 Output phase loss detection

<F605: Output phase loss detection>



■ Function

When the phase loss on the inverter output side is detected, and after a certain period of time passed, a trip occurs. The trip display is "EPHO".

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F605	Output phase loss detection	0: Disabled 1: At startup (only one time after power on) 2: At every startup 3: During run 4: At every startup + during run 5: Output shut off detection	0

6

■ How to select a setting value

0: Disabled

A trip does not occur. (Failure signal FL disabled)

1: At startup (only one time after power on)

After the power is turned on, output phase loss is detected at the first startup, and a trip occurs after a certain period of time passed. (Failure signal FL enabled)

2: At every startup

At every startup, output phase loss is detected, and a trip occurs after a certain period of time passed. (Failure signal FL enabled)

3: During run

A phase loss is detected during run, and a trip occurs after a certain period of time passed. (Failure signal FL enabled)

4: At every startup + during run

At every startup and during run, a phase loss is detected, and a trip occurs after a certain period of time passed. (Failure signal FL enabled)

5: Output shut off detection

In case you release between the motor and inverter for commercial power supply, restart the operation with low-voltage by controlling impact after the connection at the output side is off and connect it again. (Failure signal FL disabled)

Detection is not performed at auto-restart.

An output phase loss is detected at auto-tuning regardless of the setting for <F605: Output phase loss detection>.

Memo

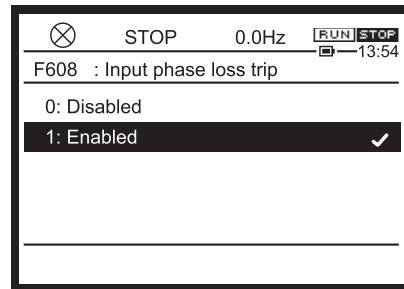
- If <Pt: V/f Pattern> = "5" and "6" is set, 3-phase loss at <F605>="3", or "4", and <F605>="5" will be disabled.
- For special motors such as high-speed motors, detection error may occur.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 6 Input phase loss detection

<F608: Input phase loss trip>



■ Function

If the phase loss on the inverter input side is detected and an abnormal ripple voltage persists in the power circuit capacitor for a certain period of time, a trip occurs. The trip display is "EPHI".

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F608	Input phase loss trip	0: Disabled 1: Enabled	1

6

■ Difference between the settings

0: Disabled

A trip does not occur. (Failure signal FL disabled)

1: Enabled

If the phase loss is detected during run and an abnormal ripple voltage persists in the power circuit capacitor for a certain period of time, a trip occurs. (Failure signal FL enabled)



Important

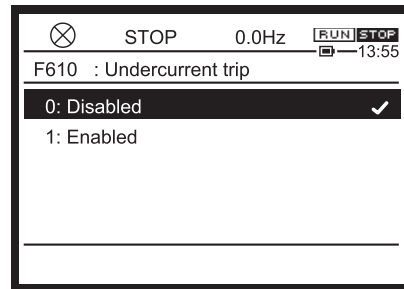
- In case of light-load operation or if the motor capacity is too small for the inverter capacity, input phase loss may not be detected.
- If the power supply capacity is too large for the inverter capacity (500 kVA or more, and 10 times or more), detection error may occur. In this case, install an input reactor.
- When <F608> = "0: Disabled", if heavy-load operation continues in the phase loss status on the input side, the power circuit capacitor of inverter may be damaged.
- To operate the inverter with DC input, set <F608: Input phase loss trip> to "0: Disabled".
- To operate the inverter with DC input with size A4 to A6, set <F640: DC supply input> to "1". In this case input phase loss detection is disabled independent to F608 setting.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 30. 7 Undercurrent detection

- <F610: Undercurrent trip>
- <F609: Undercurrent detection hysteresis>
- <F611: Undercurrent detection level>
- <F612: Undercurrent detection time>



■ Function

Trips or outputs an alarm when the output current falls to the value set in <F611: Undercurrent detection level> or less for the time specified in <F612: Undercurrent detection time>.

Hysteresis can be set by <F609: Undercurrent detection hysteresis> The trip display is "UC".

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F610	Undercurrent trip	0: Disabled 1: Enabled		0
F609	Undercurrent detection hysteresis	1 - 20	%	10
F611	Undercurrent detection level	0 - 150	%	0
F612	Undercurrent detection time	0 - 255	s	0

■ Difference depending on the setting of <F610: Undercurrent trip>

0: Disabled

A trip does not occur. (Failure signal FL disabled)

Undercurrent (UC) alarm can be output from the output terminal.

Assign "26: Undercurrent (UC) alarm" to an unused output terminal.

1: Enabled

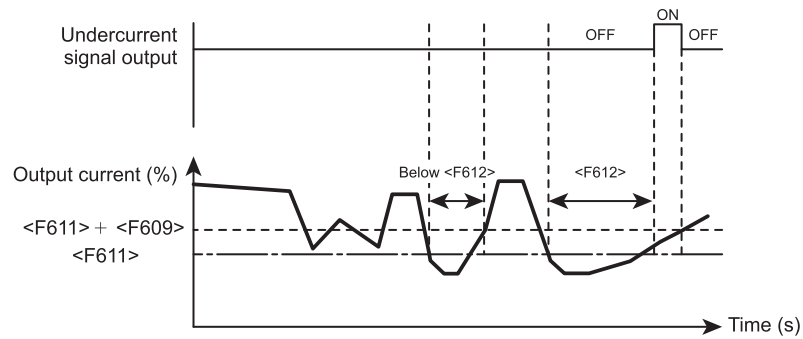
When a current level set in <F611: Undercurrent detection level> or less is detected for the period of time set in <F612: Undercurrent detection time> or more, the inverter trips and "UC" is displayed.

(Failure signal FL enabled)

■ Setting example

Set "26: Undercurrent (UC) alarm" to the unused output terminal.

In the case of <F610: Undercurrent trip> = "0: Disabled", the signal can be output from the output terminal as follows.



In the case of <F610: Undercurrent trip> = "1: Enabled", when a current is <F611: Undercurrent detection level> or less for the period of time specified by <F612: Undercurrent detection time>, the inverter trips.

After tripping, undercurrent (UC) alarm signal remains ON.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 8 Overtorque detection

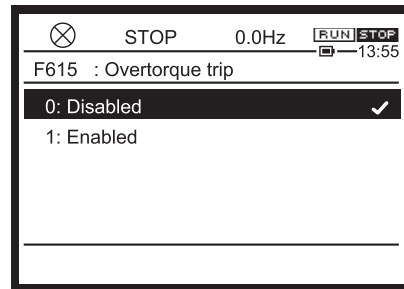
<F615: Overtorque trip>

<F616: Overtorque detection level during power running>

<F617: Overtorque detection level during regen>

<F618: Overtorque detection time>

<F619: Overtorque detection hysteresis>



■ Function

The power running torque value is <F616: Overtorque detection level during power running> or more, or the regen torque value is <F617: Overtorque detection level during regen> or more, and remains over for the time specified by <F618: Overtorque detection time>, tripping or alarm can be output. You can enable or disable the trip setting by <F615: Overtorque trip>. The trip display is "Ot".

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F615	Overtorque trip	0: Disabled 1: Enabled		0
F616	Overtorque detection level during power running	0: Disabled *1 1 - 320	%	150
F617	Overtorque detection level during regen	0: Disabled *1 1 - 320	%	150
F618	Overtorque detection time	0.0-10.0 *2	s	0.5
F619	Overtorque detection hysteresis	0 - 100	%	10

*1 You can output an alarm set regardless of the <F615> setting. Trip or alarm cannot be output when <F616> or <F617> is set to "0: Disabled".

*2 <F618>="0.0" seconds is the shortest time detected on control.

■ Difference depending on the setting of <F615: Overtorque trip>

0: Disabled

A trip does not occur. (Failure signal FL disabled)

Overtorque (OT) alarm can be output when the power running torque value is <F616> or more, or the regen torque value is <F617> or more, is detected for the period of time specified by <F618>.

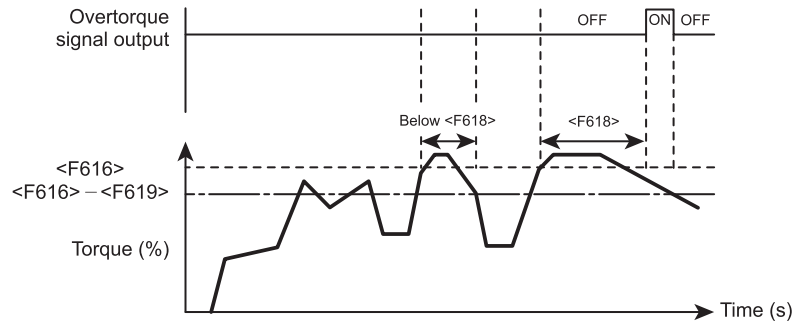
1: Enabled

The inverter trips when the power running torque value is <F616> or more, or the regen torque value is <F617> or more, is detected over the period of time specified by <F618> or longer. Overcurrent (OT) alarm can also be output from the output terminal. (Failure signal FL enabled)

■ **Setting example**

Assign "28: Overcurrent (OT) alarm" to the unused output terminal.

In the case of <F615: Overcurrent trip> = "0: Disabled", the alarm functions as follows.



When <F615: Overcurrent trip> = "1: Enabled", the inverter trips if overcurrent is detected for the period of time specified by <F618: Overcurrent detection time>. After that, overcurrent (OT) alarm remains ON.

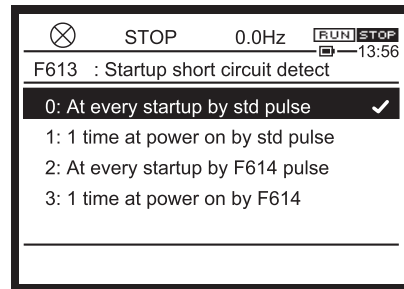
6

Reference	<ul style="list-style-type: none"> • How to operate the operation panel -> Refer to [3. 1. 1]. • How to switch display mode on the operation panel -> Refer to [3. 1. 2]. • Procedure to change parameter setting -> Refer to [4. 2. 3] • Details on operation by external signals -> Refer to [Chapter 7].
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6. 30. 9 Short circuit detection at start

<F613: Short circuit detection at start>

<F614: Pulse width of short circuit detection at start>



■ Function

Inverter detects inverter output short-circuit at the start.

Normally, short-circuit can be detected in the length of standard pulse (50 μs). When operating a low-impedance motor, such as a high-speed motor, however, select the short-time pulse by <F614:Pulse width of short circuit detection at start> to prevent an error detection.

■ Parameter setting

6

Title	Parameter name	Adjustment range	Unit	Default setting
F613	Short circuit detection at start	0: At every startup by standard pulse 1: Only one time after power on by standard pulse 2: At every startup by F614 setting pulse 3: Only one time after power on by F614 setting pulse		0
F614	Pulse width of short circuit detection at start	0: No short circuit detection at start in case F613="2", or "3" 1 - 50	μs	25

■ Setting the <F613: Short circuit detection at start>

0: At every startup by standard pulse

Detection is executed in the length of standard pulse every time at the start of inverter operation.

1: Only one time after power on by standard pulse

Detection is executed in the length of standard pulse only during the first start-up at power on or after resetting.

2: At every startup by F614 setting pulse

Detection is executed in the length of short-time pulse specified by <F614: Pulse width of short circuit detection at start> every time at the start of inverter operation.

3: Only one time after power on by F614 setting pulse

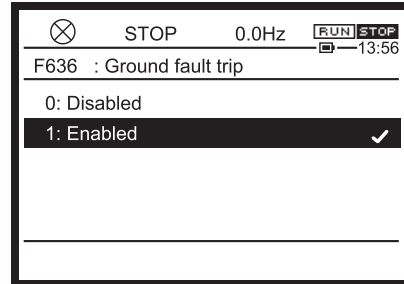
Detection is executed in the length of short-time pulse specified by <F614: Pulse width of short circuit detection at start> only one time during the first start-up at power on or after resetting.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 10 Ground fault detection

<F636: Ground fault trip>



■ Function

Inverter detects the ground fault.

If a ground fault occurs in the inverter unit or output side, the inverter will trip. The trip display is "EF2".

6

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F636	Ground fault trip	0: Disabled 1: Enabled	1

■ How to select a setting value

0: Disabled

A trip does not occur. (Failure signal FL disabled)

In this case, installation of a ground detector, such as a ground relay, is recommended.

1: Enabled

Ground fault detection is enabled.

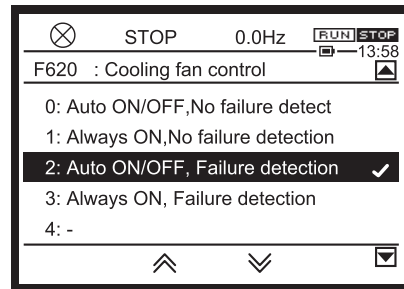
The inverter will trip when ground fault is detected. (Failure signal FL enabled)

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 11 Cooling fan control

<F620: Cooling fan control>



■ Function

The cooling fan runs only when the ambient temperature is high and during run. This way, the service life of cooling fan can be extended compared to when keep running the cooling fan while the power is ON. It is also able to trip when the capability of the cooling fan falls below a certain level. The trip display is "E-42".

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F620	Cooling fan control	0: Auto ON/OFF, No failure detection 1: Always ON, No failure detection 2: Auto ON/OFF, Failure detection 3: Always ON, Failure detection 4 - 7: -	2

*When the motor speed of the cooling fan is lower than a certain level, cooling fan fault alarm can be output from the output terminal regardless of the setting in <F620>.

■ Selecting a setting value

0: Auto ON/OFF, No failure detection

Cooling fan is automatically controlled. Cooling fan operates only when the ambient temperature is high and during run.

Cooling fan operates automatically, if the ambient temperature is high, even when the inverter is in a stop.

1: Always ON, No failure detection

Cooling fan runs all the time when the inverter is on.

Trip does not occur at the time of the cooling fan failure. (Failure signal FL disabled)

2: Auto ON/OFF, Failure detection

Cooling fan is automatically controlled. Cooling fan runs only when the ambient temperature is high and during operation.

When the motor speed of the cooling fan is lower than a certain level, a trip occurs. (Failure signal FL enabled)

3: Always ON, Failure detection

Cooling fan runs all the time when the inverter is on.

6

When the motor speed of the cooling fan is lower than a certain level, a trip occurs. (Failure signal FL enabled)

■ Output during cooling fan run

If you assign the function to the unused output terminal, cooling fan fault alarm can be output while the cooling fan is running.

"50: During cooling fan run"

"190: Cooling fan fault alarm"

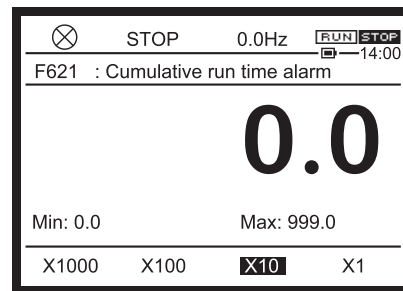
If you set <F620: Cooling fan control> to "2" or "3", a trip occurs at the time of the cooling fan fault. The trip display is "E-42".

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 12 Cumulative run time alarm setting

<F621: Cumulative run time alarm>



■ Function

This parameter activates the alarm from the output terminal after the inverter's cumulative run time is <F621: Cumulative run time alarm> or more.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F621	Cumulative run time alarm	0.0 - 999.0	100 h	876.0

■ Signal output of cumulative run time alarm

Assign "56: Cumulative run time alarm" to the unused output terminal.

Memo

- Cumulative run time up to the present time can be confirmed in the [Monitor mode].
- Monitor value of the cumulative run time can be reset to 0 (zero) by selecting "5: Clear cumulative run time" in the default setting <tyP: Default setting>. For details, refer to [5. 2. 9].

Reference

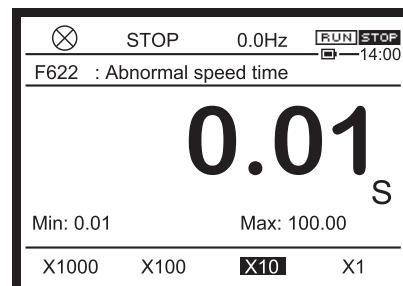
- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 13 Speed error (over speed) detection

<F622: Abnormal speed detection time>

<F623: Abnormal speed increase band>

<F624: Abnormal speed decrease band>



■ **Function**

When operating without the PG feedback (<Pt: V/f Pattern> = "0" - "9"), if the rough speed exceeds the speed limit over the setting time, this parameter announces an error and outputs a failure.

When operating with the PG feedback (<Pt: V/f Pattern> = "10" or "11"), the parameter monitors the speed feedback value and a trip occurs when speed exceeds the speed limit over the setting time.

When output frequency > (<FH> +12 Hz) or > (<FH> + <vL>/10) at all <Pt>, a trip occurs.

The trip display is "E-13".

■ **Parameter setting**

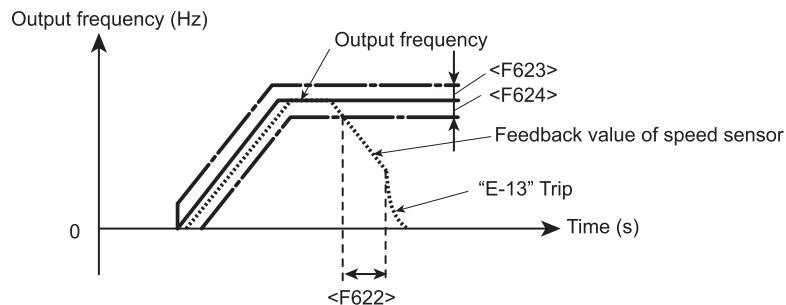
Title	Parameter name	Adjustment range	Unit	Default setting
F622	Abnormal speed detection time	0.01 - 100.0	s	0.01
F623	Abnormal speed increase band	0.00: Disabled 0.01 - 30.0	Hz	0.00
F624	Abnormal speed decrease band	0.00: Disabled 0.01 - 30.0	Hz	0.00

■ **Guideline for the setting**

If speed feedback (Estimated speed) > (Output frequency + <F623>) or speed feedback (Estimated speed) < (Output frequency - <F624>), and a certain period of time set with <F622: Abnormal speed detection time>, a trip occurs.

You can provide range for a detection level of a trip with a setting of <F623: Abnormal speed increase band> and <F624: Abnormal speed decrease band>

During torque control, if speed feedback (Estimated speed) > (Speed upper limit + <F623>) or > (Speed lower limit - <F624>) a certain period of time set with <F622: Abnormal speed detection time>, "E-13" trip occurs.



Memo

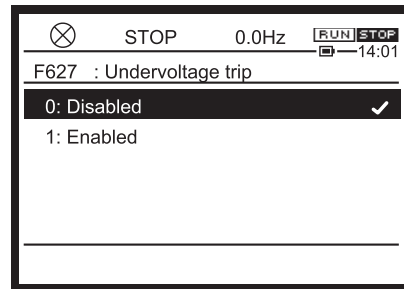
- When the setting value is 0 (zero), this function may not become activated properly while in the stall protection mode. To maintain this function, use of setting <F451: Acc/Dec operation after stall operation> = "1: Minimum time" is recommended. For details, refer to [6. 24. 2].

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 14 Undervoltage trip setting

- <F627: Undervoltage trip>
- <F625: Undervoltage detection level>
- <F628: Undervoltage detection time>



■ Function

This parameter sets the action when undervoltage of the power circuit is detected. When undervoltage is detected, it displays "MOFF" and stops. Alarm can be output from the output terminal. If you want to trip, set by <F627: Undervoltage trip>. The trip display is "UP1".

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F627	Undervoltage trip	0: Disabled 1: Enabled		0
F625	Undervoltage detection level	50 - 79 80: Auto	%	80 *1
F628	Undervoltage detection time	0.01 - 10.00	s	0.03
F629	Regenerative power ride-through level	55 - 100	%	75

*1 100% reference of <F625> is 200 V (240V class), 400 V (480V class).

■ Detection level of undervoltage alarm "MOFF"

Exclude <F625: Undervoltage detection level> = "80: Auto"
The occurrence level of MOFF alarm is the setting value of <F625>. MOFF alarm will be cleared at the setting value of <F629: Regenerative power ride-through level>.

When <F625: Undervoltage detection level> = "80: Auto"
Both occurrence level and clear level of MOFF alarm is followed by the level specified by the internal setting.

■ Setting the <F627: Undervoltage trip>

0: Disabled

The inverter stops but does not trip. (Failure signal FL disabled)

1: Enabled

The inverter trips after undervoltage is detected for the period of time set by <F628: Undervoltage detection time> or longer. The trip display is "UP1". (Failure FL enabled)

Memo

- While the inverter is stopped, undervoltage is not detected.

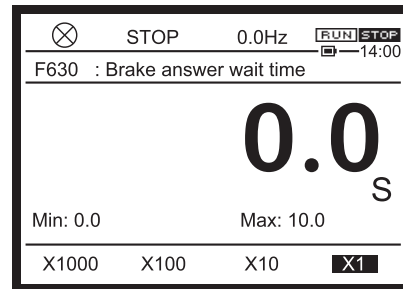
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6

6. 30. 15 Brake answer waiting time setting

<F630: Brake answer wait time>



■ Function

This parameter can set the waiting time for the brake answer (reply) from the system. Input brake answer to the input terminal with "130: Brake answerback" is assigned.

After the operation start, when there is no answer after elapse of the setting time, the inverter trips. The trip display is "E-11".

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F630	Brake answer wait time	0.0: Disabled 0.1 - 10.0	s	0.0

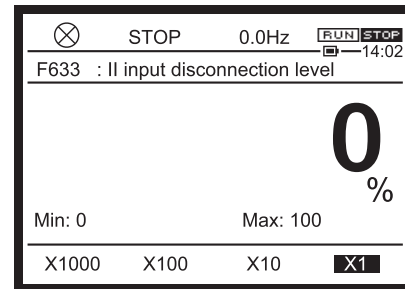
6

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- This function is used with "brake function".
About "brake function", refer to "E6582104".

6. 30. 16 Analog input disconnection detection

- <F633: II analog input disconnection detection level>
- <F644: Operation after II analog input disconnection detection>
- <F649: Fallback frequency>



■ Function

This parameter sets the action when the analog input level for [II] terminal is the setting value of <F633: II analog input disconnection detection level> or less for approximately 0.3 seconds. You can trip the inverter or maintain its operation. The trip display is "E-18". If you select other than a trip, alarm "A-18" blinks.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F633	II analog input disconnection detection level	0: Disabled 1 - 100	%	0
F644	Operation after II analog input disconnection detection	1 : Frequency reference keeps just before reference, & Alarm. 2 : Ramp Coast stop, & Alarm 3 : Free wheel, & Alarm 4 : Free wheel, & Fault 5 : Frequency reference becomes F649, & Alarm.	-	4
F649	Fallback frequency	LL-UL	Hz	0.0

■ Setting the <F633: II analog input disconnection detection level>

0: Disabled
No detection.

1 - 100

Action of the inverter is based on the setting of <F644: Operation after II analog input disconnection detection> when the analog input level for [II] terminal is the setting value of <F633> or less for approximately 0.3 seconds.

■ Setting the <F644: Operation after II analog input disconnection detection>

This parameter sets the action when the analog input level for [II] terminal is the setting value of <F633> or less for approximately 0.3 seconds.

1 : Frequency reference keeps just before reference
Continue running.

6

Alarm "A-18" blinks.

2 : Ramp Coast stop,

Deceleration stop.

Alarm "A-18" blinks.

3 : Free wheel

Coast stop.

Alarm "A-18" blinks.

4 : Free wheel, & Fault

Trip. The trip display is "E-18".

5 : Frequency reference becomes F649

The inverter runs with the frequency setting by <F649: Fallback frequency>.

Alarm "A-18" blinks.

Memo

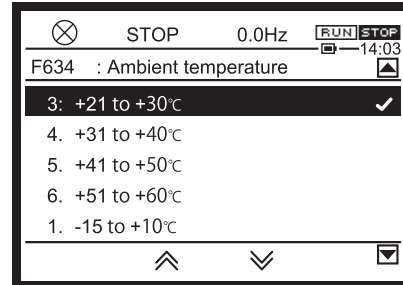
- Depending on the degree of deviation of the analog data detected, disconnection may be detected too early.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 17 Setting parts replacement alarm by the ambient temperature

<F634: Annual average ambient temperature>



■ Function

Based on the inverter ON time (cumulative power ON time), motor run time (cumulative run time), cooling fan run time (cumulative cooling fan run time), output current, and <F634: Annual average ambient temperature>, the time of replacement of the cooling fan, power circuit capacitor, and capacitor mounted on a printed circuit board is calculated. When the time of replacement approaches, the alarm can be output on the monitor display and output terminal.

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F634	Annual average ambient temperature	1: -15 to +10°C 2: +11 to +20°C 3: +21 to +30°C 4: +31 to +40°C 5: +41 to +50°C 6: +51 to +60°C	3

■ Selecting a setting value

Set the annual average temperature around the inverter. (This is not the annual highest temperature.)



Important

- Set <F634: Annual average ambient temperature> when installing the inverter. After the installation, this setting should not be changed. Otherwise, calculation of parts replacement alarm may have an error.

■ Signal output of parts replacement alarm

Assign the parts replacement alarm to the unused output terminal. For details, refer to [7. 2. 2].

"128: Parts replacement alarm"

"160: Cooling fan replacement alarm"

■ Monitor display of parts replacement alarm

Parts replacement alarm information (refer to [8. 1. 1]) can be checked in the [Monitor mode].

Memo

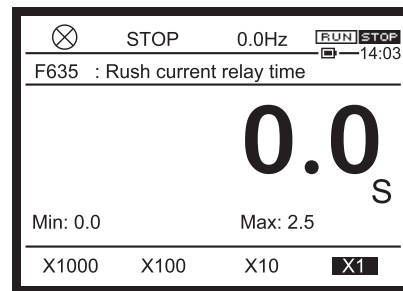
- Cumulative power ON time, cumulative fan run time, and cumulative run time can be checked in the [Monitor mode]. For details, refer to [8. 1. 1].
- Monitor value of cumulative fan run time and cumulative run time can be reset to 0 (zero) by the setting of <tyP: Default setting>. For details, refer to [5. 2. 9].

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 18 Rush current suspension relay control

<F635: Rush current suppression relay delay time>



■ Function

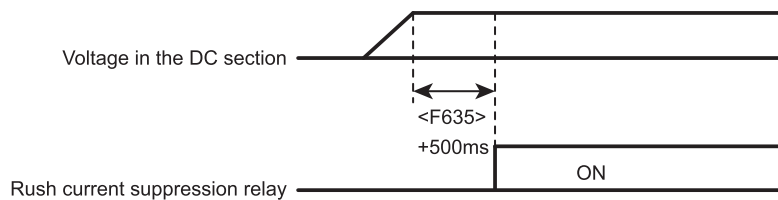
This function is used for DC input or when multiple inverters are connected with DC section and when the rush current suspension resistor relay needs to be controlled.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F635	Rush current suppression relay delay time	0.0 - 2.5	s	0.0

■ Guideline for the setting

When the voltage of DC section in the inverter has reached the specified voltage, after a lapse of setting time by <F635: Rush current suppression relay delay time> +500ms (basic wait time), the rush current suspension relay is turned on.



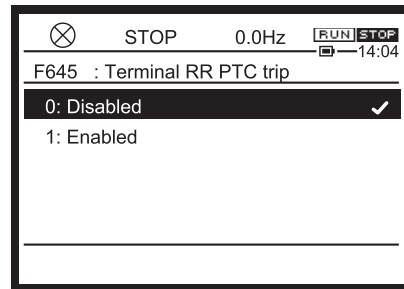
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6

6. 30. 19 Motor PTC thermal protection setting

- <F645: Terminal RRPTC trip>
- <F646: PTC detection resistance>
- <F108: Terminal RR input select>
- <F148: Terminal AI4 input select>
- <F149: Terminal AI5 input select>
- <F637: Terminal AI4 PTC trip>
- <F638: Terminal AI5 PTC trip>



■ Function

This function is set to protect the motor from overheating by using PTC, which is integrated in the monitor.

You can trip the motor. The trip display is "E-32".

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F645	Terminal RR PTC trip	0: Disabled 1: Enabled		0
F646	PTC detection resistance	100 - 9999	Ω	3000
F656	PTC detection temperature	0 - 200	°C	90
F108	Terminal RR input	1: Voltage input (0-10V) 2, 3: - 4: PTC input 5: PT100 (2-wire) input 6: - 7: PT100 (2-wire) input 8: - 9: KTY84 input		1
F148	Terminal AI4 input select	1: Voltage input (0-10 V) 2: Voltage input (-10 to +10 V) 3: Current input (0-20 mA) 4: PTC input 5: PT100 (2-wire) input 6: PT100 (3-wire) input 7: PT100 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input		0
F149	Terminal AI5 input select			
F637	Terminal AI4 PTC trip	0: Disabled		0
F638	Terminal AI5 PTC trip	1: Enabled		

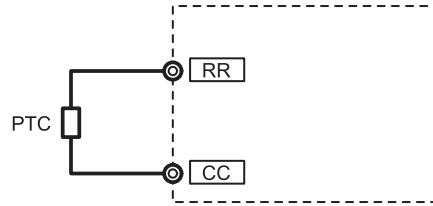
■ PTC thermal protection using terminal [RR]

Connect PTC between terminals [RR]-[CC].

Set "4", "5", "7", and "9" with <F108: Terminal RR switching>.

In <F645: Terminal RR PTC trip>, when "0: Disabled" is selected, pre-alarm only, and when "1: Enabled" is selected, pre-alarm and trip are enabled.

The trip level is the value which is set by <F646> when <F108>= "4: PTC input", and if <F108>= "5: PT100", "7: PT1000", and "9: KTY84", it is the setting value of <F656>.
 Pre-alarm level is 60% of <F646> when <F108>="4".
 Pre-alarm level is <F656> - 10 deg.C when <F108>="5", "7", and "9".



■ **Signal output of PTC input pre-alarm**

Assign "150: PTC input pre-alarm" to the unused output terminal.

Memo

- With optional terminals [AI4] and [AI5], PTC thermal protection is possible in the same manner. For details, refer to "I/O extension 1 installation manual" (E6582128).

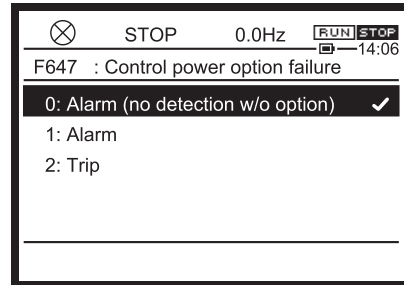
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6

6. 30. 20 Protecting the control power supply option unit at a time of failure

<F647: Control power option failure detection>



■ Function

When the control power supply option unit (CPS002Z) is used, if the unit does not output the voltage for 15 minutes or more due to some error, this function can activate alarm display or tripping.

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F647	Control power option failure detection	0: Alarm (no detection without option) 1: Alarm 2: Trip	0

6

■ How to select a setting value

0: Alarm (no detection without option)

This is selected when the control power supply backup is not necessary.

When no control power supply is input between terminals [+SU] externally, use this setting.

Also when the control power supply backup is selected, when failure occurs during run, the inverter output is shut off and the alarm "COFF" is displayed. When failure exists already at the time of voltage input, errors are not detected.

1: Alarm

This is selected for the control power supply backup (alarm output).

When voltage of the control power supply which is input to terminal [+SU] drops, the inverter output is shut off, and the alarm "COFF" is displayed.

Once "COFF" has occurred, the alarm is not reset even when the control power supply voltage is recovered to the normal level. The alarm can be reset by turning off the power circuit.

2: Trip

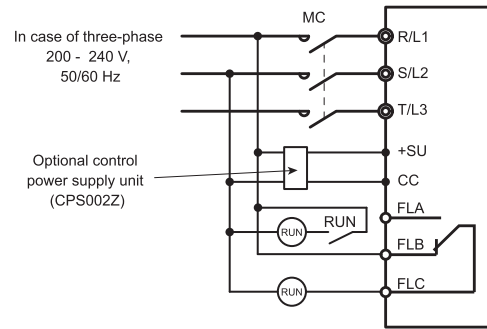
This is set for the control power supply backup (trip output).

This option enables the inverter trip when voltage of the control power drops. The trip display is "E-29". Different from the normal trip, the trip is maintained regardless of the setting status of <F602: Trip record retention>.

This setting is valid when the standard connection in [2. 3. 2] is used.

When an inverter failure occurs while the control power supply has an failure as follows, the main power supply may turn ON/OFF repeatedly. In such a case, select "1: Retain at power off" in <F602: Trip record retention>.

For details, refer to [6. 30. 3].



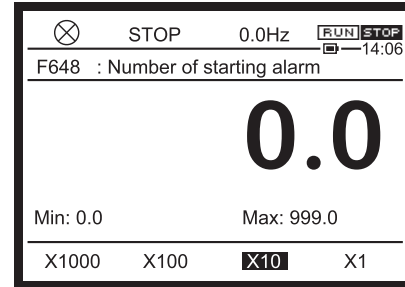
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6

6. 30. 21 Setting number of starting alarm and alarm occurrence of the specified trip

- <F648: Number of starting alarm>
- <F658: Number of external equipment starting alarm>
- <F664: Specified trip 1>
- <F665: Specified trip 2>
- <F666: Specified trip 3>



■ Function

This parameter counts the number of starting of the inverter, and when it reaches the value set by <F648: Number of starting alarm>, it outputs the alarm and confirm it in [Monitor mode].

For number of external equipment starting alarm, you can outputs the alarm and confirm it in [Monitor mode]. For number of starting for external equipment, the number of input to the input terminal is counted.

Also, occurrence of the specified trip can be confirmed in [Monitor mode].

6

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F648	Number of starting alarm	0 - 999.0	x10,000 times	999.0
F658	Number of external equipment starting alarm	0 - 999.0	x10,000 times	999.0
F664	Specified trip 1	0 - 1 00	Times	0
F665	Specified trip2	0 - 1 00	Times	0
F666	Specified trip3	0 - 1 00	Times	0

■ Signal output of the number of starting alarm of the inverter

This parameter counts the number of starting of the inverter, and when it reaches the value set by <F648: Number of starting alarm>, it outputs the alarm and confirm it in [Monitor mode].

Output alarm

Assign "162: Number of starting alarm" to the unused output terminal. For details, refer to [7. 2. 2]. [Monitor mode]

Set "100: Number of starting" to <F711: Monitor mode 1 display> through <F718: Monitor mode 8 display>. For details, refer to [8. 1. 1].

■ Signal output of the number of external equipment starting alarm

This parameter counts the number of starting of the external equipment, and when it reaches the values set by <F658: Number of external equipment starting alarm>, it outputs the alarm and can be confirmed in [Monitor mode].

For Number of starting for external equipment, a signal to the input terminal with the function of "114: External equipment counter" is assigned is counted.

Output alarm

Assign "184: Number of external equipment starting alarm" to the unused output terminal. For details, refer to [7. 2. 2].

[Monitor mode]

Set "103: External equipment counter" to <F711: Monitor mode 1 display> through <F718: Monitor mode 8 display>. For details, refer to [8. 1. 1].

■ **Signal output of the number of occurrence of the specified trip**

You can confirm occurrence of the specified trip in [Monitor mode]. You can set up to three specified trips.

Set the monitor numbers shown in the following table to <F711: Monitor mode 1 display> to <F718: Monitor mode 8 display>. For details, refer to [8. 1. 1].

"113: Number of specified trip 1"

"114: Number of specified trip 2"

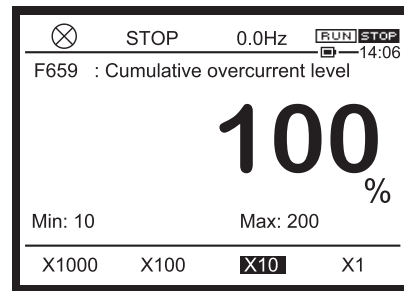
"115: Number of specified trip 3"

6

Memo	<ul style="list-style-type: none"> • The number of starting, the number of forward run, and the number of reverse starting up to the present time can be confirmed in [Monitor mode]. You can reset the monitor value to 0 with the setting of "12: Clear number of starting" in <tyP: Default setting>. For details, refer to [5. 2. 9]. • You can reset the monitor value of "external equipment counter" to 0 with the setting of "14: Clear number of external equipment starting" in <tyP: Default setting>. For details, refer to [5. 2. 9].
Reference	<ul style="list-style-type: none"> • How to operate the operation panel -> Refer to [3. 1. 1]. • How to switch display mode on the operation panel -> Refer to [3. 1. 2]. • Procedure to change parameter setting -> Refer to [4. 2. 3] • Details on operation by external signals -> Refer to [Chapter 7].

6. 30. 22 Setting cumulative overcurrent level and time

<F659: Cumulative overcurrent level>



■ Function

Inverter cumulates the time when motor current is over this parameter. This cumulative time can be confirmed in [Monitor mode].

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F659	Cumulative overcurrent level	10 - 200	%	100

6

■ Signal output of the cumulative overcurrent time

You can confirm the cumulative overcurrent time in [Monitor mode].

Set the monitor numbers shown below to <F711: Monitor mode 1 display> to <F718: Monitor mode 8 display>. For details, refer to [8. 1. 1].

"93: Cumulative overcurrent time"

Memo

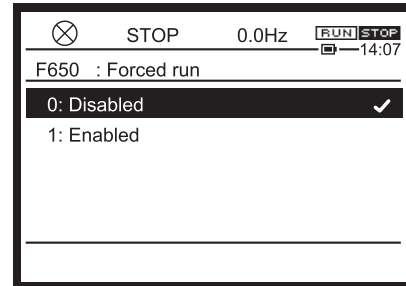
- Cumulative overcurrent time can be confirmed in [Monitor mode]. You can reset the monitor value to 0 with the setting of "15: Clear cumulative overcurrent time" in <tyP: Default setting>. For details, refer to [5. 2. 9].

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 31 Forced run control in emergency

<F650: Forced run>



■ Function

With the forced run control, the motor runs at the specified speed in an emergency.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F650	Forced run	0: Disabled 1: Enabled		0
F294	Preset speed 15 / Forced run speed	LL - UL	Hz	0.0

■ Setting the parameters and input terminal

Set <F650: forced run> = "1: Enabled"

Set any of the function to the unused input terminal. For details, refer to [7. 2. 1].

You can perform the forced run or fire speed run with the setting of <F650> = "1" and an assigned input terminal is ON.

"56: Forced run"

- Once the input signal is ON, it is self-retained. The motor runs at the frequency set by <F294>.
- In case of a slight failure, the motor performs the forced run, in which the operation is continued.

"58: Fire speed run"

- Once the input signal is ON, it is self-retained. The motor performs the fire speed run at the frequency set by <F294>.

In both cases, to stop the running, the power circuit needs to be turned off.

During the forced run and the fire speed run, "FIR" is displayed.

■ Signal output of forced run

Assign any of these to the unused output terminal. For details, refer to [7. 2. 2].

"138: During forced run"

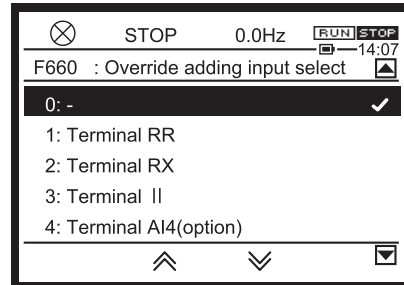
"140: During fire speed run"

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 32 Frequency adjustment using external input (override function)

- <F660: Override adding input select>
- <F661: Override multiplying input select>
- <F729: Panel override multiplication gain>



■ Function

You can make adjustment for adding or multiple to frequency command value by external signal.

■ Parameter setting

6

Title	Parameter name	Adjustment range	Unit	Default setting
F660	Override adding input select	0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal AI4 (option) 5: Terminal AI5 (option) 6 - 9: - 10: Touch wheel 1 (power off or press OK to save) 11 - 14: - 15: Terminal Up/Down frequency 16: Pulse train 17: High resolution pulse train (option) 18/19: - 20: Embedded Ethernet 21: RS485 communication connector 1 22: RS485 communication connector 2 23: Communication option		0
F661	Override multiplying input select	0: - 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal AI4 (option) 5 - 11: - 12: F729 13 - 30: - 31: Terminal RR *1 32: Terminal RX *1 33: Terminal II *1 34: Terminal AI4 (option) *1 35 - 41: - 42: F729 *1		0

Title	Parameter name	Adjustment range	Unit	Default setting
F729	Panel override multiplication gain	-100 to +100	%	0

■ **Guideline for the setting**

The override functions calculate the frequency command value by means of the following expression:

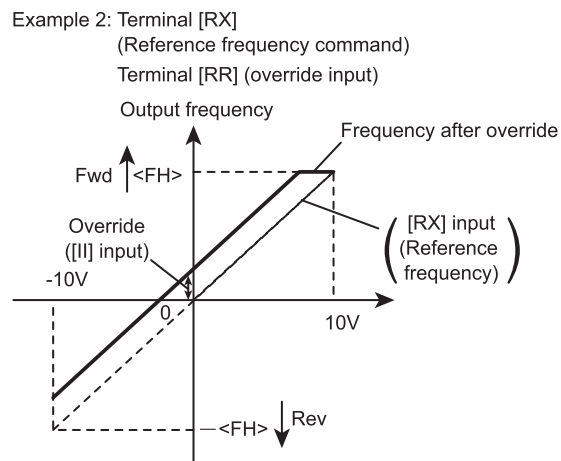
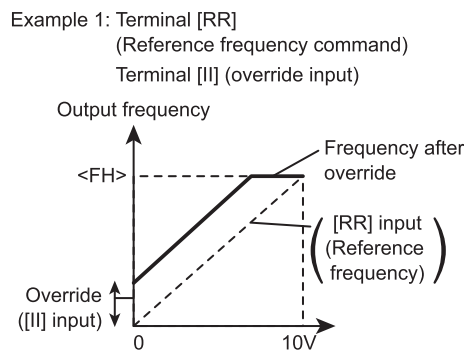
- Frequency command value × (1+<F661> Input (%)/100) + <F660> Input (Hz)
- <F661> is limited to -100 to +100

However, when the setting value of <F661: Override multiplying input select> is *1 in the table, use the following expression.

- Frequency command value × (<F661> Input (%)/100) + <F660> Input (Hz)
- <F661> is not limited

■ **Additive override**

An input override frequency is added to the frequency command value externally.



Example 1: <F660>= "3: Terminal II", <F661>= "0: Disabled"

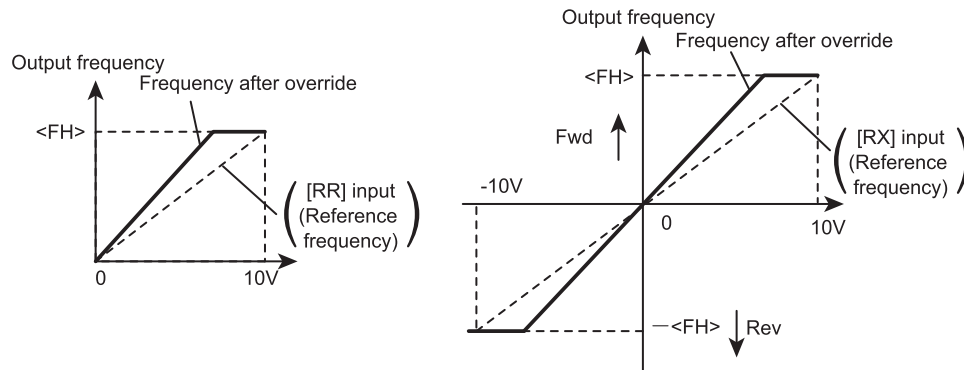
Output frequency = Reference frequency + Override (terminal [II] input (Hz))

Example 2: <F660>= "1: Terminal RR", <F661>= "0: Disabled"

Output frequency = Reference frequency + Override (terminal [RR] input (Hz))

■ **Multiple override**

An input override frequency is added to the frequency command value externally.



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Example 1: $\langle F660 \rangle = "0: Disabled"$, $\langle F661 \rangle = "3: Terminal II"$

$\langle FMOd \rangle = "1: Terminal RR"$, $\langle FH \rangle = "80.0"$, $\langle UL \rangle = "80.0"$

terminal [RR] input

$\langle F201 \rangle = "0"$, $\langle F202 \rangle = "0.0"$, $\langle F203 \rangle = "100"$, $\langle F204 \rangle = "80.0"$

terminal [II] input

$\langle F216 \rangle = "0"$, $\langle F220 \rangle = "0"$, $\langle F218 \rangle = "100"$, $\langle F221 \rangle = "100"$

Output frequency = Reference frequency x {1 + Override (terminal [II] input (%)/100)}

Example 2: $\langle F660 \rangle = 0$ (disabled), $\langle F661 \rangle = 1$ (terminal [RR])

$\langle FMOd \rangle = "2: Terminal RX"$, $\langle FH \rangle = "80.0"$, $\langle UL \rangle = "80.0"$

terminal [RX] input

$\langle F210 \rangle = "0"$, $\langle F211 \rangle = "0.0"$, $\langle F212 \rangle = "100"$, $\langle F213 \rangle = "80.0"$

terminal [RR] input

$\langle F201 \rangle = "0"$, $\langle F205 \rangle = "0"$, $\langle F203 \rangle = "100"$, $\langle F206 \rangle = "100"$

Output frequency = Reference frequency x {1 + Override (terminal [RR] input (%)/100)}

Example 3

Output frequency = Reference frequency x {1 + Override ($\langle F729$: Panel override multiplication gain> Setting value (%)/100)}

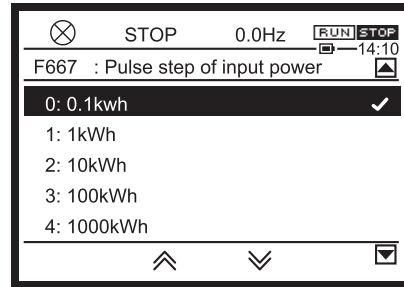
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 33 Adjustment parameters

6. 33. 1 Pulse output based on input cumulative power by a fixed integral value

- <F667: Pulse output step of input cumulative power>
- <F668: Pulse output width of input cumulative power>



■ Function

Every time the integral input power reaches the cumulative power unit set by <F667: Pulse output step of input cumulative power>, pulse signal can be output. You can display the power by pulse count without an external power meter.

Pulse output width is set by <F668: Pulse output width of input cumulative power>.

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■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F667	Pulse output step of input cumulative power	0: 1.0=1 kWh 1: 1.0=10 kWh 2: 1.0=100 kWh 3: 1.0=1000 kWh 4: 1.0=10000 kWh 5: 1.0=100000 kWh		1
F668	Pulse output width of input cumulative power	0.1 - 1.0	s	0.1

■ Setting the parameters

This is a setting for pulse output from terminal [FP].

Set <F130: Terminal FP function 1> = "180: For input cumulative power"

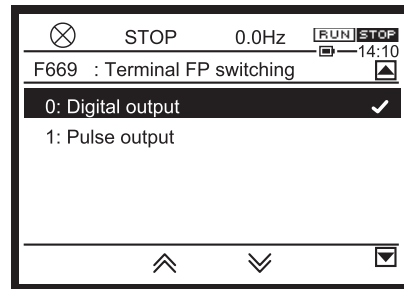
Set the integral power unit with <F667: Pulse output step of input cumulative power>, and set the pulse output width with <F668: Pulse output step of input cumulative power>.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 33. 2 Pulse train output

- <F669: Terminal FP switching>
- <F676: Terminal FP pulse train output function>
- <F677: Maximum pulse number of pulse train output>
- <F678: Pulse train output filter>



■ Function

Pulse trains can be output from terminal [FP]. Set the pulse output function and the number of pulses.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F669	Terminal FP switching	0: Digital output 1: Pulse output		0
F676	Terminal FP pulse train output function	0-149 *1		0
F677	Maximum pulse number of pulse train output	0.50 - 30.00	kpps	8.00
F678	Pulse train output filter	1 - 1000	ms	64

*1 For details, refer to [11. 7].

■ Setting method

For example, to output frequency (0 - 60Hz) at 0 - 600 pulse, set as follows.

<FH>= "60.0", <F669>= "1", <F676>= "0", <F677>= "0.60"

When the item selected by <F676> has reached the value of the reference of maximum value, the number of pulse set by <F677: maximum pulse number of pulse train output> is output.

ON pulse width is a fixed width. When outputting the maximum number of pulses set by <F677>, the width is fixed at a value, where the duty ratio is 50%.

Therefore, the duty ratio varies according to the output pulse.

For example,

- <F677>="0.80" (kpps), ON pulse width = approx. 0.6 (ms)
- <F677>="1.00" (kpps), ON pulse width = approx. 0.5 (ms)
- <F677>="1.60" (kpps), ON pulse width = approx. 0.3 (ms)

Pulses below 15pps cannot be output.

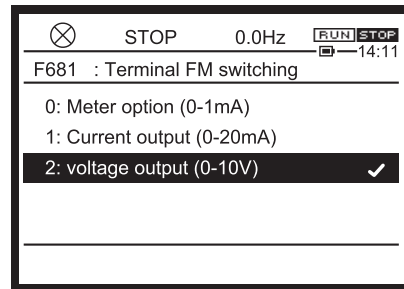
6

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 33. 3 Analog output adjustment

- <F681: Terminal FM switching>
- <F682: Terminal FM inclination polarity>
- <F683: Terminal FM bias>
- <F684: Terminal FM filter>
- <F685: Terminal FM upper-limit level>
- <F686: Terminal AM switching>
- <F687: Terminal AM inclination polarity>
- <F688: Terminal AM bias>
- <F689: Terminal AM filter>
- <F690: Terminal AM upper-limit level>



■ **Function**

With the setting of <F681>, you can switch the output signal from terminal [FM] to 0 - 1mAdc output, 0 - 20mAdc output, and 0 - 10 Vdc output. Default setting is 0 - 10Vdc output. Similarly, the output signal from the terminal [AM] can be also switched.

■ **Parameter setting**

6

Title	Parameter name	Adjustment range	Unit	Default setting
F681	Terminal FM switching	0: Meter option (0-1mA) 1: Current output (0-20mA) 2: Voltage output (0-10V)		2
F682	Terminal FM inclination polarity	0: Negative inclination (downward slope) 1: Positive inclination (upward slope)		1
F683	Terminal FM bias	-100.0 to +100.0	%	0.0
F684	Terminal FM filter	1 - 1000	ms	1
F685	Terminal FM upper-limit level	0.0 - 100.0	%	100.0
F686	Terminal AM switching	0: Meter option (0-1mA) 1: Current output (0-20mA) 2: Voltage output (0-10V)		2
F687	Terminal AM inclination polarity	0: Negative inclination (downward slope) 1: Positive inclination (upward slope)		1
F688	Terminal AM bias	-100.0 to 100.0	%	0.0
F689	Terminal AM filter	1 - 1000	ms	1
F690	Terminal AM upper-limit level	0.0 - 100.0	%	100.0

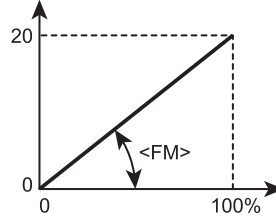
■ **Setting methods**

To obtain 4 - 20 mAdc output, adjust <F683: Terminal FM bias> and <F688: Terminal AM bias>. When using the optional frequency meter (QS60T), set <F681> to "0" or F686 to "0".

■ Setting example

<F681>="1", <F691>="1", <F692>="0" (%)

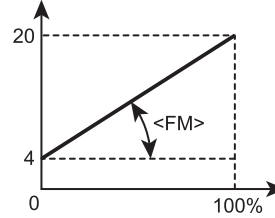
Analog output current (mA)



Internal calculated value

<F681>="1", <F691>="1", <F692>="20" (%)

Analog output current (mA)

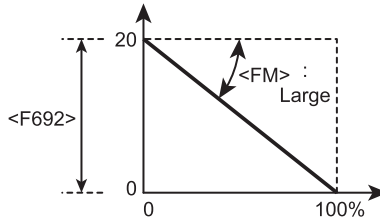


<F692>

Internal calculated value

<F681>="1", <F691>="1", <F692>="100" (%)

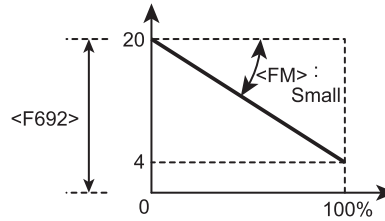
Analog output current (mA)



Internal calculated value

<F681>="1", <F691>="0", <F692>="100" (%)

Analog output current (mA)



<F692>

Internal calculated value

6

Set the inclination of analog output with <FM: Terminal FM adjustment> and <F671: Terminal AM adjustment>. For details of how to adjust, refer to [5. 2. 6].

Reference

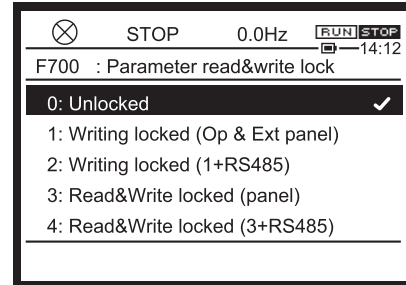
- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].
- Details on operation by external signals -> Refer to [Chapter 7].

6. 34 Setting functions of operation panel

Lock or unlock the key operation of the operation panel and parameter setting.
Also, set the display functions of the operation panel.

6. 34. 1 Lockout key operation and parameter setting

- <F700: Parameter reading&writing access lockout>
- <F730: Panel frequency setting lockout>
- <F731: Operation after disconnection detection during panel run>
- <F732: Panel Hand/Auto function lockout>
- <F733: Panel Run lockout>
- <F734: Panel emergency off lockout>
- <F735: Panel reset lockout>
- <F736: CMOD/FMOD change lockout during run>
- <F737: Panel keys lockout>
- <F738: Password setting>
- <F739: Password verification>



6

■ Function

These parameters allow you to locked or unlocked operation on the operation panel and the change of parameters. Using these parameters, you can also lock various key operations to prevent malfunction.

Lock parameters with a password to prevent configuration.

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F700	Parameter reading&writing access lockout *1	0: Unlocked 1: Writing locked (Operation panel, Extension panel) 2: Writing locked (1+RS485) 3: Reading&Writing locked (Operation panel, Extension panel) 4: Reading&Writing locked (3+RS485)	0
F730	Panel frequency setting lockout	0: Unlocked 1: Locked 2: Unlocked after press OK	2
F731	Operation after disconnection detection during panel run *2	1: Continue running 2, 3: - 4: Trip	4
F732	Panel Hand/Auto function lockout *3	0: Unlocked 1: Locked	1
F733	Panel Run lockout	0: Unlocked 1: Locked	0
F734	Panel emergency off lockout	0: Unlocked 1: Locked	0

Title	Parameter name	Adjustment range	Default setting
F735	Panel reset lockout	0: Unlocked 1: Locked	0
F736	CMOd/FMOd change lockout during run	0: Unlocked 1: Locked	1
F737	Panel keys lockout *4	0: Unlocked 1: Locked 2: Locked only extension panel 3: Locked only operation panel	0
F738	Password setting *5	0: Disabled 1 - 9998 9999: Password was set	0
F739	Password verification	0: non-setting 1 - 9998 9999: Password was set	0

*1 The setting of <F700>="2" and "4" is valid after reset (turning off power).

*2 Enabled when run command is input from the operation panel.

*3 <F732> is only for extended LED panel. <F750> is for LCD panel.

*4 After setting <F737>. turn on the power again. The setting is valid after the power is turned on again.

*5 The setting of <F738>="9999" is valid after reset (turning off power).

■ **Selecting a setting value**

In [Standard mode], if you lock the frequency setting on the operation panel (<FC>, <FPId>, Preset speed), set <F730: Panel frequency setting lockout> to "1".

You cannot lock the setting with <F700>.

■ **Setting/clearing method of password when it is required for protection**

1) **Password setting method**

Parameters other than <F700>, <F738>, and <F739> cannot be changed when <F700> is set to "1" to "4".

When <F738> or <F739> is "0", a password has not been set. You can set a new password.

When <F738> or <F739> is "9999", a password has already been set.

If not set, select and register a number from "1" to "9998" for <F738> as a password. Do not forget your password as it is required to release the lock.



Important

- The lock cannot be released if you forget the password. Do not forget this password as we cannot retrieve it.

Memo

- The password cannot be set when <F700> = "0". Select a number other than 0 and then set the password.
- The password can be read out to parameter writer (optional device) until the power is off after setting <F738>. Please note that password will not be able to read out due to password protection after the power is off.

2) Password clearing method

When <F738> or <F739> is read out and the value is "9999", a password has already been set. The password has to be cleared in order to change parameters.

To <F739>, input the number registered to <F738> when the password was set.

If the password matches, "PASS" is displayed and the password is cleared.

If the password is incorrect, "FAIL" is displayed and the screen returns to <F739>.

The setting of <F700> can be changed after the password is cleared.

By setting <F700> to "0", settings of all the parameters are enabled.



Important

- You cannot try inputting <F739> for more than three times. If a wrong password has been input three times, setting is no longer possible. However, the number of times is reset after power is off.

6

■ Cancellation method of <F700> and <F737> lockout setting

3) Cancellation of <F700> lockout setting

The setting of <F700> can be changed at any time, regardless of its setting value.

4) Cancellation of <F737> lockout setting

When the key operation lockout is set, press and hold down the [OK] key for 5 seconds or more.

The message "Undo" appears and this setting is canceled temporarily for the key operation.

To cancel this setting permanently, change the setting of <F737> directly.

■ Parameter setting unlocked with digital input

When "110: Parameter writing unlocked" is assigned to the unused input terminal, setting of parameters is possible regardless of the setting of <F700: Parameter reading&writing access lockout>.

■ Parameter setting lockout with digital input

If the following functions are assigned to the unused input terminal, parameter writing or reading is locked.

"200: Parameter writing locked"

"202: Parameter reading locked"

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 34. 2 Changing current/voltage display from percentage to unit (A/V)

<F701: Current, voltage units select>

For details, refer to [5. 2. 7].

6. 34. 3 Displaying motor or line speed

<F702: Free unit multiplication factor>

<F703: Target of free unit>

<F705: Free unit inclination polarity>

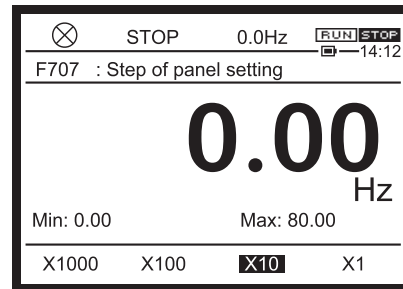
<F706: Free unit bias>

For details, refer to [5. 4. 3].

6. 34. 4 Changing variation steps of panel display

<F707: Step of panel setting>

<F708: Step of panel display>



■ Function

The changeable step width can be changed at panel frequency setting.

This function is useful when only running with frequencies of intervals of 1 Hz, 5 Hz, and 10 Hz units.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F707	Step of panel setting	0.00: Disabled 0.01 - FH	Hz	0.00
F708	Step of panel display	0: Disabled 1 - 255		0

6

■ Caution when used

The settings of these parameters do not work when <F702: Free unit multiplication factor> is set.

When you set other than "0" to <F707> and increase the frequency by turning the touch wheel to the right, frequency will not be increased beyond this point and the "HI" message is displayed if the frequency is over <UL: Upper limit frequency> with just one more step rotation.

Similarly, when you decrease the frequency by turning the touch wheel to the left and if the frequency falls under <LL: Lower limit frequency> with just one more step rotation, the "LO" message is displayed in advance and the frequency cannot be lowered beyond this point.

■ Setting example

1) <F707> = not "0.00", <F708> = "0: Disabled"

Under normal conditions, the frequency command value on the operation panel increases by 0.1 Hz when you turn the touch wheel to the right. If <F707> is not "0.00", the frequency command value will increase by the value with <F707> each time you turn the touch wheel to the right by 1 step. Similarly, the frequency command value on the operation panel will decrease by the value set with <F707> when you turn the touch wheel to the left by 1 step.

When the second decimal place of <F707> is 0, the second decimal place of the frequency command value is not displayed.

2) When <F707> is not "0.00", and <F708> is not "0"

The value displayed on the panel can also be changed in steps.

Output frequency displayed on LCD screen = Internal output frequency x <F708>/<F707>

■ Operation example

<F707> = "0.00: Disabled"

By rotating the touch wheel by 1 step, the panel run frequency command value changes only by 0.1 Hz.

<F707> = "10.00"

Rotating the touch wheel by 1 step changes the panel run frequency command value in 10.00 Hz increments, from 0.00 up to 60.00 (Hz).

<F707> = "1.00", <F708> = "1"

By rotating the touch wheel by 1 step, the frequency command value changes in steps of 1Hz: 0→ 1 → 2 → ... → 60 (Hz) and also the value displayed on the LCD panel changes in steps of 1.

Use these settings to hide decimal fractions.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 34. 5 Selecting data displayed in [Standard mode]

<F710: Standard mode display>

<F720: Standard mode display of extension panel>

<F723: Status area display of operation panel>

Different contents can be displayed on the operation panel of the inverter unit and the extension panel (optional).

You can set the content displayed on Status area on the operation panel.

For details, refer to [5. 4. 3].

6. 34. 6 Changing display in [Monitor mode]

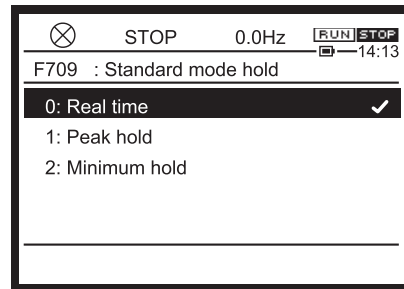
<F711: Monitor mode 1 display> to <F718: Monitor mode 8 display>

Change the display items in [Monitor mode].

For details, refer to [8. 1. 1].

6. 34. 7 Holding display in [Standard mode]

<F709: Hold function of standard mode>



■ Function

The display in [Standard mode] can be held.

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F709	Hold function of standard mode	0: Real time 1: Peak hold 2: Minimum hold	0

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■ Selecting a setting value

0: Real time

The contents selected with <F710: Standard mode display> are displayed.

1: Peak hold

2: Minimum hold

For peak hold values and minimum hold values, the maximum/minimum values in each operation cycle are displayed.

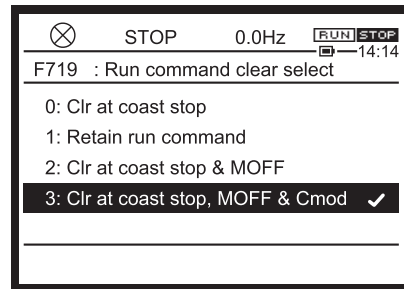
- When the motor is at a standstill, the values monitored last are held as they were until the motor is started the next time.
- The maximum and minimum values monitored after power is on are always displayed whether the motor is running or at a standstill.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 34. 8 Clearing run command

<F719: Run command clear select>



■ Function

This parameter is used to select whether the run command is retained or cleared when the following events occur during panel run or RS485 communication run.

- Coast stop with standby function (ST) is off (OFF display)
- Coast stop with coast command function (FRR) is on (OFF display)
- Power circuit undervoltage (MOFF) alarm

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F719	Run command clear select	0: Clear at coast stop. Retain when MOFF occurs and CMOd is changed. 1: Retain run command. 2: Clear at coast stop and at MOFF. Retain when CMOd is changed. 3: Clear at coast stop, at MOFF and when CMOd is changed.	2

6

■ Difference between the settings

<F719> setting value	Coast stop	When power circuit undervoltage (MOFF) alarm occurred	When <CMOd> is changed
0	Run command clear	Retain run command	
1	Retain run command		
2	Run command clear		Retain run command
3	Run command clear		



Important

- If "PrA" alarm occurs when STO activated, run command is cleared regardless of the <F719> setting.

Retain run command.

Inverter restarts when coast stop is cleared after its occurrence.

Inverter restarts when power is supplied again when the power circuit undervoltage (MOFF) alarm occurs.

Run command clear

Inverter does not restart after coast stop or occurrence of the power circuit undervoltage (MOFF) alarm.

Press the [RUN] key to operate it again in panel run. Turn on the run command in RS485 communication run.

■ Setting example of parameters of input terminals

Set necessary function to the unused input terminal. For details, refer to [7. 2. 1].

"6: Standby"

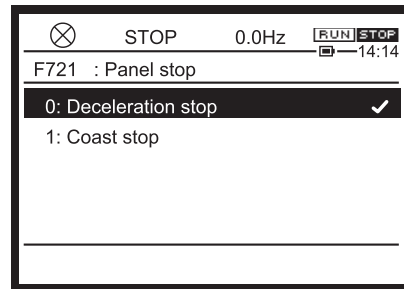
"96: Coast stop"

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- <CMod: Run command select> -> Refer to [5. 2. 1]
- Details of operation by external signals -> Refer to Chapter 7

6. 34. 9 Selecting panel stop pattern

<F721: Panel stop>



■ Function

This parameter is used to select a panel stop pattern by pressing the [STOP] key on the operation panel from Deceleration stop or Coast stop.

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F721	Panel stop	0: Deceleration stop 1: Coast stop	0

6

■ Selecting a setting value

0: Deceleration stop

The motor decelerate to a stop in the deceleration time set with <dEC: Deceleration time 1>.

1: Coast stop

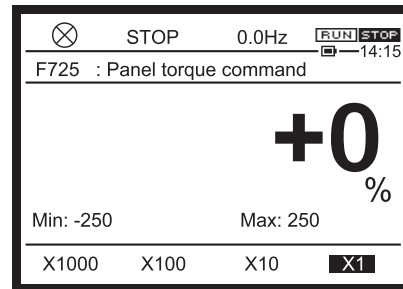
The inverter cuts off power supply to the motor. The motor comes to a stop after coasting for a while. Depending on the load, the motor may keep running for a longer time.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- <dEC: Deceleration time 1> -> Refer to [5. 2. 4]

6. 34. 10 Setting torque command value in panel run

<F725: Panel torque command>



■ Function

This parameter is used to set a torque command value when torque control is performed in panel run.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F725	Panel torque command	-250 to +250	%	0

■ Guideline for the setting

<F725: Panel torque command> is enabled only when <F420: Torque command select> is "12" and acts as command value(%).

For details, refer to torque control (E6582106).

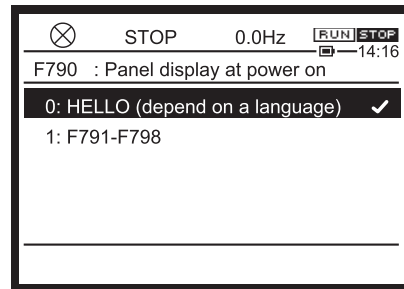
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

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6. 34. 11 Selecting panel display at power on

- <F790: Panel display at power on>
- <F791: 1st and 2nd characters of F790>
- <F792: 3rd and 4th characters of F790>
- <F793: 5th and 6th characters of F790>
- <F794: 7th and 8th characters of F790>
- <F795: 9th and 10th characters of F790>
- <F796: 11th and 12th characters of F790>
- <F797: 13th and 14th characters of F790>
- <F798: 15th and 16th characters of F790>



■ Function

These parameters allow you to change the characters on panel display at power on.

By default setting, "HELLO" is displayed, but the word changes depending on the language selection. (The word equivalent of "Hello" for each language is displayed.)

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F790	Panel display at power on	0: HELLO (depending on language selection) 1: F791 - F798 2, 3: -	0
F791	1st and 2nd characters of F790	0-FFFF	2d2d
F792	3rd and 4th characters of F790	0-FFFF	2d2d
F793	5th and 6th characters of F790	0-FFFF	2d2d
F794	7th and 8th characters of F790	0-FFFF	2d2d
F795	9th and 10th characters of F790	0-FFFF	2d2d
F796	11th and 12th characters of F790	0-FFFF	2d2d
F797	13th and 14th characters of F790	0-FFFF	2d2d
F798	15th and 16th characters of F790	0-FFFF	2d2d

■ Guideline for the setting

To display characters other than "HELLO", set <F790> to "1" and set the characters Changing variation steps of panel display displayed with <F791> to <F798>.

Refer to "ASCII LED" of RS485 Communication Function Instruction Manual (E6582143) for setting of characters and set by hex number.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6

6. 35 Trace function

<F740: Trace>

<F741: Trace cycle>

<F742: Trace data 1>

<F743: Trace data 2>

<F744: Trace data 3>

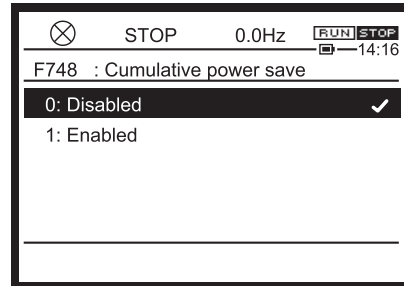
<F745: Trace data 4>

For details, refer to Trace Function Instruction Manual (E6582134).

6. 36 Store cumulative power

<F748: Cumulative power save>

<F749: Cumulative power unit>



■ Function

At the main power off, the cumulative power can be stored, or the unit of the cumulative power can be selected.

Cumulative power can be monitored as monitor number 20 (input), 21 (output).

The parameter setting in detail is referred to section 8. 1. 1.

6

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F748	Cumulative power save	0: Disabled 1: Enabled	0
F749	Cumulative power unit	0: 1.0=1 kWh 1: 1.0=10 kWh 2: 1.0=100 kWh 3: 1.0=1000 kWh 4: 1.0=10000 kWh 5: 1.0=100000 kWh	*1

*1 Depending on capacity. For details, refer to [11. 6].

Memo

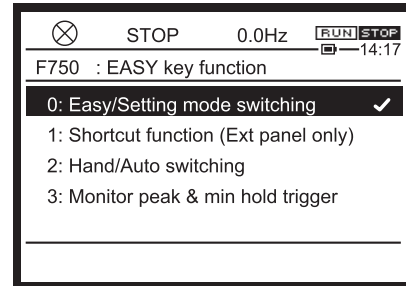
- Cumulative power monitor can be cleared by the signal to the input terminal. Assign "74: Cumulative power monitor clear" to the unused input terminal. For details, refer to [7. 2. 1].
- When monitor of cumulative power is saturated, change the value of F749.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- Details on operation by external signals -> Refer to [Chapter 7].

6. 37 Select EASY key function

<F750: EASY key function>
LED extension panel option



■ Function

This parameter is valid when the [EASY] key exists (extension panel, etc.)

Since the operation panel of this inverter has no [EASY] key, values other than "0", "2" are invalid even if they are set with <F750>.

When the [EASY] key exists, the following four functions can be selected.

- [Easy mode]/[Setting mode] switching
- Shortcut key function
- Hand/Auto switching
- Monitor peak and minimum hold trigger

For options such as the extension panel, refer to [10. 3].

■ Parameter setting

Title	Parameter name	Adjustment range	Default setting
F750	EASY key function	0: Easy/Setting mode switching 1: Shortcut function (Extension panel only) 2: Hand/Auto switching 3: Monitor peak and minimum hold trigger	0

■ Difference between the settings

0: Easy/Setting mode switching

When you press the [EASY] key while the inverter is stopped, the [Setting mode] and [Easy mode] can be switched.

In the default setting, the [Setting mode] is set at the time of power on.

The display of parameter setting varies depending on the mode. For details, refer to [4. 2. 1].

1: Shortcut function (Extension panel only)

Parameters whose settings are frequently changed can be registered as shortcuts so that they can be read out easily with one operation.

Shortcuts are valid only in [Standard mode]

After setting <F750: EASY key function> to "1", read the setting value of the parameter to be stored and press the [EASY] key for two seconds or more. Now shortcut registration is complete.

To read out the parameter, press the [EASY] key.

2: Hand/Auto switching

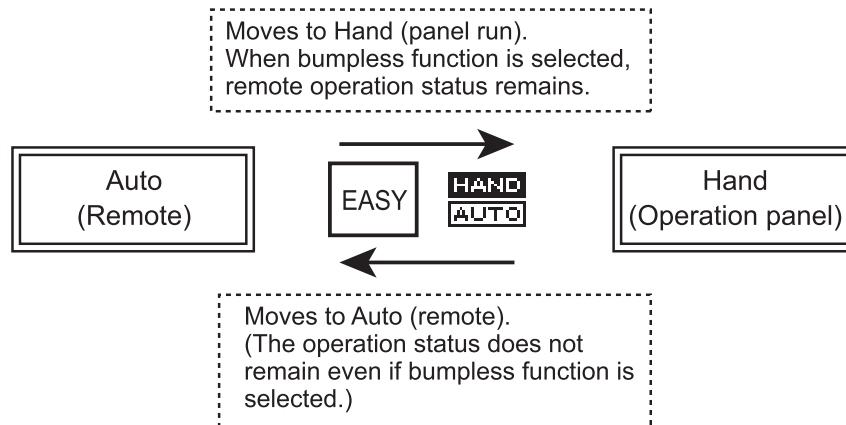
You can switch manual (operation panel) and automatic (remote) easily.

After setting <F750: EASY key function> to "2", switch the mode with the [EASY] key.

When <F295: Bumpless> is set to "1: Enabled", the mode can be switched even during run.

In manual, the [EASY] key lamp or  is lit .

In automatic, the inverter is operated with the operation method selected with <CMOd: Run command select>, <FMOd: Frequency command select 1>, etc.



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Memo

- Note that when you set <F750> to "0" in manual, the panel operation status remains and the setting is different from the one with <CMOd: Run command select>.

3: Monitor peak and minimum hold trigger

Set the peak hold and minimum hold triggers of <F709: Hold function of standard mode> with the [EASY] key.

The measurement of the minimum and maximum values set for <F709> starts at the instant when you press the [EASY] key after setting <F750: EASY key function> to "3".

The peak hold and minimum hold values are displayed in absolute values.

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]
- <F295: Bumpless> of parameter -> Refer to [6. 13]
- <F709: Hold function of standard mode> of parameter -> Refer to [6. 34. 7]

6. 38 Communication functions

Use the communication and monitor functions in communication run using RS485 communication and various optional open networks.

6. 38. 1 Setting communication functions

! WARNING



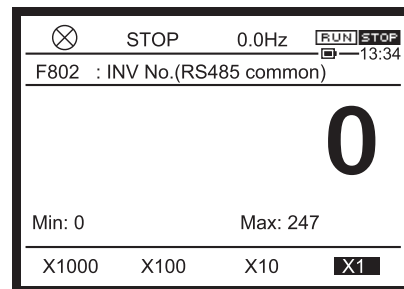
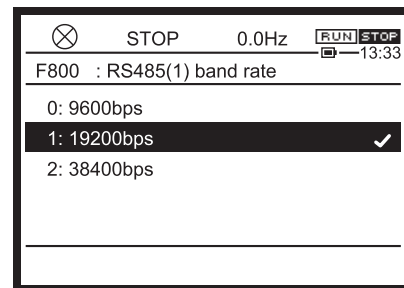
Mandatory
action

- Set the parameter Communication time-out.
If the parameter is not properly set, the inverter cannot be stopped immediately and this will result in injury and accidents.
- Install an emergency stop device and an interlock that are configured in accordance with the system specifications.
If the inverter cannot be stopped immediately via communication or the extension panel, this will result in injury and accidents.

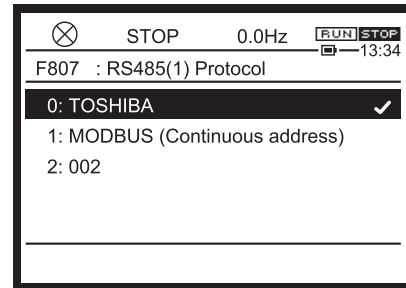
For details, refer to RS485 Communication Function Instruction Manual (E6582143).

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- <F800: RS485 (1) baud rate>
- <F801: RS485 (1) parity>
- <F802: Inverter number (RS485 common)>
- <F803: RS485 (1) time-out time>
- <F804: RS485 (1) time-out operation>
- <F805: RS485 (1) transmission wait time>
- <F806: RS485 (1) inverter to inverter communication>
- <F807: RS485 (1) protocol>
- <F808: RS485 (1) time-out detection>
- <F809: Operation panel connection priority>
- <F810: Communication frequency point select>
- <F811: Communication point 1 input value>
- <F812: Communication point 1 frequency>
- <F813: Communication point 2 input value>
- <F814: Communication point 2 frequency>
- <F820: RS485 (2) baud rate>
- <F821: RS485 (2) parity>
- <F823: RS485 (2) time-out time>
- <F824: RS485 (2) time-out operation>
- <F825: RS485 (2) transmission wait time>
- <F826: RS485 (2) inverter to inverter communication>



- <F827: RS485 (2) protocol>
- <F828: RS485 (2) time-out detection>
- <F829: RS485 (2) wiring type>
- <F830: MODBUS continuous address>
- <F856: Motor pole number for communication>
- <F870: Block write data 1>
- <F871: Block write data 2>
- <F875: Block read data 1>
- <F876: Block read data 2>
- <F877: Block read data 3>
- <F878: Block read data 4>
- <F879: Block read data 5>
- <F899: Communication option reset>



■ Function

RS485 communication is built-in as standard.

It can be connected to the host to create a network for transmitting data between multiple inverters.

An inverter-to-inverter communication function is also available.

6

Communication function

1) Computer-linking functions

The following functions are enabled by data communication between the computer and inverter.

- Monitoring inverter status (such as the output frequency, current, and voltage)
- Sending Run/Stop and other control commands to the inverter
- Reading, editing and writing inverter parameter settings

2) Inverter-to-inverter communication function

This function allows you to set up a network that makes it possible to carry out proportional operation of multiple inverters. A host computer is not required.

One inverter serves as a leader and sends data selected with the parameter to other inverters that are followers in the same network. By using this function, you can configure a network for easy synchronized operation and proportional operation (setting of point frequency).

Time-out

This is a function to detect cable disconnection during communication.

When data is not sent even once to the inverter during a user-defined period of time, an inverter trip ("Err5" is displayed on the panel) or an alarm("t" is blinking) is output.

Broadcast communication

This is a function used to send a command (data write) to multiple inverters with single communication.

Communication protocol

Toshiba inverter protocol and a part of Modbus RTU protocol are supported.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Unit	Default setting
F800	RS485 (1) baud rate *1	0: 9600 bps 1: 19200 bps 2: 38400 bps		1
F801	RS485 (1) parity *1	0: Disabled 1: Even parity 2: Odd parity		1
F802	Inverter number (RS485 common)	0 - 247		0
F803	RS485 (1) time-out time *2	0.0: Disabled 0.1 - 100.0	s	0.0
F804	RS485 (1) time-out operation *2	1: Continue running 2, 3: - 4: Trip 5: - 6: Trip after deceleration stop		0
F805	RS485 (1) transmission wait time	0.00 - 2.00	s	0.00
F806	RS485 (1) inverter to inverter communication *1	0: Follower (0Hz command when Leader fails) 1: Follower (continue running when Leader fails) 2: Follower (emergency off when Leader fails) 3: Leader (transmit frequency command) 4: Leader (transmit output frequency signal) 5: Leader (transmit torque command) 6: Leader (transmit output torque command)		0
F807	RS485 (1) protocol	0: TOSHIBA 1: MODBUS		0
F808	RS485 (1) time-out detection	0: Always 1: Run command and frequency command by communication are enabled. 2: During run by communication		1
F809	Operation panel connection priority *3	0: By the parameter setting 1: Connect to connector 1 2: Connect to connector 2		1
F810	Communication frequency point select	0: Disabled 1: RS485 (1) 2: RS485 (2) 3: Communication option 4: Embedded Ethernet		0
F811	Communication point 1 input value	0-100	%	0
F812	Communication point 1 frequency	0.0-FH	Hz	0.0
F813	Communication point 2 input value	0-100	%	100

Title	Parameter name	Adjustment range	Unit	Default setting
F814	Communication point 2 frequency	0.0-FH	Hz	50.0/60.0 *4
F820	RS485 (2) baud rate *1	0: 9600 bps 1: 19200 bps 2: 38400 bps		1
F821	RS485 (2) parity *1	0: Disabled 1: Even parity 2: Odd parity		1
F823	RS485 (2) time-out time *2	0.0: Disabled 0.1 - 100.0	s	0.0
F824	RS485 (2) time-out operation *2	1: Continue running 2, 3: - 4: Trip 5: - 6: Trip after Deceleration stop		0
F825	RS485 (2) transmission wait time	0.00 - 2.00	s	0.00
F826	RS485 (2) inverter to inverter communication *1	0: Follower (0Hz command when Leader fails) 1: Follower (continue running when Leader fails) 2: Follower (emergency off when Leader fails) 3: Leader (transmit frequency command) 4: Leader (transmit output frequency signal) 5: Leader (transmit torque command) 6: Leader (transmit output torque command)		0
F827	RS485 (2) protocol	0: TOSHIBA 1: MODBUS		0
F828	RS485 (2) time-out detection	0: Always 1: Run command and frequency command by communication are enabled. 2: During run by communication		1
F829	RS485 (2) wiring type	0: 2-wire 1: 4-wire		0
F830	MODBUS continuous address	0: Disabled 1: Enabled		0
F856	Motor pole number for communication	1: 2 pole 2: 4 pole 3: 6 pole 4: 8 pole 5: 10 pole 6: 12 pole 7: 14 pole 8: 16 pole		2
F870	Block write data 1	0: Disabled 1: Communication command 1		0
F871	Block write data 2	2: Communication command 2 3: Frequency command 4: TB output 5: Analog output 6: Speed command by communication		0

Title	Parameter name	Adjustment range	Unit	Default setting
F875	Block read data 1	0: Disabled 1: Status information 2: Output frequency 3: Output current 4: Output voltage 5: Alarm information 6: PID feedback value 7: Input terminal monitor 8: Output terminal monitor 9: Terminal RR monitor 10: Terminal RX monitor 11: Terminal II monitor 12: Input voltage (DC detection) 13: Speed feedback frequency 14: Torque 15: My function output monitor 1 16: My function output monitor 2 17: My function output monitor 3 18: My function output monitor 4 19: Free memorandum 20: Motor speed 21: Input power 22: Output power 23: Trip information		0
F876	Block read data 2			0
F877	Block read data 3			0
F878	Block read data 4			0
F879	Block read data 5			0
F899	Communication option reset	0: - 1: Reset option and inverter		0

*1 Valid after the setting is changed and the power is turned off and on again.

*2 The setting contents are as follows.

- Disabled: The inverter does not trip even if a communication error occurs.
- Trip: The inverter trips when communication time-over occurs, and "Err5" is displayed.
- Alarm: When communication time-over occurs, an alarm can be output from the output terminal. Assign the output terminal function "78" (RS485 communication time-out) (79 is inversion output) to the output terminal.

*3 When using RS485 communication, set <F809>="0".

*4 Depending on the setup menu. Refer to [11. 10].

■ **Communication option**

Refer to [10. 3. 5] and [10. 3. 6] for options connected to RS485 communication connectors.

To use these options, set <F805: RS485 (1) transmission wait time > to "0.00".

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 38. 2 Using RS485 communication

■ Operation by RS485 communication

To run/stop the inverter by RS485 communication, select "3: RS485 communication (connector 1)" or "4: RS485 communication (connector 2)" with <CMOd: Run command select>.

To issue frequency commands by RS485 communication, select "21: RS485 communication (connector 1)" or "22: RS485 communication (connector 2)" with <FMd: Frequency command select 1>.

Run commands and frequency commands by communication have priority over those from the operation panel and terminals. Therefore, run commands and frequency commands from communication can be enabled regardless of the settings of <CMOd> and <FMd>.

However, when "48" (Communication priority cancel) of input terminal function selection is assigned to the input terminal and a signal is input externally, perform panel run with the setting of <CMOd> and <FMd>.

When "2: Hand/Auto switching" is selected with <F750: EASY key function>, you can switch the operation panel run and communication run with the [HAND/AUTO] key of the operation panel.

■ Transmission specifications

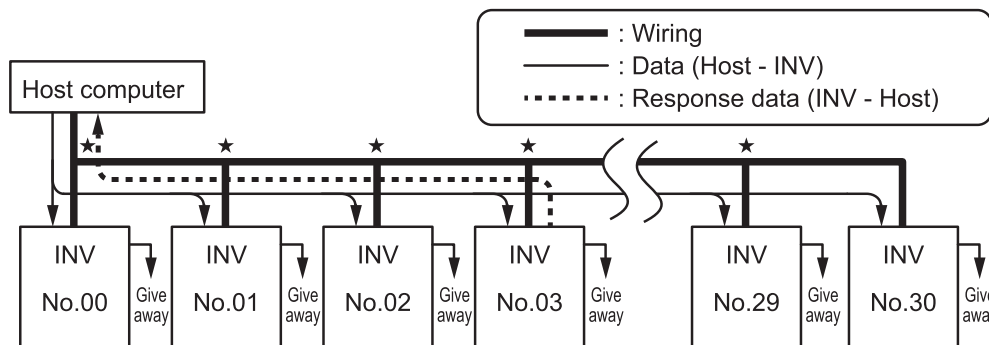
Item	Specifications	
Communication protocol	TOSHIBA inverter protocol	MODBUS-RTU protocol
Interface	RS485 compliant	
Transmission scheme	Half duplex [Serial bus type (Line terminations resistor necessary at both ends of system)]	
Wiring	2-wire	
Transmission distance	500 m max. (total length)	
Connection terminals	32 max. (including upper host computer) Inverters connected in the system: 32 max.	
Synchronization scheme	Start-stop synchronization	
Communication baud rate	9600 bps - 38.4 kbps	
Character transmission	ASCII mode: JIS X0201 8-bit (ASCII) Binary mode: Binary codes fixed to 8 bits	Binary codes fixed to 8 bits
Error detecting scheme 1	Parity: Even/Odd/Non parity (selectable using a parameter)	
Error detecting scheme 2	Checksum	CRC
Stop bit length	Received by inverter: 1bit/Sent by inverter: 2 bits	
Order of bit transmission format	Least significant bit transmitted first	
Character transmission format	11-bit characters (Stop bit =1, with parity)	
Inverter Number	ASCII mode: 0 - 99 Binary mode: 0 - 63 (3Fh)	1 - 247

Item	Specifications	
Broadcast communication	Inverter Number should be set to ASCII mode: ** (*? or ??* (?=0-9) is available) Binary mode: 255 (0FFh)	Inverter Number should be set to 0
Frame length	Variable	
Error correction	Disabled	
Response monitoring	Disabled	
Other	Inverter operation at communication time-over: Select from trip/alarm/none - When alarm is selected, an alarm is output from the output terminal. - When trip is selected, "Err5" blinks on the panel.	

■ **Connection example when using computer link function**

1) Independent communication

Here is a case where an operation frequency command is sent from the host computer to inverter No.3.



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INV: Inverter

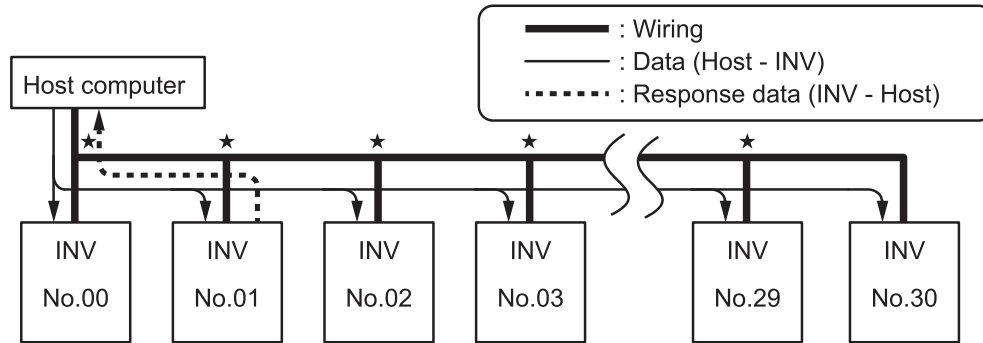
Give away: Only the inverter with the selected inverter number conducts data processing. All other inverters, even if they have received the data, give it away and stand by to receive the next data.

★ : Use the terminal block, etc. to branch the cable.

1. Data is sent from the host computer.
2. Data from the computer is received at each inverter, and the inverter numbers are checked.
3. The command is decoded and processed only by the inverter with the selected inverter number.
4. The selected inverter responds by sending the processing results, together with its own inverter number, to the host computer.
5. As a result, only the selected inverter starts operating in accordance with the operation frequency command sent by the host computer.

2) Broadcast communication

Here is a case where a frequency command is sent via a broadcast from the host computer.



INV: Inverter

★ : Use the terminal block, etc. to branch the cable.

1. Data is sent from the host computer.
2. Data from the computer is received at each inverter and the inverter numbers are checked.
3. When "*" is added to the position of an inverter number, it is judged a broadcast. The command is decoded and processed.
4. To prevent data conflicts, only inverters where "*" is overwritten to "0" can reply with data to the host computer.
5. As a result, all inverters are operating with the broadcast operation frequency command.

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Specify inverter numbers by group for group broadcasts.

This is a function only for ASCII mode. For parity mode, refer to RS485 Communications Function Instruction Manual (E6582143).

For example, when "*1" is set, inverters "01", "02", "03", "04", ..., "09" can be broadcast to.

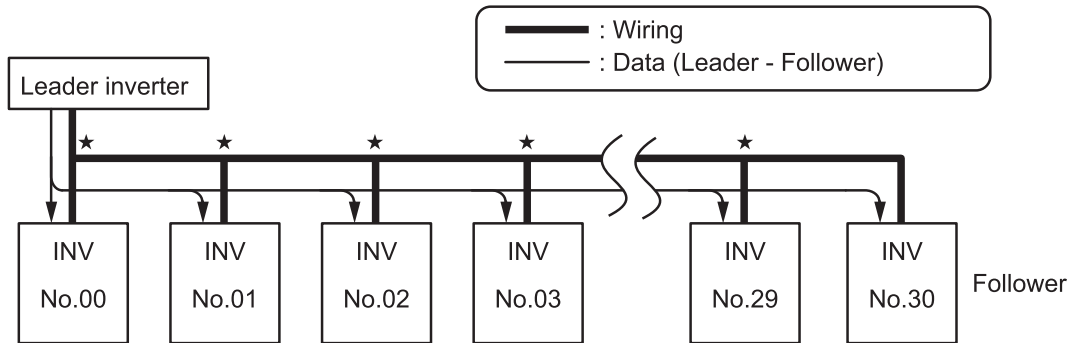
In this case, the inverter specified as "01" can reply.

■ Connection example of inverter-to-inverter communication

One inverter is a leader and the other inverters are followers.

Here is a case where all follower inverters connected operate at the same frequency as the leader inverter.

No frequency point is set.



INV: Inverter

★ : Use the terminal block, etc. to branch the cable.

1. The leader inverter transmits frequency command data to its follower inverters.

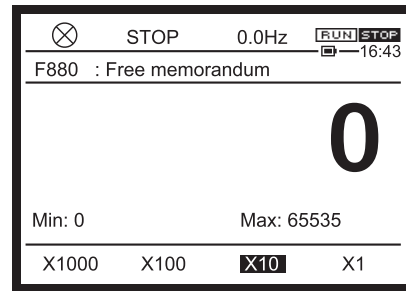
2. The follower inverters calculate a frequency reference from the data received and save the frequency calculated.
3. As a result, all follower inverters operate at the same frequency as the leader inverter.

The leader inverter always sends frequency command data to its follower inverters.

The follower inverters are always on standby so that they can receive an frequency command from the leader inverter at any time.

6. 38. 3 Input numbers as memorandum

<F880: Free memorandum>



■ **Function**

You can enter the identification number, etc. for easier management and maintenance of the inverter.

■ **Parameter setting**

Title	Parameter name	Adjustment range	Default setting
F880	Free memorandum	0 - 65535	0

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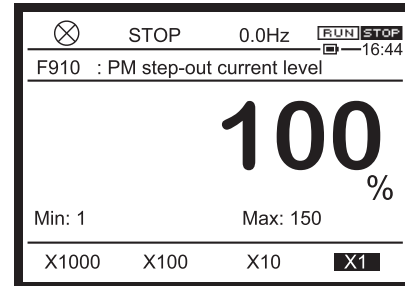
Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3].

6. 39 Step-out detection of PM motor

<F910: PM step-out detection current level>

<F911: PM step-out detection time>



■ Function

If the PM motor steps out and if the exciting current increases (it increases in such a case) and remains over the value set by <F910: PM step-out detection current level > for the period of time set by <F911: PM step-out detection time>, the inverter will judge the motor to be stepping out and trip it.

At that time, the trip message "SOUT" is displayed.

■ Parameter setting

Title	Parameter name	Adjustment range	Unit	Default setting
F910	PM step-out detection current level	1 - 150	%	100
F911	PM step-out detection time	0.00: Disabled 0.01 - 2.55	s	0.00



Important

- When using an PM motor, consult your Toshiba distributor, since the inverter is not compatible with all types of PM motors.
- The inverter may fail to detect step-out in some cases, because it uses an electrical method to detect step-out. To avoid detection failures, you are recommended to install a mechanical step-out detector.

Memo

- For setting of PM motor parameter, refer to [6. 23. 2].

Reference

- How to operate the operation panel -> Refer to [3. 1. 1].
- How to switch display mode on the operation panel -> Refer to [3. 1. 2].
- Procedure to change parameter setting -> Refer to [4. 2. 3]

6. 40 Traverse function

<F980: Traverse operation>

<F981: Traverse Acc time>

<F982: Traverse Dec time>

<F983: Traverse step>

<F984: Traverse jump step>

For details, refer to Traverse Function Instruction Manual (E6582100).

6.41 My function

My function <A800> - <A847>, <A900> - <A982>

For details, refer to My Function Instruction Manual (E6582114).

7

Operating using external signals

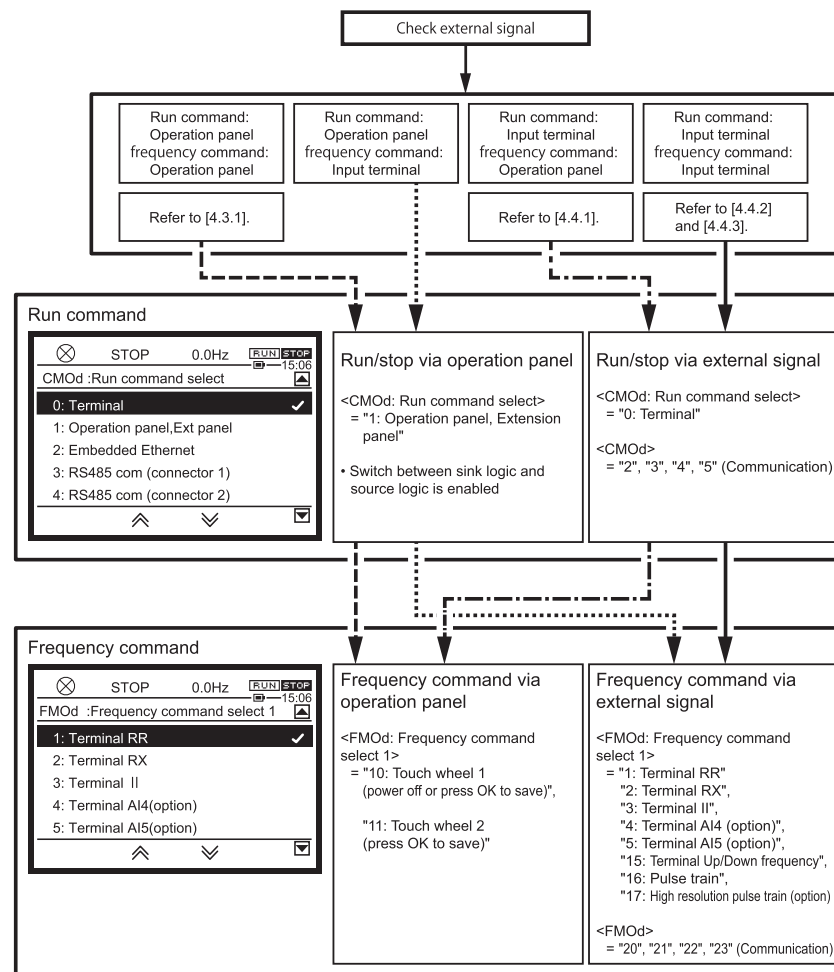
I

II

You can operate the inverter by inputting external signals to the control terminals. The run commands are input to the digital input terminals by the ON/OFF signals. The frequency commands are input to the analog input terminals by the voltage signals (potentiometer, etc.), or the current signals. This chapter explains how to set the parameters required to operate the inverter using external signals and how to assign the functions to the terminals.

7.1 How to externally operate the inverter

You can operate the inverter by external signals. The parameter setting items vary depending on the operation method. Before setting the parameters, be sure to check the operation method (how to input run commands and frequency commands).



For operation by communication, refer to "Communication Function Instruction Manual" (E6582143) and [6. 38].

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7.2 Applied operation by I/O signals

You can assign the functions to the digital input terminals. The assigned functions can be switched for operation.

Also, you can assign the functions to the digital output terminals and the relay logic output terminals to output signals to external equipment.

For the digital terminals, sink logic and source logic can be switched with the slide switch [SW1]. For details, refer to [2. 3. 5].

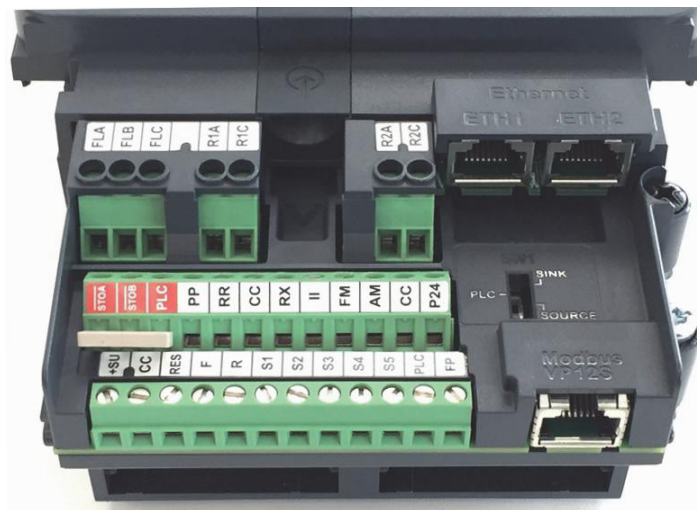
7.2.1 Setting the functions to the input terminals (for sink logic)

Signals are input to the digital input terminals from an external programmable controller. The signals are used for operating the inverter and switching the functions.

The digital input terminal functions can be selected from a variety of functions, thus allowing flexible compatibility with system design.

■ Configuration of the control terminal block

7



■ Function setting for the digital input terminals

Terminal symbol	Title	Parameter name	Adjustment range	Default setting
F	F111	Terminal F function 1	0 - 203 *1	2
	F151	Terminal F function 2		0
	F155	Terminal F function 3		0
R	F112	Terminal R function 1	0 - 203 *1	4
	F152	Terminal R function 2		0
	F156	Terminal R function 3		0

Terminal symbol	Title	Parameter name	Adjustment range	Default setting
RES	F113	Terminal RES function 1	0 - 203 *1	8
	F153	Terminal RES function 2		0
	F157	Terminal RES function 3		0
S1	F114	Terminal S1 function 1	0 - 203 *1	10
	F154	Terminal S1 function 2		0
	F158	Terminal S1 function 3		0
S2	F115	Terminal S2 function	0 - 203	12
S3	F116	Terminal S3 function	0 - 203	14
S4	F117	Terminal S4 function *2	0 - 203	16
	F146	Terminal S4 input select	0: Digital input 1: Pulse train input 2: PG input	0
S5	F118	Terminal S5 function *3	0 - 203	118
	F147	Terminal S5 input select	0: Digital input 1: Pulse train input 2: PG input	0
DI11	F119	Terminal DI11 function *4	0 - 203	0
DI12	F120	Terminal DI12 function *4	0 - 203	0
DI13	F121	Terminal DI13 function *4	0 - 203	0
DI14	F122	Terminal DI14 function *4	0 - 203	0
DI15	F123	Terminal DI15 function *4	0 - 203	0
DI16	F124	Terminal DI16 function *4	0 - 203	0
F	F140	Terminal F response time	1 - 1000 (ms)	1 *5
R	F141	Terminal R response time	1 - 1000 (ms)	1 *5
RES	F142	Terminal RES response time	1 - 1000 (ms)	1 *5
S1	F143	Terminal S1 response time	1 - 1000 (ms)	1 *5
S2 - S5	F144	Terminal S2-S5 response time	1 - 1000 (ms)	1 *5
DI11-DI16	F145	Terminal DI11-DI16 response time *4	1 - 1000 (ms)	1 *5

*1 If a variety of functions are assigned to a terminal, the assigned functions will be simultaneously enabled.

*2 When you use the terminal [S4] as digital input, set <F146: Terminal S4 input select> = "0: Digital input".

*3 When you use the terminal [S5] as digital input, set <F147: Terminal S5 input select> = "0: Digital input".

*4 Indicated optional terminals on IO extension 1 (ETB013Z), refer to E6582128.

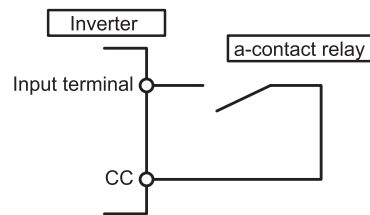
*5 If stable operation cannot be achieved because of noise of the frequency setting circuit, etc., increase the values for <F140: Terminal F response time> to <F145: Terminal DI11-DI16 response time>.

Memo

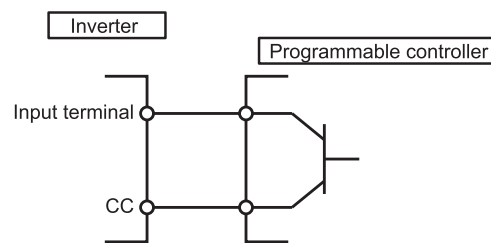
- To always enable the functions, assign the functions to <F110: Always active function 1>, <F127: Always active function 2>, and <F128: Always active function 3>.

■ Connecting methods

1) A contact input (for sink logic)



2) Transistor output connection (for sink logic)



You can connect the input terminal and the terminal [CC] (common) to the programmable controller output (non-logic switch) for control purposes. Use this connecting method for forward/reverse run, or preset speed operation, etc.

■ Usage example: 3-wire operation (one-push operation)

The use of the 3-wire operation function allows the one-push signal (reset logic signal) to be self-held during operation. No external sequence circuit is needed.

To perform 3-wire operation, make setting as shown below:

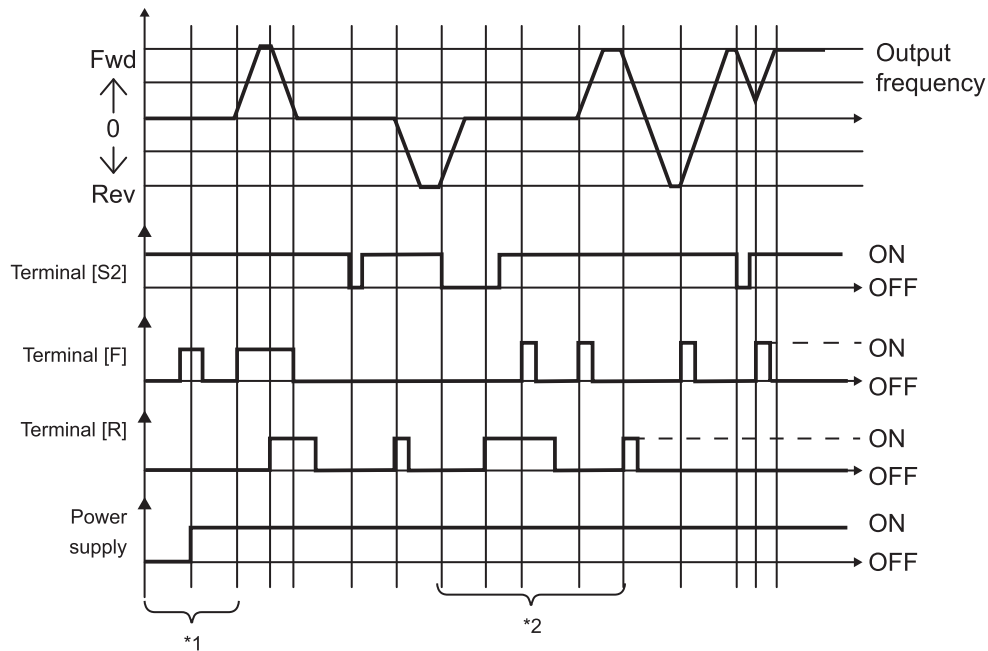
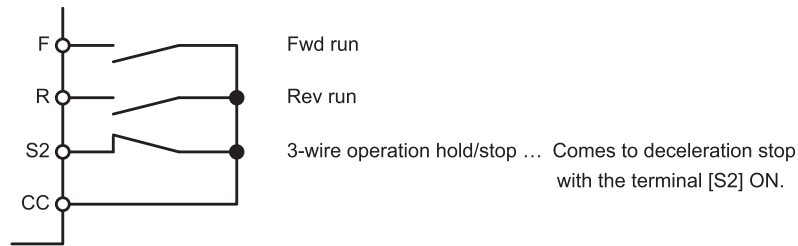
- <F110: Always active function 1> = "6: Standby"
- <CMOd: Run command select> = "0: Terminal"
- <F111: Terminal F function 1> = "2: Fwd run" (default setting)
- <F112: Terminal R function 1> = "4: Rev run"(default setting)

Also, assign "50: 3-wire operation hold/stop" ("51" for inversion input) to the input terminal.

The following shows an example for assignment to the terminal [S2].

- <F115: Terminal S2 function > = "50"

For sink logic



*1 -> If each terminal is turned ON before the power is turned ON, it is very dangerous because sudden movement occurs. Therefore, the input terminal ON signal is ignored at power on. After power on, turn ON the input terminal again.

*2 -> Turn ON 3-wire operation hold/stop(HD), and then Fwd run (F) or Rev run (R). Even if Fwd run or Rev run is turned ON while 3-wire operation hold/stop is OFF, the signal will be ignored. Even if 3-wire operation hold/stop is turned ON while Rev run is ON, operation will not occur. Even if Fwd run is turned ON in that state, operation will not occur. Turn OFF Fwd run and Rev run, and then turn ON Fwd run or Rev run.

The input terminal function of 3-wire operation hold/stop is held only for Fwd run (F) and Rev run (R). Keep in mind that the other functions are not held when Fwd run or Rev run is used in combination of any other function. For example, when Fwd run and Preset speed switching 1 (SS1) are assigned, Fwd run is held, but not Preset speed switching 1.

Memo

- If the jog run command is input during 3-wire operation, operation will stop.
- Keep in mind that DC braking continues even if a run command is input during DC braking.

■ List of the digital input terminal functions

Setting value		Input terminal function	Setting value		Input terminal function
Positive logic	Negative logic (Inverse)		Positive logic	Negative logic (Inverse)	
0	1	No function	84	85	Terminal R2 output hold
2	3	Fwd run	88	89	Terminal Up frequency *1
4	5	Rev run	90	91	Terminal Down frequency *1
6	7	Standby	92	93	Terminal Up, Down frequency clear *1
8	9	Reset 1	94	95	Dancer correction OFF
10	11	Preset speed switching 1	96	97	Coast stop
12	13	Preset speed switching 2	98	99	Fwd/Rev
14	15	Preset speed switching 3	100	101	Run/Stop
16	17	Preset speed switching 4	102	103	Commercial power run switching
18	19	Jog run	104	105	FMOd/F207 priority switching
20	21	Emergency off	106	107	Terminal II priority
22	23	DC braking	108	109	Terminal operation priority
24	25	Acc/Dec switching 1	110	111	Parameter writing unlocked
26	27	Acc/Dec switching 2	112	113	Speed control/Torque control switching
28	29	V/f switching 1	114	115	External equipment counter
30	31	V/f switching 2	116	117	PID 1, 2 switching
32	33	Stall prevention switching/Torque limit switching 1	118	119	Preset speed switching 5
34	35	Torque limit switching 2	120	121	Quick deceleration 1
36	37	PID control OFF	122	123	Quick deceleration 2
38	39	Pattern operation 1	124	125	Preliminary excitation
40	41	Pattern operation 2	126	127	Brake
42	43	Pattern operation continuation	130	131	Brake answerback
44	45	Pattern operation start	134	135	Traverse operation
46	47	External thermal trip	136	137	Rescue operation
48	49	Communication priority cancel	138	139	Pump control switching
50	51	3-wire operation hold/stop	140	141	Fwd slowdown
52	53	PID differential/integral reset	142	143	Fwd stop
54	55	PID plus/minus switching	144	145	Rev slowdown
56	57	Forced run	146	147	Rev stop

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Setting value		Input terminal function	Setting value		Input terminal function
Positive logic	Negative logic (Inverse)		Positive logic	Negative logic (Inverse)	
58	59	Fire speed run	148	149	Fwd/Rev slowdown
60	61	Dwell operation	150	151	Hit and stop clear
62	63	Synchronized Acc/Dec	152	153	No.2 motor switching
64	65	My function start	154	155	External PID3 enabled
66	67	Offline auto-tuning	156	157	External PID4 enabled
68	69	Speed control gain switching	158	159	Reset 2
70	71	Servo lock	162	163	External PID3 differential/integral reset
72	73	Simple positioning	164	165	External PID3 plus/minus switching
74	75	Cumulative power monitor clear	170	171	External PID4 differential/integral reset
76	77	Trace trigger	172	173	External PID4 plus/minus switching
78	79	Light-load high-speed operation inhibited	176	177	Pump control release
80	81	Terminal FP output hold	200	201	Parameter writing locked
82	83	Terminal R1 output hold	202	203	Parameter reading locked

*1 Enabled only for <FMOd: Frequency command select 1> = "15: Terminal Up/Down frequency".

The frequency command range is 0.0 to <FH: Maximum frequency>. The acceleration/deceleration time is the time set for <ACC: Acceleration time 1> and <dEC: Deceleration time 1> unless acceleration/deceleration switching is performed.

For details on the input terminal functions, refer to [11. 5].

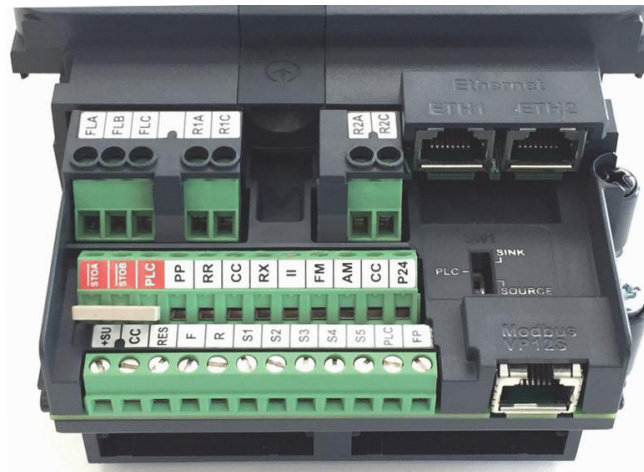
7. 2. 2 Setting the functions to the output terminals (for sink logic)

Signals are output to external equipment from the inverter.

You can select the functions for the digital output terminals and the relay logic output terminals from a variety of output terminal functions.

Two types of functions can be set for the terminals [FP] and [R1A]-[R1C]. In this case, output is possible when the two functions are simultaneously turned ON or either of the functions is turned ON.

■ Configuration of the control terminal block



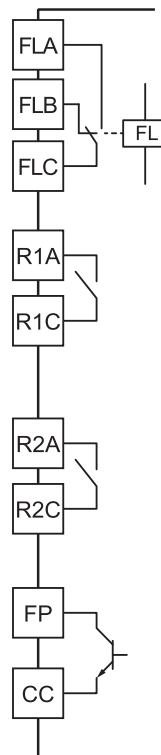
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■ Use conditions

Functions of the terminals
[FLA]-[FLB]-[FLC]:
Set in parameter <F132> *1

Functions of the terminals [R1A]-[R1C],
[R2A]-[R2C]:
Set in parameter <F130>, <F137> *1

Functions of the terminal [FP]:
Set in parameter <F131>, <F138> *1



*1 With relay contact output, chattering (momentary ON/OFF of contact) is generated by external factors of the vibration and the impact, etc. In particular, please set a filter of 10 ms or more, or timer for measures when connecting it directly to the input unit of the programmable controller. When connecting the programmable controller, use the terminal [FP] if possible.

■ Function setting for the output terminals

Terminal symbol	Title	Parameter name	Adjustment range	Default setting
FP	F130	Terminal FP function 1 *1	0 - 255	6
	F137	Terminal FP function 2 *1		255
	F669	Terminal FP switching	0: Digital output 1: Pulse train output	0
FLA-FLB-FLC	F132	Terminal FL function	0 - 255	10
R1A-R1C	F133	Terminal R1 function 1	0 - 255	4
	F138	Terminal R1 function 2		255
R2A-R2C	F134	Terminal R2 function	0 - 255	254
DQ11	F159	Terminal DQ11 function *2	0 - 255	254
DQ12	F160	Terminal DQ12 function *2	0 - 255	254
R4	F161	Terminal R4 function *2	0 - 255	254
R5	F162	Terminal R5 function *2	0 - 255	254
R6	F163	Terminal R6 function *2	0 - 255	254
R1	F135	Terminal R1 delay time	0.0 - 60.0 (s)	0.0
R2	F136	Terminal R2 delay time	0.0 - 60.0 (s)	0.0
FP R1A-R1C	F139	Terminal FP, R1 logic select	0: F130 and F137, F133 and F138 1: F130 and F137, F133 or F138 2: F130 or F137, F133 and F138 3: F130 or F137, F133 or F138	0

*1 When you use the terminal [FP] as digital input, set <F669: Terminal FP switching> = "0: Digital output".

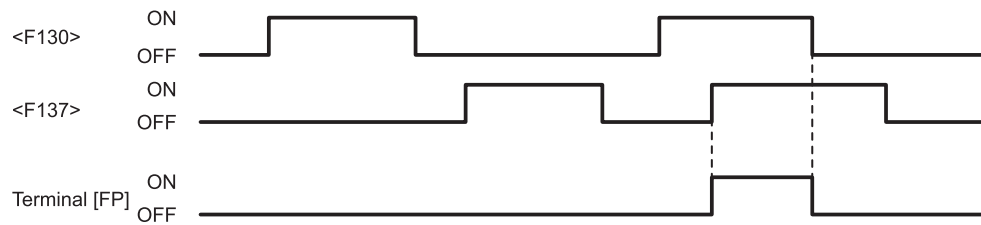
*2 Indicated optional terminals on IO extension 1 (ETB013Z) or IO extension 2 (ETB014Z), refer to E6582128 or E6582129.

■ Assigning two types of functions to a terminal

For the output terminals, you can assign two types of functions to the terminals [FP] and [R1A]-[R1C].

1) Logical product (AND): Signals are output when two types of functions are simultaneously turned ON.

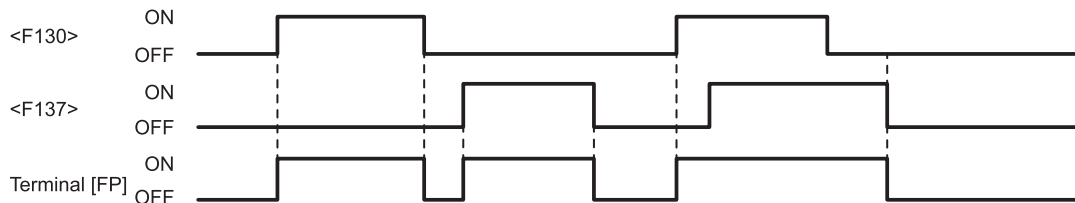
In case of the terminal [FP], when you set <F139: Terminal FP, R1 logic select> = "0" or "1", signals are output when the functions set for <F130: Terminal FP function 1> and <F137: Terminal FP function 2> are simultaneously turned ON.



In case of the terminals [R1A]-[R1C], when you set <F139> = "0" or "2", signals are output when the functions set for <F133: Terminal R1 function 1> and <F138: Terminal R1 function 2> are simultaneously turned ON.

2) Logical sum (OR): Signals are output when either of two functions is turned ON.

In case of the terminal [FP], when you set <F139: Terminal FP, R1 logic select> = "2" or "3", signals are output when either of the functions set for <F133: Terminal FP function 1> and <F137: Terminal FP function 2> is turned ON.



In case of the terminals [R1A]-[R1C], when you set <F139> = "1" or "3", signals are output when either of the functions set for <F133: Terminal R1 function 1> and <F138: Terminal R1 function 2> is turned ON.

■ Holding the signal output ON state (output hold function)

You can set the terminals [FP], [R1A]-[R1C], and [R2A]-[R2C] so that the ON state is held even after the condition is changed when a signal is once turned ON.

When a corresponding output terminal is turned ON while the input terminal where the output hold function is assigned is ON, the ON state is held.

Assign the following function numbers to any open input terminals.

For holding the output of the terminal [FP]: "80: Terminal FP output hold"

For holding the output of the terminal [R1A]: "82: Terminal R1 output hold"

For holding the output of the terminal [R2A]: "84: Terminal R2 output hold"

■ Usage example 1: Outputting running signals

The following shows examples for outputting running signals.

Running signals can be output from the terminals [R1A]-[R1C] as default setting.

- <F133: Terminal R1 function 1> = "4: Low-speed signal" (default setting)

- <F100: Low-speed signal output frequency> = "0.0" (Hz) (default setting)

For the output terminal function of "4: Low-speed signal", signals are output when the output frequency becomes the frequency set for <F100: Low-speed signal output frequency> or more. In case of <F100> = "0.0" (Hz), the signal is turned ON when the frequency is output. Therefore, you can use it as a running signal.

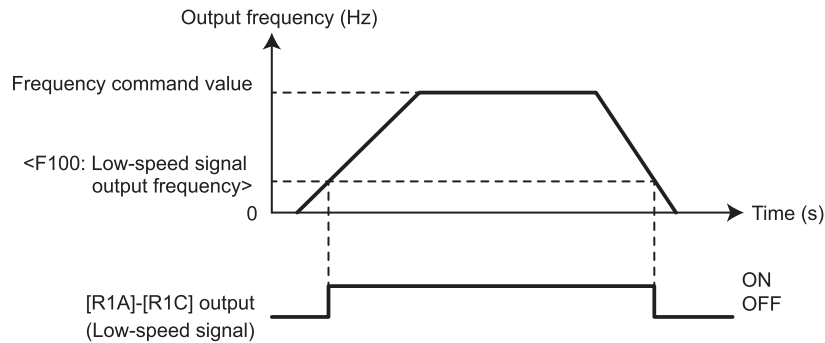
■ Usage example 2: Outputting braking signals

The following shows an example for outputting the excitation/release signals for the electromagnetic brake.

To output the braking signals from the terminals [R1A]-[R1C], make setting as follows:

- <F133: Terminal R1 function 1> = "4: Low-speed signal" (default setting)
- <F100: Low-speed signal output frequency> = "2.5" (Hz) (setting example)

Set <F100> to the value for the motor rated slip.



■ List of the digital output terminal functions

Setting value		Output terminal function	Setting value		Output terminal function
Positive logic	Negative logic (Inverse)		Positive logic	Negative logic (Inverse)	
0	1	Lower limit frequency (LL)	116	117	Failure signal 4
2	3	Upper limit frequency (UL)	118	119	Stop positioning completion
4	5	Low-speed signal	120	121	During sleep
6	7	Acc/Dec completed	122	123	During synchronized Acc/Dec
8	9	Specified frequency attainment	124	125	During traverse operation
10	11	Failure signal 1	126	127	During traverse Dec
12	13	Failure signal 2	128	129	Parts replacement alarm
14	15	Overcurrent (OC) pre-alarm	130	131	Overtorque (OT) pre-alarm
16	17	Inverter overload (OL1) pre-alarm	132	133	Frequency command 1/ Frequency command 2
18	19	Motor overload (OL2) pre-alarm	134	135	Failure signal 3
20	21	Overheat (OH) pre-alarm	136	137	Hand/Auto
22	23	Overvoltage (OP) pre-alarm	138	139	During forced run
24	25	Main circuit undervoltage (MOFF) alarm	140	141	During fire speed run
26	27	Undercurrent (UC) alarm	142	143	Undertorque alarm
28	29	Overtorque (OT) alarm	144	145	PID1, 2 frequency command agreement

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Setting value		Output terminal function	Setting value		Output terminal function
Positive logic	Negative logic (Inverse)		Positive logic	Negative logic (Inverse)	
30	31	Braking resistor overload (OLr) pre-alarm	150	151	PTC input pre-alarm
32	33	Emergency off trip	152	153	During Safe Torque Off (STO)
34	35	During retry	154	155	Analog input disconnecting alarm
36	37	Pattern operation end	156	157	Terminal F ON/OFF
38	39	PID deviation limit	158	159	Terminal R ON/OFF
40	41	Run/Stop	160	161	Cooling fan replacement alarm
42	43	Serious failure	162	163	Number of starting alarm
44	45	Slight failure	164	165	Light load detection 2
46	47	Commercial power/Inverter Switching 1	166	167	During Acc
48	49	Commercial power/Inverter Switching 2	168	169	During Dec
50	51	During cooling fan run	170	171	During constant speed run
52	53	During jog run	172	173	During DC braking
54	55	During terminal run	174	175	During hit and stop
56	57	Cumulative run time alarm	176	177	During run including servo lock
58	59	Communication option communication time-out	178	179	During servo lock
60	61	Fwd/Rev run	180	181	For input cumulative power
62	63	Ready for run 1	182	183	Shock monitoring alarm
64	65	Ready for run 2	184	185	Number of external equipment starting alarm
68	69	During brake	186	187	V/f switching status 1
70	71	During alarm or pre-alarm	188	189	V/f switching status 2
72	73	During Fwd speed limit	190	191	Cooling fan fault alarm
74	75	During Rev speed limit	192	193	Embedded Ethernet communication time-out
76	77	Inverter healthy output	194 - 201		Calendar 1 - 4
78	79	RS485 communication time-out	202	203	During PID2 control
92	93	Designated data bit 0	204	205	During External PID3 control
94	95	Designated data bit 1	206	207	External PID3 deviation limit
106	107	Light load detection 1	208	209	During External PID4 control
108	109	Heavy load detection	210	211	External PID4 deviation limit
110	111	During positive torque limit	212	213	Pump control

Setting value		Output terminal function	Setting value		Output terminal function
Positive logic	Negative logic (Inverse)		Positive logic	Negative logic (Inverse)	
112	113	During negative torque limit	222 - 253		My function output 1 - 16
114	115	For external relay of rush current suppression	254	255	254: Always OFF 255: Always ON

The setting items in the table are as follows:

- Alarm: Indicates an alarm output where the inverter or external equipment may be damaged if it continues.
- Pre-alarm: Indicates an alarm output almost at the trip level.

For positive logic

- "ON": Indicates that the digital output transistor or the relay is ON.
- "OFF": Indicates that the digital output transistor or the relay is OFF.

For negative logic

- "ON": Indicates that the digital output transistor or the relay is OFF.
- "OFF": Indicates that the digital output transistor or the relay is ON.

For details on the output terminal functions and the levels, refer to [11. 6].

7.3 Frequency commands by the analog signals

You can input voltage signals and current signals to the analog input terminals as a frequency command.

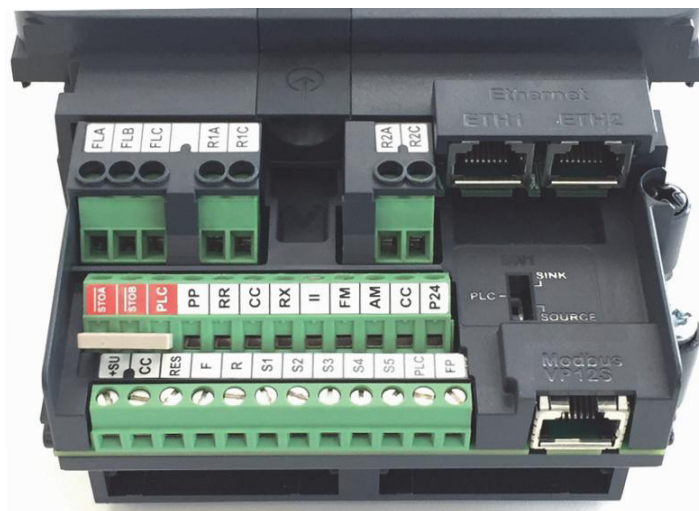
7.3.1 Inputting frequency commands by analog signals

You can select four types of analog signals as a frequency command signal.

- Potentiometer
- 0 - 10 Vdc
- 4(0) - 20 mAdc
- -10 to +10 Vdc

For how to fine adjust the analog signals and output frequencies, refer to [6. 6. 3].

■ Configuration of the control terminal block



■ Analog input terminal function settings

Terminal symbol	Title	Parameter name	Adjustment range	Default setting
RR	F201	RR point 1 input value	0 - 100 (%)	0
	F202	RR point 1 frequency	0.0 - 590.0 (Hz)	0.0
	F203	RR point 2 input value	0 - 100 (%)	100
	F204	RR point 2 frequency	0.0 - 590.0 (Hz)	50.0/60.0 *1

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Terminal symbol	Title	Parameter name	Adjustment range	Default setting
RX	F210	RX point 1 input value	-100 to 100 (%)	0
	F211	RX point 1 frequency	0.0 - 590.0 (Hz)	0.0
	F212	RX point 2 input value	-100 to 100 (%)	100
	F213	RX point 2 frequency	0.0 - 590.0 (Hz)	50.0/60.0 *1
	F107	Terminal RX input voltage select	0: 0 to +10 V 1: -10 to +10 V	0
II	F216	II point 1 input value	0 - 100 (%)	20
	F217	II point 1 frequency	0.0 - 590.0 (Hz)	0.0
	F218	II point 2 input value	0 - 100 (%)	100
	F219	II point 2 frequency	0.0 - 590.0 (Hz)	50.0/60.0 *1
AI4	F222	AI4 point 1 input value *2	-100 to 100 (%)	0
	F223	AI4 point 1 frequency *2	0.0 - 590.0 (Hz)	0.0
	F224	AI4 point 2 input value *2	-100 to 100 (%)	100
	F225	AI4 point 2 frequency *2	0.0 - 590.0 (Hz)	50.0/60.0 *1
	F148	Terminal AI4 input select *2	1: Voltage input (0 - 10 V) 2: Voltage input (-10 to +10 V) 3: Current input (0 - 20 mA) 4: PTC input 5: PT100 (2-wire) input 6: PT100 (3-wire) input 7: PT1000 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input	1
AI5	F228	AI5 point 1 input value *2	-100 to 100 (%)	0
	F229	AI5 point 1 frequency *2	0.0 - 590.0 (Hz)	0.0
	F230	AI5 point 2 input value *2	-100 to 100 (%)	100
	F231	AI5 point 2 frequency *2	0.0 - 590.0 (Hz)	50.0/60.0 *1
	F149	Terminal AI5 input select *2	1: Voltage input (0 to 10V) 2: Voltage input (-10 to +10 V) 3: Current input (0 - 20 mA) 4: PTC input 5: PT100 (2-wire) input 6: PT100 (3-wire) input 7: PT1000 (2-wire) input 8: PT1000 (3-wire) input 9: KTY84 input	1

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Terminal symbol	Title	Parameter name	Adjustment range	Default setting
Common	F209	Analog input filter	1: Disabled 2 - 1000 (ms)	1 *3
	A959	Analog input function target 11	0: Disabled 1: Terminal RR 2: Terminal RX 3: Terminal II 4: Terminal AI4 5: Terminal AI5	
	A961	Analog function setting destination 11	0: Disabled 1: Acc/Dec rate (ACC.dEC etc.) 2: Upper limit frequency (UL) 3: Acc multiplication factor (FH/ACC etc.) 4: Dec multiplication factor (FH/dEC etc.) 5: Manual torque boost (vb etc.) 6: Stall prevention level (F601 etc.) 7: Motor OL protection current (tHrA) 8: Speed control response (F460 etc.) 9: Droop gain (F320 etc.) 10: PID proportional gain (F362 etc.) 11: Base frequency voltage (VL etc.) 12 - 20: -	
	A962	Analog input function target 21	Same as A959	
	A964	Analog function setting destination 21	Same as A961	

*1 The default setting value is depending on the setup menu. Refer to [5. 3. 10].

*2 Indicated optional terminals on IO extension 1 (ETB013Z), refer to E6582128.

*3 If stable operation cannot be achieved because of noise of the frequency command circuit, etc., increase the value for <F209: Analog input filter>.

For details on switching two types of analog signals for operation, refer to [5. 4. 1].

7. 3. 2 Inputting the frequency commands by potentiometer/voltage (0 - 10 Vdc)

Connect a potentiometer (1 k - 10 kΩ) between the terminals [PP]-[RR]-[CC] to input frequency commands.

Divide the reference voltage (10 Vdc) of the terminal [PP] using a potentiometer to input the voltage of 0 - 10 Vdc between the terminals [RR]-[CC].

You can also directly input a voltage signal of 0 - 10 Vdc between the terminals [RR]-[CC] without using a potentiometer.

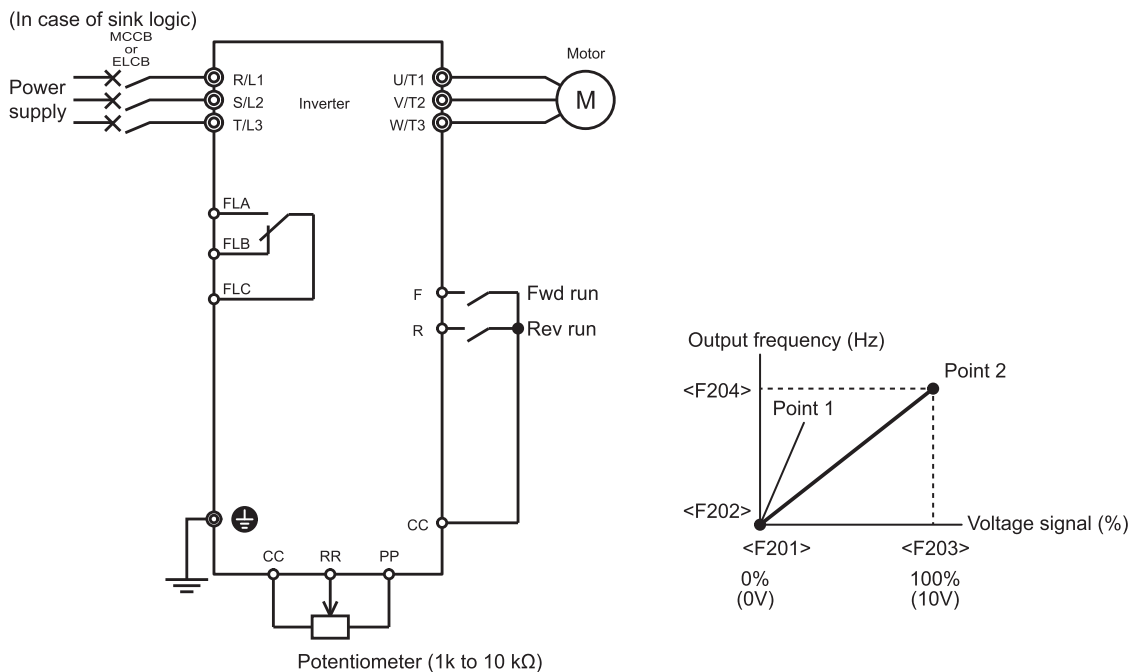
■ Setting example

The following shows an example of how to externally input the run commands to the digital input terminals, and how to input the frequency commands using a potentiometer.

The frequency shall be 0 Hz at the minimum setting of a potentiometer, and 60 Hz at the maximum setting of a potentiometer.

- <CMOD: Run command select> = "0: Terminal"
- <FMOD: Frequency command select 1> = "1: Terminal RR"
- <F201: RR point 1 input value> = "0" (%) (default setting)
- <F202: RR point 1 frequency> = "0" (Hz) (default setting)
- <F203: RR point 2 input value> = "100" (%) (default setting)
- <F204: RR point 2 frequency> = "60" (Hz) (default setting)

For the characteristics of input voltages and output frequencies, set at two points of <F201> and <F202>, and <F203> and <F204>. The reference for 100% of the input value is 10 V.



7. 3. 3 Inputting the frequency commands by current (4 - 20 mAdc)

Input the current signal of 4(0) - 20 mAdc between the terminals [II]-[CC].

■ **Setting example**

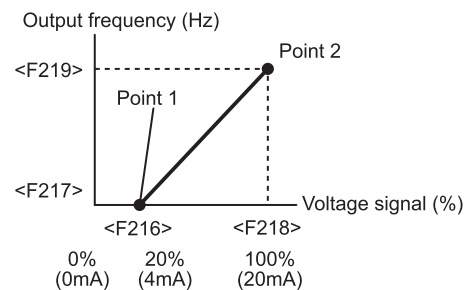
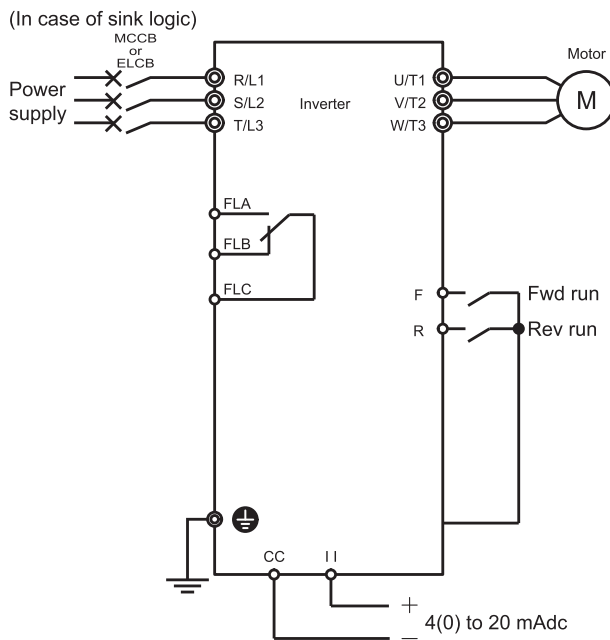
The following shows an example of how to externally input the run commands to the digital input terminals with a current input of 4 - 20 mAdc.

The frequency shall be 0 Hz for the minimum input of 4 mA, and 60 Hz for the maximum input of 20 mA.

- <CMOD: Run command select> = "0: Terminal"
- <FMOd: Frequency command select 1> = "3: Terminal II"
- <F216: II point 1 input value> = "20" (%) (default setting)
- <F217: II point 1 frequency> = "0" (Hz) (default setting)
- <F218: II point 2 input value> = "100" (%) (default setting)
- <F219: II point 2 frequency> = "60" (Hz) (default setting)

For the characteristics of input currents and output frequencies, set at two points of <F216> and <F217>, and <F218> and <F219>. The reference for 100% of the input value is 20mA.

7



7. 3. 4 Inputting frequency commands by voltage (-10 to +10 Vdc)

Input the voltage signal of -10 to +10 Vdc between the terminals [RX]-[CC].

You can also input a voltage of 0 - 10 Vdc. Set <F107: Terminal RX input voltage select> = "0: 0 to +10 V".

■ **Setting example**

The following shows an example of how to externally input the run commands to the digital input terminals with a voltage input of -10 to +10 V.

The frequency shall be 0 Hz at 0 V, and 60 Hz at +10 V. At this time, the frequency becomes 60 Hz in reverse run at -10 V.

- <CMOD: Run command select> = "0: Terminal"
- <FMOD: Frequency command select 1> = "2: Terminal RX"
- Set <F107: Terminal RX input voltage select> = "1: -10 to +10 V".
- <F210: RX point 1 input value> = "0" (%) (default setting)
- <F211: RX point 1 frequency> = "0" (Hz) (default setting)
- <F212: RX point 2 input value> = "100" (%) (default setting)
- <F213: RX point 2 frequency> = "60" (Hz) (default setting)

For the characteristics of input currents and output frequencies, set at two points of <F210> and <F211>, and <F212> and <F213>. The reference for 100% of the input value is 10 V.

