

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].

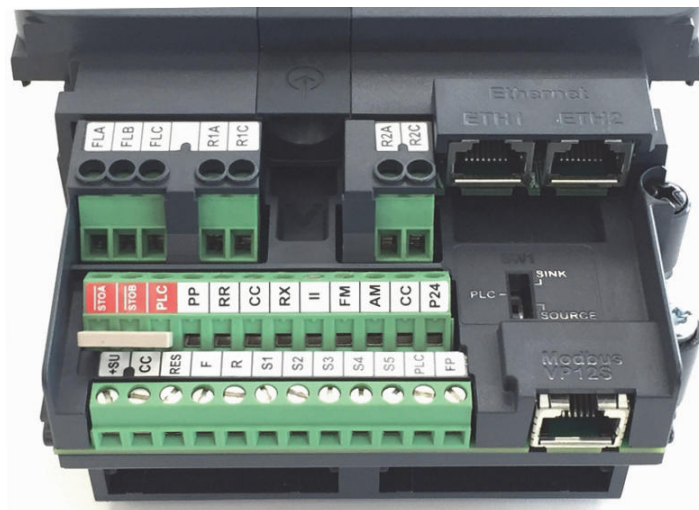
7.2.1 Setting the functions to the input terminals (for sink logic)

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

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■ 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.

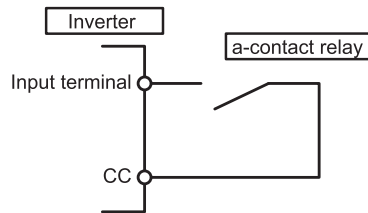
*5 If stable operation cannot be achieved because of noise of the frequency setting circuit, etc., increase the values for <F140: Terminal F response time> to <F145: Terminal DI11-DI16 response time>.

Memo

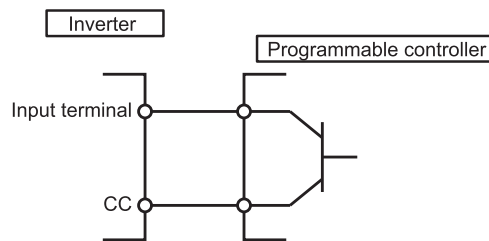
- To always enable the functions, assign the functions to <F110: Always active function 1>, <F127: Always active function 2>, and <F128: Always active function 3>.

■ 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:

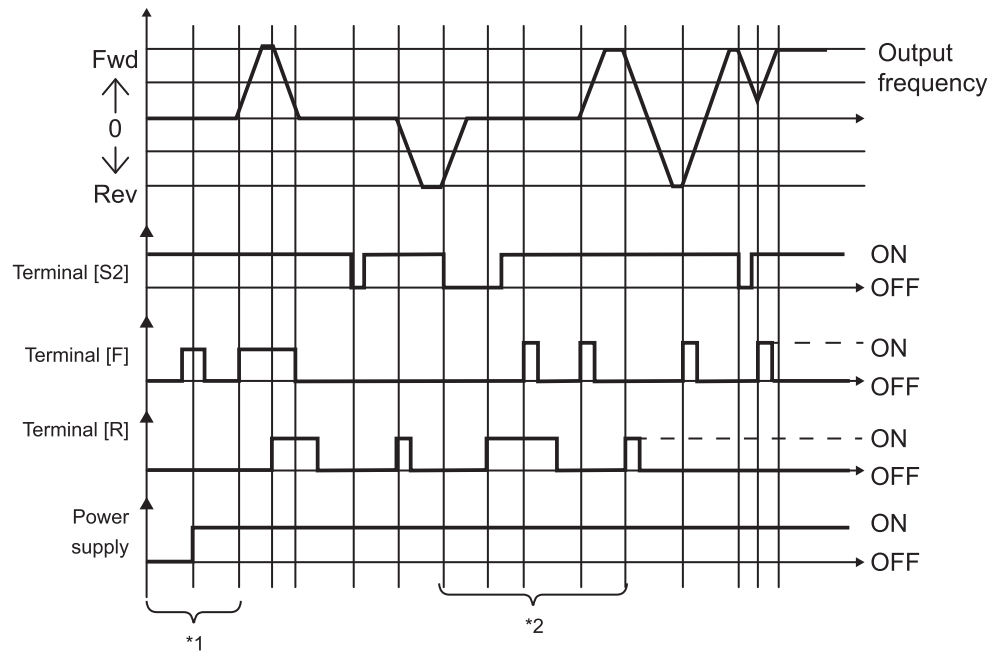
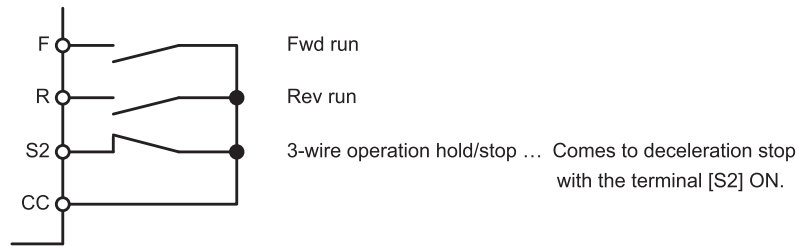
- <F110: Always active function 1> = "6: Standby"
- <CMOd: Run command select> = "0: Terminal"
- <F111: Terminal F function 1> = "2: Fwd run" (default setting)
- <F112: Terminal R function 1> = "4: Rev run"(default setting)

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

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].

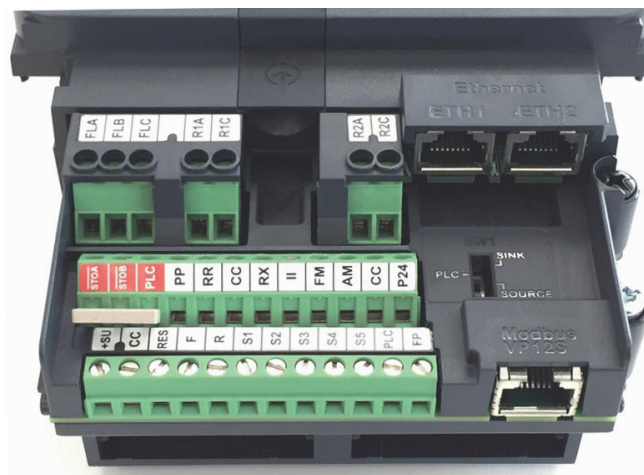
7. 2. 2 Setting the functions to the output terminals (for sink logic)

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



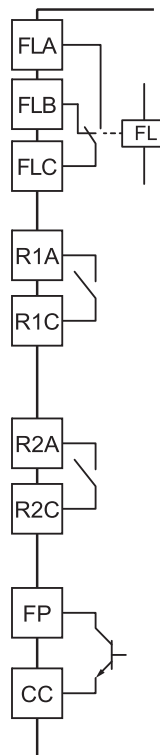
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■ Use conditions

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".

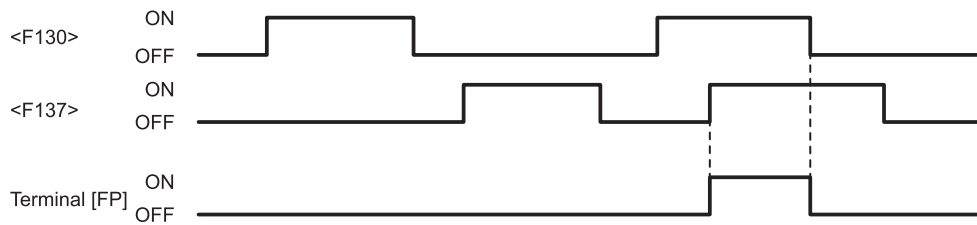
*2 Indicated optional terminals on IO extension 1 (ETB013Z) or IO extension 2 (ETB014Z), refer to E6582128 or E6582129.

■ **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.

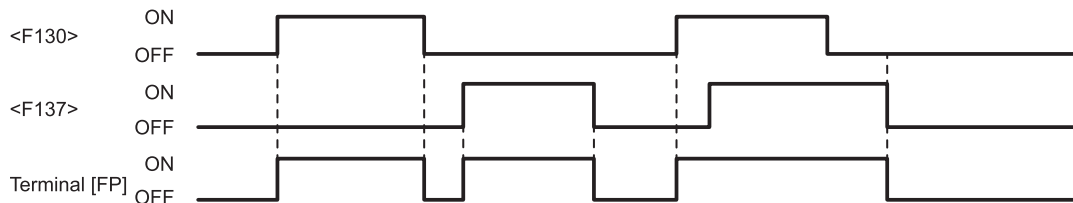
In case of the terminal [FP], when you set <F139: Terminal FP, R1 logic select> = "0" or "1", signals are output when the functions set for <F130: Terminal FP function 1> and <F137: Terminal FP function 2> are simultaneously turned ON.



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.

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■ **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.

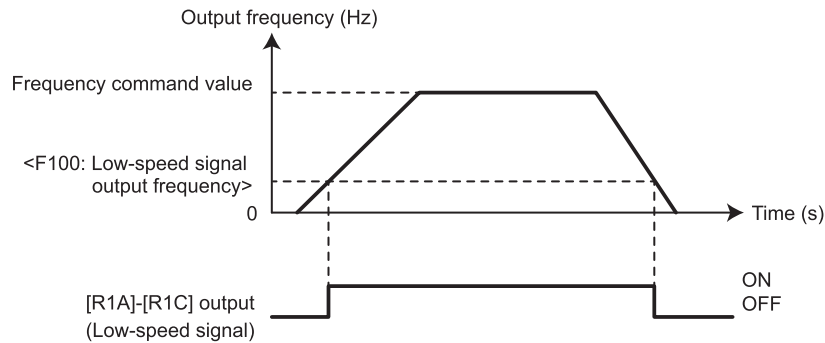
■ Usage example 2: Outputting braking signals

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].