

Digital Input/Output Interface Card "OPC-DIO"

Thank you for purchasing the digital input/output interface card "OPC-DIO". By installing digital input/output interface card "OPC-DIO" on the FRENIC series, frequency settings can be specified with binary codes and BCD codes, output frequency and so on can be monitored with binary codes, and general-purpose input/output terminals can be expanded.

1. Applicable Inverters

Table 1 shows applicable inverter series.

Table 1 Applicable Inverter and ROM Version

Series	Inverter type	Inverter capacity	ROM version
FRENIC-Ace	FRN□□□E2□-□□□	Full capacity	0300 or later

2. Product Check

Check the following items.

- Ensure that the package contains the DIO interface card and 2 screws (M3 x 8).
- Ensure that no damage such as abnormalities, dents, or bending has occurred to the parts on the DIO interface card during transport.
- Ensure that the "OPC-DIO" model name is stamped on the top of the DIO interface card. (Fig. 2-1)

If you suspect the product is not working properly or if you have any questions about your product, contact the shop where you bought the product or your local Fuji branch office.

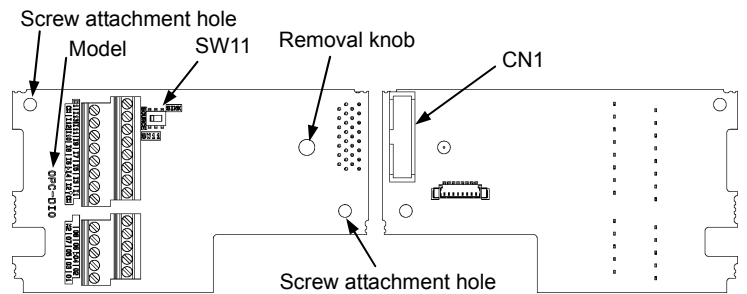


Fig. 2-1 Front of Card

Fig. 2-2 Back of Card

3. Basic Connection Drawing

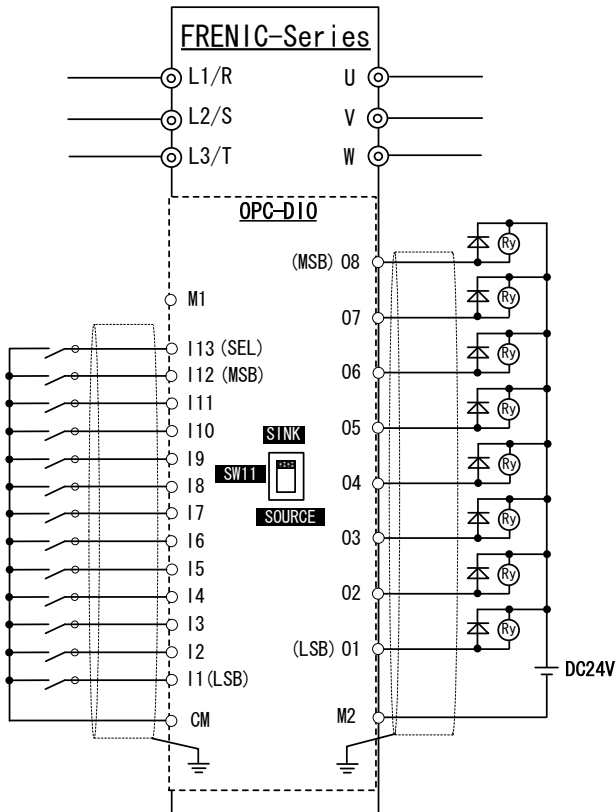


Fig. 3-1 Basic Connection Drawing

4. Electrical Specifications

Table 4-1 Electrical Specifications List

Terminal symbol	Item		Specification	
			Min.	Max.
I1 - I13	Operating voltage (SINK)	ON level	0 V	2 V
		OFF level	22 V	27 V
	Operating voltage (SOURCE)	ON level	22 V	27 V
		OFF level	0 V	2 V
	Operating current at ON (when input voltage 0 V)		2.5mA	5mA
	Allowable leakage current at OFF		-	0.5mA
O1 - O8	Operating voltage	ON level	-	2 V
		OFF level	-	27 V
	Maximum current at ON		-	50mA
	Leakage current at OFF		-	0.1mA

⚠ WARNING

Before starting installation and wiring, turn OFF the power and wait at least ten minutes. Make sure that the LED monitor and charging lamp are turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped to the safe level (+25 VDC or below)

Otherwise, electric shock could occur.

5. Terminal Allocation

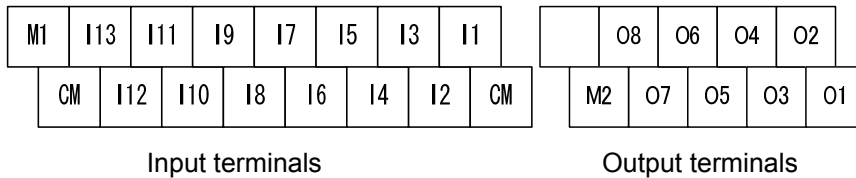


Fig. 5-1 Connection Terminal Allocation Drawing

Table 5-1 Terminal Specifications	
Terminal size	M2
Tightening torque (N·m)	0.19 ±10%
Recommended wire size *	AWG22 – 24
Stripped wire length (mm)	5
* An insulated wire with allowable temperature of 105 °C (UL compliant product) is recommended.	

6. Terminal Functions

Table 6-1 shows a list of terminal functions.

Table 6-1 Terminal Function List

Terminal symbol	Terminal name	Terminal function description
I1 - I13	Digital input 1 to 13	<p>(1) Frequency can be set with a setting method for all frequencies set with function code o20. In this case, terminal I13 is a hold input signal. Furthermore, frequency settings can be given polarity with o19. Refer to the respective inverter user's manuals for details.</p> <p>(2) These terminals can be used as general-purpose input terminals (inverter unit X terminal or equivalent). Functions can be selected from o101 to o113. Assign input signals requiring responsiveness to the inverter unit side X terminal.</p> <p>(3) SW11 can be used to switch between the SINK and SOURCE methods. The minimum permissible variation width of input terminal signals is 2 [ms] or higher.</p>
M1	External power supply input	This is a power supply terminal used for external power supplies (+22 to +27 VDC).
CM	Digital common	This is a common terminal for digital input signals. It has the same electric potential as inverter unit terminal CM .
O1 - O8	Transistor output 1 to 8	<p>(1) All types of monitor data (output frequency, output current, etc) set with function code o21 can be output as 8-bit binary output signals.</p> <p>(2) When function code o21 is set to 99, all output terminals can be used as general-purpose output terminals (inverter unit Y terminal or equivalent). Functions can be selected from o01 to o08. Refer to the respective inverter user's manuals for details. Assign output signals requiring responsiveness to the inverter unit side Y terminal.</p>
M2	Transistor output common	This is a common terminal for transistor output signals. Inverter unit terminals CM, 11, and CMY are insulated.

7. Option Communication Error (E-4)

This error occurs when a communication error occurs between the digital I/O card and inverter unit.

Cause	Check and countermeasure
(1) There is a problem with the connection between the digital I/O card and inverter unit.	Check whether the option connection cable between the digital I/O card and inverter unit is connected properly, and ensure that the cable fits securely into the adapter connector. → Connect the option connection cable properly. Insert securely into the adapter connector.
(2) Influenced by strong noise from surroundings	Check noise countermeasures (connection status, signal wire and communication cable/main circuit wiring installation, etc.) → Improve noise countermeasures.

Note: There may also be a problem with the connection between the digital I/O card and inverter unit (E-4 does not appear) when the code for function code o (option function) does not appear. In this case also, check whether the option connection cable is connected properly.

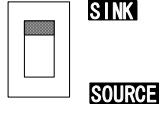
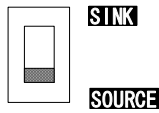
8. I/O Interface

8-1. Input Interface

8-1-1. Switching Between Digital Input Terminal (I1 - I13) SINK/SOURCE Methods

Switching between input terminal (I1 - I13) SINK and SOURCE methods is possible with switch SW11. Refer to Table 8-1 and set the input method.

Table 8-1 Switch SW11 Setting

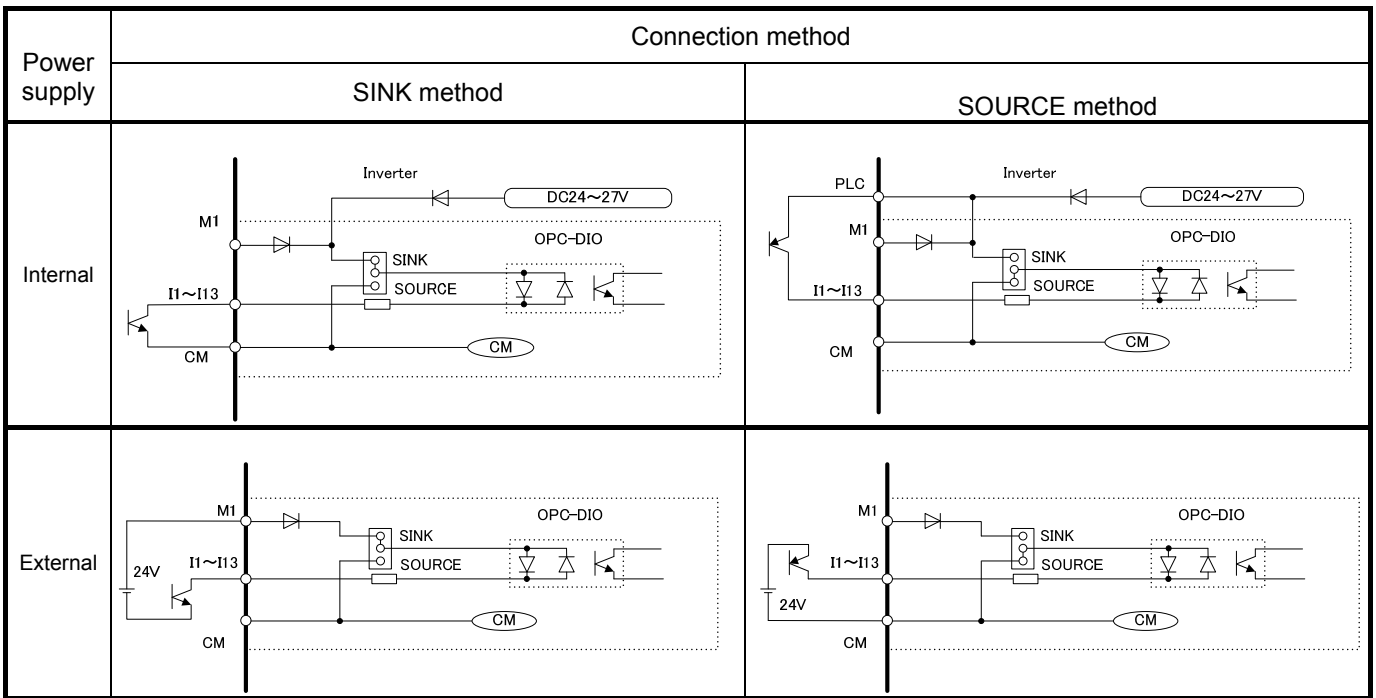
Input method	Switch setting
SINK method (default)	Switches to SINK side. 
SOURCE method	Switches to SOURCE side. 

Note It is also possible to switch between the SINK and SOURCE methods for inverter unit digital input terminals. Set the SINK/SOURCE method setting the same as that for the inverter unit.

8-1-2. Connecting with Digital Input Terminal (I1 - I13) SINK/SOURCE Methods

The digital input interface circuit connection method is shown in Table 8-2.

Table 8-2 Input Interface Circuit Connection Method



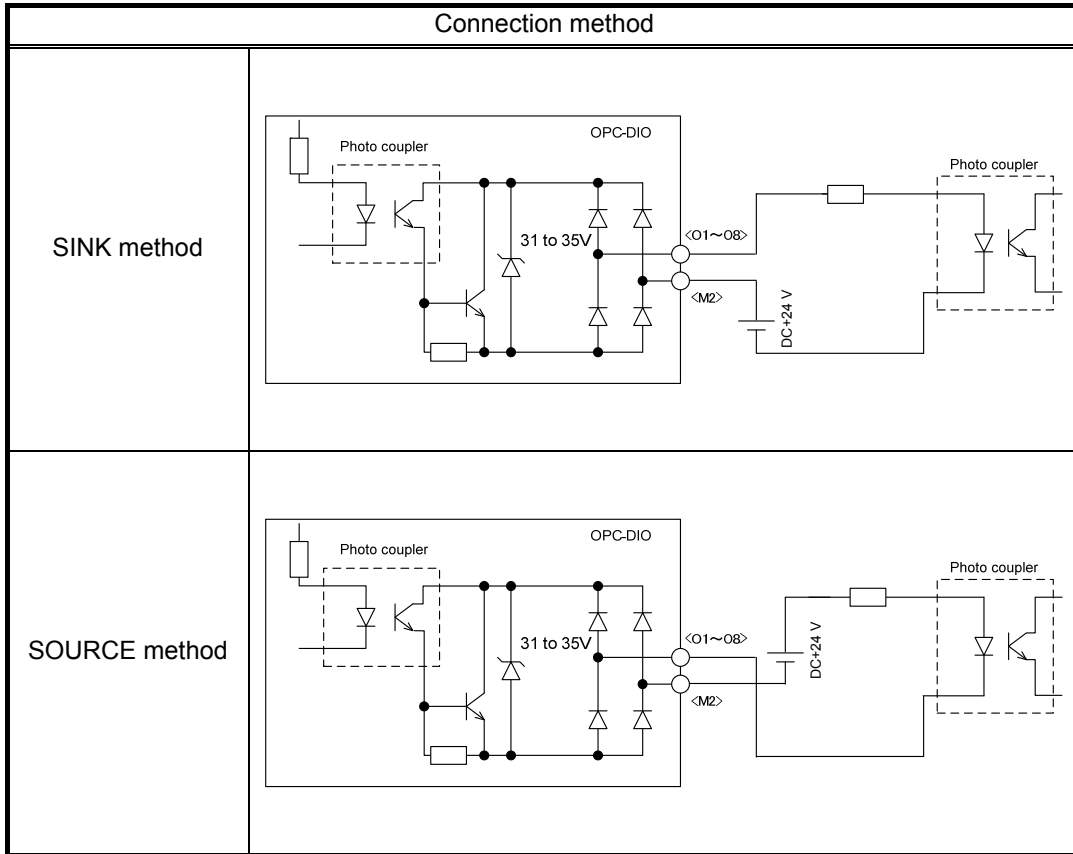
8-1-3. Contact Use Precaution

If configuring input circuits with contacts, use contacts that don't cause contact defects (contacts with high contact reliability).

8-2. Output Interface

The output interface circuit connection method is shown in Table 8-3.

Table 8-3 Output Interface Circuit Connection Method



9. I/O Check

The I/O status of external signals can be displayed on the LED monitor with program mode menu No.4 "I/O Check" on the keypad. (*)

The digital interface option I/O signal status can be displayed with an "LED segment ON/OFF indication" and "hexadecimal indication".

Assignment of each signal is as follows.

(*) Refer to the inverter unit instruction manual for details on menu No.4 "I/O Check".

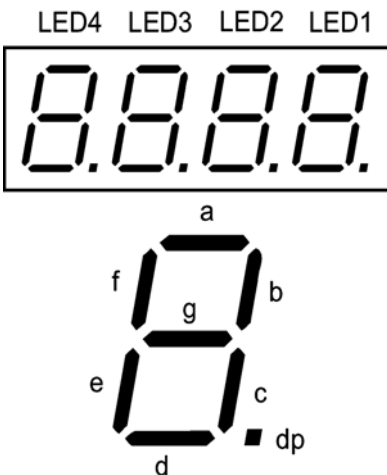


Table 9-1 LED Segment ON/OFF Indication

Segment	LED4	LED3	LED2	LED1
a	-	O1	I9	I1
b	-	O2	I10	I2
c	-	O3	I11	I3
d	-	O4	I12	I4
e	-	O5	I13	I5
f	-	O6		I6
g	-	O7		I7
dp	-	O8		I8

Table 9-2 Hexadecimal Indication with 7 Segment LED

LED No.	LED4				LED3				LED2				LED1			
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Input terminal	-	-	-	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1
Output terminal	-	-	-	-	-	-	-	-	O8	O7	O6	O5	O4	O3	O2	O1

10. Function Code Settings

To enable frequency setting input from this interface card, it is necessary to set "11" (digital input interface) for function code F01 (frequency setting 1) or C30 (frequency setting 2). Furthermore, the frequency setting polarity and input mode are set with option function code o20 (DI mode selection).

Monitor items assigned to digital output signals for this interface card is set with option function code o21 (DO mode selection).

10-1. Function Code List

FRENIC-Ace series				
Function code	Function code details	Data	Data content	Remarks
F01 (C30)	Frequency selection 1 (Frequency selection 2)	11	Frequency setting with DIO option	
		Other than 11	Frequency setting corresponding to each data item	
o20	Input mode selection	0	8-bit binary setting	Note: I13 is a dedicated terminal for hold signals. • Input data (I1 to I12) is received when I13=0. • Input data (I1 to I12) is not received when I13=1.
		1	12-bit binary setting	
		4	BCD 3 digit setting 0 to 99.9	
		5	BCD 3 digit setting 0 to 500	
		99	General-purpose input processing	General-purpose input functions can be selected with o101 to o113.
o101 - o113	Terminal I1 to I13 function selection	Same as inverter unit function code E01		Valid when o20=99
Function code	Function code details	Data	Monitor content	Remarks
o21	Output mode selection	0	Output frequency (before compensation) slide	100%/8-bit (Output frequency/max. output frequency) x 255
		1	Output frequency (after compensation) slide	100%/8-bit (Output frequency/max. output frequency) x 255
		2	Output current	200%/8-bit (Output current/(inverter rated output current x 2)) x 255
		3	Output voltage	100%/8-bit (Output voltage/250 V) x 255: 200 V series (Output voltage/500V) x 255: 400 V series
		4	Output torque	200%/8-bit (Output torque/(motor rated torque x 2)) x 255
		5	Load factor	200%/8-bit (Load factor/(motor rated load x 2)) x 255
		6	Power consumption	200%/8-bit (Power consumption/(inverter rated output x 2)) x 255
		7	PID feedback value (PV)	100%/8-bit (PID feedback value/100% of feedback value) x 255
		8	Detected speed/estimated speed	100%/8-bit (PG feedback frequency/max. output frequency) x 255
		9	Intermediate DC circuit voltage	100%/8-bit 200 V series: (Intermediate DC circuit voltage/500 [V]) x 255 400 V series: (Intermediate DC circuit voltage/1000 [V]) x 255
		13	Motor output	200%/8-bit (Motor output/(motor rated output x 2)) x 255
		15	PID command (SV)	100%/8-bit (PID command/100% of feedback value) x 255
		16	PID output (MV)	100%/8-bit (PID output/max. output frequency) x 255
17	Synchronous angle deviation	±180 deg./7-bit (± synchronous angle deviation/180 deg.) x 127		
18	Inverter cooling fin temperature	200 °C/8-bit (Inverter cooling fin temperature/200 °C) x 255		
21	PG feedback value (PV)	100%/8-bit (PG feedback frequency/max. output frequency) x 255		
99	Individual signal output	General-purpose output functions can be selected with o01 to o08.		
o01 to 08	Terminal 01 to 08 function selection	Same as inverter unit function code E20		Valid when o21 = 99

If the monitor amount exceeds 100%, the 8-bit maximum output is "11111111(255)".

11. Detailed Function Description

A detailed function description when each function code is set is shown in Table 11-1, Table 11-2, and Table 11-3.

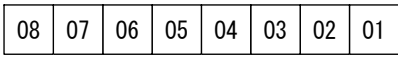
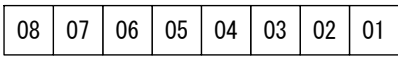
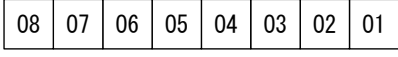
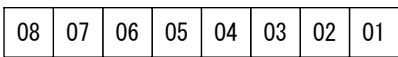
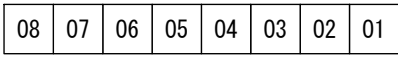
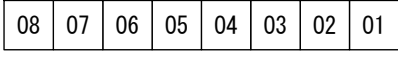
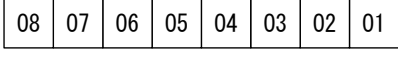
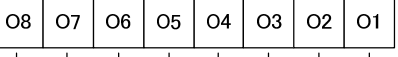
Table 11-1 Detailed Function Description (Input)

Function code	Data	Input signal name	Terminal function and setting content description																										
o20	0	8-bit binary frequency setting	<div style="text-align: center;"> <table border="1" style="margin: auto;"> <tr> <td colspan="8">MSB</td> <td colspan="4">LSB</td> </tr> <tr> <td>I13</td><td>I12</td><td>I11</td><td>I10</td><td>I9</td><td>I8</td><td>I7</td><td>I6</td><td>I5</td><td>I4</td><td>I3</td><td>I2</td><td>I1</td> </tr> </table> </div> <p style="text-align: center;"> Invalid Frequency setting Hold signal Sign bit when o19 = "1" Data update possible when I13 = "0" Data update not possible when I13 = "1" </p> <p>(1) Set resolution = set max. frequency x (1/255) (2) Upper/lower limiters are given priority.</p>	MSB								LSB				I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1	
	MSB								LSB																				
	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1																
	1	12-bit binary frequency setting	<div style="text-align: center;"> <table border="1" style="margin: auto;"> <tr> <td colspan="12">MSB</td> <td colspan="1">LSB</td> </tr> <tr> <td>I13</td><td>I12</td><td>I11</td><td>I10</td><td>I9</td><td>I8</td><td>I7</td><td>I6</td><td>I5</td><td>I4</td><td>I3</td><td>I2</td><td>I1</td> </tr> </table> </div> <p style="text-align: center;"> Hold signal Frequency setting Sign bit when o19 = "1" Data update possible when I13 = "0" Data update not possible when I13 = "1" </p> <p>(1) Set resolution = set max. frequency x (1/4095) (2) Upper/lower limiters are given priority.</p>	MSB												LSB	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1
	MSB												LSB																
I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1																	
4	BCD 3-digit frequency setting (0.0 - 99.9Hz)	<div style="text-align: center;"> <table border="1" style="margin: auto;"> <tr> <td colspan="8">MSB</td> <td colspan="5">LSB</td> </tr> <tr> <td>I13</td><td>I12</td><td>I11</td><td>I10</td><td>I9</td><td>I8</td><td>I7</td><td>I6</td><td>I5</td><td>I4</td><td>I3</td><td>I2</td><td>I1</td> </tr> </table> </div> <p style="text-align: center;"> 10Hz position 1Hz position 0.1Hz position Hold signal Data update possible when I13 = "0" Data update not possible when I13 = "1" </p> <p>(1) Frequency can be set in the 0.0 to 99.9Hz (set resolution = 0.1Hz) range. (2) Upper/lower limiters are given priority. (3) When values greater to or equal than the maximum output frequency are input, the maximum output frequency is output.</p>	MSB								LSB					I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1	
MSB								LSB																					
I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1																	
5	BCD 3-digit frequency setting (0 - 500Hz)	<div style="text-align: center;"> <table border="1" style="margin: auto;"> <tr> <td colspan="8">MSB</td> <td colspan="5">LSB</td> </tr> <tr> <td>I13</td><td>I12</td><td>I11</td><td>I10</td><td>I9</td><td>I8</td><td>I7</td><td>I6</td><td>I5</td><td>I4</td><td>I3</td><td>I2</td><td>I1</td> </tr> </table> </div> <p style="text-align: center;"> 100Hz position 10Hz position 1Hz position Hold signal Data update possible when I13 = "0" Data update not possible when I13 = "1" </p> <p>(1) Frequency can be set in the 0 to 500Hz (set resolution = 1Hz) range. (2) Upper/lower limiters are given priority. (3) When values greater to or equal than the maximum output frequency are input, the maximum output frequency is output.</p>	MSB								LSB					I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1	
MSB								LSB																					
I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1																	
99	General-purpose input	<div style="text-align: center;"> <table border="1" style="margin: auto;"> <tr> <td colspan="13">MSB</td> <td colspan="1">LSB</td> </tr> <tr> <td>I13</td><td>I12</td><td>I11</td><td>I10</td><td>I9</td><td>I8</td><td>I7</td><td>I6</td><td>I5</td><td>I4</td><td>I3</td><td>I2</td><td>I1</td> </tr> </table> </div> <p style="text-align: center;">General-purpose</p> <p>The input operation for each signal is the same as that for the inverter unit general-purpose input function.</p>	MSB													LSB	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1
MSB													LSB																
I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1																	

Table 11-2 Detailed Function Description (Output)

Function code	Data	Output signal name	Terminal function and setting content description								
o21	0	Output frequency (before slide compensation)	<p>MSB LSB</p> <table border="1" style="margin-left:auto; margin-right:auto;"> <tr> <td>08</td><td>07</td><td>06</td><td>05</td><td>04</td><td>03</td><td>02</td><td>01</td> </tr> </table> <p style="text-align:center">100% of max. output frequency / 8-bit</p>	08	07	06	05	04	03	02	01
	08	07	06	05	04	03	02	01			
	1	Output frequency (after slide compensation)	<p>MSB LSB</p> <table border="1" style="margin-left:auto; margin-right:auto;"> <tr> <td>08</td><td>07</td><td>06</td><td>05</td><td>04</td><td>03</td><td>02</td><td>01</td> </tr> </table> <p style="text-align:center">100% of max. output frequency / 8-bit</p>	08	07	06	05	04	03	02	01
	08	07	06	05	04	03	02	01			
	2	Output current	<p>MSB LSB</p> <table border="1" style="margin-left:auto; margin-right:auto;"> <tr> <td>08</td><td>07</td><td>06</td><td>05</td><td>04</td><td>03</td><td>02</td><td>01</td> </tr> </table> <p style="text-align:center">200% of inverter rated output current / 8-bit</p>	08	07	06	05	04	03	02	01
	08	07	06	05	04	03	02	01			
	3	Output voltage	<p>MSB LSB</p> <table border="1" style="margin-left:auto; margin-right:auto;"> <tr> <td>08</td><td>07</td><td>06</td><td>05</td><td>04</td><td>03</td><td>02</td><td>01</td> </tr> </table> <p style="text-align:center">100% of 250 V / 8-bit: 200 V series 100% of 500 V / 8-bit: 400 V series</p>	08	07	06	05	04	03	02	01
	08	07	06	05	04	03	02	01			
	4	Output torque	<p>MSB LSB</p> <table border="1" style="margin-left:auto; margin-right:auto;"> <tr> <td>08</td><td>07</td><td>06</td><td>05</td><td>04</td><td>03</td><td>02</td><td>01</td> </tr> </table> <p style="text-align:center">200% of motor rated torque / 8-bit</p>	08	07	06	05	04	03	02	01
08	07	06	05	04	03	02	01				
5	Load factor	<p>MSB LSB</p> <table border="1" style="margin-left:auto; margin-right:auto;"> <tr> <td>08</td><td>07</td><td>06</td><td>05</td><td>04</td><td>03</td><td>02</td><td>01</td> </tr> </table> <p style="text-align:center">200% of motor rated load / 8-bit</p>	08	07	06	05	04	03	02	01	
08	07	06	05	04	03	02	01				
6	Power consumption	<p>MSB LSB</p> <table border="1" style="margin-left:auto; margin-right:auto;"> <tr> <td>08</td><td>07</td><td>06</td><td>05</td><td>04</td><td>03</td><td>02</td><td>01</td> </tr> </table> <p style="text-align:center">200% of inverter rated output / 8-bit</p>	08	07	06	05	04	03	02	01	
08	07	06	05	04	03	02	01				
7	PID feedback value (PV)	<p>MSB LSB</p> <table border="1" style="margin-left:auto; margin-right:auto;"> <tr> <td>08</td><td>07</td><td>06</td><td>05</td><td>04</td><td>03</td><td>02</td><td>01</td> </tr> </table> <p style="text-align:center">100% of feedback value / 8-bit</p>	08	07	06	05	04	03	02	01	
08	07	06	05	04	03	02	01				
8	Detected speed/estimated speed	<p>MSB LSB</p> <table border="1" style="margin-left:auto; margin-right:auto;"> <tr> <td>08</td><td>07</td><td>06</td><td>05</td><td>04</td><td>03</td><td>02</td><td>01</td> </tr> </table> <p style="text-align:center">100% of max. output frequency / 8-bit</p>	08	07	06	05	04	03	02	01	
08	07	06	05	04	03	02	01				

Table 11-3 Detailed Function Description (Output)

Function code	Data	Output signal name	Terminal function and setting content description
o21	9	Intermediate DC circuit voltage	<div style="text-align: center;"> MSB LSB  100% of 500 V / 8-bit: 200 V series 100% of 1000 V / 8-bit: 400 V series </div>
	13	Motor output	<div style="text-align: center;"> MSB LSB  200% of motor rated output / 8-bit </div>
	15	PID command (SV)	<div style="text-align: center;"> MSB LSB  100% of feedback value / 8-bit </div>
	16	PID output (MV)	<div style="text-align: center;"> MSB LSB  100% of max. output frequency / 8-bit </div>
	17	Synchronous angle deviation	<div style="text-align: center;"> MSB LSB  100% of deviation -180 deg. to 180 deg. / 8-bit </div>
	18	Inverter cooling fin temperature	<div style="text-align: center;"> MSB LSB  100% of 200 °C / 8-bit </div>
	21	PG feedback value	<div style="text-align: center;"> MSB LSB  100% of max. output frequency / 8-bit </div>
	99	Individual signal output	<div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;">  </div> <div> <ul style="list-style-type: none"> — RUN: Running — FDT: Frequency detection — FAR: Frequency reached — LU: Insufficient voltage stoppage — IOL: Inverter output restricted — IPF: Restoring power — None: No function </div> </div> <p>The default settings are shown above. The output operation for each signal is the same as that for the inverter unit general-purpose output function.</p>

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