

# 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.

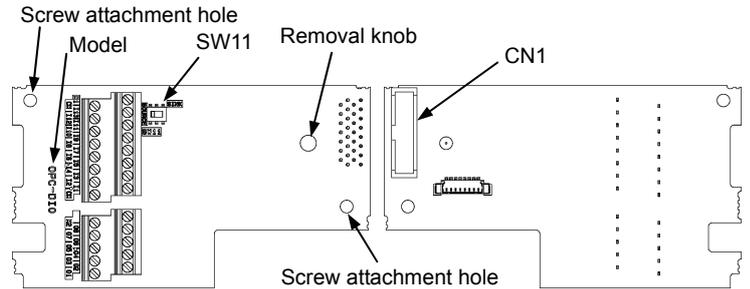


Fig. 2-1 Front of Card

Fig. 2-2 Back of Card

## 3. Basic Connection Drawing

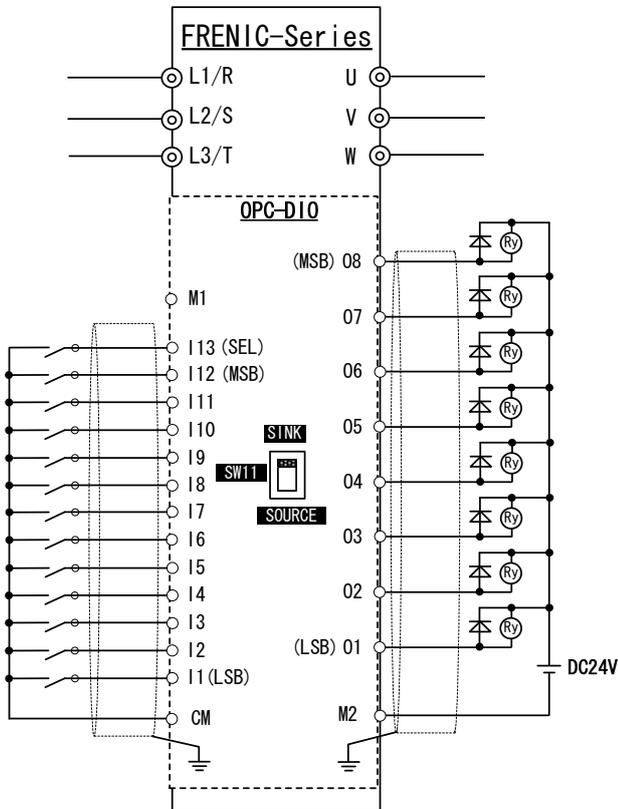


Fig. 3-1 Basic Connection Drawing

## 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.**



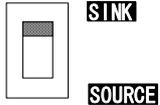
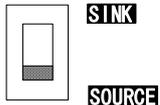
8. I/O Interface

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

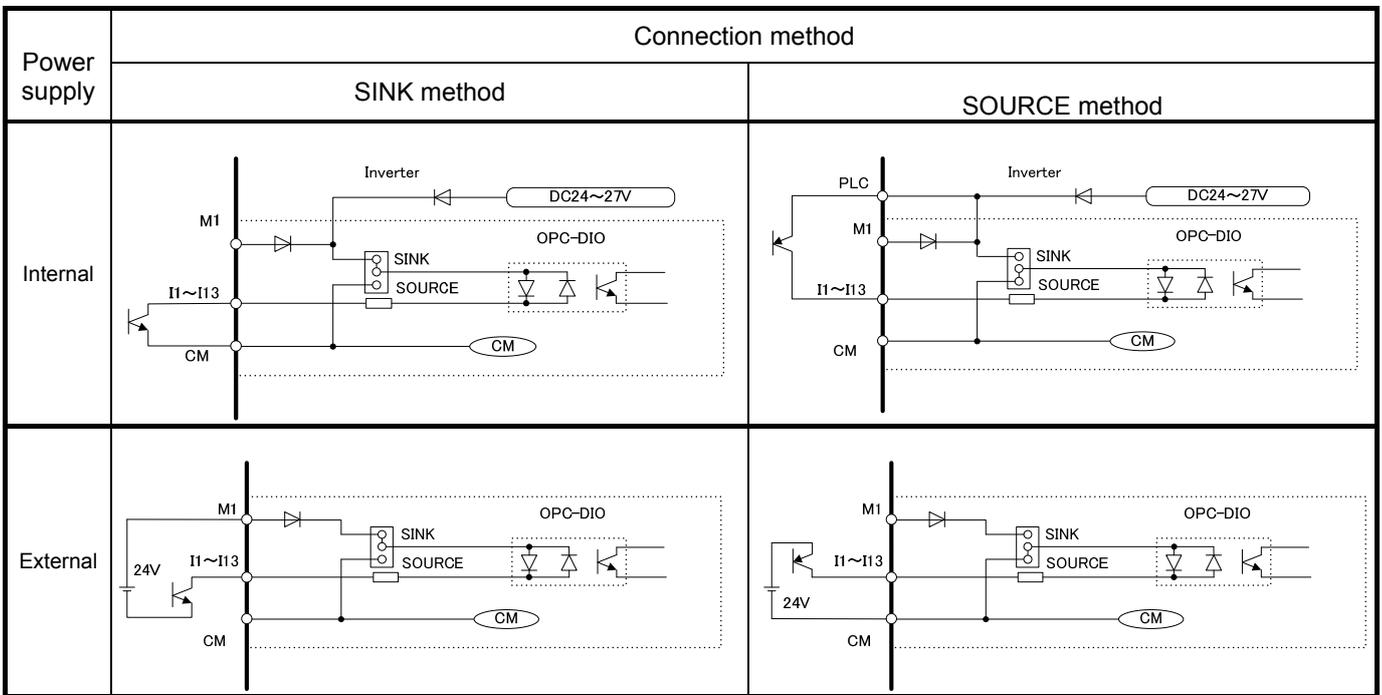
Input method	Switch setting
SINK method (default)	Switches to SINK side. 
SOURCE method	Switches to SOURCE side. 

**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



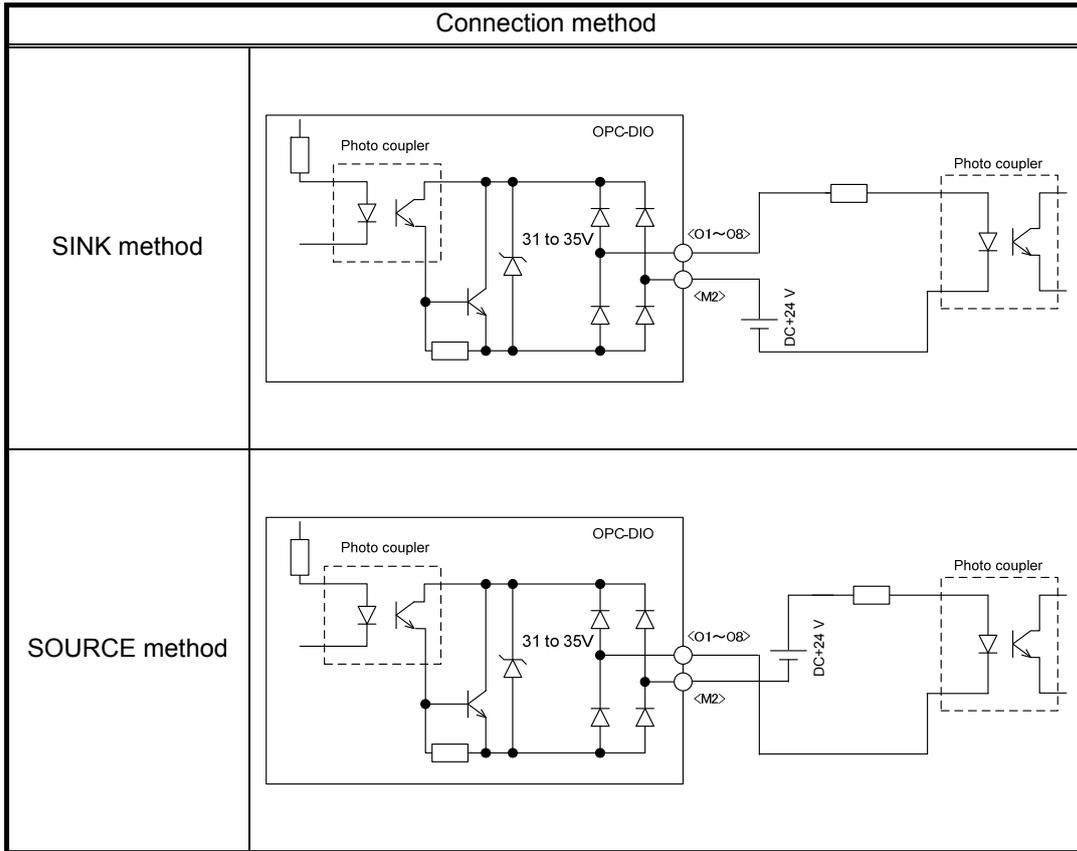
8-1-3. Contact Use Precaution

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".

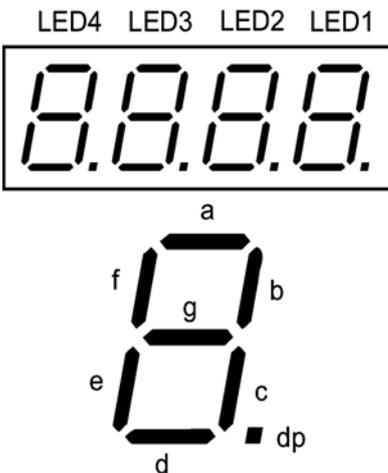


Table 9-1 LED Segment ON/OFF Indication

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			
	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" style="text-align: left;">MSB</td> <td colspan="4" style="text-align: right;">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;"> <span style="margin-right: 100px;">Invalid</span> <span>Frequency setting</span>              Hold signal <span style="margin-left: 100px;">Sign bit when o19 = "1"</span>              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" style="text-align: left;">MSB</td> <td colspan="1" style="text-align: right;">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;"> <span style="margin-right: 100px;">Hold signal</span> <span>Frequency setting</span>              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="9" style="text-align: left;">MSB</td> <td colspan="4" style="text-align: right;">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;"> <span style="margin-right: 100px;">10Hz position</span> <span style="margin-right: 100px;">1Hz position</span> <span>0.1Hz position</span>              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="12" style="text-align: left;">MSB</td> <td colspan="1" style="text-align: right;">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;"> <span style="margin-right: 100px;">100Hz position</span> <span style="margin-right: 100px;">10Hz position</span> <span>1Hz position</span>              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="12" style="text-align: left;">MSB</td> <td colspan="1" style="text-align: right;">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 <span style="float:right">LSB</span></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 <span style="float:right">LSB</span></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 <span style="float:right">LSB</span></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 <span style="float:right">LSB</span></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 <span style="float:right">LSB</span></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 <span style="float:right">LSB</span></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 <span style="float:right">LSB</span></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 <span style="float:right">LSB</span></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 <span style="float:right">LSB</span></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="display: flex; justify-content: space-between;"> <span>MSB</span> <span>LSB</span> </div> <table border="1" style="margin: 0 auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">08</td> <td style="padding: 2px 5px;">07</td> <td style="padding: 2px 5px;">06</td> <td style="padding: 2px 5px;">05</td> <td style="padding: 2px 5px;">04</td> <td style="padding: 2px 5px;">03</td> <td style="padding: 2px 5px;">02</td> <td style="padding: 2px 5px;">01</td> </tr> </table> <p style="text-align: center;">100% of 500 V / 8-bit: 200 V series 100% of 1000 V / 8-bit: 400 V series</p>	08	07	06	05	04	03	02	01
	08	07	06	05	04	03	02	01			
	13	Motor output	<div style="display: flex; justify-content: space-between;"> <span>MSB</span> <span>LSB</span> </div> <table border="1" style="margin: 0 auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">08</td> <td style="padding: 2px 5px;">07</td> <td style="padding: 2px 5px;">06</td> <td style="padding: 2px 5px;">05</td> <td style="padding: 2px 5px;">04</td> <td style="padding: 2px 5px;">03</td> <td style="padding: 2px 5px;">02</td> <td style="padding: 2px 5px;">01</td> </tr> </table> <p style="text-align: center;">200% of motor rated output / 8-bit</p>	08	07	06	05	04	03	02	01
	08	07	06	05	04	03	02	01			
	15	PID command (SV)	<div style="display: flex; justify-content: space-between;"> <span>MSB</span> <span>LSB</span> </div> <table border="1" style="margin: 0 auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">08</td> <td style="padding: 2px 5px;">07</td> <td style="padding: 2px 5px;">06</td> <td style="padding: 2px 5px;">05</td> <td style="padding: 2px 5px;">04</td> <td style="padding: 2px 5px;">03</td> <td style="padding: 2px 5px;">02</td> <td style="padding: 2px 5px;">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			
	16	PID output (MV)	<div style="display: flex; justify-content: space-between;"> <span>MSB</span> <span>LSB</span> </div> <table border="1" style="margin: 0 auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">08</td> <td style="padding: 2px 5px;">07</td> <td style="padding: 2px 5px;">06</td> <td style="padding: 2px 5px;">05</td> <td style="padding: 2px 5px;">04</td> <td style="padding: 2px 5px;">03</td> <td style="padding: 2px 5px;">02</td> <td style="padding: 2px 5px;">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			
17	Synchronous angle deviation	<div style="display: flex; justify-content: space-between;"> <span>MSB</span> <span>LSB</span> </div> <table border="1" style="margin: 0 auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">08</td> <td style="padding: 2px 5px;">07</td> <td style="padding: 2px 5px;">06</td> <td style="padding: 2px 5px;">05</td> <td style="padding: 2px 5px;">04</td> <td style="padding: 2px 5px;">03</td> <td style="padding: 2px 5px;">02</td> <td style="padding: 2px 5px;">01</td> </tr> </table> <p style="text-align: center;">100% of deviation -180 deg. to 180 deg. / 8-bit</p>	08	07	06	05	04	03	02	01	
08	07	06	05	04	03	02	01				
18	Inverter cooling fin temperature	<div style="display: flex; justify-content: space-between;"> <span>MSB</span> <span>LSB</span> </div> <table border="1" style="margin: 0 auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">08</td> <td style="padding: 2px 5px;">07</td> <td style="padding: 2px 5px;">06</td> <td style="padding: 2px 5px;">05</td> <td style="padding: 2px 5px;">04</td> <td style="padding: 2px 5px;">03</td> <td style="padding: 2px 5px;">02</td> <td style="padding: 2px 5px;">01</td> </tr> </table> <p style="text-align: center;">100% of 200 °C / 8-bit</p>	08	07	06	05	04	03	02	01	
08	07	06	05	04	03	02	01				
21	PG feedback value	<div style="display: flex; justify-content: space-between;"> <span>MSB</span> <span>LSB</span> </div> <table border="1" style="margin: 0 auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">08</td> <td style="padding: 2px 5px;">07</td> <td style="padding: 2px 5px;">06</td> <td style="padding: 2px 5px;">05</td> <td style="padding: 2px 5px;">04</td> <td style="padding: 2px 5px;">03</td> <td style="padding: 2px 5px;">02</td> <td style="padding: 2px 5px;">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				
99	Individual signal output	<table border="1" style="margin: 0 auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">O8</td> <td style="padding: 2px 5px;">O7</td> <td style="padding: 2px 5px;">O6</td> <td style="padding: 2px 5px;">O5</td> <td style="padding: 2px 5px;">O4</td> <td style="padding: 2px 5px;">O3</td> <td style="padding: 2px 5px;">O2</td> <td style="padding: 2px 5px;">O1</td> </tr> </table> <div style="margin-left: 100px;"> <ul style="list-style-type: none"> <li>— RUN: Running</li> <li>— FDT: Frequency detection</li> <li>— FAR: Frequency reached</li> <li>— LU: Insufficient voltage stoppage</li> <li>— IOL: Inverter output restricted</li> <li>— IPF: Restoring power</li> <li>— None: No function</li> </ul> </div> <p style="margin-top: 10px;">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>	O8	O7	O6	O5	O4	O3	O2	O1	
O8	O7	O6	O5	O4	O3	O2	O1				

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