

Digital Input/Output Interface Card "VF1A-DIO"

Thank you for purchasing the digital input/output interface card "VF1A-DIO". By installing digital input/output interface card "VF1A-DIO" on the Doesa VF1A 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 |
|------------|---------------|-------------------|---------------|
| Doesa VF1A | VF1A-G□□□□S4 | All 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 "VF1A-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 IDEC branch office.

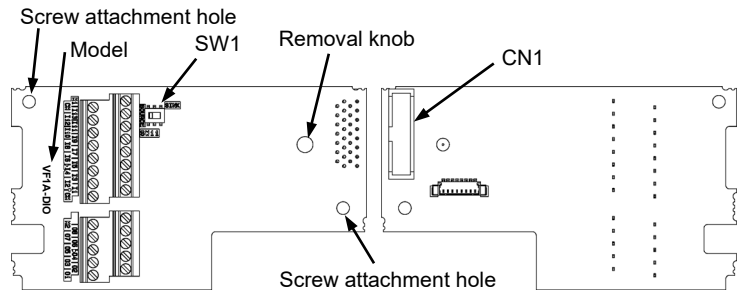


Fig. 2-1 Front of Card

Fig. 2-2 Back of Card

3. Basic Connection Drawing

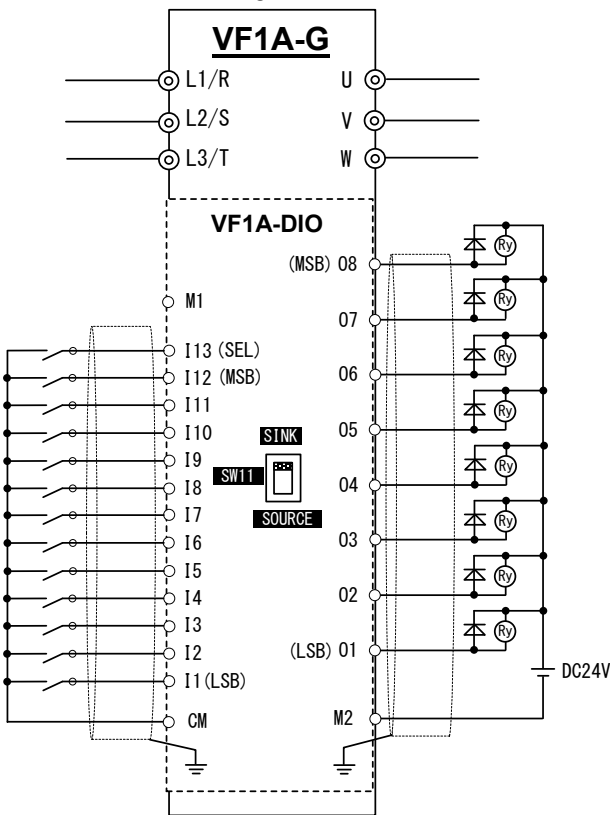


Fig. 3-1 Basic Connection Drawing

4. Electrical Specifications

Table 4-1 Electrical Specifications List

| Terminal symbol | Item | | Specification | |
|------------------------|--|-----------|---------------|-------|
| | | | Min. | Max. |
| I1 to 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 to 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 for the time shown in a target inverter's instruction manual to elapse. 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

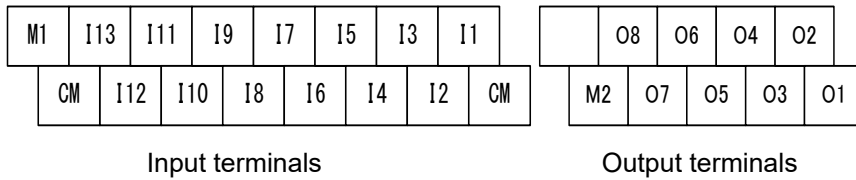


Fig. 5-1 Connection Terminal Allocation Drawing

| Table 5-1 Terminal Specifications | |
|---|-------------|
| Terminal size | M2 |
| Tightening torque (N-m) | 0.19 ±10% |
| Recommended wire size * | AWG22 to 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 to I13 | Digital input 1 to 13 | (1) The frequency setting method can be selected 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. (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. (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. |
| 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 to O8 | Transistor output 1 to 8 | (1) All types of monitor data (output frequency, output current, etc) specified with function code o21 can be output as 8-bit binary output signals. (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. |
| 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.

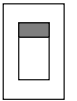
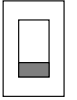
8. I/O Interface

8-1. Input Interface

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

Switching between input terminal (I1 to 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

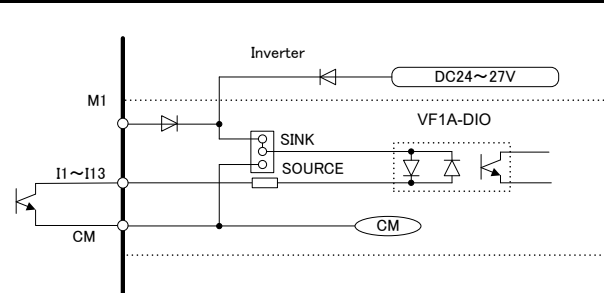
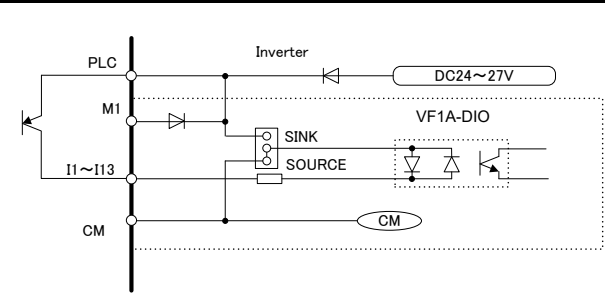
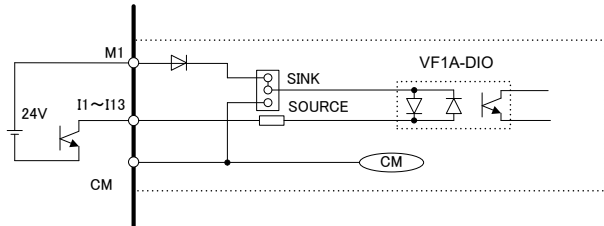
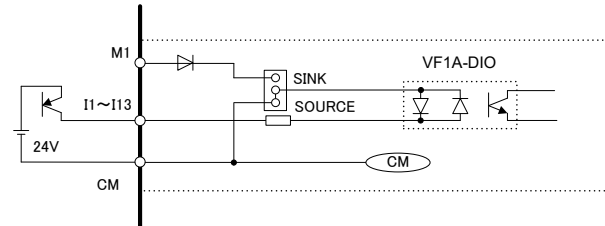
| Input method | Switch setting |
|-----------------------|---|
| SINK method (default) | Switches to SINK side.  |
| SOURCE method | Switches to SOURCE side.  |

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 to 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

| Power supply | Connection method | |
|--------------|---|--|
| | SINK method | SOURCE method |
| Internal |  |  |
| External |  |  |

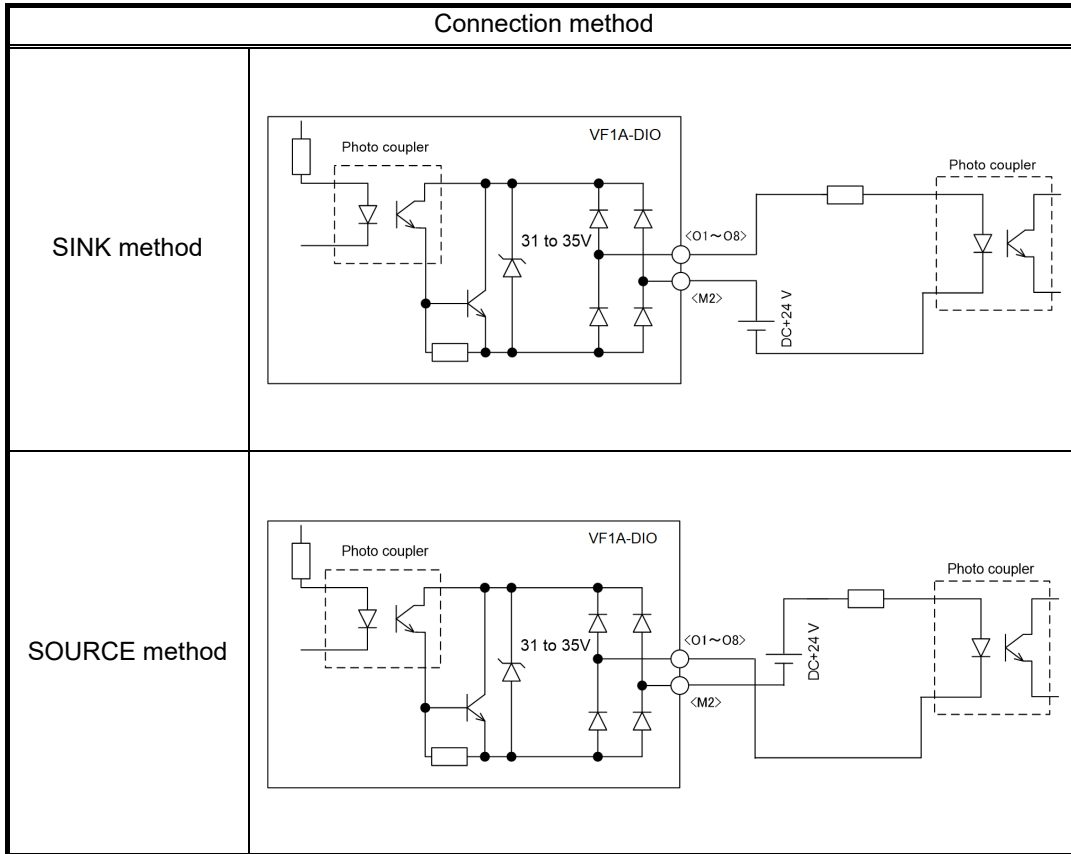
8-1-3. Contact Use Precaution

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".

LED4 LED3 LED2 LED1

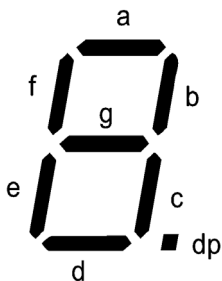


Table 9-1 LED Segment ON/OFF Indication

| 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

| Doesa VF1A 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 to 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 o08 | Terminal O1 to O8 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)

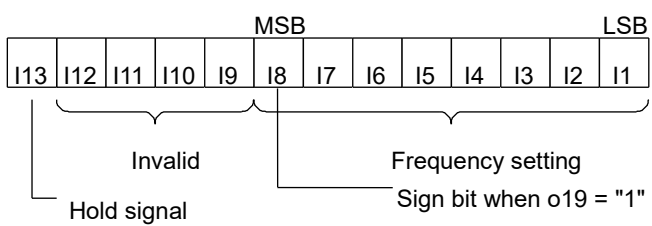
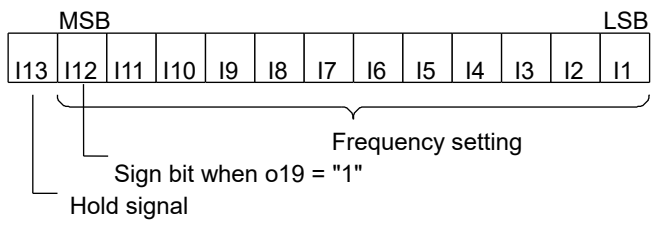
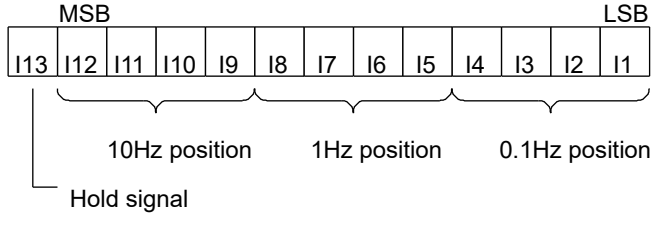
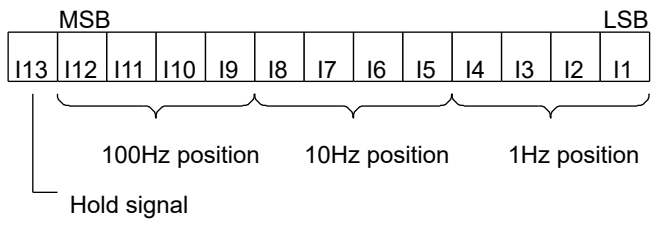
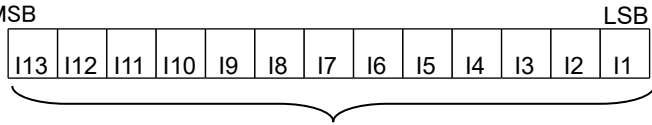
| Function code | Data | Input signal name | Terminal function and setting content description |
|---------------|------|---|--|
| o20 | 0 | 8-bit binary frequency setting |  <p>Hold signal Data update possible when I13 = "0" Data update not possible when I13 = "1"</p> <p>(1) Set resolution = set max. frequency x (1/255) (2) Upper/lower limiters are given priority.</p> |
| | 1 | 12-bit binary frequency setting |  <p>Hold signal 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> |
| | 4 | BCD 3-digit frequency setting (0.0 to 99.9Hz) |  <p>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> |
| | 5 | BCD 3-digit frequency setting (0 to 500Hz) |  <p>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> |
| | 99 | General-purpose input |  <p>General-purpose</p> <p>The input operation for each signal is the same as that for the inverter unit general-purpose input function.</p> |

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="display: flex; justify-content: space-between;"> MSB LSB </div> <table border="1" style="margin: 0 auto; text-align: center;"> <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 500 V / 8-bit: 200 V series 100% of 1,000 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;"> MSB LSB </div> <table border="1" style="margin: 0 auto; text-align: center;"> <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 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;"> MSB LSB </div> <table border="1" style="margin: 0 auto; text-align: center;"> <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 | | | |
| | 16 | PID output (MV) | <div style="display: flex; justify-content: space-between;"> MSB LSB </div> <table border="1" style="margin: 0 auto; text-align: center;"> <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 | | | |
| 17 | Synchronous angle deviation | <div style="display: flex; justify-content: space-between;"> MSB LSB </div> <table border="1" style="margin: 0 auto; text-align: center;"> <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 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;"> MSB LSB </div> <table border="1" style="margin: 0 auto; text-align: center;"> <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 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;"> MSB LSB </div> <table border="1" style="margin: 0 auto; text-align: center;"> <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 | | | | |
| 99 | Individual signal output | <table border="1" style="margin: 0 auto; text-align: center;"> <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> <div style="margin-left: 100px;"> <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> <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> | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | |
| 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | | | | |