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DIO Digital Input/Output Option Card for the GP10 and VG10

Option Card Part Number
SOPCG11SDIO

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Document Part Number 027-2136

Preface

Thank you for purchasing our OPCG11SDIO drive option. Before using the option, read this manual carefully to understand how to use the option correctly. Improper use may result in abnormal operation, reduce product life, and possible failure. This manual does not describe how to use the Drive main unit. Refer to the VG10 / GP10 Instruction Manual for details about the Drive unit. Keep this manual on hand for reference when using the option.

To use the option safely

Note the following items when using the option. Improper use may result in unexpected failure, electric shock, or possible injury.

(1) Installation and Wiring

WARNING

Wait at least five minutes after turning off the power before installing or wiring the Drive option. Use a multi-meter or similar instrument to check the voltage before performing installation or wiring. (Check whether the charge lamp goes off.), **as electric shock may occur**
Discharge static electricity from your body before handling the Drive option. Never touch the Drive option with wet hands, **as accident or electric shock may occur**
No foreign matter such as screws, metal patches, lint, chips, and dust in the Drive option.
There is risk of fire or accident.
Do not damage or stress the wiring, **as accident or electric shock may occur.**

CAUTION

Do not install or operate a damaged option or one that is lacking parts, **as injury may occur.**
Since noise is generated by the drive, motor, and wiring, carefully monitor surrounding sensors and devices for abnormal operation. **There is a risk of accident.**

(2) Operation

WARNING

Check and adjust parameters before operation. Improper parameters may cause an unexpected action for some machines. **There is a risk of accident.**

CAUTION

High-speed operation can be set easily for the drive. Fully check motor or device performance before changing the setup, **as accident may occur.**

(3) Maintenance and Inspection, and Parts Replacement

WARNING

Wait at least five minutes after turning off the power before inspecting the Drive option. (Check whether the charge lamp goes off.) **There is a risk of electric shock.**
Only authorized personnel are allowed to maintain and inspect the Drive option and replace parts, **as electric shock or injury may occur.**
Never modify the Drive option, **as electric shock or injury may occur.**

CAUTION

Do not execute a megger test (insulation resistance measurement).

(4) Discard

CAUTION

Since the drive option uses soldering lead, treat it as an industrial waste when discarding it.

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Note: If anything is unclear about the option or there is something doubtful about its condition, contact your distributor or our nearest branch office.

1 Before Using this Product

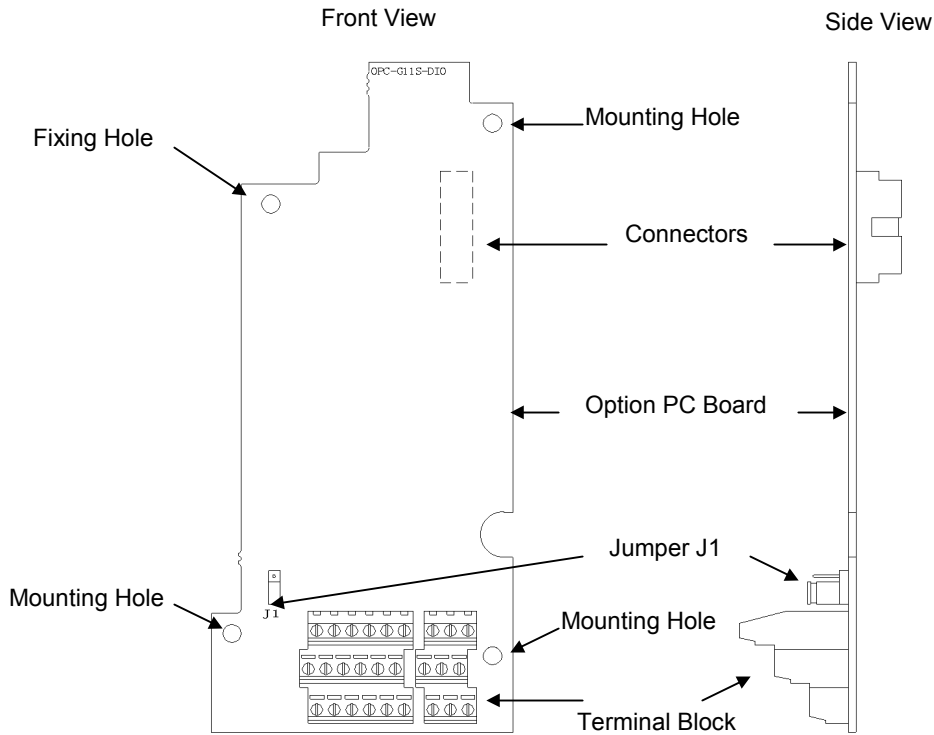
Check the items described below when you receive this product. Also check whether this product has been damaged during transport. If anything is amiss, contact your distributor.

1-1 Checking Accessories

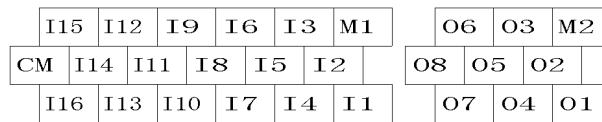
Confirm that the following accessories are included in the package:

- 1. Instruction Manual _____ 1
- 2. Accessories
 - 1) Mounting screw M3 x 6 _____ 1
 - 2) Supports _____ 3

1-2 Product Appearance



Terminal Arrangement



2 Product Inquires

2-1 Overview

This product is an interface card that is installed in the GP/VG10 general-purpose drive. It provides the following functions:

- (1) For setting frequency using a binary code.
- (2) For monitoring frequency, output current, and output voltage using a binary code.

2-2 Product Warranty

Warranty period is 12 months after installation or 18 months after shipment from the Company, whichever occurs first. However the troubles caused by the following reasons are not covered by this warranty even in warranty period.

- (1) Problems caused by incorrect operation or by unauthorized repairs or modifications.
- (2) Problems resulting from using the Drive in the range outside the standard specification.
- (3) Damage to the Drive after purchase or during delivery.
- (4) Damage caused by earthquakes, fire, floods, lightning, abnormal voltage fluctuations or other natural disasters and secondary disasters.

3 Installation

3-1 Installation Environment

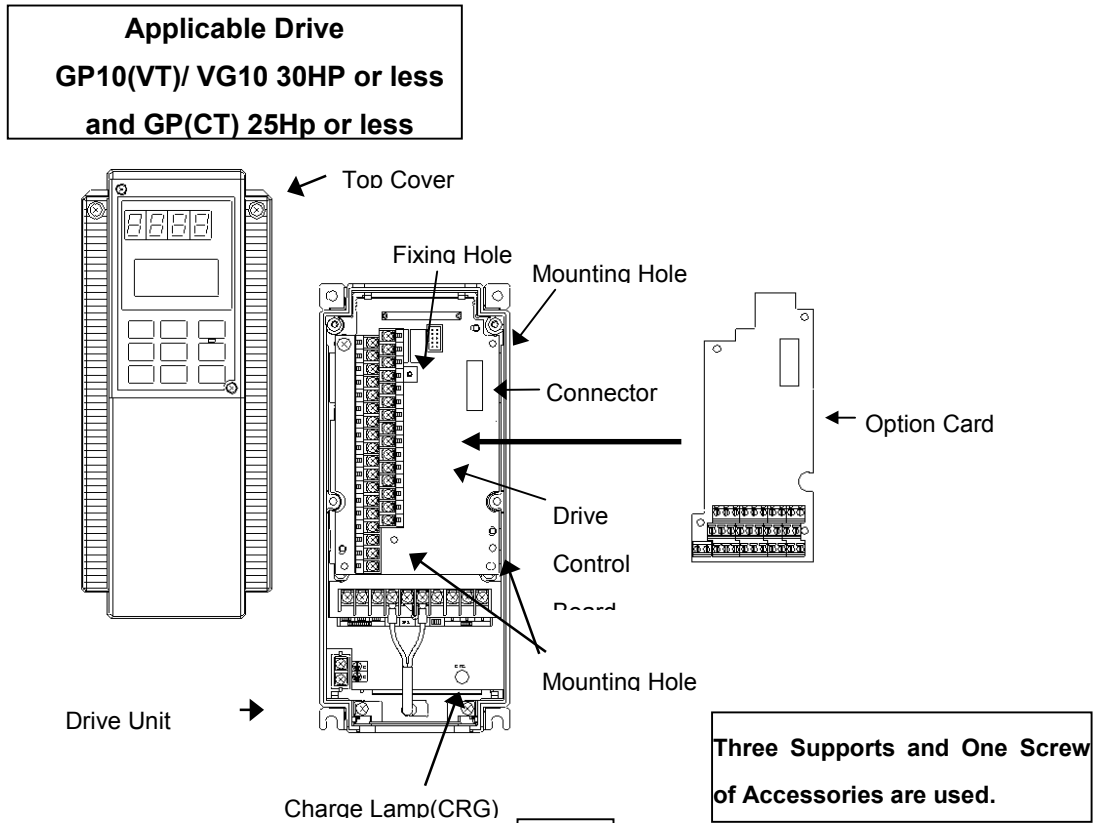
The installation environment for the Drive in which this product is being installed is listed Table 3-1-1 and Drive instruction book page 2-1.

Table 3-1-1 Installation Environment.

Item	Specifications	Remarks
Location	Indoors	-
Ambient temperature	-10 to 50°C, (+14 to +122°F) , -10 to 40°C(+14 to 104°F) for NEMA4/12 (Remove the ventilation cover of the Drive when the temperature exceeds +40°C(30HP or less).)	-
Ambient relative humidity	5 to 95%	-
Environment	The place should be away from direct sunlight and free from dust, corrosive gases, inflammable gases, oil mists, steam, dripping water or vibration. Salty environments should preferably be avoided. Avoid places where sudden changes in temperature occur which could cause condensation or freezing.	-
Altitude	Up to 3300 feet (1000m)	-

3-2 Installation Procedure

Before installing or removing the option, be sure to turn off input power to the Drive and confirm that the charge lamp (CHARGE or CRG) is off.



Step1

Remove the top cover, and insert the accessory supports into the three mounting holes on the Drive control Board.

Step2

Set the supports inserted in step 1 on the option card, and insert the Drive control board connector to the option card connector. After that, check that you can see the nails of the supports on the option card.

Step3

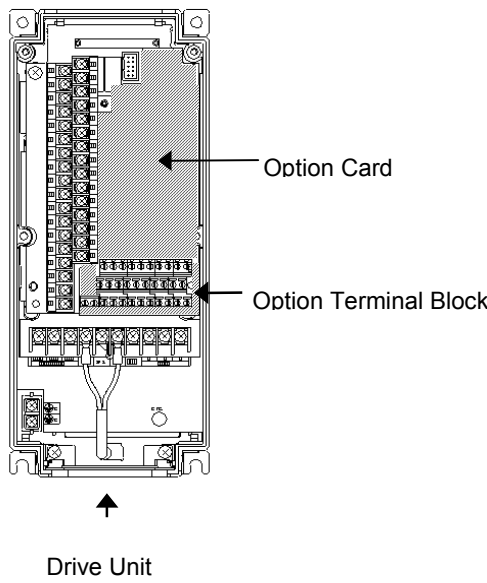
Insert and tighten the screws (M3 x 6) in the fixing holes to secure the option card.

Step4

Wire the option according to the basic connection diagram.

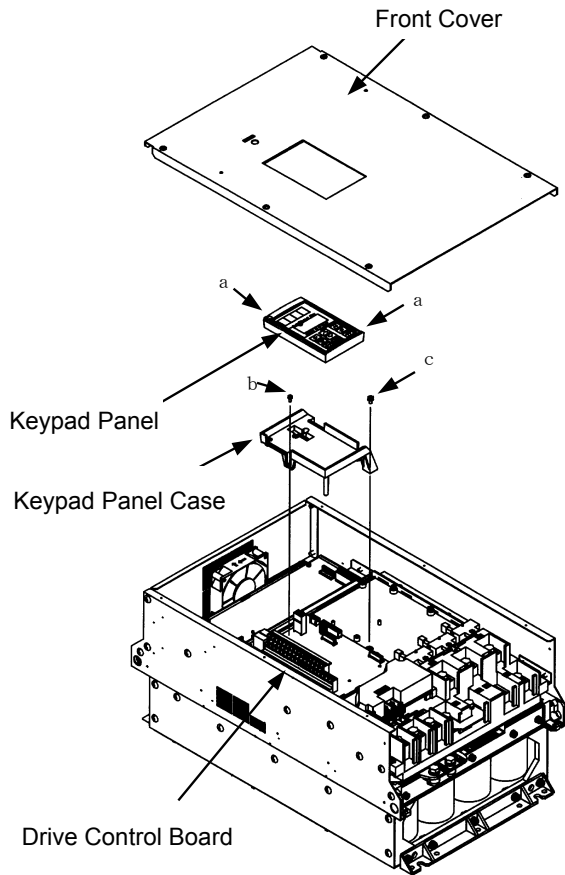
Step5

Confirm that the option card and all wires are installed correctly, then place the top cover of the Drive.

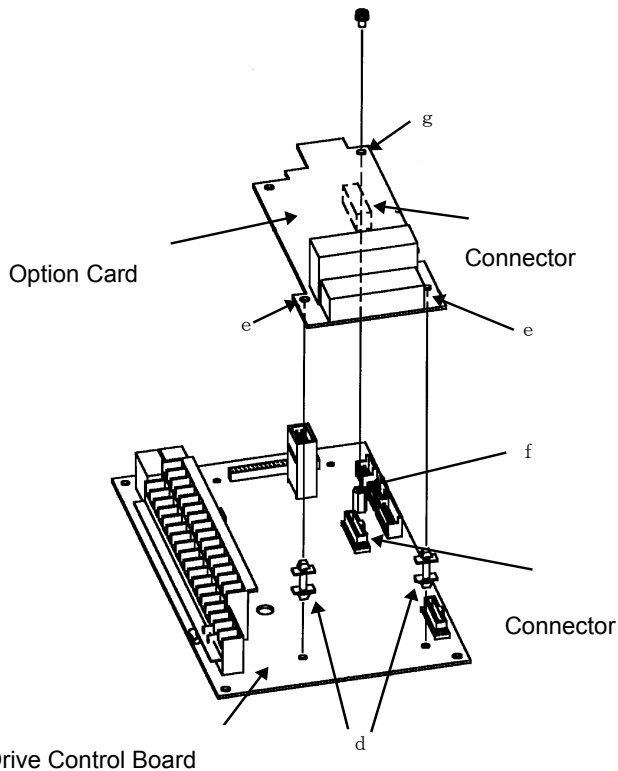
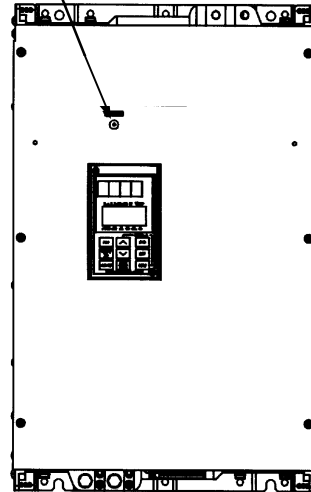


**Applicable Drive
GP10(VT)/ VG10 30HP or less
and GP(CT) 25Hp or less**

**Two Supports and One Screw
of Accessories are used.**



Charge Lamp (CHARGE)
(Location Depends on the Device Type.)



Step 1

Remove the front cover and loosen the two M3 screws (a) to remove the keypad panel.

Step 2

Remove one M3 screw (b) and one M4 screw (c) to remove the keypad panel case.

Step 3

Insert the two accessory supports (d) into the Drive control board.

Step 4

Insert the two supports (d) into the holes (e) on the option card. Align the support (f) with the hole (g) on the option card, then and insert one connector.

Step 5

Insert and tighten the accessory screws (M3 x 6) at (f) and (g) to secure the option card.

Step 6

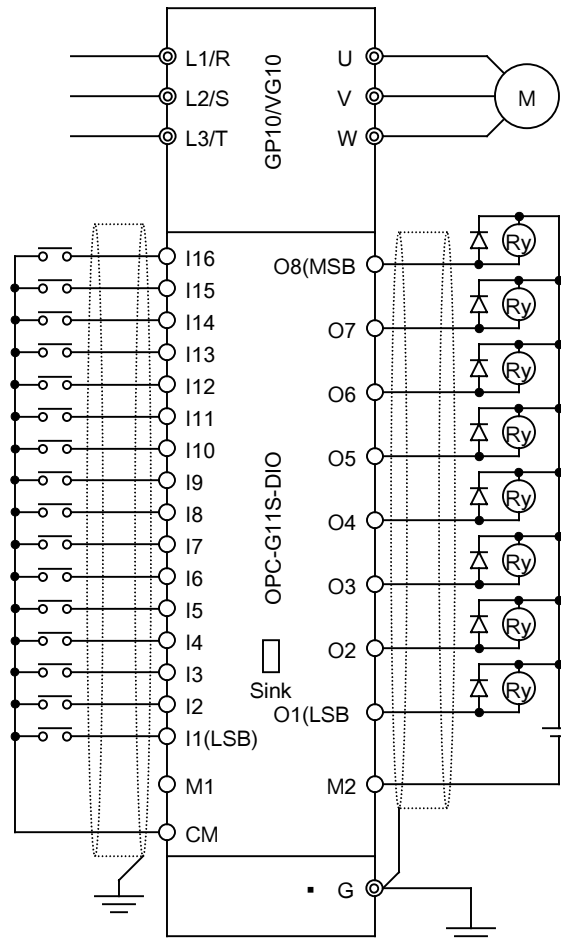
Place the keypad panel and the front cover, then assemble the Drive as it was before.

4 Wiring

CAUTION

Check the wiring again before operating the Drive. Improper wiring may cause unexpected Drive operation or device operation. **There is a risk of accident or injury.**

4-1 Basic Connection Diagram



4-2 Terminal Functions

Table 4-2-1 Terminal Functions

	Terminal Symbol	Terminal Function
Digital Inputs	I1 – I16	Terminals for setting input
	M1	External power supply connection terminal for setting input
	CM	Common terminal for setting input
Digital Outputs	O1 – O8	Terminals for output monitor
	M2	Common terminal for output monitor

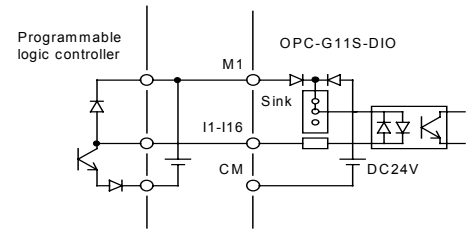
4-3 Electrical Specifications

Table 4-3-1 Electrical Specifications

Termi-nal symbol	Item	Abbre-viation	Condition	Specification			
				min.	typ.	max.	
11 ~ 116	Sink	Operating input voltage at ON level	V _{IL}	V _{CC} =22V	0V	-	2V
		Operating output current at ON level	I _{IL}	V _{CC} =24V V _{IL} =0V	-	3.2mA	-
				V _{CC} =27V V _{IL} =0V	-	-	4.5mA
		Operating output voltage at OFF level	V _{IH}		22V	24V	27V
	Operating leakage current at OFF level	I _{IH}		-	-	0.5mA	
	Source	Operating input voltage at ON level	V _{IL}		22V	24V	27V
		Operating input voltage at OFF level	V _{IH}		0V	1V	5V
		Operating input current at ON level	I _{IL}	V _{CC} =24V V _{IL} =0V	-	3.2mA	-
				V _{CC} =27V V _{IL} =0V	-	-	4.5mA
	01 ~ 08	Sink	Operating sink current at ON level	I _{OL}	V _o =27V	-	-
Operating output voltage at ON level			V _{OL}	I _{OL} =50mA	-	2V	3V
Operating output voltage at OFF level			V _{OH}		-	DC24V	DC27V
Operating leakage current at OFF level			I _{OH}	V _o =24V	-	-	0.5mA
Source		Operating source current at ON level	I _{OL}	V _o =27V	-	-	-50mA
		Operating output voltage at ON level	V _{OL}	I _{OL} =-50mA	-	2V	3V
		Operating output voltage at OFF level	V _{OH}		-	DC24V	DC27V
		Operating leakage current at OFF level	I _{OH}	V _o =24V	-	-	-0.5mA

4-4 Digital Input Terminals

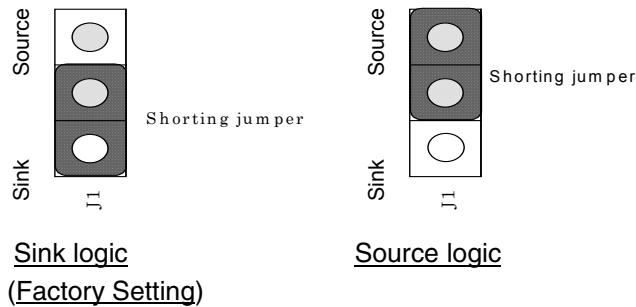
- Digital input terminals (e.g. I1 to I16) are generally turned on or off by connecting or disconnecting the line to or from the CM terminal. If digital input terminals are turned on or off by switching the open collector output of PLC using an external power supply, a resulting bypass circuit may cause the Drive to malfunction. To prevent a malfunction, connect the M1 terminal as shown in Fig.4-4-1.
- When using a contact input, a relay having highly reliable contact must be used.



4-5 Logic Settings Of Digital Inputs

Jumper J1 is used to set between sink logic and source logic of digital input. Set the setting cap before turning the drive on.

(The digital output can be used in both the sink logic and source logic modes without relations to the setting at jumper J1.)



4-6 Digital Output Terminal

- These terminals have a circuit configuration as shown in Table 4-8-1. The digital output terminal can be used in both the sink logic and source logic modes without relations to the setting at jumper J1.
- To connect a control relay, connect a surge absorbing diode to both ends of its exciting coil.

4-7 Terminal Connection on Options

The wire size for the option connection terminal is AWG 16 to 18. When an unshielded connection terminal is used, make the length of the unshielded wire 1/4" (5 mm). When using a crimp terminal, be sure to use an insulated ferrule. Insert the wire into the upper side of the metal bracket on the terminal block, and tighten the screw.

Wiring : AWG 16 to 26

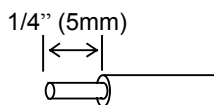


Figure 4-7-1 Wire Terminal on Option Connection Terminal Side.

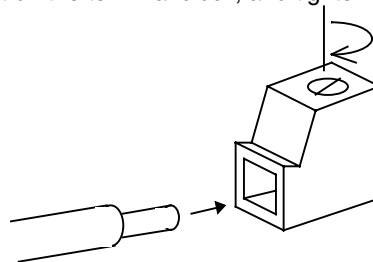


Figure 4-7-2 Connection of Wiring on Optional Terminal Side.

4-8 Input Interface

Table 4-8-1 Input Interface

Power supply	Logic	Connection method
Internal	Sink	
External	Sink	
External	Source	

4-9 Output Interface

Table 4-9-1 Output Interface

Logic	Connection method
Sink	
Source	

4-10 Additional Information

Run the option wiring at least 4" (10 cm) from the main circuit wiring of the drive main unit and other power cables to avoid abnormal operation due to noise. Do not run the option wiring in the same electrical duct with other power cables. Connect the sheath of the shielded cable to the terminal G of drive, then leave the other end open.

5 Function Code Settings

5-1 Digital Input Function Settings

Table 5-1-1 Digital Input Function Settings

Function code	Contents of function code	Data	Contents of data	Remarks
F01 (C30)	Frequency command 1 (Frequency command 2)	11	Setting by digital input	* 1
		Other than 11	Frequency setting corresponding to each piece of data	
o19	Input function selection	0	Frequency setting (without polarity)	When 4 or 5 (BCD code) is selected for o20, the function is the same as that with no polarity.
		1	Frequency setting (with polarity)	
o20	Input mode selection	0	8-bit binary setting	* 2
		1	12-bit binary setting	* 2
		2	15-bit binary setting	* 2
		3	16-bit binary setting	
		4	4-digit BCD setting: 0 to 99.99	
		5	4-digit BCD setting: 0 to 400.0	* 2

(Notes) *1. The frequency setting method selected using function code F01 (C30) takes priority over this setting even when OPCG11SDIO is installed. To make the frequency setting at OPCG11SDIO effective, set function code F01 (C30) to "11".

*2. I16: Hold signal

When I16 is "OFF", the set frequency is updated according to the input data.

When I16 is "ON", the input data is ignored and the set frequency is held.

5-2 Digital Output Function Settings

Table 5-2-1 Digital Output Function Settings

Function code	Function code item	Data	Monitor item	Remarks
o21	Output mode selection	0	Output frequency 1 (before slip compensation)	*1
		1	Output frequency 2 (after slip compensation)	*1
		2	Output current	*2
		3	Output voltage	*3
		4	Output torque	*4
		5	Load rate	*5
		6	Power consumption	*6
		7	PID feedback amount	*7
		8	PG feedback amount	*8
		9	DC link circuit voltage	*9

- *1 : Output frequency 1,2 monitor = (Output frequency 1,2 / Maximum output frequency) x 255
- *2 : Output current monitor = (Output current / (Rated output current of Drive x 2)) x 255
- *3 : Output voltage monitor = (Output voltage / 250V) x 255 : 230V series
= (Output voltage / 500V) x 255 : 460V series
- *4 : Output torque monitor = (Output torque / (Rated torque of motor x 2)) x 255
- *5 : Load rate monitor = (Output power / (Rated load of motor x 2)) x 255
- *6 : Power consumption monitor = (Output power / (Rated output of motor having the same capacity as INV. x 2)) x 255
- *7 : PID feedback amount monitor = (PID feedback amount /12 input :10V , C1 input : 20mA) x 255
- *8 : PG feedback amount monitor = (PG feedback amount / Synchronous speed at maximum output frequency) x 255
- *9 : DC link circuit voltage monitor = (DC link circuit voltage / 500 [V]) x 255 : 230V series
= (DC link circuit voltage / 1000 [V]) x 255 : 460V series

All the eight bits are output when the monitoring amount exceeds 100%.

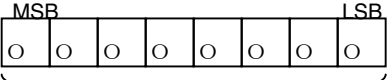
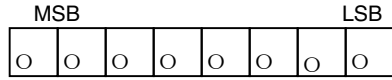
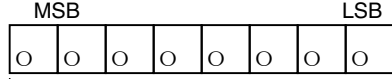
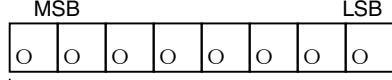
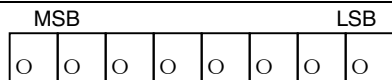
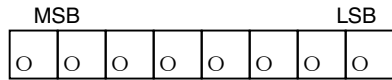
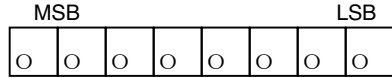
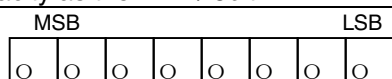
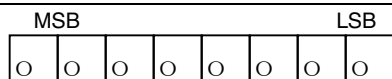
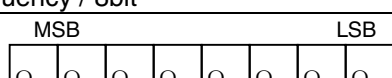
5-3 Detail Description of Functions

Functions for each function code are described in detail.

Table 5-3-1 Detail description of functions

№	o 1 9	o 2 0	Name of input signal	Terminal function and description of setting
①	0	0	8-bit binary frequency setting	<div style="display: flex; justify-content: space-between; align-items: center;"> MSB LSB </div> <p>Disregarded Hold signal</p> <p style="text-align: center;">Frequency setting</p> <p>Data can be updated when I16 is "OFF". Data cannot be updated when I16 is "ON".</p> <p>① Minimum increment = (Max. setting frequency) x (1/255) ② The upper and lower limits set by the limiter are given priority.</p>
②	0	1	12-bit binary frequency setting	<div style="display: flex; justify-content: space-between; align-items: center;"> MSB LSB </div> <p>Disregarded Hold signal</p> <p style="text-align: center;">Frequency setting</p> <p>Data can be updated when I16 is "OFF". Data cannot be updated when I16 is "ON".</p> <p>① Minimum increment = (Max. setting frequency) x (1/4095) ② The upper and lower limits set by the limiter are given priority.</p>
③	0	2	15-bit binary frequency setting	<div style="display: flex; justify-content: space-between; align-items: center;"> MSB LSB </div> <p>Disregarded Hold signal</p> <p style="text-align: center;">Frequency setting</p> <p>Data can be updated when I16 is "OFF". Data cannot be updated when I16 is "ON".</p> <p>① Minimum increment = (Max. setting frequency) x (1/32767) ② The upper and lower limits set by the limiter are given priority.</p>
④	0	3	16-bit binary frequency setting	<div style="display: flex; justify-content: space-between; align-items: center;"> MSB LSB </div> <p style="text-align: center;">Frequency setting</p> <p>① Minimum increment = (Max. setting frequency) x (1/65535) ② The upper and lower limits set by the limiter are given priority.</p>
⑤	0 , 1	4	4-digit BCD frequency setting (0 ~ 99.99Hz)	<div style="display: flex; justify-content: space-between; align-items: center;"> MSB LSB </div> <p style="text-align: center;">Tens digit (Hz) Units digit (Hz) Tenths digit (Hz) Hundredths digit (Hz)</p> <p>① The frequency is set in the 0 to 99.99 Hz range (minimum increment: 0.01 Hz). ② The upper and lower limits set by the limiter is given priority. ③ For inputs larger than the maximum output frequency, the maximum output frequency is output.</p>

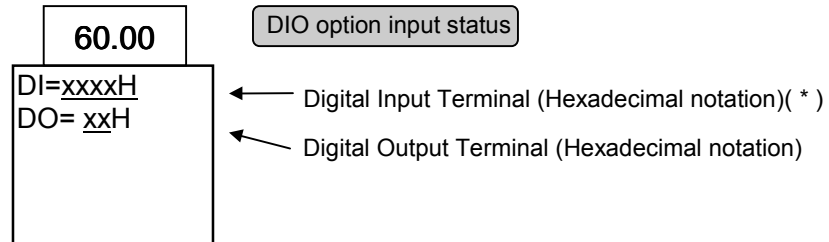
No	o 1 9	o 2 0	Name of input signal	Terminal function and description of setting
⑥	0 , 1	5	4-digit BCD frequency setting (0 ~ 400.0 Hz)	<p>Data can be updated when I16 is "OFF". Data cannot be updated when I16 is "ON".</p> <ol style="list-style-type: none"> The frequency is set in the 0 to 400.0 Hz range (minimum increment: 0.1 Hz). The upper and lower limits set by the limiter is given priority. For inputs larger than the maximum output frequency, the maximum output frequency is output.
⑦	1	0	8-bit binary frequency setting	<p>Data can be updated when I16 is "OFF". Data cannot be updated when I16 is "ON".</p> <ol style="list-style-type: none"> Frequency setting range: -(Max. frequency) to + (Max. frequency), or -128 to +127 Minimum increment = (Max. setting frequency) x (1/127) The upper and lower limits set by the limiter is given priority.
⑧	1	1	12-bit binary frequency setting	<p>Data can be updated when I16 is "OFF". Data cannot be updated when I16 is "ON".</p> <ol style="list-style-type: none"> Frequency setting range: -(Max. frequency) to + (Max. frequency), or -2048 to +2047 Minimum increment = (Max. setting frequency) x (1/2047) The upper and lower limits set by the limiter is given priority.
⑨	1	2	15-bit binary frequency setting	<p>Data can be updated when I16 is "OFF". Data cannot be updated when I16 is "ON".</p> <ol style="list-style-type: none"> Frequency setting range: -(Max. frequency) to + (Max. frequency), or -16384 to +16383 Minimum increment = (Max. setting frequency) x (1/16383) The upper and lower limits set by the limiter is given priority.
⑩	1	3	16-bit binary frequency setting	<ol style="list-style-type: none"> Frequency setting range: -(Max. frequency) to + (Max. frequency), or -32768 to +32767 Minimum increment = (Max. setting frequency) x (1/32767) The upper and lower limits set by the limiter is given priority.

Function code	Data	Name of input signal	Terminal function and description of setting
o21	0	Output frequency 1 (before slip compensation)	 100% of maximum output frequency / 8bit
	1	Output frequency 2 (after slip compensation)	 100% of maximum output frequency / 8bit
	2	Output current	 200% of rated output current of Drive/ 8bit
	3	Output voltage	 100% of 250V / 8bit : 230V series 100% of 500V / 8bit : 460V series
	4	Output torque	 200% of rated torque of motor / 8bit
	5	Load rate	 200% of rated load of motor / 8bit
	6	Power consumption	 200% of the rated output of the motor having the save capacity as the INV. / 8bit
	7	PID feedback amount	 100% of 12 inputs: 10V/C1 input 20 ma / 8bit
	8	PID feedback amount (only when option is installed)	 100% of synchronization speed at maximum output frequency / 8bit
9	DC link circuit voltage	 100% of 500V / 8bit : 230V series 100% of 1000V / 8bit : 460V series	

6 Additional Information

6-1 I/O Check

The digital input status of the DIO option can be checked on the drive keypad panel. Switch from the run mode screen to the program menu screen, then select [4. I/O check]. The I/O check monitor has seven screens. Using the up and down keys, scroll through the screens to check the digital input status of the DIO option. See the explanation of how to operate the keypad panel in the drive Instruction Manual.



(*)I16: The current state of digital input terminals is displayed without the hold signal.

6-2 Changeover by External Signal

The frequency setting by means of the DIO option and the regular frequency setting method can be changed over according to an external digital input signal.

- Frequency setting by means of DIO option when the external input signal is turned on.
- Regular frequency setting (via keypad panel, analog input, etc.) when the external input signal is turned off.

The setting method for the above case is described below.

[Setting method]

- 1 Connect an external input signal to one of digital input terminals (X1 to X9) of the Drive.
- 2 Set "11" (frequency command 2 / frequency command 1) to the function code corresponding to the terminal connected in step 1, among the function codes E01 to E09 (for X1 to X9 terminals).
- 3 Set one of regular frequency setting methods (keypad panel, analog input, etc.) other than DIO option to function code F01 (frequency command 1).
- 4 Set "11" (DIO option) to function code C30 (frequency command 2).

6-3 Frequency Indication at Keypad Panel

When the frequency is set through digital input, the frequency displayed on the keypad panel may differ from the set frequency. This is because the maximum number of digits displayed on the keypad panel is four (0.00 to 99.99, 100.0 to 400.0). The minimum increment inside the drive is described in Table 5-3-1.