

<b><u>PBUS66-Z Operating Manual</u></b>	No.	QG18743
	ISSUED DEPARTMENT	INDUSTRIAL BUSINESS DIVISION INDUSTRIAL SYSTEM WORKS INDUSTRIAL DEVELOPMENT DEPARTMENT

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# Foreword

Thank you for choosing Toyo inverter product.

This instruction manual contains information regarding PBUS66-Z Optional Circuit Board for VF66B Inverter. For correct use, please carefully read this instruction manual prior to using the PBUS66-Z.

In order to accommodate the many special functions to a wide variety of applications in addition to the basic inverter functions, please thoroughly read the VF66B inverter manual as well as any other applicable specialized instruction manuals.

This instruction manual covers functions, connection procedures for the PBUS66-Z, and setting up VF66B Inverter.

For information about PROFIBUS-DP communication, please refer to the "**PBUS66-Z Communication Protocol Manual**".

## Please read before use

### For safety

Before installing, operating, maintaining and inspecting the PBUS66-Z, please read this manual and all other appendices thoroughly in order to get familiarize with the feature of this option, safety information and correct handling. For safe operation, be sure to also thoroughly read the VF66B Inverter operating manual. In this instruction manual, the safety instructions are classified in to two levels: DANGER and CAUTION. These signs have important instructions. Please follow the instructions without fail.



Indicates a hazardous situation which may result in death or serious injury if it is handled improperly.



Indicates a hazardous situation which may result in moderate or minor injury or only in property damage if it is handled improperly. However, such a situation may lead to serious consequences depending on circumstances.

### **CAUTION** [Installation]

- Do not use optional circuit board if you discover damage or deformation during unpacking. Doing so may cause optional circuit board failure or malfunction.
- Do not place any flammable materials near the optional circuit board. Doing so may cause a fire.
- Do not allow the optional circuit board to drop, fall over or sustain severe impacts. Doing so may cause optional circuit board failure or damage.
- Do not install or operate the optional circuit board if it is damaged or have any of its parts missing. Doing so may lead to personal injury.

### **DANGER** [Wiring]

- Before wiring, make sure the power is OFF. Failure to do so may cause an electric shock or fire.
- Wait more than 10 minutes after turning the power OFF before opening the unit case lid.
- Make sure that the unit is correctly earthed. Failure to do so may cause an electric shock or fire.
- Wiring must be done by skilled technicians. Failure to do so may cause an electric shock or fire.
- Wire the unit after it is installed. Failure to do so may cause an electric shock or fire.

## **CAUTION** [Wiring]

- Make sure that communication cables and connectors are properly installed and locked in place. Failure to do so may cause optional circuit board failure or malfunction.

## **DANGER** [Operation]

- Turn the power ON after fitting the inverter front cover.  
Do not remove the cover while the power is ON.  
Doing so may cause an electric shock.
- Do not operate any switch with wet hands.  
Doing so may cause an electric shock.
- Do not touch the inverter terminals while the power is ON, even if the inverter is in the idle state.  
Doing so may cause an electric shock.
- If the alarm is reset with the operation signal kept input, the inverter will suddenly restart. Reset the alarm after making sure that the operation signal is OFF.  
Failure to do so may lead to personal injury.
- The inverter can be set to operate in a wide range of speed. Operate the inverter after sufficiently checking the allowable range of the motor and equipment.  
Failure to do so may cause personal injury, equipment failure or damage.

## **CAUTION** [Operation]

- The inverter radiating fin and the radiating resistance are hot. Do not touch them.  
Failure to follow this warning may cause burns.

## **DANGER** [Maintenance, Inspection and Parts Replacement]

- Always turn the power OFF before inspecting the inverter.  
Failure to do so may cause an electric shock, personal injury or fire.
- Unauthorized persons shall not perform maintenance, inspection or parts replacement.  
Use insulated tools for maintenance and inspection.  
Failure to do so may cause electric shock or personal injury.

## **CAUTION** [Other]

- Never modify the unit.  
Doing so may cause electric shock or personal injury.

## **CAUTION** [General Precautions]

Some illustrations given in this manual show the inverter from which the covers or safety shields have been removed to illustrate the details. Before operating the inverter, reinstall the covers and shields to their original positions and operate the inverter according to this manual.  
These safety precautions and specifications stated in this manual are subject to change without notice.

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# Chapter 1 Outline of Functions

The PBUS66-Z Optional Circuit Board has been designed to connect to the VF66B Inverter's internal VFC66-Z circuit board connector.

In addition to the PROFIBUS-DP slave station communication function, the PBU66-Z is also equipped with analogue input/output, multifunction input and PG input/output functions.

Through PROFIBUS-DP communication, the PBUS66-Z can input operation, speed and torque commands to the VF66B Inverter as well as monitor factors such as operating conditions, protection conditions, current and voltage. It can also read and rewrite the inverter parameter as well as read the trace-back data, protection history and monitor data. Furthermore, it can be used as the input/output signal of the VF66B Inverter built-in PLC function. For information about PROFIBUS-DP communication, please refer to the "[PBUS66-Z Communication Protocol Manual](#)". For information about the built-in PLC function, please refer to the VF66 PCTool manual.

In order to reduce environmental impact, the PBUS66-Z has been designed to contain levels of lead, mercury, cadmium, hexavalent chromium, PBB and PBDE that conform to the RoHS directive issued by the EU.



## **CAUTION** [Safety Precautions]

Carefully read the instruction manual before use, and use the inverter correctly.

Our inverter and optional circuit board are not designed or manufactured for the use in life-support machines or systems.

If you intend to use the product stated in this manual for special purposes, such as passenger cars, medical devices, aerospace devices, nuclear energy controls and submarine relaying machines or systems, consult our sales department.

This product is manufacture under strict quality control. However, if it is used in critical equipment in which inverter and optional circuit board failure may result in death or serious damage, provide safeguard to avoid serious accidents.

If you wish to use this inverter with loads other than three-phase AC traction, please contact us.

To use product, electrical work is necessary. The electrical work must be done by qualified expert.

# Chapter 2 Basic Specifications

## 2.1 Multifunction Input Terminal Specifications

### Multifunction Input

PBUS66-Z Terminal Block TB1	Terminal Name	Use	Description
	PS (2 Terminals)	+12V Power Supply Terminal	Outputs a +12V DC voltage.
	G (2 Terminals)	GND Terminal	Never connect the G terminal to the earth terminal. Never connect or allow contact between the PS and G terminals.
	MI6	Multifunction input terminal (6)	(Max input voltage DC24V/Max input current 3mA) By input the signal in multifunction input terminal, the same operation can be done as that of console. [In the initial condition, the VF66B inverter parameters for the C-area are set to: - Multifunction input terminal (6) – Preset speed selection 1 - Multifunction input terminal (7) – Preset speed selection 2 - Multifunction input terminal (8) – Preset speed selection 3 - Multifunction input terminal (9) – Accel./decel. time selection 1 - Multifunction input terminal (10) – Accel./decel. time selection 2 - Multifunction input terminal (11) – Speed UP command] * See each detailed mode instruction manuals for details of multifunction input terminals.
	MI7	Multifunction input terminal (7)	
	MI8	Multifunction input terminal (8)	
	MI9	Multifunction input terminal (9)	
	MI10	Multifunction input terminal (10)	
	MI11	Multifunction input terminal (11)	

### Multifunction Input Source Mode/Sink Mode Configuration Jumper Connector

PBUS66-Z Jumper Connector	Connector Code	Use	Description
	CN-SO	Source Mode	- Source mode and sink mode can be toggled by changing the jumper shunt position. - Always turn the power off before changing any jumper positions. [In the initial configuration, the device is set to source mode.]
	CN-SI	Sink Mode	- For source mode, mount switches between multifunction input terminals (6) – (11) and the PS terminal and set them to ON/OFF. - For sink mode, mount switches between multifunction input terminals (6) – (11) and the G terminal and set them to ON/OFF.  For more information, please refer to Chapter 4.

## 2.2 Analog Input/Output Terminal Specifications

### Analog Input/Output

	Terminal Name	Use	Description
PBUS66-Z Terminal Block TB1	AIN2	Analog Input (2) Terminal	<ul style="list-style-type: none"> <li>- The input range for the Analog Input (2) Terminal can be set to 4 to 20mA, 0 to <math>\pm 10V</math>, or 0 to 10V by operating SW1 or changing the VF66B inverter parameters.</li> <li>(For more information about input range switching, please refer to Chapter 5)</li> <li>- For analog voltage input, the input impedance is 150k<math>\Omega</math>.</li> <li>- For analog current input, the input resistance is 250<math>\Omega</math>.</li> <li>[0 to 10V input is set in the initial condition.]</li> <li>* See each detailed mode instruction manuals for details of Analog Input (2).</li> </ul>
	AOT2	Analog Output (2) Terminal	<ul style="list-style-type: none"> <li>- By changing the VF66B inverter configuration parameters, the output range of the Analog Output (2) Terminal can be set to either 0 to 10V or 0 to <math>\pm 10V</math> (max current 1mA).</li> <li>[In the initial configuration, the inverter output current is set at "5V/Inverter rated current"]</li> <li>* For more information about the Analog Output (2) Terminal, please refer to the VF66B Inverter manual (for each mode in detail).</li> </ul>
	G2	GND Terminal	Never connect the G2 terminal to the earth terminal.

## 2.3 PG Input/Output Terminal Specifications

### PG Input/Output

	Terminal Name	Use	Description
PBUS66-Z Terminal Block TB2	+12	+12V Power Supply Terminal	Outputs a +12V DC voltage.
	G (3 Terminals)	GND Terminal	Never connect the G terminal to the earth terminal.
	A	PG Input Terminal	Inputs A, B, U/Z, V and W signal (complimentary output) of 12V power supply PG respectively.
	B		
	U/Z		
	V		
	W		
	PGOUT	PG Output Terminal	Outputs a divided waveform of the PG A-signal.

## 2.4 PROFIBUS-DP Communication Terminal Specifications

### PROFIBUS-DP Communication

PBUS66-Z Terminal Block TB1	Terminal Name	Use	Description
	N. A	Communication Signal Terminal	- A-line (RxD/TxD-N) connection terminal.
	P. B		- B-line (RxD/TxD-P) connection terminal.
	RTS	Request To Send	- Used when connecting to equipment where the communication direction must be clearly defined. Output is Hi (+5V) during PBUS66-Z data transmission and Low (0V) for all other times.
	P5	+5V Power Supply Terminal	- Outputs a +5V DC voltage.
	G3	Communication Earth Terminal	- Signal line data earth terminal.
	E (4 Terminals)	Protective Earth Terminal	- Connects to the connection-cable shielded wire.

## 2.5 PROFIBUS-DP Communication Specifications

### PROFIBUS-DP Communication Specifications

Communication Protocol	Based on PROFIBUS-DP
International Standard	EN 50 170 (IEC61158)
Physical Layer	Based on RS-485
Connection Form	Bus connection
Baud rate and Connection Distance	9.6K, 19.2K, 45.45K, 93.75Kbps → Less than 1,200m 187.5Kbps → Less than 1,000m 500Kbps → Less than 400m 1.5Mbps → Less than 200m 3M, 6M, 12Mbps → Less than 100m
Transmission Procedure	Half Duplex Transmission
Synchronous System	Start-Stop Transmission
Communication Control System	Polling Selecting Mode
Error Check Method	FCS (Frame Check Sequence)
Data Form	Start bit (1 bit) Data (8 bits) Parity (1 bit, even) Stop bit (1 bit)
Connection, Wiring Method	Terminal block → 2 line (RS485)
Connection Cable	Twisted-pair cable with shield (PROFIBUS-DP dedicated cable).
The Maximum Number Of a Connectable Stations	32 stations is each segment without repeater. With repeaters, this can be extended to 126.
Setting Method of an Address Number	It sets up by the console panel of VF66B inverter.
Setting Method of a Baud Rate	It sets up automatically by receiving the transmitting data from a master.
GSD File	TOYO0BE7. GSD

## 2.6 Other

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Other standard specifications follows those of the VF66B inverter. For more details, please refer to the VF66B inverter manual.



### **DANGER** [Wiring]

- Before wiring, make sure the power is OFF.  
Failure to do so may cause an electric shock or fire.
- Substitution of Jumper socket is performed after certainly turning off an inverter.  
Failure to do so may cause an electric shock, personal injury, equipment failure or malfunction.



### **CAUTION** [Wiring]

- Never connect the G or G2 terminal to earth.  
Doing so may cause equipment failure or damage.
- Never connect or allow contact between the PS and G terminals.  
Doing so may cause equipment failure or damage.

# Chapter 3 Board Description

## 3.1 Name of Each Parts

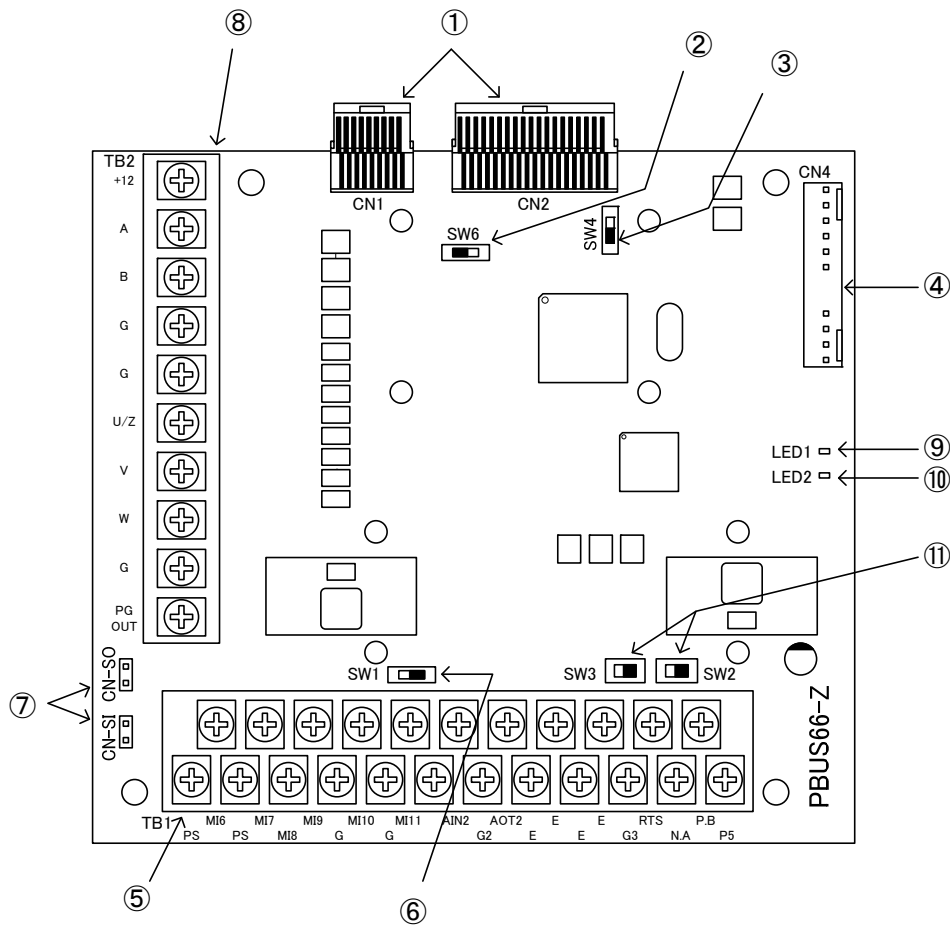


Figure 3.1 PBUS66-Z Circuit Board

- ① Connector to VFC66-Z (CN1, CN2)
- ② PG Frequency Dividing Output Switch (SW6)
- ③ PG Signal ON/OFF Switch (SW4)
- ④ Connector to External Expansion Option IOEXT66-Z(CN4)
- ⑤ Analog Input/Output, Multifunction Input, PROFIBUS-DP Communication Terminal Block (TB1)
- ⑥ Analog Input Signal Characteristic Switch (SW1)
- ⑦ Multifunction Input Signal Characteristic Jumper Connector (CN-SI, CN-SO)
- ⑧ PG Input/Output Terminal Block (TB2)
- ⑨ PROFIBUS-DP Communication LED (LED1)
- ⑩ PBUS66-Z CPU Operational Check LED (LED2)
- ⑪ PROFIBUS-DP Terminating Resistor Switch (SW2, 3)

As connector connecting to ④, please use housing : 5051-12, terminal coated gold : 2759G or 2759PBG produced by Molex. For connection to CN3 and usage of CN3 and so on, please refer to the introduction manual about IOEXT66-Z.

### 3.2 PBUS66-Z Switches

You can change various function by switching the switch on PBUS66-Z.

#### Each Kind Of Function Of Switch On PBUS66-Z

Switch Name	Use	Description
SW1	Analog Input (2) Signal Characteristic Switch	Switch input signal characteristics of Analog Input (2) Terminal. - 0 to 10V, 0 to $\pm 10V$ when the switch is OFF. - 4 to 20mA input when the switch is ON. [In the initial condition, the switch is set to OFF] * When you switch input range, please change the parameters of VF66B inverter. For more detail, please refer to Chapter 5.
SW2 SW3	PROFIBUS-DP Terminating Resistor Switch	A terminating resistor can be connected on the bus line. - When the switch is OFF, the terminating resistor is disconnected. - When the switch is ON, the terminating resistor is connected. [In the initial condition, the switch is set to OFF] * Ensure that both SW2 and SW3 are set together in the same orientation. If only SW2 or SW3 is set to ON, the terminating resistor will not function correctly on the bus line.
SW4	PG Signal ON/OFF Switch	Switch ON/OFF PG signal. - PG signal is no effect when the switch is OFF. - PG signal is available when the switch is ON. [In the initial condition, the switch is set to ON]
SW6	PG Frequency Dividing Output Switch	Switch output of PG frequency dividing signal. - $\frac{1}{4}$ frequency dividing signal is output when the switch is side "3". - $\frac{1}{2}$ frequency dividing signal is output when the switch is side "1". [In the initial condition, the switch is set to position "3"]



## **DANGER** [Switch]

- Change of a switch is performed by certainly turning off the inverter.  
Failure to do so may cause an electric shock, personal injury, equipment failure or malfunction.

### 3.3 Installation of Procedure

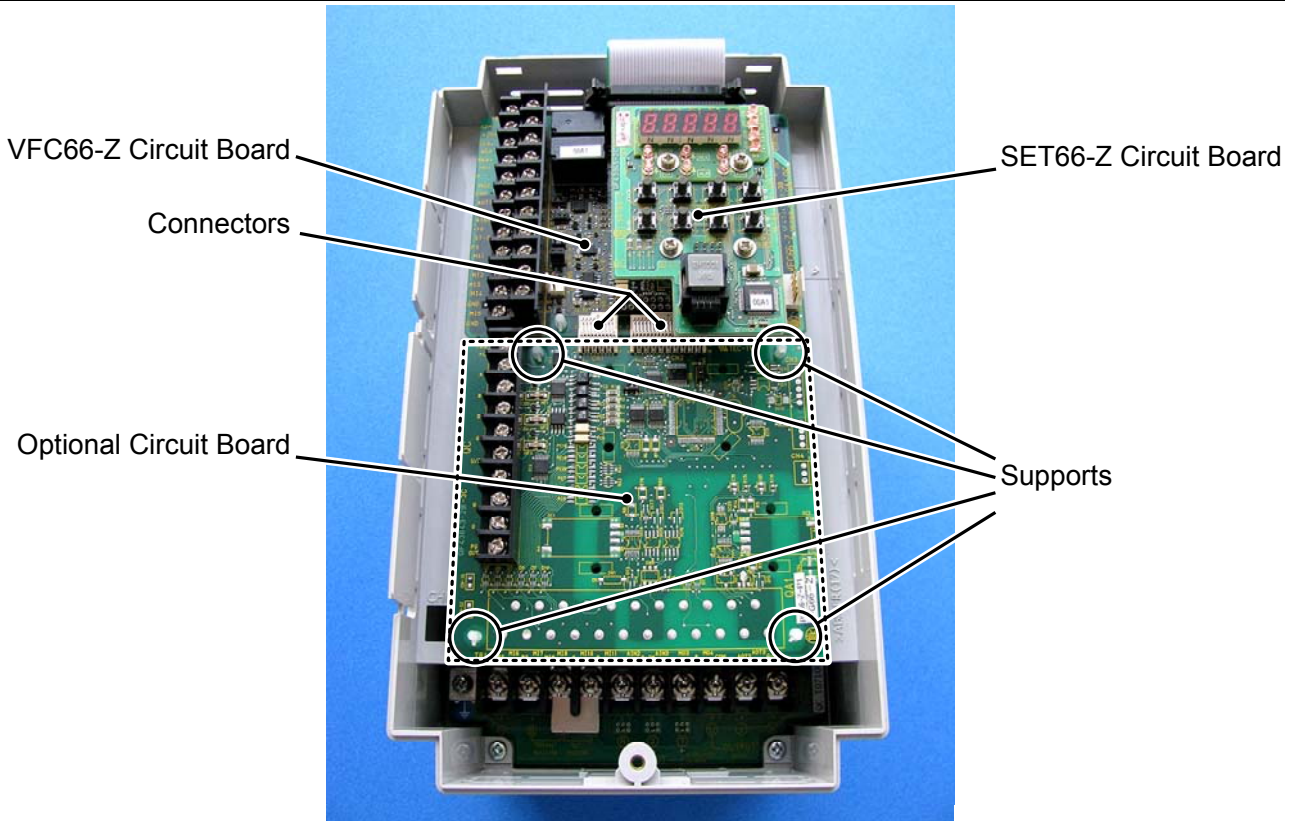


Figure 3.2 Optional Circuit Board Installation Position (VF66B-2R222)

\* For information about opening and closing the inverter unit cover lid, please refer to the VF66B inverter manual.

- (1) Confirm that the power is off before performing any work.
- (2) Install the PBUS66-Z board in the location designated by the dotted lines shown in Figure 3.2. (The figure shows the VF66B-2R222 model, however, the installation location is the same for other models.) If another optional circuit board is already installed, remove it by following the procedure described below. If another optional circuit board is not already installed, skip to (6).
- (3) In order to safely remove the optional circuit board, first remove the SET66-Z board. Remove the 4 screws indicated by the circles in the figure on the right. Pull the SET66-Z board away from the VFC66-Z board in order to detach it.
- (4) Next, release the two connectors between the VFC66-Z board and the optional circuit board. Figure 3.4 (a) shows the connector in its engaged position. Pull up the tab to release the connector as shown in Figure 3.4 (b).
- (5) 4 board supports are included to mount the optional circuit board to the inverter housing, as indicated by the circles in Figure 3.2. Press down on the board support locking hooks as shown in Figure 3.5 to remove the optional circuit board.

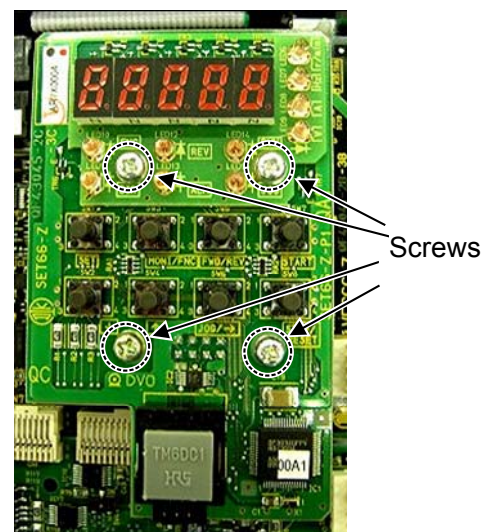


Figure 3.3 SET66-Z Circuit Board

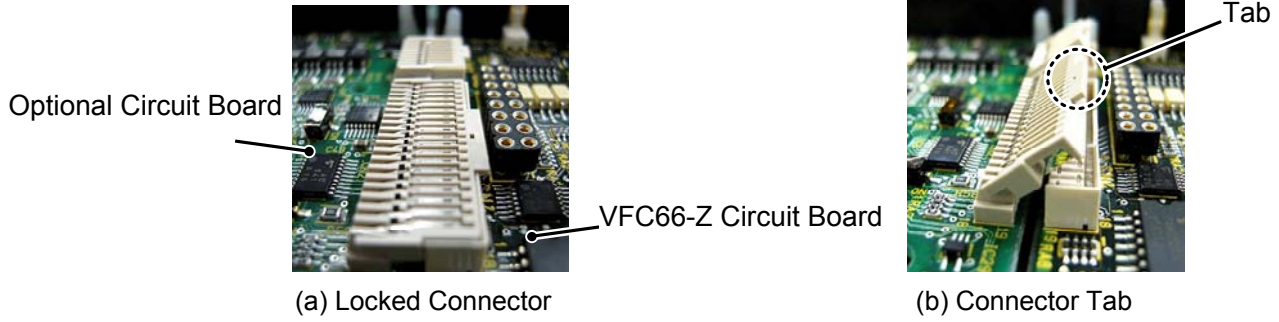


Figure 3.4 Connector

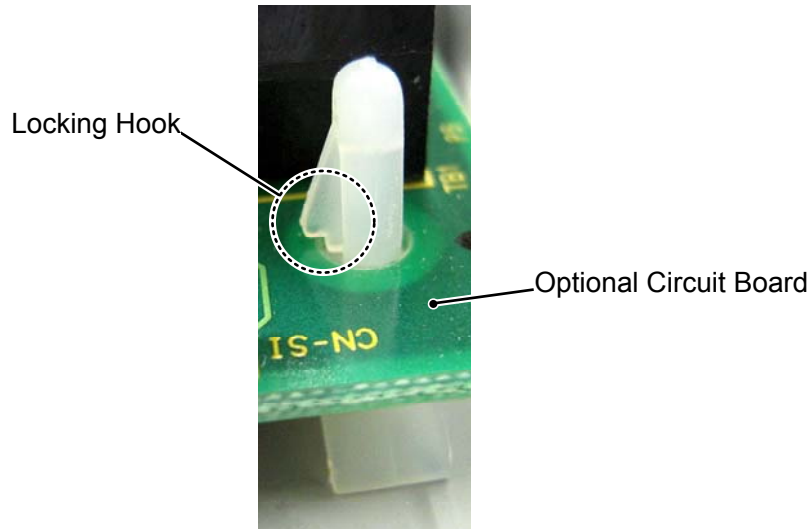


Figure 3.5 Support Locking Hook

- (6) Align the four holes of the PBUS66-Z board with the 4 board supports indicated by the circles in Figure 3.2. Push down on the board until the support locking hooks snap into place as shown in Figure 3.5.
- (7) Align the tabs (shown in Figure 3.4 (b)) of the PBUS66-Z board connectors CN1 and CN2 with the VFC66-Z board connectors CN7 and CN4. Press down on the tabs to engage with the connectors. Once the connectors are correctly joined, it will look like Figure 3.4 (a). The movable part of the connector has some elasticity and if the joint is weak, it may become disconnected. Ensure that it is properly locked in place.
- (8) Install the SET66-Z board to its original position.
- (9) Return the inverter unit cover lid to its original position.



## **DANGER** [Installation/Removal]

- Always confirm that the power is off before installing/removing any circuit boards. Failure to do so may cause an electric shock, personal injury, equipment failure or malfunction.



## **CAUTION** [Installation/Removal]

- Avoid excess connection and disconnection of the connectors. The connector mounting area may become loose, leading to problems such as poor connections.
- Do not attempt to insert any object other than a compatible connector. The connector mounting area may deform, leading to problems such as poor connections.

### 3.4 LED Operation

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- **LED1 Operation**

When PROFIBUS-DP communication is established, LED1 stays illuminated during regular communication.

- **LED2 Operation**

LED2 illuminates when PBUS66-Z is operating normally. If LED2 is not illuminated properly when power is on, the following situations may be the cause:

- The connection between VFC66-Z and PBUS66-Z may be faulty.
- VFC66-Z or PBUS66-Z may be malfunctioning.

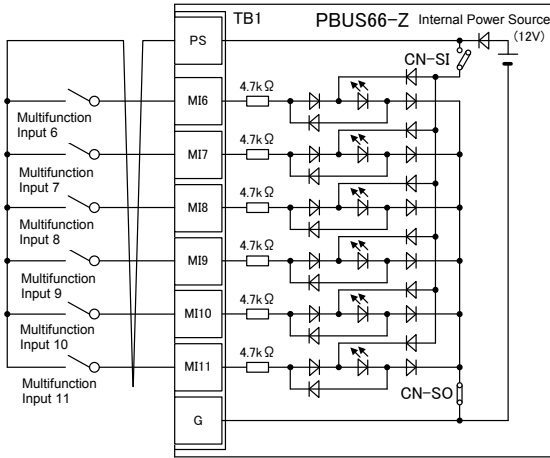


## **CAUTION** [Safety Precautions]

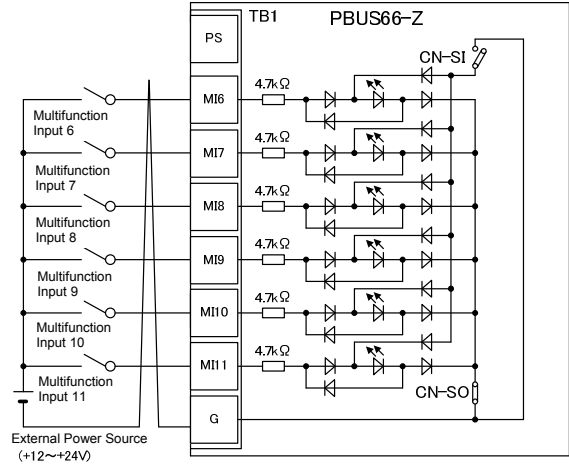
- If LED2 is not operating normally, the PBUS66-Z or VFC66-Z board may be malfunctioning. If this is the case, please contact us immediately.

# Chapter 4 Multifunction Input Function

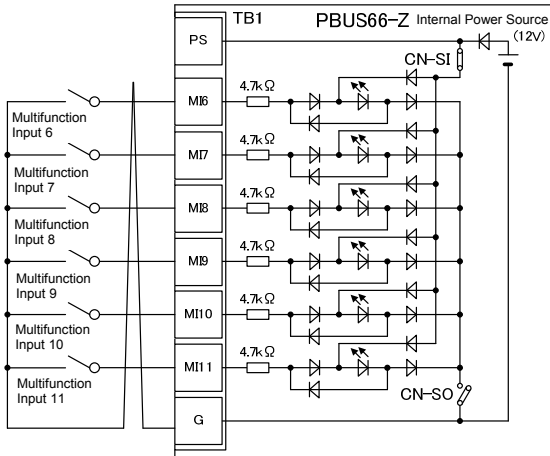
## 4.1 Multifunction Input



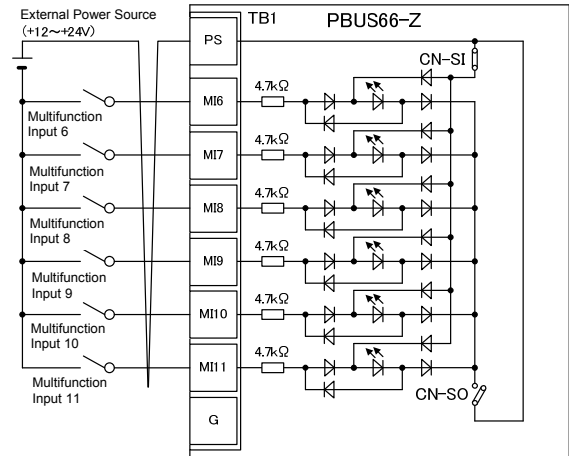
**1. Source Mode (with internal power source)**



**2. Source Mode (with external power source)**



**3. Sink Mode (with internal power source)**



**4. Sink Mode (with external power source)**

Figure 4.1 Multifunction Input Connections

The PBUS66-Z can use the VF66B inverter multifunction input. The above figures show typical multifunction input signal connection methods. The **maximum allowable voltage is 24V** and the **maximum allowable current for any one terminal is 3mA**. For more information about the functions of the individual multifunction input terminals, please refer to the VF66B inverter manual.

The multifunction input signal can be set to either source mode or sink mode and an internal power source or external power source can be chosen for the inverter. In the initial configuration, it is set to source mode. To switch between source mode and sink mode, place a jumper shunt on either the PBUS66-Z jumper connector CN-SO (source mode) or CN-SI (sink mode).

### Multifunction Input Related Inverter Parameters

Console Display	Items	Item Selection	Default Data	Unit
c-00	Multifunction input place selection	0: Terminal block 1: Digital communication option	0: Terminal block	—
c-06	Multifunction input terminal (6) function selection	0: Preset frequency selection 1 (V/f mode) Preset speed selection 1 (induction motor/ED motor vector mode)	0: Preset frequency selection 1	—
c-07	Multifunction input terminal (7) function selection	1: Preset frequency selection 2 (V/f mode) Preset speed selection 2 (induction motor/ED motor vector mode)	1: Preset frequency selection 2	
c-08	Multifunction input terminal (8) function selection	2: Preset frequency selection 3 (V/f mode) Preset speed selection 3 (induction motor/ED motor vector mode)	2: Preset frequency selection 3	
c-09	Multifunction input terminal (9) function selection	3: Accel./decel. time selection 1 4: Accel./decel. time selection 2	3: Accel./decel. time selection 1	
c-10	Multifunction input terminal (10) function selection	5: Frequency UP command (MRH mode) (V/f mode) Speed UP command (MRH mode) (induction motor/ED motor vector mode)	4: Accel./decel. time selection 2	
c-11	Multifunction input terminal (11) function selection	6: Frequency DOWN command (MRH mode) (V/f mode) Speed DOWN command (MRH mode) (induction motor/ED motor vector mode)	5: Frequency UP command	
		7: Frequency hold (V/f mode) Speed hold (induction motor/ED motor vector mode)		
		8: S-pattern accel./decel. prohibition 9: Max. frequency reduction (V/f mode) Max. speed reduction (induction motor/ED motor vector mode)		
		10: Droop control disabled 11: No function (V/f mode) Speed/torque control selection (induction motor/ED motor vector mode)		
		12: Forward/reverse operation command selection 13: DC brake command 14: No function (V/f mode) Initial Excitation command (induction motor/ED motor vector mode)		
		15: External failure signal 1 (protection relay 86A enabled) 16: External failure signal 2 (protection relay 86A enabled) 17: External failure signal 3 (protection relay 86A enabled) 18: External failure signal 4 (protection relay 86A enabled)		
		19: External failure signal 1 (protection relay 86A disabled) 20: External failure signal 2 (protection relay 86A disabled) 21: External failure signal 3 (protection relay 86A disabled) 22: External failure signal 4 (protection relay 86A disabled)		
		23: Trace back external trigger 24: Second set-up block selection 25: Emergency stop (B contact) 26: No function 27: Frequency commanding terminal block selection (V/f mode) Speed commanding terminal block selection (induction motor/ED motor vector mode)		
		28: No function 29: Operation command [reverse] (STARTR) 30: Jog command [forward] (JOGF) 31: Jog command [reverse] (JOGR) 32: Emergency stop (A contact) 33: Protection reset (RESET) 34: External signal input1 35: External signal input2 36: External signal input3 37: External signal input4		

The PBU66-Z multifunction input can be performed via the terminal block as well as via PROFIBUS-DP communication. Either input method can be chosen through the c-00 inverter parameter. For information about the multifunction input via communication, please refer to the “**PBUS66-Z Communication Protocol Manual**”.

The PBUS66-Z multifunction input signal can also be used as the VF66B inverter built-in PLC function input relay. For more information, please refer to the “**PBUS66-Z Communication Protocol Manual**” as well as the VF66B inverter manual and the VF66 PCTool manual.



## **DANGER** [Wiring]

- Before wiring, make sure the power is OFF.  
Failure to do so may cause an electric shock or fire.
- Substitution of Jumper socket is performed after certainly turning off an inverter.  
Failure to do so may cause an electric shock, personal injury, equipment failure or malfunction.



## **CAUTION** [Wiring]

- Never connect the G or G2 terminal to earth.  
Doing so may cause equipment failure or damage.
- Never connect or allow contact between the PS and G terminals.  
Doing so may cause equipment failure or damage.

# Chapter 5 Analog Input and Output Function

## 5.1 Analog Input (2)

The Analog input (2) to the terminals on PBUS66-Z can be used as the input value to the speed command value (or frequency command value), torque command value or built-in PLC function by analog Input (2) function.

For usage of Analog Input (2) function correctly, the correct VF66B inverter parameter setting as mentioned below is required. Please see the VF66B inverter manual together. Furthermore, for the built-in PLC function, please see VF66 PCTool manual.

Before usage of Analog Input (2), Please conduct the adjustment of gain and offset as mentioned below.

### Analog Input (2) Input Characteristic selection

Console Display	Items	Set-up Range (Item Selection)	Default Data	Unit
G-03	Analog Input (2) Characteristic Selection	0: 0 to $\pm 10V$ 1: 0 to 10V 2: 4 to 20mA	1	—

\* If setting the torque command value as Analog Input (2), set this to "0". Only the 0 to  $\pm 10V$  voltage input characteristic can be used.

The analog signal input into Analog Input (2) should be connected between the [AIN2] and [G2] terminals of the PBUS66-Z terminal block TB1, as shown in the following figures. The input analog signal characteristics can be chosen as either "voltage input 0 to  $\pm 10V$ ", "voltage input 0 to 10V" or "current input 4 to 20mA", as shown in the above table. Choose an appropriate setting that matches the characteristics of the input signal. Also set the SW1 switch as shown in the following figures.

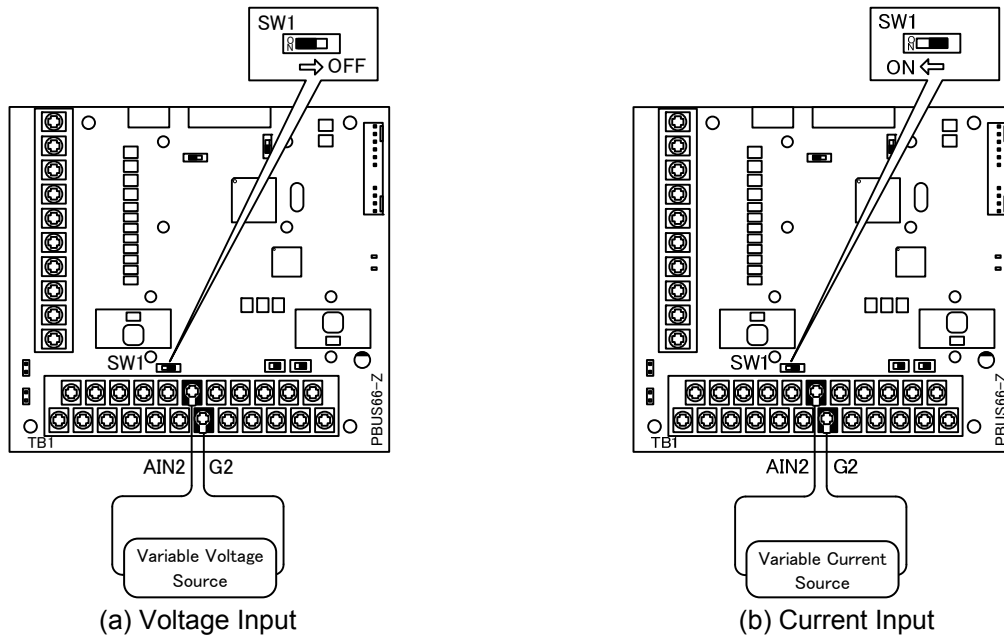


Figure 5.1 Connection of Analog Input (2)

## 5.2 Analog Input (2) Gain/Offset Adjustment

Before usage of Analog Input (2), gain and offset adjustment are required. Adjustment is conducted under the temperature about 25°C.

Perform Analog Input (2) gain and offset adjustment after the VF66B inverter Analog Input (1) gain and offset adjustment has been completed. For more information about the Analog Input (1) gain and offset adjustment procedure, please refer to the VF66B inverter manual. As Analog Input (1) gain and offset have been adjusted initially at our factory, adjustment is usually not necessary.

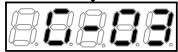
### Inverter Parameters Related To Analog Input (2) Gain/Offset Adjustment

Console Display	Items	Set-up Range (Item Selection)	Default Data	Unit
L-05	Analog Input (2) Gain	50.00 to 150.00	100.00	%
L-06	Analog Input (2) Offset	-50.00 to 50.00	0.00	%
S-08	Analog Input (2) Adjust	1: Analog Input (2) offset adjustment. Input analog input (2) voltage (V) × 1,000: Analog Input (2) gain adjustment	—	—

**(1) Input Characteristic “0 to ±10V” or “0 to 10V”:**



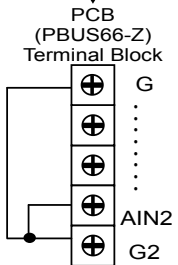
Press the [MONI/FNC] key to turn on FNC (function selection) mode (LED-FNC will be lit).



Use the [↑][↓] keys to select “G-03” and press [SET] to confirm it.



Use [JOG/→] key to shift the digits to right, and [↑][↓] keys to input “0”. Press [SET] to confirm it.



Turn OFF the inverter, open the front cover, and short circuit between terminals [AIN2]-[G]-[G2] on the terminal block of optional PCB (PBUS66-Z).

**⚠ CAUTION [Short Circuiting of Terminals]**

- Before short circuiting terminals, please be sure to turn OFF the inverter. There is a risk of electrical shock.



After power is ON, press [MONI/FNC] key to turn on FNC (function selection) mode (LED-FNC will be lit). Use [JOG/→] and [↑][↓] keys to select “S-08” then press [SET] to confirm it.



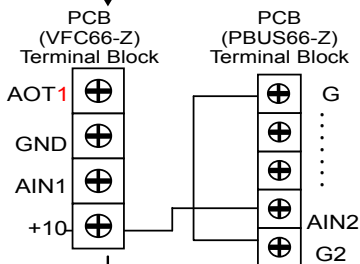
Use [JOG/→] and [↑][↓] keys to input “1040” then press [SET] to confirm it.



“S-08” will appear again. Press [SET] key to confirm.



Use [JOG/→] and [↑][↓] keys to select “1” then press [SET] to confirm it.



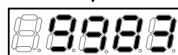
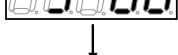
Turn OFF the inverter power, open the front cover, and short circuit terminal of the PCB (PBUS66-Z) and [+10] terminal of the PCB (VFC66-Z). Remain short circuited terminals between [G] and [G2] of the PCB (PBUS66-Z).

**⚠ CAUTION [Short Circuiting of Terminals]**

- Before short circuit terminals, please be sure to turn OFF the inverter. There is a risk of electrical shock.



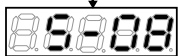
- After power is ON, press [MONI/FNC] key to turn on FNC (function selection) mode (LED-FNC will be lit). Use [JOG/→] and [↑][↓] keys to select “S-08” then press [SET] to confirm it.
- Use [JOG/→] and [↑][↓] keys to input “1040” then press [SET] to confirm.
- “S-08” will appear again. Press the [SET] to confirm.



Measure the voltage between PCB (PBUS66-Z) terminals [AIN2] and [G] with a tester and enter 1,000 times of the measured value.  
If measurement is not available, the value “9930” can be used, however, accuracy is inferior.

**⚠ CAUTION [Voltage Measurement]**

- When the voltage between the terminals is measured, please be sure not to touch wirings or terminals. There is a risk of electrical shock.



If “S-08” appears again, and Analog input (2) gain (L-05) and Analog input (2) offset (L-06) will be changed automatically. Press [MONI/FNC] key to indicate monitor items.

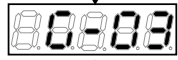
When adjustment is done, turn OFF the inverter, open the front cover, and remove the short circuit wirings installed between terminals [AIN2] on the PCB (PBUS66-Z) and [+10] on the PCB (VFC66-Z), as well as [G] and [G2] on the PCB (PBUS66-Z).

## (2) Input Characteristic “4 to 20mA”:

\* Conduct this after adjustment of the aforementioned “(1) Input Characteristic 0 to ±10V or 0 to 10V”.



Press [MONI/FNC] key to turn on FNC (function selection) mode (LED-FNC will be lit).



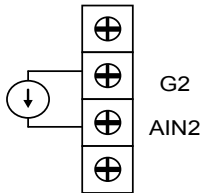
Use [↑][↓] keys to select “G-03”. Press [SET] to confirm it.



Use [JOG/→] key to shift the digit to right, and [↑][↓] keys to input “2(4-20mA)”. Press [SET] to confirm it.

PCB  
(PBUS66-Z)  
Terminal Block

Turn OFF the inverter, open the front cover, connect power between terminals [AIN2] and [G2] on the terminal block of PCB (PBUS66-Z).

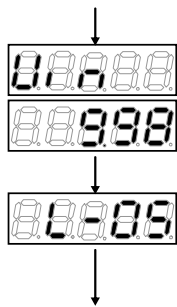


Turn the SW1 ON while the power of inverter is OFF.



### **CAUTION** [Connection of Current Power]

- Before connecting current power, please be sure to turn OFF the inverter.  
There is a risk of electrical shock.
- Please be sure to turn OFF the inverter before switching a switch.  
There is a risk of electrical shock.



- After turning the power on, set “G-16” to “2” using the method described above. After that, select “Vin” with [↑][↓] keys of monitor items. The monitor “Vin” will display the input voltage of analog input (2).
- Turn the current source power ON, and apply a current of 20mA to the [AIN2] terminal.
- A number will be displayed.
- Adjust the value of “L-05” so that the value of monitor item “Vin” becomes “10.00”.

When adjustment is done, remove the current power.

## 5.3 Analog Input (2) Usage Instructions

Before using the Analog Input (2) function, perform gain and offset adjustment as described in the preceding section.

Through the Analog Input (2), the input analog signal can be set to be the speed command value (or frequency command value), torque command value or built-in PLC input value. The following explanation is for when it is set as the speed command value or the torque command value. For instructions when using it as the input value to the built-in PLC, please refer to the VF66 PCTool manual.

### (1) When using the input as a speed command value

When using the analog input as a speed command value, the inverter parameters shown in the following table must be set.

### Analog Input Speed Command Settings

Console Display	Items	Set-up Range (Item Selection)	Default Data	Unit
b-10	Speed commanding place selection	0: Coupled with b-09 1: Analog input (1) [VFC66-Z terminal block AIN1] 2: Console [SET66-Z] 3: Digital communication option 4: Analog Input (2) [Optional terminal block AIN2] 5: (For expansion option) 6: Analog Input (3) [Optional terminal block AIN3] 7: Built-in PLC function output	0	—
G-04	Analog Input (2) upper limit speed	[Absolute value of Analog Input (2) lower limit speed (G-05)] to [100.0] <sup>(*)</sup>	100.0	% <sup>(*)</sup>
G-05	Analog Input (2) lower limit speed	- [Analog Input (2) upper limit speed (G-04)] to [Analog Input (2) upper limit speed (G-04)] <sup>(*)</sup>	0.0	% <sup>(*)</sup>

(\*) This is set as a percentage with respect to the maximum speed (parameter A-00). For information about parameter A-00, please refer to the VF66B inverter manual.

- Set b-10 to "4".
- Set G-03 (described in section 5.1) to a set value that matches the input signal characteristics.

#### - In the case of voltage input of 0 to ±10V:

The rotational direction can be reversed by setting the command input voltage to a negative value. The speed command value is set as the Analog Input (2) upper limit speed (G-04) when the input is +10V. When the input is -10V, it is set as the negative value of the Analog Input (2) upper limit speed (G-04). However, it is possible to set a lower limit by setting the Analog Input (2) lower limit speed (G-05). (Figure 5.2, left) If the minimum speed (A-01) is other than "0", the speed command absolute value is controlled to prevent falling below the minimum speed. In this case, when the command input voltage is around the 0V range, its behavior shows hysteresis characteristics (It will run forward if started in the forward direction and will run in the minimum reverse speed if started in the reverse direction) as shown in the right side of Figure 5.2.

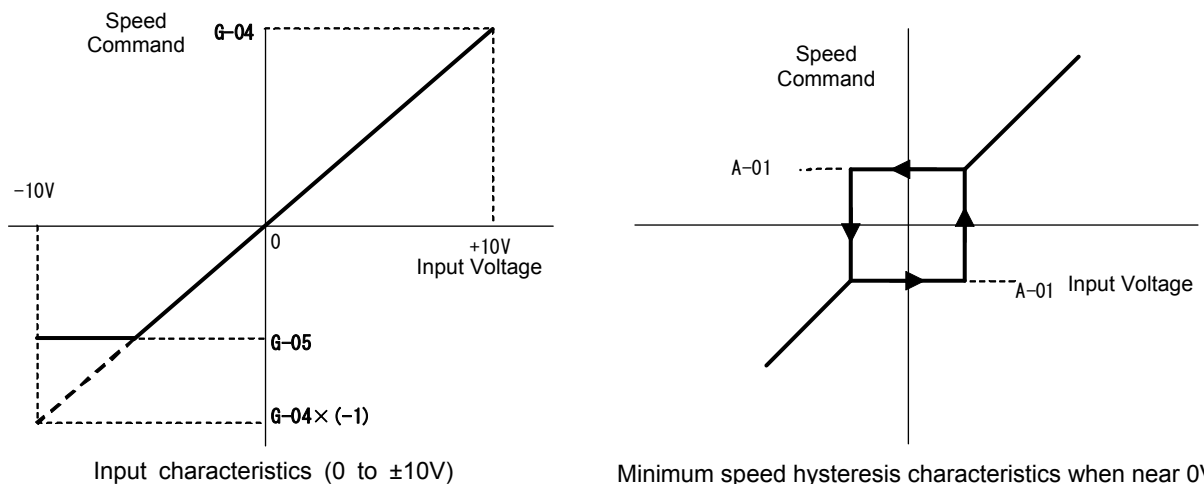


Figure 5.2 Speed command characteristics with voltage input of 0 to ±10V

#### - In the case of voltage input of 0 to 10V:

The speed command value is set as the Analog Input (2) lower limit speed (G-05) when the input is 0V. When the input is 10V, it is set as the Analog Input (2) upper limit speed (G-04). However, this will be set to "0" if the Analog Input (2) lower limit speed (G-05) has a negative value. (Figure 5.3) If the minimum speed (A-01) is other than "0", the speed command absolute value is controlled to prevent falling below the minimum speed. As a speed command, this only allows forward operation. For reverse operation, a reverse operation command should be used.

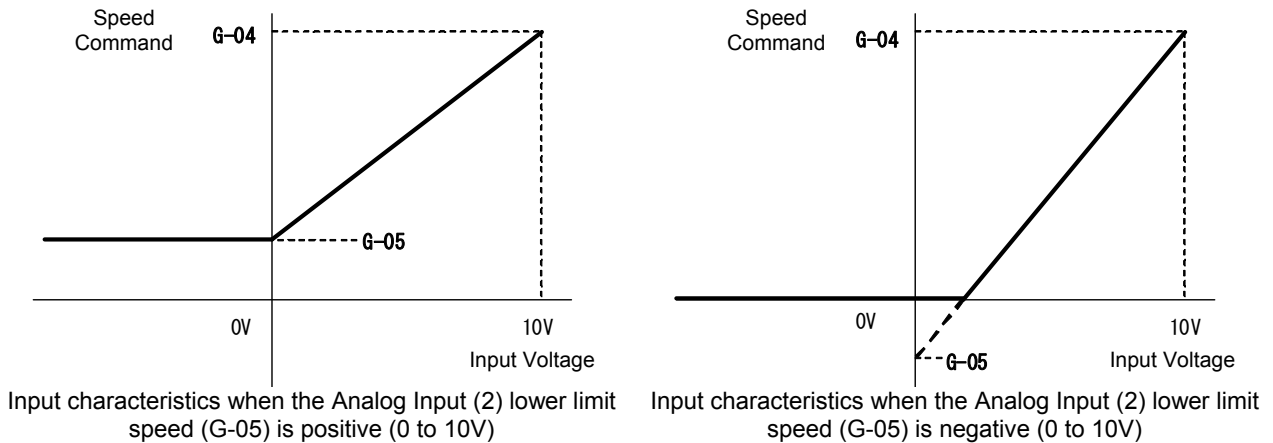


Figure 5.3 Speed command characteristics with voltage input of 0 to 10V

**- In the case of current input of 4 to 20mA:**

The speed command value is set as the Analog Input (2) lower limit speed (G-05) when the input is 4mA. When the input is 20mA, it is set as the Analog Input (2) upper limit speed (G-04). However, this will be set to "0" if the Analog Input (2) lower limit speed (G-05) has a negative value. (Figure 5.4) If the minimum speed (A-01) is other than "0", the speed command absolute value is controlled to prevent falling below the minimum speed. As a speed command, this only allows forward operation. For reverse operation, a reverse operation command should be used.

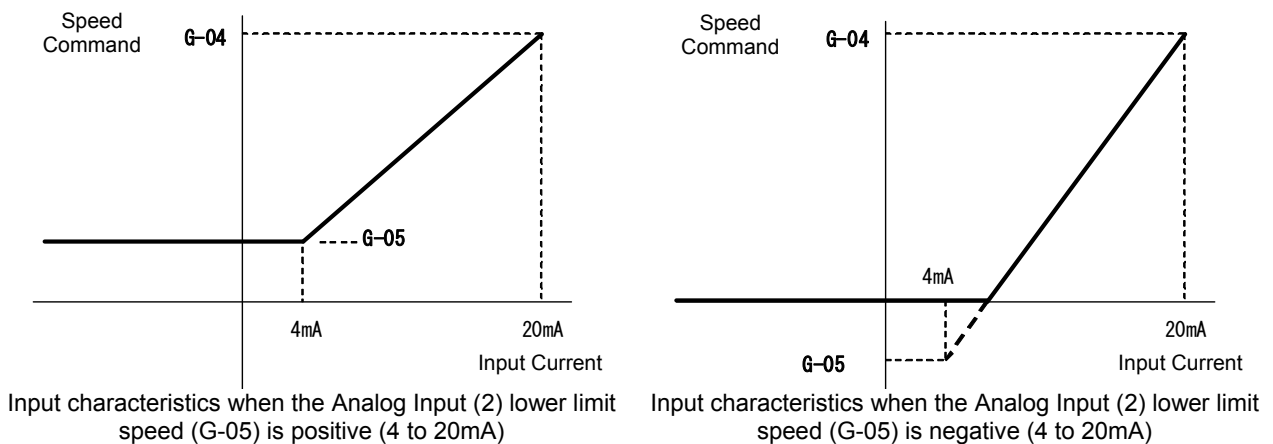


Figure 5.4 Speed command characteristics with current input of 4 to 20mA

**(2) When using the input as a torque command value**

When using the analog input as a torque command value, the inverter parameters shown in the following table must be set.

- \* **Torque command is disabled in V/f mode.**
- \* **The 4 to 20mA current input characteristic cannot be used for the torque command value. Only the 0 to  $\pm 10V$  voltage input characteristic can be used.**

### Inverter Parameters Related To Analog Input Torque Command

Console Display	Items	Set-up Range (Item Selection)	Default Data	Unit
i-08	Torque command input place selection	0: Analog Input (1) [VFC66-Z terminal block AIN1] 1: Analog Input (2) [Optional terminal block AIN2] 2: Digital communication option 3: Built-in PLC function output	1	—
i-09	Analog torque command gain	50.0 to 200.0	150.0	%

- Set i-08 to “1”.
- Set G-03 (described in section 5.1) to “0”. Only the 0 to  $\pm 10V$  voltage input characteristic can be used.

The torque command value is set as the negative value of the analog torque gain (i-09) when the input is +10V. When the input is -10V, it is set as the positive value of the analog torque gain (i-09). (Figure 5.5)

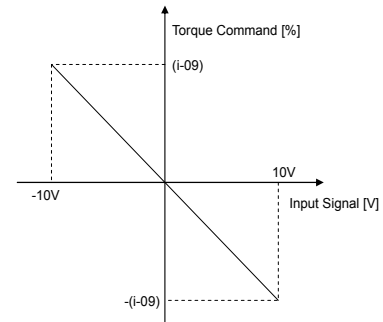


Figure 5.5 Analog Input Torque Command Characteristic

## 5.4 Analog Output (2)

Through the Analog Output (2) function, internal variables such as the inverter output voltage or **motor** speed, output to the built-in PLC can be output as an analog signal from the PBUS66-Z terminal. The analog signal runs between the terminals “AOT2” and “G2” on terminal block TB1. The values that can be output can be selected with inverter parameter G-09, as shown in the following table. Please also refer to the VF66B inverter manual. For information about the built-in PLC function, please refer to the VF66 PCTool manual.

Before using the Analog Output (2) function, perform gain and offset adjustment as described in the following section.

### Analog Output Setting

Console Display	Items	Set-up Range (Item Selection)	Default Data	Unit
G-09	Analog Output (2) characteristic selection	0: Output voltage 1: Output current 2: Torque command (induction motor/ED motor vector mode) Torque output (V/f mode) 3: Motor speed (induction motor/ED motor vector mode) Frequency (V/f mode) 4: Speed command (induction motor/ED motor vector mode) Frequency command (V/f mode) 5: Built-in PLC output 6: Calibration 7: Internal monitor	1	—

### Analog Output Set At G-09

G-09	Selection Items	Output Voltage
0	Output voltage	7.5V/200V (200V class) 7.5V/400V (400V class)
1	Output current	5V/Inverter rated current
2	Torque command (induction motor/ED motor vector mode) Torque output (V/f mode)	5V/100%
3	Motor speed (induction motor/ED motor vector mode) Frequency (V/f mode)	10V/Maximum speed (A-00) 10V/Maximum frequency (A-00)
4	Motor speed command (induction motor/ED motor vector mode) <sup>(*1)</sup> Frequency command (V/f mode) <sup>(*1)</sup>	10V/Maximum speed (A-00) 10V/Maximum frequency (A-00)
5	Built-in PLC output <sup>(*2)</sup>	5V/20000 (100%) <sup>(*2)</sup>
6	Calibration	Outputs 5V
7	Internal monitor	—

(\*1) It is value after acceleration/deceleration control. For more detail, please refer to the VF66B inverter manual.

(\*2) When built-in PLC output is selected, the value of output resistor o00009 is output at the rate of 5V/20000. For more detail, please refer to the VF66 PCTool manual.

Analog Output (2) runs between terminals [AOT2] and [G2] of the PBUS66-Z terminal block TB1, as shown in the following figure.

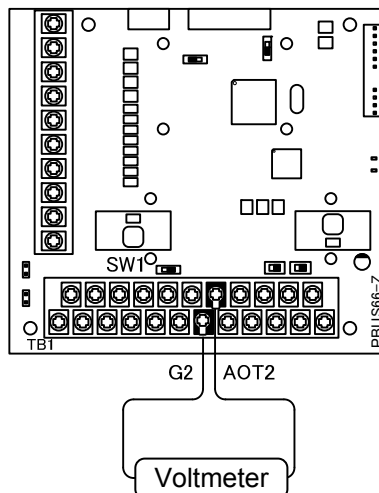


Figure 5.6 Connection of Analog Output (2)

## 5.5 Analog Output (2) Gain/Offset Adjustment Procedure

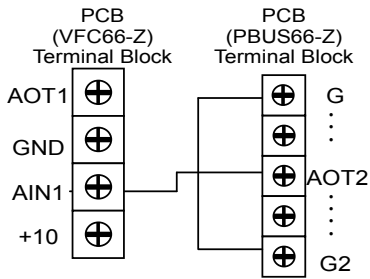
Before usage of Analog Output (2), perform gain and offset adjustment. This adjustment should be performed in an environment with an ambient temperature of 25°C.

Perform Analog Output (2) gain and offset adjustment after the VF66B inverter Analog Input (1) gain and offset adjustment has been completed. For more information about the Analog Input (1) gain and offset adjustment procedure, please refer to the VF66B inverter manual. As Analog Input (1) gain and offset have been adjusted initially at our factory, adjustment is usually not necessary.

**Inverter Parameters Related To Analog Output (2) Gain/Offset Adjustment**

Console Display	Items	Set-up Range (Item Selection)	Default Data	Unit
L-09	Analog Output (2) gain	50.0 to 150.0	100.00	%
L-10	Analog Output (2) offset	-50.0 to 50.0	0.00	%
S-09	Analog Output (2) adjust	1: Analog Output (2) offset adjustment 2: Analog Output (2) gain adjustment	—	—

## - Analog Output (2) Gain/Offset Adjustment Procedure



Turn OFF the inverter, open the front cover, and short circuit between terminals [AOT2] on the terminal block of the PCB (PBUS66-Z) and [AIN1] on the PCB (VFC66-Z).  
Insert a short circuit between terminals [G] and [G2] on the terminal block of the PCB (PBUS66-Z).



### CAUTION [Short Circuiting of Terminals]

- Before short circuiting terminals, please be sure to turn OFF the inverter. There is a risk of electrical shock.



After power is on, press [MONI/FNC] key to turn on FNC (function selection) mode (LED-FNC will be lit).



- After pressing [MONI/FNC] key to turn on FNC (function selection) mode (LED-FNC will be lit),



use [JOG/→] and [↑][↓] keys to select “b-17” then press [SET] to confirm it.



• Use [JOG/→] and [↑][↓] keys to input “0” and press [SET] to confirm it.



• “b-17” will appear again.



• Use [JOG/→] and [↑][↓] keys to select “G-09” then press [SET] to confirm it.



• Use [JOG/→] and [↑][↓] keys to input “0” then press [SET] to confirm it.



• “G-09” will appear again.



• Use [JOG/→] and [↑][↓] keys to select “S-09” then press [SET] to confirm it.



• Use [JOG/→] and [↑][↓] keys to input “1040” then press [SET] to confirm it.



• “S-09” will appear again. Press the [SET] key to confirm.



• Use [JOG/→] and [↑][↓] keys to input “1” and press [SET] to confirm it.



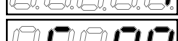
• “S-09” will appear again.



• Use [JOG/→] and [↑][↓] keys to select “G-09” then press [SET] to confirm it.



• Use [JOG/→] and [↑][↓] keys to input “6” then press [SET] to confirm it.



• “G-09” will appear again.



• Use [JOG/→] and [↑][↓] keys to select “S-09” then press [SET] to confirm it.



• Use [JOG/→] and [↑][↓] keys to input “1040” and press [SET] to confirm it.



• “S-09” will appear again. Press the [SET] key to confirm.



• Use [JOG/→] and [↑][↓] keys to input “2” and press [SET] to confirm it.



• If “S-09” appears again, Analog output (2) gain (L-09) and Analog output (2) offset (L-10) will be changed automatically.



• Press [MONI/FNC] key to indicate monitor items.



When adjustment is done, turn OFF the inverter, open the front cover, and remove the short circuit wirings installed between terminal [AOT2] on the PCB (PBUS66-Z) and [AIN1] on the PCB (VFC66-Z) as well as [G] and [G2] on the PCB (PBUS66-Z).

Restore the settings of “G-09” and “b-17”, which have been changed during adjustment, to their original configuration.

# Chapter 6 PG Input and Output Function

PG input/output functionality is used when driving a motor from the signal which detected the magnetic pole position and speed of the rotor by the sensor (PG). PG input/output function is used in the VF66B inverter induction motor vector mode and ED motor vector mode. PG is a correspondence only a complementary output with 12V power source. The manual of VF66B inverter (induction motor vector mode, ED motor vector mode) is referred to for a PG selection, and an inverter mode change.

## 6.1 PG Input Signal

In order to use PG input/output functionality, it is necessary to set correctly the inverter set-up parameter shown in the following table according to the operation mode of an inverter, and PG specification to be used. Please also refer to the manual of VF66B inverter collectively.

\* When switch SW4 on PBUS66-Z is "ON", the input of PG signal is enabled.

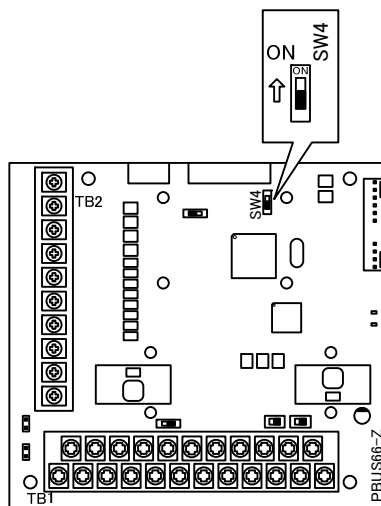


Figure 6.1 PG Signal Input Switching

### Inverter Parameters For PG Selection

Console Display	Items	Inverter Mode	Set-up Range (Item Selection)	Default Data	Unit
A-10	PG selection	V/f mode	(PG not used)	1	—
		Induction motor vector mode	0: S-mode Sensor-less drive (PG not used) 1: V-mode With PG (AB phase input)	0	—
		ED motor vector mode	0: S-mode Sensor-less drive (PG not used) 1: V-mode With PG (ABZ phase input) <sup>(*1)</sup> 2: P-mode With PG (ABUVW phase input) 3: RL-mode With resolver (resolution 10bit) <sup>(*2)</sup> 4: RH-mode With resolver (resolution 12bit) <sup>(*2)</sup>	0	—

(\*1) For special motors

(\*2) An optional is required



## **DANGER** [Switches]

- Change of a switch is performed by certainly turning off an inverter.  
Failure to do so may cause an electric shock, personal injury, equipment failure or malfunction.

### 6.2 PG Output Signal

PG frequency dividing signal is outputted from A-signal of PG input. **Peak value is about 10V and duty ratio is 1:1.** If SW6 of PBUS66-Z is switched to side of "3",  $\frac{1}{4}$  PG frequency divided signal is outputted, and if SW6 is switched to side of "1",  $\frac{1}{2}$  PG frequency divided signal is outputted. Please switch according to a destination.

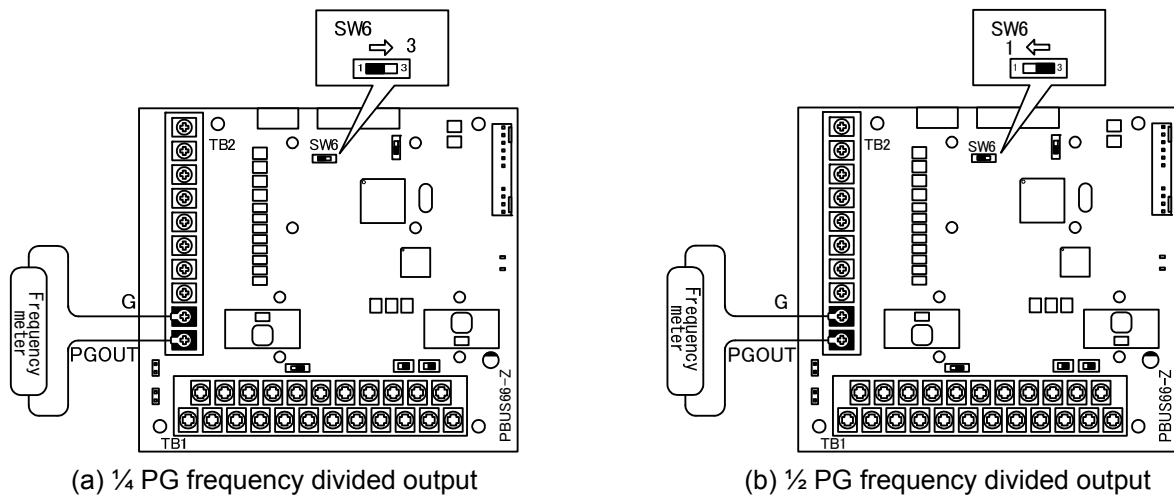


Figure 6.4 PG signal output

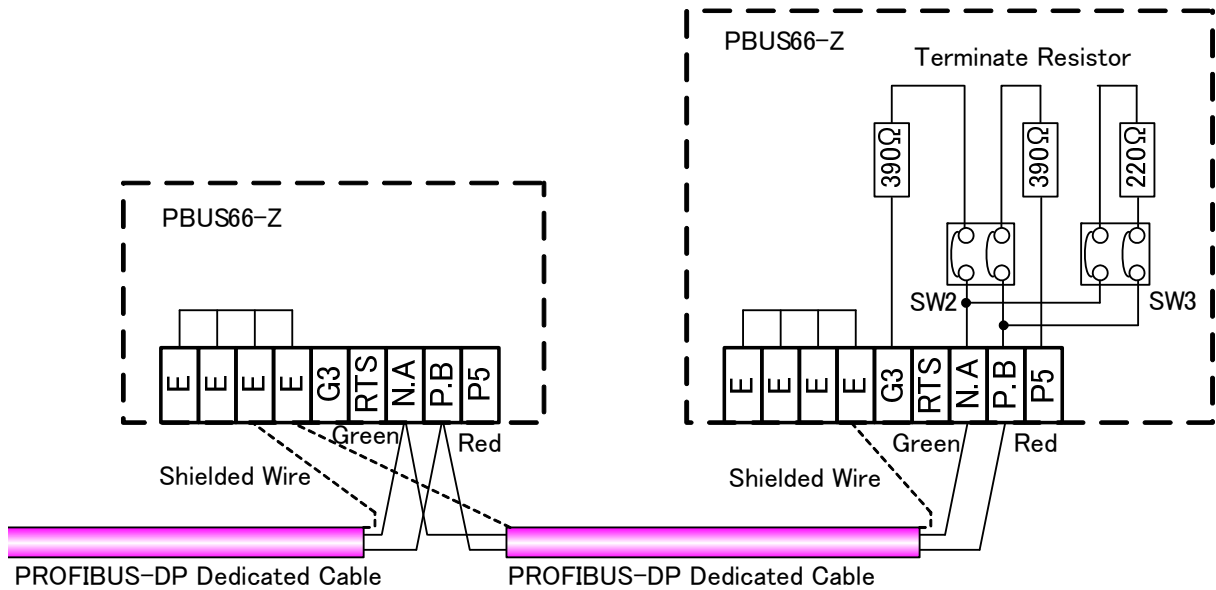
## **DANGER** [Wiring]

- Making wiring after confirmation of OFF of input power source.  
Failure to do so may cause an electric shock, personal injury, equipment failure or malfunction.
- Don't wire G terminal to earth.  
Doing so may cause equipment failure or damage.

# Chapter 7 PROFIBUS-DP Communication Function

## 7.1 Communication Cable Connection Procedure

Connect the PROFIBUS-DP dedicated cable to the PBUS66-Z terminal block (TB1) as shown in the following figure.



- \* If PBUS66-Z is the termination device, turn SW2 and 3 to the “ON” position and connect a terminate resistor.
  - \* The communication cable shielded wire should be connected to the E terminal.
  - \* Please perform the following measures if the device is used in an environment with noise.
    - Measure: - Move the communication cable away from power lines.
    - Insert a common mode core into the communication cable.
    - Insert a CR between communication grounding terminal (TB1-G3) of the communication line, and shield (TB1-E).
- C: 2.2 to 22nF (1,200V and over), R: 1MΩ (2W and over).

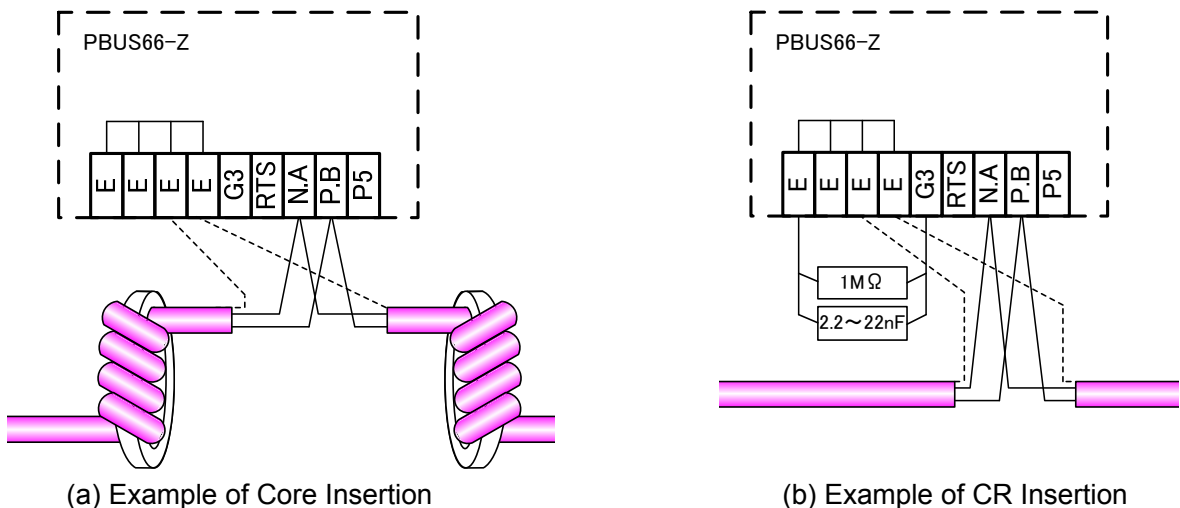


Figure 7.1 Cable Connection Example

## **7.2 PROFIBUS-DP Communication Function Configuration**

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Through PROFIBUS-DP communication, the PBUS66-Z can input operation and speed commands, torque commands and multifunction input to the VF66B Inverter as well as monitor factors such as operating conditions, protection conditions, current and voltage. It can also read and alter the inverter parameter data as well as read the trace-back data, protection history and monitor data.

For information about PROFIBUS-DP communication, please refer to the "PBUS66-Z Communication Protocol Manual". Furthermore, it can be used as the input/output signal of the VF66B Inverter built-in PLC function. For information about the built-in PLC function, please refer to the VF66 PCTool manual.

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◆ Contents of this manual are subject to change without notice.