

TOSVERT VF-A7

PG FEEDBACK BOARD Instruction Manual

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Toshiba Schneider Inverter Corporation**NOTE**

1. Make sure that this instruction manual is delivered to the end user of the PG feedback board.
2. Read this manual before installing or operating the inverter unit, and store it in a safe place for reference.




Safety Precautions

On the inverter and in its instruction manual, important information is contained for preventing injuries to users and damages to assets and for proper use of the device. Read the instruction manual attached to the inverter along with this instruction manual for completely understanding the safety precautions and adhere to the contents of these manuals.

■ Handling in general

 Danger	
 Never Disassemble	<p>Never disassemble, modify or repair the inverter. Disassembling the inverter could cause electric shocks, fire or injuries. Request your TOSHIBA dealer for repairs.</p>
 Prohibited	<p>Do not remove connectors when the power is on. It could lead to electric shocks.</p> <p>▼ Do not put or insert foreign objects such as waste cable, bars, or wires into the inverter. It could lead to electric shocks or fire.</p> <p>Do not splash water over the inverter. It could lead to electric shocks or fire.</p>
 Mandatory	<p>▼ Wiring should be conducted after turning the inverter power off.</p> <p>▼ Turn off the power immediately in case any abnormalities such as smokes, smells or abnormal noise are found. Neglect of these conditions could lead to fire. Ask your TOSHIBA dealer for repairs.</p>

■ Transportation and Installation

 Danger	
 Prohibited	<p>Do not install or operate the inverter if it is damaged or any part is missing from it. Operating the inverter in a defective condition could lead to electric shocks or fire. Ask your TOSHIBA dealer for repairs.</p> <p>Do not put any inflammable material near the inverter. It could catch fire if the inverter sparks because of a breakdown and the like.</p> <p>Do not install the inverter where it could be splashed with water and the like. It could lead to electric shocks or fire.</p>
 Mandatory	<p>Inverter must be used under environmental conditions prescribed in this instruction manual. Using the inverter under conditions not specified by the instruction manual could lead to breakdown.</p>

Warning



Prohibited

Do not install the inverter in any place subject to vibrations or it could fall.
Otherwise it can cause injury to people.

■ Wiring

Danger



Mandatory

- ▼ Be sure to perform the following preparatory work before proceeding to wiring.
- Turn the power off.
 - Wait 10 minutes or more after turning the power off and confirm that the charge lamp (on the inverter) is extinct.
 - Using a circuit tester that has a D.C. voltage measuring capacity of more than 800V, check to see that the voltage remaining in the D.C. main circuit (between PC and PA) is below 45V.
- Failure to do this preparation could lead to electric shocks.
Tighten the terminal board fixing screws at the specified torque.
Failure to do this could lead to fire.

■ About operation

Danger



Prohibited

Do not touch inverter terminals when they are energized even if the motor is halted.
Touching terminals while the power is energized could lead to electric shocks.
Do not wipe the body with a wet cloth.
It could lead to electric shocks.
Do not pull on the cable
It could cause damage or error.

■ About disposal of Inverter

Warning



Mandatory

Dispose of the inverter as an industrial waste.
Unless it is disposed of as an industrial waste, it will become risks for human injury.

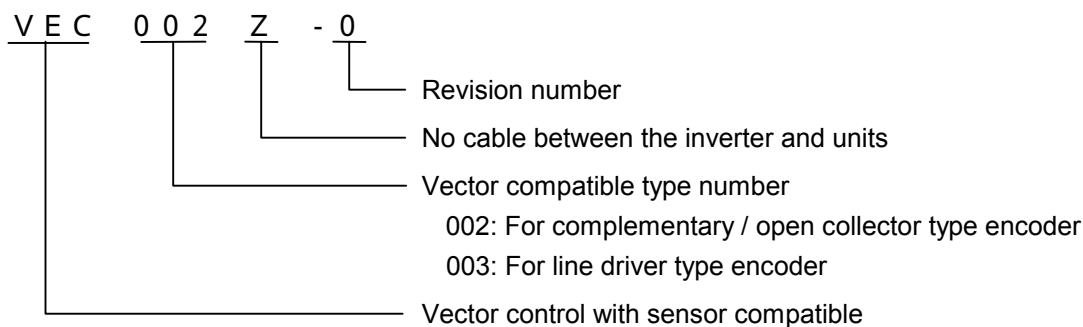
1. Introduction

Thank you for purchasing the PG Feedback Board (PGFB board) for Industrial Inverter, TOSVERT VF-A7 series.

By the use of this optional board, it is possible for the VF-A7 series inverters to conduct pulse row speed command and vector control with sensor. This instruction manual describes installation and application of "PGFB board". Read this manual carefully before using the board.

Keep this manual near at hand of the operator who uses the "PGFB Board" for future reference in the maintenance and inspection.

<Description of the PGFB Board type>

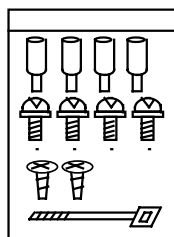
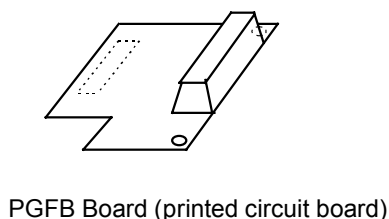
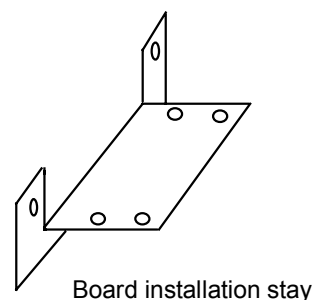
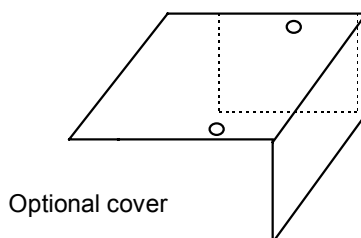
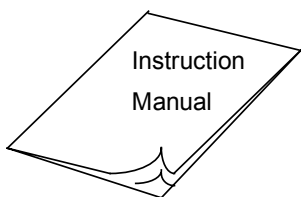


<Confirmation on Accessories>

Following accessories are the options to the PGFB Board.

Upon unpacking, confirm on the following items:

- ◎Instruction Manual: one (E6580764)
- ◎Optional cover (to be used when using units with 22kW or less)
- ◎Board installation stay
- ◎PGFB Board (printed circuit board)
- ◎Installation screw set (one bag)

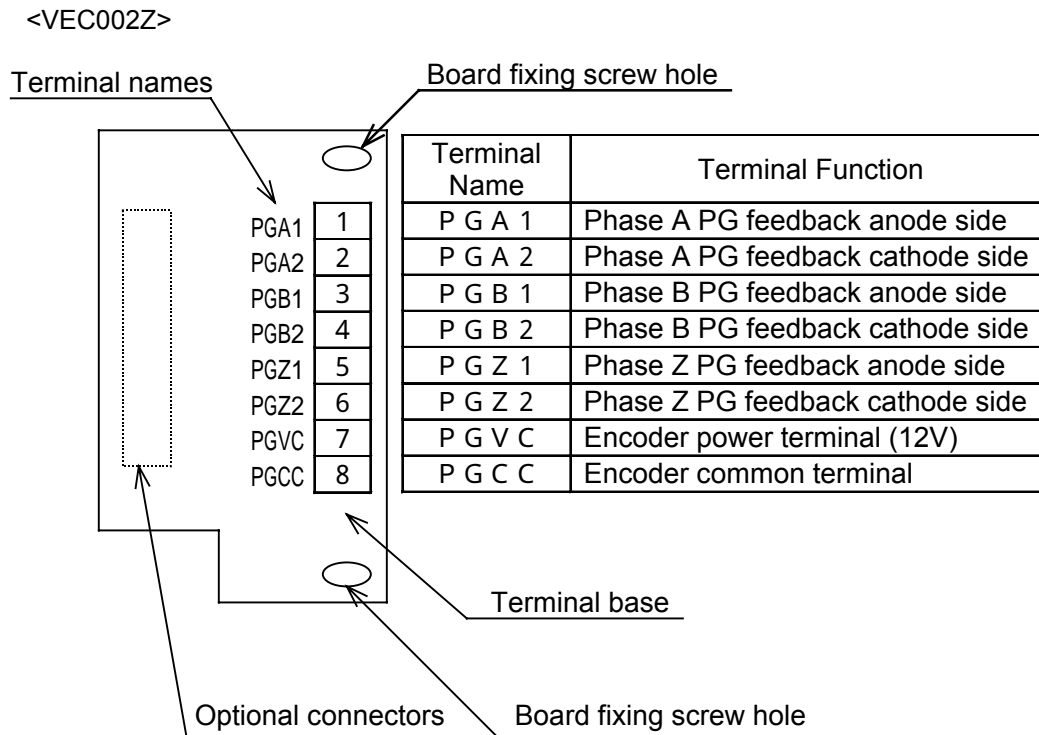


- Installation screw set (one bag)
- M3 support screw x 4 (10mm)
 - M3 setting screw x 4
 - M3 tap tight screw x 2
 - Insulation-lock band

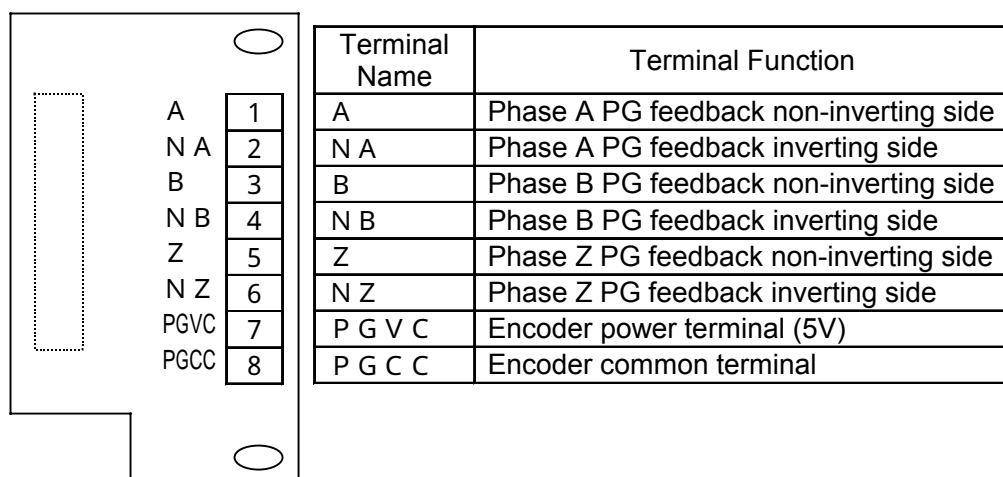
2. Names of the Parts on the Board

External views of the PGFB Board are described in this section together with the names of parts on the board.

■ External views and names of parts on the board (terminals)



<VEC003Z>



3. Connection to the Inverter

Install the PGFB to the inverter according to the procedures below.

3.1. Installation to the Inverter

- (1) Confirm that the all power of the inverter are turned off beforehand.

Note: Wait 10 minutes or more after turning the power off and confirm that the charge lamp on the inverter is unlit.

Remove the slide window for the options on the right side of the panel by sliding it in the right direction. For units that are larger than 30KW, remove the front cover.

- (2) Fastening the board on the inverter (Refer to figure 3-1.)

- ① Fasten the M3 support installation screws to the board installation stay.
- ② Fasten the board installation stay to the right side of the unit or on the option installation screw hole on the right side of the control unit by using M3 tap tight screws (Refer to Table 3-1.) When fastening the stay, connect grounding wire to the board installation stay.
- ③ Install the board while aligning it to the option connector position so that it can be caught sturdily proper coupling with the connector can be made. (Insert the board into the connector until there will be clicking sound.)
- ④ Using M3 support screws or M3 set screws, fasten the board to the board fastening screw holes. (Refer to Table 3-1.)

- (3) Installing option cover (Refer to figure 3-1.)

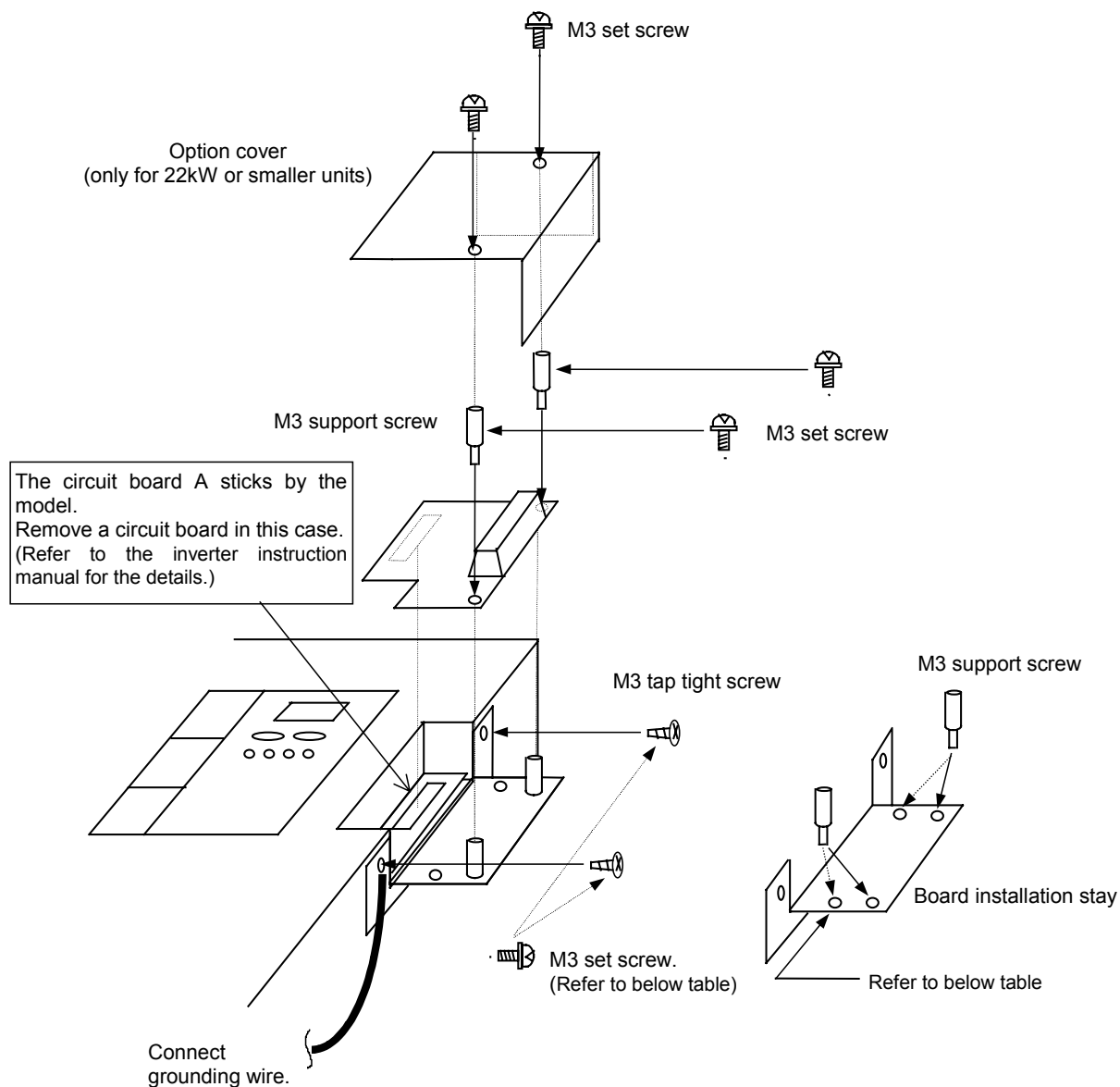
- ⑤ Align the option cover with the M3 support screw holes and fasten it with M3 set screws.

There is no need to install option cover for 30kW or larger units. Install the front cover of the unit.

Table 3-1 List of Option Installation Screws

VFA7-****P	2220P or smaller units 4220P or smaller units	2300P 4300P	2370P or larger units 4370P or larger units
VFA7-****P1 (Note)	---	2370P1 to 2750P1 units 4370P1 to 4132KP1 units	2900P1 4160KP1 or larger units
VFP7-****P (Note)	2220P or smaller units 4220P or smaller units	2300P to 2750P units 4300P to 4160KP units	2900P 4220KP or larger units
①Board fastening support	M3 support screw	M3 support screw	M3 support screw
②Fastening board installation stay	M3 tap tight screw, fastening to unit outer frame	M3 set screw, fastening to unit outer frame	M3 tap tight screw, fastening to control unit frame.
④Fastening board	M3 support screw	M3 set screw	M3 set screw
⑤Fastening option cover	M3 set screw	Not needed	Not needed
Spare parts	M3 set screw x 2	M3 support screw x 2, M3 tap tight screw x 2, option cover	M3 support screw x 2, M3 set screw x 2, option cover

(Note) Remove the circuit board A. Refer to figure 3-1 and the inverter instruction manual for the details.



As for the following model, install the board installation stay by the M3 set screws, and fix M3 support screws on the inside of circuit board installation stay.

VFA7-****P	2300P 4300P
VFA7-****P1	2370P1 to 2750P1 units 4370P1 to 4132KP1 units
VFP7-****P	2300P to 2750P units 4300P to 4160KP units

Figure 3-1 Installation to inverter

3.2. Wiring

When conducting wiring, follow the instructions below.

- ◆ Use twisted pair shield wire for signal lines.
- ◆ Applicable wire size is 0.2 to 0.75 mm².
- ◆ Peel the wire end for about 5 mm.
- ◆ When wiring, use a screw driver with the blade thickness of about 0.4 mm and width of about 2.5 mm.
- ◆ Tightening torque for terminal base should be about 0.22 to 0.25 N·m.
- ◆ Bind the signal lines together with the attached insulation-lock band (attached parts) and connect them to M3 support screw for fastening the board.
- ◆ Never bind the signal lines and main circuit wiring.

■ <Encoder output format and PGFB board interface>

	Encoder output format	PGFB board wiring	PGFB board interface
Complementary			<p><VEC002Z></p>
Open collector			<p><VEC002Z></p>
Line driver	<p>26LS31 equivalent</p>		<p><VEC003Z></p>

4. Functional Description

In this section, functions added by the installation of the PGFB board, on top of the standard VF-A7 functions, are described.

4.1. Vector control with sensor

Using the pulse-row feedback signal from the encoder installed on the motor shaft or load rotation shaft, vector control with sensor can be conducted.

Speed control operation :0 speed to 150% torque, speed control range 1:1000 (1000 ppr-PG)
speed accuracy $\pm 0.02\%$ (50Hz base digital input)

Torque control operation :Torque control accuracy: $\pm 10\%$ (torque control range: -100% to 100%)

4.1.1. PG feedback wiring

■ In case of VEC002 (complementary/open collector)

As for the pulse input signals, PGA1 and PGA2 are connected for Phase A, PGB1 and PGB2 are connected for Phase B, and PGZ1 and PGZ2 are connected for Phase Z.

(The wiring for Phase Z is done only when using Z-marker is necessary.)

The polarity of the pulse input signals should be as follows:

+ side: PGA1, PGB1, PGZ1

- side: PGA2, PGB2, PGZ2

The encoder installation direction and signal line wiring should be determined so that the signal that are fed back from the encoder will show the waveform shown in Figure 4-1 in terms of the motor rotation direction.

★ Forward rotation or reverse rotation is judged from the feedback pulses of Phase A and Phase B (2-phase pulse that have 90 degrees of phase difference). Therefore, it should be noted that, when connections are wrong, there is possibility for abnormal rotation of the motor.

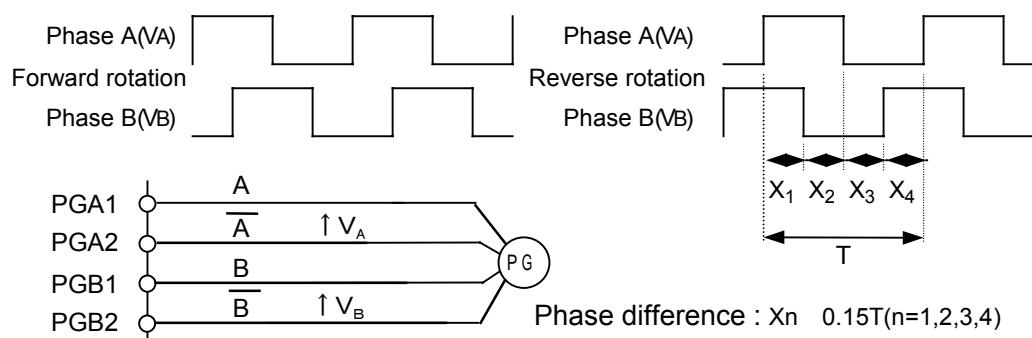


Figure 4-1 Judgement on normal and reverse rotations by the PG feedback of two phases (Phases A and B)

<When PG feedback signal is single phase>

1. For PG feedback signal, connect terminals PGA1 and PGA2.
2. The judgement on forward rotation and reverse rotation is impossible.
Only the speed control mode is applicable.

★ **Caution in case of using open collector encoder connection**

In case using pulse command oscillator and open collector encoder, the rise time of the voltage when the transistor is OFF tends to be longer than the fall time at the time when the transistor is ON. Therefore, if the maximum input frequency becomes higher, the pulse duty cannot maintain the 50±10% specification. Conduct derating on the maximum input frequency so that the pulse duty will be within the following specification range.

<Derating computation formulae of open collector's maximum input pulse frequency >

$$0.8 / (\text{Maximum input frequency} \times A) - \text{Voltage rise time} \geq 3 \times 10^{-6} \dots\dots\textcircled{1}$$

A : (single phase input: 2) (two-phase input: 4)

Voltage rise time : Encoder exclusive pulse rise time + R x C

Encoder exclusive pulse rise time (s) : Please inquire at the encoder manufacturer.

R (Ω) (Input resistance) : internal resistance 1000(Ω) + external resistance value
(in case there is external resistance)

C(F) (Cable static capacity) : Please inquire at the cable manufacturer.

<Example>

Encoder : LBJ-005-500 (SUMTAK), 2-phase input

Encoder pulse rise time: 0.35×10^{-6} (s)

Cable : ROVV-SB-0.2-5P-10m (Furukawa Electric)

Static capacity: 120×10^{-12} (F/m) x 10 (m)

From Formulae $\textcircled{1}$

$$0.8 / (\text{Maximum input frequency} \times A) - \text{Voltage rise time} \geq 3 \times 10^{-6}$$

$$\text{Voltage rise time} = (0.35 \times 10^{-6}) + 1000 \times (120 \times 10^{-12} \times 10) = 1.55 \times 10^{-6}$$

$$[\text{Maximum input frequency}] \leq 87912 \text{ (Pulse/s) [Single phase input]}$$

$$\leq 43956 \text{ (Pulse/s) [Two-phase input]}$$

■ **The case of VEC003(Line Driver)**

As for the PG feedback signals, Terminal A and NA are connected for Phase A, Terminal B and NB are connected for Phase B, and Terminal Z and NZ are connected for Phase Z. (The connection for Phase Z is made only when reading Z-marker is necessary.)

The polarity of the pulse input signal should be as follows.

Non-inverting input side: A, B, Z

Inverting input side: NA, NB, NZ

The signal feedback from the encoder should have the waveform shown in Figure 4-1 in terms of the motor rotation direction. The encoder installation direction and signal wiring should be done accordingly.

★ Forward rotation or reverse rotation is judged from the feedback pulses of Phase A and Phase B (2-phase pulse that have 90 degrees of phase difference). Therefore, it should be noted that, when connections are wrong, there is possibility for abnormal rotation of the motor.

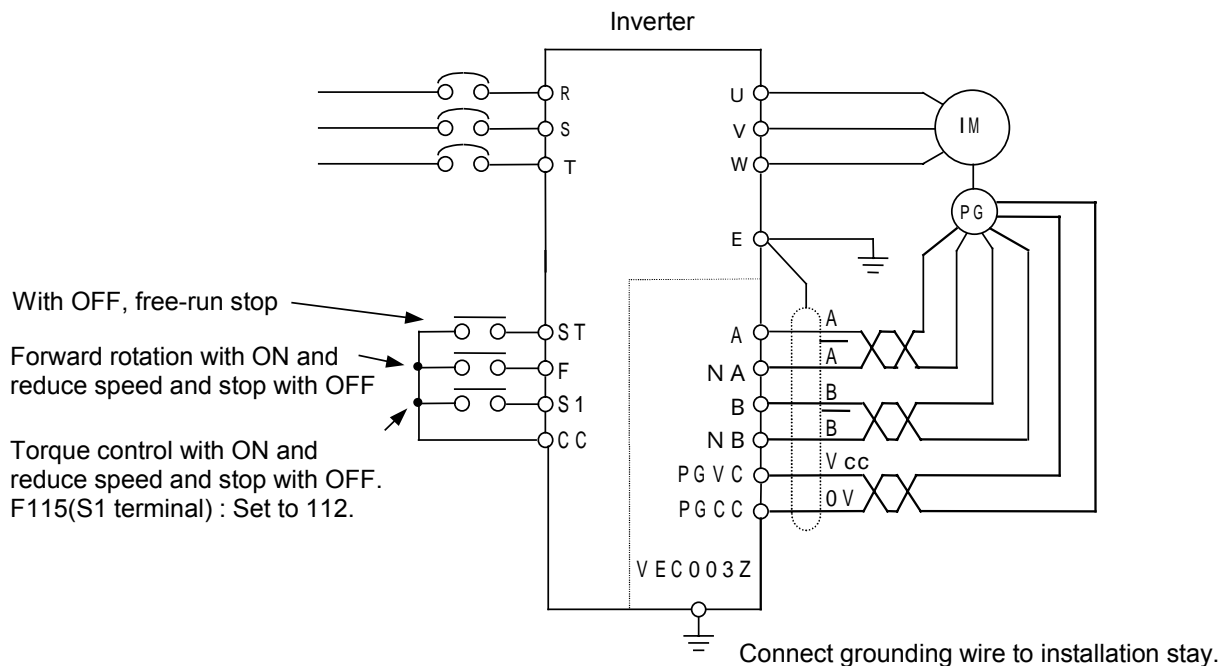


Figure 4-4 Example of wiring for line driver encoder (Speed/Torque switching operation)

★When using two-phase PG, motor forward and reverse rotation can be judged by PG.

When prohibition on reverse rotation is set by the inverter parameter ($F31=1$) and when the motor is rotating to reverse direction due to an external force, the inverter starts with reverse operation in accordance with the motor's direction for a time and the motor will be able to shift to the forward rotation and the smooth startup becomes possible.

4.1.2. Selection of encoder type

The encoder type should be selected, following the table below.

Encoder Type	Characteristics	Maximum Wiring Length	PG Compatible Board
Complementary	Rated voltage output with emitter/follower combination. High anti-noise characteristics. High-speed response. Long-distance transmission capability. Need to pay attention to waveform irregularity.	100m	VEC002Z
Open Collector	The collector of the transistor is output directly. Low anti-noise characteristics. Low-cost. Need to pay attention to waveform irregularity and distortion.	10m	
Line Driver	IC output for high-speed transmission. High anti-noise characteristics. High-speed response. When transmitting over a long-distance, need to pay attention to power voltage drop.	30m	VEC003Z

4.1.3. Vector control setting parameter

During operation with vector control with sensor, it would be necessary to set the following parameters shown in the table below.

Table 4-1 <Basic parameters>

Title	Function Name	Parameter Setting	Setting at Shipment
$P\bar{t}$	V/F Selection	0: Constant torque characteristics 1: Squared reduced torque characteristics 2: Automatic torque boost 3: Sensorless torque control (speed) 4: Automatic torque boost + automatic energy conservation 5: Sensorless vector control + automatic energy conservation 6: V/F 5-point setting 7: Sensorless vector control (speed/torque switching) 8: PG feedback vector control (speed/torque switching) 9: PG feedback vector control (speed/position switching)	0 } Standard : speed control

When conducting vector control with sensor (speed/torque control) with this board option, $P\bar{t} = \bar{8}$ should be set.

For torque control operation, it is necessary to allocate control switching (torque/position) to one of the terminal function selection $F\bar{1}\bar{1}\bar{0}$ to $F\bar{1}\bar{1}\bar{8}$ (input terminal function selection 1 to 8), in addition to the above parameters.

For details of adjustment methods by the speed control command and torque control command, refer to the inverter manual.

Table 4-2 Extended Parameter

Title	Function Name	Parameter Setting	Setting at Shipment
$F\bar{3}\bar{6}\bar{7}$	Number of PG input pulse	1~9999	500
$F\bar{3}\bar{6}\bar{8}$	Selection of number of PG input phases	1: Single phase input 2: 2-phase input	2
$F\bar{3}\bar{7}\bar{4}$	Current control proportional gain	100.0~1000	Depends on type.
$F\bar{3}\bar{7}\bar{5}$	Current control integral gain	100.0~1250	Depends on type.
$F\bar{3}\bar{7}\bar{6}$	Speed loop proportional gain	3.2~1000	Depends on type.
$F\bar{3}\bar{7}\bar{7}$	Speed loop integral gain	0.1~200.0(rad/sec)	Depends on type.
$F\bar{4}\bar{0}\bar{0}$	Auto tuning	0: No auto tuning (internal table) 1: Motor constant initialization 2: Auto tuning (0 after execution)	0
$F\bar{4}\bar{0}\bar{1}$	Slip frequency gain	0.00~2.55	0.60
$F\bar{4}\bar{0}\bar{2}$	Motor constant 1	0.00~100000mΩ	Depends on type.
$F\bar{4}\bar{0}\bar{3}$	Motor constant 2	0.00~100000mΩ	Depends on type.
$F\bar{4}\bar{0}\bar{4}$	Motor constant 3	0.0~6500mH	Depends on type.
$F\bar{4}\bar{0}\bar{5}$	Motor constant 4	0.0~100.0	1.0
$F\bar{4}\bar{1}\bar{0}$	Motor constant 5	0.00~650.0mH	Depends on type.
$F\bar{4}\bar{1}\bar{1}$	Number of poles of motor	2,4,6,8,10,12,14,16	4
$F\bar{4}\bar{1}\bar{2}$	Rated capacity of motor	0.1~280kW	Depends on type.
$F\bar{4}\bar{1}\bar{3}$	Motor type	0: TOSHIBA Standard Motor 1 1: TOSHIBA VF motor 2: TOSHIBA V3 motor 3: TOSHIBA Standard motor 2 4: Other	0

The motor constant parameter ($F\bar{4}\bar{0}\bar{0}$ to $F\bar{4}\bar{1}\bar{3}$) requires setting according to the motor used.

For details, refer to the inverter manual.

- (1) The PG number of input pulses (F367) is the number of encoder output pulses per one motor rotation.
- (2) For PG input phase number selection (F368), set as follows:
 If the encoder pulse is single-phase: 1
 If the encoder pulse is two-phase (Phase A and Phase B or Phase A and Pulse b + Z origin signal): 2
When the settings for the above (1) and (2) are wrong, the motor rotation will become abnormal.
- (3) Adjustment methods for current control ratio gain (F374) and current control integration gain (F375):
 These need to be adjusted when it is necessary to fine-tune torque responses. (Normally, standard setting should be used.) For details of adjustment, refer to the inverter manual.
- (4) Adjustment method for speed loop ratio gain (F376) and speed loop integration gain (F377)

The principle of the feedback control is a proportional action. This action produces output in proportion to the speed deviation. It is a simple mechanism but it takes some time until the speed becomes stable. Proportional action merely produces some offset values. (The speed deviation will not be eliminated completely with reference to the command frequency.)
 In order to eliminate the offset, integration action is effective where the output is calculated by the accumulation of past deviations (from start of operation until now) and added to the proportional action.

<Speed loop ratio gain>

Adjustments are necessary in accordance with the inverter capacity and load inertia ratio.

Set the ratio referring the formulae below as the rule of thumb.

$$\text{Speed loop ratio gain} = (50 \times A \times Pw) \times J^{0.12}$$

A : Coefficient by number of motor poles (2 poles: 1.8 4 poles: 2.0 6 poles: 2.2)

Pw : Inverter capacity (Example: in case of 3.7kW unit Pw=3.7)

J : Load inertia/TOSHIBA standard motor inertia

(Example: In case of inertia ratio being 4, J = 4)

<Speed loop integration gain>

Standard setting at shipment should be used usually.

In case fine-tuning of speed response is necessary, adjust parameters by the following procedure.

Measurement device needed for adjustment: Waveform measurement device such as an oscilloscope.

- ① Connect the probe of the measurement device to the analog monitor output terminal of the inverter (between the FM terminal and CC terminal).
Set FM terminal output to Speed Feedback (real-time value). (Refer to 4.1.4 Monitoring method for feedback amount.)
- ② Set the acceleration time to minimum, so that there will be no over-current stall. ([] blinking)
- ③ Set the Operational Control Setting ([]) and Speed Command Setting (F) to panel input effective. ([]="1", F="5")
- ④ Set the Speed Setting to about 10Hz and press (RUN) key to measure the speed response waveform at operation start. Press (STOP) key to stop operation.
- ⑤ In order to improve the speed response, gradually make the speed ratio gain greater (F) and repeat above ④ operation and adjust to immediately prior to motor oscillation.
- ⑥ Adjust the speed loop integration gain (F). Repeat the operation in ④ above and adjust the parameter so that the speed deviation is contained at expected response time.

This concludes the speed loop gain setting.

4.1.4. Monitoring method for feedback amount

Motor rotation speed can be monitored.

The motor is equipped with status monitor which is displayed on the panel and analog monitor which used analog output terminals (FM, AM terminals)

Set items ① and ② for motor speed monitoring.

- ① Speed feedback (real-time value) (Unit: Hz/free unit)

The real-time display of motor speed can be made (Monitor display setting: 5).

- ② Speed feedback (one-second filter) (Unit: Hz/free unit)

The filtered motor speed (feedback value) is displayed. (Monitor display setting: 7).

The monitoring for the above ① and ② is possible also in cases except for P_{LH} (PG feedback vector control operation). For example, the monitoring can be used for confirmation of the initial PG feedback amount in open loop (V/F operation and the like).

<Setting method for status monitoring>

In order to monitor motor rotation speed in condition monitoring, it is necessary to change the setting for extended parameters (F711 to F714).

Refer to Monitoring Operating Condition section of the inverter manual.

<Setting method for analog monitoring>

In order to monitor motor rotation speed by the analog output terminal, it is necessary to change the setting for basic parameter (F15L, F1) and extended parameter (F670, F671).

Refer to Meter Setting and Calibration section of the inverter manual.

4.1.5. Confirmation of PG's rotational direction

PG's connection in A and B phases and rotational direction of motor can be confirmed as follows.

Set the parameters changed back to the original values following confirming the rotational direction.

Set parameter P_{LH} (V/F control selected) = 0 (constant torque characteristics).

Set parameter F711 (status monitor 1 display selected) = 22 (motor counter dummy PG).

Enter an operating command for positive rotation and command frequency of 1-10Hz to the inverter.

Confirm the motor be turning in the positive direction.

Display status monitor 1 by using the status monitor indication of inverter.

Monitor display, when PG input is determined positive turn, counts up. When it is counting down, PG's A/B phase connections and motor wiring are not correct. They must be corrected.

4.1.6.Speed abnormality detect function

* Parameter

Title	Function Name	Adjustment Range	Setting at Shipment
F622	Abnormal speed detection filter	0.01~100sec	10
F623	Over-speed detection frequency range	0: Invalid, 0.1~30Hz	0
F624	Speed drop detection frequency range	0: Invalid, 0.1~30Hz	0

* Functions

When the detect frequency from the encoder is higher than the over-speed detection frequency range (F623) for the set-up frequency, or when a status of being lower than speed drop detection frequency range (F624) continues for an abnormal speed detection filter (F622), the system trips by a speed error (E-13).

A difference between the set-up frequency and detect frequency from the encoder is produced by an acceleration/deceleration time at speed control, therefore the speed abnormality detect time must be set longer than the acceleration/deceleration time. It does not function in stop.

This function is effective only when speed is controlled.

When it is set invalid and an output frequency or the detect frequency of encoder exceeds 1.25 times a maximum frequency, the system trips by a speed error (E-13).

4.1.7.Accuracy of speed control

The accuracy of speed control with the PG feedback can be obtained by the following formulae.

Accuracy of speed control = Command frequency accuracy + feedback detection accuracy

$$\text{Command frequency accuracy} = \pm \frac{0.01(\text{Hz})}{F_c(\text{Hz})} \times 100 \times \frac{1}{2} \quad [\%]$$

(using digital command)

$$\text{Feedback detection accuracy} = \pm \frac{1}{(F_c/(P/2)) \times PG \times PH \times 0.04} \times 100 \times \frac{1}{2} \quad [\%]$$

F_c : Inverter output frequency

P : Number of motor poles

PG : Number of PG pulses/rotation

PH : Single Phase = 1, Two-Phase = 4

0.04 : Response speed of 40ms

4.2.Pulse input command (speed command selection)

Depending on the software version, the commands may not be compatible.
Please confirm with the inverter manual.

It is possible to input inverter operation frequency command by pulse signals.(Only with VEC002Z).

This command cannot be used when vector control operation with sensor is effective.

- Inverter output frequency can be controlled in ratio with the pulse output signal from the pulse oscillator.
- By inputting two-phase pulse with 90 degrees phase difference, it is possible to input forward and reverse rotation commands.

4.2.1.Pulse command connection method

■ Two-phase pulse input command

1. Connect pulse input signal to the point between terminals PGA1 and PGA2 on phase A and for between terminals PGB1 and PGB2 .on phase B
2. The polarity of the pulse input signals should be as follows:
+ side: PGA1 and PGB1 - side: PGA2 and PGB2
3. Forward and reverse operation can be judged by the pulse from the phase A and B by using a judgement circuit together with the operational frequency command.
4. The judgement on forward and reverse rotation is made as shown in Figure 4-5.

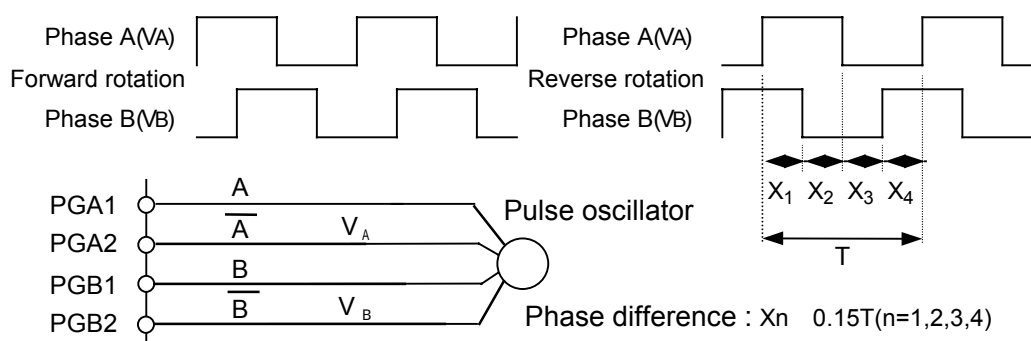


Figure 4-5 Judgement on forward and reverse rotation by the two-phase (Phase A and Phase B) pulse rows

<Caution when using open collector method>

When using open collector method in 4.1.1, the maximum frequency should be derated by referring to the caution item.

■ The case for single-phase pulse input command

For the pulse input signal, connect between PGA1 and PGA2.

For switching between forward and reverse rotation, with $\overline{CC} = \overline{0}$ (Terminal input validation), ON and OFF actions between Terminal F-CC and R-CC are used.

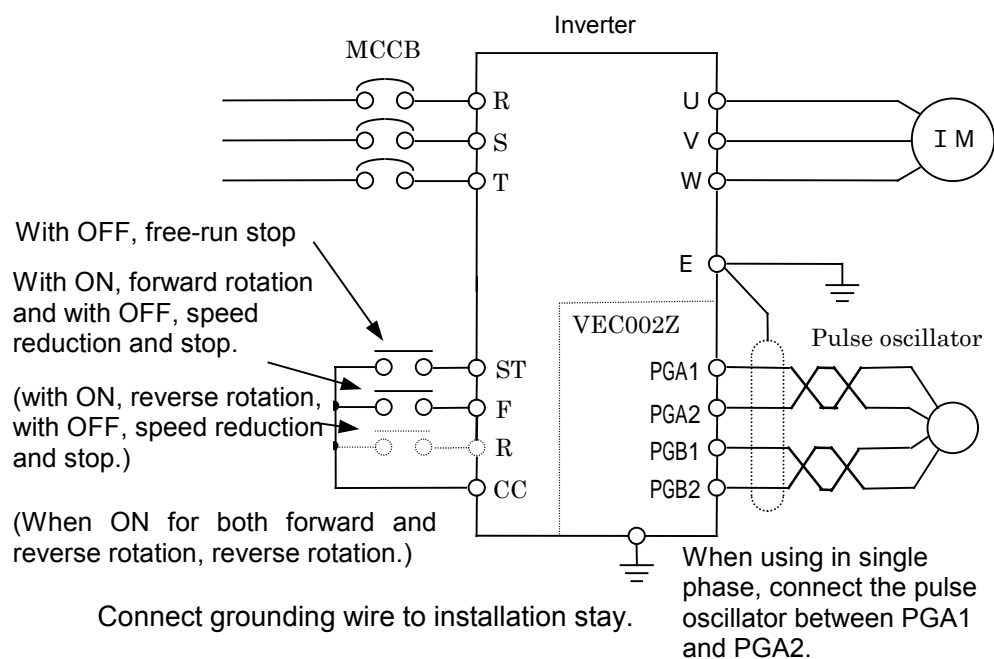


Figure 4-6 Example of connection when operating on pulse row command (speed command)

4.2.2.Pulse input setting parameter

Table 4-3 Necessary Parameter for pulse input setting

Title	Function Name	Adjustment Range	Setting at Shipment
<i>F00d</i>	Speed command selection	1: PG pulse input setting	2
<i>F367</i>	Number of PG input pulse *1	1~9999	500
<i>F368</i>	Selection of number of PG input phases	1: Single-phase input 2: Two-phase input	2
<i>F234</i>	PG reference point #1 *2	-100~100	0
<i>F235</i>	PG reference point #1 frequency *2	-FH~FH*3	0
<i>F236</i>	PG reference point #2 *2	-100~100	100
<i>F237</i>	PG reference point #2 frequency *2	-FH~FH*4	80

*1: Number of PG of input pulse (*F367*) is the number of pulse per one (1) Hz.

The operation frequency command value of the inverter is expressed by the following formulae.

$$\text{Frequency command value} = \frac{\text{Pulse input frequency}}{F367}$$

*2: Gain and bias adjustment method against the pulse input frequency is as expressed in Figure 4-7.

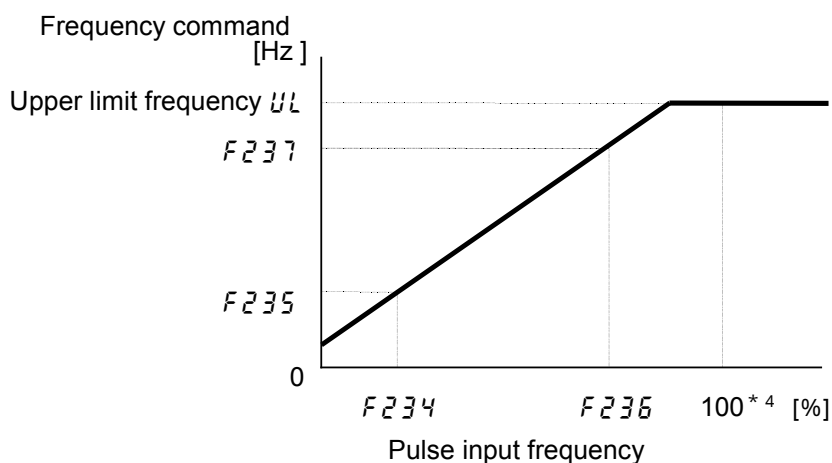


Figure 4-7 Pulse input frequency and frequency command value

*3: FH is the highest frequency.

*4: Pulse input frequency 100(%) value is the maximum value at its highest.

$$\text{Pulse input frequency 100(%) value} = FH \times F367$$

4.2.3. Monitoring method of pulse input command

The pulse input command frequency can be monitored.

In order to monitor the pulse input command frequency, set up the monitor display in the frequency command value [Unit: Hz/free unit].

The pulse input command frequency can be confirmed even before the motor is used.

Initial value can be confirmed for the combination testing.

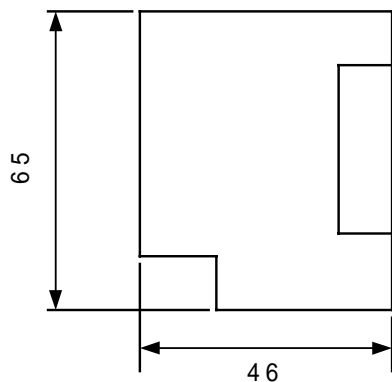
For setting method of the condition monitor, refer to the inverter instruction manual in the “monitoring operation condition” section.

5.External View

When installing, do not forget the option space.

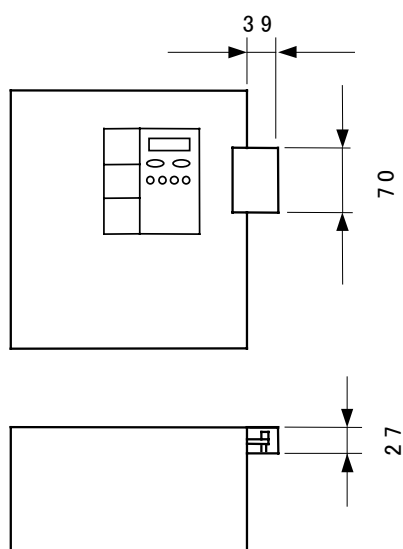
■ External view of PGFB board / Unit external dimension when installing the board. (Unit: mm)

Option board dimension

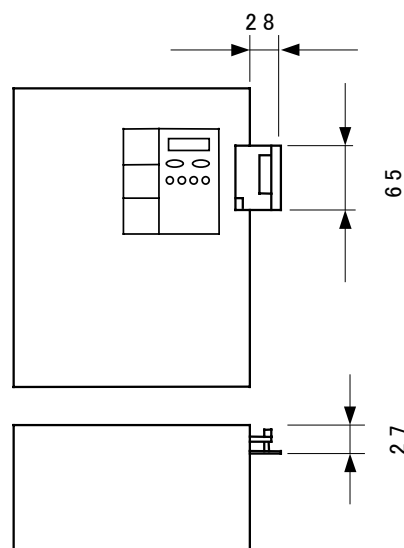


Inverter	Inverter type	Outline drawings
VFA7-****P	2220P or smaller, 4220P or smaller units	①
	2300P, 4300P	②
	2370P or larger, 4370P or larger units	Board is contained within the unit.
VFA7-****P1	2370P1 to 2750P1 units 4370P1 to 4132KP1 units	②
	2900P1 or larger, 4160KP1 or larger units	Board is contained within the unit.
VFP7-****P	2220P or smaller, 4220P or smaller units	①
	2300P to 2750P units 4300P to 4160KP units	②
	2900P or larger, 4220KP or larger units	Board is contained within the unit.

External dimension when installing the unit



External dimension when installing the unit



6. Specification

<Environment Specification>

Item	Specification
Use Environment	Indoor, less than 1,000 m from the sea level. No direct sunlight, corrosive or explosive gas, steam, cutting dusts or dusts, grinding solution, and grinding oil.
Ambient Temperature	-10 to + 50°C
Storage Temperature	-25 to +65°C
Relative Humidity	20 to 90 % (No condensation)
Vibration	5.9m/s ² or less

<Control Specification>

Type	VEC002Z	VEC003Z
Full-vector operation with sensor	Speed control operation[150% torque at zero speed, speed control range: 1:1000(1000 ppr PG), speed accuracy $\pm 0.02\%$ (50 Hz base digital input)] Torque control operation: [torque control accuracy $\pm 10\%$, (torque control range: -100 to 100%)]	
PG Method	Complementary, Open-collector	Line driver
PG Wiring Length	100m (Max.)(Complementary)	30m (Max.)
PG Power Supply	12V -160mA	5V-160mA
Max. Pulse Input Frequency	120kHz or less (single-phase), 60kHz or less (two-phase) * (In case of 2-phase open collector method, deleting need to be considered) Pulse duty: 50 \pm 10%	
Pulse input voltage	12V DC to 15V DC	Line Driver (26LS31 equivalent)
Recommended Encoder	Manufacturer: SUMTAK Co., Ltd. Type: LBJ series Supply Voltage: 12V Output Method: complementary output	Manufacturer: SUMTAK Co., Ltd. Type: LBJ series Supply Voltage: 5V Output Method: line-driver output
Encoder Wiring (Recommended Cable)	Type of Wire: Twisted Pair Shield Cable Conductor Resistance: Conductor Resistance (Ω /m) x cable length (m) x 2 x power consumption (A) <VD (V) V _D (V): 1.0(V) (VEC002Z) 0.3(V) (VEC003Z) Applicable Wire: 0.2 to 0.75mm ² (Power Line) In case of 0.2mm ² cable, maximum of 30m (VEC002Z) maximum of 10m (VEC003Z) KURAMO Electric: KVC-36SB , Furukawa Electric: ROVV-SB	

7.Option Cable

TOSHIBA's sensor cable for VFV3 motor:

When using CAB010 (option), conduct terminal processing on the CN8 side, referring to Table 7-1.

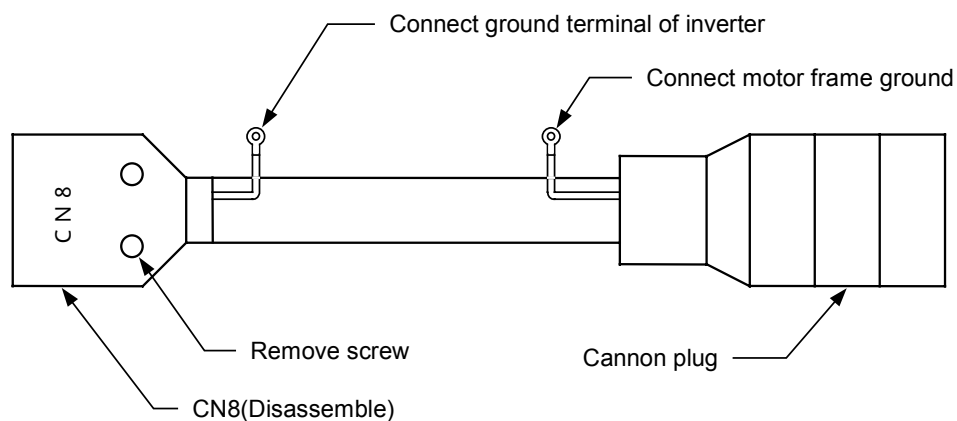


Table7-1 Processing of VFV3 sensor cable

CN8	Cannon Plug	Wire color [※]	Signal Name	Description (PG terminal side processing)
1	A	-	-	Not used (cutting)
2	B	-	-	Not used (cutting)
3	C	-	-	Not used (cutting)
4	D	-	-	Not used (cutting)
5	E	-	-	Not used (cutting)
6	F	-	-	Not used (cutting)
7	G	Blue/White	NZ	Connect to NZ terminal.
8	-	-	-	-
9	N	Black	-	Not used
10	H	Blue	Z	Connect to Z terminal.
11	J	Yellow	NA	Connect to NA terminal.
12	K	Yellow/White	A	Connect to A terminal.
13	L	Green	NB	Connect to NB terminal.
14	M	Green/White	B	Connect to B terminal.
15	N	Brown, Red	COM	Connect to PGCC terminal.
16	P	Brown/White, Red/White	P5	Connect to PGVC terminal.

*There are cases where the wire color may have been changed. Therefore, be sure to confirm on the terminal number of the connector before processing to wire.

8. Warranty

TOSHIBA provides guarantee with the product under the following conditions.

1. If and when a trouble occurs on the board properly installed and handled within one year of delivery, and if the trouble is clearly attributable to defects inherent in our design and manufacture, the product will be repaired free of charge.
2. The warranty covers only the delivered board.
3. Even in the term of the warranty, repair/adjustment service will be changed for the following cases.
 - Fault or damage resulting from misuse, unauthorized modification or repair.
 - Fault or damage resulting from falling down of the product or traffic accident during transportation.
 - Fault or damage originating from fire, salt water/salty breezes, some kind of gas, earthquake, storm or flood, lightning, abnormal supply voltage, other natural disasters.
 - Fault or damage caused by improper use of the inverter as it is used for a purpose out of its original application.
4. If field inspection of the inverter is carried out at the spot of installation, all travelling expenses incurred will be charged. If there is another special warranty contracted for the inverter, the special warranty has priority over this warranty.