

Varispeed G5/F7/G7 OPTION CARD  
PG SPEED CONTROLLER CARD PG-B2  
**INSTRUCTIONS**

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Upon receipt of the product and prior to initial operation, read these instructions thoroughly and retain them for future reference.

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## NOTES FOR SAFE OPERATION

Before installation, operation, maintenance or inspection of this option, a technically qualified individual who is familiar with this type of equipment and the hazards involved should read this entire manual thoroughly. In this manual, the NOTES FOR SAFE OPERATION are classified as "CAUTION".



Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury to personnel and damage equipment.

Failure to heed notices labeled with  may result in dangerous situations or equipment damage.



Steps to be taken to insure proper operation and to avoid malfunctions.

### CAUTION

- The option card uses a CMOS IC chip. It may break if touched by bare fingers because of static electricity. Be careful when handling.
- When removing the option card from the drive for transportation or storage, the card should be placed in the anti-static package it was received in.
- DO NOT alter wiring or connect or disconnect connectors while equipment power is ON.

Failure to observe these cautions may result in injury or equipment damage!



Before use,

1. Before installing the Encoder (PG) Feedback Card (the PG-B2 card), read this manual and the manual for the installation of the drive.
  2. Before connecting the PG-B2 card or external terminals, turn OFF the main power to the drive and verify that the CHARGE indicator lamp of the Drive is OFF.
  3. When ordering the PG-B2 card, specify the product type and code number.
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## 1 Inspection after Delivery

 <b>CAUTION</b>
<ul style="list-style-type: none"><li>• Verify that the products received are the products ordered.</li></ul> Installation of incorrect product may lead to injury or damage.



Prior to shipment, all Yaskawa products undergo rigorous inspection procedures to ensure accuracy and reliability. We recommend checking the following items upon receipt.

- Check that the code number (73600-A013X) and product type (PG-B2) labeled on the actual card correspond to product ordered.
- Check for damage or shortage caused during transportation.

Report any material or manufacturing defects on the card to your Yaskawa representative.

## 2 Introduction and Component Names

The Encoder (PG) Feedback Card (hereafter referred to the PG-B2 card) is mounted on the drive's control board to provide speed and direction feedback. The drive's control logic can use this information for purposes such as correcting for speed fluctuation caused by motor slip and maintaining the velocity.

Using standard software, the PG-B2 card can be used for closed loop control (Flux Vector or V/F with PG). The marker (C or Z) pulse cannot be used from the encoder.

The PG-B2 card is compatible with the G5, F7 and G7 Yaskawa drives.

Name	Code No.	Functions
PG speed controller card PG-B2	73600-A013X	<ul style="list-style-type: none"> <li>• Applicable to complementary output PG</li> <li>• Phase A and phase B pulse (2-phase pulse) inputs for vector control</li> <li>• Maximum input PG frequency: 32,767 Hz</li> <li>• Pulse monitor output: +24 V, 30 mA (max.) (Open collector output)</li> </ul>

The external appearance and component names are shown in *Fig. 1*

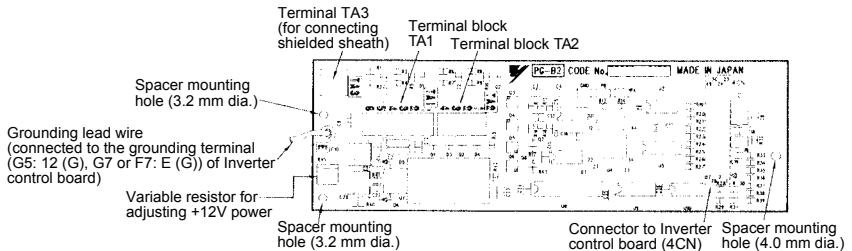


Fig. 1 Encoder (PG) Feedback Card (PG-B2)

## 3 Installation Procedure

### 3.1 Before Installation

Remove contents from package and verify that a mounting spacer (code number SRNT41028-9) is included with the PG-B2 card (see *Fig. 2*).

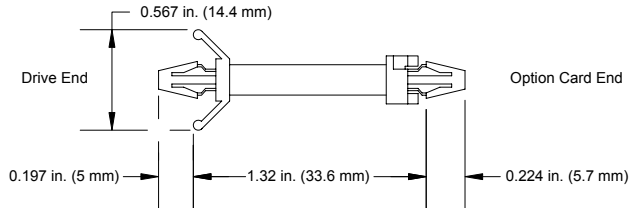
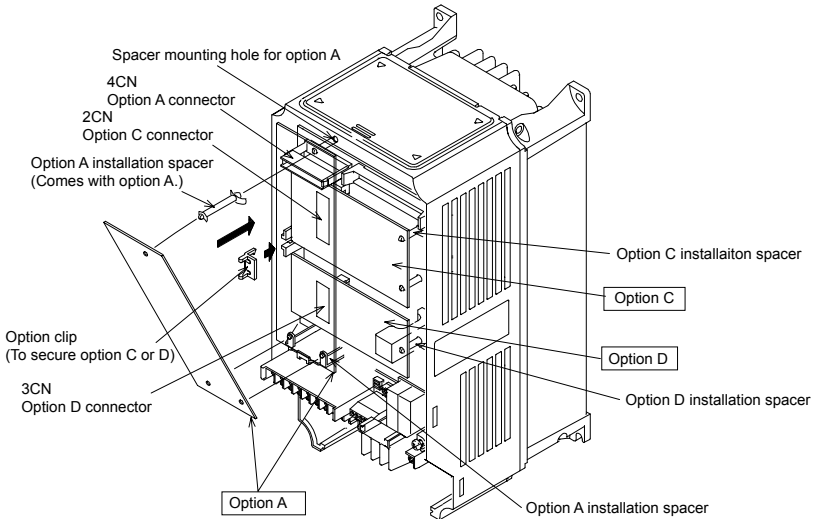
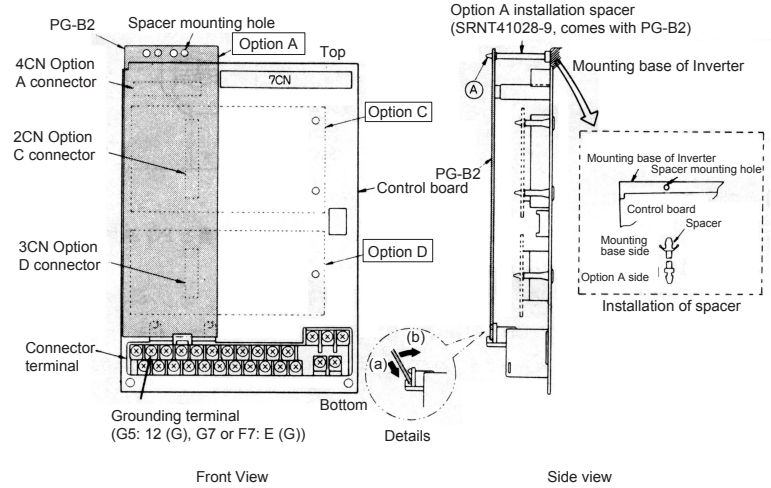


Fig. 2 Spacer

### 3.2 Drive Installation Procedure

1. Turn OFF the main power and wait for the time specified on the cover of the Drive for voltage to bleed off the DC bus capacitors. Remove the cover and verify that the CHARGE indicator lamp is OFF.
2. Insert the spacer (SRNT41028-9) into the spacer mounting hole in the mounting base of the Drive (see *Fig. 3*). Drive models of 3.7 kW or smaller capacities have two closely spaced mounting holes. Insert the spacer into the hole closest to the 7CN connector on the control board. Insertion of the spacer into the incorrect hole will stack the spacer. Be careful to insert in the proper hole in the proper inserting direction.
3. Align the two holes of the PG-B2 card and projections as shown in the detailed side view, first at location (a) and then at (b), and precisely place the card on the option A connector. Insert the spacer mounted at 2 above into the PG-B2 spacer mounting hole. (See part A of the side view on the next page.)
4. Rotate the top edge of the card down into place, carefully aligning connector 4CN on the back of the card with connector 4CN on the control board.
5. Gently press the card into place until 4CN and the spacer click into place.
6. Connect the grounding lead wire of the PG-B2 card to the grounding terminal (G5: 12 (G), G7 or F7: E (G)) on the control board.



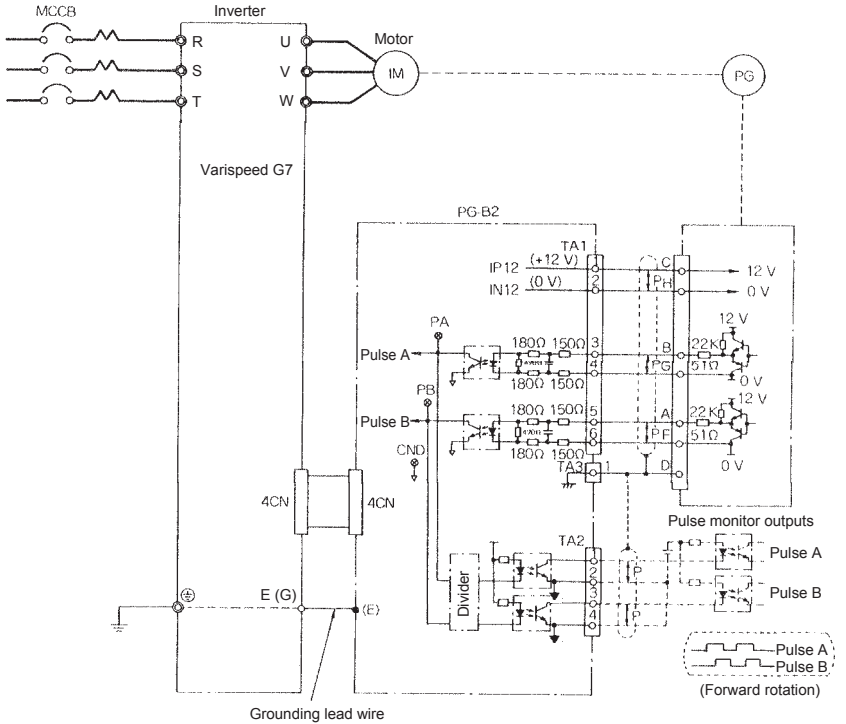
Note: Be sure to remove the option clip before installing the PG-B2 card. If the card is installed with the clip attached, the card cannot be correctly installed, and the card will perform poorly.

Fig. 3 Installation of the PG-B2 Card



# 4 Interconnection

Fig. 4 shows interconnection between the Drive, the PG-B2 card, and peripheral equipment.



Note: The PG terminal symbols are the examples when using a Yaskawa's motor.

PG type: LMA-□□B-S185Y (complementary output)

The pulse monitor emitter is connected to common inside the PG-B2.

The emitter common must be used for external circuits.

Fig. 4 Basic Interconnection Diagram (Example when Used with a G7-series Inverter)

## 5 Wiring

### 5.1 Terminal Functions

Table 1 Terminal Functions of PG-B2

Terminal Block Symbol	Pin No.	Functions		Remarks			
TA1	1	+12 V	+12 V power supply (+12 V $\pm$ 5 %, maximum current 200 mA)*		Power supplies for PG		
	2	0 V					
	3	+	A Pulse	Encoder (Pulse generator, PG) signal input.	Signal input level H: +8 V to +12 V L: +1 V or lower		
	4	-					
	5	+	B Pulse				
	6	-					
TA2	1	+	A Pulse			Pulse monitor output.	Open collector 24 V max. 30 mA max.
	2	-					
	3	+	B Pulse				
	4	-					
TA3	Shielded sheath connection terminal						

\* Up to +14 V  $\pm$ 5 % can be supplied by adjusting variable resistor RV1.  
RV1 is set to 13.0 V at the factory prior to shipment.

#### ■ PG Signal Output

The PG signal output (phases A and B) may vary according to installation location on the motor. Refer to *Fig. 4* for correct wiring.

In general, motor forward direction is counterclockwise (CCW) as viewed from the load shaft. For YASKAWA's motor, phase A of PG output leads phase B by a phase angle of 90° in clockwise (CW) rotation. According to PG, phase A lags phase B by a phase angle of 90° in clockwise (CW) rotation. In this case, when PG is installed at the opposite drive end, connect phases A and B output from PG to the option card as it is.

For YASKAWA's Inverter motor with PG, PG is installed at the opposite drive end. Then, phase A lags phase B by a phase angle of 90° at motor forward run. (Motor runs CCW as viewed from PG.) Therefore, when using this motor or similar motors, connect phases A and B to the option card after replacing phase output. The pulse monitor on this option shows phase A leading phase B by a phase angle of 90°.

## 5.2 Wiring Precautions

Make sure of the followings when wiring.



- Separate the control signal wires (terminal blocks TA1 and TA2) of the PG-B2 card from the main circuit wires and other power cables.
- Use a shielded wire to connect the encoder (PG). Connect the wires as shown in *Fig. 5* to prevent noise interference. The wire distance must be 328 ft. (100 m) or less. Provide an exclusive cable. (Refer to the table below.)

Also, use type of KPEV-S, 0.5 mm<sup>2</sup>.

Wire specification: Polyethylene insulated wire for instrumentation manufactured by NIHON ELECTRIC WIRE & CABLE.

KPEV-S 0.5 mm<sup>2</sup> (1.25 mm<sup>2</sup>) 3-pair wire

Terminal TA1 specification: MKDS1 series manufactured by Phoenix Contact GmbH & Co.

Cable length	YASKAWA Code No.
32.8 ft. (10 m)	72616-W5010
98.4 ft. (30 m)	72616-W5030
164 ft. (50 m)	72616-W5050
328 ft. (100 m)	72616-W5100

- Cable length for pulse monitor output must be 98.4 ft. (30 m) or less.

Wire specification: Polyethylene insulated wire for instrumentation manufactured by NIHON ELECTRIC WIRE & CABLE.

KPEV-S 0.5 mm<sup>2</sup> 2-pair wire

Terminal TA2 specification: MKDS1 series manufactured by Phoenix Contact GmbH & Co.

- To prevent noise, use shielded wire and separate from heavy current circuits (200 VAC or greater) or relay drive circuits. (Wire length to the PG connector must be 328 ft. (100 m) or less.)
- If the PG signal is affected by noise, disconnect the grounding lead wire (E) from the grounding terminal (G5: 12 (G), G7 or F7: E (G)) of the control board of the Inverter.
- The recommended tightening torque is 0.22 to 0.25 N·m.

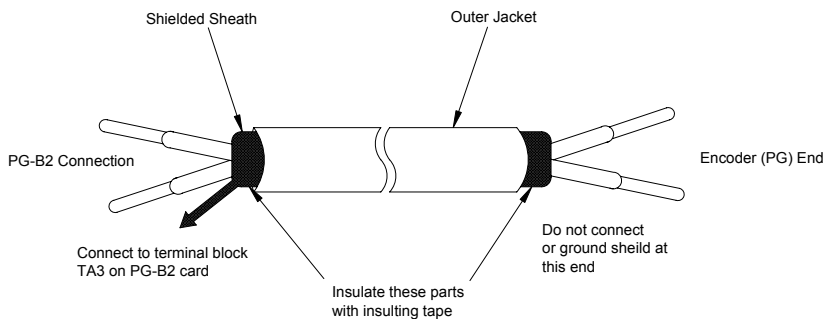


Fig. 5 Shielded Wire Termination

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Applicable wire specifications for terminal blocks TA1 and TA2 are shown in *Table 2*.  
Terminal: MKDS1 series manufactured by Phoenix Contact GmbH & Co.

Table 2 Wire Specifications

	(mm <sup>2</sup> )	AWG	I (amps)	VAC
Thin Twisted Wire	1	16	12	125
Solid Wire	1.5	16	12	125
UL	–	22-16	10	300
CSA	–	28-16	10	300
CSA	–	28-16	10	150

Strip back insulation for a distance of 0.22 inches (5.5 mm) on wire leads connected to the PG-B2 card.

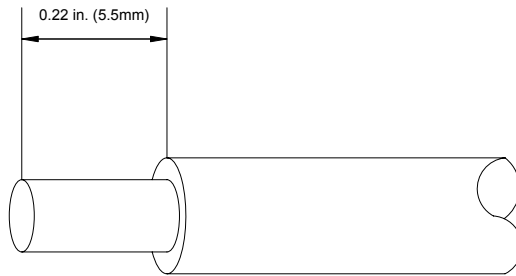


Fig. 6 Connecting Wire End for Terminal Blocks TA1 and TA2 Side



■ Notes on selecting cables

- The thicker a cable is, the greater the pressure on the option card and the greater the possibility of a failure occurring will be.
- The thinner a cable is, the poorer the electrical contact and the greater the possibility of the conductor breaking will be.
- The longer the cable is, the more likely a voltage drop in the PG power supply or PG signal will occur.

## 6 Application of Encoder (PG)

The maximum frequency of the encoder (PG) output pulses that can be detected is 32,767 Hz.

Therefore, select a PG that outputs about 20 kHz at the motor rotation speed at maximum frequency output.

$$\frac{\text{Motor rotation speed (min}^{-1}\text{) at max. frequency output}}{60} \times \text{PG constant (p/rev)} = 20,000 \text{ Hz}$$

### Examples of PG Selection

Motor Rotation Speed at Maximum Frequency Output (min <sup>-1</sup> )	PG Parameter (p/rev)	PG Output Frequency at Maximum Frequency Output (Hz)
1800	600	18,000
1500	800	20,000
1200	1000	20,000
900	1200	18,000

- Note: 1. The motor rotation speeds at maximum frequency output are represented as synchronous rotation speeds.  
 2. PG power supply is +12 V.  
 3. If the PG power current is 200 mA or greater, provide a separate power supply. (If momentary power loss ride-through function is necessary, provide backup capacitor or take other necessary measures.)

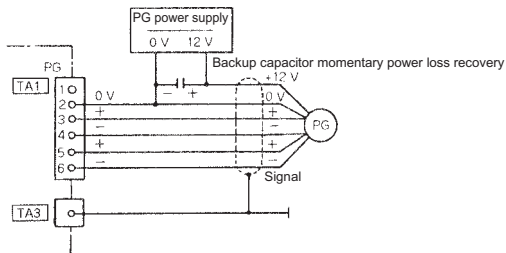


Fig. 7 Connection Example with Encoder (PG) when Using Separate Power Supply

## 7 PG-B2 Card Parameter List

If using the PG-B2 card with any Yaskawa drives other than the G5, F7, or G7, refer to the instruction manual of the drive being used.

Table 3 PG-B2 Card Parameter List

PG-B2 Card Parameter List												
Digital Operator Function Group	Digital Operator Display	Parameter No.	Parameter Name	Setting Range	Factory Setting	Change During Operation *1	Data Selection	Control Method *2				
								G5, G7, F7			G7	
								V/f Control	V/f w/PG Fdbk	Open loop Vector		Flux Vector *9
PG Option Setup	PG Pulses/Rev	F1-01	PG constant	0 to 60000	600	×		×	○	×	○	×
	PG Fdbk Loss Sel	F1-02	Operation selection at PG open circuit (PGO)	0 to 3	1	×	0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	×	○	×	○	×
	PG Overspeed Sel	F1-03	Operation selection at overspeed (OS)	0 to 3	1	×		×	○	×	○	○
	PG Deviation Sel	F1-04	Operation selection at deviation	0 to 3	3	×		×	○	×	○	○
	PG Rotation Sel	F1-05	PG rotation	0,1	0	×		0:Fwd=CCW 1:Fwd=CW	×	○	×	○
	PG Output Ratio	F1-06	PG division rate	1 to 132	1	×	Set the pulse output division rate of the PG-B2 card: Division rate = $(1+n)/m$ (n = 0 or 1, m = 1 to 32) F1-6 = $\frac{\square}{n} \frac{\square}{m}$	×	○	×	○	×
	PG Ramp PI/I Sel	F1-07	Integral value during accel/decel enable/disable	0,1	0	×	0: Disabled 1: Enable	×	○	×	×	×
	PG Overspd Level	F1-08	Overspeed detection level	0 to 120 %	115 %	×		×	○	×	○	○
	PG Overspd Time	F1-09	Overspeed detection delay-time	0 to 2.0 s	0.0 s *3 (1.0 s) *4	×		×	○	×	○	○
	PG Deviate Level	F1-10	Excessive speed deviation detection level	0 to 50 %	10 %	×		×	○	×	○	○
	PG Deviate Time	F1-11	Excessive speed deviation detection delay time	0 to 10 s	0.5 s	×		×	○	×	○	○

Table 3 PG-B2 Card Parameter List (cont'd)

PG-B2 Card Parameter List												
Digital Operator Function Group	Digital Operator Display	Parameter No.	Parameter Name	Setting Range	Factory Setting	Change During Operation *1	Data Selection	Control Method *2				
								G5, G7, F7				G7
								V/f Control	V/f w/PG Fdbk	Open loop Vector	Flux Vector*9	
PG Option Setup	PG# Gear Teeth 1	F1-12	Number of PG gear teeth 1	0 to 1000	0	×		×	○	×	×	×
	PG# Gear Teeth 2	F1-13	Number of PG gear teeth 2	0 to 1000	0	×		×	○	×	×	×
	PGO Detect Time *5	F1-14	PG open-circuit detection time	0 to 10 s	2 s	×		×	○	×	○	×
ASR Tuning *6	ASR P Gain 1	C5-01	ASR proportional (P) gain 1	0 to 300.00	20.00 *3 (0.20) *4	○		×	○	×	○	○
	ASR I Time 1	C5-02	ASR integral (I) time 1	0 to 10.000 s	0.500 s *3 (0.200 s) *4	○		×	○	×	○	○
	ASR P Gain 2	C5-03	ASR proportional (P) gain 2	0 to 300.00	20.00 *3 (0.02) *4	○		×	○	×	○	○
	ASR I Time 2	C5-04	ASR integral (I) time 2	0 to 10.000 s	0.500 s *3 (0.050 s) *4	○		×	○	×	○	○
	ASR Limit	C5-05	ASR limit	0.0 to 20 %	5.0 % *4	×		×	○	×	×	×
	ASR Delay Time 1 *8	C5-06	ASR primary delay time 1	0.000 to 0.500 s	0.004 s *3	×		×	×	×	○	○ *3
	ASR Gain SW Freq *8	C5-07	ASR switching frequency	00 to 400.00 Hz	0.0 Hz	×		×	×	×	○	○
	ASR Limit *8	C5-08	ASR integral (I) limit	0 to 400 %	400 %	×		×	×	×	○	○
	ASR Delay Time 2 *7	C5-10	ASR primary delay time 2	0.000 to 0.500 s	0.010 s	×		×	×	×	×	○

\* 1. ○ = Enable, × = Disable

\* 2. ○ = Setting enable, × = Setting disable

\* 3. For flux-vector control

\* 4. For V/f with PG feedback control

\* 5. For the F7, setting and reference are enabled for the software No. (U1-14) of 1030 or after.

\* 6. ASR - Automatic Speed Regulator


\* 7. For the G7 only



\* 8. If using the flux-vector control with the F7, be sure to use an Inverter with a design revision number of E or later. Versions C or earlier do not support the flux-vector control.

## Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

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# Varispeed G5/F7/G7 OPTION CARD PG SPEED CONTROLLER CARD PG-B2 INSTRUCTIONS

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In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

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