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1. Part Number: PG-X2.

2. Applicability: F7, G7, GPD515/G5, G5HHP.

3. Introduction: The PG-X2 encoder feedback option card (Figure 1) is mounted on the drive's Control Board and performs speed feedback using the pulse generator (PG) on the motor to correct speed fluctuation caused by motor slip. Motor rotation direction is detected by phase A and phase B PG pulse inputs. The terms encoder, PG (pulse generator), and pulse train are used interchangeably in this guide. The card can be used for flux vector control or V/Hz with PG feedback control.

4. Receiving: All equipment is tested against defect at the factory. Report any damages or shortages evident when the equipment is received to the commercial carrier who transported the equipment.

5. Cautions:

a. Hazardous voltage can cause severe injury or death. Lock all power sources feeding the drive in the "OFF" position.
b. This option card uses CMOS IC chips. Use proper electrostatic discharge (ESD) protective procedures when handling the card to prevent I.C. damage or erratic drive operation.
c. If other option cards are to be installed at the Option C (2CN) or Option D (3CN) positions (See Figure 2), their installation and wiring should be completed before installation of this option.
d. Before installing this option, a technically qualified individual, who is familiar with this type of equipment and the hazards involved, should read this entire installation guide.

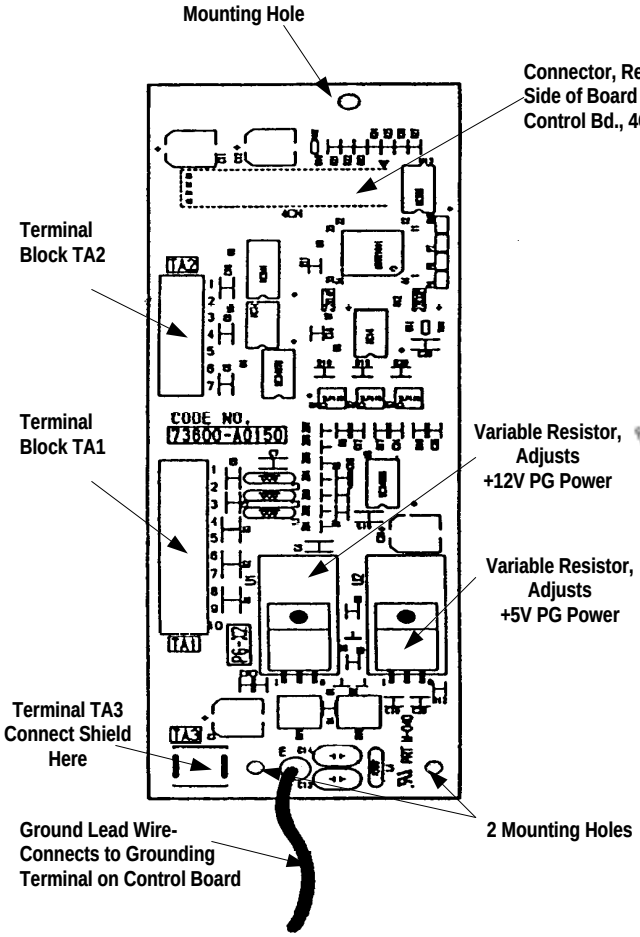


Figure 1. PG-X2 Encoder Feedback Card

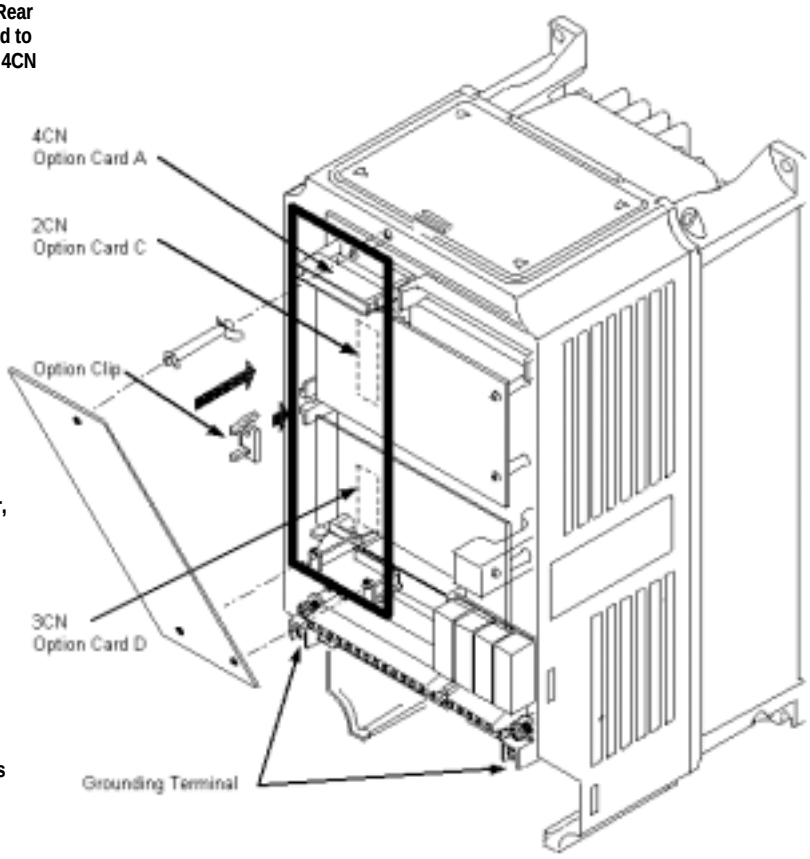


Figure 2. PG-X2 Option Card installation

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6. Precautions and Preliminary Installation:

a. Remove contents from package. Verify that a mounting spacer (P/N 5RNT41028-9) is included with the card. See Figure 3.
b. Disconnect all electrical power to the drive.
c. Remove the drive's front cover.
d. Check that the "CHARGE" indicator lamp inside the drive is off.
e. Use a voltmeter to verify voltage at incoming power terminals (L1, L2, L3) has been disconnected.
f. Insert the spacer into the mounting hole in the base of the drive, just above the top edge of the control board. See Figure 2.
g. **Note:** When re-installing the cover, please take care not to pinch any of the encoder wires.
h. **Important:** GPD 515/G5 models 20P2 to 22P2 and 40P2 to 41P5 have two closely spaced mounting holes. Insert the spacer into the hole closest to the control board's connector 4CN. If inserted in the wrong hole, the spacer WILL NOT properly align with the PG-W2's mounting hole.

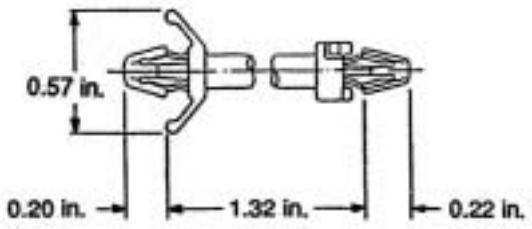


Figure 3. Mounting Spacer

7. PG-X2 Installation: See Figure 2.

a. Position the bottom edge of the option card into the mounting bracket on the control board's terminal block. Align two mounting holes in the card with pins on the bracket.
b. Then angle the top edge of the card into place, carefully aligning connector 4CN on the back of the card with connector 4CN on the control board. Gently press the card into place until 4CN and the spacer click into place.

8. Wiring: Refer to Figure 4 and Tables 1 & 2. Make wire connections between the PG-X2 card and encoder as well as any external monitoring circuits. Observe the following:

a. The need for the marker Z (C) channel depends on the installed custom (CASE) software. Standard software does not use the marker pulse.
b. Keep the PG-X2 (i.e. control circuit) wiring separate from main circuit input/output wiring. A separate metallic grounded conduit with ONLY the PG wiring running through it is preferred.
c. To prevent erroneous operation caused by noise interference, use shielded cable for control signal wiring, and limit the distance to 50m (165 feet) or less.
d. Recommended cable is twisted pair, 22AWG, with overall shield, such as Belden 9504. Refer to "Electrical Installation" in the drive technical manual for further information on use of shielded cable. The shielded sheath connection points on the PG-X2 card are terminal TA3.
e. Strip back insulation for a distance of 0.22 in. on wire leads connected to the PG-X2 terminals.
f. Connect the option card ground wire (E) to the drive's ground terminal TB3 (12 for G5).

9. Adjustment: The+12VDC and +5VDC outputs of the PG-X2 card are factory calibrated. No adjustment should be necessary.

10. Cover: Reinstall and secure drive's front cover.

11. Programming: Table 3 lists all drive parameters related to encoder feedback. Ensure that all of these parameters are programmed to meet the requirements of the application.

12. Start-up: Refer to Section 2 in the drive's technical manual for testing and start-up information.

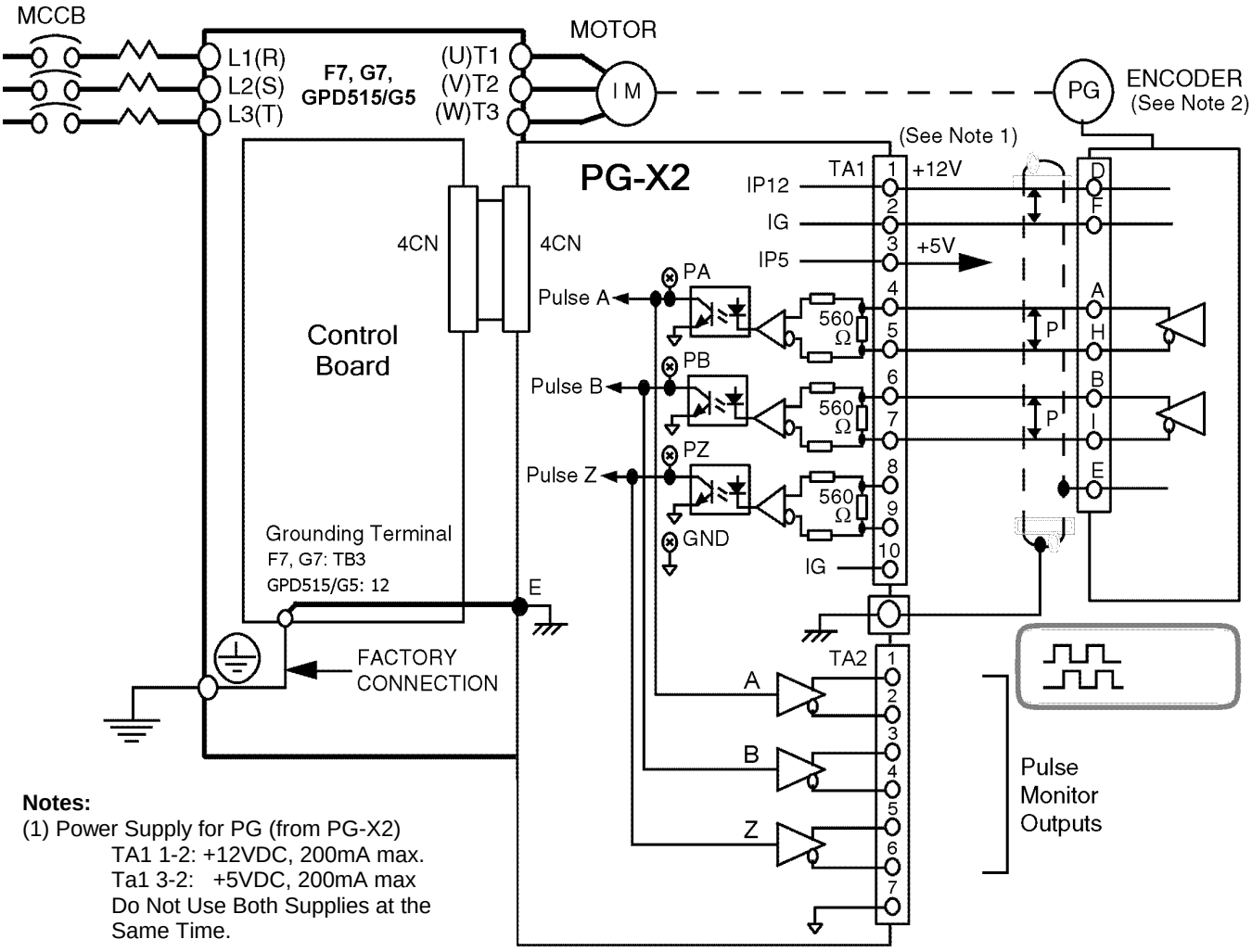
13. IG Storage: Place this instruction guide with the drive's technical manual.

Table 1. Terminal Functions				
Terminal Block	**Terminal Number**	**Function**		
TA1	1	+12VDC	Power supply for Pulse Generator (PG). **Important:** Use either +12V or +5V, but never both at the same time.	
	2	0V	+12VDC, 200mA max	
	3	+5VDC	+5VDC, 200mA max	
	4	+	A Pulse	PG Signal Inputs RS-422 Level Input
	5	-		
	6	+	B Pulse	
	7	-		
	8	+	Z Pulse*	
	9	-		
	10	0V	Common Terminal	
TA2	1	+	A Pulse	Pulse Monitor Output RS-422 Level Output
	2	-		
	3	+	B Pulse	
	4	-		
	5	+	Z Pulse*	
	6	-		
	7	IG5	Isolated Common Terminal	
TA3	Shield Drain for Encoder Wiring			

* Not required for standard software. May be required for custom software.

Table 2. Terminal and Wire Specifications			
Terminal Symbol	**Terminal Screw**	**Clamping Torque Lb-in (N-m)**	**Wire Range AWG (mm^2)**
TA1, TA2	M2	1.8 to 2.2 (0.22 to 0.25)	26 to 16 (Stranded: 0.14 to 1) (Solid: 0.14 to 1.5)

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Notes:

(1) Power Supply for PG (from PG-X2)
TA1 1-2: +12VDC, 200mA max.
Ta1 3-2: +5VDC, 200mA max
Do Not Use Both Supplies at the Same Time.

(2) H20 Dynapar Encoder Connections Shown

Figure 4. PG-X2 Interconnection Diagram

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14. Application: If the encoder's power requirement is greater than 200mA, provide a separate power supply source as shown in Figure 5. If the momentary power loss ride thru function of the drive is to be used, include a backup capacitor in the PG power wiring or take other necessary precautions.

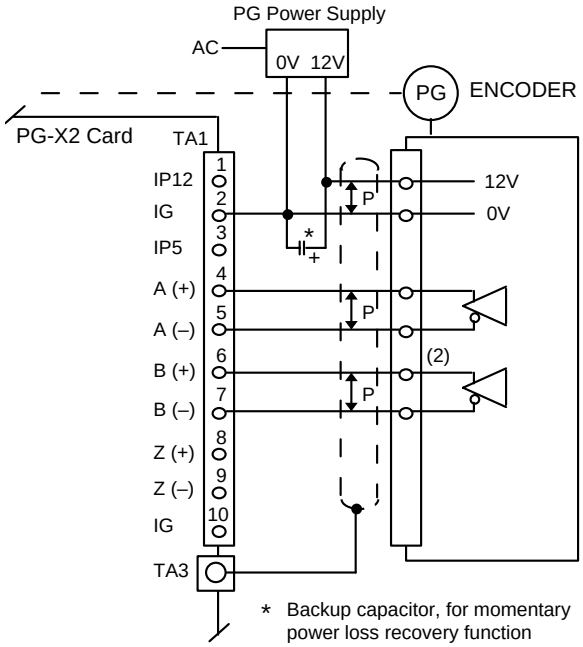


Figure 5. Using Separate PG Power Supply

15. Maximum Input Frequency: The maximum input frequency of the PG-W2 card is 300kHz. To find the output frequency of the encoder (PG) in Hertz, use the following formula. Please make sure a 20% safety margin is built-in.

$$f_{PG}\ (Hz) = \frac{\text{Maximum Motor Speed (RPM)}}{60} \times \text{Encoder PPR (Pulses/Rev)}$$

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16. Signal type / level requirements: The PG-X2 card requires a "quadrature line driver with compliments" signal type from the encoder (pulse generator). As shown in Figure 6, line driver signals include both a primary signal (Signal A+) and it's compliment (Signal A-). The compliment is the inverse of the primary signal. This scheme is used to improve the noise immunity of the system. The encoder output signal voltage should be between +5VDC and +12VDC. An "open collector" signal type WILL NOT work with the PG-X2 card.

A quadrature signal is one that lags the primary signal by 90 electrical degrees (1/2 of a pulse). The purpose of this is so that the drive can detect the direction of the encoder rotation. As shown in Figure 6, for "forward" rotation of the encoder, signal A+ will lead signal B+ by 90^{o}.

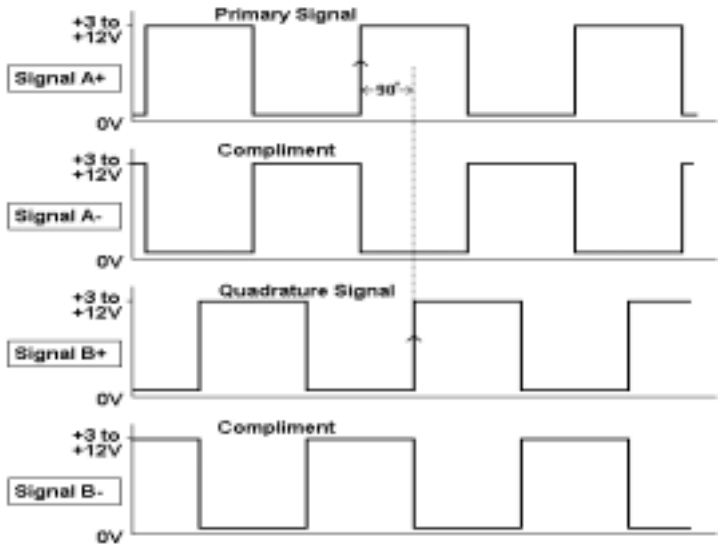
If any one of the four signals is missing, the drive cannot accurately measure the encoder rotation speed or direction.

17. Viewing Signals With An Oscilloscope: The PG-X2 option card has test points that can be used to connect an oscilloscope. Test points PA, PB, and PZ are after the compliment is subtracted out and the signals are buffered through the opto-isolators. See Figure 4. The voltage level on all test points varies between 0 and +5VDC (TTL).

Caution: Always use an un-grounded oscilloscope so no noise is introduced into the common.

Table 3. PG-X2 Test Points

Test Point	Description
GND	Although labeled GND, it is NOT earth ground. This test point should only be used in conjunction with test points PA, PB, and PZ.
PA	Channel A (Terminals 4 & 5)
PB	Channel B (Terminals 6 & 7)
PZ	Channel Z (Terminals 8 & 8)



Note: All signals shown are in relation to power supply common, Terminal 2 of the PG-X2.

Figure 6. Encoder (PG) Signals – Forward Direction

Table 3. GPD 515/G5, F7, and G7 Encoder Feedback Parameter List									
Digital Operator Function Group	Digital Operator Display	Parameter Number	Parameter Name	Setting Range	Factory Setting	Change During Operation (1)	Data Selection	Control Method (2)	
								V/f w/ PG Feedback	Flux Vector
PG Option Setup	PG Pulse/Rev	F1-01	PG Constant	0 to 60000	1024	X		O	O
	PG Fdbk Loss Sel	F1-02	Operation at Open PG Circuit	0 to 3	1	X	0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	O	O
	PG Overspeed Sel	F1-03	Operation Selection at Overspeed	0 to 3	1	X		O	O
	PG Deviation Sel	F1-04	Operation Selection at Deviation	0 to 3	3	X		O	O
	PG Rotation Sel	F1-05	PG Rotation	0,1	0	X	0: Fwd = CCW 1: Fwd = CW	O	O
	PG Ramp PI/I Sel	F1-07	Integral Control during Accel/Decel	0,1	0	X	0: Disabled 1: Enable	O	X
	PG Overspeed Level	F1-08	Overspeed Detection Level	0 to 120%	115%	X		O	O
	PG Overspeed Time	F1-09	Overspeed Detection Delay Time	0 to 2.0s	1.0s	X		O	O
	PG Deviation Level	F1-10	Speed Deviation Detection Level	0 to 50%	10%	X		O	O
	PG Deviation Time	F1-11	Speed Deviation Detection Delay Time	0 to 10s	0.5s	X		O	O
	PG# Gear Teeth 1	F1-12	Number of Gear Teeth 1	0 to 1000	0	X		O	X
	PG# Gear Teeth 2	F1-13	Number of Gear Teeth 2	0 to 1000	0	X		O	X
	PGO Detect Time	F1-14	PGO Detection Time	0 to 10s	2s	X		O	O
	Speed Detection Filter Selection	F1-15	Speed Detection Filter Selection	0, 1	1	X	0: No Average 1: 2 Scan Moving Average	O	O

Table 3. GPD 515/G5, F7, and G7 Encoder Feedback Parameter List									
Digital Operator Function Group	Digital Operator Display	Parameter Number	Parameter Name	Setting Range	Factory Setting	Change During Operation (1)	Data Selection	Control Method (2)	
								V/f w/ PG Feedback	Flux Vector
ASR Tuning	ASR P Gain 1	C5-01	ASR Proportional Gain 1	0 to 300.00	0.00	O		O	O
	ASR I Time 1	C5-02	ASR Integral Time 1	0 to 10.000s	0.00s	O		O	O
	ASR P Time 2	C5-03	ASR Proportional Gain 2	0 to 300.00	0.00	O		O	O
	ASR I Time 2	C5-04	ASR Integral Time 2	0 to 10.000s	0.00s	O		O	O
	ASR Limit	C5-05	ASR Limit	0.0 to 20%	0.0%	X		O	X
	ASR Delay Time	C5-06	ASR Primary Delay Time	0.000 to 0.500s	0.000s	X		X	O
	ASR Gain SW Freq	C5-07	ASR Switching Frequency	0.0 to 400.00Hz	0.0Hz	X		X	O
	ASR Integral Limit	C5-08	ASR Integral Limit	0 to 400%	400%	X		X	O

(1) O = Yes, X = No.
(2) O = Available, X = Hidden. The PG-X2 is not applicable for A1-02 = 0 (V/f Control) or 2 (Open Loop Vector).

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