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VG5 and VG5+
PG-W2 Dual Encoder
Interface Card Kit

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SAFETY FIRST !

PLEASE READ THIS INSTRUCTION MANUAL THOROUGHLY BEFORE ATTEMPTING ANY INSTALLATION, OPERATION, MAINTENANCE OR INSPECTION. FAILURE TO FOLLOW THE RECOMMENDED PROCEDURES OR CAUTIONS IN THIS MANUAL COULD RESULT IN INJURY TO PERSONNEL AND/OR DAMAGE TO EQUIPMENT.

Disconnect and lockout all power before working on the equipment.
THERE ARE LETHAL VOLTAGES PRESENT AND COULD RESULT IN INJURY OR DAMAGE TO EQUIPMENT.

CAUTION !

1. CHECK THE NAME WRITTEN ON THE PRODUCTS AND INSURE THAT THE PROPER PART HAS BEEN RECEIVED.

2. INSPECT THE PART FOR ANY DAMAGE DUE TO SHIPMENT.

3. THE OPTION CARD USES CMOS IC CHIPS AND CAN BE DAMAGED BY STATIC ELECTRICITY.

4. BEFORE INSTALLING THE OPTION CARD, TURN OFF ALL POWER TO THE EQUIPMENT AND INSURE THE CHARGE INDICATOR LAMP ON THE INVERTER IS OFF. *LETHAL VOLTAGES ARE PRESENT !*

5. DO NOT CONNECT OR DISCONNECT WIRING WHILE POWER IS *ON !*

6. FOLLOW GOOD STANDARD WIRING PRACTICES AND ANY APPLICABLE CODES THAT MAY APPLY.

Description

The PG-W2 card designed for use with the VG5 and VG5+ series of inverters, provides for dual encoder inputs, channel 1 and Channel 2. Channel 1 is used with the local encoder to provide speed feedback to control and minimize motor speed changes do to load variations. Channel 2 is used to interface with a second encoder connected to a process that is to be followed. For both channels the PG-W2 card accepts a two phase input, A and B (quadrature) for directional detection, and a marker pulse, (Z input, one pulse per revolution) The PG-W2 also provides A,B, and Z outputs, for either channel 1 or 2 (software selectable), for monitoring or control. A 12VDC@ 200 mA supply to power the local encoder is provided, while an external supply must be used for the second encoder.

The card is designed to operate in the V/F or Flux Vector modes. (see table 1,and also refer to the VG5 or VG5+ programming manual, for further information).

Specifications

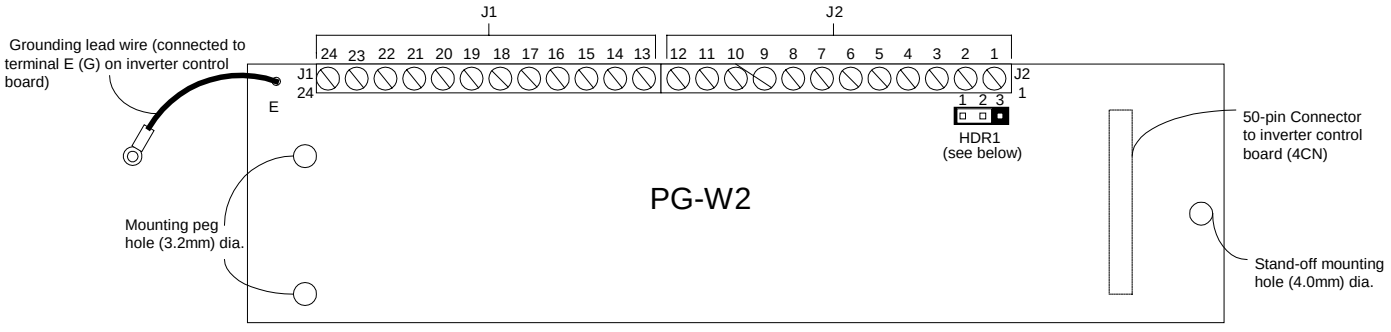
FOR BOTH CHANNELS:

1 - A,B, & Z inputs - differential RS-422 compatible
2 - Input Frequency range - 50 to 300 kHz
3 - A,B, & Z outputs - differential RS-422 compatible
4 - Software - 10011 / 11102

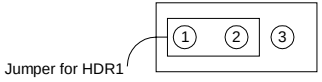
FOR CHANNEL 1 ONLY:

Encoder Power Supply - +12 VDC @ 200 mA max. (see note)

NOTE: THE MAXIMUM CURRENT AVAILABLE IS 200 MA . IF THE ENCODER REQUIREMENTS EXCEED THIS THEN AN EXTERNAL SUPPLY MUST BE PROVIDED. (SEE FIGURE 5)



Encoder #2 Velocity Processing



HDR1 Jumper Position	Scan Time
1 - 2 *	5 ms
2 - 3	2 ms

* Default position. The 2 ms scan time is not supported at this time

Fig. 1 Dual PG Speed Control Card PG-W2

Kit Includes

(1) PG-W2 Encoder Interface Card (Fig. 1)

Installation Procedure

(1) Turn OFF the main power to the inverter and wait for the time specified on the cover of the inverter. Remove the cover and verify that the CHARGE indicator lamp is OFF.

(2) Insert the attached spacer (SRNT41028-9) into the spacer mounting hole in the mounting base of the inverter (see FIGURE 2).

Inverters of 3.7 kW or smaller capacities have two closely placed holes. Insert the spacer into the hole on the 7CN side. Inserting into the wrong hole will stack the spacer. Be careful to insert in the proper hole in the proper inserting direction.

(3) Align the two holes of PG-W2 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-W2 spacer mounting hole (see Part A of the side view).

Verify that 4CN is precisely aligned to PG-W2. Gently push the card until it clicks.

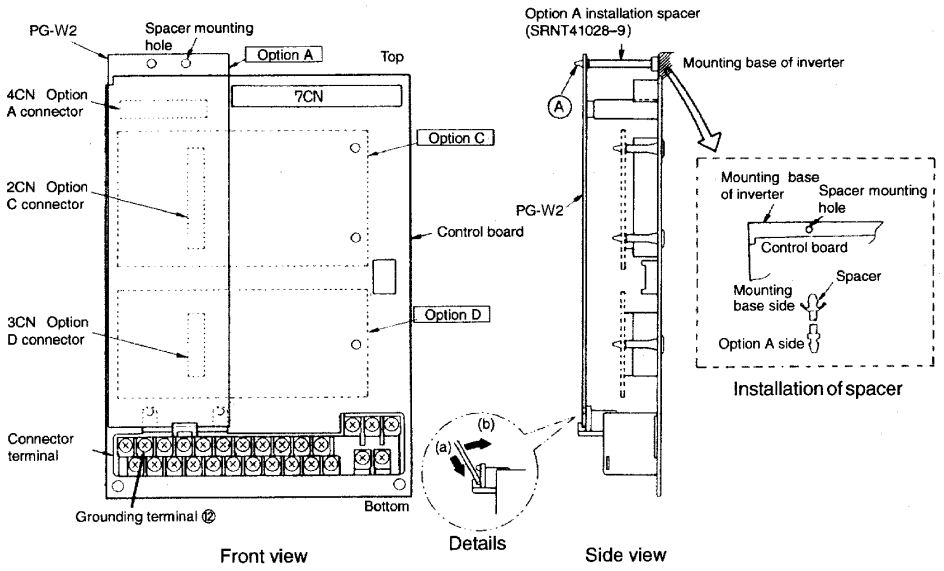
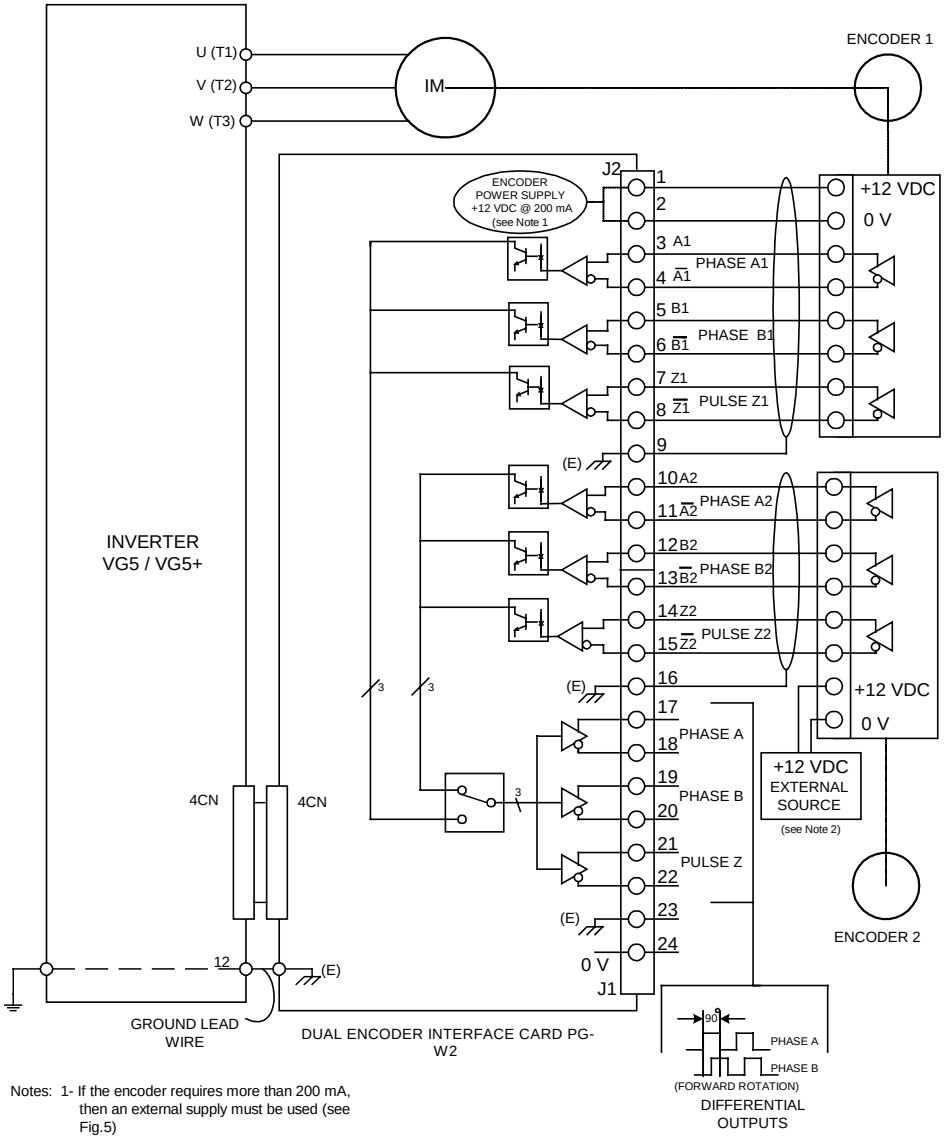


FIGURE 2 - INSTALLATION OF ENCODER INTERFACE CARD PG-W2



Notes: 1- If the encoder requires more than 200 mA, then an external supply must be used (see Fig.5)
2 - Encoder 2 requires an external +12 vdc power supply.

FIGURE 3 - INTERCONNECTION DIAGRAM

Wiring Recommendations

(1) All signal wiring (from terminals J1 and J2) of the PG-W2 card should be run separately from any power wiring or cable.

(2) Use shielded twisted cable between the PG-W2 card and the encoder, and ground the shield properly as shown in FIGURE 3. Good shield grounding practices will help minimize any noise problems. Also, the cable length should not exceed 160 ft. (50 m).

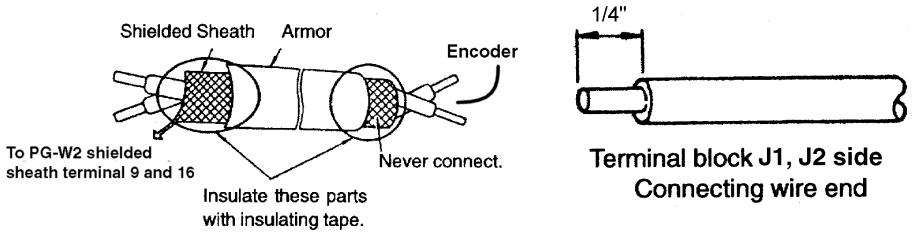


FIGURE 4

(3) Applicable wire sizes for terminal blocks J1 and J2 are shown in the following table. The terminals are the MKDS1 series, manufactured by Phoenix Contact GmbH & Co.

	AWG	I(A)	VAC(V)
Stranded	**16**	**12**	**125**
Solid	**16**	**12**	**125**
UL	**22-16**	**10**	**300**
CSA	**22-16**	**10**	**300**
CSA	**22-16**	**10**	**300**

Encoder Selection

The maximum frequency of the encoder output pulses that can be detected is 300 kHz.
Find the output frequency, f (Hz), according to the following formula.

$$f\,(Hz) = \frac{\text{Motor rotation speed (r/min) at max. frequency output}}{60} \times \text{Encoder constant (p/rev)}$$

If the encoder current requirements is 200 mA or greater, provide a separate power supply. (If momentary power loss ride-through function is necessary, provide back-up capacitor Figure 5 or take other necessary measures.)

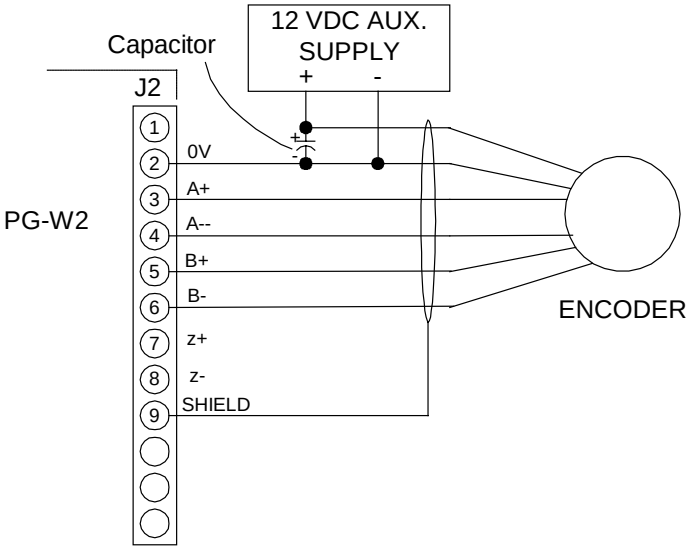
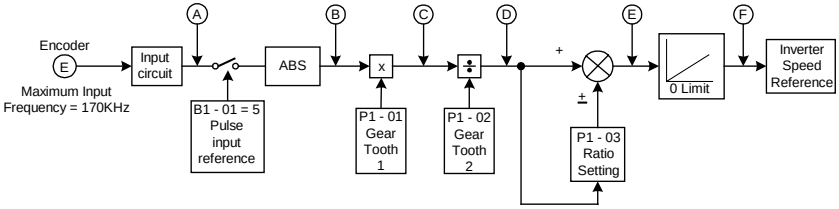


FIGURE 5 - CONNECTION EXAMPLE WITH ENCODER WHEN USING SEPARATE POWER SUPPLY

Channel 2 Operation

As described earlier Channel 1 is used to interface with the local encoder to provide speed feedback to control and minimize speed changes do to load variations. Channel 2 provides an interface with a second encoder to enable a following or tracking of a process. The input of the second encoder is conditioned and scaled as shown in the block diagram shown in Fig. 6 below.

The encoder output is converted to a signal **(A)** in which 1 pulse / sec. equals 0.001 Hz. of frequency reference once every 5 ms. as set by the HDR1 jumper default position as shown in Fig.1. **NOTE: The 2 ms. scan time is not supported at this time.** The frequency is converted to an absolute value to negate the directional (quadrature) information of the encoder. This absolute reference **(B)** is then multiplied by the constant set in the inverter parameter P1-01 having a range of 0 – 10,000. This output **(C)** is then divided by a constant set in parameter P1-02 also with a range of 0 – 10,000. The output of the divide block **(D)** is the scaled speed or frequency reference required by the inverter. The scaled reference is input to a ratio block, which adds or subtracts a percentage of the scaled reference to the base reference. This is set in parameter P1-03 having a range of + 99.99% to – 99.99%. This combined signal **(E)** is limited not to be less than zero and is the input speed reference at **(F)** to the inverter.



EQUATIONS

POINT	VALUE
(A)	+/- 1 Pulse/sec. input = 0.001 Hz frequency reference
(B)	Absolute value of (A)
(C)	(B) x P1-01
(D)	(C) / P1-01
(E)	(D) + [((D) x P1-03) / 100]
(F)	If (E) ≥ 0 , then (E) else zero

PARAMETERS

NUMBER	NAME	RANGE	DEFAULT
P1 - 01	Gear tooth 1	0 - 10,000	1
P1 - 02	Gear tooth 2	0 - 10,000	1
P1 - 03	Ratio setting	- 99.99 to + 99.99 %	0.00

Programming

When programming the VG5 & VG5+ inverter with Pulse Input software (No. 10011 / 11102), all of the standard parameters are supported in the VG5 & VG5+ programming manual. Additional parameters to support the Pulse Input software are described as follows.

(1) B1-01 selects the speed reference of the slave inverter. A value of (5) selects the pulse input from the master encoder as the speed reference.
(2) H1-01 - H1-06 multi-function input terminals.
A value of 80 (pulse B with N.O. contact), or 81 (pulse B with N.C. contact) will allow toggling of the pulse monitor output signal between the default slave encoder signal, or the master encoder signal. A value of 82 slave / local, reference is from terminal 13 when closed.
(3) P1-01 Gear tooth 1, range 0 – 10,000 (multiplier)
(4) P1-02 Gear tooth 2, range 0 - 10,000 (divisor)
(5) P1-03 Ratio setting, range – 99.99% to +99.99% (the final bias value added to the frequency reference input signal)

Formulae

Master reference (Mref)

$$Mref = \frac{\text{master encoder PPR x max. motor RPM}}{60} \div 1000$$

Slave reference (Sref)

Sref = Maximum desired frequency of slave inverter. NOTE: Parameter E1-04 Max. Frequency must be equal to or greater than the intended Sref

Gear tooth 1 (P1-01)

Numerator - This value will be derived from the formula below*

Gear tooth 2 (P1-02)

Denominator - 2 x master encoder PPR

$$* P1\text{-}01 = \frac{Sref \times P1\text{-}02}{Mref}$$

Example: The master motor is a 4 pole design (1800 rpm), and the encoder is 512 PPR. The slave motor has a base frequency of 60 Hz, but the application calls for a ratio of 3.2:1. The Sref and Mref must first be determined before the pulse input parameters are calculated

$$Sref = 60\ Hz \div 3.2 = 18.75\ Hz$$

$$Mref = \frac{512\ PPR \times 1800\ RPM}{60} \div 1000 = 15.360\ Hz$$

NOTE: P1-03 IS SET TO THE DEFAULT VALUE OF 0.00

Setting P1-02 = 2 x 512 = 1024 PPR

$$P1\text{-}01 = \frac{18.75\ Hz \times 1024\ PPR}{15.360\ Hz} = 1250$$

Digital Operator Function Display	Digital Operator Display	Parameter No.	Parameter Name	Setting Range	Factory Setting	Change during Operation (O=Enable, X=Disable)	Data Selection	Control Method (O=Enable, X=Disable)			
								V/f Control	V/f with PG feedback	OLV**	FV***
PG Channel 1 Option Setup	PG Pulse/Rev	F1-01	PG Constant	0 to 60000	600	X	-	X	O	X	O
	PG Feedback Loss Sel	F1-02	Operation selection at PG open circuit	0 to 3	1	X	0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	X	O	X	O
	PG Overspeed Sel	F1-03	Operation selection at overspeed	0 to 3	1	X	0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	X	O	X	O
	PG Deviation Sel	F1-04	Operation selection at deviation	0 to 3	1	X	0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	X	O	X	O
	PG Rotation Sel	F1-05	PG rotation	0/1	0	X	0: Fwd=C.C.W. 1: Fwd=C.W.	X	O	X	O
	PG Output Ratio	F1-06	PG division ratio	1 to 132	1	X	-	X	O	X	O
	PG Ramp PI/I Sel	F1-07	Integral value during accel/decel enable/disable	0/1	0	X	0: Disabled 1: Enabled	X	O	X	X
	PG Overspeed Level	F1-08	PG overspeed detection level	0 to 120%	115%	X	-	X	O	X	O
	PG Overspeed Time	F1-09	PG overspeec detection delay time	0 to 2.0s	1.0s	X	-	X	O	X	O
	PG Deviate Level	F1-10	Excessive speed deviation detection level	0 to 50%	10%	X	-	X	O	X	O
	PG Deviate Time	F1-11	Excessive speed deviation detection delay time	0 to 2.0s	1.0s	X	-	X	O	X	O
	PG# Gear Teeth 1	F1-12	Number of PG gear teeth 1	0 to 1000	0	X	-	X	O	X	X
	PG# Gear Teeth 2	F1-13	Number of PG gear teeth 2	0 to 1000	0	X	-	X	O	X	X
ASR Tuning*	ASR P Gain 1	C5-01	ASR proportional gain 1	0 to 300.00	0.00	O	-	X	O	X	O
	ASR I Time 1	C5-02	ASR intergral time 1	0 to 10.000 sec	0.00sec	O	-	X	O	X	O
	ASR P Gain 2	C5-03	ASR proportional gain 2	0 to 300.00	0.00	O	-	X	O	X	O
	ASR I Time 2	C5-04	ASR integral time 2	0 to 10.000sec	0.00sec	O	-	X	O	X	O
	ASR Limit	C5-05	ASR Limit	0.0 to 20.0%	0.0%	X	-	X	O	X	X
	ASR Delay Time	C5-06	ASR primary delay time	0.000 to 0.500s	0.000s	X	-	X	X	X	O
	ASR Gain SW Freq	C5-07	ASR switching frequency	0.0 to 400.0Hz	0.0Hz	X	-	X	X	X	O

*ASR: Automatic Speed Regulation
** Open Loop Flux Vector
*** Closed Loop Flux Vector

TABLE 1: PARAMETER LIST FOR PG CHANNEL 1

WARNING!

Saftronics manufactures component parts that can be used in a wide variety of industrial applications. The selection and application of *Saftronics* products remains the responsibility of the equipment designer or end user. *Saftronics* accepts no responsibility for how it's products may be incorporated into the final design.

Under no circumstances should any *Saftronics* product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to dynamically fault detect and fail safe under all circumstances. All products designed to incorporate a component part manufactured by *Saftronics*, must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation. Any warnings provided by *Saftronics* must be passed through to the end user.

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