YASKAWA

For GPD 503
Adjustable Frequency Drives

PG Speed Controller Card (PG-D)
(Part of Speed Feedback Kit, Model DS312)

Before installing this option, a TECHNICALLY QUALIFIED INDIVIDUAL, who is familiar with this type of equipment and the hazards involved, should READ this ENTIRE INSTRUCTION SHEET.

IMPORTANT

This option may have been installed by the factory. However, certain steps can only be completed at the installation site. Therefore, review and then perform those steps which complete the installation process.

IMPORTANT

The Speed Feedback Kit is only compatible with drives having suffix E or higher in the "SPEC" which follows the "MODEL NO" on the data nameplate. These drives have the following Control PCBs:

Control PCB Code No.	Used in (CT rating) drives:
ETC613190	230V, 5 HP and below
ETC613180	230V, 7.5 - 30 HP; 460V, 1 - 60 HP; 575V, 5 - 25 HP
ETC613200	230V, 40 - 100 HP; 460V, 75 - 400 HP; 575V, 30 - 200 HP

INTRODUCTION

When installed, this option allows the use of an encoder (i.e. pulse generator, or PG) to provide speed feedback for the GPD 503 to use in compensating for speed fluctuations. This allows up to 0.03% speed regulation. The PG-D card also provides pulse monitor output. The Speed Feedback Kit also includes replacement EPROMs for the GPD 503 drive.

CAUTION

This option contains electrostatic sensitive devices. Personnel must be properly grounded before removing and installing carton contents.

IMPORTANT

This option also requires the installation of a separately supplied motor shaft encoder with an external 12 Vdc power supply.

NOTE: There are three sections to this instruction sheet – INSTALLATION, for physical setup of the drive with the PG Speed Controller Card; OVERVIEW OF CONSTANT CHANGES, for the experienced GPD 503 operator; and SPECIFIC CHANGES FOR TECHNICAL MANUAL TM 4231.

CHANGE RECORD					

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ORIGINAL

IMPORTANT

If this option is being field installed in a drive which has already been in operation, be sure that ALL USER CONSTANT SETTINGS have been recorded, **BEFORE** proceeding with installation. The Speed Feedback EPROMs redefine some constants and add others. When the Reset Code is entered in installation step 8, all constants (**except** Sn-01 and Sn-02) will change to their new default (i.e. factory setting) values.

INSTALLATION

1. Disconnect all electrical power to drive.
2. Remove drive front cover. Check that CHARGE indicator lamp inside drive is off.
3. Use a voltmeter to verify power has been disconnected at incoming power terminals (L1, L2, L3).

WARNING

Hazardous voltage can cause severe injury or death. Lock all power sources feeding drive in "OFF" position.

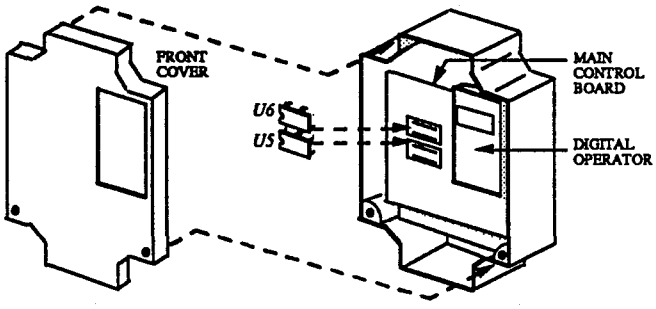

Figure 1. Installation of Speed Feedback EPROM Set in GPD 503

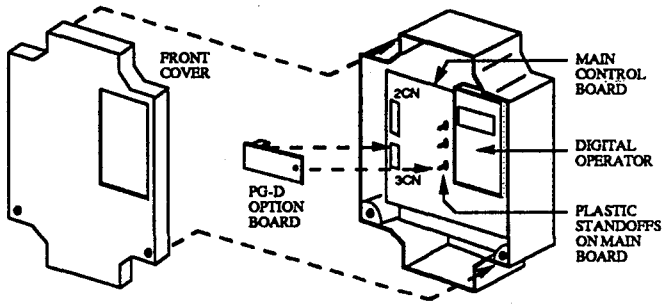

Figure 2. Installation of PG-D in GPD 503

4. See Figure 1. Remove the standard EPROM set and install the Speed Feedback EPROM set as shown. Be sure to locate U5 and U6 in their proper place **with notches facing left!** Failure to do this will ruin the EPROMs.

5. See Figure 2. Install the option on the Main Control Board, 1PCB, and ensure 3CN is properly connected. Make sure Electrostatic procedure is followed.

6. Connect the PG-D's ground (green) wire to terminal 12 of the GPD 503.

7. **Wiring.** See Figure 3. Wire encoder input and (if desired) pulse generator output at PG-D terminals. See Table 1 for terminal functions.

CAUTION

Keep PG-D (i.e. control circuit) wiring separate from main circuit input/output wiring.

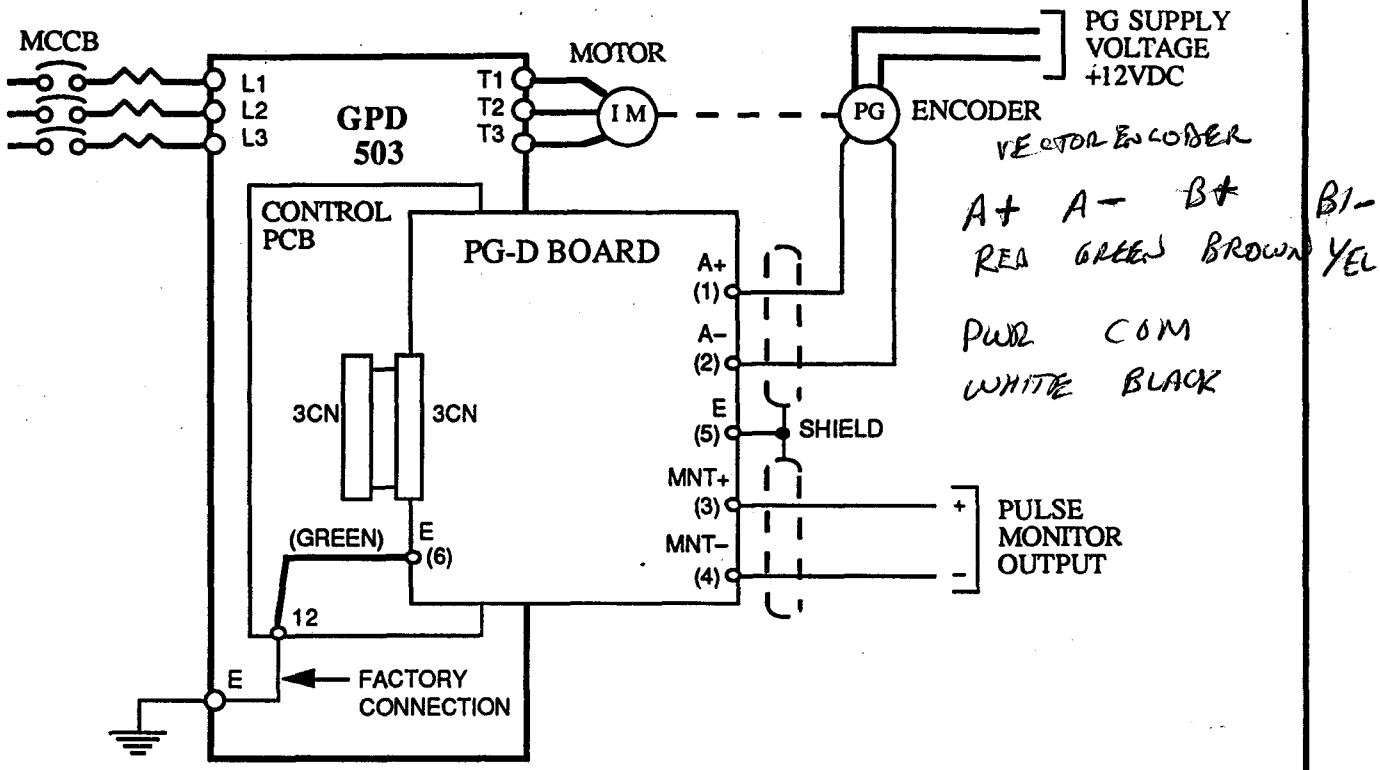

Figure 3. Interconnection for PG-D Circuit

CAUTION

To prevent erroneous operation caused by noise interference, use shielded cable for control signal wiring, and limit distance to 50m (165 feet) or less.

Route wires from the GPD 503 and connect to the peripheral device(s). Refer to "Electrical Installation" in the GPD 503 technical manual for further information on use of shielded cable.

Table 1. Terminal Functions of PG-D

Terminal	Function and Specifications	
A(+) (1) A (–) (2)	Inputs from PG (encoder)	(1) For differential input (2) Phases: A & $\overline{A}$ (3) PG frequency range: 50 to 32,767 Hz (4) Input/output standard is in compliance with RS-422-A $50 \frac{\text{pulses}}{\text{sec}} \leq \left[\text{Encoder rating}\left(\frac{\text{pulses}}{\text{rev.}}\right)\right]\left[\text{speed}\left(\frac{\text{rev.}}{\text{min}}\right)\right]\left[\frac{1}{60}\right] \leq 32{,}767 \frac{\text{pulses}}{\text{sec}}$
MNT + (3) MNT – (4)	Pulse monitor output	• Normal mode: 3 volts max. • Differential mode: ≥ 2 volts • Output current: ± 60 mA max.
E (5) & (6)	Ground	

8. Reinstall and secure drive cover. Apply power to the drive. A " ***CPFO4*** " fault code will appear on the Digital Operator display. A constant initialization (i.e. reset) must be performed, by entering ***1110*** (for 2-Wire control) or ***1111*** (for 3-Wire control) at Sn-03. (See para. 2.25 in the GPD 503 technical manual if not familiar with this procedure.) 2-Wire control is for maintained contact run/stop control; 3-Wire control is for momentary contact run/stop control.

9. **Adjustments**. There are no adjustments to be made on the PG-D option. However, because of the change of constants introduced by the Speed Feedback EPROMs, the remaining sections of this instruction sheet must be examined to determine the effect on information presented in the GPD 503 technical manual; then all previous user setting values for unchanged constants must be re-entered, and new or redefined constants must be programmed as required to achieve the required drive operation.

10. After constant programming is completed, place this instruction sheet with the GPD 503 technical manual.

THIS COMPLETES INSTALLATION OF THIS OPTION.

OVERVIEW OF CONSTANT CHANGES

The following is a listing of the constants that are added or changed once the PG-D Card is is installed. This is intended as a general reference for the GPD 503 operator who is already familiar with the constants and Program mode operation of the standard GPD 503 drive.

CONSTANT NUMBER	DATA NAME	INCREMENT	SETTING RANGE	FACTORY SETTING
An-05 An-06 An-07 An-08	Not Used			
bn-08	Not Used			
bn-11	Multi-function Analog Output Signal Select	1	1 - 12	2
bn-12	Multi-function Analog Output Gain	0.01	0.01 - 2.55	1.00
Cn-34 Cn-35 Cn-38 Cn-39 Cn-41	Not Used			
Cn-43	PG Constant	0.01 P/R	0.20 - 3000.00	0.00
Cn-44	Number of Motor Poles	2	2 - 32	4
Cn-45	ASR Proportional Gain 1	0.01	0.01 - 2.55	0.00
Cn-46	ASR Integral Time 1	0.1 sec	0.1 - 10.0	1.0
Cn-47	ASR Proportional Gain 2	0.01	0.00 - 2.55	0.02
Cn-48	ASR Integral Time 2	0.1 sec	0.1 - 10.0	1.0
Cn-49	ASR Positive Limit	0.1 %	0.1 - 10.0	5.0
Cn-50	ASR Negative Limit	0.1 %	0.1 - 10.0	0.0
Cn-51	Excessive Speed Detection Level	1 %	1 - 50	10
Cn-52	Excessive Speed Detection Level	1 %	1 - 120	110

(Continued)

CONSTANT NUMBER	DATA NAME	DIGIT	FUNCTION	FACTORY SETTING
Sn-08	Operation Reference Select	XXX<u>X</u>	0 Operated from installed option	0100
			1 Operated from Digital Operator and/or external terminals	
		<u>XXX</u>X	Not Used	
Sn-09	Not Used			
Sn-15 thru Sn-18	Terminal [5 thru 8] Function	Redefined settings: 05 Not Used 0d Speed Control: Open Speed Control provided (closed loop) Closed Speed Control not provided (open loop) 0E Integral Value in Speed Control: Open PI Control (Integral value in Speed Control is added) Closed P Control (Integral value in Speed Control is reset at time constant of accel/decel time to be selected)		
Sn-27	PG Speed Control Card Function Selection 1	XXX<u>X</u>	0 Speed control provided	0100
			1 Speed control not provided	
		XX<u>X</u>X	0 Integral Control during accel/decel provided	
			1 Integral Control during accel/decel not provided	
		<u>XX</u>XX	Condition when PG signal is lost: 00 Ramp to stop per bn-02 01 Coast to stop 10 Ramp to stop per bn-04 11 Operation to continue	

CONSTANT NUMBER	DATA NAME	DIGIT	FUNCTION	FACTORY SETTING
Sn-28	PG Speed Control Card Function Selection 2	XXXX	Condition when overspeed detection occurs: 00 Ramp to stop per bn-02 01 Coast to stop 10 Ramp to stop per bn-04 11 Operation to continue	0101
		XXXX	Condition when excessive speed deviation occurs: 00 Ramp to stop per bn-02 01 Coast to stop 10 Ramp to stop per bn-04 11 Operation to continue	

CONSTANT NUMBER	MONITOR ITEM	EXAMPLE / DESCRIPTION	
Un-10	PROM Number Lower 5 Digits : NSG6XXXXX	*16030*	
Un-11	Amount of Speed Feedback	*100.0*	Amount of Speed Feedback is displayed, in increments of 0.1%, as a ratio of max. frequency
Un-12	Amount of Speed Control Compensation	*10.0*	Amount of Speed Compensation is displayed, in increments of 0.1%, as a ratio of max. frequency

Refer to Sheet 1 for latest change.

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SPECIFIC CHANGES FOR TECHNICAL MANUAL TM 4231

This section provides page-by-page details of how the Speed Feedback EPROM set, after installation and initialization, affects the information in Section 2, Section 6, and Appendix 1 of the GPD 503 technical manual, TM 4231. Changes may be recorded by pen and ink, with reference to this instruction sheet, or by copying sections of these pages and pasting in place.

• • • • Page 2-2 :

Addition to end of Table 2-1:

SPEED FEEDBACK (PG-D)		
PG (Encoder) Constants	2.37 *	Sn-27, Sn-28
PG-D Control Constants	2.38 *	Cn-43 thru Cn-52

* See Option Instruction Sheet 02Y00025-0355.

• • • • Page 2-21, **MONITOR DISPLAY (DIGITAL OPERATOR)** :

10	Control Section PROM (last 5 digits of PROM Part No. : NSG 6XXXXX	***16030***
11	Amount of speed feedback	***10.00*** ***
12	Amount of speed control compensation	***100*** ****

*** Displayed, in increments of 0.1%, as a percentage of maximum frequency.

**** Displayed, in increments of 0.1%, as a percentage of maximum frequency.

• • • • Page 2-25, **MULTI-FUNCTION INPUT TERMINALS** :

Setting ***05*** is Not Used . Setting ***0F*** is still Not Used ; for settings ***0d*** and ***0E*** , add reference to this instruction sheet.

• • • • Page 2-26, **MULTI-FUNCTION INPUT TERMINALS** Continued :

Settings ***61*** and ***62*** are Not Used.

• • • • Page 2-29, **MULTI-FUNCTION ANALOG MONITOR OUTPUT** :

(Note: In the Speed Feedback software, Sn-05 and Sn-09 are not associated with this feature.)

bn-11: Multi-function Analog Output Signal Selection

Factory Setting : 2
Range : 1-6; 11; 12

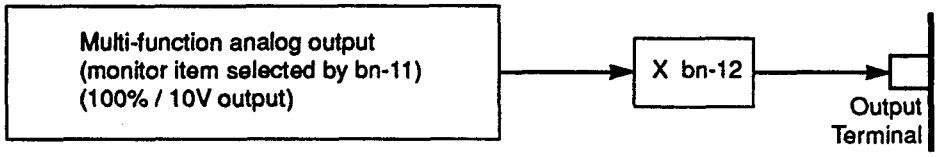
This constant is used to select the operation parameter to be applied to terminals 20 & 21 for external monitoring. The available parameters are those displayed by monitor constants Un-01 to Un-06, Un-11, and Un-12.

Meter connection diagram on page 29 remains unchanged.

bn-12: Multi-function Analog Output Gain

Factory Setting : 1.00
Range : 0.01 to 2.55

This constant is used to set the gain of the analog output signal applied to terminals 20 & 21. The factory setting of 1.00 provides a 0-10V output signal. If a 3V output is desired at the analog output circuit's 100% level, program a value of ***0.30*** into this constant.



• • • • Page 2-35, **REMOTE/LOCAL AND REFERENCE SELECTION** :

(Note: In the Speed Feedback software, An-05 thru An-08 are deleted from this feature.)

The GPD 503 allows selection of one of eight references. Two are analog inputs, five are stored in memory, and one can be from an option card, either analog or digital. In most configurations either the local reference (An-01) or the remote AUTO reference will be utilized.

• • • • Page 2-36 :

Depending on the control wiring configuration and the multi-step mode chosen, the motor can be operated at up to five different levels.

(Note; In the diagram, the An-05 thru An-08 speed steps are not applicable.)

• • • • Pages 2-36.1, 2-36.2, 2-37, & 2-38 :

(In the 2-WIRE CONTROL charts, An-05 thru An-08 selections are not applicable.)

• • • • Following Page 2-53 (that is, beginning on the blank back-up page that would be numbered as page 2-54), the following new PROGRAMMABLE FEATURES descriptions are added:

2.37 PG (ENCODER) CONSTANTS

Sn-27: PG-D Function Selection 1

The four digits in the setting of this constant determine how the drive will operate when in Speed Feedback mode.

XXX**X** Speed control selection

0 : Speed control enabled (closed loop)
1 : Speed control disabled (open loop)

XX**X**X Integral control selection

0 : Integral control during accel/decel
1 : No integral control during accel/decel

X X XX Drive response to loss of speed feedback signal:

SETTING	STOPPING METHOD	FAULT OUTPUT
00	Ramp to stop, at bn-02 rate	Digital Operator displays ***PGo*** ; fault contact is output.
01	Coast to stop	
10	Ramp to stop, at bn-04 rate	
11	Operation continues	***PGo*** blinks on Digital Operator; no fault contact output.

Sn-28: PG-D Function Selection 2

The four digits in the setting of this constant determine how the drive will react to certain fault conditions when in Speed Feedback mode.

XX**X X** Drive response to overspeed detection:

SETTING	STOPPING METHOD	FAULT OUTPUT
00	Ramp to stop, at bn-02 rate	Digital Operator displays ***oS*** ; fault contact is output.
01	Coast to stop	
10	Ramp to stop, at bn-04 rate	
11	Operation continues	***oS*** blinks on Digital Operator; no fault contact output.

X X XX Drive response to excessive speed deviation detection:

SETTING	STOPPING METHOD	FAULT OUTPUT
00	Ramp to stop, at bn-02 rate	Digital Operator displays ***dEu*** ; fault contact is output.
01	Coast to stop	
10	Ramp to stop, at bn-04 rate	
11	Operation continues	***dEu*** blinks on Digital Operator; no fault contact output.

2.38 PG-D CONTROL CONSTANTS

Cn-43: PG Constant

The setting of this constant is the number of output pulses per revolution of the pulse generator (PG). Range : 0.20 to 3000; increment: 0.1.

When the PG is connected to the motor shaft via a mechanism such as a gear, speed ratio may occur. In this case, multiply the ratio by the PG output to determine the Cn-43 setting.

EXAMPLE:

PG output : 900 P/R
Gear ratio : 1/8

900 x 1/8 = 112.5; set this value in Cn-43.

IMPORTANT: When Cn-43 is set to ***0***, speed detection and speed control are disabled.

Cn-44: Number of Motor Poles

The setting of this constant is the number of motor poles. Range : 2 to 32; increment : 2.

IMPORTANT: If the set values of Cn-43 and Cn-44 do not satisfy the following condition, a setting error occurs and ***oPE04*** is displayed on the Digital Operator.

$$\frac{2 \times \text{Cn-43} \times \text{Cn-02}}{\text{Cn-44}} > 32767$$

Set values are checked when the drive is powered up, or when changing from Program mode to Drive mode.

Cn-45: ASR Proportional Gain 1

Setting of ASR gain at 0% output frequency. Range : 0.0 to 2.55; increment : 0.01.

Cn-46: ASR Integral Time 1

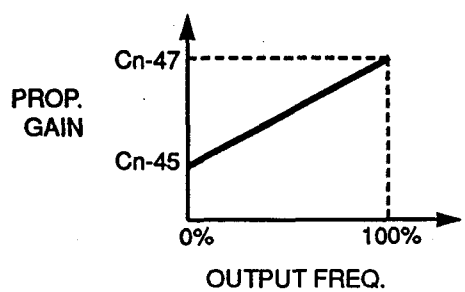
Setting of ASR integral time at 0% output frequency. Range : 0.1 to 10 sec; increment : 0.1.

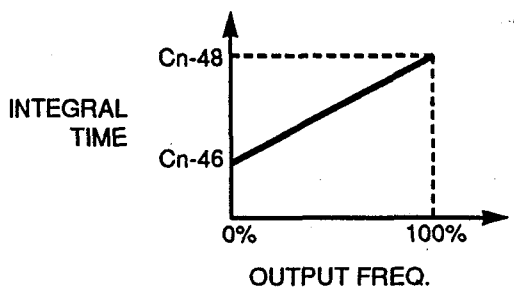
Cn-47: ASR Proportional Gain 2

Setting of ASR proportional gain at 100% output frequency. Range : 0.0 to 2.55; increment : 0.01.

Cn-48: ASR Integral Time 2

Setting of ASR integral time at 100% output frequency. Range : 0.1 to 10 sec; increment : 0.1.



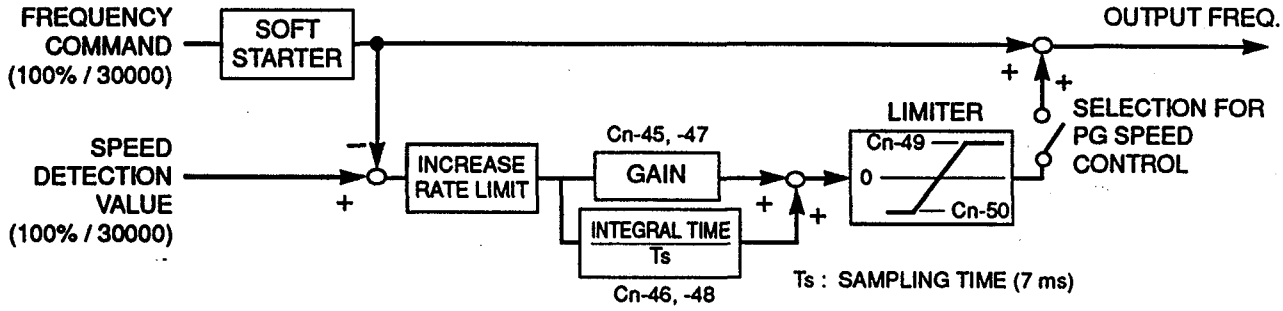


Cn-49: ASR Positive Limit

Maximum positive output of ASR circuit, as a percentage of maximum output frequency. Range : 0.1 to 10.0 %; increment : 0.1.

Cn-50: ASR Negative Limit

Maximum negative output of ASR circuit, as a percentage of maximum output frequency. Range : 0.1 to 10.0 %; increment : 0.1.



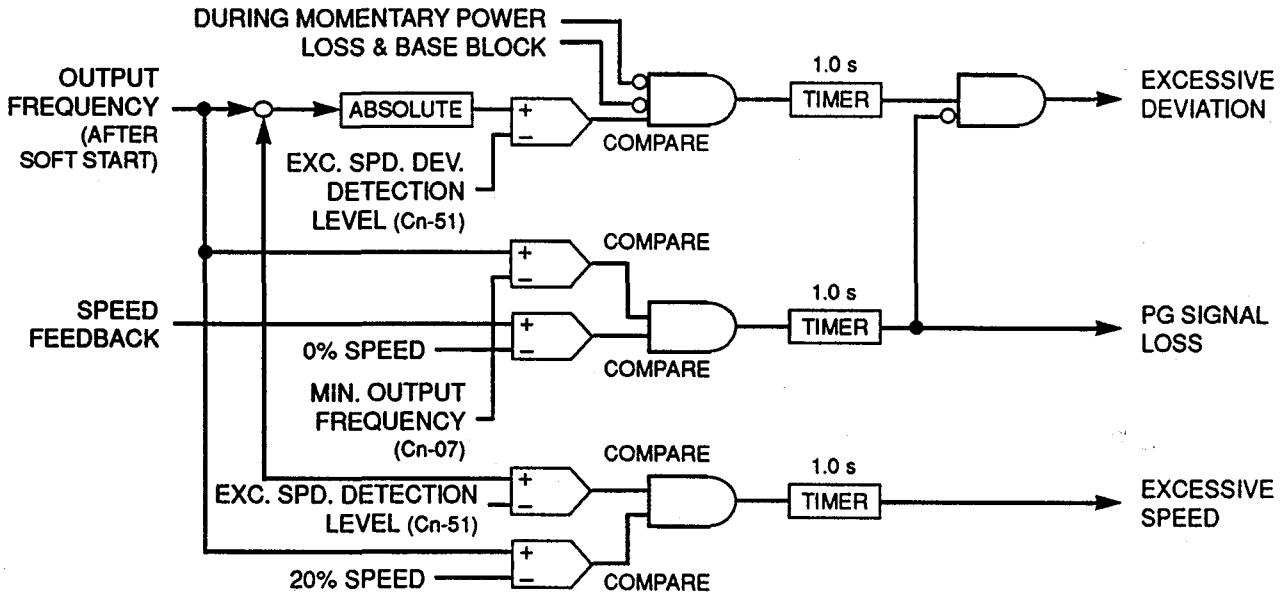
ASR Block Diagram With PG-D

Cn-51: Excessive Speed Deviation Detection Level

Set as a percentage of maximum frequency. Range : 1 to 50 %; increment : 1.

Cn-52: Excessive Speed Detection Level

Set as a percentage of maximum frequency. Range : 1 to 120 %; increment : 1.



Fault Detection Block Diagram With PG-D

• • • • Page 6-3 :

Additional Failure Indications:

dEU (blinking)	Excessive deviation	Excessive speed deviation has been detected, but drive is programmed to continue operation. No fault signal is output.
dEU	Excessive deviation	Excessive speed deviation was detected, and drive stopped by selected method (Sn-28 X X X X).
PGo (blinking)	PG signal loss	Loss of PG signal has been detected, but drive is programmed to continue operation. No fault signal is output.
PGo	PG signal loss	Loss of PG signal was detected, and drive stopped by selected by method (Sn-27 X X X X).
oS (blinking)	Overspeed	Excessive speed has been detected, but drive is programmed to continue operation. No fault signal is output.
oS	Overspeed	Excessive speed was detected, and drive stopped by selected method (Sn-27 X X X X).

• • • • Page A1-1 :

An-05, An-06, An-07, and An-08 are all " **Not Used** ".

• • • • Page A1-2 :

bn-08	Not Used				

bn-11	Multi-function Analog Output Signal Select	1	1 - 6; 11; 12	2	2.20 *
bn-12	Multi-function Analog Output	0.01	0.01 - 2.55	1.00	2.20 *

* As modified by Speed Feedback software; refer to Option Instruction Sheet 02Y00025-0355.

• • • • Pages A1-4 & A-15 :

Sn-08, digits X X X X are " **Not Used** ", and Sn-09 is " **Not Used** ".

Refer to Sheet 1 for latest change.

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Sn-27	PG Speed Control Card PG-D Function Selection 1	X X X X	0	Speed control enabled (closed loop)	0100		2.37 *
			1	Speed control disabled (open loop)			
		X X X X	0	Integral control during accel/decel			
			1	No integral control during accel/decel			
		X X X X	Condition when loss of speed feedback signal is detected: 00 = Ramp to stop, at bn-02 rate (major failure) 01 = Coast to stop (major failure) 10 = Ramp to stop, at bn-04 rate (major failure) 11 = Continue operation (minor failure)				
Sn-28	PG Speed Control Card PG-D Function Selection 2	X X X X	Condition when overspeed detection occurs:	00 = Ramp to stop, at bn-02 rate (major failure) 01 = Coast to stop (major failure) 10 = Ramp to stop, at bn-04 rate (major failure) 11 = Continue operation (minor failure)	0101		2.37 *
		X X X X	Condition when excessive speed deviation occurs:				

* See Option Instruction Sheet 02Y00025-0355.

• • • • Page A1-12 :

Cn-34 and Cn-35 are " **Not Used** ".

• • • • Page A1-13 :

Cn-38, Cn-39, and Cn-41 are " **Not Used** ".

Additions:

Cn-43	PG Constant	0.1 P/R	0.20 - 3000	0		2.38 *
Cn-44	Number of Motor Poles	2	2 - 32	4		2.38 *
Cn-45	ASR Proportional Gain 1	0.01	0.00 - 2.55	0.00		2.38 *
Cn-46	ASR Integral Time 1	0.1 s	0.1 - 10.0	1.0		2.38 *
Cn-47	ASR Proportional Gain 2	0.01	0.00 - 2.55	0.02		2.38 *
Cn-48	ASR Integral Time 2	0.1 s	0.1 - 10.00	1.0		2.38 *
Cn-49	ASR Positive Limit	0.1 %	0.1 - 10.0	5.0		2.38 *
Cn-50	ASR Negative Limit	0.1 %	0.1 - 10.0	0.0		2.38 *
Cn-51	Excessive Speed Deviation Detection Level	1 %	1 - 50	10		2.38 *
Cn-52	Excessive Speed Detection Level	1 %	1 - 120	110		2.38 *

* See Option Instruction Sheet 02Y00025-0355.

• • • • Page A1-14 :

Un-10 display will be " ***I6030*** ".

Additions:

Un-11	Amount of speed feedback	***I00.0***	2.17
Un-12	Amount of speed control compensation	***I0.0***	2.17

Refer to Sheet 1 for latest change.

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ORIGINAL