Braking Overview and Component Specifications

Chapter 1

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Manual Overview

Overview of this Publication

The *DURAPULSE* Dynamic Braking User Manual describes the installation, wiring, configuration, and operation of the dynamic braking unit and braking resistors as used with GS4 and GS30 series *DURAPULSE* AC Drives.

The content of this user manual may be revised without prior notice. Please visit the Automationdirect.com website to download the most recent version. (www.automationdirect.com)

Who Should Read This Manual

This manual contains important information for those who will install, maintain, and/or operate any *DURAPULSE* GS4 or GS30 series AC Drive that makes use of the dynamic braking in their application.

Supplemental Publications

The *DURAPULSE* AC Drive User Manuals for GS4 & GS30 are available from AutomationDirect and should be used along with this manual to properly install and operate both the *DURAPULSE* AC drive and the *DURAPULSE* dynamic braking unit.

The National Electrical Manufacturers Association (NEMA) publishes many different documents that discuss standards for industrial control equipment. Global Engineering Documents handles the sale of NEMA documents. For more information, you can contact Global Engineering Documents at:

15 Inverness Way East
Englewood, CO 80112-5776
1-800-854-7179 (within the U.S.)
303-397-7956 (international)
www.global.ihs.com

NEMA documents that might assist with your AC drive systems are:

- Application Guide for AC Adjustable Speed Drive Systems
- Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems

Technical Support

By Telephone: 770-844-4200 (Mon.-Fri., 9:00 a.m.-6:00 p.m. E.T.)

On the Web: www.automationdirect.com

Our technical support group is glad to work with you in answering your questions. If you cannot find the solution to your particular application, or, if for any reason you need additional technical assistance, please call technical support at 770-844-4200. We are available weekdays from 9:00 a.m. to 6:00 p.m. Eastern Time.

We also encourage you to visit our website where you can find technical and non-technical information about our products and our company. Visit us at www.automationdirect.com.

Special Symbols

When you see the "notepad" icon in the left-hand margin, the paragraph to its immediate right will be a special note.

When you see the "exclamation mark" icon in the left-hand margin, the paragraph to its immediate right will be a warning. This information could prevent injury, loss of property, or even death (in extreme cases).

Introduction

Dynamic Braking

All *DURAPULSE* GS4 and GS30 series AC drives are capable of dynamic braking to enable an AC motor with a high-inertia load to decelerate more rapidly than could be otherwise achieved, and to absorb the energy generated when a three-phase induction motor decelerates.

Applications with high-inertia type loads tend to cause the motor to regenerate energy back into the AC drive. This regeneration causes the AC drive's internal DC bus voltage to rise, which can cause an over voltage fault. With dynamic braking, the energy generated by the overhauling motor is dissipated through dedicated braking resistors as heat.

Lower-capacity drives can connect directly to the optional external braking resistors, but higher-capacity drives also require optional dynamic braking units installed between the drives and resistors.

Dynamic Braking Units

DURAPULSE dynamic braking units are used with larger *DURAPULSE* GS4 and GS30 AC Drives to continuously monitor the drive's DC bus voltage. When bus voltage exceeds a predetermined level (depending on the supply voltage) the dynamic braking unit dissipates the excess energy into external resistors in the form of heat. *DURAPULSE* dynamic braking units must be used along with braking resistors to provide optimum braking performance.

DURAPULSE dynamic braking units are available for both 230V or 460V *DURAPULSE* AC Drives. MASTER/SLAVE configurations allow the use of multiple *DURAPULSE* dynamic braking units in order to accommodate the power ratings of larger *DURAPULSE* AC Drives and motors.

DURAPULSE dynamic braking units (GS-1DBU, GS-2DBU, GS-3DBU and GS-4DBU) are approved by Underwriters Laboratories, Inc. (UL) and Canadian Underwriters Laboratories (cUL).

Unpacking

After receiving the *DURAPULSE* dynamic braking unit, please check for the following:

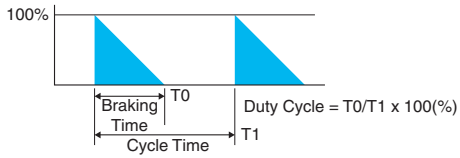
- Make sure that the part number indicated on the package corresponds with the part number of your order.
- Make sure that the package includes the *DURAPULSE* dynamic braking unit and the *DURAPULSE* dynamic braking unit User Manual.
- Inspect the contents to insure they were not damaged during shipment.

Braking Duty Cycle

Application of a *DURAPULSE* dynamic braking unit should take into account how often the motor will stop or decelerate during normal operation. The Duty Cycle is the percentage of time the brake is actually used during deceleration in comparison to the time elapsed between each start or acceleration of the motor. This Duty Cycle percentage is necessary to allow the dynamic braking unit and braking resistor(s) sufficient time to dissipate the heat created during dynamic braking. If the Duty Cycle is exceeded, the braking resistor will not cool sufficiently, causing resistance to increase as the temperature rises with the loss of effective braking torque.

Example: If in a given application it is determined that it will take 10 seconds for the motor to decelerate to a stop using dynamic braking, then the motor can only be cycled on and off continuously every 1.6 minutes (100 seconds).

- 10 / 100 x 100 = 10% Duty Cycle



The maximum braking On-Time for the maximum 10% Duty Cycle is 10 seconds.

Overload Relay

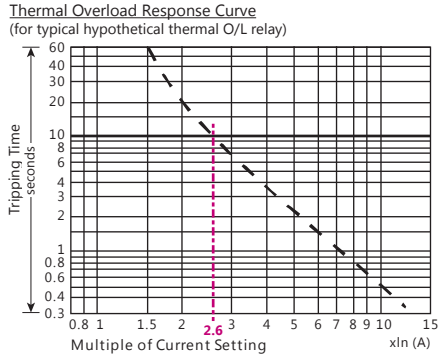
Overload Relay Purpose

For safety purposes, install an external thermal overload relay between the dynamic brake unit and the braking resistor(s). The thermal overload relay protects the braking resistor from damage due to frequent braking, or due to the braking unit operating excessively due to unusually high input voltage.

Overload Relay Selection Procedure and Example

(For a GS4-4150 drive)

1) Select a thermal overload relay based on its overload capability.



Standard braking capacity for GS4 and GS30 AC drives is 10% duty cycle (tripping time = 10s).

Determine the 10s Overload Capacity (Multiple of Current Setting) for your selected overload relay.

The intersection of the Trip Time (10s) and the Multiple of Current Setting is 2.6 (or 260%) for this example response curve.

The property of each thermal relay may vary by manufacturer, so please read the specifications carefully.

2) Use the appropriate AC Drive Braking Component Selection table from your drive's online technical pages at AutomationDirect.com to find the Max Total Brake Current for the motor, drive, and braking components. Value for this example is 126A.

GS4 AC Drive Braking Component Selection

Drive Voltage	Motor Power (hp)	Drive Model	Drive Brake Capacity - Max Torque		Braking Unit		125% Braking Torque @ 10% Duty Cycle**					
							Open Type Braking Resistor				NEMA1 Resistors with Thermal Switch		
			Min Resistor Value (Ω)	Max Total Brake Current (A)	Quantity	Part # GS-	Part #	Quantity	Brake Torque (kg-m)	Total Brake Current (A)	Part #	Qty.	Total Brake Current (A)
460V	50	GS4-4050	12.7*	60*	1	4DBU	GS-BR-1K2W015	4	25.1	50*	BR-N1-4K7W14P7	1	53.7
	60	GS4-4060	12.7*	60*	1	4DBU	GS-BR-1K5W013	4	30.5	59*	BR-N1-6K9W13P6	1	58.1
	75	GS4-4075	9.5*	80*	2	3DBU	GS-BR-1K0W5P1	8	37.2	76*	BR-N1-3K6W20	2 (1/DBU)	39.5*
	100	GS4-4100	6.3*	120*	2	4DBU	GS-BR-1K2W015	8	50.8	100*	BR-N1-4K7W14P7	2 (1/DBU)	53.7*
	125	GS4-4125	6.3*	120*	2	4DBU	GS-BR-1K5W013	8	60.9	117*	BR-N1-6K9W13P6	2 (1/DBU)	58.1*
	150	GS4-4150	6.0*	126*	1	5DBU	GS-BR-1K2W015	10	74.5	126*	BR-N1-13K0W06P4	1	123.4
	175	GS4-4175	4.0*	190*	1	6DBU	GS-BR-1K5W012	12	89.4	190*	BR-N1-18K0W03P7	1	213.5
	200	GS4-4200	4.0*	190*	1	6DBU		12	108.3			1	

* These values are per individual DBU, as seen between DBU terminals B1 and B2.
** 10% Duty Cycle with maximum ON (braking) time of 10 seconds.

3) Divide the Max Total Braking Current by the Overload Capacity (126A / 2.6 = 48.46A), and select a thermal O/L relay which has the same or higher rated current. In this case, select a 50A relay.

For wiring information, refer to "Overload Relay" in Chapter 3, page 3-2.

Dynamic Braking Unit Specifications

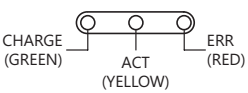
The following table provides the specifications and applications for the *DURAPULSE* dynamic braking units designed for use with GS4 and GS30 series AC drives.

Dynamic Braking Unit Specifications								
Braking Unit Part Number		GS-1DBU	GS-2DBU	GS-3DBU	GS-4DBU	GS-5DBU	GS-6DBU	GS-7DBU
Nominal Voltage (VAC)		230		460				
Max Motor Capacity (hp/[kW])		20 [15]	30 [22]	40 [30]	60 [45]	150 [110]	200 [160]	250 [185]
Output Rating	Max Discharge Current (A) @ 10% Duty Cycle*	40	60	40	60	126	190	225
	Continuous Discharge Current (A)	15	20	15	18	45	50	100
	Braking Startup Voltage (VDC)	330/345/360/ 380/400/415 ±3V		660/690/720/ 760/800/830 ±6V		618/642/667/690/ 725/750 ±6V		
	Maximum On-Time (s)	10						
Input DC Voltage (VDC)		200–415		400–830		400–750		
Min Equivalent Resistor for Each Braking Unit (Ω)		10	6.8	20	13.6	6	4	3.4
Protection	Power CHARGE Lamp/LED	Comes ON until DC bus voltage (+P – -N) drops below 50VDC				Comes ON when DC bus voltage (DC+ – DC-) rises above 300VDC. Goes OFF when DC bus voltage (DC+ – DC-) drops below 100VDC.		
	Braking ACT Lamp/LED	ON during braking						
	Fault ERR Lamp	ON if an over-temperature fault has occurred				n/a		
	Overcurrent Level LED (A)	n/a				190	290	340
	Overheat LED	n/a				Comes ON > 176°F [80°C]; Goes OFF < 149°F [65°C]		
	Heat Sink Overheat Temperture	203°F [95°C]				n/a		
	Alarm Output Relay Contact	5A @ 120VAC/28VDC (RA,RB,RC)				3A @ 250VAC/28VDC (RA,RC)		
Environment	Installation Location	indoor (no corrosive gases; no metallic dust)						
	Operating Temperature	14°F to 122 °F [-10 to +50 °C]						
	Storage Temperature	-4 to +140 °F [-20 to +60 °C]						
	Humidity	less than 90% RH, non-condensing						
	Vibration	9.8 m/s^2 [1G] under 20Hz ; 2m/s^2 [0.2G] at 20–50 Hz						
Mechanical Configuration		IP50 wall-mount enclosed				IP10 wall-mount enclosed		

** 10% Duty Cycle with maximum ON (braking) time of 10 seconds*

Lamp/LED Indicators for Dynamic Braking Units

GS-1DBU, GS-2DBU, GS-3DBU, GS-4DBU



GS-5DBU, GS-6DBU, GS-7DBU

LED Label	Meaning
ACT	Active
OC	Overcurrent
OH	Overheat

See "DBU Jumper and Wiring Terminal Locations" in Chapter 3 for locations of indicators.