

SDRIVE

DB Series

DYNAMIC BRAKING



dynamic braking unit

Getting Started Manual



DYNAMIC BRAKING

dynamic braking unit
Getting Started Manual

Edition: October 2007

VFDF01AI Rev. A

SAFETY SYMBOLS

Always follow safety instructions to prevent accidents and potential hazards from occurring.



This symbol means improper operation may result in serious personal injury or death.



Identifies shock hazards under certain conditions. Particular attention should be given because dangerous voltage may be present. Maintenance operation should be done by qualified personnel.

Edition October 2007

This publication could present technical imprecision or misprints. The information here included will be periodically modified and updated, and all those modifications will be incorporated in later editions.

To consult the most updated information of this product you might access through our website www.power-electronics.com where the latest version of this manual can be downloaded.

Revisions

Date	Revision	Description
31 / 10 / 2007	A	1 st Edition

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SAFETY INSTRUCTIONS

IMPORTANT!

- Safety instructions showed in this manual are useful to teach user how to use the product in a correct and safety way with the purpose of preventing possible personal injuries or property damages.
- Safety messages included here are classified as it follows:



WARNING

Do not remove the cover while the power is applied or the unit is in operation.

Otherwise, electric shock could occur.

Do not run the braking unit with the front cover removed.

Otherwise, you may get an electric shock due to the high voltage terminals or exposure of charged capacitors.

Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied.

Otherwise, you may access the charged circuits and get an electric shock.

Wiring and periodic inspections should be performed at least 10 minutes after disconnecting the input power of the equipment which is going to be connected with this braking unit and after checking the DC Link voltage is discharged with a meter (below 30VDC).

Otherwise, you may get an electric shock.

Operate the switches with dry hands.

Otherwise, you may get an electric shock.

Do not use cables with damaged insulation.

Otherwise, you may get an electric shock.

Do not subject the cables to the abrasions, excessive stress, heavy loads or pinching.

Otherwise, you may get an electric shock.



CAUTION

Install the braking unit on a non-flammable surface. Do not place flammable material nearby.

Otherwise, fire could occur.

Disconnect the input power if the drive or the braking unit gets damaged.

Otherwise, it could result in a secondary accident or fire.

Do not connect the braking resistor directly to the DC terminal (P/B1, N) of the braking unit.

Otherwise, fire could occur.

Do not touch the braking unit, drive and the resistor right after the power is turn off.

The resistor is still hot.

Do not apply power to a damaged drive or braking unit, or to a drive or braking unit with parts missing even if the installation is complete.

Otherwise, fire or accident could occur.

Do not allow lint, paper, wood chips, dust, metallic chips or other foreign matter into the braking unit.

Otherwise, fire or accident could occur.



WARNINGS

RECEPTION

- Material of Power Electronics is carefully tested and perfectly packed before leaving the factory.
 - In the even of transport damage, please ensure that you notify the transport agency and POWER ELECTRONICS: 902 40 20 70 (International +34 96 136 65 57) or your nearest agent, within 24hrs from receipt of the goods.
-

UNPACKING

- Make sure received merchandise corresponds with delivery note, models and serial numbers.
 - Each equipment is supplied with a technical manual.
-

SEGURIDAD

- Before operating the equipment, read this manual thoroughly to gain and understanding of the unit. If any doubt exists then please contact POWER ELECTRONICS, (902 40 20 70 / +34 96 136 65 57) or your nearest agent.
 - Wear safety glasses when operating the braking unit close to the drive with power applied and the front cover is removed.
 - Handle the braking unit with care according to its weight.
 - Do not place heavy objects on the braking unit.
 - Install the braking unit according to the instructions within this manual.
 - Ensure that the mounting orientation is correct.
 - Do not drop the braking unit or subject it to impact.
-

TRIAL RUN

- Follow the steps described in this manual.
 - Always apply voltage and current signals to each terminal that are within levels indicated within this manual. Otherwise, damage to the braking unit may result.
-

1. INTRODUCTION

1.1. Equipment Description

When operating with drives which do not include dynamic braking circuit as standard, and it is necessary to conduct the regenerated energy, it will connect an optional dynamic braking unit with the corresponding dynamic braking resistors.





1.2. Standard Ratings

The following table shows the dynamic braking unit that should be used for each drive. It will use a single braking unit or a combination of them, according to the drive capacity.

DYNAMIC BRAKING UNIT			APPLICABLE DRIVES			
GROUP	REFER.	DESCRIP.	SD450		SD700	
			FRAME	REF.	FRAME	REF.
1	DBSD4030	Dynamic braking unit for drives from 3,7 to 11kW (400V)	1	SD45008	1	SD700095xxxx
			2	SD45012		SD700125xxxx
				SD45016		SD700185xxxx
	3	SD45024		SD700245xxxx		
	DBSD4045	Dynamic braking units for drives from 15 to 18,5kW (400V)	3	SD45030	2	SD700325xxxx
			4	SD45039		SD700385xxxx
2	DBSD4075	Dynamic braking units for drives from 22 to 30kW (400V)	4	SD45045	2	SD700485xxxx
			5	SD45060	3	SD700605xxxx
	DBSD4145	Dynamic braking units for drives from 37 to 75kW (400V)	5	SD45075	3	SD700755xxxx
			6	SD45090		SD700905xxxx
			7	SD45110	SD701155xxxx	
				SD45150	SD701505xxxx	
			-	-	4	SD701705xxxx
			-	-	5	SD702105xxxx
			-	-		SD702505xxxx
			-	-		SD702755xxxx
			-	-	6	SD703305xxxx
			-	-		SD703705xxxx
	-	-		SD704605xxxx		

2. TECHNICAL CHARACTERISTICS

2.1. Technical Specifications

REFER. SPECIF.		GROUP 1		GROUP 2				
		DBSD4030	DBSD4045		DBSD4075		DBSD4145	
Max. DC Input Voltage		750Vdc	750Vdc		750Vdc		750Vdc	
Applicable Drive Capacity		11kW	15kW	18,5kW	22kW	30kW	37kW	75kW
Braking resistor	Power	2,5kW	3,5kW		5kW		10kW	
	Minimum resistor	30Ω	20Ω		12Ω		6Ω	
Average braking torque		150%	150%		150%		150%	
Enable Duty (ED)		10%	10%		5%		5%	
Output signal		Heat sink overheat			Fault output contact, Slave control signal			
Protection		Heat sink overheat			Heat sink overheat, overcurrent			
Environ. Condit.	Ambient Temp.	-10°C to +40°C			-10°C to +40°C			
	Humidity	<90% (non-condensing)			<90% (non-condensing)			
	Altitude	<1000m above sea level			<1000m above sea level			
	Cooling Method	Natural convection			Self-cooling			
	Location	Environment with no corrosive gas, combustible gas, oil mist or dust.			Environment with no corrosive gas, combustible gas, oil mist or dust.			

Notes:

- For drive capacities higher than 75kW up to 250kW, see section '4.5.4. Combination of DB Units – Group 2'.
- For drive capacities lower than 11kW and higher than 250kW, contact with Power Electronics.

2.2. Dimensions

In the following figures, you can observe external dimensions of the dynamic braking units of groups 1 and 2:

- a) Group 1 (DBSD4030 – DBSD4045).

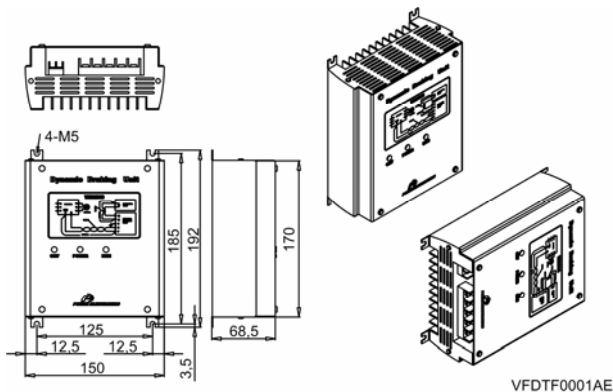


Figure 2.1 Dimensions of dynamic braking unit – Group 1
(DBSD4030 – DBSD4045)

b) Group 2 (DBSD4075 – DBSD4145).

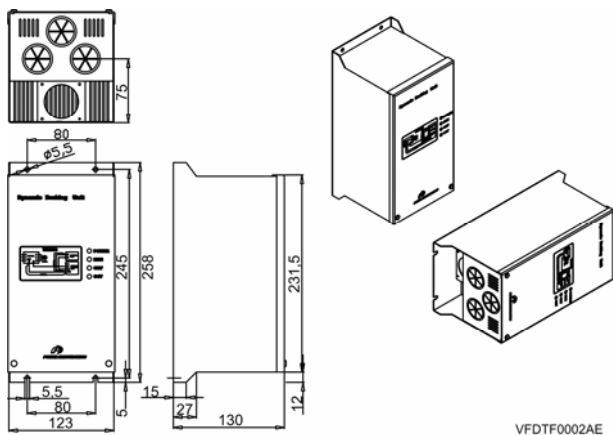


Figure 2.2 Dimensions of dynamic braking unit – Group 2
(DBSD4075 – DBSD4145)

3. MOUNTING OF DYNAMIC BRAKING UNIT

Braking units must be mounted vertically with sufficient horizontal and vertical distance between adjacent equipment.

- A = Higher than 100mm.
- B = Higher than 50mm.

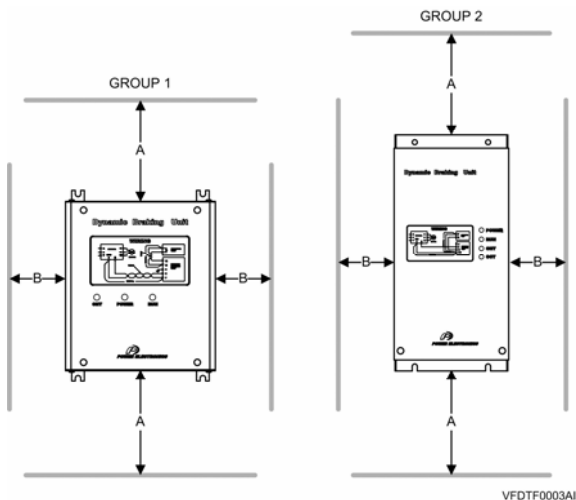


Figure 3.1 Dynamic braking unit mounting (Group 1 and Group 2)

3.1. Environmental Conditions

- Do not mount the braking unit in direct sunlight. Isolate the braking unit from excessive vibration.
- Protect the braking unit from moisture, dust, metallic particles, corrosive gasses and liquids. Install the braking unit on a non-flammable surface and as smooth as possible.
- In case of installing many braking units in a panel, consider the air flow for power dissipation.

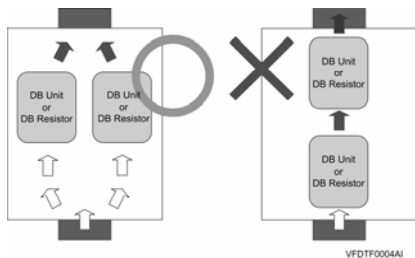


Figure 3.2 Multiple installation of braking units in a panel

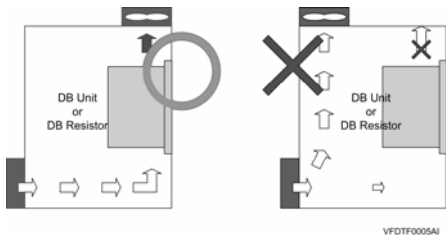


Figure 3.3 Fan location in a panel

4. INSTALLATION OF DYNAMIC BRAKING UNIT

4.1. Terminal Configuration

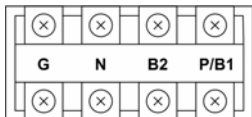
4.1.1. Dynamic Braking Unit – GROUP 1

Terminals for dynamic braking units of Group 1 are described in the following table:

TERMINAL	DESCRIPTION
CM	Common terminal for the over-temperature trip (OH).
OH	Output terminal for the over-temperature trip (Open collector: 20mA, 27Vdc).
G	Ground terminal.
B2	Connection for B2 terminal of the dynamic braking resistor.
B1	Connection for B1 terminal of the dynamic braking resistor.
N	Connection for negative terminal of DC Bus of the drive (DC Bus (-)).
P	Connection for positive terminal of DC Bus of the drive (DC Bus (+)).

4.1.2. Dynamic Braking Unit – GROUP 2

Power Terminals



VFDTF0006AE

Figure 4.1 Power terminals for dynamic braking unit – Group 2

TERMINAL	DESCRIPTION
G	Ground terminal.
N	Connection for negative terminal of DC Bus of the drive (DC Bus (-)).
B2	Connection for B2 terminal of the dynamic braking resistor.
P / B1	Connection for B1 terminal of the dynamic braking resistor. Connection for positive terminal of DC Bus of the drive (DC Bus (+)).

Control Terminals

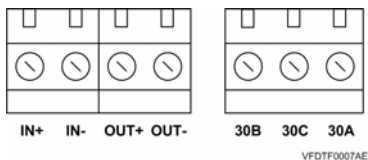


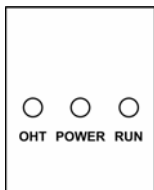
Figure 4.2 Control terminals for dynamic braking unit – Group 2

TERMINAL	DESCRIPTION
IN+ ^[1]	Input signal (+) to Slave. Only connected when DB Unit is configured as 'Slave'.
IN- ^[1]	Input signal (-) to Slave. Only connected when DB Unit is configured as 'Slave'.
OUT+ ^[1]	Output signal (+) to Slave. In this case, DB Unit can be configured as 'Master' or 'Slave'.
OUT- ^[1]	Output signal (-) to Slave. In this case, DB Unit can be configured as 'Master' or 'Slave'.
30A	Fault Output signal (Fault Relay). 30A: Normally open contact (NO).
30B	30B: Normally closed contact (NC).
30C	30C: Common terminal.

^[1] Control signals IN+/- and OUT+/- are only used when multiple DB Units are connected. See section '4.5.2. Master / Slave' Operation Mode'.

4.2. Leds Description

4.2.1. Dynamic Braking Unit – GROUP 1

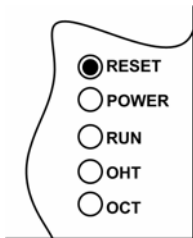


VFDTF0008AE

Figure 4.3 Leds for DB Unit - G1

LED	DESCRIPTION
OHT (Red)	When the heat sink is overheated and the level exceeds its set limit, overheat protection is activated and this led is turned on after the signal is shut off.
POWER (Red)	It is turned on when the braking unit receives power supply, because usually it is connected to the drive.
RUN (Green)	It is blinking while dynamic braking unit is operating correctly due to the energy regenerated by the motor.

4.2.2. Dynamic Braking Unit – GROUP 2



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Figure 4.4 Leds for DB Unit – G2

LED	DESCRIPTION
RESET	Press this switch to release OCT fault (overcurrent). Pressing this switch the OCT led is turned off.
POWER (Green)	It is turned on when the braking unit receives power supply because usually it is connected to the drive.
RUN (Green)	It is blinking while dynamic braking unit is operating correctly due to the energy regenerated by the motor.
OHT (Red)	When the heat sink is overheated and the level exceeds its set limit, overheat protection is activated and this led is turned on after the signal is shut off.
OCT (Red)	Overcurrent trip signal. When an over current occurs in the IGBT, this protection function turns off the operation signal and the OCT led is turned on.

4.3. Terminals of Braking Resistor

Note: It is recommended to use braking resistors equipped with thermal sensors. Connect it to one of the digital input terminals of the drive and configure it as 'external fault'.

Terminals for braking resistors are the following ones:

TERMINAL	DESCRIPTION
B1, B2	Terminals to connect to the dynamic braking unit. Connect the terminals of the braking resistor to the terminals B1 and B2 of the dynamic braking unit.
TH1, TH2 ^[1]	Thermal sensor of the resistor. Normal temperature (ambient): Normally closed (TH1 – TH2 closed). Over-temperature of the resistor: Normally open (TH1 – TH2 open). Connect this signal to one digital input terminal of the drive configured as 'External Fault'.

^[1] Terminals TH1 and TH2 will be only available whenever the used braking resistor is equipped with thermal sensor.

4.4. Connection Drawing

The following figure shows the connections between the drive, the dynamic braking unit and the braking resistor.

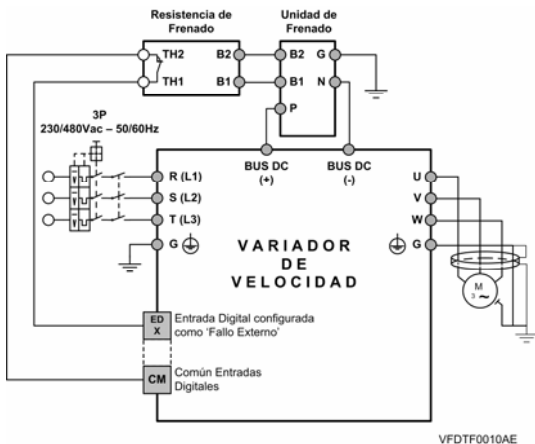


Figure 4.5 Connections between drive – DB Unit (G1) – braking resistor.

Connection of the braking resistor trip

Notes:

- Terminals B1 and P are the same one in the dynamic braking units of the Group 2. Therefore, this terminal will be connected to terminal B1 of the braking resistor and to the positive terminal of the DC Bus of the drive at the same time. See connections in figure 4.8.
- Maximum cable length between:
 - Drive → DB Unit: max. 10m.
 - DB Unit → DB Resistor: max. 10m.

4.5. Operation Modes for Dynamic Braking Unit – GROUP 2

4.5.1. 'Single' Operation Mode

This operation mode refers to the connection of only one dynamic braking unit to the drive.

In order to obtain information about the wiring between dynamic braking unit and drive, see figure 4.5.

Note: When only one dynamic braking unit is connected to the drive, this one should be configured as 'Master' (factory setting). To get additional information, see section "4.5.2. 'Master / Slave' Operation Mode".

4.5.2. 'Master / Slave' Operation Mode

When two or more dynamic braking units are connected to the drive in parallel.

In this case, one DB Unit should be configured as 'Master' and the others should be configured as 'Slave' by using the switch S1. In order to access to it, it is necessary to remove the front cover of the DB Unit. This switch is located in the centre of the electronic board (PCB) which is visible.

Configuration of DB Unit as 'Master'

- To configure the dynamic braking unit as 'Master', set the switch S1 as the following figure shows.

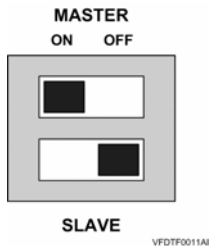


Figure 4.6 Switch S1. DB Unit configured as 'Master'

Configuration of DB Unit as 'Slave'

- To configure the dynamic braking unit as 'Slave', set the switch S1 as the following figure shows.

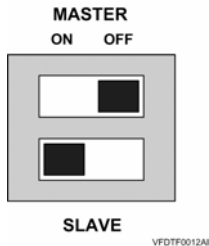


Figure 4.7 Switch S1. DB Unit configured as 'Slave'

Connections between multiple DB Units ('Master' and 'Slaves')

- To connect the dynamic braking unit configured as 'Master' with one of the dynamic braking units configured as 'Slave':
 - Connect terminal 'OUT+' of DB Unit 'Master' to terminal 'IN+' of DB Unit 'Slave'.
 - Connect terminal 'OUT-' of DB Unit 'Master' to terminal 'IN-' of DB Unit 'Slave'.

See figure 4.8.

- To connect two dynamic braking units configured as 'Slaves' between them:
 - Connect terminal 'OUT+' of the first DB Unit 'Slave' to terminal 'IN+' of the second DB Unit configured as 'Slave'.
 - Connect terminal 'OUT-' of the first DB Unit 'Slave' to terminal 'IN-' of the second DB Unit configured as 'Slave'.

See figure 4.8.

The following figure shows the correct wiring between the drive and several dynamic braking units connected in parallel with their corresponding braking resistors each one. One DB Unit will act as 'Master' and the others will act as 'Slaves'.

Note:

Maximum cable length:

- Drive → DB Unit: max. 10m.
- Between DB Units
 - Power supply (terminals P/B1 – N): max. 2m.
 - Control (terminals OUT+/- y IN+/-): max. 2m.
- DB Unit → DB Resistor: max. 10m.

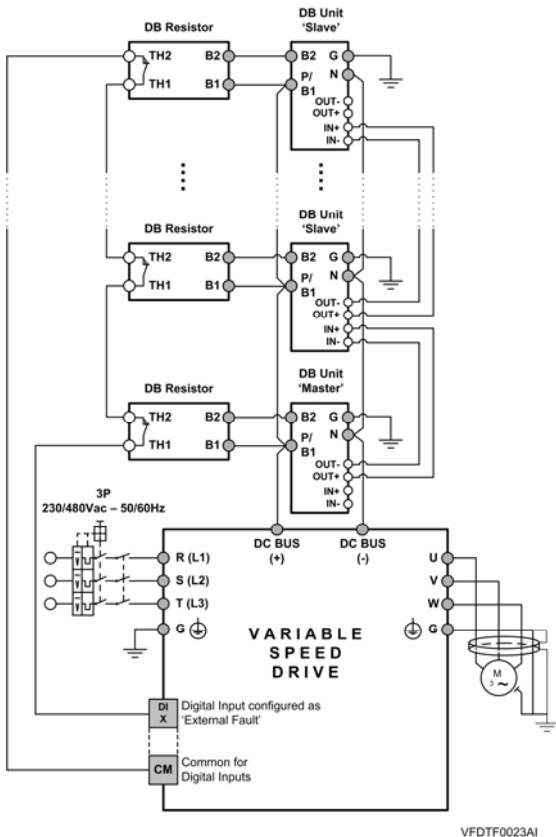


Figure 4.8 Connections between drive – DB Units (G2) – braking resistors, in 'Master / Slave' operation mode. Connection of the braking resistor trip

4.6. Combination of DB Units according to Drive Capacity

4.6.1. Combination of DB Units – GROUP 1

CAPACITY	11kW	15kW	18,5kW
DB Unit	DBSD4030	DBSD4045	
DB Resistor	30Ω, 2,5kW	20Ω, 3,5kW	

Note: For lower capacities, contact with Power Electronics.

Next, the wiring between drive, DB Units and DB Resistors is shown as a block diagram according to the drive capacity.

- **Drive capacity: 11kW**

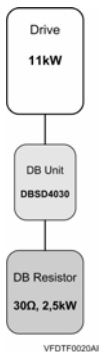


Figure 4.9 Combination of DB Unit – DB Resistor for drives with capacities of 11kW

- Drive capacity: 15kW – 18,5kW



Figure 4.10 Combination of DB Unit – DB Resistor
for drives with capacities of 15kW – 18,5kW

4.6.2. Combination of DB Units – GROUP 2

CAPACITY	22kW	30kW	37kW	45kW	55kW	75kW	90kW – 150kW	160kW – 200kW	250kW
DB Unit	DBSD4075	DBSD4145				DBSD4145 x 2 units	DBSD4145 x 3 units	DBSD4145 x 4 units	
DB Resistor	12Ω, 5kW	12Ω, 5kW x 2 units				6Ω, 10kW x 2 units	6Ω, 10kW x 3 units	6Ω, 10kW x 4 units	

Note: For higher capacities, contact with Power Electronics.

Next, the combinations above mentioned are shown as a block diagram according to the drive capacity.

- Drive capacity: 22kW – 30kW



Figure 4.11 Combination of DB Unit – DB Resistor
for drives with capacities of 22kW – 30kW

- Drive capacity: 37kW – 75kW

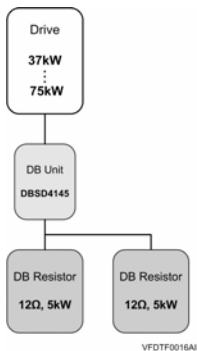


Figure 4.12 Combination of DB Unit – DB Resistors
for drives with capacities of 37kW – 75kW

- Drive capacity: **90kW – 150kW**

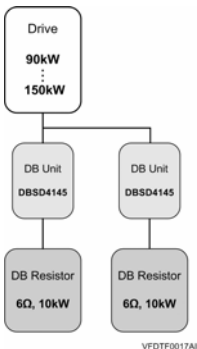


Figure 4.13 Combination of DB Units – DB Resistors
for drives with capacities of 90kW – 150kW

- Drive capacity: **160kW – 200kW**

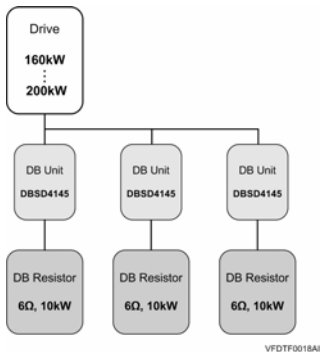
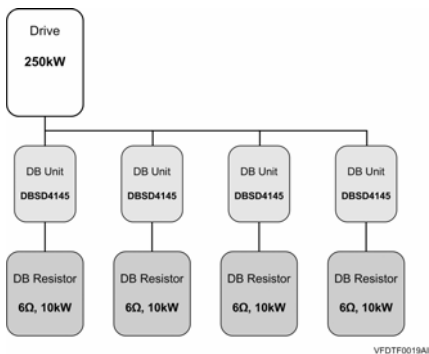


Figure 4.14 Combination of DB Units – DB Resistors
for drives with capacities of 160kW – 200kW

- Drive capacity: 250kW



*Figure 4.15 Combination of DB Units – DB Resistors
for drives with capacities of 250kW*

5. DYNAMIC BRAKING RESISTOR

5.1. Selection of the External Braking Resistor

DB UNIT	SD450 DRIVE	SD700 DRIVE	CAPACITY (kW)	DB RESISTOR (Braking Torque of 150%)			
				Resist. (Ω)	Soft Enable Duty (5%) Watts (W)	Medium Enable Duty (15%) Watts (W)	Heavy Enable Duty (35%) Watts (W)
DBSD4030 (Group 1)	SD45008	SD700095xxxx	3,7	100	150	555	1295
	SD45012	SD700125xxxx	5,5	70	300	825	1925
	SD45016	SD700185xxxx	7,5	50	400	1125	2625
	SD45024	SD700245xxxx	11	35	600	1650	3850
DBSD4045 (Group 1)	SD45030	SD700325xxxx	15	25	800	2250	5250
	SD45039	SD700385xxxx	18,5	20	1000	2775	6475
DBSD4075 (Group 2)	SD45045	SD700485xxxx	22	17	1100	3300	7700
	SD45060	SD700605xxxx	30	12	1500	4500	10500
DBSD4145 (Group 2)	SD45075	SD700755xxxx	37	10	2000	5550	12950
	SD45090	SD700905xxxx	45	8	2500	6750	15750
	SD45110	SD701155xxxx	55	7	3000	8250	19250
	SD45150	SD701505xxxx	75	6	4000	11250	26250
	-	SD701705xxxx	90	3 (2x6) in parallel	4500	13500	31500
	-	SD702105xxxx	110	3 (2x6) in parallel	5500	16500	38500
	-	SD702505xxxx	132	3 (2x6) in parallel	6600	19800	46200
	-	SD702755xxxx	150	3 (2x6) in parallel	7500	22500	52500
	-	SD703305xxxx	160	2 (3x6) in parallel	8000	24000	56000
	-	SD703705xxxx	200	2 (3x6) in parallel	10000	30000	70000
-	SD704605xxxx	250	1,5 (4x6) in parallel	12500	37500	87500	

Note: The values of this table are based on enable duty (ED) of 5%, 15% and 35%, with continuous braking of 15 seconds. For other applications, contact with Technical Department of Power Electronics.

Note: It is recommended to use braking resistors equipped with thermal sensors. Connect it to one of the digital input terminals of the drive and configure it as 'external fault'.



CAUTION

Do not touch the braking resistor during drive operation since it could be very hot (more than 150°C).



POWER ELECTRONICS

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