

PREFACE

Thanks for choosing DBKU series braking unit produced by Shenzhen SUNFAR Electric Technologies Co., Ltd.

This is the operating manual for DBKU series braking unit. It provides all relevant instructions and precautions for installation, wiring, functional parameters, daily care and maintenance, fault diagnosis and troubleshooting.

In order to use this series of braking unit correctly, guarantee product's best performance whilst ensuring the safety of users and equipment, be sure to read this manual carefully before using the product. Improper use may cause malfunction of the drive, reduce its service life and damage other equipment and lead to personal injury and death, etc

A user manual is provided with each product Please keep it in a convenient location so it can be referred to for installation and maintenance. Owing to the constant improvement of products, the data within future versions of this manual may be changed without further notice.



DBKU series braking unit User Manual

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◇ Precautions

DBKU series braking unit is suitable for general industrial inverter to realize braking function. Please contact supplier when DBKU is used for the equipment that may cause casualties due to failures, such as unclear control system, aviation system and safety equipment; if the product is used for hazardous equipment, device should have protection measures to avoid the extension of failure. The process of production has strict QA system. however, in order to ensure safety of yourself and the equipment, please read this paper carefully and meet requirements to transport, install, operate and debug.

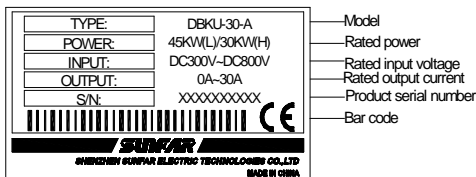
1. Precautions of unpacking inspection

Confirm the following question when unpacking

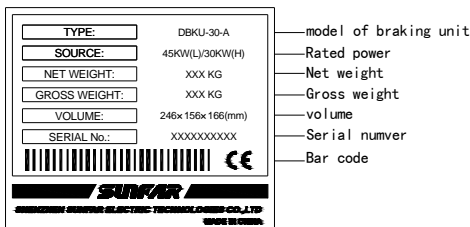
- (1) If there is any damage after the arrival of the goods.
- (2) Please confirm the model and specifications of label to see if they are in accordance with your order. If any damage or discrepancy is found, please contact the supplier promptly for solution.

◆ Nameplate of DBKU

On the left side of DBKU, there is a nameplate marked with model, rated parameters.



◆ Package Label



◆ Weight and Size

model	Net weight(KG)	Gross weight(KG)	size(mm)
DBKU-30-A	2.15	2.35	246×156×166
DBKU-50-A	2.15	2.35	246×156×166
DBKU-110-A	—	—	—
DBKU-160-A	—	—	—

2. Safety precautions

"Danger" and "Warning" in this operation manual are defined as follows:



"Danger": These requirements must be followed to avoid serious damage to the equipment or personnel injuries.



"Warning": These requirements must be followed to avoid the risk of injuries to personnel and the loss of materials.

2.1. Installation

- 1、The DBKU and brake resistor shall not be installed on combustibles, in case of the risk of fire.
- 2、The DBKU shall not be installed in the environment of explosive gases, in case of the danger of explosion.

- Foreign matter should not fall into DBKU, in case of the risk of fire and injury.
- During installation, the DBKU shall be installed at the place able to bear its weight; otherwise, it may fall down.



➤ Disassembling and assembling without permission are prohibited.

2.2. Wiring

- Please authorize the professional staff to conduct wiring and operate with proper wire diameter according to the law of electronic engineering
- For installation and wiring of the main loop, be sure to disconnect the inverter or power it off and wait for 5-10 minutes until the power indicator of the inverter or the DBKU goes off.
- The wiring of control loop is not allowed to conduct under the condition of charged.
- When connecting wires between the inverter and DBKU, reverse connection of DC+ and DC- will burn the DBKU and damage the inverter. Be sure to check carefully before powering on the inverter.
- The grounding terminal of DBKU must be reliably grounded; otherwise, there can be electric shock risk.



➤ It is forbidden to converse connection of DC+, DC- to P+,P-.

2.3. Maintenance



➤ The maintenance like wiring and inspection shall operate after the power off and wait for at least ten minutes

3. Precautions for Using

"Tips" and "Attention" in this operation manual is defined as follows:



➤ "Tip" : Tips for some useful information.



"Attention" : Matter requires attention during operation.

1. The environment for installation of DBKU and brake resistor should be well-ventilated.
2. Do not touch brake resistor to test temperature, otherwise may cause burning.
3. Under the condition of altitude more than 1000m, the output current capability drops by 10% for every rise of 1000m.
4. Please contact supplier when the using environment beyond the allowable condition of DBKU.



It is forbidden to touch brake resistor when DBKU works in case of the risk of electric shock.

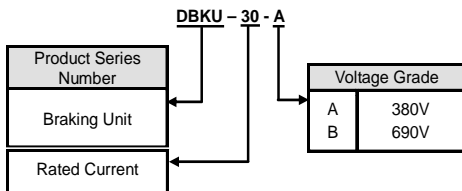
4. Safe Disposal

When dispose the DBKU and its accessories, please note that:

1. Electrolytic capacitor in the DBKU may explode if incinerated.
2. Harmful and toxic gas will be produced if the DBKU is incinerated.
3. Please classify and dispose of the DBKU as industrial waste.

1. Product Introduction

1.1. DBKU Braking Unit Model



1.2. DBKU Series Model

Model	Voltage (V)	Power (KW)	Rated Current (A)	Peak Current (A)	Min. Brake Resistance (R)
DBKU-30-A	380	L: 22-45	30	50	23
		H: 18.5-30			
DBKU-50-A	380	L: 55-90	50	100	13
		H: 37-55			
DBKU-110-A	380	L: 110-160	110	150	6
		H: 75-110			
DBKU-160-A	380	L: 185-280	160	200	4
		H: 132-160			

Notes: H: Heavy-load Type L: Light-load Type

1.3 DBKU Appearance

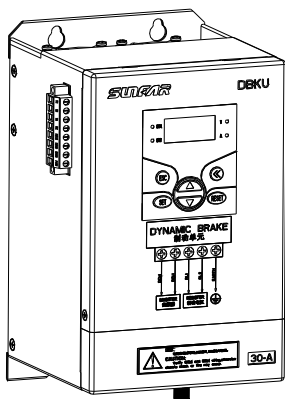


Fig1-1 DBKU appearance

Suitable mode:

DBKU-30-A/DBKU-50-A

1.4 Specifications

Voltage	380V
Frequency	45~60Hz
Braking mode	Voltage tracking mode, voltage hysteresis mode
Response time	2ms
Running voltage setting	620-730Vset by keypad
Hysteresis voltage	Set by keypad
Overvoltage protection	DC busbar voltage 850V
Over-current protection	250% of rated current
Overload protection	Time through peak current should be no more than 25S
Over-heat protection	85℃
Status indicator	Power indicator, braking status indicator, fault indicator
Installation place	Indoor
Ambient temperature	-10-40℃

2. Installation of DBKU

2.1. Environmental requirements

This series of DBKU are wall-mounted brake unit, which should be installed vertically, please install the DBKU in an appropriate enclosure with sufficient ventilation. When choosing the installation circumstance please note the following:



- Environment temperature: -10 °C – 40 °C
- Avoid high temperature and wet place, humidity is less than 90%, no frost.
- Avoid direct sunlight.
- Keep far from combustible, explosive material and caustic gas or liquid.
- No dust, floating fiber and metal particles.
- The installation plane should be solid and not vibrant.
- Be far from electro-magnetic interference source.

If users have any special installation requirements, please contact us firstly.

Requirements for installation spacing distance of a single DBKU are as shown in figure 2-1-A, enough space around the unit should be reserved; when several DBKUs adopt up and down installation method, air plate should be installed between two DBKUs to ensure good heat sinking condition as shown in figure 2-1-B;

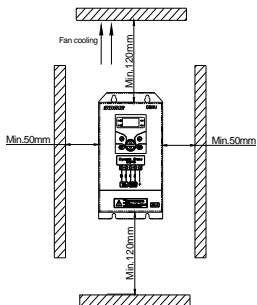


Figure 2-1-A Installation distance

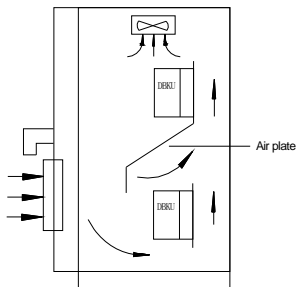


Figure 2-1-B Installation of DBKUs

2.2. Installation Dimension of DBKU

2.2.1 Dimension of DBKU

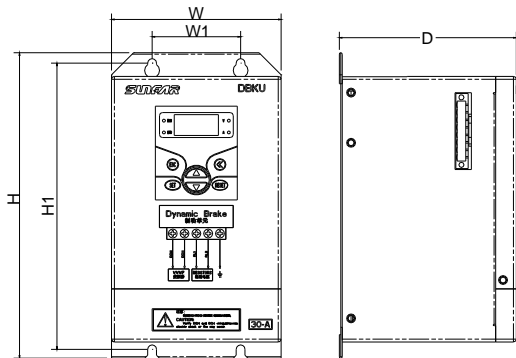


Fig. 2-2 Installation Dimension of DBKU

Adaptive models: DBKU-30-A/DBKU-50-A

Installation dimension of DBKU is shown as following table:

Model (3AC 380V)	W1	W	H1	H	D	Screw
DBKU-30-A	60	115	194	207	120	M4
DBKU-50-A						
DBKU-110-A	—	—	—	—	—	—
DBKU-160-A	—	—	—	—	—	—

3. Wiring of Inverter

3.1. Basic Wiring of DBKU

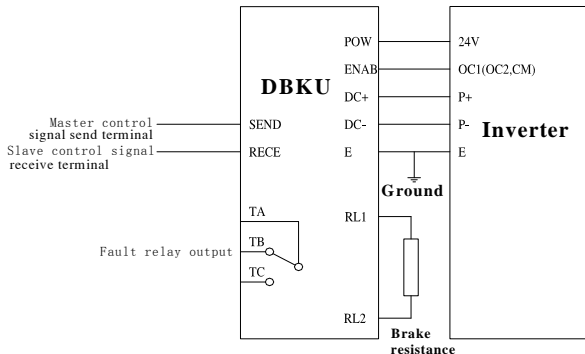


Fig.3-1 Basic Wiring of DBKU

3.2. Wiring of Main Circuit Terminal

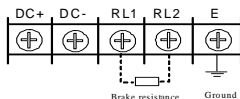


Fig. 3-2 Wiring of Main Circuit Terminal

Description of terminals:

Terminal	Function
DC+	Positive voltage terminal of DC connecting to inverter
DC-	Negative voltage terminal of DC connecting to inverter
RL1、RL2	Connecting two sides of brake resistance
E	Ground

3.3. Wiring of Control Circuit Terminal

(1) Control Circuit Terminal Diagram



Fig.3-3 Terminal of Control Circuit

(2) Description of control circuit terminal:

Terminal	Function	Notes
POW	Connecting 24V power source of inverter.	
ENAB	Connecting inverter deceleration valid terminal or 24V power source.	
SEND	When brake unit works as Master, this is control signal output terminal.	
RECE	When brake unit works as Slave, this is control signal input terminal.	
TA、TB、TC	TA,TB,TC are error output relay, generally TA-TB on, TA-TC off; while in fault TA-TB off, TA-TC on.	Contact capacity: 250V 1A resistive load

Notes:

(1) Brake enable(forbidden) function: ENAB is brake enable terminal, when ENAB is connecting with inverter deceleration valid terminal (it is OC1 or OC2 terminal of SUNFAR inverter), and POW is connecting with 24V CM, DBKU will be on enable status only when inverter is decelerating, and DBKU will decide whether work or not according to the voltage signal detected. After inverter stops decelerating, Debut will be on braking forbidden status.

(2) When work with other inverter brands, please connect POW with 24V of inverter, and connect ENAB with 24V CM. ENAB or POW unconnected or misconnected will make DBKU work abnormally.

(3) The default start braking voltage of DBKU is 670V, when power grid voltage fluctuation is large and higher braking voltage is required, user can set start braking voltage F0.00=620V-730V by keypad.

(4) Control terminal is plug type, to ensure good signal, please pull out control terminal firstly, connect wires outside then plug in terminal.

3.4. Wiring

3.4.1 Wiring of a Single DBKU Connecting SUNFAR Inverter

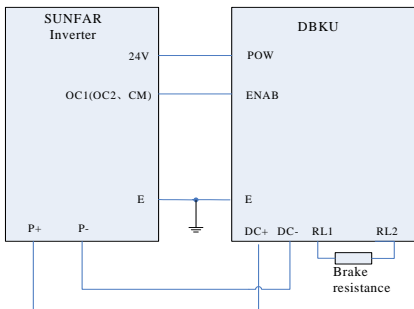


Fig. 3-4 A Single DBKU Connecting SUNFAR Inverter and Brake Resistance Diagram

Notes:

When use DBKU braking enable(forbidden) function, please set function of inverter deceleration valid control terminal which is connected with ENAB effective during deceleration before inverter running. Please connect ENAB with 24V CM when there is no use of this function.

3.4.2 Wiring of a Single DBKU Connecting Other Brand Inverter

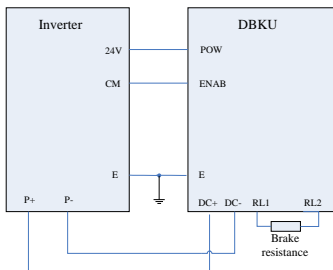


Fig. 3-5 A Single DBKU Connecting Other Brand Inverter Diagram

3.4.3 Wiring of Multiple DBKUs Parallels Connecting Inverter

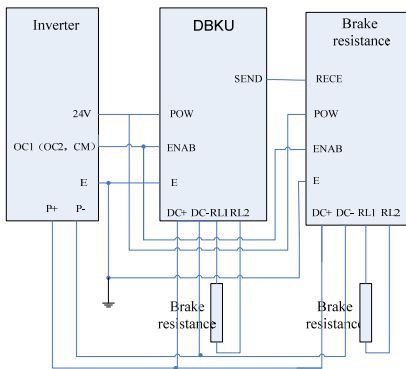


Fig.3-6 Multiple DBKU Parallels Connecting Inverter Diagram

Introduction:

- (1) When multiple DBKUs parallels operate, one runs as Master, the others run as Slave.
- (2) After setting parameter F0.04=1 by DBKU keypad, this DBKU will run as Slave, otherwise run as Master.
- (3) Connecting SEND terminal of Master to RECE terminal of Slaves.

3.5. Specifications of Main Circuit and Control Circuit Connecting Wire

- (1) Main circuit adopts 600V level pressure-resistant wire, wire connecting two sides of brake resistance should be high temperature-resistant.
- (2) Length of inverter and DBKU connecting wire should be no more than 5 meters, length of brake resistance and DBKU connecting wire should be less than 10 meters.
- (3) Please put P+ and P- mixed.
- (4) Control circuit wire must be as farthest as it can from main circuit.

Wire Selection Table (mm²):

Model	Main circuit wire (mm ²)	Control circuit wire (mm ²)
DBKU-30-A	10	1.5
DBKU-50-A	20	1.5
DBKU-110-A	40	1.5
DBKU-160-A	60	1.5

4. Panel Operation

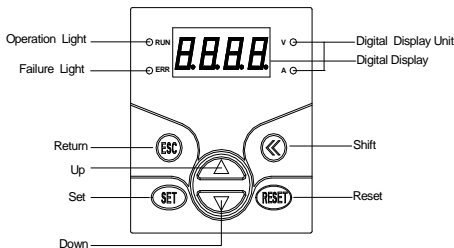







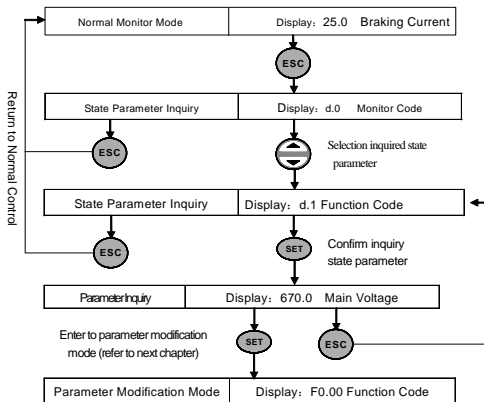
Fig 4-1 Panel Operation

4.1. Function of Key

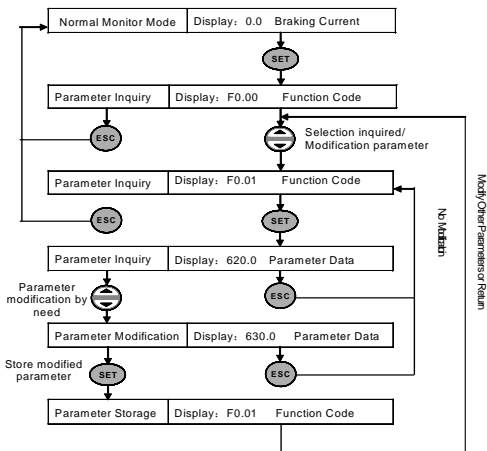
Key	Function Explanation
Digital Display	Display DBKU current operating status parameters and setting parameters.
A、V	Main digital displays data corresponding measurement unit.
RUN	Operation light means DBKU is working. RL1 and RL2 have output voltage.
ERR	Failure light means DBKU has failure problem.
	Data modification key is for modifying function code or parameter.
	Return key. With normal monitor mode, press the key to enter detection mode of abnormal monitor mode / monitor parameters, and check DBKU operation state parameters. In other operation states, press the key to return to previous state.
	Setting key. To make sure current status and parameters (parameters store in inner memorizer), and enter next function menu.
	Reset key. In the condition of DBKU failure, press the key to reset.
	Shift key. When use data modification key to modify data, press the key to select modified data with flashing display.

4.2. Panel Operation Method

(1) State Parameter Inquiry (eg.)



(2) Parameter Inquiry and Modification (eg.)



4.3. State Monitor Parameter List

Monitor Code	Content	Unit
d-0	DBKU present braking current (effective value)	A
d-1	DBKU current DC terminal voltage	V
d-2	DBKU current braking power	%
d-3	Input terminal state	
d-4	Output terminal state	
d-5	Module temperature	°C
d-6	DBKU utilization ratio	%
d-7	Accumulative braking time	S
d-8	Accumulative power-on time	H
d-9	Reserved	
d-10	Reserved	
d-11	Reserved	
d-12	Reserved	
d-13	Reserved	
d-14	Reserved	
d-15	Reserved	
d-16	Reserved	
d-17	Reserved	
d-18	Reserved	
d-19	Reserved	
d-20	1 st failure record	
d-21	2 nd failure record	
d-22	3 rd failure record	
d-23	4 th failure record	
d-24	Main voltage of latest failure	V
d-25	Barking current of latest failure	A
d-26	Braking rate of latest failure	%
d-27	Module temperature of latest failure	°C
d-28	Reserved	
d-29	Reserved	
d-30	Reserved	
d-31	Reserved	

5. Function Parameter Table

Type	Code	Name	Setting Range and Description	Min. Unit	Factory	Limit
Basic running parameters	F0.00	Start braking voltage	[F0.01] ~ 730.0V	0.1	670.0	
	F0.01	Stop braking voltage	620.0 ~ [F0.00]	0.1	650.0	
	F0.02	Start braking rate	[F0.03] ~ 100%	1	100	
	F0.03	Stop braking rate	1% ~ [F0.02]	1	20	
	F0.04	Master-slave mode selection	0: Master 1: Slave	0.1	0	
	F0.05	Braking mode	0: Voltage hysteresis mode 1: Voltage track mode	1	1	
	F0.06	Reserved				
	F0.07	Reserved				
	F0.08	Parameter initialization	0: No action 1: Standard initialization 2: Clean fault records 3: Fully initialization	1	0	x
	F0.09	Voltage correction coefficient	0.900~1.100	0.001	1.000	
	F0.10	Reserved				
	F0.11	Reserved				
	F0.12	Reserved				
	F0.13	Reserved				
	F0.14	Program version				R
F0.15	Parameter protection password	1-9999			x	

Notes: "x" represents the setting value of parameter cannot be changed during braking.

"R" represents read only for the parameter, cannot be changed.

6. Parameter description

F0.00 start braking voltage	setting range: 【F0.01】 ~730.0V
F0.01 stop braking voltage	setting range: 620.0 V~ 【F0.00】
F0.02 start braking rate	setting range: 【F0.03】 ~100%
F0.03 stop braking rate	setting range: 1% ~ 【F0.02】

This DBKU can choose to work under voltage tracking mode or voltage hysteresis mode by setting parameter F0.05; The relationship between braking rate and busbar voltage of these two kinds of mode are shown as following figures;

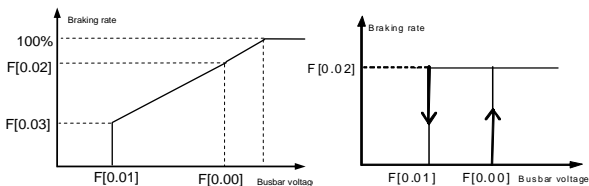


Figure 6-1 voltage tracking mode figure 6-2 voltage hysteresis mode

Under voltage tracking mode, the relation between braking rate and busbar voltage is like a straight line and it meets the voltage hysteresis relationship; when busbar voltage is bigger than start braking voltage F0.00, DBKU start to work. The braking rate increases along with the rise of busbar voltage;

$$\text{Braking rate} = \frac{\text{Busbar voltage} - [\text{F0.01}]}{[\text{F0.00}] - [\text{F0.01}]} \times ([\text{F0.02}] - [\text{F0.03}]) + [\text{F0.03}]$$

Under voltage hysteresis mode, braking rate and busbar voltage is hysteresis relationship; when busbar voltage is bigger than start braking voltage F0.00, DBKU start to work; under braking state, when busbar voltage drops to stop braking voltage F0.01, DBKU stop braking.

Braking rate increases while bus voltage is rising under voltage tracking mode, you can make this braking more smooth by setting parameter F0.00-F0.03; Braking rate is a constant value under voltage hysteresis mode and braking action is faster.

F0.04 Master-slave mode

setting range: 0 ~ 1

We can parallel several DBKUs together when a single DBKU doesn't have enough braking power. in this case, one will be Master while others are slaves, connect SEND end of Master unit to RECE end of Slave unit to synchronous the action of Master unit and Slave unit.

Under Master-slave mode, it would be better to set the same parameters F0.00-F0.03 of the Master and Slave to ensure their output power are the same, if the braking powers are not the same we can fine tuning parameters F0.00-F0.03.

F0.06~F0.07 Reserved

F0.08 Parameter initialization

setting range: 0 ~ 3

F0.08 Parameter initialization

It is used for modifying DBKU parameter to factory value.

0: parameter initialization is off;

1: parameter initialization is on; (Except F0.14, all F0 group parameters are initialized)

2: clean fault records;

3: fully initialization; (except F0.14, all F0 group parameters are initialized and fault records are cleaned)

F0.09 Voltage correction coefficient

setting range: 0.900 ~ 1.100

When the deviation between the DBKU's shown voltage and its actual voltage is too large, we can correct this shown voltage by setting this parameter.

F0.10~F0.13 Reserved

F0.14 Program version

F0.15 Parameter protection password setting range: 1-9999

7. Fault Diagnosis and Measure

7.1. Protection Function and Solution

Fault Code	Fault Description	Reason	Solution
Fu.01	Over-current	1. Brake resistor short circuit 2. Brake resistance is low 3. DBKU capacity is low 4. Feedback energy abnormal	1. Check brake resistor And wiring, exclude short circuit. 2. Choose suitable brake resistance 3. Choose suitable DBKU capacity 4. Reduce regenerative energy mutation
Fu.02	Overvoltage	1. Selected DBKU power is low 2. Regenerative energy abnormal	1. Choose suitable DBKU capacity 2. Reduce regenerative energy mutation
Fu.03	Overload	1. Brake resistance is low 2. DBKU capacity is low	1. Choose suitable brake resistance 2. Choose suitable DBKU capacity
Fu.04	Reserved		
Fu.05	Over-heat	1. Air duct block 2. Temperature is over high 3. Fan damaged 4. Fan drive circuit damaged	1. Clean the air duct 2. Improve ventilation condition 3. Replace fan 4. Seek manufacturer service
Fu.06	Reserved		
Fu.07	IGBT short circuit fault	IGBT damaged	1. Inspect IGBT damage 2. Seek manufacturer service
Fu.08	Voltage inspection fault	Voltage inspection circuit damaged	Seek manufacturer service
Fu.09	Temperature transmitter fault	Temperature inspection circuit damaged	Seek manufacturer service
Fu.10 ~ Fu.13	Reserved		
Fu.14	Inner data memory error	Control parameter read error	1. Restore factory default 2. Seek manufacturer service

7.2. Record Search

This DBKU series records the latest fourth fault codes and output parameter of last fault, search these information can help to find to fault reason.

Fault information and status monitor parameter unified stored, please refer to keypad operation method to search information.


Monitor code	Content	Monitor code	Content
d-20	The 1 st fault record	d-24	Bus voltage of last fault
d-21	The 2 nd fault record	d-25	Brake current of last fault
d-22	The 3 rd fault record	d-26	Brake rate of last fault
d-23	The 4 th fault record	d-27	IGBT temperature of last fault

7.3. Fault Reset



- Please thoroughly check fault reason and rule out before reset, otherwise permanent damage may be caused to DBKU.
- If reset failure or damage caused by reset, please check the reason, continuous reset may damage DBKU.
- Please delay 5 minutes to reset while overload, overheat protection action.

When DBKU cause fault, please choose either of following methods to restore operation.

Method I : When shows fault code, please press 

Method II : Power off

8. Brake Resistance Selection

8.1 DBKU Selection

There are two points for DBKU selection:

- 1) The voltage of DBKU should be consistent with input voltage of inverter.
- 2) The power of DBKU is selected on the basis of braking power of inverter.

In principle, the value of DBKU power should be larger than braking power.

In the case of unclear braking power, please calculate the value according to the following formula:

$$P_b = P \cdot T_d \cdot K$$

Notes: P_b ---braking power; P ---motor power;

K ---mechanical energy transform efficiency, generally $K=0.7$;

T_d ---ratio of braking torque and motor rated torque.

T_d value varies in different system, please refer as below:

Common applications	Elevator, crane, hoist	Winding & unwinding	Large inertia equipment of fast braking	Common inertia load
T_d value	100%	120%	120%	80%

8.2 Brake Resistance Selection

8.2.1 Resistance Value Selection

While braking, almost all motor regeneration energy consumes at braking resistance, please refer to the formula:

$$U^2/R = P_b$$

Notes: U --- braking voltage under stable system braking state (it varies from different systems, taking 700V for common AC 380V system)

Attention: when the calculated value of R is less than the minimum brake resistance under each voltages, several DBKU shall be serially used.

8.2.2 DBKU Power Selection

The power of brake resistance and braking power should keep consistent in theory, but 70% derating should be taken into account. Please refer to the formula:

$$0.7 \cdot P_r = P_b \cdot ED$$

P_r ---- Power of brake resistance

ED ---- braking frequency (braking time accounts for the whole working time)

Common applications	Elevator	Winding & unwinding	Lift & Centrifuge	Accidental braking load	Injection machine	Constant occasion
ED value	20%~30%	20%~30%	50%~60%	5%	5%~10%	10%

According to Table 8-1, recommended braking unit and brake resistance value can meet all application requirements from $ED=0\sim 100\%$, while the power of brake resistance varies in different applications. Please refer to Table 8-1 for selection of recommended power of braking resistance when $ED=10\%$ or $ED=50\%$.

Table 8-1 Recommend Braking Unit and Brake Resistance ($T_d=100\%$)

Inverter Power (KW)	Braking Unit	Brake Resistance	Power of Brake Resistance (ED=10%)	Power of Brake Resistance (ED=50%)
L:22-45	DBKU-30-A	$\geq 23 \Omega$	$\geq 3kW$	$\geq 15kW$
H:18.5-30				
L:55-90	DBKU-50-A	$\geq 13 \Omega$	$\geq 5.5kW$	$\geq 27kW$
H:37-55				
L:110-160	DBKU-110-A	$\geq 6 \Omega$	$\geq 12kW$	$\geq 58kW$
H:75-110				
L:185-280	DBKU-160-A	$\geq 4 \Omega$	$\geq 17.5kW$	$\geq 87.5kW$
H:132-160				