HBU series
Braking Unit
User's Manual

HNC Electric Limited

Contents

Preface **3**

Open-case inspection announcements **4**

Simple test methods **4**

Chapter 1 Safety Information **6**

1.1 Definition of safety 6
1.2 Installation and wiring announcements 6
1.3 Caution 7
1.4 Others 7

Chapter 2 Product Models and Specification **8**

2.1 Model Specifications 8
2.2 Product Tech Specification 8
2.3 current temperature curve 11
2.4 Product installation dimension 12

Chapter 3 Product Installation guidance **16**

3.1 Installation of the brake unit 16
3.2 Braking unit terminal arrangement in major loop 18
3.3 major loop connecting method 19
3.4 wiring specification of major loop 23

Chapter 4 Description of operation Panel 24

4.1 Operation panel illustration 24
4.2 Status Indication 25
4.3 Description Digital display 26
4.4 Descriptions of buttons 27
4.5 Switch over between parallel sockets and master-slave mode 28

Chapter 5 Brake unit model selection 29

5.1 Fast model selection for normal load 29
5.2 Model selection of periodical braking load 31

Chapter 6 Normal malfunction elimination 33

6.2 No braking sound 33
6.3 Braking resistor too hot 33
6.4 Resistor keep heating when inverter stop working 33
6.5 Over-current protection occurred during braking 34
6.6 Inverter could not get powered on 34
6.7 Brake unit is too hot 34

Chapter 7 Quality Guarantee 35

Preface

Thanks for choosing HBU series of dynamic braking units manufactured by HNC.

HBU series of dynamic braking units are high performance brake products joint manufactured with Germany and Tongji University. Now these series are widely used in CNC machine tools, high power manufacturing machinery, elevators, centrifuges, crane and mining hoist, oil field pumping units, etc.

HNC HBU adopts brake resistor to release the regeneration energy produced in the process of motor speed regulation, obtain enough braking torque to keep the frequency converter running well.

This user's manual provides information on installation & wiring, parameters set-up and malfunction diagnosis etc. Please read the user's manual in detail to make sure install and operate correctly.

This user's manual is attached to the device for free, please give it to device users and keep it well.

Open-case inspection announcements

Please check the following during introspection

Wear out or not.

If it is nameplate fit with your order.

If the product and package have been checked strictly, please contact us or the dealer if missing something.

Simple test methods

After unpacking, use digital multi-meter to simply test whether device is good or not by respectively connect red and black pen of diode switch to four terminal (DC(+), DC(-), RL1, RL2), the results show as belo

Table 1HBU-3HA/4HA/5HA test result

Red pen	Black pen	Normal test result
DC(+)	DC(-)	Pressure drop increases from zero eventually, stabilizes at infinity gradually.
DC(-)	DC(+)	Pressure drop ranges between 300 – 700mV
RL1	RL2	Pressure drop gradually increases from zero to infinity
RL2	RL1	Pressure drop ranges between 200 – 500mV

Table 2 HBU-1L/1SA/3SA test result

Red pen	Black pen	Normal test result
DC(+)	DC(-)	Pressure drop is infinity
DC(-)	DC(+)	Pressure drop ranges between 600-900mV

RL1	RL2	Pressure drop is infinity
RL2	RL1	Pressure drop ranges between 300-600mV

Remarks: Above test methods are only used to test whether module is good or not, not test full unit.

Chapter 1 Safety Information

1.1 Definition of safety

Dangerous	This sign means operator will be in danger if operator does not follow guidance.
Attention	This sign means it will cause damage or malfunction if operator does not follow guidance.
Notice	This sign means there is tips on how to use device better.

1.2 Installation and wiring announcements

Dangerous
Wiring has to be operated by professionally qualified person because there is danger of electric shock. When installing and wiring, braking units, inverter and other devices which are connected with braking unit must be cut off power supply. Waiting for five minutes until capacitance inside each device get fully discharged. Make sure grounding terminal of braking unit connects to ground; otherwise there is danger of electric shock.

Attention

Pole “+” & “– “of AC bus of braking unit cannot be reversely connected, or it would not work even damage the unit and related device, and might cause fire.

Install braking unit in a well-ventilated environment, otherwise it can’t work well even be damaged.

1.3 Caution

Dangerous

After power on each component of braking units has high voltage (HV). It is very dangerous for people to touch, even losing life.

Attention

Avoid dropping screw, spacer etc. metal into braking unit, otherwise cause damage to device.

Make sure housing and lid of device properly fit together during operation.

1.4 Others

Dangerous

Scrap machine should be disposed as industrial wastes, no burning because it would cause explosion.

Chapter 2 Product Models and Specification

2.1 Model Specifications

Table 2.1 Specifications of braking energy unit

Model Specifications	Usage Occasion	Power Range	Rated Current	Peak Current
General Mode				
HBU-1L	dynamic raking	0.75-18KW	6A	33A
HBU-1SA	dynamic raking	22-37 KW	9A	50A
HBU-3SA	dynamic raking	45-55 KW	10A	100A
HBU-3HA	dynamic braking	75-90KW	70A	150A
HBU-4HA	dynamic braking	110-132 KW	85A	200A
HBU-5HA	dynamic braking	160-200 KW	120A	300A
HBU-6HA	dynamic braking	220-280KW	160A	400A

Rated current is maximum average current when braking unit working. Peak current is maximum current allowed during working, its running time should last less than 20 seconds.

2.2 Product Tech Specification

Table 2.2 Product Technical Specification

item		specification
Power supply	Network voltage	Tri-phase 220V/380V/460/660V（depend on models）
	Network frequency	45Hz～65Hz

Control	Brake mode	Automatic voltage trace
	Reaction time	Within 1mS, multiple noise filter algorithm
	Operation voltage	Depend on different models
	Hysteresis voltage	less than 10V
	Protection function	Over-heat, over-current, short circuit
	Overheat protection	75℃
	Digit input port	*1pcs, set up functions by software
	Digit input port	*1pcs, set up functions by software

Display and Settings	Status indicator	There are power indicator & working indicator for all models. And power indicator, malfunctions indicator, fuse-break indicator and brake-status indicator for some models in operation panel.
	Operation monitoring & controlling	Some models with operation panels have operation parameters to monitor AC bus-bar voltage & internal temperature etc.
	Operation voltage set-up	HBU-3HA/4HA/5HA set up via operation panel, and others set up when leaving factory.
Environment	Installing place	Indoor, elevation no more than 1000m, no sunshine, no electro-conductive powder & corrosive gas
	temperature	-10~40℃，well-ventilated
	humidity	Under 90％RH No dew
	Vibration angle	Under 0.5g

Notice :

Items marked with * are effective for DR-3HA/4HA/5HA only.

2.3 current temperature curve

Allowed maximum current changes when internal heat sink temperature of braking unit changes. Relationship between maximum current and temperature is shown as below.

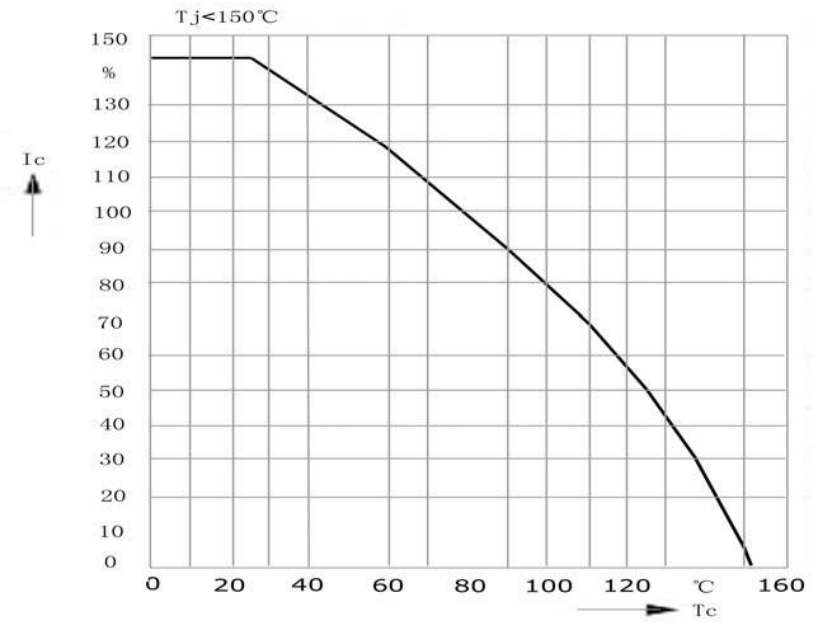
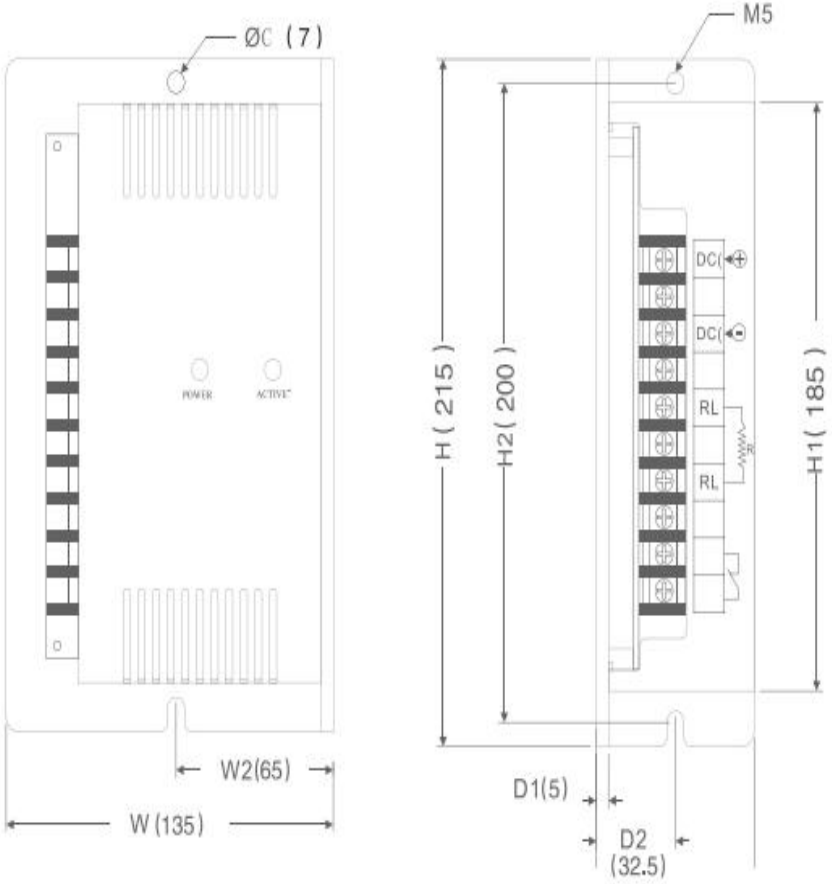


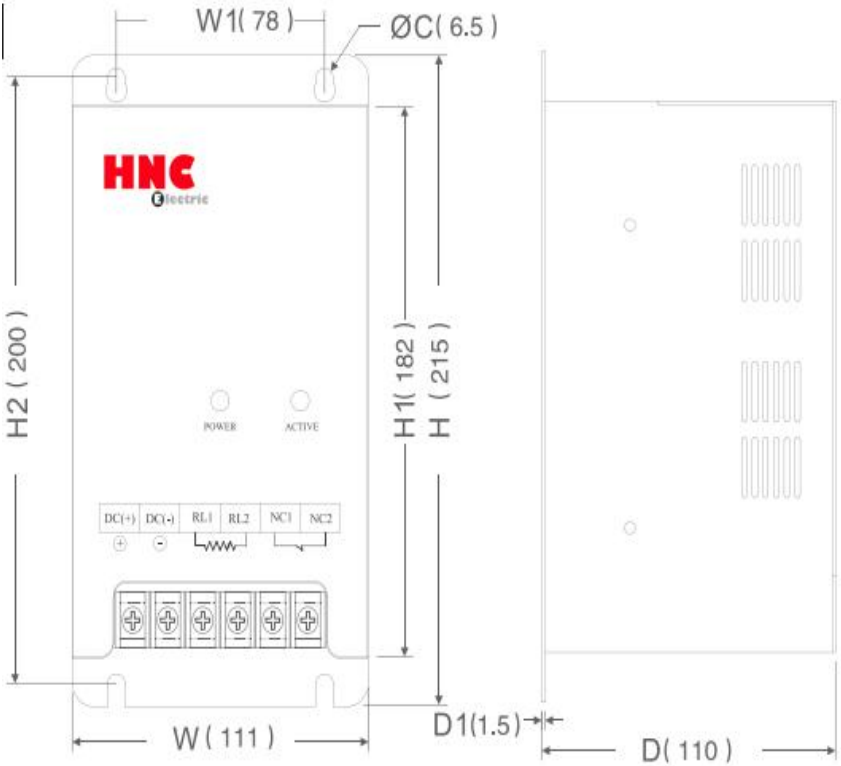
Table 2.1 Relation between current &temperature

From above Table, allowed maximum current drops down when heat sink's temperature is above 75 ℃ , so working temperature of braking unit has to be limited.

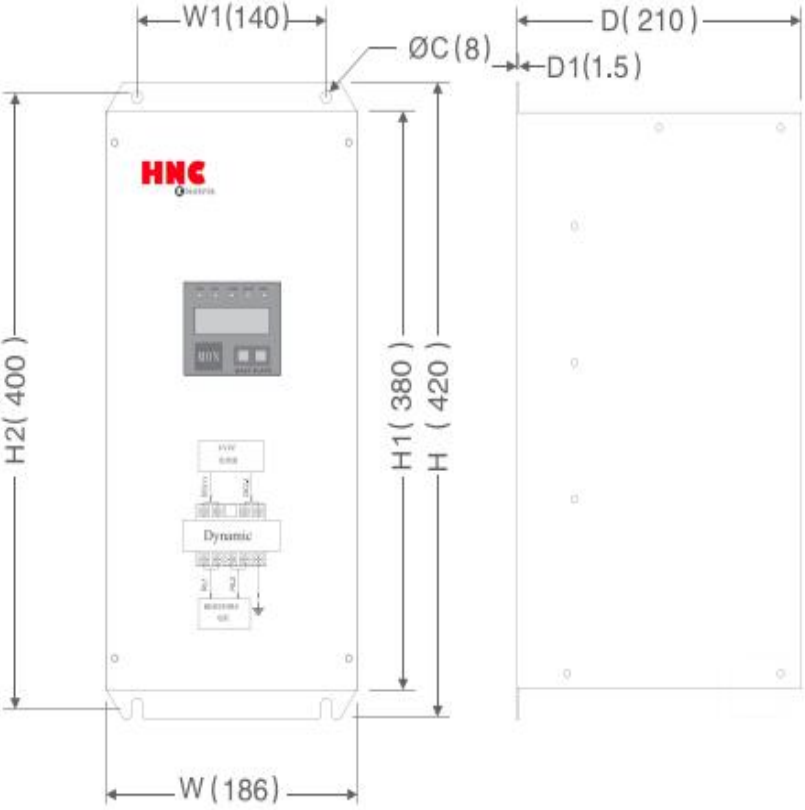
2.4 Product installation dimension



HBU-1L dimension



HBU-1SA/3SA dimension



HBU-3HA/4HA/5HA/6HA dimension

Table 2.3 HBU series mechanical parameter list (unit: mm)

Type	External dimension L*W*H	Installation dimension L1*L2*L3	Mounting hole size
HBU-1L	215×135×65	200×32.5	M5×2
HBU-1SA	215×111×110	200×78	M6×4
HBU-3SA			
HBU-3HA	420×186×210	400*140	M6×4
HBU-4HA			
HBU-5HA			
HBU-6HA			

Chapter 3 Product Installation guidance

3.1 Installation of the brake unit

Install braking unit vertically onto noncombustible & solid surface. Because of heat energy generated by braking unit itself, users must choose well-ventilated, heat dissipation and safe installation environment. Leave enough space around braking unit, minimum ventilation space is top & bottom 100mm, left & right 30mm.

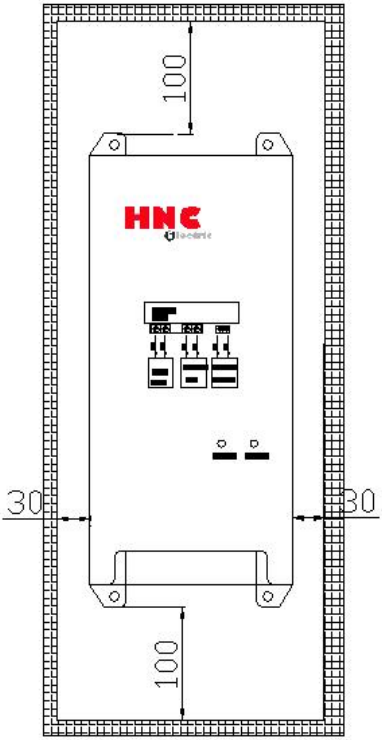


Table 3.1 Installation space requirements of HBU series

To more than one braking units have to be installed in arrangement of up & down, vertical distance between each braking unit is 200mm at least, and plus stream-guided baffle to protect above braking unit from heat energy generated by underneath braking unit. Installing method is shown as below.

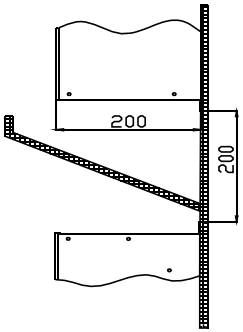


Table 3.2 Installation instruction for two up & down braking units

Attention

Braking unit must be installed in well-ventilated environment. If brake unit need to be installed inside cabinet, make sure there is suitable hole for heat dissipation in the cabinet, if necessary, install ventilator in suitable place.

Attention

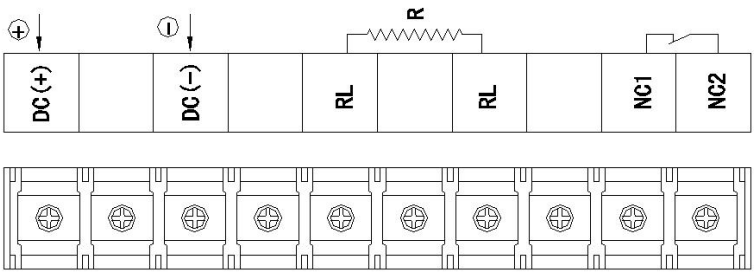
During operation, braking resistor connects with braking unit generate high heat, so must be not installed together with inverter, braking unit and other device. An inappropriate installation site of resistor might cause malfunction or damage of other device.

Attention

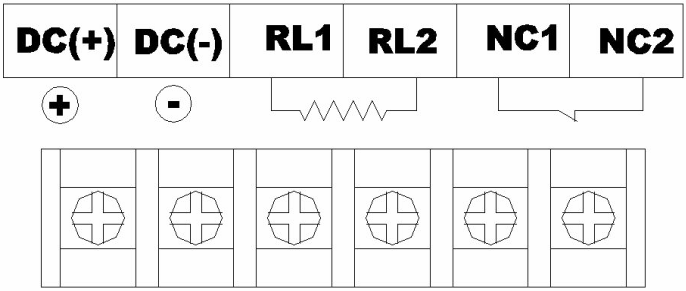
Do not put braking resistor near the explosive & flammable stuffs, keep beyond the scope of touch.

3.2 Braking unit terminal arrangement in major loop

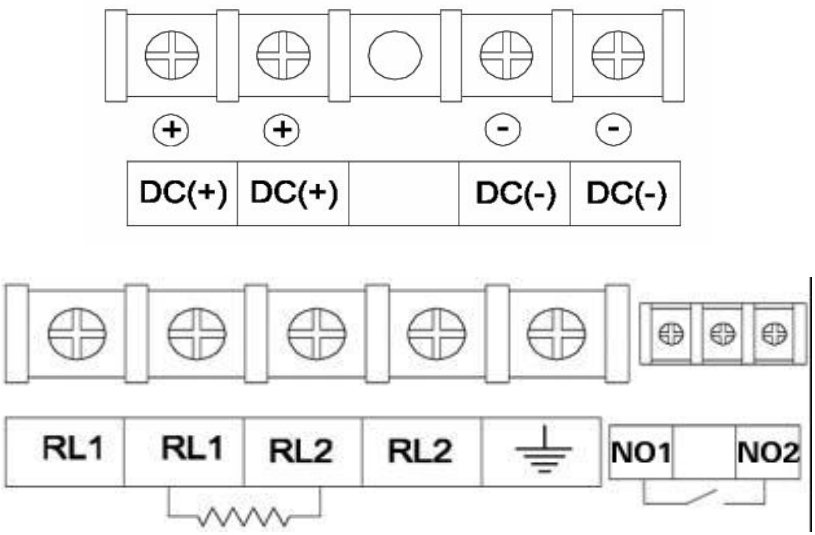
3.2.1 HBU-1L Brake unit terminal arrangement



3.2.2 HBU-1SA/3SA Brake unit terminal arrangement



3.2.3 HBU-3/4/5/6HA Brake unit terminal arrangement



3.3 major loop connecting method

3.3.1 Power input terminals

DC(＋) & DC(-) are positive and negative input respectively for braking unit's DC bus, please connect with positive and negative input of Inverter's DC bus correctly. When inverter connects with DC electric reactor externally, positive connecting point of braking unit's DC bus should behind DC electrical reactor. Cable between DC bus and brake unit should be as short as possible.

3.3.2 Brake unit, fault protection and ground terminal

RL1 & RL2 are wiring terminals of braking unit, should be correctly connected with braking resistor. Braking resistor's value & power should have been selected properly.

NC1 & NC2 are main contact output of internal malfunction protection. Internal contact act when brake unit over-heat internally. By this main contact could alarm and display PLC status coordinating with external control circuit.

HBU-3HA/4HA/5HA series braking unit provide special grounding terminal, please connect according to rules.

3.3.3 Auxiliary power terminal.

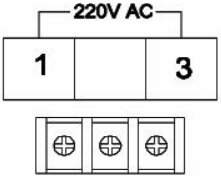


Table 3.6 Auxiliary power terminal

HBU-3HA/4HA/5HA series braking unit of 660V voltage classes provide auxiliary power terminal, connect corresponding terminal with 220V AC power supply in use, and make sure electricity go through 220V power supply firstly before DC bus voltage joint in. False power-on sequence and too high auxiliary power supply voltage will lead to brake unit malfunction even damage. Brake units of 220V/380V/460V voltage classes have no such wiring terminal, no need to connect in use.

3.3.4 Identify of inverter DC bus terminals

When HNC HBU series brake unit cooperate with inverter, please correctly connect braking unit's DC input terminal DC（+） DC（-） with positive and negative terminal of inverter's DC bus. Due to there are more than one major loop wiring terminal related with inverter's DC bus, it is difficult to identify inverter's DC bus wiring terminal. Below picture shows wiring terminal inverter provides normally.

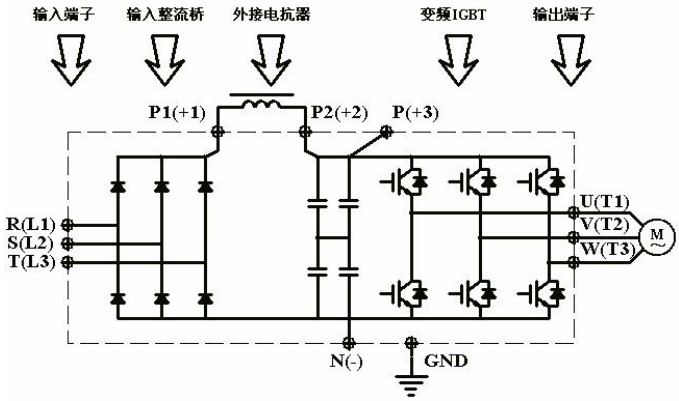


Table 3.7 Normal wiring terminal of inverter's major loop

"P1"、"P2"、"P"、"N" are related to DC bus. Among them, "N" is negative wiring terminal of DC bus, which can be easily identified, which should be connected with DC (-) of braking unit.

"P1"、"P2" are wiring terminal externally connected with DC electric reactor, normally these two terminals are connected with short-out copper bar when inverters leave factory, and there is no DC electric reactor to connect with.

"P" is external terminal for energy-assumption brake unit, positive terminal of DC bus. DC (+) should be connected with "P" terminal.

Notice

Because of different inverter manufacturers making different power, actually quantity of terminals inverter provide may be different from what marked in the diagram Read user manual for inverter carefully to rightly find out inverter's DC bus terminal.

Notice

In the Table, external DC electric reactor terminals "P1" and "P2" are sometimes marked as "+1" and "+2". There is no terminal to externally connect with DC electric reactor for some inverters with mini-watt, possibly "P2" and "P" is integrated to one positive terminal of DC bus. Normally this terminal is marked as "P+", "+" etc. as well, and the negative wiring terminal of inverter's DC bus is marked as "N-". "-" etc. please check user manual of inverter.

3.4 wiring specification of major loop

Table 3.1 wiring specification of major loop

Models Specifications	**Rated Current**	**Peak Current**	**Section of Copper cable**
HBU-1L	6A	33A	4 mm^2
HBU-1SA	10A	50A	4 mm^2
HBU-3SA	12A	100A	10 mm^2
HBU-3HA	70A	150A	16mm^2
HBU-4HA	85A	200A	16 mm^2
HBU-5HA	120A	300A	25 mm^2
HBU-5HA	160A	400A	32 mm^2

Notice

Soft cable is more flexible. Because of possible contact with high-temperature device, please adopt copper core, heat-resistant and anti-flaming cable.

Attention

Install braking unit close to inverter as possible as you can, no more than 1 meter. Otherwise, please twist cables of direct current side to reduce radiation and inductance.

Chapter 4 Description of operation Panel

4.1 Operation panel illustration

Operation panel of HNC HBU-3HA/4HA/5HA brake units is consist of status indication, data display, and operation buttons and paralleled connected sockets, as below Table shows.

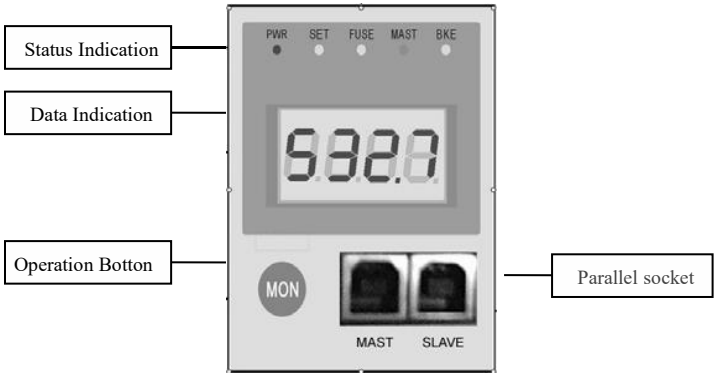


Table 4.1 Operation panel of HBU-3HA/4HA/5HA

*Except HBU-3HA/4HA/5HA series dynamic braking units, there is no operation panel for other HBU series dynamic braking units in this manual.

4.2 Status Indication

There are five indicator lights for Status indication of HBU-3HA/4HA/5HA, each has its implication.Table 4.1 Definition of indicator light

Indicator	Function	Implication
PWR	Power supply indication	light is on after power on
SET	Parameter status indication	When light is on, parameters is checkable, can check out rated voltage, maximum current, operation voltage, temperature for heat sinking, malfunction records, and software version. When the light flash, rated voltage & operation voltage can be set.

FUSE	fuse-break indication	When light is on, fuse break inside braking unit
MAST	master-slave status indication	When light is on, brake unit operate under master mode. Off under slave mode
BKE	braking indication	When light is on, brake unit is working

4.3 Description Digital display

Four LED on operation panel display digits. According to light of "SET" is on or off, there are three statuses to display:

When light of "SET" is off, it displays voltage value of brake unit's DC bus.

When light of "SET" is on, rated voltage, rated current, operation voltage, temperature for heat sinking, malfunction records and software version are displayed. Refer to form 4.2 for details.

When light of "SET" flashes, it displays setting value for rated voltage or operation voltage.

Table 4.2 Parameters and format display

Display contents	Display format	Explanation

Rated voltage	**L 380**	Network voltage (Change the network voltage arbitrarily will cause changes of related parameters, please use with caution in.)
Maximum current	**A 300**	Maximum current for brake unit
Operation voltage	**P 675**	Present operation voltage setting
Temperature display for heat sinking	**H 31.0**	Heat sinking temperature display
Malfunction records	**E.- - -**	Malfunction happened to braking unit
Software version	**U 2.02**	Display software version

4.4 Descriptions of buttons

Operate buttons on operation panel of HBU-3HA/4HA/5HA series is used to change display status and parameters setting.

Light of “SET” is off under default condition,, it is in status of displaying present DC bus voltage. Push button “MON”, start to check parameters, light of “SET turn on meanwhile. Every push of the button, display contents in form 4.2 automatically switch over. In this status there is no push

within 5 seconds, display status will back to DC bus voltage, “SET” light is off

If display operation voltage at present, keep pushing button “MON” for more than 2.5 seconds, enter to status of setting up operation voltage. At this time, light “SET” and character “P” shown before rated voltage flash for every 0.75 second. Push the button again at this condition, operation voltage switch over in circle between 10 setting value corresponding to relevant rated voltage.

4.5 Switch over between parallel sockets and master-slave mode

To operate HBU-3HA/4HA/5HA series in parallel conveniently, operation panel provides sockets for parallel operation. When need to operate brake units in parallel, use special wire to connect “MAST” brake unit in back and “SLAVE” brake unit in front. Meanwhile, in order to make sure all brake units connected in parallel wok at the same time, under condition of displaying DC bus voltage, keep pressing button “MON” for more than 2.5 seconds (till light ”MAST” change indication status) to switch over master-slave mode, “MAST” on means braking unit is mainframe, “MAST” off means braking unit is slave. Choose and set one braking unit to master mode, others to slave mode.

When operate separately, brake unit must be set to master mode (default mode leaving factory), otherwise it will not work in normal.

Attention

When operate in parallel, one and only one brake unit is set to master mode, others set to slave mode. Do not allow more than one master modes or set all to slave mode. Or brake unit will not work in normal.

Attention

When use in parallel, a special wire must be used to connect brake units, or it will not work normally.

Chapter 5 Brake unit model selection

Brake unit is electronic equipment which is designed working intermittently in short time. It has limitation to work with strong current for long time, so choosing a reasonable model will prevent brake unit from damage because of over-current and over-heat.

Model selection is based on rated & peak current of brake unit. Rated current is in direct proportion to the current brake unit working continuously. Peak current stands for maximum current allowed going through. To keep brake unit work regularly, brake unit's maximum current should be lower than peak current, and the product of maximum current and braking frequentness Kc is less than rated current.

5.1 Fast model selection for normal load

Table 5.1 Fast model selection for normal load（power：KW）

Specifications models	Rated current	Peak current	Applicable power	Minimum resistance value
HBU-1L	6A	33A	0.75-18KW	20 Ω
HBU-1SA	9A	50A	22-37 KW	15 Ω
HBU-3SA	10A	100A	45-55 KW	7 Ω
HBU-3HA	70	150A	75-90KW	5 Ω
HBU-4HA	85	200A	110-132 KW	3.5 Ω
HBU-5HA	120A	300A	160-200 KW	2.5 Ω
HBU-6HA	160A	400A	220-280KW	1.8 Ω

If braking period of speed regulating system is more than 200S and braking frequentness Kc<10% within one braking period, choose model from form 5.1 according to the load.

Notice

When actual load with motor is less than 60% of power of motor, take it as light-load device. Otherwise it is heavy-load device.

Notice

If braking period of speed regulating system is less than 200S, or braking frequentness Kc is >10% within one braking period, simply choosing model for braking unit from form 5.1 could not guarantee normal work of device. At this time, calculate out rated current and peak current which is required for braking according to braking request of actual load, then from form 2.1, choose out model which rated current and peak current meet requirements.

5.2 Model selection of periodical braking load

As for load of periodical braking, using following ways choose suitable braking units.

5.2.1 Confirm system's peak braking current **Imax**

Peak braking current should be brake current which make sure system work properly and load get enough braking torque.

(1) Normally, for 380V speed regulating system, when braking torque need 100% rated torque during braking, maximum braking current can be calculated as below:

Imax ≈Motor power (kW)

(2) After correctly choosing braking resistor, the current can be approximately calculated out through below formulation:

Imax ≈ 700/ brake resistor (Ω)

(3) Because great inertia load requires emergence braking, it needs braking torque more than 100%, under this situation bigger peak braking current is needed.

5.2.2 Confirm the average braking current Iav

(1) First confirm brake frequentness Kc of system, Kc is defined as proportion of system braking time to total braking period.

Kc = Brake continuing time/Brake period×100%

There is different braking frequentness KC for different load type, so please confirm Kc according to actual running status of speed regulating device. When running status of actual load can not be confirmed, please refer to bellowing experience value to confirm Kc. Normal braking frequentness

for load type are followed:

Elevator	Kc=10-15%
Oil extraction machine	Kc=10-20%
Uncoil and coil	Kc=50-60%
Centrifugal machine	Kc=5-20%
Crane drop more than 100 meters	Kc=20-40%
Accidental braking	Kc=5%
Other	Kc=10%

(2)Confirm system's average braking current Iav, which approx. calculate out via below formulation:

Iav ＝ Kc×Imax

5.2.3 Experimental Recommendation

Normal braking time is less than 15s, refer to peak current (exclude frequently braking), refer to rated current if it is more than 15s.

5.2.4 Choose model for brake unit according to Imax & Iav.

After getting Iav & Imax, just make sure both rated current and peak current of selected brake unit are no less than calculated Iav & Imax.

Final evidence to judge model selection f is current passing through brake unit is less than maximum current under any condition to avoid brake unit got damaged because of over-current. Meanwhile under any condition temperature of brake unit should be no more than 70℃ to avoid braking unit got damaged because of over-heat.

Chapter 6 Normal malfunction elimination

6.1 Exist braking sound and overvoltage in inverter.

✧ Deceleration time of inverter is too short, postpone deceleration time

✧ Value of braking resistor is too big, re-calculate value of resistor and select brake unit.

✧ Not enough capacity for brake unit, re-check specification of selected braking unit is right or not.

6.2 No braking sound

✧ Wrong model selection for brake unit or working voltage is unmatched.

✧ Resistor disconnected or cables are not well-connected, brake is ineffective.

✧ Resistor short out, brake stop output automatically.

✧ Brake unit malfunctions.

6.3 Braking resistor too hot

✧ Power for selected braking resistor is too low, increase power of braking resistor.

6.4 Resistor keep heating when inverter stop working

✧ Wrong model selection of brake unit or working voltage is unmatched.

✧ On-site network voltage fluctuates too much, beyond operation voltage.

✧ Wrong settings for operation voltage

6.5 Over-current protection occurred during braking

✧ Value of braking resistor is too small, braking torque is too big, increase value of resistor or postpone deceleration time of inverter

✧ Wrong system design

6.6 Inverter could not get powered on

✧ Wrong direction for input wire's positive and negative poles

6.7 Brake unit is too hot

✧ Not good ventilation, re-install

✧ Braking frequentness is too high, choose more powerful brake unit or multiple brake unit in parallel.

Chapter 7 Quality Guarantee

★ It is designed according to international standards, to make sure best quality is provided.

★ Make sure lifespan is more than 10 years under condition of normally used.

★ Three guarantees for product quality are provided, which include return within one month, replacement within 3 months, and maintenance within 18 months, and permanent repair (free charge).

★ As per request from users, technician could be sent to scene to guide installation and debugging.

★ As per request from users, provide free technical training in factory.

★ If product malfunction because of quality of product, after-sales person arrive at scene to handle within shortest time after the complaint.