

## Preface

Thank you for purchasing BR100 Braking Unit.

**Document No.: 31010009**

**Version No.: 102**

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BR100 Features:

1. Performance: Stable and reliable
2. Protections: Over-heating and braking resistor short-circuit
3. Real-time detection on DC bus voltage
4. Absorb the motor regenerative energy through braking resistors.
5. Compatible with various inverters
6. Applications: The devices driven by frequency inverter like: hoist, centrifuges, industrial washer, dryer, crane, elevator, or the load system which requires quick stop.

It is the duty of any user to perform the appropriate, correct installation and wiring or selecting the compatible braking resistor of the braking unit. Neither SINEE nor its distributors shall be responsible or liable for misuse of the information contained herein.

In the interests of commitment to a policy of continuous development and improvement, SINEE reserves the right to update the specification of the product or its performance, or the content herein without notice.

More updates and information available at [www.sinee.cn](http://www.sinee.cn) Pictures herein are for reference only.

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## Verifying Product

- Verify that the device reference marked on the label conforms to the delivery note corresponding to the purchase order.
- Open the packaging and check that the device has not been damaged in transit.
- Contact the distributor or SINEE directly for any quality issue.

## Safety Information





The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

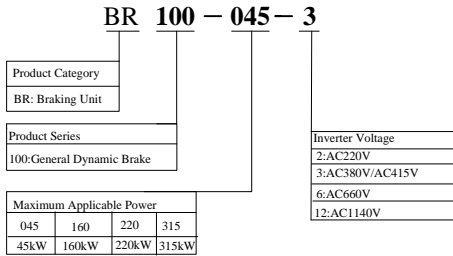
## Safety Precautions

	<b>Danger</b>
<ol style="list-style-type: none"><li>1. Wiring must be performed by authorized and qualified personnel.</li><li>2. Wait 5~10 minutes for capacitor discharge after disconnected from power supply.</li><li>3. Electrical hazard exists in the parts of braking unit after power-on. Failure to follow the instructions will result in fatal injury.</li></ol>	

	<b>Caution</b>
<ol style="list-style-type: none"><li>1. Well connect positive/negative poles of braking unit DC bus. Otherwise, devices damage and fire may occur.</li><li>2. Locate the braking unit in a place with good ventilation, and keep the ambient temperature lower than 40°C. Overheating may result in fire or other accidents.</li><li>3. Always tighten the screws and gaskets inside the braking unit. Any loosen may result in devices broken.</li><li>4. Be sure that housing is well located.</li></ol>	

## 1. Model Numbering Scheme and Specifications

### 1.1 Model Numbering Scheme



- BR100-045 is applicable to the inverter with 3-phase AC220V/3-phase AC 380V power supply.
- For 3-phase AC220V inverter (customization), the braking voltage is 395V or 420V. For 3-phase AC380V inverter (customization), the braking voltage is 675V or 720V.
- BR100-160/BR100-315 is only applicable to the inverter with 3-phase AC380V power supply. the braking voltage is 675V or 720V.
- BR100-220-6 is only applicable to the inverter with 3-phase AC660V power supply, the brake voltage is 1135V.

### 1.2 Model Specifications

Model No.	Application	Minimum Resistance ( $\Omega$ )	Average Brake Current $I_{av}$ (A)	Peak Brake Current $I_{max}$ (A)	Inverter Power Range (kW)
BR100-045	Dynamic Brake	10	45	75	18.5~45
BR100-160	Dynamic Brake	6	75	150	55~160
BR100-315	Dynamic Brake	3	120	300	185~315
BR100-220-6	Dynamic Brake	6	120	200	220~350

#### Remarks:

When BR100-160 and BR100-220-6 are in minimum resistance, and when brake duty ratio  $D \leq 33\%$ , braking unit can work continuously, it needs to work discontinuously when brake duty ratio  $D > 33\%$ . Otherwise, braking unit will trip over-heating protection.

## 2. Technical Specifications

See Table 2-1 for BR100 technical specifications.

Table 2-1 BR100 Technical Specifications

Item		Specifications
Control Mode	Output Voltage Control	Auto-modulated switch-mode
	Brake Voltage	Varies with models 395V,420V,675V(Standard),720V,1135V
	Protection	Over-heating, short-circuit
	Overheating Trip	80 °C (Heatsink)
Display	LED	POWER indicator, BRAKE Indicator, FAULT indicator
Application Conditions	Installation Site	Indoor, with altitude less than 1,000 meters, free of dust and corrosive gas, and no direct
	Ambient Temperature	-10°C ~ +40°C. In the temperature range +40°C...+50 °C, the rated output current is decreased by 1% for every additional 1 °C 20% ~ 90% RH (no condensation)
	Vibration	<0.5g
	Storage Temperature	-20 °C ~ +65 °C
	Installation Method	Wall mounting
Degree of Protection		IP20
Cooling Method		Self-cooling (BR100-045, BR100-160) Air cooling (BR100-315, BR100-220-6)

### 3. Overall and Installation Dimensions

#### 3.1 BR100-045 Dimensions

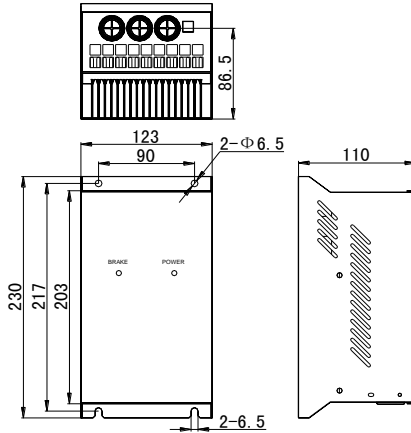


Figure 3-1 BR100-045 Overall Dimensions

#### 3.2 BR100-160 Dimensions

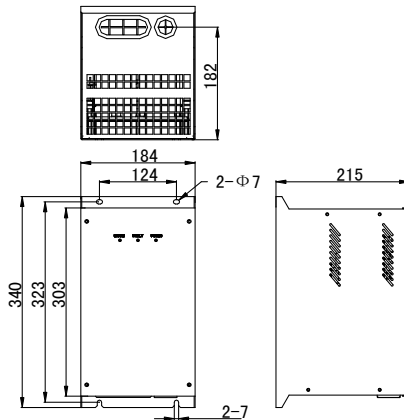


Figure 3-2 BR100-160 Overall Dimensions

### 3.3 BR100-315 Dimensions

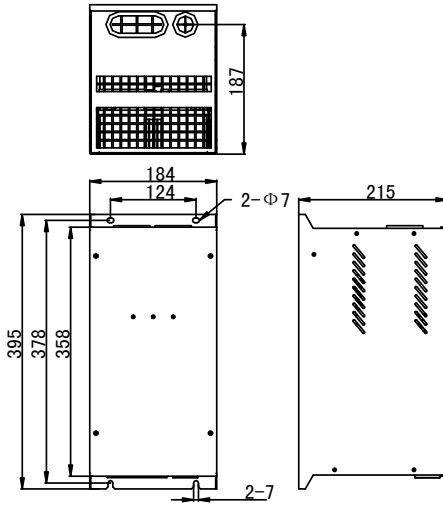


Figure 3-3 BR100-315 Overall Dimensions

### 3.4 BR100-220-6 Dimensions

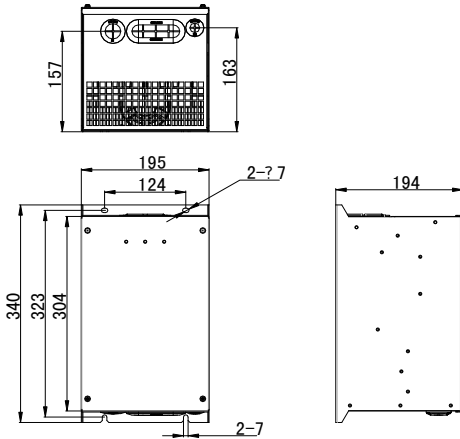


Figure 3-4 BR100-220-6 Overall Dimensions

## 4. Considerations for Installation Site

### 4.1 Considerations for Installation Site

- No water drops
- Clean and dry
- No corrosive gas and liquid
- No dust and metal particles
- Ambient temperature:  $-10^{\circ}\text{C}\sim 40^{\circ}\text{C}$
- Humidity: 20% RH $\sim$ 90% RH(no condensation)
- Firm and steady installation base
- No electromagnetic interference
- Install a cooling fan or air-conditioner to keep the ambient temperature in a maximum of  $40^{\circ}\text{C}$  if the braking unit is installed in a cabinet.

### 4.2 Installation Space

See Figure 4-1 for installation space of the braking unit.

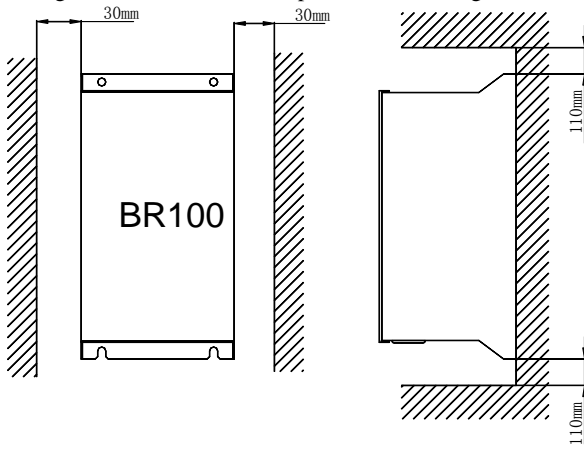


Figure 4-1 Installation Dimensions

If multi-braking units are mounted in vertical parallel, the distance should be in a minimum of 200mm, and a baffle is required for heat resistance between 2 braking units. See Figure 4-2 for installation.



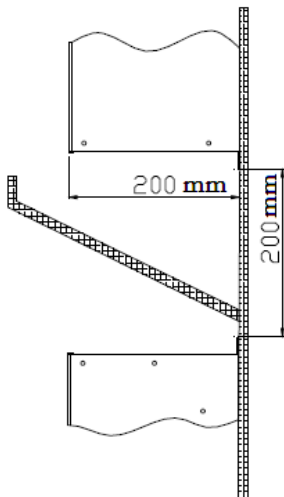


Figure 4-2 Parallel Installations for 2 Braking Units

Locate the braking unit in a place with good ventilation. A cooling fan must be fitted at appropriate location in the cabinet for heat dissipation. The braking resistor must be installed in a separate cabinet and cannot be installed with the inverter, braking unit or other devices because it will generate high heat. The distance between braking resistor and other devices requires more than 2 meters. Otherwise, other devices may be damaged.

## 5. Installation and Wiring

### 5.1 Assembly and Disassembly of the Front Panel

- Unscrew the front cover, and disassemble it by following the arrow direction. See Figure 5-1.

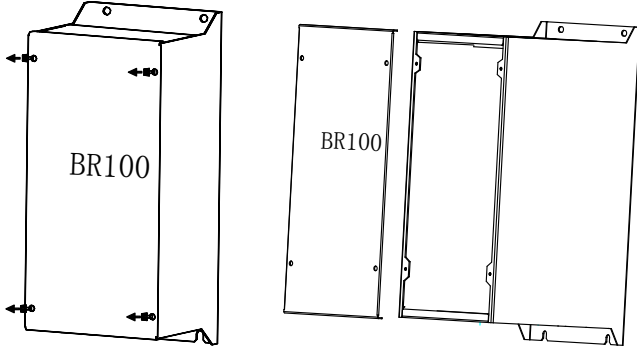


Figure 5-1 Front Cover Disassembly

- Assemble the cover in opposite direction and by opposite steps, and tighten the screws after wiring is completed. See Figure 5-2.

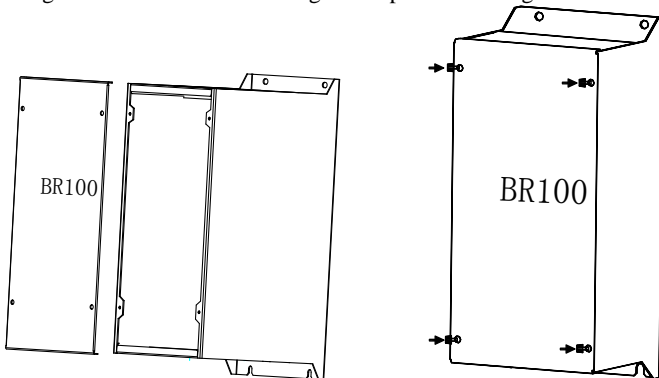


Figure 5-2 Front Cover Assembly

## 5.2 Main Circuit Terminals

- BR100-045 Main circuit terminal as shown in Figure 5-3

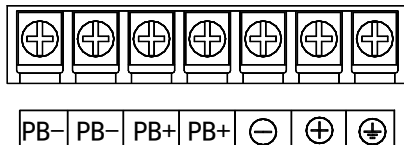


Figure 5-3 Main Circuit Terminal Block of BR100-045

- BR100-160 Main circuit terminal as shown in Figure 5-4

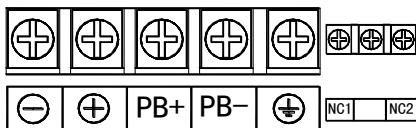


Figure 5-4 Main Circuit Terminal Block of BR100-160

- BR100-315 Main circuit terminal as shown in Figure 5-5

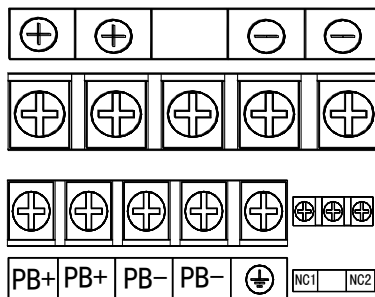


Figure 5-5 Main Circuit Terminal Block of BR100-315

- BR100-220-6 Main circuit terminal as shown in Figure 5-6

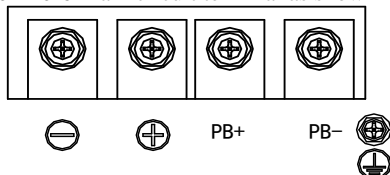


Figure 5-6 Main Circuit Terminal Block of BR100-220-6

Table 5-1 Functions of Main Circuit Terminals

Terminal Symbol	Terminal Name	Function
⊕	DC bus ⊕	Connect to inverter DC bus ⊕
⊖	DC bus ⊖	Connect to inverter DC bus ⊖
PB+	Wiring terminal of braking resistor	Connect to one end of braking resistor
PB-	Wiring terminal of braking resistor	Connect to one end of braking resistor
⊕	Grounding terminal of braking resistor	Connect to the ground on-site
EA, EC	Fault output terminal of relay	Connect to electric system protection circuit, cut off the power when faults occur. Normal: Off      Fault: On

### 5.3 Connecting Cable

Since all braking units and braking resistors work at a high voltage (>400VDC) in a non-continuous working status, please select applicable cables. See Table 5-2 for specifications of main circuit cable, and take the cable which meets the insulation and cross-section requirements.

Table 5-2 Cable Selection for Braking Unit and Braking Resistor

Model No.	Average Brake Current $I_{av}(A)$	Peak Brake Current $I_{max}(A)$	Cross-section of Copper Cable (mm <sup>2</sup> )
BR100-045	45	75	6
BR100-160	75	150	10
BR100-315	120	300	16
BR100-220-6	120	200	16

Soft cable possesses a better flexibility, so copper cable, soft heat-proof cable or flame-proof cable is suggested because the cable may contact the equipment with high temperature. The distance between braking unit and inverter shall be <2m. Otherwise, the cable on DC side shall be twisted and shielded with magnetic ring to reduce radiation and induction.

See Figure 5-7 for the cable length between braking unit and braking resistor, inverter and braking unit.

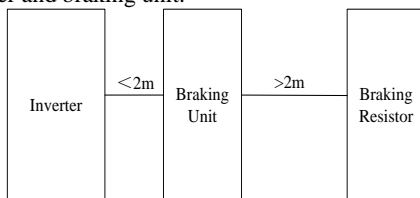


Figure 5-7 Cable Length

## 6. Selection of Braking Unit

The braking unit is an electric device designed for short-time and intermittent work, which is with a limited working capacity when under big current for a long time. Proper selection can protect braking unit from damage caused by high heat due to over-current.

The braking unit is selected based on  $I_{av}$  (its average braking current) and  $I_{max}$  (peak braking current). The value of  $I_{av}$  is in direct proportion to the current of braking unit working continuously for a long time.  $I_{max}$  refers to the maximum current of braking unit. To ensure normal work of braking unit, the peak current of braking unit  $< I_{max}$ , and  $I_{max} * D < I_{av}$

### 6.1 Defining the Peak Brake Current $I_{max}$

The peak brake current is the brake current of braking unit to ensure normal work of system and sufficient brake torque of load.

a. Under general circumstances, if the braking torque required is the same as rated torque of motor, for 380V speed control system:

$$I_{max} \approx \text{motor power rating (kW)}$$

b. After braking resistor is selected, the current can be achieved by following formula:  $I_{max} \approx 700 / \text{braking resistor } (\Omega)$

### 6.2 Defining the Average Brake Current $I_{av}$

a. Define the brake duty ratio  $D$ ,  $D = \text{brake duration} / \text{brake period} * 100\%$ .

Since the brake duty ratio  $D$  varies with different loads,  $D$  can be defined based on actual operation of governor. If load cannot be determined, please take following empirical values as reference:

Elevator	$D$	= 10-15%
Oil Pump	$D$	= 10-20%
Winding	$D$	= 50-60%
Centrifuge	$D$	= 5-20%
Tower crane(>100 meters high)	$D$	= 20-40%
Load with occasional brake	$D$	= 5%
Others	$D$	= 10%

b. Formula for calculating the average brake current  $I_{av}$ ,

$$I_{av} = D * I_{max}$$

Thereafter, please refers to the value of  $I_{av}$  and  $I_{max}$  to select the exact model of braking unit.

## 7. Braking Resistor

User can choose different resistance and power ratings based on real needs (But the resistance cannot be less than the minimum brake resistance.) The braking resistor should be selected based on motor power ratings, and it could vary with system inertia, deceleration time, and potential energy load. The greater inertia is, the shorter deceleration time is, and the bigger the brake duty ratio  $D$  will be, then the braking resistor should be with bigger power rating and smaller resistance.

### 7.1 Resistance Selection of Braking Resistor

Braking resistor almost absorbs all regenerative energy of motor at brake.

Formula:  $U^2/R=P_b$

$U$ — Brake voltage of system stable brake

(Varies with models. For 380V, it is 700V; For 660V, it is 1140V)

$P_b$ — Brake Power

### 7.2 Power Selection of Braking Resistor

Theoretically, the power of braking resistor and brake power are in accordance with each other, but it has to derate by 70% in practice.

Formula:  $0.7*P_r=P_b*D$

$P_r$ —Resistor Power

$D$ —Brake Duty Ratio

(The ratio of regenerative energy in the whole working process )

Elevator	$D$	= 10-15%
Oil Pump	$D$	= 10-20%
Winding	$D$	= 50-60%
Centrifuge	$D$	= 5-20%
Tower crane(> 100 meters high)	$D$	= 20-40%
Load with occasional brake	$D$	= 5%
Others	$D$	= 10%

### 7.3 Considerations for Installation

- Firm and steady installation base
- Install a cooling fan or air-conditioner to keep the ambient temperature in a maximum of 40 °C if the braking unit is installed in a cabinet.

- Install the braking resistor on the top if it is installed with other devices in the same cabinet.
- Choose heat-proof cable since temperature of braking resistor will be  $> 150^{\circ}\text{C}$  in the process of brake.
- To avoid risk of burn, maintenance can only be conducted after braking resistor cooled down.
- The power of braking resistor should be selected based on appropriate is calculation on real application needs.

## 8. Operation Project

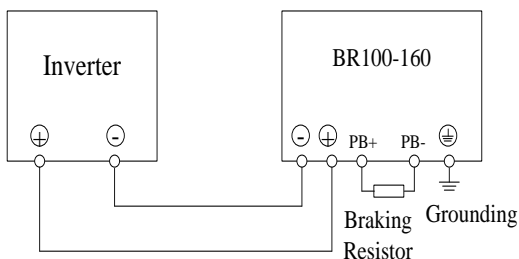
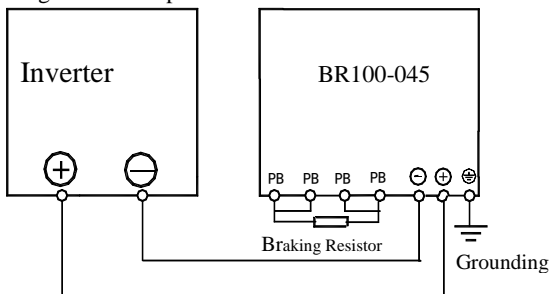
User can select braking units with the brake voltage of 395V, 420V, 675V, 720V or 1135V based on real requirement and inverter model. As shown in Table 8-1.

Table 8-1 Brake Voltage Options

Input of Inverter	Brake Voltage Options
3-phase 220VAC	395V (Default), 420V
3-phase 380VAC	675V (Default), 720V
3-phase 660VAC	1140V (Default)

- Check the parameters of applicable inverter and motor, and select the proper braking unit.
- Select applicable power cable, and connect two power cables in parallel when under great current.
- Brake indicator is flashing which indicates that the braking unit is in normal working status.

Wiring of single inverter operation:





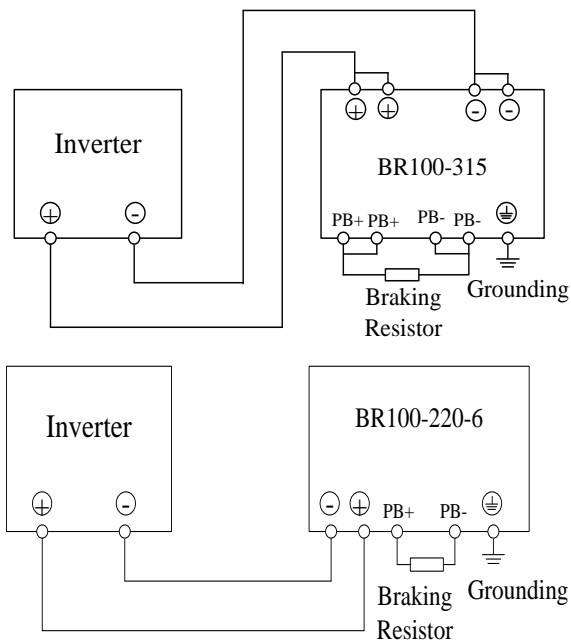


Figure 8-1 Wiring of single inverter operation

## 9. Troubleshooting

Maintenance, inspection, and replacement of accessories can only be performed by authorized and qualified personnel.

Table 9-1 Faults and Corrective Actions

Fault	Cause	Corrective Actions
1. Power indicator does not flash.	Wrong wiring or poor contact	Check wiring
	Frequent brake, damages components overheating.	Select another model of braking unit
2. Braking unit does not function.	Braking resistor damaged	Replace braking resistor
	Poor contact of resistor wiring	Check resistor wiring
	Improper brake voltage	Recalculate brake voltage, and replace the braking unit
3. Inverter trips overvoltage	Deceleration time of inverter is too short.	Prolong the deceleration time
	Excessive brake resistance, and insufficient energy discharge	Replace braking resistor
	Wrong selection of braking unit	Change an applicable braking unit model
	Improper wire	Replace wire
4. Brake indicator flashes before brake.	Frequent brake, overheating damages components.	Select a different model of braking unit
	Big grid fluctuation results in overvoltage of braking unit input, or brake voltage is selected too low.	Measure grid voltage, and select applicable brake voltage
5. Fault indicator flashes.	High ambient temperature	Install extra cooling fan
	Brake resistance exceeds the minimum brake resistance.	Replace the braking resistor
6. Fault indicator flashes and buzzer alarms.	Short circuit of braking resistor.	Turn the power off, check wiring of braking resistor and braking resistor
7. Braking resistor is hot when inverter stops	Excessive grid voltage fluctuation which exceeds the brake voltage of braking unit.	Recalculate brake voltage, and replace the inverter
	Improper selection of brake voltage	
8. Braking resistor overheating	Resistor power is too small	Upgrade power of braking resistor or install an extra cooling fan for braking resistor