



**TRANSISTORIZED  
INVERTER  
INSTRUCTION MANUAL**

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**BRAKE UNIT  
200V CLASS  
TYPE BU**

Thank you for choosing this Mitsubishi Transistorized inverter option unit. This instruction manual gives handling information and precautions for use of this equipment.

Incorrect handling might cause an unexpected fault. Before using the inverter, always read this instruction manual carefully to use the equipment to its optimum.

This instruction manual uses the International System of Units (SI). The measuring units in the yard and pound system are indicated in parentheses as reference values.

Please forward this manual to the end user.

### **This section is specifically about safety matters**

Do not attempt to install, operate, maintain or inspect the inverter until you have read through the instruction manual and appended documents carefully and can use the equipment correctly. Do not use the inverter until you have a full knowledge of the equipment, safety information and instructions.

In this instruction manual, the safety instruction levels are classified into "WARNING" and "CAUTION".



Assumes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.



Assumes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.

Note that even the CAUTION level may lead to a serious consequence according to conditions. Please follow the instructions of both levels because they are important to personnel safety.

## **SAFETY INSTRUCTIONS**

### 1. Electric Shock Prevention

#### **WARNING**

- While power is on or when the inverter is running, do not open the front cover. You may get an electric shock.
- Do not run the inverter with the front cover removed. Otherwise, you may access the exposed high-voltage terminals or the charging part of the circuitry and get an electric shock.
- If power is off, do not remove the front cover except for wiring or periodic inspection. Doing so can cause an electric shock because the inverter connected to the brake unit is charged internally.
- Before starting wiring or inspection, check for residual voltages with a meter etc. more than 10 minutes after power-off.
- Any person who is involved in wiring or inspection of this equipment should be fully competent to do the work.
- Always install the option unit before wiring. Otherwise, you may get an electric shock or be injured.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise, you may get an electric shock.

### 2. Fire Prevention

#### **CAUTION**

- Mount the brake resistor on an incombustible surface. Installing the inverter directly on or near a combustible surface could lead to a fire.
- Use the alarm signal of the brake unit to switch power off. Otherwise, a brake transistor failure or the like can overheat the brake resistor abnormally, causing a fire.
- Do not connect a resistor directly to the DC terminals P(+), N(-). This could cause a fire.

### 3. Injury Prevention

#### **CAUTION**

- Apply only the voltage specified in the instruction manual to each terminal to prevent damage etc.
- Ensure that the cables are connected to the correct terminals. Otherwise, damage etc. may occur.
- Always make sure that polarity is correct to prevent damage etc.
- While power is on and for some time after power-off, do not touch the brake resistor as it is hot and you may get burnt.

#### 4. Additional instructions

Also note the following points to prevent an accidental failure, injury, electric shock, etc.

##### (1) Transportation and installation

### CAUTION

- When carrying products, use correct lifting gear to prevent injury.
- Do not stack the brake resistor boxes higher than the number recommended.
- Ensure that installation position and material can withstand the weight of the inverter. Install according to the information in the Instruction Manual.
- Do not operate if the brake resistor is damaged or has parts missing.
- Do not stand or rest heavy objects on the brake resistor.
- Check the brake resistor mounting orientation is correct.
- Prevent screws, wire fragments, other conductive bodies, oil or other flammable substances from entering the brake resistor.
- Do not drop the brake resistor, or subject it to impact.

##### (2) Operation

### WARNING

- Do not modify the equipment.

##### (3) Emergency stop

### CAUTION

- Provide a safety backup such as an emergency brake which will prevent the machine and equipment from hazardous conditions if the inverter and brake unit fail.

##### (4) Maintenance, inspection and parts replacement

### CAUTION

- Do not carry out a megger (insulation resistance) test on the brake resistor.

##### (5) Disposing of the brake resistor

### CAUTION

- Treat as industrial waste.

##### (6) General instructions

Many of the diagrams and drawings in this instruction manual show the inverter without a cover, or partially open. Never operate the inverter like this. Always replace the cover and follow this instruction manual when operating the inverter.

## Brake Unit <Type BU>

The brake unit is used in applications that require large brake torque, e.g. when a motor is run by a 200V class transistorized inverter, when the motor is rotated by a load, or when sudden deceleration is necessary.

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# TYPE BU 200V CLASS BRAKE UNITS

The brake unit is used for application which requires large brake torque for a motor operated by the inverter, for example, when the motor is rotated by a load, or when the motor requires sudden deceleration.

## 1. EXTERNAL VIEW

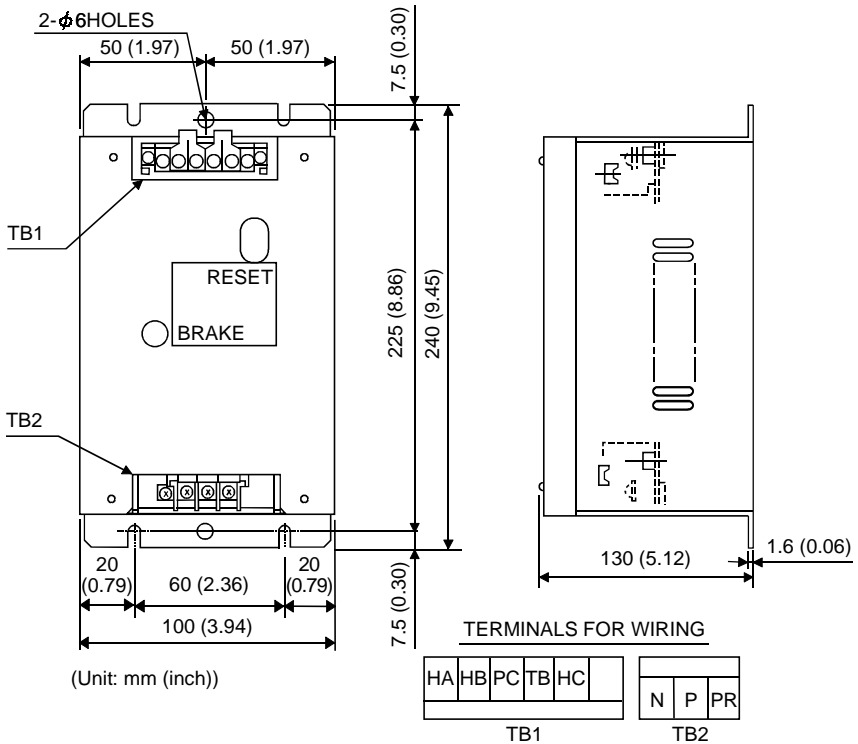


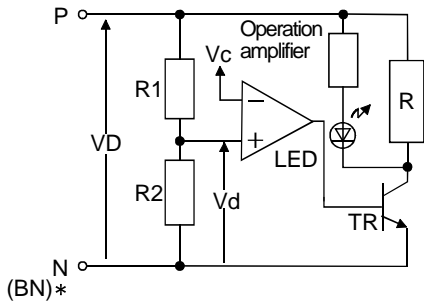
Fig. 1 External View

## 2. SPECIFICATIONS

Line voltage:	Less than 400V DC
Operating voltage:	360V DC $\pm$ 3V
Braking torque:	50% 30s
Ambient temperature:	-10°C to +50°C (14°F to 122°F)
Painting color:	Munsell 5Y 8/1 (50% luster)
Approximate weight:	2.0kg (4.4lbs)

## 3. CIRCUIT CONFIGURATION

The voltage  $V_D$  across input terminals P and N (BN)\* is normally approximately 300V. However, when the motor is rotated by load or makes sudden deceleration, the voltage rises due to regenerative power. When  $V_D$  reaches 360V, the voltage  $V_d$  divided by voltage divide resistor R1 and R2 becomes higher than the reference voltage  $V_c$  and the operational amplifier causes the transistor TR to conduct. Accordingly, the regenerative power is consumed through the discharging resistor R, thereby causing the motor to generate large brake torque.



**Fig. 2 Brake Unit Circuit Configuration**

*\*BN for single phase input inverter*

## 4. RATING AND BRAKE TORQUE

The 200V class brake units BU-1500 to 15K are options, which fully exhibit the regenerative braking performances of inverters, and are used in combination with the discharging resistors (refer to page 5 ). The 200V class brake units are available in three types. Although the rated braking torque is indicated 50% 30s, 100% 30s is also possible depending on the combination with the motor. Make selection from the following selection table.

Class	Motor Capacity kW (HP)	0.75 (1)	1.5 (2)	2.2 (3)	3.7 (5)	5.5 (7.5)	7.5 (10)	11 (15)	15 (20)	22 (30)	30 (40)	37 (50)	45 (60)	55 (75)
	Braking Torque													
200V class	50% 30s	BU-1500		BU-3700		BU-7.5K		BU-15K		2 × BU-15K*		3 × BU-15K*		4 × BU-15K*
	100% 30s	BU-1500	BU-3700	BU-7.5K		BU-15K		2 × BU-15K*		3 × BU-15K*	4 × BU-15K*	5 × BU-15K*	6 × BU-15K*	7 × BU-15K*

\*: Brake units are connected in parallel. (Refer to Fig.9.)

**Table 1 Brake Unit Selection Table**

## 5. DISCHARGING RESISTOR BURNING PREVENTION CIRCUIT

If the torque higher than the rating is kept generated, the internal thermal relay of brake unit is tripped. This activates the overvoltage protection circuit of inverter and the motor comes to a stop after coasting. If it is desired to fetch the tripping of thermal relay to the outside of brake unit as an alarm signal, remove the short-circuit conductors located between the terminals HB and PC and between TB and HC of TB1, mount a short-circuit conductor between PC and TB, and then use terminals HA and HC or HB and HC.

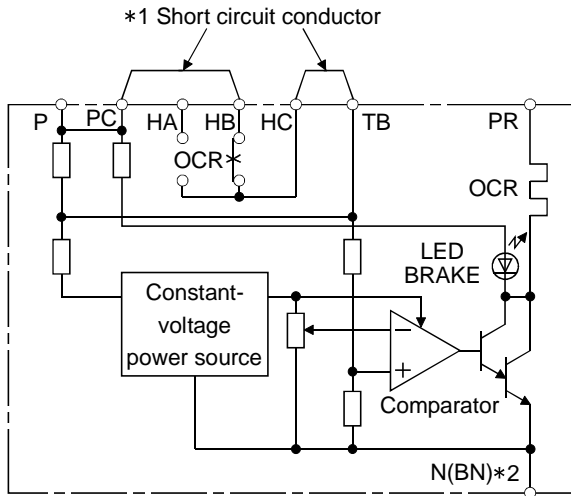
When the thermal relay is tripped, the circuit is closed across HA and HC and opened across HB and HC. In this case, the motor may not stop, resulting in the overheating of discharging resistors. To prevent this, therefore, take measures, e.g. turn off the input power of inverter. When the thermal relay has been tripped, perform reset by use of the RESET button and also re-set the deceleration time of motor to a longer value.



**⚠ WARNING**

● When the alarm signal is output due to a thermal relay trip, switch off the inverter's input power. It can prevent the discharging resistor from becoming overheated and cause a fire should the brake unit fail (the transistor be damaged).

## 6. INTERNAL CIRCUIT DIAGRAM



**Fig. 3 Internal Circuit Diagram**

\*1: Short-circuit conductors are factory-set at the above positions.

\*2: BN for single phase input inverter.

## 7. EXTERNAL CONNECTION DIAGRAM

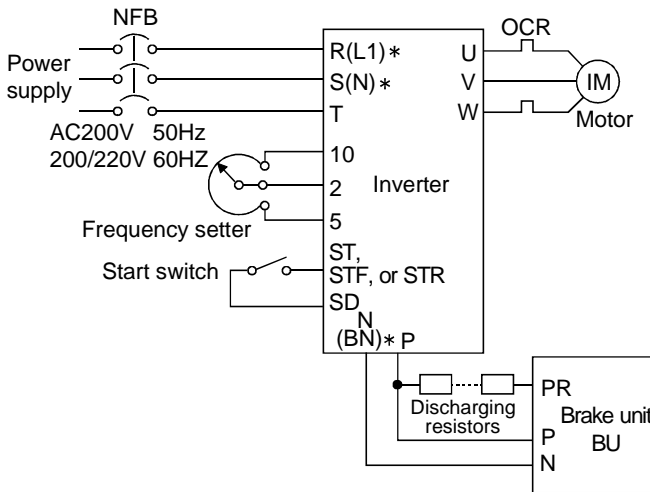


Fig. 4 External Connection Diagram

\*L1, N and BN for single-phase input inverter.

## 8. HANDLING INSTRUCTIONS

- When installing the brake unit, always mount it on a vertical surface in a vertical direction since mounting it horizontally or on a horizontal surface will reduce the heat dissipation effect.

### (1) Discharging resistors

1) Use the discharging resistors shown in Table 2. When installing the discharging resistors, select a well-ventilated place. The use of resistors having resistance and capacity lower than the specified may result in the failure of brake unit or the overheating of resistors. Therefore, caution should be exercised.

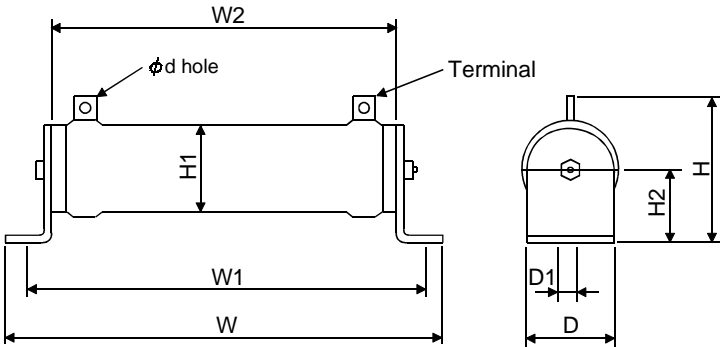
Since the discharging resistors are separately available, arrange or prepare them separately.

Brake Unit	Discharging Resistor	Resistor Type
BU-1500	300W, 50Ω, 1pc.	GZG300W-50Ω
BU-3700	300W, 10Ω, 3pcs. connected in series	GRZG200-10Ω
BU-7.5K	450W, 5Ω, 4pcs. connected in series	GRZG300-5Ω
BU-15K	600W, 2Ω, 6pcs. connected in series	GRZG400-2Ω

Table 2 Combinations of Discharging Resistors for Brake Unit

**⚠ CAUTION**

- Use the resistor of the specified resistance value and capacity. Not doing so can cause the brake unit to fail or the resistor to overheat.
  - The surface of the discharging resistor is not insulated. Since a high voltage is applied to its surface, install the discharging resistor at least 5mm (0.20inches) away.
- Because of heat dissipation, provide clearances of at least 60mm (2.36inches) between the discharging resistors or between the discharging resistor and panel.



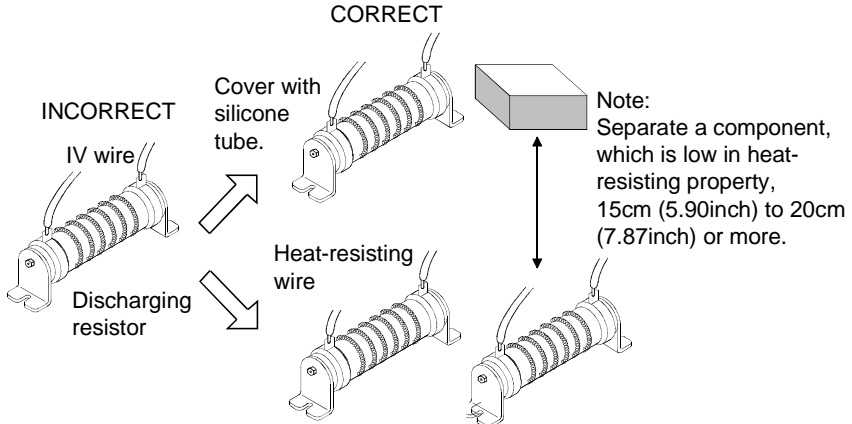
Unit: mm (inch)

Type	W	W1	W2	H	H1	H2	D	D1	d
GZG300W	335 (13.19)	309 (12.17)	274 (10.79)	78 (3.07)	42 (1.65)	40 (1.57)	40 (1.57)	9.5 (0.37)	5.5 (0.22)
GRZG200	306 (12.05)	287 (11.30)	266 (10.47)	53 (2.09)	33 (1.30)	22 (0.87)	26 (1.02)	6 (0.24)	5.5 (0.22)
GRZG300	334 (13.15)	309 (12.17)	274 (10.79)	79 (3.11)	47 (1.85)	40 (1.57)	40 (1.57)	9.5 (0.37)	5.5 (0.22)
GRZG400	411 (16.18)	385 (15.16)	350 (13.78)	79 (3.11)	47 (1.85)	40 (1.57)	40 (1.57)	9.5 (0.37)	5.5 (0.22)

**Fig. 5 External View of Discharging Resistor**

2)The maximum temperature rise of discharging resistors is approximately 100°C (212°F). For wiring, therefore, use heat-resisting wires (such as fiber-glass braided wires) or cover the wires with silicone tube. Also, perform wiring so that the wires do not make contact with the resistors.

Also, separate a component, which is low in heat-resisting property, at least 15cm (5.91inches) to 20cm (7.87inches) from the resistors.



**Fig. 6 Installation of discharging resistor**

*Note: When it is inevitable to place a component, which is low in heat-resisting property, in the vicinity of the resistors, mount a temperature sensor to the resistors and change sequence so that the power of inverter input side is turned off by the temperature sensor signal.*

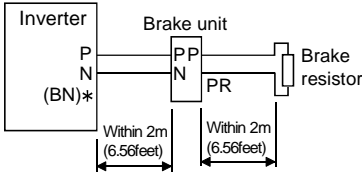
*For the temperature sensor, contact the maker.*

## (2) Wiring

1)In wiring, use 2mm<sup>2</sup> wires for the BU-1500 and 3700 and 3.5mm<sup>2</sup> wires for the BU-7.5K and 15K.

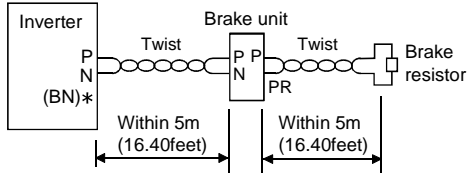
2)Minimize the wiring distance between the brake unit and inverter and also the wiring distance between the resistors and brake unit. (2m (6.56feet) or less)

3) Twist the wires when they are more than 2m (6.56feet). (Even when the wires are twisted, the wiring distances should be within 5m (16.40feet).)



\* BN for single phase input inverter

**Fig. 7 Wiring of Within 2m (6.56feet)**



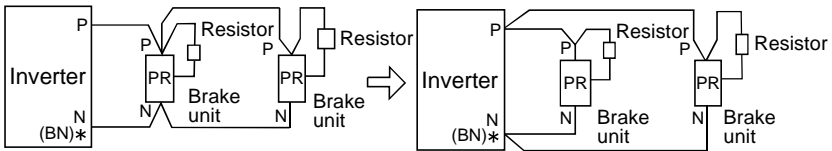
\* BN for single phase input inverter

**Fig. 8 Wiring of More than 2m (6.56feet)**

4) When the brake units are used in parallel, perform the wiring also in parallel as shown in Fig.9.

INCORRECT

CORRECT



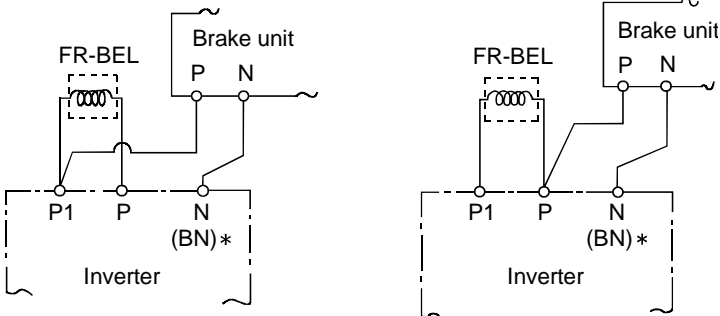
\* BN for single phase input inverter

**Fig.9 Wiring for Parallel Application**

5) When the FR-BEL power factor improving DC reactor (option) is used (the target inverter should be equipped with the terminals P, P1), make connections properly as shown below. An incorrect connection will cause the brake unit to be damaged.

INCORRECT

CORRECT



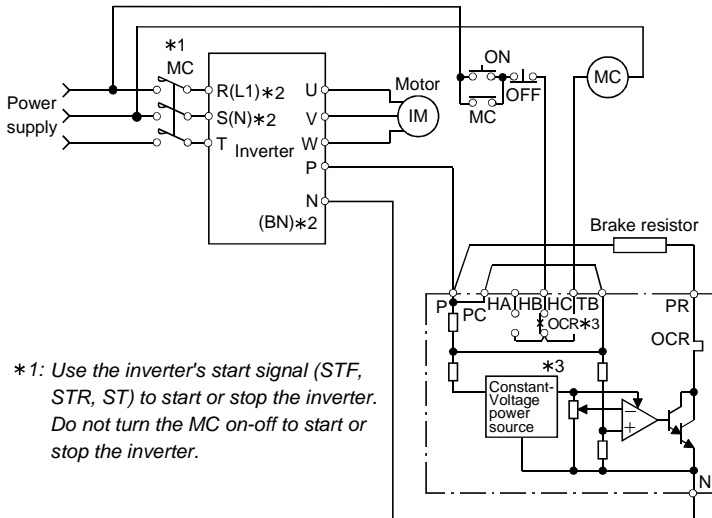
\* BN for single phase input inverter

Note: Always connect the terminal P of the brake unit to the terminal P of the inverter.

(3) Discharging resistor burning prevention at the failure of brake unit

If the transistor inside the brake unit is damaged, the burning of discharging resistors cannot be prevented by the external connection shown in Fig. 4.

Sequence, which causes the power of input side to be turned off by the trip signal of thermal relay inside the brake unit, allows the prevention of abnormal temperature rise and burning of the discharging resistors if the failure of brake unit occurs (if the transistor is damaged). Fig. 10 shows the external connection diagram.



\*1: Use the inverter's start signal (STF, STR, ST) to start or stop the inverter. Do not turn the MC on-off to start or stop the inverter.

\*2: L1, N and BN for single phase input inverter.

\*3: The contact rating of OCR is 5A for 110V AC, 2A for 220V AC (AC11 class), 0.5A for 110V DC, and 0.25A for 220V DC (DC11 class).

**Fig. 10 External Connection Diagram in Consideration of Discharging Resistor Burning Prevention at the Failure of Brake Unit**

## REVISIONS

\*The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision				
Sep., 1985	IB(NA)-66035-A	First edition				
Mar., 2001	IB(NA)-66035-B	<table border="1"><tr><td data-bbox="479 300 580 331">Addition</td></tr><tr><td data-bbox="479 336 676 368">Safety precautions</td></tr><tr><td data-bbox="479 373 647 405">Partial addition</td></tr><tr><td data-bbox="479 410 997 480">Instructions for installation of discharging resistors</td></tr></table>	Addition	Safety precautions	Partial addition	Instructions for installation of discharging resistors
Addition						
Safety precautions						
Partial addition						
Instructions for installation of discharging resistors						