

mitsubishi
VARIABLE FREQUENCY DRIVE
INVERTER



Option Instruction Manual

575 V

BRAKE UNIT
TYPE FR-BU (C)

RESISTOR UNIT
TYPE FR-BR (C)

Thank you for choosing this option unit for the Mitsubishi FREQROL transistorized inverters. This manual gives handling information and instructions for use of this option unit. Please read this manual carefully to use the equipment to its maximum capability. This manual covers the FR-BU-C brake unit and FR-BR-C resistor unit.

Brake Unit (FR-BU-C)

This option unit is used for applications where a motor driven by the FR-Z260 inverters requires large brake torque, e.g. when the motor is rotated by a load or must be decelerated suddenly.

CONTENTS

1. UNPACKING AND CHECKING	1
2. STRUCTURE	2
3. INSTALLATION	3
4. WIRING	5
5. OPERATION	10
6. SPECIFICATIONS	11
7. SELECTION	12
8. OUTLINE DRAWING	13

CAUTION

The discharge resistor used with this brake unit must be any of the following resistor units.

Do not use together the previous BU type brake unit and the FR-BU type brake unit.

Combination table

	Brake Unit Model	Resistor Unit Model
575V	FR-BU-C7.5K	FR-BR-C3.7K
		FR-BR-C7.5K
	FR-BU-C22K	FR-BR-C22K
	FR-BU-C55K	FR-BR-C55K

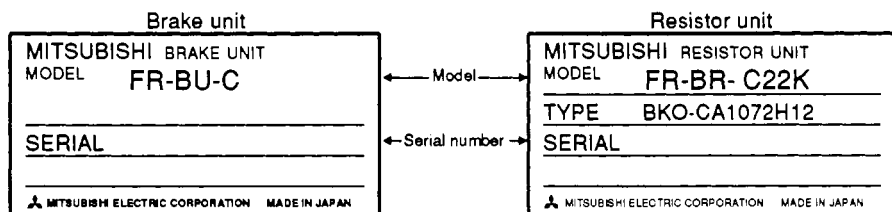
1. UNPACKING AND CHECKING

After unpacking, check the following:

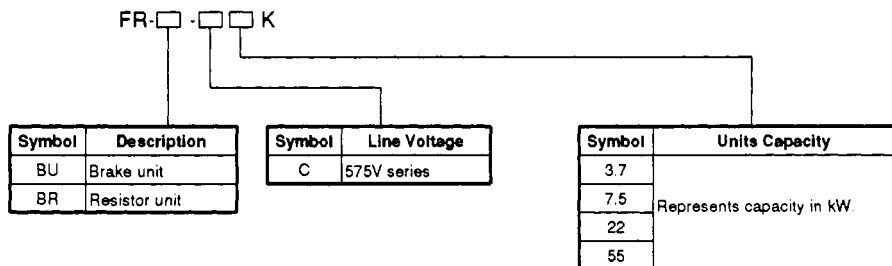
- (1) Check the rating plates on the brake unit and resistor unit covers and make sure that the models agree with your order.
- (2) Check that the units have not been damaged during transportation.

If you have any question on the above or found damage, etc., please contact your sales representative.

Rating Plates



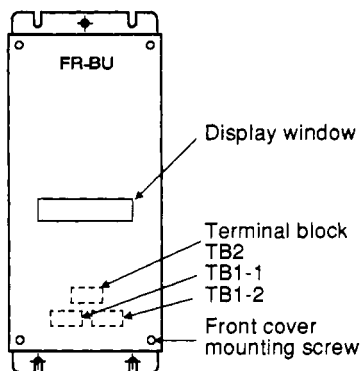
Model



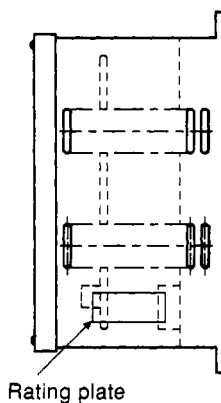
2. STRUCTURE

• Brake Unit

Front view



Right side view



Terminal block arrangement

TB1-1

R		S
---	--	---

TB1-2

C7.5K, C22K

N/-	P/+	PR
-----	-----	----

C55K

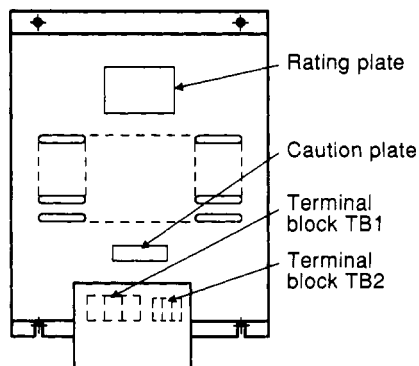
N/-	P/+	PR
-----	-----	----

TB2

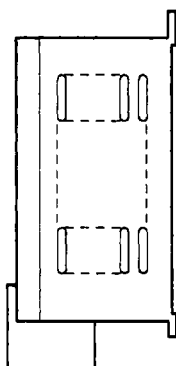
HA	HB	HC
----	----	----

• Resistor Unit

Front view



Right side view



Terminal block arrangement

TB1

PR		P
----	--	---

TB2

TH1		TH2
-----	--	-----

3. INSTALLATION

3.1 Handling

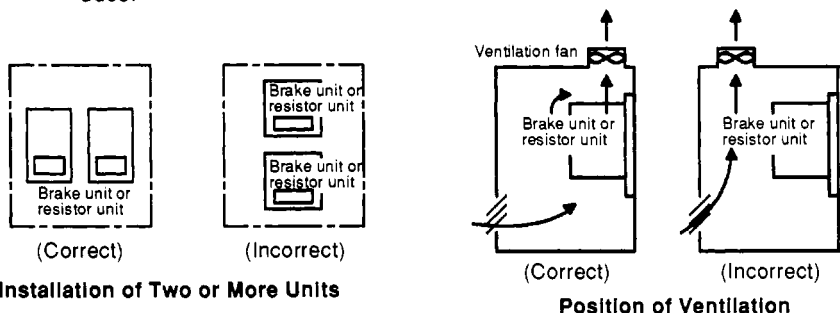
During transportation, handle the brake unit and resistor unit carefully to protect them from damage. When holding the brake unit and resistor unit, do not apply force only to their front covers.

3.2 Place of Installation

- (1) Do not install the brake unit and resistor unit where they are subjected to direct sunlight, high temperature, high humidity, oil mist, flammable gases, fluff, dust, dirt, etc. Install the unit in a clean place or inside a totally enclosed panel which does not accept any suspended matter.

Note: When the brake unit or resistor unit is installed in a panel, the cooling method and panel dimensions should be determined so that the ambient temperature of the unit is within the permissible range (as specified on page 4).

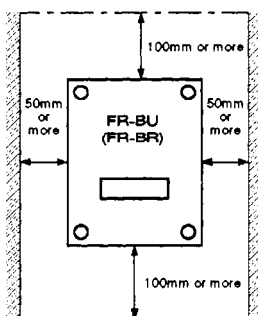
Extreme care should be taken when two or more brake units or resistor units are installed in the same panel or when a ventilation fan is mounted in the panel. If the units and/or ventilation fan is installed in an improper position, the ambient temperature of the units will rise and ventilation effect will reduce.



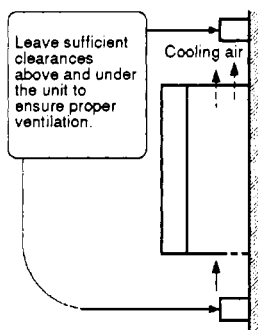
- (2) Install the brake and resistor units where they are not subjected to vibration outside of permissible range.

3.3 Installation Direction and Clearances

- (1) Install the brake unit and resistor unit on an even surface securely and vertically (so that the letters FR-BU of the brake unit and FR-BR of the resistor unit are situated at the front) with screws or bolts.
- (2) Leave sufficient clearance around the brake unit and resistor unit for adequate heat dissipation.
- (3) If they are repeatedly operated, the rear surface temperature of the brake unit and resistor unit may rise (up to about 150°C), so install the units on incombustible backplate (such as metal and earth the backplate).



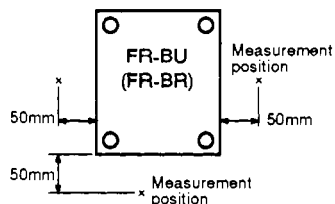
Clearances Around the FR-BU and FR-BR



Notes on Ambient Temperature

The ambient temperature of installation must not exceed the permissible value (50°C 122°F) as it greatly influences the life of the unit.

Check that the ambient temperature is within the permissible range in the positions shown on the right.



4. WIRING

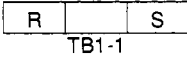
4.1 Terminals

4.1.1 Brake unit

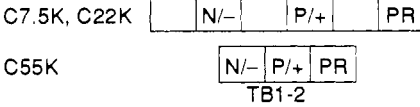
Terminal Symbol		Terminal Name	Rating	Description
Main circuit	R	AC power input terminals	575 VAC ±10% 60Hz	Terminals connected with the inverter terminals R, S
	S			
	P/+	Converter terminals	—	Terminals connected with the inverter terminals P, N Refer to p.7.
	N/-			
	PR	Resistor unit terminal		Terminal connected with the resistor unit terminal PR
Control circuit	HA	Alarm output terminals	1C contact 230VAC 0.3A 30VDC 0.3A	Output signal indicating that the protective circuit has operated. Normal...HB-HC connected, HA-HC disconnected. Alarm....HB-HC disconnected, HA-HC connected.
	HB			
	HC			

Terminal arrangement

AC power input terminal block



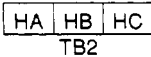
Converter terminal block



Terminal screw sizes

Model	TB1-1	TB1-2	TB2
FR-BU-C7.5K	M4	M4	M3
FR-BU-C22K	M4	M4	M3
FR-BU-C55K	M4	M5	M3

Alarm output terminal block



4.1.2 Resistor unit

Terminal Symbol	Terminal Name	Rating	Description
Main circuit P PR	Resistor unit input terminals	—	Terminals connected with the brake unit terminals P/+, PR
Control circuit TH1 TH2	Alarm output terminals	110VAC 5A 220VAC 3A	Output signal indicating that the resistor has overheated. Normal...connected Alarm...disconnected

Terminal arrangement

Resistor unit input terminal block

PR		P
----	--	---

TB1

Alarm output terminal block

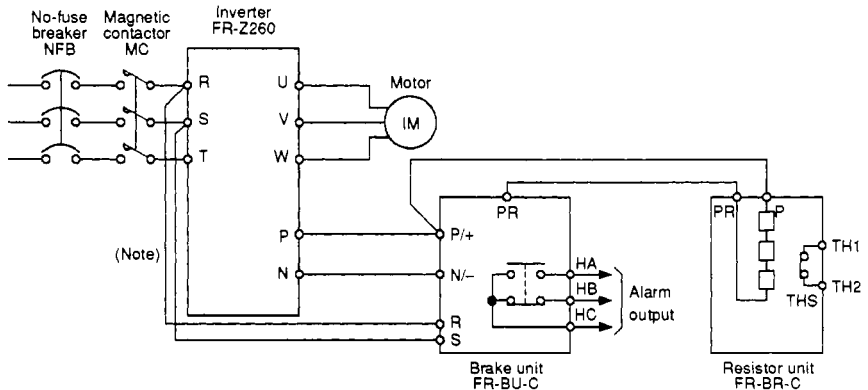
TH1		TH2
-----	--	-----

TB2

Terminal screw sizes

Model	TB1	TB2
FR-BR-C3.7K	M3	M3
FR-BR-C7.5K	M3	M3
FR-BR-C22K	M4	M3
FR-BR-C55K	M5	M3

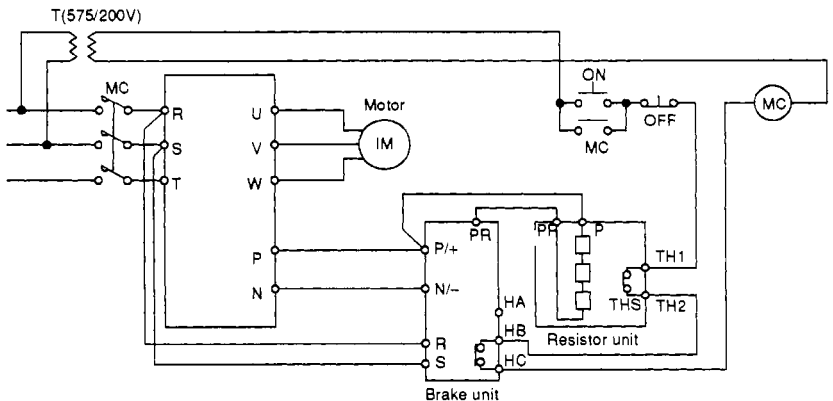
4.2 External Connection Example



Note: Connect FR-BU-C R, S with inverter R, S, supplying power to FR-BU-C control circuit.

For prevention of the discharge resistor from burning out due to brake unit fault

Design the circuit so that if the transistor in the brake unit should be damaged, an alarm signal from the brake unit or an overheat signal given by the thermal relay in the resistor unit switches off the input power supply. This prevents the temperature of the discharge resistor from rising abnormally, thereby protecting the discharge resistor from burnout. The external connection diagram is shown below.



4.3 Wiring Instructions

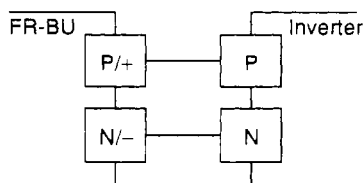
4.3.1 Recommended cable core sizes

Brake Unit Model	Resistor Unit Model	Cables	
		R-R, S-S	P-P/+, N-N/-, P/+ -P, PR-PR
FR-BU-C7.5K	FR-BR-C3.7K	2mm ²	3.5mm ²
FR-BU-C7.5K	FR-BR-C7.5K	2mm ²	3.5mm ²
FR-BU-C22K	FR-BR-C22K	2mm ²	3.5mm ²
FR-BU-C55K	FR-BR-C55K	2mm ²	5.5mm ²

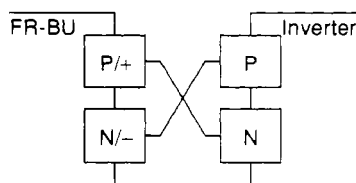
The core size of the cables used should be equal to or larger than the above indicated recommended size.

4.3.2 Instructions

- (1) Correctly connect the terminals P/+ and N/- with the inverter terminals P and N. Miswiring will cause damage to the brake unit. Check the connection before applying power to the unit.



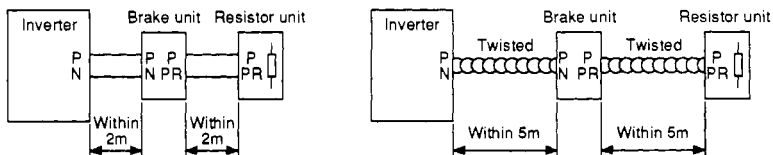
[Correct connection]



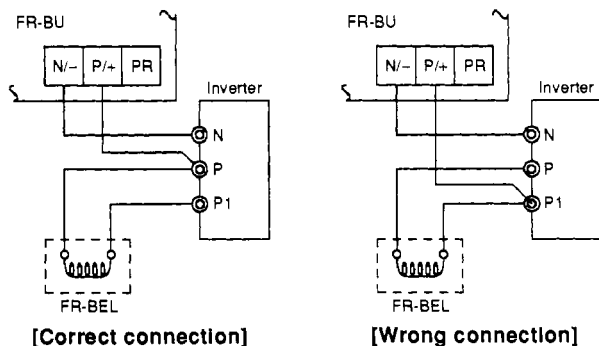
[Wrong connection]

- (2) Connect the brake unit terminals R,S with inverter terminals R,S (575VAC single phase power supply). Miswiring, such as connection with inverter terminals P, N or resistor unit terminal PR, will cause damage to the brake unit (the internal transformer may burn out).
- (3) The temperature of the resistor unit rises up to approximately 150°C. Therefore, the cables used should be heat-resistance cables (such as glass-braided cables) or covered with silicone tubes.

- (4) The cable length between the inverter and brake unit and between the resistor unit and brake unit should be as short as possible. If the cable length is longer than 2m, the wiring must be twisted. (Even when the wiring is twisted, the cable length must not exceed 5m.) The size of the cables used should be equal to or larger than the recommended size (see page 8). The different color cables twisted is recommended to prevent miswiring (ex. P....red, N....blue).










- (5) Do not allow wire offcuts to enter the unit, e.g. cover the vent hole at the top only during wiring operation.
- (6) When connecting the FR-BEL power factor improving DC reactor (option), the brake unit terminal P/+ must be connected to the inverter terminal P.



5. OPERATION

5.1 Display

7-Segments LED Display	Description	Remarks
 (0)	Displayed at power-on.	
 ,  to  ,  (1, 2 to 9, A)	Brake transistor duty is displayed during braking operation.	For description, see the table given below.
 (E)	Indicates that the brake transistor is faulty.	• Alarm output is provided.
 (F) (Note)	Indicates that braking operation has been performed in excess of permissible brake transistor duty.	<ul style="list-style-type: none"> • Alarm output is not provided. • The brake unit self-resets after sufficient cooling time has elapsed. At this time, 0 is displayed.

Note: • When this (F) is lit, the brake unit stops operating. So the overcurrent or overvoltage protective function of the inverter will be activated. To resume operation, check and remove the cause, then reset the inverter.

- Powering down and resetting the brake unit clears the brake duty data accumulated. Note that repeating reset will cause the resistor unit to overheat.
- Connecting the brake unit terminals R,S with a.c. power supply different from that of the inverter main circuit allows the alarm display, signal and the brake duty data to be retained.

Relationship between brake transistor duty during Braking Operation and LED display

Brake transistor duty	7-Segments LED Display	Remarks
0 to 1	1	When there is sufficient cooling time, the value displayed on the LED decreases.
1 to 2	2	
2 to 3	3	
...	...	
9 to 10	A	
10 and up	F	

6. SPECIFICATIONS

• Brake Unit

Model FR-BU-□		C7.5K		C22K	C55K
Input voltage		P-N	1000VDC or less		
		R-S	575 VAC±10% 60Hz		
Applicable motor capacity		Refer to p. 12.			
Braking torque		Refer to p. 12. (Braking torque depends on the motor capacity and %ED.)			
%ED		Refer to p. 12. (%ED depends on the motor capacity and braking torque.)			
Applicable controllers		Mitsubishi transistorized inverter FR-Z260 series			
I/O signals		Alarm outputs (1C contact)			
Protective functions		Resistor overheat, brake transistor fault			
Display		Brake transistor duty, Alarm code (by 7 segments LED)			
Environment	Ambient temperature	-10°C to +50°C			
	Ambient humidity	90%RH or less			
	Storage temperature	-20°C to +65°C			
	Ambience	No corrosive gases, oil mist, flammable gases, dust and dirt. Indoors.			
	Altitude, vibration	1000m or less above the sea, vibration: 5.9m/s ² (0.6G) or less (conforming to JIS C0911)			
Protective structure		NEMA1			
Cooling system		Natural air cooling			

• Resistor Unit

Resistor Unit Model	Discharging Resistor Specifications	Remarks
FR-BR-C3.7K	300w 50Ω 4S	Resistance value tolerance ±3% S: series P: parallels
FR-BR-C7.5K	300w 50Ω 4S2P	
FR-BR-C22K	300w 31Ω 4S4P	
FR-BR-C55K	300w 26Ω 4S8P	

7. SELECTION

(1) Selection of the brake unit

- 1) Select the brake unit according to the motor capacity.
- 2) If only the inverter capacity is one or more ranks higher, braking torque and %ED are as indicated below.

• Allowable %ED at 100% braking torque (short duration rating)

Motor Capacity	2.2KW	3.7KW	5.5KW	7.5KW	11KW	15KW	18.5KW	22KW	30KW	37KW	45KW	55KW
Inverter Z260	2.2K	3.7K	7.5K	15K	22K	37K	55K					
FR-BU-C7.5K(*)	30	10	—	—	—	—	—	—	—	—	—	—
FR-BU-C7.5K	—	40	20	10	—	—	—	—	—	—	—	—
FR-BU-C22K	—	—	—	85	40	20	15	10	—	—	—	—
FR-BU-C55K	—	—	—	—	—	—	90	60	30	20	15	10

Note: * Indicates the case combined with the FR-BR-C3.7K.

• Maximum braking torque (%) at 10%ED and $t_b=15$ seconds (short duration rating)

Motor Capacity	2.2KW	3.7KW	5.5KW	7.5KW	11KW	15KW	18.5KW	22KW	30KW	37KW	45KW	55KW
Inverter Z260	2.2K	3.7K	7.5K	15K	22K	37K	55K					
FR-BU-C7.5K(*)	170	100	—	—	—	—	—	—	—	—	—	—
FR-BU-C7.5K	340	200	130	100	—	—	—	—	—	—	—	—
FR-BU-C22K	—	—	—	300	200	145	120	100	—	—	—	—
FR-BU-C55K	—	—	—	—	—	—	300	250	180	150	120	100

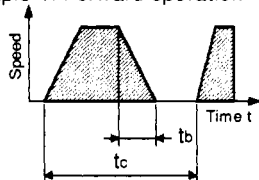
Note: * Indicates the case combined with the FR-BR-C3.7K.

$$\%ED = \frac{t_b}{t_c} \times 100 (\%)$$

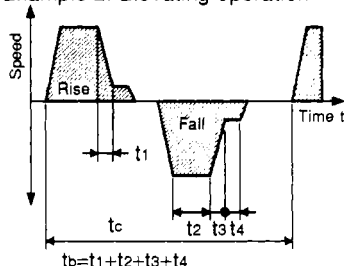
$t_b < 15$ seconds
(continuous operation time)

Regenerative load time rate
(effective duty
frequency of operations)

Example 1: Forward operation



Example 2: Elevating operation



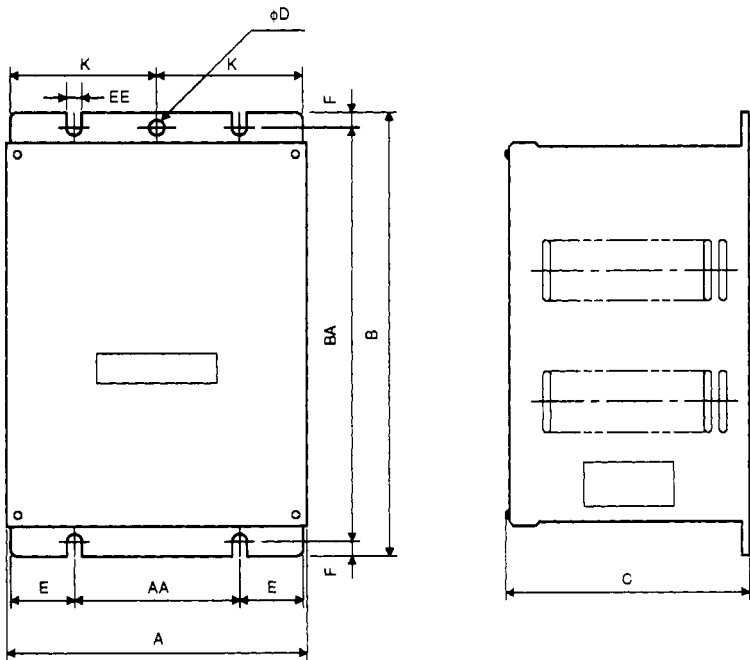
(2) Selection of the resistor unit

Brake Unit Model	Resistor Unit Model
FR-BU-C7.5K	FR-BR-C3.7K
FR-BU-C7.5K	FR-BR-C7.5K
FR-BU-C22K	FR-BR-C22K
FR-BU-C55K	FR-BR-C55K

Select the resistor unit according to the brake unit as shown in the left table.

8. OUTLINE DRAWINGS

- Brake Unit

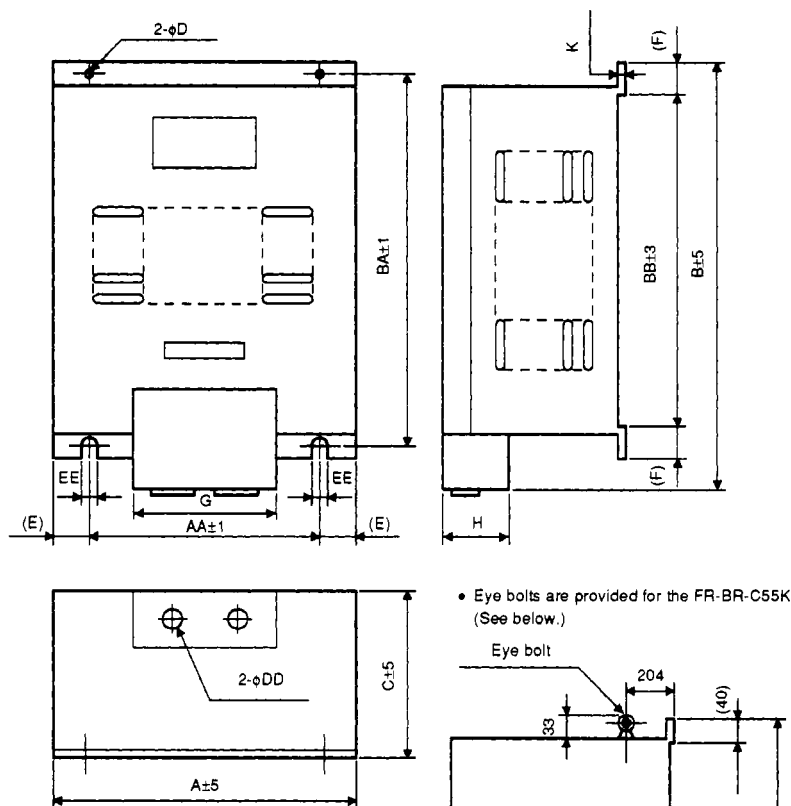


(Unit: mm)

Brake Unit Model	A	AA	B	BA	C	D	E	EE	K	F	Approx. Weight (kg)
FR-BU-C7.5K	160	90	330	315	176	6	33.5	6	78.5	7.5	5
FR-BU-C22K	160	90	330	315	176	6	33.5	6	78.5	7.5	5
FR-BU-C55K	265	145	330	315	176	—	58.5	6	—	7.5	9

Note: The vent holes are furnished at the side plates.

• Resistor Unit



• Eye bolts are provided for the FR-BR-C55K.
(See below.)

(Unit: mm)

Resistor Unit Model	A	AA	B	BA	BB	C	D	DD	E	EE	F	G	H	K	Approx. Weight (kg)
FR-BR-C3.7K	170	140	490	432	410	220	6	28	15	6	20	120	60	1.6	10
FR-BR-C7.5K	170	140	490	432	410	220	6	28	15	6	20	120	60	1.6	15
FR-BR-C22K	340	270	640	582	560	220	10	28	35	10	20	150	60	2	30
* FR-BR-C55K	480	410	720	670	620	450	12	28	35	12	40	210	120	3.2	70

Note: The vent holes are furnished at the front and side plates.

* Indicates the eye bolts are provided at two places.

REVISION RECORD

* The instruction manual number has been given on the bottom left of the back cover of this manual.

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