PAC30Z Series

Thyristor Three-phase Power Regulator

Instruction Manual

Request

Please make sure that this instruction manual is delivered to the end user.

Preface

This instruction manual is written for people involved with PAC30Z-Series wiring, installation, operation, and daily maintenance.
This instruction manual describes precautions, mounting methods, and wiring for the PAC30Z Series, so always keep it in a convenient location when handling the PAC30Z Series.

Also, be sure to observe the contents described in this instruction manual. Precautions regarding equipment and facility damage and safety precautions are listed under the following headings.

"⚠ WARNING"
◎ Precaution that may lead to injury or death if not followed
"⚠ CAUTION"
◎ Precaution that may lead to damage to equipment or facilities if not followed

"⚠ WARNING"

1. Place this device in a control panel or other location. Do not allow your body to touch the terminals during use.
2. Do not use this device as a switch.
   Even if the output is zero, the output circuit is charged through a capacitor/resistor, and there is a risk of fatal accident or serious injury due to electric shock.
3. Radiator fins can become extremely hot. Never touch them.
   Touching a radiator fin may cause burns or an electric shock.
4. Do not turn on the device when wiring. Doing so may cause an electric shock.
5. For models with a grounding terminal, be sure to ground the grounding terminal.
6. Do not touch the terminals or other charged parts while the power is on. Do not allow any foreign objects to enter the product. Be sure to turn off the power and ensure your safety before inserting tools or hands in the machine if they have accidentally entered.

"⚠ CAUTION"

1. Install a switch or circuit breaker in the external power supply circuit connected to the power supply terminal of the device as a means to disconnect the power supply. Install and fix the switch or circuit breaker in a position close to the device where it can be easily used by the operator and put a label to indicate that it is a power disconnect device for the device.
2. Securely tighten all wiring connections. Insufficient tightening may cause overheating due to contact resistance, which could lead to a burnout accident.
3. For models with a cooling fan, keep your hands and other objects away from the rotating fan blades.
4. Use this device within the rated power supply voltage and frequency.
5. Do not apply non-standard input voltage or current to the input terminals.
   Failure to comply may shorten the product life or cause damage to the device.
6. Ensure that the voltage and current of the load connected to the output terminal are within the ratings. If the ratings are exceeded, the temperature will rise, the product life may be shortened, and the device may be damaged.
7. Be sure to install the included terminal cover after wiring.
8. The user must not modify the product or use it irregularly under any circumstances.
9. To use this device safely and correctly and to maintain its reliability, please follow the precautions described in this instruction manual.

NOTE: Shimaden shall not be liable or compensate for any accident or injury caused by failure to follow the warnings and cautions in this manual.

Thank you for using the PAC30Z Series Three-phase Power Regulator.
This instruction manual provides basic instructions for using the product. Please use it correctly according to the instructions.

Request

Be sure to provide this instruction manual to the end user.

Contents

[1] Confirmation of specifications

Confirm that your product meets the ordered specifications. If you have any questions, please contact your local distributor or nearest sales office.

1.1. Code selection table

Item	Code	Specifications					
1. Series	PAC30Z	Periodic zero voltage switching control three-phase power regulator					
2. Control input		5	4 to 20 mA DC (Receiving resistance: 200 Ω) and contact signal				
		9	Other				
3. Current capacity (kVA values represent the standard rated load capacity.)			Current capacity	200 to 220 V	220 to 240 V	380 to 400 V	400 to 440 V
		018	18 A			11.8 kVA	12.5 kVA
		020	20 A	7 kVA	7.7 kVA		
		030	30 A	10 kVA	11 kVA	19 kVA	20 kVA
		045	45 A	15 kVA	16.5 kVA	29 kVA	30 kVA
		060	60 A	20 kVA	22 kVA	39 kVA	40 kVA
		090	90 A	30 kVA	33 kVA	59 kVA	60 kVA
		135	135 A	45 kVA	49.5 kVA	88 kVA	90 kVA
		200	200 A	70 kVA	77 kVA	133 kVA	140 kVA
		300	300 A	100 kVA	110 kVA	190 kVA	200 kVA
		450	450 A	150 kVA	165 kVA	290 kVA	300 kVA
4. Power supply		15-	200 to 220 V AC ± 10% 50 / 60 Hz				
		16-	220 to 240 V AC ± 10% 50 / 60 Hz				
		17-	380 to 400 V AC ± 10% 50 / 60 Hz				
		18-	400 to 440 V AC ± 10% 50 / 60 Hz				
		99-	Other				
5. Shock-prevention cover			0	Without			
			1	With *1			
6. External power adjuster			0	Without (equipped with an internal power adjuster as standard)			
			3	With (B10kΩ including scale plate, knob, and 1-m lead wire)			
			9	Others (Please consult before ordering)			
7. Operating output indicator				0	Without		
				1	With QSM001: □60 mm, 0 to 1 mA DC, 0 to 100% scale		
				2	With QSM002: □80 mm, 0 to 1 mA DC, 0 to 100% scale		
8. Remarks					0	Without	
					9	With	

NOTE: *1 For 20 to 45 A/200 to 240 V and 18 A/380 to 440 V, the main unit is shipped with a shock-prevention cover installed. For other current capacities, a shock-prevention cover is packed and shipped separately from the main unit.

1.2. Accessories check

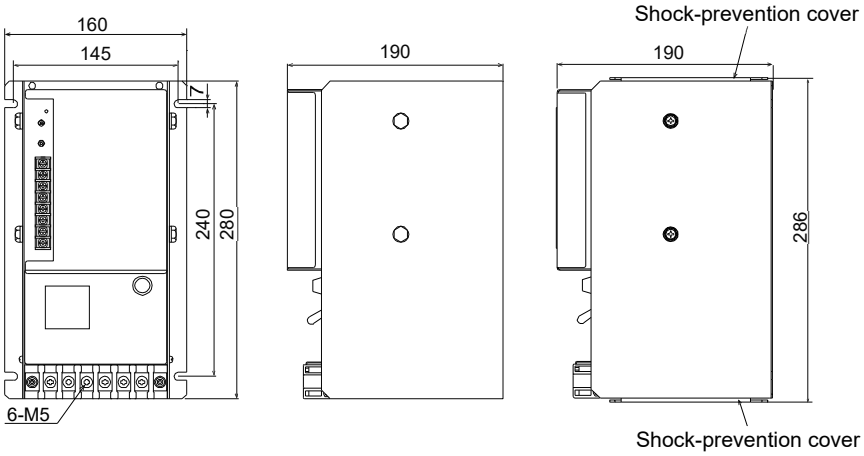
Instruction Manual	x1
Glass tube fuse	x1

NOTE: If there are any problems, missing accessories, or any other inquiry about the product, please contact your distributor or nearest sales office.

[2] External dimensions and weight

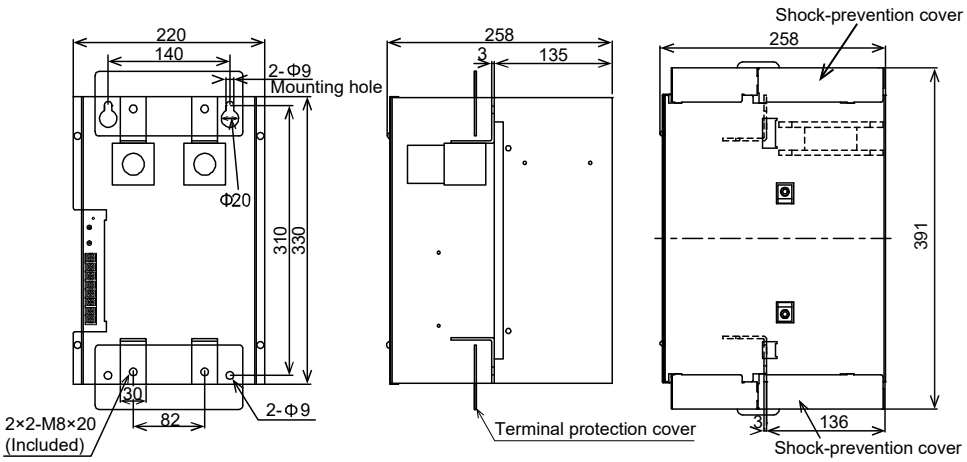
■ 20, 30, 45 A/200 to 240 V
■ 18 A/380 to 440 V

- External dimensions
  Without shock-prevention cover
  H 280 x W 160 x D 190 mm
  With shock-prevention cover
  H 286 x W 160 x D 190 mm
- Mounting hole dimensions:
  H 240 x W 145 mm
- Mass:
  Without shock-prevention cover:
  Approx. 4.9 kg
  With shock-prevention cover:
  Approx. 5.3 kg



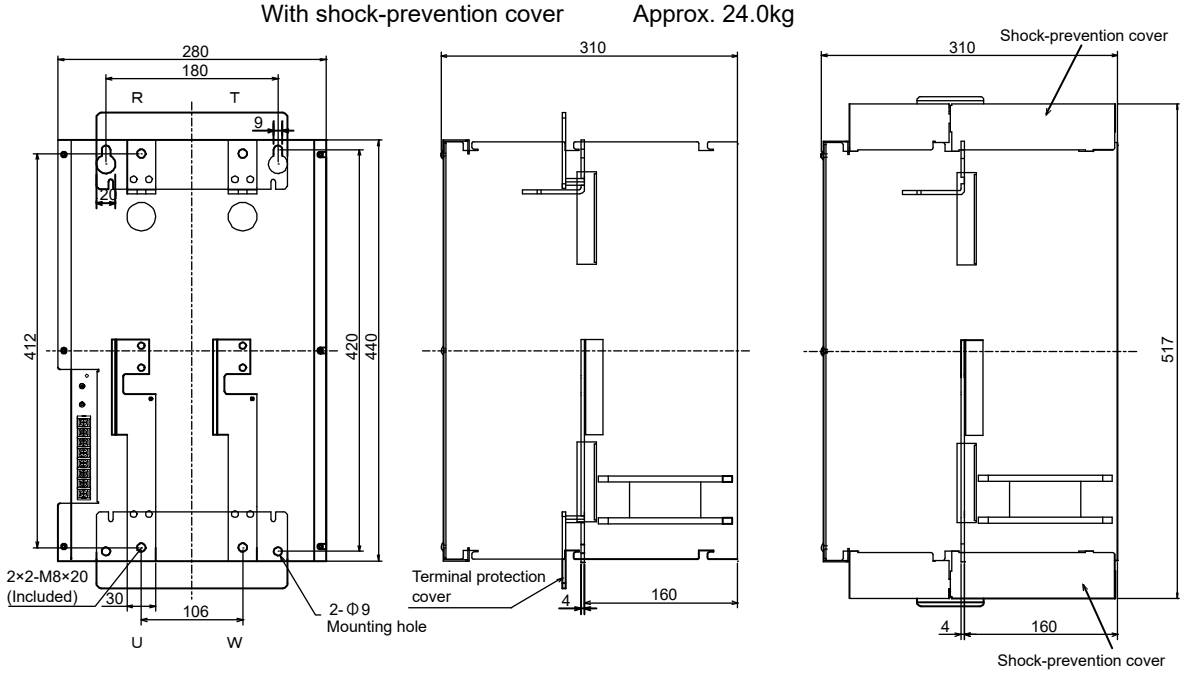
■ 60, 90, 135 A/200 to 240 V, 380 to 440 V
■ 30, 45 A/380 to 440 V

- External dimensions
  Without shock-prevention cover
  H 330 x W 220 x D 258 mm
  With shock-prevention cover
  H 391 x W 220 x D 258 mm
- Mounting hole dimensions
  H 310 x W 140
- Mass:
  Without shock-prevention cover
  Approx. 12.0 kg
  With shock-prevention cover
  Approx. 14.0kg

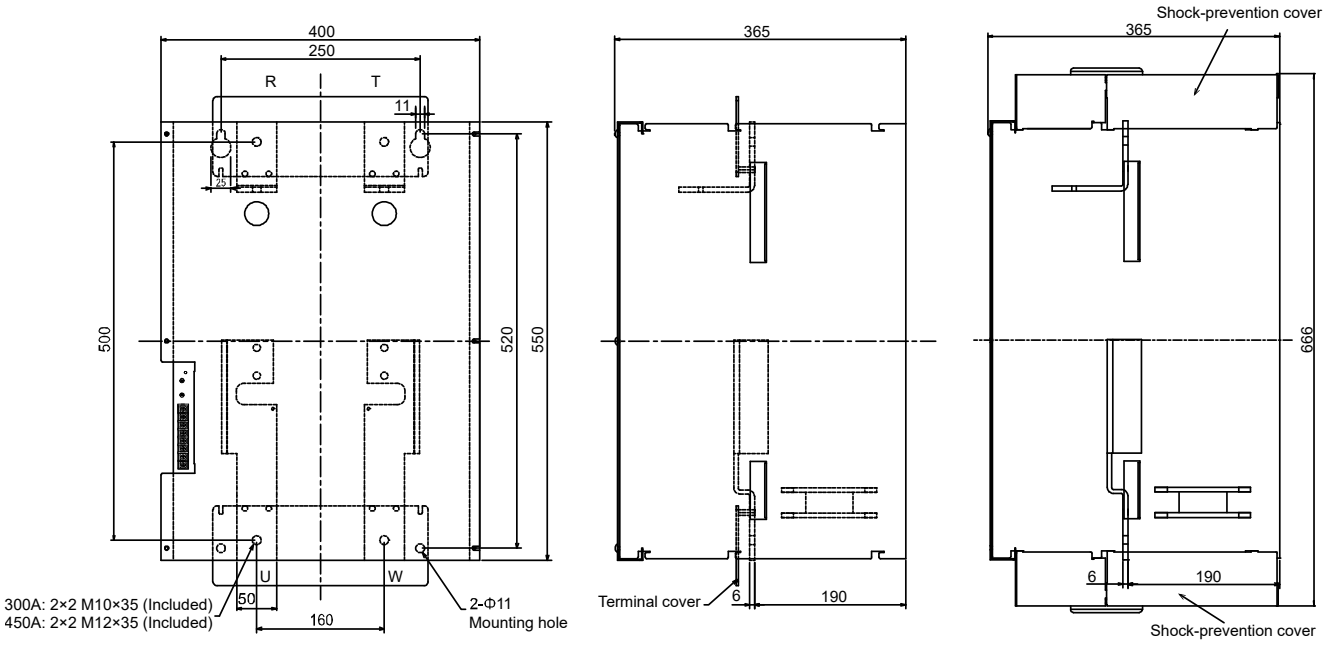


■ 200 A/200 to 240 V, 380 V to 440 V

- External dimensions: Without shock-prevention cover H440 x W280 x D310 mm
  With shock-prevention cover H517 x W280 x D310 mm
- Mounting hole dimensions: H 420 x W 180
- Mass: Without shock-prevention cover Approx. 22.0kg
  With shock-prevention cover Approx. 24.0kg



- 300, 450 A/200 to 240 V, 380 to 440 V
- External dimensions: Without shock-prevention cover H550 x W400 x D365 mm
  With shock-prevention cover H666 x W400 x D365 mm
- Mounting hole dimensions: H520 x W250 mm
- Mass: 300 A / Without shock-prevention cover Approx. 39.0kg
  With shock-prevention cover Approx. 41.0kg
  450 A / Without shock-prevention cover Approx. 30.0kg
  With shock-prevention cover Approx. 32.0kg

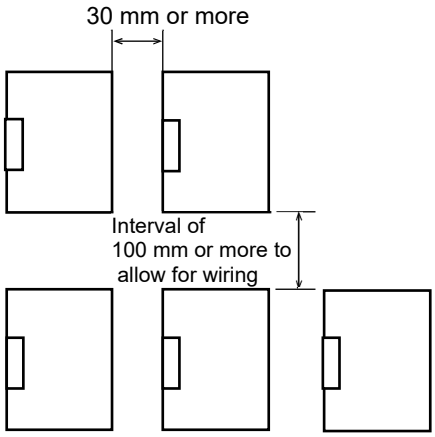


[3] Mounting

- To increase the cooling effect, mount this device vertically.
  Use this device at 70% or less of the rated current if it is unavoidable to mount it in a non-vertical position.
- Pay attention to rises in temperature in the installation location (inside the control panel). If necessary, install a ventilation fan to keep the ambient temperature within the range of -10 to 50° C.
- This device has a built-in cooling fan. Be careful not to allow dust or debris to enter it.

3.1. Mounting interval

When mounting more than one unit of this device, ensure that the power supply side (upper part) and the load side (lower part) are at least 100 mm apart from each other to allow for wiring work, and that the effect of heat on the lower unit is minimized.



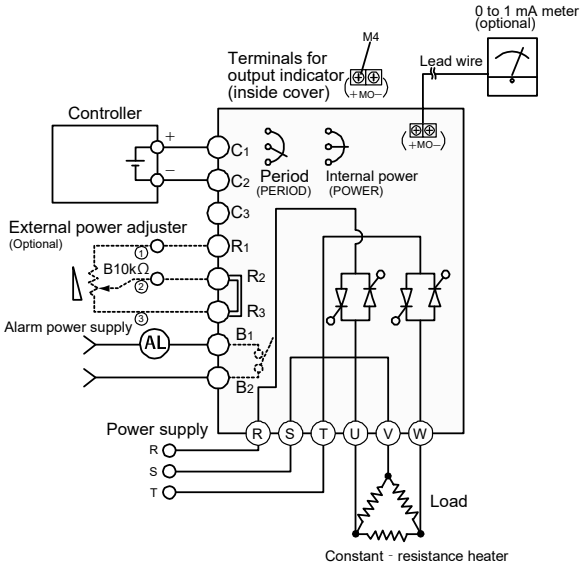
[4] Wiring diagram and terminal layout

For wiring, refer to the following wiring examples.

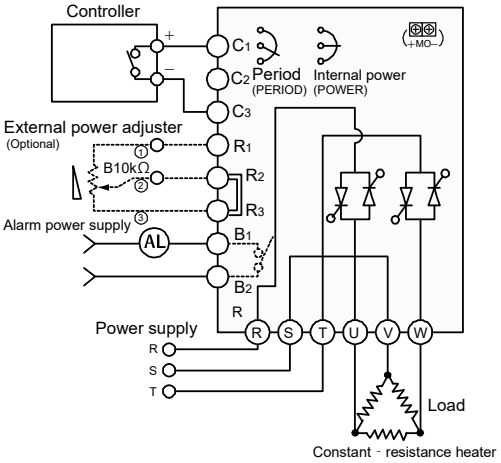
[Wiring examples]

■ 20, 30, 45 A/200 to 240 V
18 A/380 to 440 V

● For current input

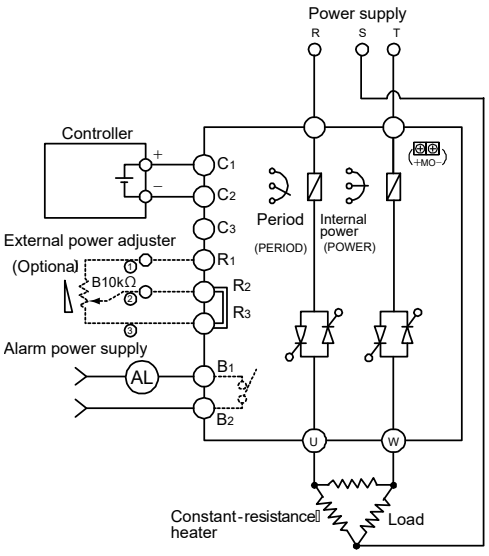


● For contact input

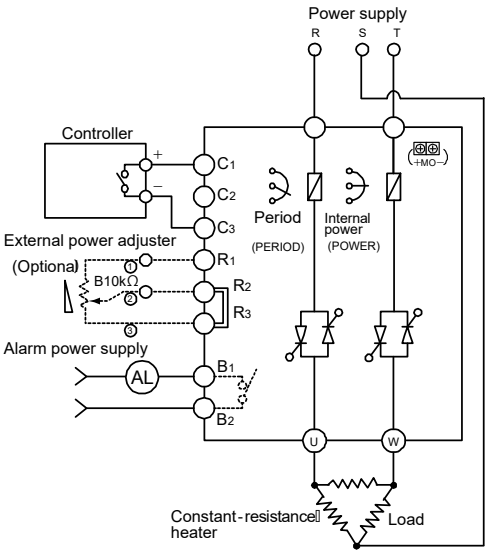


■ 60, 90, 135, 200, 300, 450 A/200 to 240 V, 380 to 440 V
30, 45 A/380 to 440 V

● For current input



● For contact input



Terminal layout

C1 ○ (+) : Positive input terminal for control signal

C2 ○ (-) : Negative input terminal for control signal

C3 ○: Output for short circuit between C3 and C1 (contact signal input)

R1 ○: Connection terminal for external power adjuster #1

R2 ○: Connection terminal for external power adjuster #2

R3 ○: Connection terminal for external power adjuster #3

B1 ○
B2 ○ Contact signal output for rapid fuse blow or thyristor overheat

4.1. Wiring for input signals

- This device can be used for either contact input or current signal input. Select either of these signals and perform wiring.

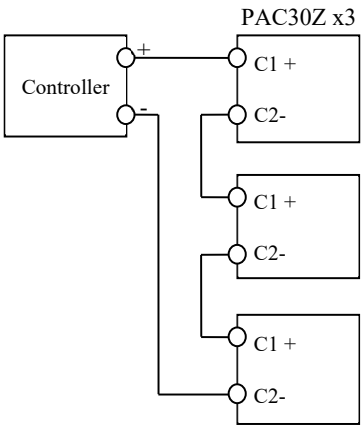
4.1.1. Contact input

- Connect a contact signal from a controller or other device to terminals C1 to C3.
- When there is a short-circuit between terminals C1 and C3, power is supplied to the load. When they are open, the power supply is stopped.

4.1.2. Current input

- Connect a control output signal current from a controller or other device to terminals C1 and C2.
- Terminal C1 is positive (+) and terminal C2 is negative (-).
- The input resistance of this device is 200 Ω (for 4 to 20 mA input). Check the permissible load resistance of the controller or other device to connect before wiring.
- The figure on the right shows the wiring for connecting multiple units of this device to a single controller.
- The input resistance of this device is 200 Ω. Therefore, when three units are connected, the total input resistance is 600 Ω.

Wiring example for current input



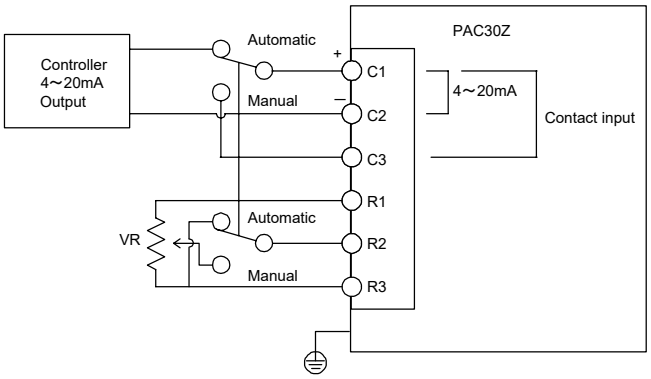
4.2. Power supply and load wiring

- When performing the power supply and load wiring, check the rated power supply voltage.
  For the load wiring, there are three wiring methods: delta connection, star connection and v-connection.
  This device supports all of these wiring methods.

4.2.1. Ground wiring

- In principle, connect the ground wire through this device's mounting screw to the connected device.
  Be sure to connect the ground wire to the connected device.
  If the ground wire needs to be extended, it is recommended to use a wire thickness of approximately 7 mm^2 or less.

Wiring example for automatic/manual switching



* As for the grounding terminal, use a device-mounting screw location and tighten the ground wire together with the screw.
For details on the mounting screw location, refer to "[12] Ground cable routing path for rapid fuse type."

* Attach the ground cable to the mounting hole on the lower left of the device.

4.3. Wiring for automatic/manual switching

- In automatic operation, the control volume is determined by the output signal of the controller (the external power adjuster does not function). In manual operation, the control volume is determined by the setting of the external power adjuster.

4.4. Wiring for the external power adjuster (optional)

- This device is equipped with an internal power adjuster as standard. However, you can install an external power adjuster as an option.
  To use an external power adjuster, turn the internal power regulator clockwise to Max, remove the short connection piece (short-circuit strip) between terminals R2 and R3, and wire a variable resistor (B 10 kΩ/1 kW) to terminals R1, R2, and R3.

4.5. Wiring for the operating output indicator (optional)

- To use an operating output indicator, remove the main unit cover and wire the operating output indicator according to the MO terminal symbols (+) and (-) on the printed circuit board.

4.6. Wiring for alarm output signals

- Circuit protector type
  An alarm signal indicates that a contact is "closed" when the circuit protector is OFF or “open” when the circuit protector is ON. Terminals B1 and B2 are alarm signal terminals. The contact capacity is 250 V AC at 1 A/inductive load.

  NOTE: Although this device uses a circuit protector as the power switch, it causes an alarm signal to be output when the circuit protector is turned OFF. It is recommended to install a separate power switch on the power input side instead of using the circuit protector as a power switch.

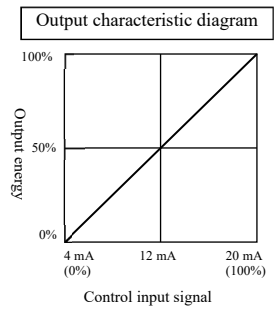
- Rapid fuse type
  An alarm signal is the contact signal to indicate that the circuit remains “closed” between B1 and B2 when the rapid fuse for element protection has blown. The contact capacity is 250 V AC at 1 A/inductive load.

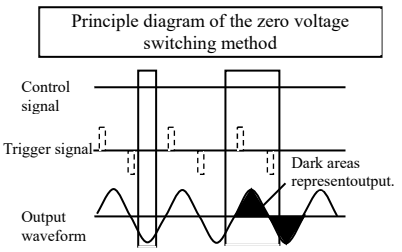
[5] Output characteristics

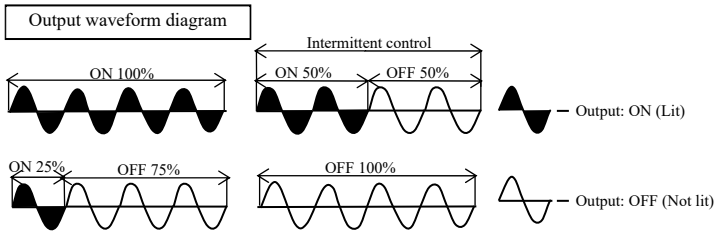
- The output energy is approximately proportional to the control input signal.
  For an input signal of 20 mA, or a "closed" signal for contact input, the output energy is approximately proportional to the setting of the power adjuster (MIN to MAX for an internal adjuster and 0 to 100% for an external adjuster).

- The principle of the zero voltage switching is to output power only in the position where the control signal and the trigger signal match, as shown in the figure on the right.
  In the zero voltage switching method, the output is binary: i.e., ON (100%) or OFF (0%).
  The energy is controlled by changing the ON/OFF time ratio.

  Energy (kWh) = Power (kW) x Time (h)
  Since power is a fixed quantity, this device uses a time-control method.







5.1. Applicable load

- Applicable load — Non-inductive constant resistance load (Nichrome heater, Kanthal heater, etc.)
- Non-applicable load — Inductive load (Primary side of transformer, motor, etc.)
  Variable resistance load (Platinum heater, Molybdenum heater, Kanthal Super heater, SiC heater, etc.)

[6] Operation preparation

Before turning on the power, check the following:

- Set the internal power adjuster to the minimum (MIN) position.
- With an external power adjuster, set the internal power adjuster to the maximum (MAX) position and the external power adjuster to the minimum (0) position.

[7] Operation confirmation

7.1. Load connection and safety confirmation

- Confirm that there are no short-circuits or ground faults in the connected load.
- When test-running this device, connect a load that can carry a load current of at least 10% of the rated value. (The device does not operate normally under no-load conditions.)
  Set the input signal to the maximum (20 mA, or a "closed" signal for contact input), turn on the power, and check the following.

7.1.1. Operation indicator light and power adjuster

Gradually increase the output of the power adjuster from the minimum position. The operation indicator light starts blinking and stays lit when the maximum position is reached. This is the normal operation.

7.1.2. Operating output indicator (optional)

When you perform the operation described earlier in "7-1-1 Operation indicator light and power adjuster." the indicated value increases gradually almost in proportion to the setting of the power adjuster.

NOTE: If the thyristor element is defective, the operating output indicator shows an output value, but it is incorrect.

7.1.3. Intermittent period

You can change the period in which the ON-OFF status of the output is repeated. This is effective when changing the period by the time constant of the control process.
The change range is approximately two to four seconds. To reduce the period, turn the knob counterclockwise when viewed from the front of the device.

[8] Maintenance and inspection

- Check and clean the inside of the device to ensure that there is no dust or debris.
- From time to time, confirm that wiring connections are tight.
- This device is equipped with a cooling fan. Check that the fan is rotating.

[9] Replacement of rapid fuse

This device is equipped with a rapid fuse to protect the thyristor element from overcurrent due to a short-circuit or overload in the load.

- You can determine that the rapid fuse has blown by an alarm and a protruding blow indicator strip.
- If the fuse blows, replace it according to the replacement procedure, assembly drawing, and rapid fuse table.
- For the rapid fuse, this device uses a Super-rapid Fuse manufactured by Fuji Electric Co., Ltd.
- Please purchase the fuse from a fuse dealer or Shimaden since spare parts are not included.

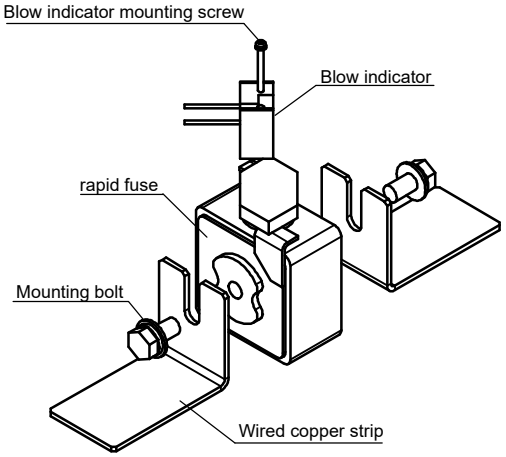
Table of applicable rapid fuses

Current capacity	Fuse capacity	Fuse model
30 A	40 A	CS5F‐40
45 A	75 A	CS5F‐75
60 A	100 A	CS5F‐100
90 A	150 A	CS5F‐150
135 A	200 A	CS5F‐200
200 A	250 A	CS5F‐250
300 A	450 A	CS5F‐450
450 A	600 A	CS5F‐600

9.1. Replacement procedure

a. Remove the main unit cover.
b. Remove the blow indicator from the rapid fuse.
c. Loosen the rapid fuse tightening bolt and remove the rapid fuse.
d. Insert a new rapid fuse and tighten it securely with the bolts.
e. Mount the blow indicator to the rapid fuse.

Assembly drawing



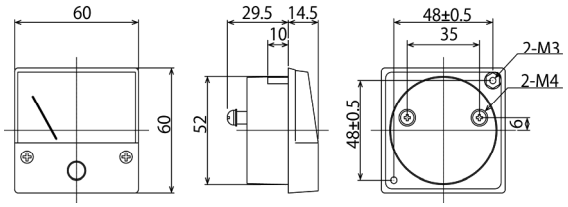
[10] External equipment

10.1. Operating output indicator

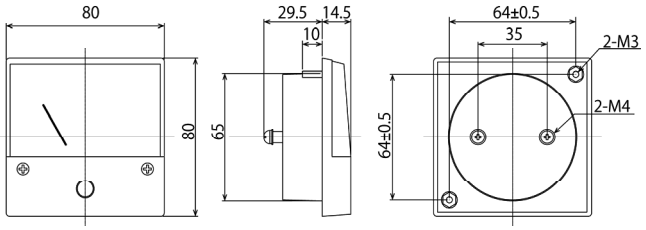
This device uses a zero voltage switching control method for cycle calculation. This causes the indicated value to fluctuate when the indicator is connected to the output side because the output is intermittent.
This operating output indicator displays as a percentage the received output signal (0 to 1mA) from the electronic circuit.

External dimension drawing

Model : QSM001



Model : QSM002



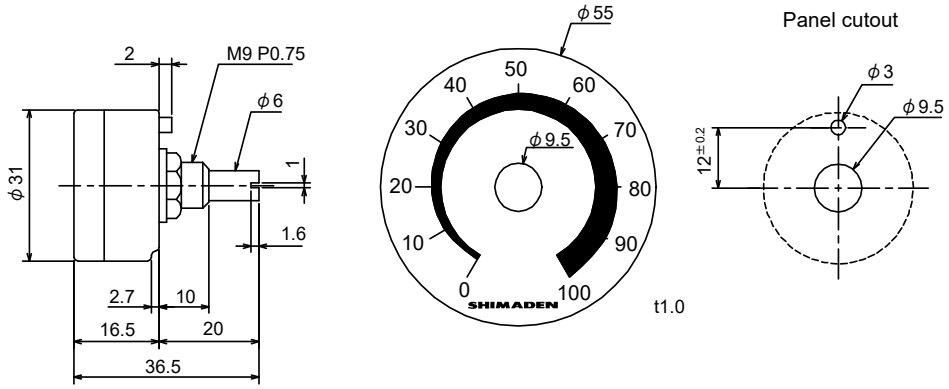
Unit: mm

The percentage scale corresponds to the load power.

10.2. External power adjuster

- Model: QSV002
- Specifications: Applicable volume control: RV30YN 20S
  Lead wire: Vinyl-coated lead wire (1 m) with an M4 crimp terminal
  Characteristics and resistance: B 10 kΩ
  Scale plate and knob included, one each

- External dimensions and panel cutout



Unit: mm

[11] **Shock-prevention** cover installation procedure (optional)

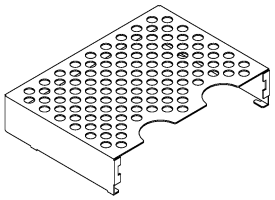
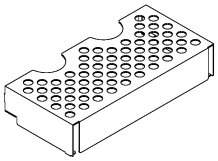
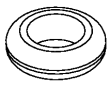
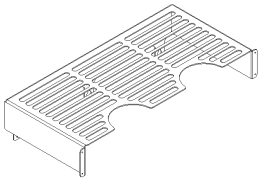
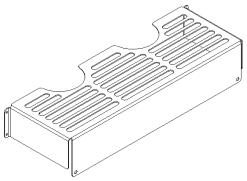
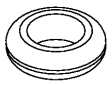
11.1. Check before use

This product has undergone a thorough shipping inspection before shipment.

Even so, please check it for product damage or any missing accessories.

NOTE: For 20 to 45 A/200 to 240 V and 18 A/380 to 440 V, the main unit is shipped with a shock-prevention cover installed.

For other current capacities, a shock-prevention cover is packed and shipped separately from the main unit.

	・Cover R	・Cover F	・Grommet	Mounting screw
60 A 90 A 135 A 200 A 300 A	 x2	 x2	 x4	
450 A	 x2	 x2	 x4	M4 x8: x10 M3 ×6: x8

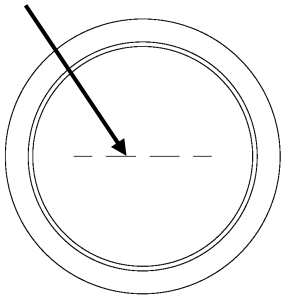
11.2. Installation procedure for 60 A, 90 A, 135 A, 200 A, and 300 A

The following describes the procedure for installing the shock protection cover using the PAC30Z 60 A as an example.

1) Remove the main unit cover from the PAC30Z.
2) In the center of each grommet, make a cut for the main circuit wires (R, T, U, and W). (Fig. 1)
3) Insert the main circuit wires (R, T, U, and W) into the grommets and connect them to the PAC30Z main unit. (Fig. 2)

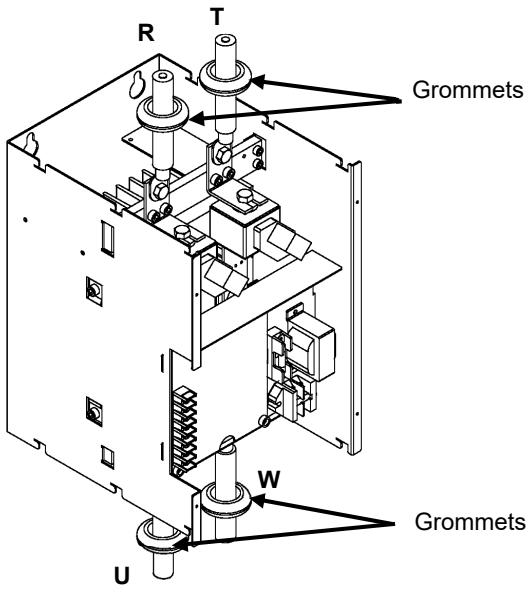
Fig. 1

Make a cut.



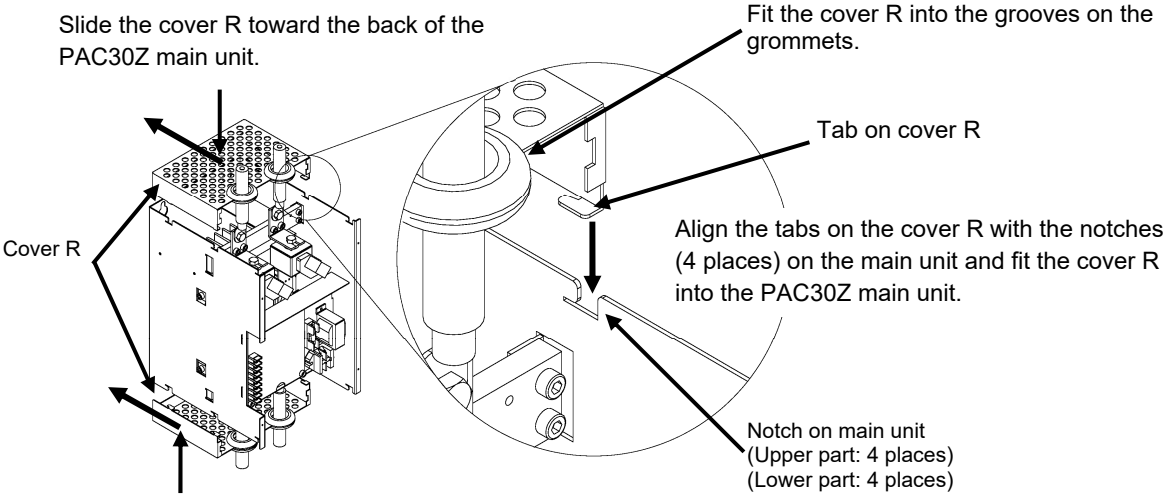
Note 1) This step is not required for 60 A, 90 A, and 135 A. For 200 A, 300 A, and 450 A, make a cut into the grommets.

Fig. 2



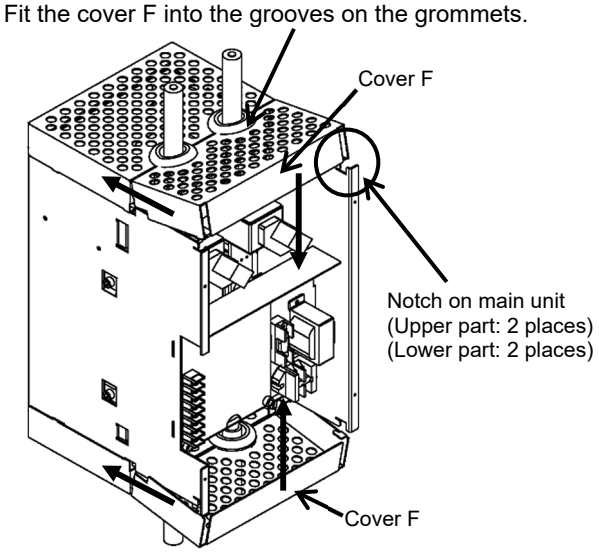
4) Fit the cover R into the grooves on the grommets.

5) Install the cover R on the PAC30Z main unit.



Note 2) Confirm that the cover R correctly fits in the notch on the PAC30Z main unit before sliding it.

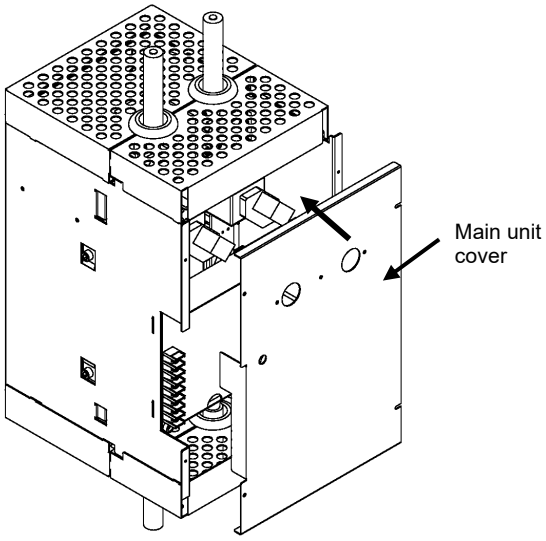
6) Install the cover F on the PAC30Z main unit.



Align the tabs on the cover F with the notches (2 places) on the PAC30Z main unit and slide the cover F toward the back of the PAC30Z main unit.

Note 3) Confirm that the cover F correctly fits in the notch on the PAC30Z main unit and the grooves on the grommets before sliding it.

7) Install the main unit cover on the PAC30Z main unit.



Note 4) Do not allow wire scrap to enter the main unit during wiring to the terminal block.

Note 5) Re-confirm that the cover R, cover F, and grommets correctly fit in the PAC30Z main unit before installing the main unit cover.

* If you need to ground the cable, refer to “[12] Ground cable routing path for rapid fuse type.”

11.3. Installation procedure for 450 A

1) Remove the main unit cover from the PAC30Z main unit.
2) In the center of each grommet, make a cut for the main circuit wires (R, T, U, and W). (Fig. 1)
3) Insert the main circuit wires (R, T, U, and W) into the grommets and connect them to the PAC30Z main unit. (Fig. 2)

Fig. 1

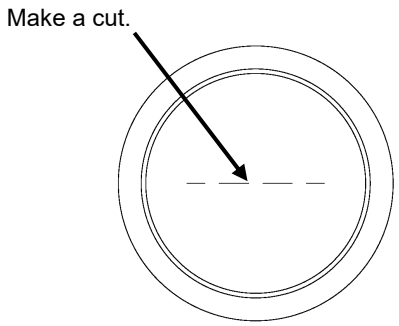
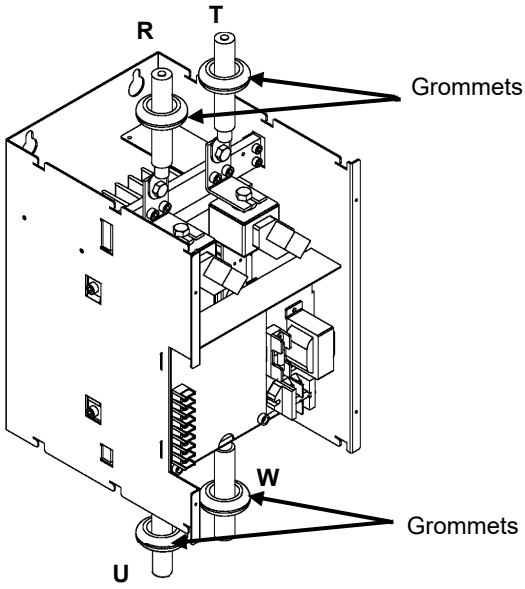
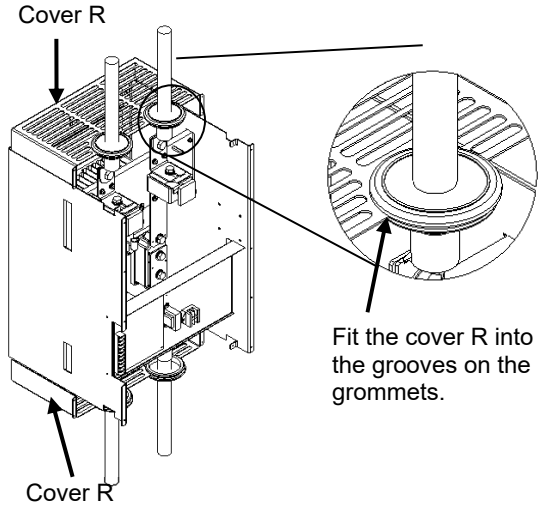
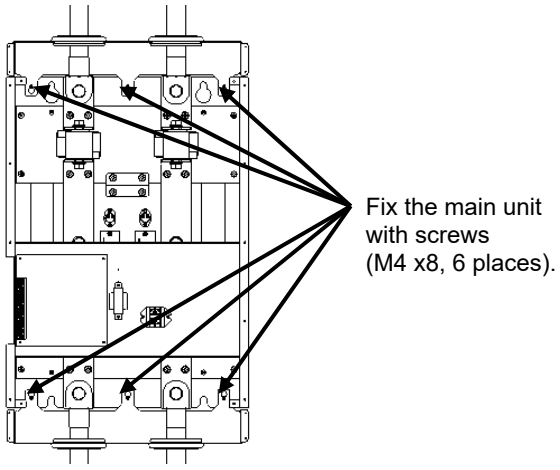


Fig. 2



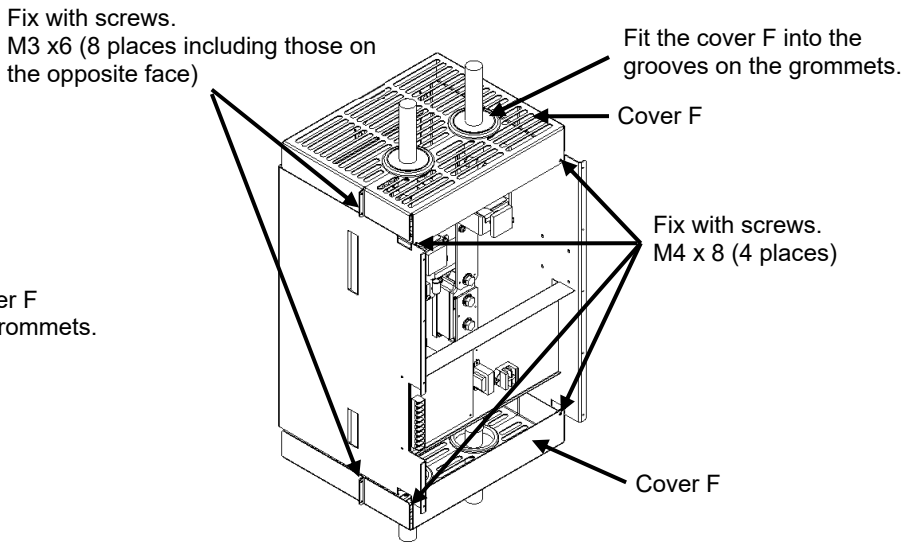
4) Fit the cover R into the grooves on the grommets.
5) Install the cover R on the PAC30Z main unit.





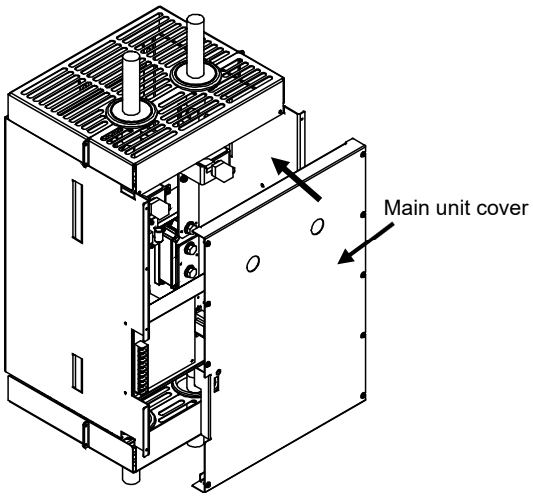
Note 1) You can install the cover R by inserting the screws first because its screw-fixing part has keyholes.

6) Install the cover F on the PAC30Z main unit.



NOTE: Confirm that the cover F correctly fits in the grommets.

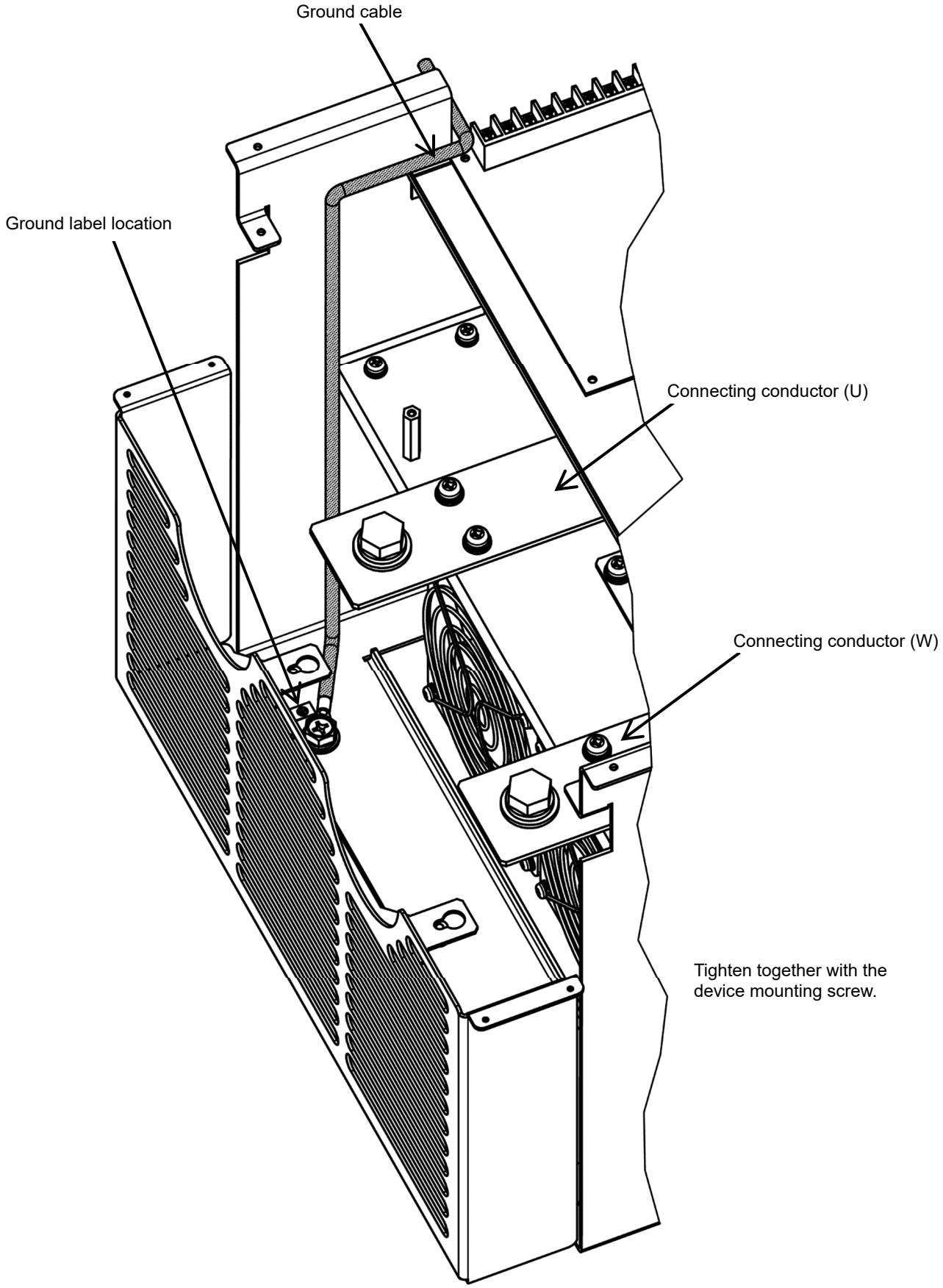
7) Install the main unit cover on the PAC30Z main unit.



* If you need to ground the cable, refer to “[12] Ground cable routing path for rapid fuse type.”

[12] Ground cable routing path for rapid fuse type (for 200 A or higher)

Route the ground cable along the side of the PAC30Z main unit so that it does not touch the connecting conductors.



NOTE: For 135 A, the location of the fan is different. (This figure is not applicable because the fan is located on the opposite side.)

[13] Specifications

- Name: Thyristor three-phase power regulator
- Control method: Periodic zero voltage switching control method (two-phase control)
- Rated voltage: 200 to 220 V AC, 220 to 240 V AC, 380 to 400 V AC, 400 to 440 V AC
  (Refer to the model code selection table.)
- Frequency: 50 / 60 Hz
- Power control range: 0 to 95% or more
- Connection terminal for operating output indicator:
  With output terminal (Connection indicator: 0 to 1 mA DC) (inside cover)
- Rated current: 18 to 450 A (At ambient temperature of 50° C) (Refer to the code selection table.)
- Control signal: Current signal and contact signal, common type
- Control input: Common for 4 to 20 mA DC input and contact input between terminals (C1) and (C2)
- Current receiving resistance:
  200 Ω
- Contact input for control: Non-voltage contact between terminals (C1) and (C3)
- Proportional period: 2 to 4 seconds (Factory default: 3 seconds)
- Power control: Variable from 0 to 100% (Internal power adjuster equipped as standard)
  External power adjuster available as an option
- Applicable load type: Constant resistance load (Nichrome heater, Kanthal heater, etc.)
- Overcurrent protection method: Circuit protector or rapid fuse
  Shape
  Circuit protector type: 20 to 45 A/200 to 240 V
  18 A/380 to 440 V
  Rapid fuse type: 60 to 450 A/200 to 240 V, 380 to 440 V
  30 to 450 A/380 to 440 V
- Alarm circuit: Make contact output when the circuit protector is OFF or when the rapid fuse is blown
- Alarm output: Triggered in the event of overcurrent (exceeding the total current capacity) or overheating (135 A, 200 A, 300 A, 450 A)
  Continuity between output terminals (B1) and (B2)
  Alarm output contact capacity:
  250 V AC at 1 A / induced load
  Output operation indication:
  Green indicator light is on during output (lights up when the load is charged)
- Cooling method: 18 to 90 A Self-cooling
  135 to 450 A Forced air cooling
- Ambient operating temperature range:
  -10 to 50℃
- Ambient operating humidity range:
  90% RH or lower (No dew condensation)
- Storage temperature: -20 to 65℃
- Insulation resistance: Between the power supply terminal and chassis 500 V DC 20 MΩ or more
  Between the power supply terminal and control input terminal 500 V DC 20 MΩ or more
- Withstand voltage: Between the power supply terminal and chassis 200 to 240 V: 2000 V AC for 1 minute
  380 to 440 V: 2500 V AC for 1 minute
- Minimum load current
  18, 20, 30 A: 0.2 A
  45, 60, 90, 135 A: 0.25 A
  200, 300 A: 0.5 A
  450 A: 0.3 A

Temperature and Humidity Control Specialists

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