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"

O Precaution that may lead to injury or death if not followed

" CAUTION"

O Precaution that may lead to damage to equipment or facilities if not followed

"A 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.
- Use this device within the rated power supply voltage and frequency.
 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.
- 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.

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[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	Perio	Periodic zero voltage switching control three-phase power regulator									
2 Control in	out	5	4 to 20 mA DC (Receiving resistance: 200 Ω) and contact signal									
2. Control ing	Jui	9	Othe	Other								
				Current capacit			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		۱	7.7 kVA		
			030	30 A			10 kVA		`	11 kVA	19 kVA	20 kVA
3. Current ca	pacity		045	45 A			15 kVA		1	16.5 kVA	29 kVA	30 kVA
(kVA values	represent th	ne	060	60 A			20 kVA		1	22 kVA	39 kVA	40 kVA
standard rat	ed load cap	oacity.)	090		90 A		30 kVA		1	33 kVA	59 kVA	60 kVA
			135	135 A			4	5 kVA	1	49.5 kVA	88 kVA	90 kVA
			200	200 A			70 kVA		1	77 kVA	133 kVA	140 kVA
			300	300 A			100 kVA		1	110 kVA	190 kVA	200 kVA
45			450	450 A		15	0 kVA	1	165 kVA	290 kVA	300 kVA	
·			15- 200 to 220 V AC ± 10% 50 / 60 Hz									
				16- 220 to 240 V AC ± 10% 50 / 60 Hz								
4. Power supply				17- 380 to 400 V AC ± 10% 50 / 60 Hz								
				18- 400 to 440 V AC ± 10% 50 / 60 Hz								
				99-	J9- Other							
5. Shock-prevention cover				0	Witl	nout						
				1	1 With *1							
6. External power adjuster					0	With	out	(equ	ipped with an int	ernal power adju	ster as standard)	
		3			With (B10kΩ including scale plate, knob, and 1-m lead wire)							
				9	9 Others (Please consult before ordering)							
7 Operating output indicator					1	W/ith		SM001: □60 mm		to 100% scale		
				2	With		SM001: ⊡00 mm	0 to 1 mA DC, 0	to 100% scale			
								0	Wit	hout	, o to i mia do, o	
8. Remarks								9	Wit	h		

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 shockprevention 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.

External dimensions and weight [2]

- 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



Shock-prevention cover

517

- 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:
- Mounting hole dimensions:
- Mass:

Without shock-prevention cover With shock-prevention cover H 420 x W 180

Without shock-prevention cover With shock-prevention cover

H440 x W280 x D310 mm H517 x W280 x D310 mm

Approx. 22.0kg



- 300, 450 A/200 to 240 V, 380 to 440 V
- External dimensions:

Without shock-prevention cover With shock-prevention cover H550 x W400 x D365 mm H666 x W400 x D365 mm

- Mounting hole dimensions:
- Mass:

- H520 x W250 mm 300 A / Without shock-prevention cover With shock-prevention cover 450 A / Without shock-prevention cover
 - With shock-prevention cover

Approx. 39.0kg Approx. 41.0kg Approx. 30.0kg 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



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





Terminal layout

C1	\circ (+) : Positive input terminal for control signal
C2	\circ (-) : 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	o: Connection terminal for external power adjuster #2
R3	o: Connection terminal for external power adjuster #3
B1	
В2	 contact signal output for rapid fuse blow or thyristor overheat

• For contact input





4.1. Wiring for input signals

This device can be used for either contact input or current signal input. Selec.
 Wiring example for current input 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.

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 mm² or less.

- * 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 "[13] 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

 When switching between automatic and manual operation, wire as shown in the diagram and switch all three switches simultaneously. If the controller is a current output model, there is a risk of overvoltage being applied when the circuit is open, so protect C1-C2 with a 1/4W 100Ω limiting resistor. In automatic operation, the operation amount is determined by the output signal from the controller. In that case, the external power regulator will not function. In manual operation, the operation amount is determined by the setting of the external power regulator.

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] Alarm

8-1. Overcurrent Protection Alarm

This function activates when the circuit protector (20A, 30A, 45A/200-240V, 18A/380-440V) operates or when the fast-blow fuse (60-450A/200-240V, 380-440V/30-450A/380-440V) blows, causing the gate to shut off. The alarm output between B1 and B2 will be closed, signaling an abnormal condition.

8-2. Overheating Alarm (135A or above)

If the rated current is 135A or above, forced air cooling is provided by the fan. In the event that the fan stops for any reason and the internal temperature of the device rises excessively, the control output will remain unchanged, but the alarm output between B1 and B2 will close, signaling an abnormal condition.

[9] 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.

[10] 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.
- Please purchase the fuse from a Shimaden since spare parts are not included.

Table of applicable rapid fuses						
	Current capacity	Fuse capacity	Fuse model			
	30 A	40 A	QSF038			
	45 A	75 A	QSF039			
	60 A	100 A	QSF040			
	90 A	150 A	QSF041			
	135 A	200 A	QSF042			
	200 A	250 A	QSF043			
	300 A	450 A	QSF044			
	450 A	600 A	QSF034			

10.1. Replacement procedure

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



[11] External equipment

11.1. 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



The percentage scale corresponds to the load power.

11.2. External power adjuster

Model: QSV002

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- Specifications: Applicable volume control:

Lead wire:

Characteristics and resistance: Scale plate and knob included, one each

RV30YN 20S Vinyl-coated lead wire (1 m) with an M4 crimp terminal B 10 $k\Omega$



Unit: mm

[12] Shock-prevention cover installation procedure (optional)

12.1. 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.

12.2. 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



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.



Fit the cover F into the grooves on the grommets.

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

Install the main unit cover on the PAC30Z main unit.

7)

- 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 "[13] Ground cable routing path for rapid fuse type."

12.3. 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)





- 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.



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



* If you need to ground the cable, refer to "[13] Ground cable routing path for rapid fuse type."

[13] 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. Ground cable



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.)

[14] Specifications

2	Name:	Thyristor three-phase power regulator
	Rated voltage:	200 to 220 V AC, 220 to 240 V AC, 380 to 400 V AC, 400 to 440 V AC
	Frequency: Power control range:	50 / 60 Hz 0 to 95% or more
-	Connection terminal for c	With output terminal (Connection indicator: 0 to 1 mA DC) (inside cover)
	Rated current: Control signal:	18 to 450 A (At ambient temperature of 50° C) (Refer to the code selection table.) 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 recenting recieta	200 Ω
	Contact input for control:	Non-voltage contact between terminals (C1) and (C3)
-	Proportional period:	2 to 4 seconds (Factory default: 3 seconds) Variable from 0 to 100% (Internal power adjuster equipped as standard)
-	T Ower control.	External power adjuster available as an option
	Applicable load type:	Constant resistance load (Nichrome heater, Kanthal heater, etc.)
	Overcurrent protection	Circuit protector or rapid fuse
	method:	
	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 ca	apacity: 250 V AC at 1 A / induced load
	Output operation indica	ation:
		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 tempe	erature range: -10 to 50 $^\circ\!\mathrm{C}$
	Ambient operating humic	lity range: 90% RH or lower (No dew condensation)
	Storage temperature:	-20 to 65°C
	Insulation resistance:	Between the power supply terminal and chassis 500 V DC 20 M Ω or more Between the power supply terminal and control input terminal 500 V DC 20 M Ω 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:	U.5 A
	40U A.	U.3 A

The contents of this manual are subject to change without notice.

Temperature and Humidity Control Specialists



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