

SINGLE PHASE POWER REGULATOR

SERIES PAC26 20~450A

- Wide application with variety of functions
- Suitable for air conditioning, electric furnace, dryer, bio engineering, food industry, chemical industry, plastic formation and control of heat source applications.



350A, 450A

150A, 250A

80A, 100A

45A, 60A

20A, 30A

FUNCTION

Standard Function

Electronic over current protect function:

Protects thyristor element by shutting off the over current detected by a load current monitoring CT.

Constant voltage characteristics by means of voltage feedback:

Stable output provided by the voltage control function and easy operation achieved by the linear characteristics of control input and output voltage.

Soft start function:

Setting suitable soft start time for the load.

Additional Function (option)

Automatic power adjusting function:

The suitable power for the control temperature is continuously controlled by a signal from the programmable controller, computer and adjuster. Applicable for soft control of the low range.

Constant-current control (Current feedback):

Applicable to controlling the pure metallic heater and the Kanthal Super heater.

Constant-power control (Power feedback):

Applicable to controlling the SiC and the carbon heater, and applicable to high stability controlling.

Power linear control (Voltage square feedback):

Applicable to precise controlling for Nichrome heater load with power linear characteristics of the control input/output voltage.

Current limiting function:

Applicable to loads with rush current on starting and continuous usage over current condition such as pure metallic, Tungsten and Molybdenum heaters.

Start up output limiting function:

Applicable to the rush current reduction and load protection on turning on the power supply.

Heater break alarm:

Alarm display and output in case of detecting the low power condition of the broken heater and heater defect.

Rapid fuse:

Perfect protection for the thyristor device and the power line from the over current of the short circuit and the grounding.

Power adjustment function:

Addition of various manual equipment used for adjusting ramp, base (residual output), manual and high/low.

Monitor and Alarm Output on the Trouble Situation

Over-current protection:

[O.C] monitor lights and alarm output on

Fan stop (for models over 150A):

[FAN] monitor lights and alarm output on

Rapid fuse burnt out:

[FUSE] monitor lights and alarm output on

Heater break alarm:

[H/B] monitor lights and warning output on

COMMON SPECIFICATION

Control input and Ratings

Contact signal:	Non-voltage contact signal
Current input:	4~20mA DC, Receiving impedance: 100 Ω
Voltage input:	1~5V DC, Input impedance: 200kΩ 0~10V DC, Input impedance: 200kΩ

Power Voltage and Ratings

100V type:	100~110V ±10% 50/60Hz 110~120V ◇
200V type:	200~220V ◇ 220~240V ◇
400V type:	380~400V ◇ 400~440V ◇

Power Supply for 400V Type and External Power Ratings

20~100A:	200~220V 20VA
150~450A:	200~220V 50VA

Current Capacity and Cooling System

20,30,45,60,80 & 100A:	Self-cooling system
150,250,350 & 450A:	Forced air cooling system

Over-current Protection System

Electronic type (gate breaking system)	
standard:	about 130% of rated current
Rapid fuse type (optional):	130~150% of rated current
Reset	
Electric type:	Turn power OFF and reapply
Rapid fuse type:	Replace fuse

Power Control Function

Standard:	Power adjustment (internal)/0~100%
Option:	External power/0~100%
	Manual power/0~100%
	Base power/0~100%
	High-low lower (contact input type)
	• High power/0~100%
	• Low power/High × 0~100%
	External power+Manual power
	External power+Base power
	Auto power control function/50~100%

Alarm Monitors and Rating

Over-current:	[O.C] monitor lights./AI1-AI2 conducted
Fan stop for models over 150A:	[FAN] monitor lights./Same as above
Fuse burnt out:	[FUSE] monitor lights./Same as above
Heater break:	[H/B] monitor lights./HB1-HB2 conducted
Output contact rating:	240V AC 1A/load resistance

Operating Environment

Ambient temperature range:	-10~50°C
Ambient humidity:	90% or less without condensation

Insulation Resistance

Power terminals and chassis:	500V DC 20MΩ
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Dielectric Strength

Power supply terminals and chassis:	
100~240V power supply:	2000V AC 1 minute
380~440V power supply:	2500V AC 1 minute

Material/Finish

Ordinary steel plate/paint coating

External Dimensions and Weight

See external dimension diagrams.

INDIVIDUAL SPECIFICATIONS

Phase Control System (PAC26P)

Control system:	Phase control system
Soft start time:	Adjustable 1~10 sec. (90% rise)
Output voltage control range:	0~97% minimum of input voltage
Output stability:	Output fluctuation less than ±2% when input fluctuation is ±10%
Output voltage characteristics:	Linear output by voltage feedback
Over-current protection system:	Equipped with electronic protective function
Applicable load:	All types of heaters (added functions to be selected according to heater characteristics)

Additional Functions (options)

Power control function:	See "Common Specification."
Constant-current control (current feedback):	For pure metallic heaters, super Kanthal, etc.
Constant-power control (power feedback):	For SiC and carbon heaters
Voltage square control (voltage feedback):	Nichrome wire heaters
Output limiting function:	
Current limiting:	To limit to 50~100% of rated current
Start up output limiting:	To limit to 0~60% output for 1~60sec.
Rapid fuse:	Equipped with alarm output function
Heater break alarm:	Setting at 0~100% of rated current

Cycle Base Zero Voltage Switching System (PAC26C)

Control System:	Cycle base zero voltage switching system
Output power control range:	0~95% minimum of load current
Over-current protection system:	Equipped with electronic protective function
Applicable load:	Constant-resistance heaters such as a nichrome wire heater
Additional Functions (options)	
Power control function:	See "Common Specification."
Operating output indicator:	1~100%
Rapid fuse:	Equipped with alarm output function
Heater break alarm:	Setting at 0~100% of rated current

ORDERING INFORMATION (PAC26P)

ITEM	CODE		SPECIFICATIONS	
SERIES	PAC26P		Phase Angel Cotrol Single Phase Power Regulator	
CONTROL INPUT	2		Contact	
	3		1~5V DC Input Impedance: 200kΩ	
	4		4~20mA DC Receiving Impedance: 100Ω	
	6		0~10V DC Input Impedance: 200kΩ	
	9		Others (please consult before ordering.)	
POWER SUPPLY	13-		100~110V AC	
	14-		110~120V AC	
	15-		200~220V AC	
	16-		220~240V AC	
	17-		380~400V AC	
	18-		400~440V AC	
			Note: 200V power supply is separately required for electric source and power for fan.	
CURRENT CAPACITY	100~240V AC		380~440V AC	
	021	20A	022 20A	
	031	30A	032 30A	
	041	45A	042 45A	
	061	60A	062 60A	
	081	80A	082 80A	
	101	100A	102 100A	
	151	150A	152 150A	
	251	250A	252 250A	
	351	350A	352 350A	
	451	450A	452 450A	
	FEEDBACK FUNCTION	0		Constant voltage (standard feature)
		1		Constant current
		2		Constant power
3			Voltage Square-root	
OUTPUT CONTROL FUNCTION	0		None	
	1		Startup time output control limiting (0~60%, 1~60 sec.)	
	2		Current limiting	
	3		Startup time output control + Current limiting	
EXTERNAL POWER ADJUSTER	CONTACT INPUT	N	None (Internal installation as standard)	
		P	External power adjuster	
		B	Base (low) power adjuster	
		H	High / Low power adjuster	
	CURRENT/VOLTAGE INPUT	P	External power adjuster	
		M	Manual power adjuster	
		B	Base power adjuster	
		W	External power + Manual power	
	Y	External power + Base power		
HEATER BREAK ALARM	0		Without	
	1		With (0~100% setting of rated current)	
RAPID FUSE	0		Without	
	1		With (See rapid fuse option.)	
AUTO POWER ADJUSTMENT FUNCTIONS	0		Without	
	4		4~20mA DC Receiving Impedance: 100Ω	
	6		0~10V DC Input Impedance: 200kΩ	
REMARKS	0		Without	
	9		With (Please consult before ordering.)	

Rapid Fuse Option

CONSTANT CURRENT/ VOLTAGE	PARTS NO.
20A	100~240V 25SHA 30S
	380~440V 50SHA 30S
30A	100~240V 25SHA 40S
	380~440V 50SHA 40S
45A/100~440V	50SHA 60S
60A/100~440V	50SHA 80S
80A/100~440V	50SHB 120S
100A/100~440V	50SHB 150S
150A/100~440V	50SHB 200S
250A/100~440V	50SHB 350S
350A/100~440V	CSSF 500
450A/100~440V	CSSF 600

ORDERING INFORMATION (PAC26C)

ITEM	CODE		SPECIFICATIONS		
SERIES	PAC26C		Zero Voltage Switching Single Phase Power Regulator		
CONTROL INPUT	2		Contact		
	3		1~5V DC Input Impedance: 200k Ω		
	4		4~20mA DC Receiving Impedance: 100k Ω		
	6		0~10V DC Input Impedance: 200k Ω		
	9		Others (please consult before ordering.)		
POWER SUPPLY	13-		100~110V AC		
	14-		110~120V AC		
	15-		200~220V AC		
	16-		220~240V AC		
	17-		380~400V AC		
	18-		400~440V AC		
CURRENT CAPACITY	100~240V AC		380~440V AC		
	021	20A	022	20A	
	031	30A	032	30A	
	041	45A	042	45A	
	061	60A	062	60A	
	081	80A	082	80A	
	101	100A	102	100A	
	151	150A	152	150A	
	251	250A	252	250A	
	351	350A	352	350A	
	451	450A	452	450A	
	EXTERNAL POWER ADJUSTER	CONTACT INPUT	N	None (Internal installation as standard)	
			P	External power adjuster	
			B	Base (low) power adjuster	
H			High / Low power adjuster		
CURRENT/VOLTAGE INPUT		P	External power adjuster		
		M	Manual power adjuster		
		B	Base power adjuster		
		W	External power + Manual power		
		Y	External power + Base power		
HEATER BREAK ALARM	0	Without			
	1	With			
RAPID FUSE	0	Without			
	1	With (See rapid fuse option.)			
AUTO POWER ADJUSTMENT FUNCTIONS	0	Without			
	4	4~20mA DC Receiving Impedance: 100 Ω			
	6	0~10V DC Input Impedance: 200k Ω			
OPERATING OUTPUT INDICATOR	0	Without			
	1	With			
REMARKS	0	Without			
	9	With			

Rapid Fuse Option

CONSTANT CURRENT/ VOLTAGE	PARTS NO.	
20A	100~240V	25SHA 30S
	380~440V	50SHA 30S
30A	100~240V	25SHA 40S
	380~440V	50SHA 40S
45A/100~440V	50SHA 60S	
60A/100~440V	50SHA 80S	
80A/100~440V	50SHB 120S	
100A/100~440V	50SHB 150S	
150A/100~440V	50SHB 200S	
250A/100~440V	50SHB 350S	
350A/100~440V	CSSF 500	
450A/100~440V	CSSF 600	

SINGLE PHASE POWER REGULATOR

TABLE OF POWER AND GENERATED HEAT

Note that the maximum output of the thyristor on the voltage/power control experiences a 5~6% power loss as the efficiency values of the phase control system and the cycle operation system are 94% and 95%, respectively. It has to be considered while designing the power system. The ventilation also has to be considered for temperature rise of the installed area by referring to the following heat generated.

CURRENT CAPACITY	ITEM	POWER FOR VOLTAGE [KW]				TOTAL HEAT GENERATED ON MAXIMUM OUTPUT [W]		COOLING	
		100V	200V	380V	400V	440V	WITH FUSE		WITHOUT FUSE
20A		2	4	7.6	8	8.8	32	29	Self-cooling system
30A		3	6	11.4	12	13.2	49	45	
45A		4.5	9	17.1	18	19.8	60	54	
60A		6	12	22.8	24	26.4	75	65	
80A		8	16	30.4	32	35.2	94	85	
100A		10	20	38.0	40	44.0	117	105	
150A		15	30	57.0	60	66.0	193	175	Forced air cooling system
250A		25	50	95.0	100	110.0	327	300	
350A		35	70	133.0	140	154.0	420	385	
450A		45	90	171.0	180	198.0	560	520	

*Total heat generated is a summation of the generated heat on the thyristor, fan and fuse.

SELECTION OF SPECIAL HEATER AND CONTROL SYSTEM AND ADDITIONAL FUNCTION

In case of using the heater listed in the following table, an additional function (single or multiple) should be selected.

ITEM SERIES	CONTROL SYSTEM	APPLICABLE HEATER	ADDITIONAL FUNCTION				REQUIREMENT FOR SETTING TO HEATER TERMINAL VOLTAGE BY USING TRANSFORMER
			CONSTANT CURRENT CONTROL	CONSTANT VOLTAGE CONTROL	CURRENT LIMITING	START-UP TIME OUTPUT LIMIT	
PAC26P	Phase control system	Super Kanthal	suitable		applicable		yes
		Platinum	suitable		applicable		yes
		Molybdenum	suitable		suitable	applicable	yes
		Tungsten	suitable		suitable	applicable	yes
		Carbon	applicable	suitable			yes
		Saltbath	suitable				yes
		SiC		suitable	applicable		yes

CONTROL SYSTEM AND CHARACTERISTICS

ITEM	NOISE GENERATION	ADDITIONAL TRANSFORMER	INPUT VOLTAGE FLUCTUATION AND OUTPUT FLUCTUATION
PHASE CONTROL SYSTEM	exist	can be used	Output fluctuation less than $\pm 2\%$ when input fluctuation is $\pm 10\%$ (constant voltage function is standard)
CYCLE BASE ZERO VOLTAGE SWITCHING SYSTEM	none	cannot be used	output with fluctuation

Note: For the cycle base zero voltage switching system, output indication fluctuates when a power meter or a current meter is connected to the output terminal. Select operating output indicator (option) for indicating output value.

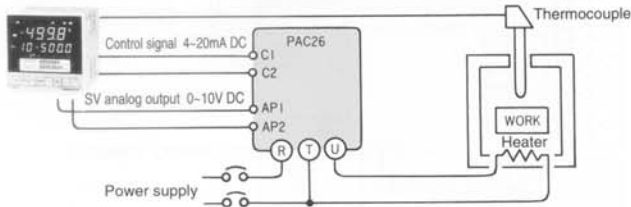
CONTROL SYSTEM AND OUTPUT WAVEFORM

OUTPUT	OUTPUT WAVEFORM OF THE PHASE CONTROL SYSTEM	OUTPUT WAVEFORM OF THE CYCLE BASE ZERO VOLTAGE SWITCHING SYSTEM
0%		
30%		
50%		
70%		
100%		

• Soft Control by Automatic Power Adjusting Function

In case of achieving small temperature stress such as bio industry and fine ceramic manufacturing, the automatic power adjustment is effective for precision control. The temperature control range expands for the same PID value in the PID control condition.

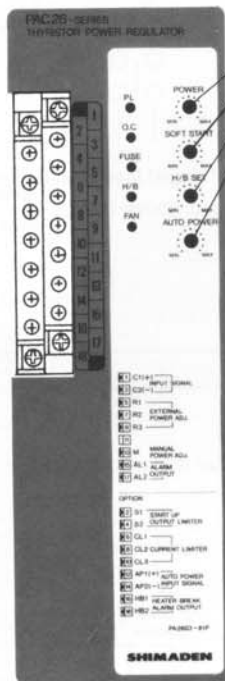
• Combination with Type SR25 Controller



When the SV analog output (4~20mA or 0~10V) of the SR25 controller is input to the auto power terminals (AP1 and AP2) of the PAC26, maximum power (ramping) is set automatically by controller setting (SV) and the efficiency of control is improved. The combination plays another role; it effectively saves a total load when several thyristors are turned ON simultaneously.

PANEL INFORMATION AND CONTROL TERMINALS

Terminal No.	Code	Terminal code	
		Voltage / current	Contact
Upper terminal	1	C 1	C 1
	3	C 2	C 2
	5	R 1	R 1
	7	R 2	R 2
	9	R 3	R 3
	11	-	L 2
	13	M	L 3
15	AL1	AL1	
17	AL2	AL2	
		Phase control	Cycle
Lower terminal	2	S 1	MO1
	4	S 2	MO2
	6	CL1	-
	8	CL2	-
	10	CL3	-
	12	AP1	AP1
14	AP2	AP2	
16	HB1	HB1	
18	HB2	HB2	



• Adjusters

- Power adjuster (standard)
- Soft start time adjuster (standard)
- Heater break alarm setting device (option)
- Automatic power adjuster (option)

• Monitor Lamps

- P.L.: Power supply and output indication
- O.C.: Over-current
- Fuse: Burning-out of rapid fuse (option)
- H/B: Heater break alarm (option)
- FAN: Stoppage of cooling fan (standard for 150A or above)

• Terminal Codes and Functions

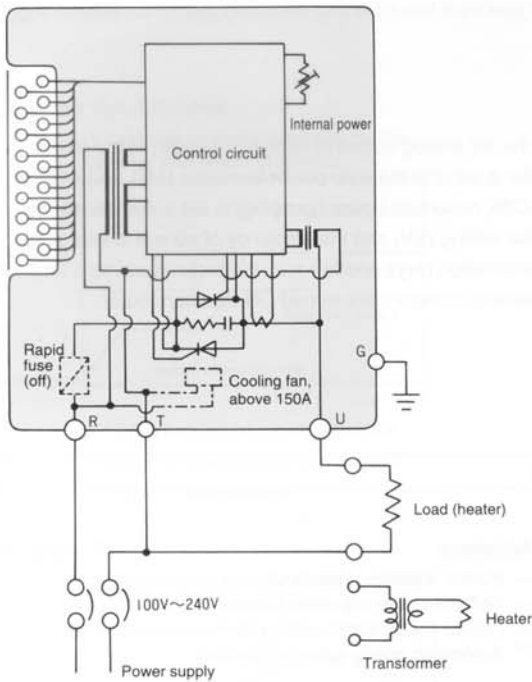
- C1-C2: Control input
- R1-R2-R3: External power (option)
- M: Manual/base adjustment (option)
- L2-L3: Low power adjustment (option)
- AL1-AL2: Alarm output common to over-current, FAN, FUSE
- S1-S2: External sequence signal for limiting start power (P)
- MO1-MO2: Operating output indicator (C)
- CL1-CL2-CL3: Current limiting adjuster
- AP1-AP2: Automatic Power signal input
- HB1-HB2: Heater break alarm output

(P): Phase control system

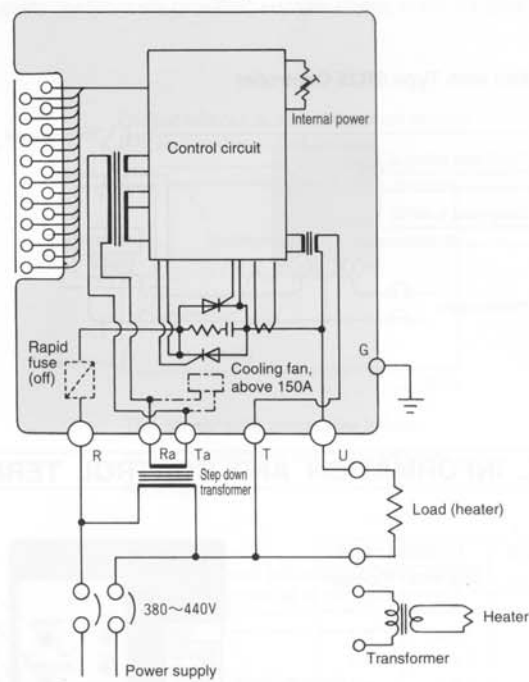
(C): Cycle base zero voltage switching system

CIRCUIT BLOCK AND TERMINAL DIAGRAMS

• 100~240V Power Supply



• 380~440V Power Supply



* Rapid fuse is an optional item. Fan is a provided instrument of above 150A.

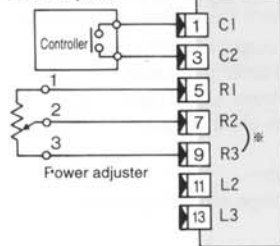
WIRING OF CONTROL TERMINAL

• Output Adjusting Function (Upper Terminal)

This function is available by connecting adjuster (rating B 10kΩ 1W), after delivered to the user.

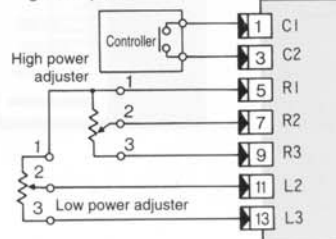
Wiring with contact output type controller

External power



- With internal power standard
- To adjust output in case of conduction between input terminals C1 and C2.
- *Short circuit R2 and R3 when power adjuster is not used (adjust by internal power adjuster).
- Conduct between C1 and C2: 0~100%

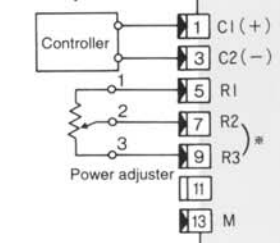
High / low power



- To adjust maximum output for conducted (on) input terminals C1-C2 and to maintain non-conduct (off) output.
- High power: Conduct between C1 and C2 0~100%
- Low power: No conduct between C1 and C2
- High power × Low power

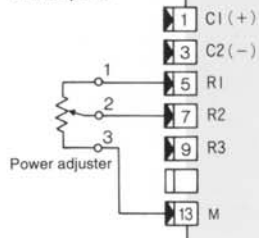
Wiring with voltage / current output type controller

External power



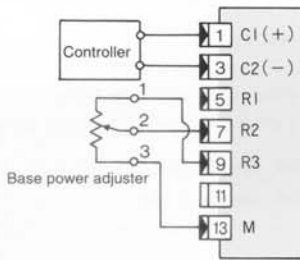
- With internal power standard
- * Short circuit R2 and R3 when power adjuster is not used (adjust by internal power).
- Input of 100%: 0~100%

Manual power



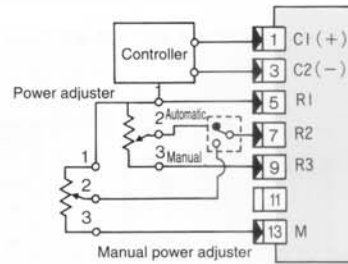
- To adjust power manually.

Base (residual) power



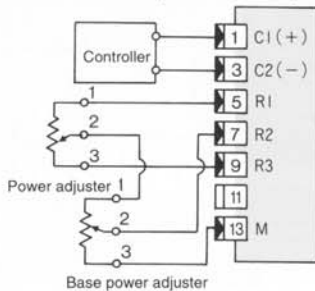
- To keep output steady when the control signal is at 0%.
- The maximum power is adjusted by internal power adjuster.
- Input of 0%: 0~100%

External power+Manual power (Automatic/Manual)



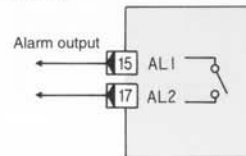
- External contact switches automatic/manual for power adjusting selection of automatic and manual operations.
- Please prepare the automatic/manual switch.

External power+Base (residual) power



- To adjust maximum output and to maintain some part of output of 0% control signal.

Alarm circuit

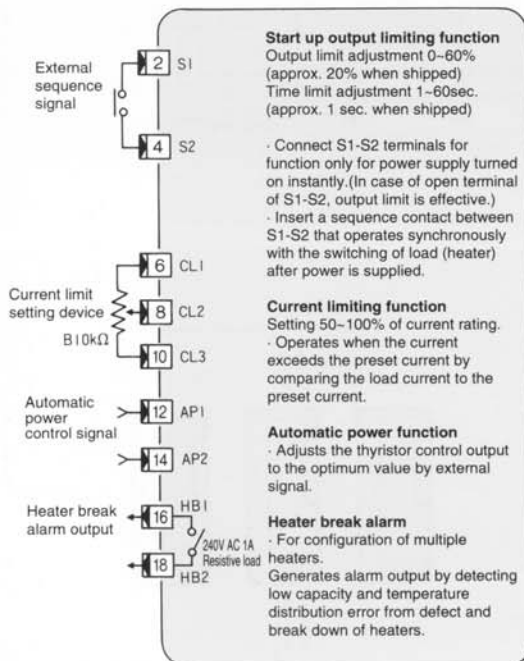


- Alarm on. Conduct between AL1 and AL2.
- Operation Over-current protection circuit in operation. Fuse burnt out. Cooling fan stopped.

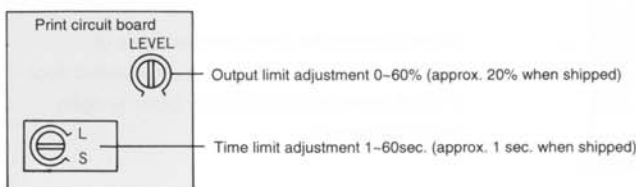
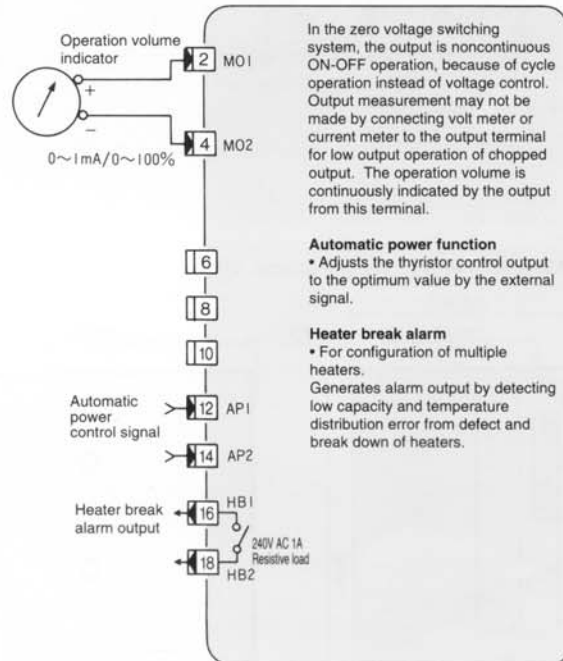
• Additional Function (Option) (Lower Terminal)

Additional function terminals are all optional items.

PAC26P (Phase angle control system)



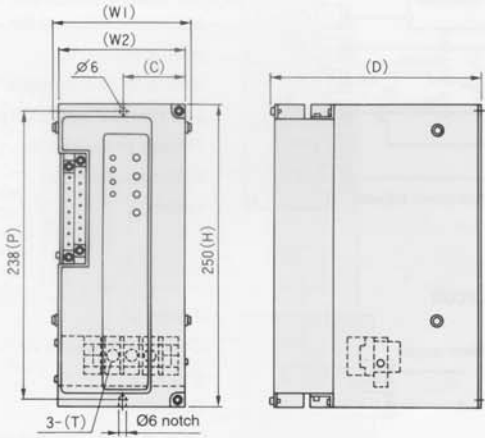
PAC26C (Cycle base zero voltage switching system)



SINGLE PHASE POWER REGULATOR

EXTERNAL DIMENSIONS AND WEIGHT

20A, 30A, 45A & 60A (Note: Dimensions of 20A and 30A are those of 45A and 60A, respectively, for 380~440V)



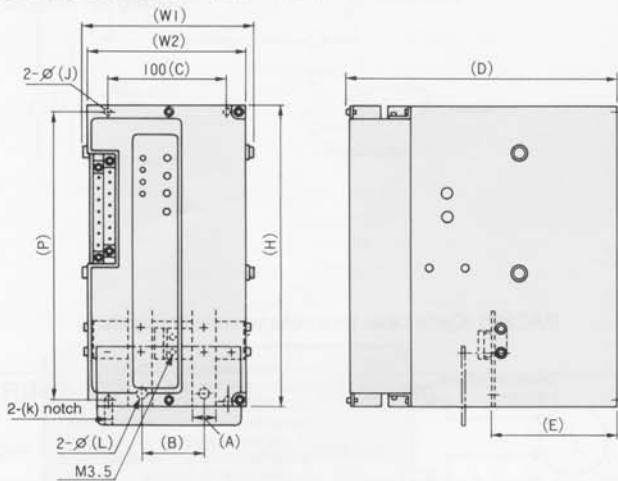
Current	100~240 V	100~440 V
Code	20, 30 A	45, 60 A
W 1	87	113
W 2	80	105
D	166	176
C	39.5	52.5
T	M 4	M 6

Note) For 380~440V, 20 and 30A use 45 and 60A cases,

Weight
 20A & 30A: approx. 3kg.
 45A & 60A: approx. 3.8kg.

Unit: mm

80A, 100A, 150A & 250A (100~440V)

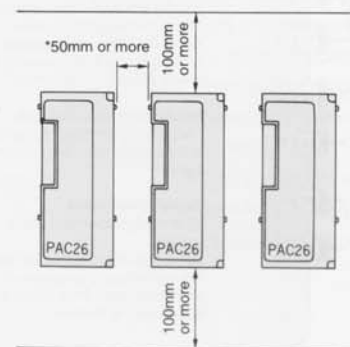
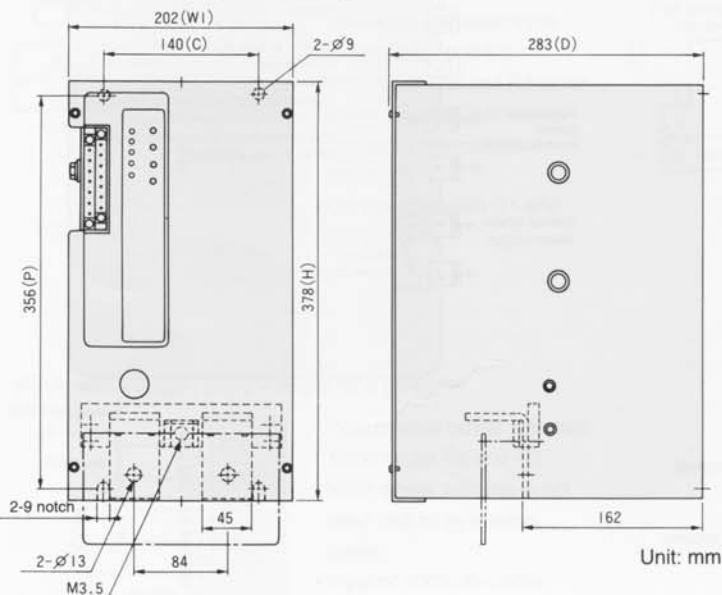


Current	80, 100 A	150, 250 A
Code	80, 100 A	150, 250 A
W 1	141	140
W 2	130.5	128
H	250	300
D	225	274
P	238	286
A	20	25
B	53	58
J	6	7
K	6	7
L	9	11
E	104	165

Weight
 80A & 100A: approx. 6.1kg.
 150A & 250A: approx. 8.7kg.

Unit: mm

350A & 450A(100~440V) Weight: approx. 17kg.



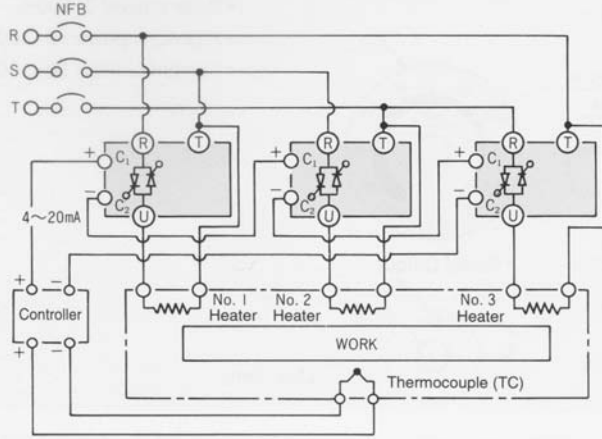
- Wiring should be conducted for ease of maintenance and inspection at the opened door. (*Avoid adherent installation in order to open cover for wiring.)

Unit: mm

APPLICATION EXAMPLES

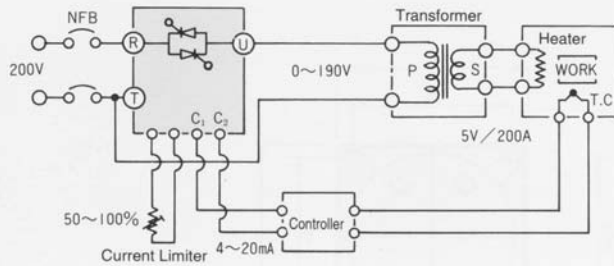
• Application of 1 Controller with 3 PAC26's

(Since receiving impedance is 100Ω, up to 6 PAC26's can be used with one controller.)



No.1~No.3 are controlled by the same control signal from the controller. In order to broaden the soaking temperature band in the furnace, the respective outputs should be differentiated. In such a case, the built-in (or external: option) power adjuster serves to make balancing adjustment.

• Application with Transformer (Phase Angle Control System Only)



—Transformer is used for:—

1. Matching the heater terminal voltage.
2. Insulating between the primary side and secondary side.

Applicable Heating Unit:
Pure metallic heater, SiC heater