SHIMADEN 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.



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	Stable output provided by the voltage control function and easy operation achieved
feedback:	by the linear characteristics of control input and output voltage.
Soft start function:	Setting suitable soft start 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		Power Control Function	
Contact signal:	Non-volatage contact signal	Standard:	Power adjustment (internal) / 0~100%
Current input:	4~20mA DC,	Option:	External power / 0~100%
	Receiving impedance: 100Ω		Manual power / 0~100%
Voltage input:	1~5V DC,		Base power / 0~100%
	Input impedance: 200k Ω		High-low power (contact input type)
	0~10V DC,		•High power / 0~100%
	Input impedance: 200k Ω		•Low power / High × 0~100%
Power Voltage and Ratings			External power + Manual power
100V type:	100~110V ±10% 50 / 60Hz		External power + Base power
	110~120V ±10% 50 / 60Hz		Auto power control function / 50~100%
200V type:	200~220V ±10% 50 / 60Hz	Alarm Monitors and Rating	
	220~240V ±10% 50 / 60Hz	Over-current:	[O.C] monitor lights. / AL 1-AL 2 conducted
400V type:	380~400V ±10% 50 / 60Hz	Fan stop for models over	
	400~440V ±10% 50 / 60Hz	150A:	[FAN] monitor lights. / Same as above
Power Supply for 400V		Fuse burnt out:	[FUSE] monitor lights. / Same as above
Type and External Power		Heater break:	[H / B] monitor lights. / HB1-HB2 conducted
Ratings		Output contact rating:	240V AC 1A / load resistance
20~100A:	200~220V 20VA	Operating Environment	
150~450A:	200~220V 50VA	Ambient temperature	
Current Capacity and		range:	-10~50°C
Cooling System		Ambient humidity:	90% or less without condensation
20, 30, 45, 60, 80 & 100A:	Self-cooling system	Insulation Resistance	
150, 250, 350 & 450A:	Forced air cooling system	Power terminals	
Over-current Protection		and chassis:	500V DC 20MΩ
System		Dielectric Strength	
Electronic type (gate		Power supply terminals	
breaking system)		and chassis:	
standard:	about 130% of rated current	100~240V power supply:	2000V AC 1 minute
Rapid fuse type (optional):	130~150% of rated current	380~440V power supply:	2500V AC 1 minute
Reset		Material / Finish	Ordinary steel plate / paint coating
Electric type:	Turn power OFF and reapply	External Dimensions and	
Rapid fuse type:	Replace fuse	Weight	See external dimension diagrams.

INDIVIDUAL SPECIFICATIONS

Phase Control System (PAC26P)

Control system: Soft start time: Output voltage control range: Output stability: Output voltage characteristics: Over-current protection system: Applicable load: Additional Functions (options) Power control function: Constant-current control (current feedback): Constant-power control (power feedback): Voltage square control (voltage feedback): Output limiting function: Current limiting: Start up output limiting: Rapid fuse: Heater break alarm: Cycle Base Zero Voltage Switching System (PAC26C) Control system: Output power control range: Over-current protection system: Applicable load: Additional Functions (options) Power control function:

Operating output indicator: Rapid fuse: Heater break alarm: Phase control system Adjustable 1~10 sec. (90% rise) 0~97% minimum of input voltage Output fluctuation less than ± 2% when input fluctuation is ± 10% Linear output by voltage feedback Equipped with electronic protective function All types of heaters (added functions to be selected according to heater characteristics)

See "Common Specification" For pure metallic heaters, super Kanthal, etc. For SiC and carbon heaters Nichrome wire heaters

To limit to $50 \sim 100\%$ of rated current To limit to $0 \sim 60\%$ output for $1 \sim 60$ sec. Equipped with alarm output function Setting at $0 \sim 100\%$ of rated current

Cycle base zero voltage switching system 0~95% minimum of load current Equipped with electronic protective function Constant-resistance heaters such as a nichrome wire heater

See "Common Specification" 1~100% Equipped with alarm output function Setting at 0~100% of rated current

SHIMADEN SINGLE PHASE POWER REGULATOR

ORDERING INFORMATION (PAC26P)

ITEMS	ITEMS CODE				SPECIFICATIONS								
SERIES PAC	26P					Pł	Phase Angle Control Single Phase Power Regulator						
	2				-				Co	Contact			
	3								1~	1~5V DC Input Impedance: 200kΩ			
CONTROL INI	PUT 4								4~	20mA DC Receivi	ing Impedance: 100 Ω		
	6								0~	10V DC Input Imp	pedance: 200kΩ		
	9								Ot	hers (Please cons	sult before ordering.)		
	1	13-							10	0~110V AC			
	1	14-							11	0~120V AC			
POWER SUPP	PLY 1	15-							20	0~220V AC			
	1	16-							22	240V AC			
	1	17-							38	0~400V AC	Note: 200V power supply is separetely required for electric		
	1	18-							40	0~440V AC	sourse and power for fan.		
				1	00~2	240V	AC			380~440V	AC		
		0)21			20A			022	20A			
		0)31			30A			032	30A			
		0	041			45A			042	45A			
		0)61			60A			062	60A			
CURRENT CA	APACITY	0	81			80A			082	A08			
		1	01			00A			102	100A			
		1	51			50A			152	150A			
		2	51			250A			252	250A			
		3	51			150A			352	350A			
		4	0			AUCI			452	AUCH 400	andard feature)		
			1							onstant current			
FEEDBACK F	UNCTION		2	-									
			3							ltage Square-root			
				0					No	one			
				1					St	artup time output	control limiting (0~60%, 1~60sec.)		
OUTPUT CON	NTROL FU	INCT	ION	2					Current limiting				
				3			St	Startup time output control + Current limiting					
					Ν				No	one (Internal instal	lation as standard)		
				ст	Ρ				E>	External power adjuster			
					В				Ba	Base (low) power adjuster			
EXTERNAL P	OWER	Ľ			Н	L			Hi	High / Low power adjuster			
ADJUSTER					Ρ	ļ			E>	ternal power adju	ster		
		C		NT /	Μ	 			Ma	anual power adjus	ter		
			/OLIAG	ΞE	В				Ba	ase power adjuster	r		
		'			W				E>	ternal power + Ma	anual power		
					Y	 _			E>	ternal power + Ba	ise power		
HEATER BRE		M				0			W	ithout			
						1			W	ith (0~100% settin	g of rated current)		
RAPID FUSE						-	0		W	ithout			
							1	0	VV	ith (See rapid fuse	option.)		
		-		IOTI	ONC		-	0	VV				
AUTO POWER	K ADJUSI	NE	NIFUN		ONS	,	_	4	4~	20mA DC Receiv			
								0	0~ W/	ithout			
REMARKS								0					
9			VV	ith (Please consul	t before ordering.)								

CONSTANT C	URRENT / VOLTAGE	PARTS NO.					
004	100~240V	25SHA 30S					
20A	380~440V	50SHA 30S					
20.4	100~240V	25SHA 40S					
30A	380~440V	50SHA 40S					
45A / 1	100~440V	50SHA 60S					
60A / ⁻	100~440V	50SHA 80S					
80A / ⁻	100~440V	50SHB 120S					
100A / 1	100~440V	50SHB 150S					
150A / 1	100~440V	50SHB 200S					
250A / 1	00~440V	50SHB 350S					
350A / 1	00~440V	CSSF 500					
450A / 1	00~440V	CSSF 600					

ORDERING INFORMATION (PAC26C)

ITEMS					COD	E								SPECIFICATIONS		
SERIES	PAC26C											С	Cycle Base Zero Voltage Switching Single Phase Power Regulator			
		2										С	Contact			
		3										1.	-5V DC Input Im	pedance: 200kΩ		
CONTRO	OL INPUT	4										4	-20mA DC Rece	eiving Impedance: 100Ω		
		6										0.	-10V DC Input I	mpedance: 200kΩ		
		9										0	thers (Please co	onsult before ordering.)		
			13-									1(00~110V AC			
			14-									1	10~120V AC			
POWER	SUPPLY		15-									20	00~220V AC			
	001121		16-									2	20~240V AC			
			17-									3	30~400V AC	Note: 200V power supply is separately required for electric sourse and power for fan.		
			18-									4	00~440V AC			
					1	00~2	240V	' AC					380~440	V AC		
				021			20/	4				022	20	A		
				031			30/	4				032	30	A		
				041			45/	4				042	45	A		
CURREN	NT CAPAC	ITY		061			60/	4				062	60	60A		
				081	80A					082	80A					
				101		100A					102	150A				
				151			2504					152	150	250A		
				251	51 250A					252	250	A				
				<u>351</u> 451		350A				152	52 450A					
				401		N	100/	`				432 N	one (Internal ins	tallation as standard)		
						P						F	xternal power ac	liuster		
				COI	NTACT	B						В	Base (low) power adjuster			
EXTERN		R		INP	UI	 H					Н	High / Low power adjuster				
ADJUST	ER					Р						E	External power adjuster			
				CUE		M				M	Manual power adjuster					
				VOL	TAGE	В						Base power adjuster		ter		
				INP	UT	W						External power + Manual power		Manual power		
						Y						E	External power + Base power			
			214				0					N	/ithout			
	DREAR P	ALAF	< IVI				1					N	/ith			
RAPID F	USE							0				N	lithout			
	002							1				N	ith (See rapid fu	ise option.)		
								-	0			N	lithout			
AUTO PO	OWER AD	JUS	TME	ENT	FUNCT	ION	S	-	4			4	-20mA DC Rece	eiving Impedance: 100Ω		
			6			0.	-10V DC Input I	mpedance: 200kΩ								
OPERAT	ING OUTI	PUT	INC	ICAT	OR					0		N	/ithout			
										1		N	/ith			
REMAR	<s< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td><td>M</td><td>/ithout</td><td></td></s<>										0	M	/ithout			
					9	N	ith (Please cons	sult before ordering.)								

Rapid Fuse Option

CONSTANT C	PARTS NO.					
20.4	100~240V	25SHA 30S				
20A	380~440V	50SHA 30S				
20.4	100~240V	25SHA 40S				
30A	380~440V	50SHA 40S				
45A /	50SHA 60S					
60A /	50SHA 80S					
80A /	100~440V	50SHB 120S				
100A /	100~440V	50SHB 150S				
150A /	100~440V	50SHB 200S				
250A /	50SHB 350S					
350A /	100~440V	CSSF 500				
450A /	CSSF 600					

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.

ITEMS		POWER	R FOR VOLTA	TOTAL HEAT GENERATED	ON MAXIMUM OUTPUT [W]			
CURRENT CAPACITY	100V	200V	380V	400V	440V	WITH FUSE	WITHOUT FUSE	COOLING
20A	2	4	7.6	8	8.8	32	29	
30A	3	6	11.4	12	13.2	49	45	
45A	4.5	9	17.1	18	19.8	60	54	Self-cooling
60A	6	12	22.8	24	26.4	75	65	system
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	
250A	25	50	95.0	100	110.0	327	300	Forced air
350A	35	70	133.0	140	154.0	420	385	cooling system
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.

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

CONTROL SYSTEM AND CHARACTERISTICS

-			
ITEMS	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	can not 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 SYTEM	OUTPUT WAVEFORM OF THE CYCLE BASE ZERO VOLTAGE SWITCHING SYSTEM
0%		
30%	<u>_</u>	\\\
50%		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
70%	_^	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
100%	\sim	~~~~~~~

DRAWING OF ADDITIONAL FUNCTION CHARACTERISTICS

Automatic Power Adjusting Function



• Power Linear Characteristics (Voltage Square Feedback)



• Current Limiting Characteristics



• External Power Characteristics



• High / Low Power Characteristics



• Constant Current Characteristics (Current Feedback)



• Constant Power Characteristics (Power Feedback)



Start up Output Limiting Characteristics



Base (Residual) Power Characteristics



Heater Break Alarm Circuit



EXAMPLE OF THE AUTOMATIC POWER FUNCTION

The automatic power function is a power adjusting function that provides suitable control output to the thyristor by external equipment (programmable controller, computer and etc.) and improves controlling ability continuously providing suitable power to the SV (Set Value)

Constant Value Control



value to prevent overshooting and allow optimum control.

• Program Control



• Procedure for Automatic Power Adjusting Function



By setting output optimum to the low range set value on the [AUTO-POWER] adjuster, the output characteristic is designated to the line connecting automatic power adjusting value and the output at the maximum temperature. In case adjusting maximum output, adjusters for internal power and the external power are employed.



The power gets excessive in low range, resulting in overshooting and hunting.

Output without automatic power control function and result of control



Power gets excessive at the start time, resulting in overshooting, and in some cases control characteristics deteriorate in a low range.

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 SR253(SR25) Controller



When the SV analog output (4~20mA or 0~10V) of the SR253(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

$\left \right>$	Code	Terminal Code				
Terminal No.		Voltage / Current	Contact			
	1	C 1	C 1			
	3	C 2	C 2			
nal	5	R 1	R 1			
Ē	7	R 2	R 2			
te	9	R 3	R 3			
per	11	-	L 2			
d	13	М	L 3			
	15	AL1	AL1			
	17	AL2	AL2			
		Phase Control	Cycle			
	2	S 1	MO1			
	4	S 2	MO2			
nal	6	CL1	-			
Ē	8	CL2	-			
te	10	CL3	-			
Ver	12	AP1	AP1			
P L	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 and adjustment (option)
- AL1-AL2: Alarm output common to over-current, FAN,FUSE
- S1-S2: External sequence signal for limitting 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





* Rapid fuse is an optional items. 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 10k Ω 1W), after delivered to the user.

· With internal power standard

• To adjust output in case of

conduction between input

when power adjuster is not used

terminals C1 and C2.

Short circuit R2 and R3

(adjust by internal power

•Conduct between C1 and

adjuster).

C2: 0~100%

Wiring with contact output type controller

External power



High / Low power



- To adjust maximum output for conducted (on) input terminals C1-C2 and to maintain nonconduct (off) output.
- High power: Conduct between C1 and C2 0~100%

• Low power: No conduct between C1 and C2 High power x 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%



• To adjust power manually.

External contact

power adjusting

Please prepare the

automatic / manual

automatic / manual for

selection of automatic

and manual operations.

switches

switch.

External power + Manual power (Automatic / Manual)



Controlle

1

Base power adjuster

2

<u>_3</u>

Power adjuster

External power + Base(residual) power

1 CI(+)

3 C2(-)

5 R1

7 R2

9 R3

13 M

11

Base(residual) power

To keep output steady when the control signal is at 0%.

- The maximum power is adjusted by intenal power adjuster.
- Input of 0%: 0~100%

To adjust maximum

0% control signal.

output and to maintain

some parts of output

Power adjuster

Alarm circuit



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

• Aditional Function (Option) (Lower Terminal) Additional function terminals are all optional items.



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S

PAC26C (Cycle base zero voltage switching)



Output limit adjustment 0~ 60% (approx. 20% when shipped)

Time limit adjustment 1~ 60 sec. (approx. 1 sec. when shipped)

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	100~240V 20 , 30A	100~440V 45,60A				
W1	87	113				
W2	80	105				
D	166	176				
С	39.5	52.5				
Т	T M4 M6					
Note: For 380~440V, 20 and 30A use 45 and 60A cases						

Weight 20A & 30A: approx.3.0kg. 45A & 60A: approx.3.8kg.

Unit: mm

150 , 250A

140

128

300

274

286

25

58

7

7

11

165

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



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.)

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 case, the built-in (or external: option) power adjuster serves to make balancing adjustment.



- Transformer is used for: --

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

Applicable Heating Unit: Pure metalic heater, SIC heater

EXTERNAL POWER ADJUSTER & OPERATING OUTPUT INDICATOR

• External Power adjuster



• Operating Output Indicator (Zero Voltage Switching System)

The indicator that shows power value in continuous %, as it is improper indication (fluctuated) by showing output voltage and current by conventional panel meters for cycle operation zero voltage switching system.



400V STEP DOWN TRANSFORMER

In case of using system with power supply of 380~440V (high voltage), 200V low voltage power supply is required to provide electronic circuit and fan driving. No 200V power is supplied to the installed area, use the power supply (380~440V) after conversion down to 200V.

Transformer type: H40 - 20R25 Primary (input) voltage: 380V, 400V, 440V, 50 / 60Hz Secondary (output) voltage: 200V, 220V (200V terminal for PAC26) Capacity: 50VA (20A~100A / 2 sets, 150A~450A / 1 set of thyristor can be connected.) Voltage endurance: Between primary terminal and secondary terminal: 2500V AC 1 minute



Unit: mm

🕂 Warning

- This product is designed for controlling the power of a heater or similar equipment used in a general industrial facilities. (It is not to be used for any purpose which regulates the prevention of serious effects on human life or safety.)
- If the possibility of loss or damage to your system or property as a result of failure of any part of the process exists, proper safety measures must be made before the instrument is put into use so as to prevent the occurrence of trouble.

