SHIMADEN THREE-PHASE POWER REGULATOR

SERIES PAC36P 20~600A

- 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.

20A 30A, 45A 60A, 90A 135A, 180A 240A, 300A 450A, 600A

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) Stable output provided by the voltage control function and easy operation achieved

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 funcion:	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 180A):	[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

SPECIFICATION

Control input and Rating

Current input:	4~20mA / DC, Receiving impedance: 100Ω
Voltage input:	1~5V / DC, Input impedance: 200kΩ min. 0~10V / DC, Input impedance: 200kΩ min.
Contact signal:	Non-volatage contact signal Note: Select external power (P) or (H) in the table of code Selection Item 7, (Output Adjusting Function)

Power Supply and Rating

200V type:	200~220V AC ± 10% 50 / 60Hz 220~240V AC ± 10% 50 / 60Hz
400V type:	380~400V AC ± 10% 50 / 60Hz 400~440V AC ± 10% 50 / 60Hz
Control Mode:	Phase angle control system
Soft start:	Adjustable approx. 1~10 sec. (time for reaching 90%)
Applicable load:	Resistive load, inductive load (transformer primary side control)
Output voltage control range:	0~98% minimum of input voltage
Output stability (95% or less of output voltage):	Input fluctuation ± 2% or less when input fluctuation is ± 10%.
Control element configuration:	Mixed antiparallel configuration of SCRs and diodes

Over-current Protection System

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

Current Capacity and Cooling System

20A,30A,45A,60A,90A,135A:	Self-cooling system
180A,240A,300A,450A,600A:	Forced air cooling system

Alarm Monitors and Rating

Over-current:	[O.C] monitor lights. / AL1-AL2 conducting
Fan stop:	[FAN] monitor lights. / AL1-AL2 conducting
Fuse burnt out:	[FUSE] monitor lights./AL1-AL2 conducting
Heater break:	[H / B] monitor lights. / HB1-HB2 conducting
Output contact rating:	240V AC 1A / Resistive load

Power Lamp

Correct Phase sequence:	Green LED lights.
Open / opposite phase: sequence:	Red LED lights.

Operating Environment

Ambient temperature range:	-10~50˚C
Ambient humidity:	90% RH max. with no condensation

Insulation Resistance

Power terminal and chassis:	500V DC 20MΩ min.
Input terminal and power terminal:	500V DC 20MΩ min.

Dielectric Strength

Power terminals and chassis:	
200~240V power supply:	2000V AC 1 minute
380~440V power supply:	2500V AC 1 minute
Material / Finish:	Ordinary steel plate / paint coating (equivalent to N8.5 Munsell number)
External Dimensions and Weight:	See external demension drawings.
Terminal Cover:	Installed as standard equipment.

Additional functions (option)

Power adjuster

Connection to voltage / current output type controller	
Internal Power (standard):	0~100%
External Power:	0~100%
Manual Power:	0~100%
Base Power:	0~100%
External power + Manual power:	0~100%
External power + Base power:	0~100%
Connection to contact output type controller	
External Power:	0~100%
High-low power:	0~100%

Constant-current control (current feedback)

Applicable loads:	Pure metallic heaters, super Kathal, etc.

Constant-power control (power feedback)

Applicable loads:	SiC, carbon heaters

Power linear control (voltage feedback)

Applicable loads:	Nichrome heater
Output limiting function:	
Current limit:	50~100% of rated current
Start up output limiting:	0~60% output for 1~60sec.
Rapid fuse:	With alarm output function
Heater break alarm:	Setting at 0~100% of rated current
Automatic power adjusting function:	50~100%

INTERNAL HEAT GENERATED

Internal heat generated by series PAC36P at maximum current operation is as follows.The heat decreases is proportional to the current decrease. Ventilation should be considered for the system.

Rating current (A)	20	30	45	60	90	135	180	240	300	450	600
Internal heat generated (W)	82	121	151	196	274	442	620	731	1040	1567	2000

Approx. 10% more heat is generated in case of using rapid fuse.

SHIMADEN THREE-PHASE POWER REGULATOR

ORDERING INFORMATION

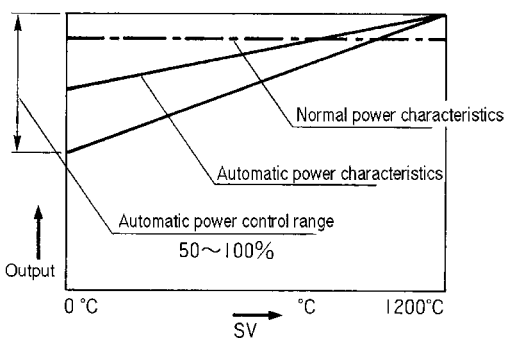
ITEMS	CODE																				SPECIFICATIONS
SERIES	PAC36P																				Phase Angle Control 3-Phase Power Regulator
CONTROL INPUT		3																			1~5V DC, Input Impedance: 200kΩ / contact signal
		4																			4~20mA DC, Receiving Impedance: 100Ω / contact signal
		6																			0~10V DC, Input Impedance: 200kΩ / contact signal
		9																			Others (Please consult before ordering.)
POWER SUPPLY			15-																		200~220V
			16-																		220~240V
			17-																		380~400V
			18-																		400~440V
CURRENT CAPACITY				200~240V																	380~440V
				CODE																	CODE
				021	20A																022 20A
				031	30A																032 30A
				041	45A																042 45A
				061	60A																062 60A
				091	90A																092 90A
				131	135A																132 135A
				181	180A																182 180A
				241	240A																242 240A
				301	300A																302 300A
				451	450A																452 450A
				601	600A																602 600A
FEEDBACK FUNCTION						0															Constant voltage (standard feature)
						1															Constant current
						2															Constant power
						3															Voltage Square-root
OUTPUT CONTROL FUNCTIONS							0														None
							1														Startup time output control limiting (0~60%, 1~60sec.)
							2														Current limiting
							3														Startup time output control + Current limiting
EXTERNAL POWER ADJUSTER								WHEN USED WITH VOLTAGE AND CURRENT OUTPUT CONTROLLER	N												None (Internal installation as standard)
									P												External power adjuster
									M												Manual power adjuster
									B												Base power adjuster
									W												External power + Manual power
									Y												External power + Base power
								WHEN USED WITH CONTACT OUTPUT	P												External power adjuster
									H												High-Low power adjuster
HEATER BREAK ALARM										0											Without
										1											With (0~100% setting of rated current)
RAPID FUSE											0										Without
											1										With (See rapid fuse table.)
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**

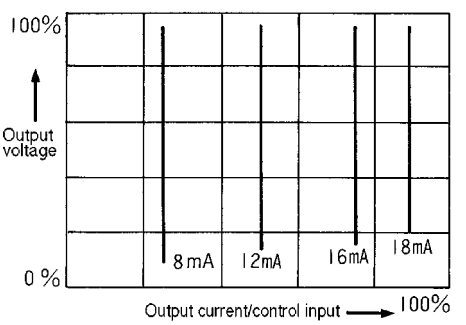
CURRENT CAPACITY	FUSE CAPACITY	PARTS NO.
20A	30A	CR6L- 30S
30A	40A	50SHA 40S
45A	60A	50SHA 60S
60A	100A	50SHB 100S
90A	120A	50SHB 120S
135A	200A	CS5F 200
180A	250A	CS5F 250
240A	350A	CS5F 350
300A	450A	CS5F 450
450A	600A	CS5F 600
600A	800A	CS5F 800

DRAWING OF ADDITIONAL FUNCTION CHARACTERISTIC

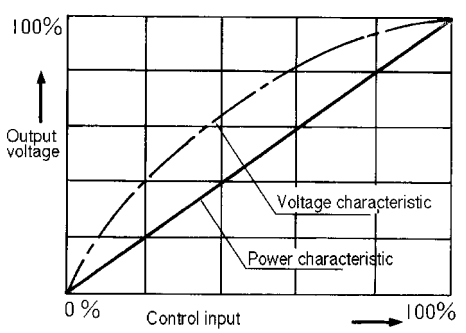
• **Automatic Power Adjusting Function**



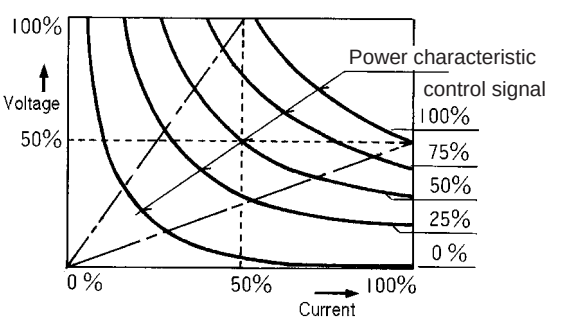
• **Constant Current Characteristics (Current Feedback)**



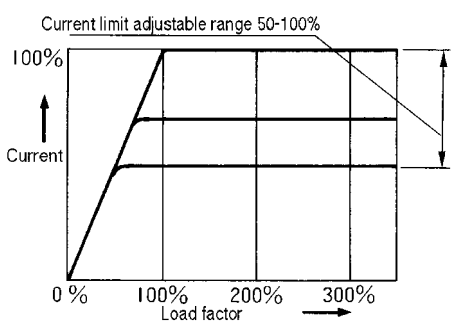
• **Power Linear Characteristics (Voltage Feedback)**



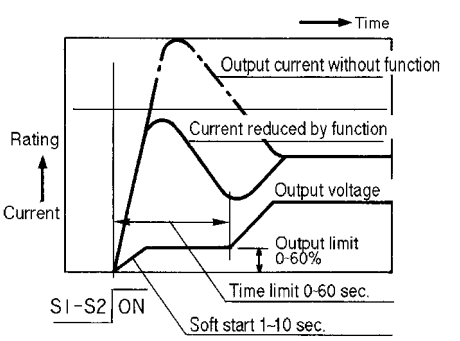
• **Constant Power Characteristics (Power Feedback)**



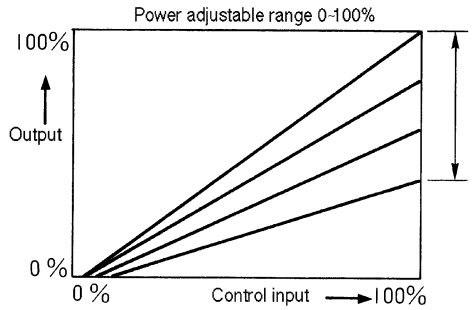
• **Current Limiting Characteristics**



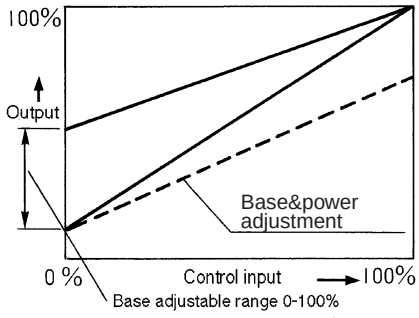
• **Start up Output Limiting Characteristics**



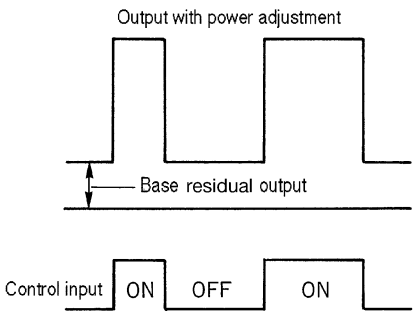
• **Output Power**



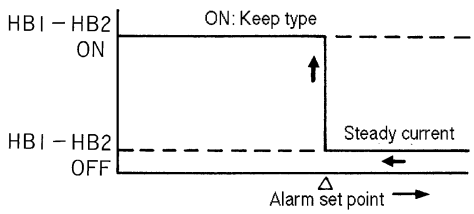
• **Base (Residual) Power Characteristics**



• **High / Low Power Characteristics**

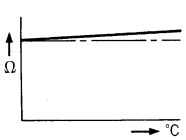
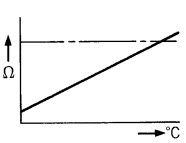
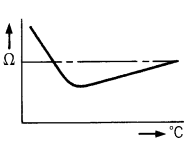


• **Heater Break Alarm Circuit**



HEATER CHARACTERISTICS

Heater elements are characterized as listed in the following table. Start up time output control limiting circuit is necessarily used for infrared lamp load. Addition of current limiting function is required for the loads with large heat capacity such as Platinum, Molybdenum, Tungsten and Kanthal Super.

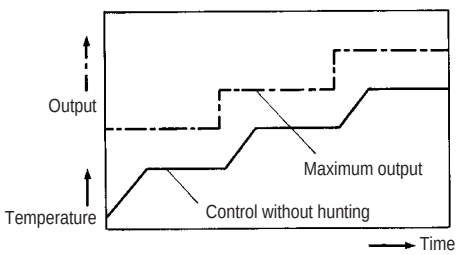
	Group	Load Type	Maximum Temperature	Resistance-Temperature characteristics	Additional Function
Rated Resistance Heater	Alloy	Nichrome Iron • Chrome Graphite Kanthal A	1100˚C (in air) 1200˚C (in air) 1330˚C (in air)		• General characteristics. Covered by standard specification.
Variable Resistance Heater	Pure Metallic	Tungsten Molybdenum Platinum Kanthal Super	2400˚C (in vacuum) 1800˚C (in vacuum) 1400˚C (in vacuum) 1700˚C (in air)		• Infrared lamp (Tungsten): Start up time output control limiting circuit. • Rush current should be reduced to the rating range by current limiting function.
	Carbonized Silicon	Techorandom Silliconit Elema	1600˚C (in air) 1600˚C (in air) 1600˚C (in air)		• Covered by standard specification by selecting twice current capacity. • Covered by load capacity by adding current limiting function. (Care has to be taken in the configuration without transformer.) • Adjust voltage to the terminal voltage of the load by using transformer.

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 or controller) and improves controlling ability continuously providing suitable power to the SV(Set Value)

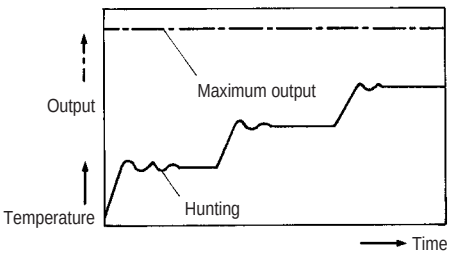
• Contstant Value Control

Output with automatic power control function and result of control



Power changes along with the SV value to prevent overshooting and allow optimum control.

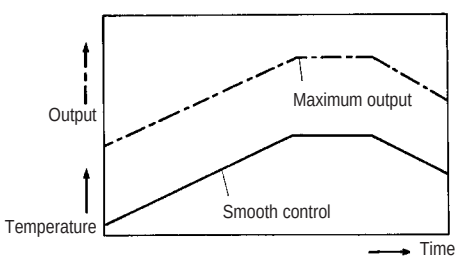
Output without automatic power control function and result of control



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

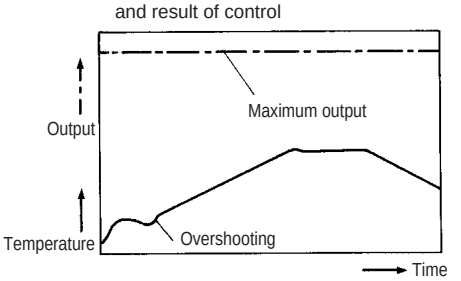
• Program Control

Output with automatic power control function and result of control



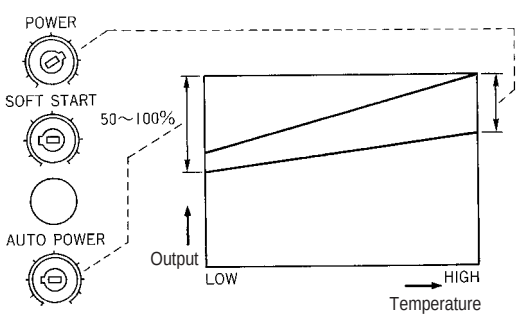
Soft control of the program is possible without transient characteristic (overshooting) at the start time

Output with automatic power control function and result of control



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

• Procedure for Automatic Power Ajusting Function

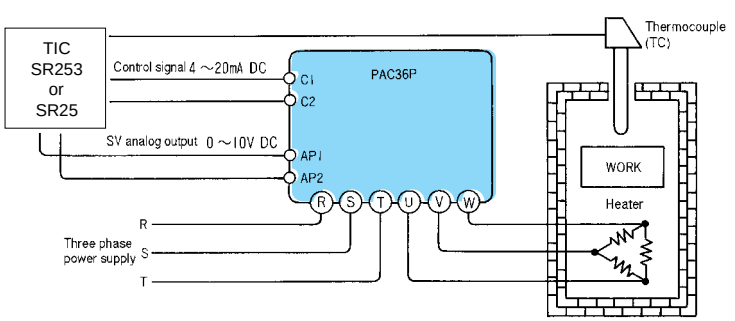


By setting output optimum to the low range set value on the [AUTO-POWER] adjuster, the output characteristic is designated to the line connecting automatic power adjusting value and the output at the maximum temperature. In case of adjusting maximum output, adjusters for internal power and external power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

• 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 or SR25 Adjuster

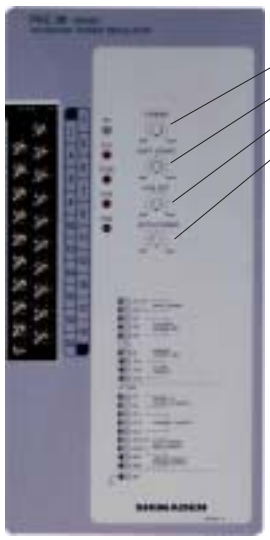


When the SV analog output (4~20mA or 0~10V) of the SR253 (SR25) controller is input to the auto power terminals (AP1 and AP2) of the PAC36, maximum power cramping, is set automatically by controller setting (SV) and the efficiency of control is improved. The combination plays another role; it effectively saves a total load when several thyristors are turned on simultaneously.
AP1-AP2.

SHIMADEN THREE-PHASE POWER REGULATOR

PANEL INFORMATION AND CONTROL TERMINALS

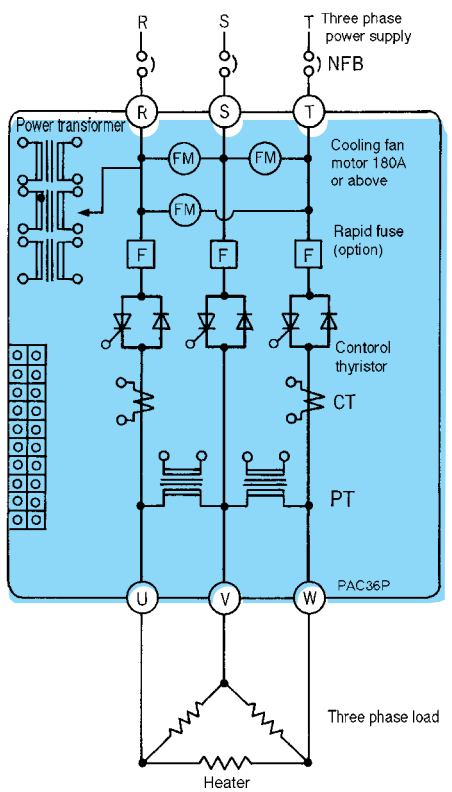
	Code / Terminal No.	Terminal code
Upper terminal	1	C 1 (+)
	3	C 2 (-)
	5	R 1
	7	R 2
	9	R 3
	11	—
	13	M
	15	AL 1
	17	AL 2
	19	AL 3
Lower terminal	2	S 1
	4	S 2
	6	CL 1
	8	CL 2
	10	CL 3
	12	AP 1
	14	AP 2
	16	HB 1
	18	HB 2
	20	G



- **Adjusters**
  - Internal power adjuster (standard)
  - Soft start time adjuster (standard)
  - Heater break alarm setting device (option)
  - Automatic power adjuster (option)
- **Monitor Lamps**
  - P.L.: Power supply
  - : Green LED turns on at correct phase sequence.
  - : Red LED turns on at open / opposite phase sequence.
  - O.C.: Over-current
  - Fuse: Burning-out of rapid fuse (option)
  - H / B: Heater break alarm (option)
  - FAN: Stoppage of cooling fan (standard for 180A or above)
- **Terminal Codes and Functions**
  - C1-C2: Control input
  - R1-R2-R3: External power (option)
  - M: Manual / base adjustment (option)
  - AL1-AL2-AL3: Alarm output common to over-current, FAN and FUSE
  - S1 - S2: External sequence signal for start up time output control limiting
  - CL1-CL2-CL3: Current limiting adjuster
  - AP1-AP2: Automatic Power signal input
  - HB1-HB2: Heater break alarm output

CIRCUIT BLOCK AND WIRING OF CONTROL TERMINAL

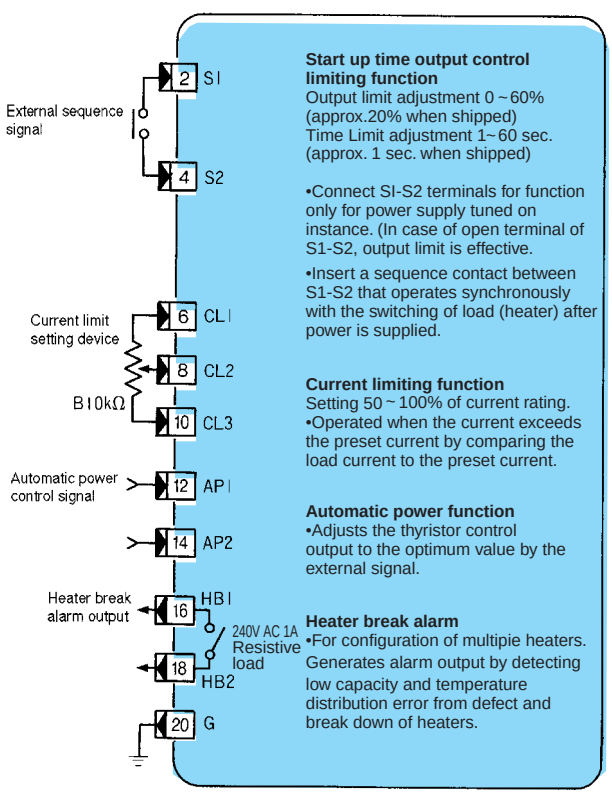
- **Circuit Block**



- **Additional Function (Option) (Lower Terminal)**

Terminal)

Additional function terminals are all optional items. No addtion can be made after delivery. Select the option on ordering.



Start up time output control limiting function
Output limit adjustment 0 ~ 60% (approx.20% when shipped)
Time Limit adjustment 1~ 60 sec. (approx. 1 sec. when shipped)

•Connect SI-S2 terminals for function only for power supply tuned on instance. (In case of open terminal of S1-S2, output limit is effective.

•Insert a sequence contact between S1-S2 that operates synchronously with the switching of load (heater) after power is supplied.

Current limiting function
Setting 50 ~ 100% of current rating.
•Operated when the current exceeds the preset current by comparing the load current to the preset current.

Automatic power function
•Adjusts the thyristor control output to the optimum value by the external signal.

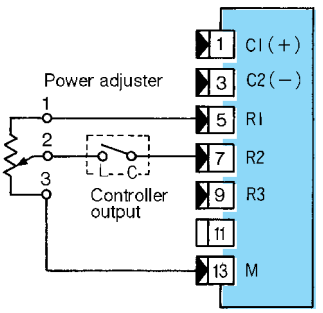
Heater break alarm
•For configuration of multipie heaters. Generates alarm output by detecting low capacity and temperature distribution error from defect and break down of heaters.

• Output Adjusting Function (Upper Terminal)

This function is availalbe by connecting adjuster (rating B 10kΩ 1W), after delivery.

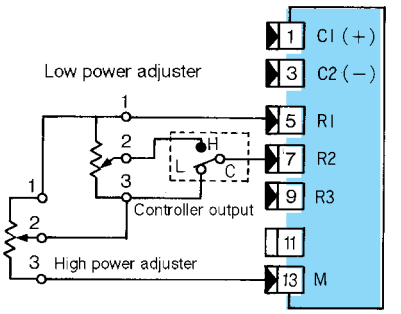
Wiring with contact output controller

External power



- To adjust output of contact ON (Controller output contact C-L conducted).
- Conduct ON: 0~100%

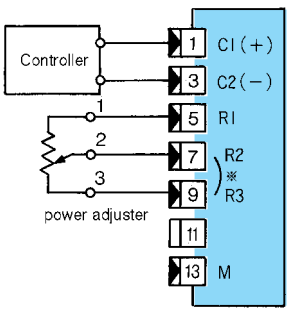
High / Low power



- To adjust maximum output for conducted (on) output contact C-L and to maintain non-conduct (off) (C-H conducted) output.
- High power: With C-L on 0~100%
- Low power: With C-H on High power x Low power

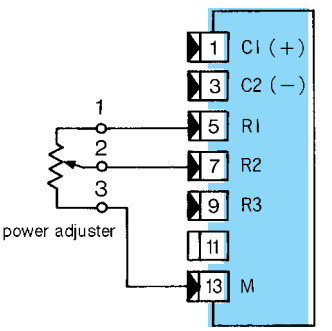
Wiring with voltage / current output controller

External power



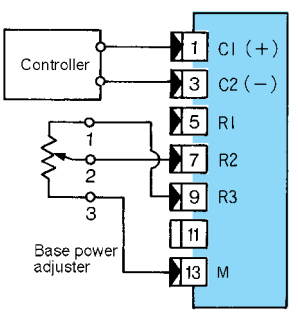
- Internal power adjuster as standard
- Short circuit R2 and R3 when power adjuster is not used. (Adjust by internal power adjuster).
- Input of 100%: 0~100%

Manual power



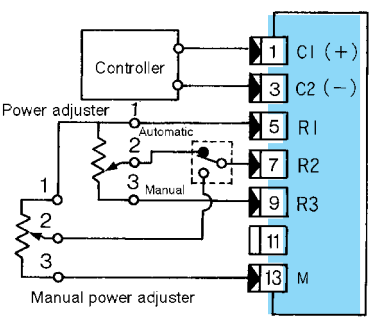
- To adjust power manually

Base (residual) power



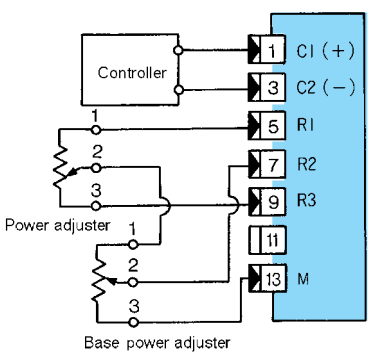
- To keep output steady when the control signal is at 0%.
- The maximum power is adjusted by internal power adjuster.
- Input of 0%: 0~100%

External power + Manual power (auto / manual)



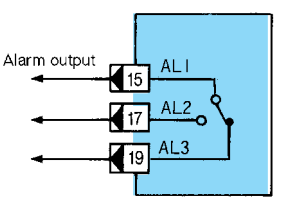
- External contact switches automatic / manual for power adjusting selection of automatic and manual operations.
- Please prepare the automatic / manual switch.

External power + Bass (residual) power



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

Alarm circuit

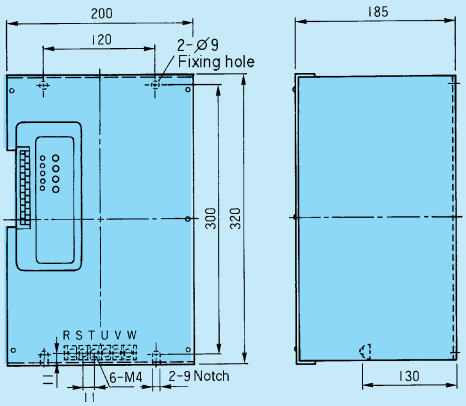


- Alarm output.
  Conduct between AL1 and AL2.
  Non conduct between AL1 and AL3.
- Operation
  Over-current protection circuit on operation.
  Fuse burnt out.
  Cooling fan stopped.

SHIMADEN THREE-PHASE POWER REGULATOR

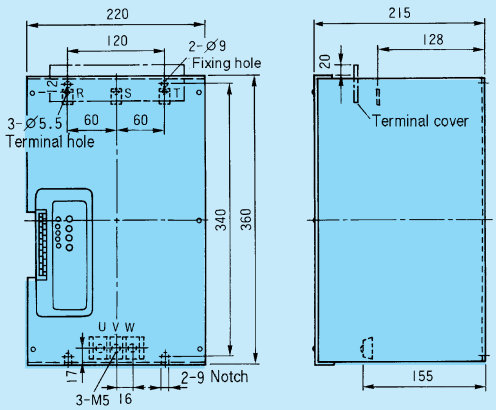
EXTERNAL DIMENSION, WEIGHT, MOUNTING

20A



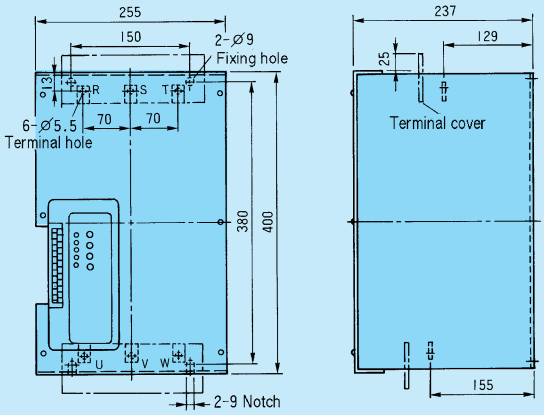
Weight: approx. 9kg.

30A • 45A



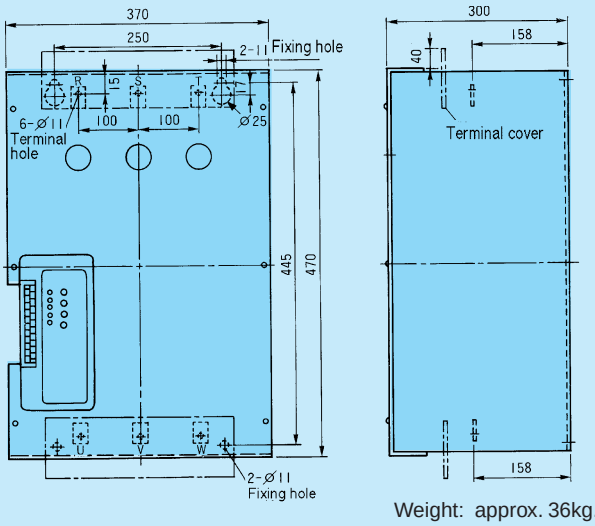
Weight: approx.12kg.

60A • 90A



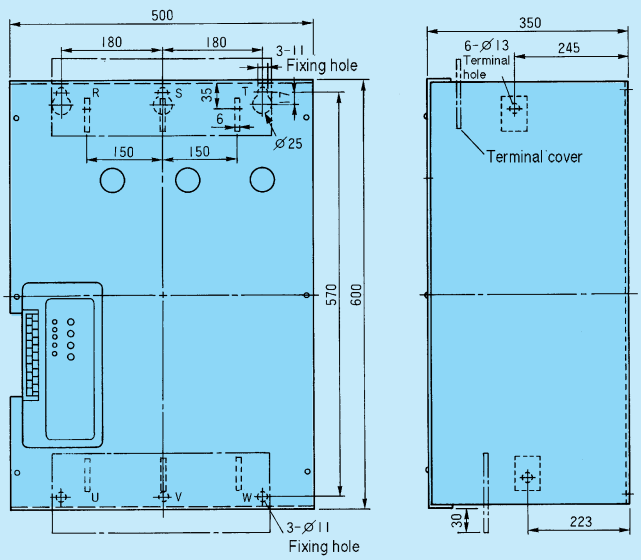
Weight: approx. 16.5kg.

135A • 180A • 240A • 300A



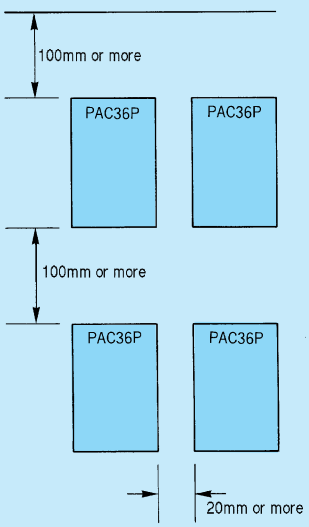
Weight: approx. 36kg.

450A • 600A



Weight: approx. 55kg.

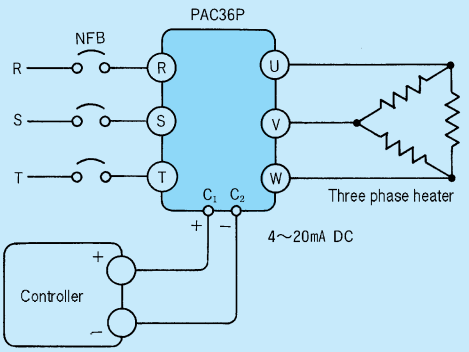
Mounting diagram



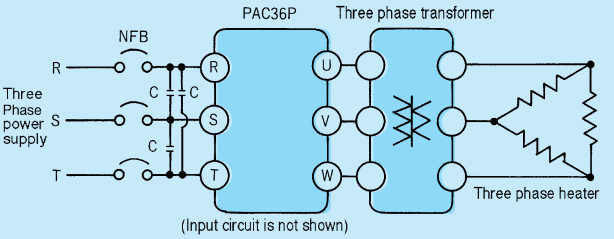
Unit : mm

APPLICATION EXAMPLES

•Application Connecting a Conventional Heater



•Application with Transformer



•Noise absorbing capacitor
C Oil capacitor
0.1~0.5 F / 1500V

The aim of transformer
•Isolates primary / secondary circuits.
•Adjust to the terminal voltage of the load.

– Note for transformer design –

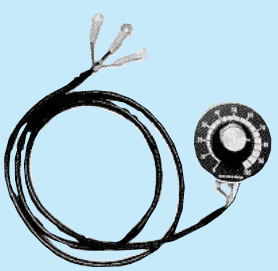
Generally, margin is set for magnetic flux density in application of switching controlling. The value of the magnetic flux density should be less than 8000 Gauss. Avoid unbalance of load and rush current from magnetic saturation.

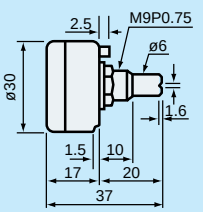
EXTERNAL POWER ADJUSTER

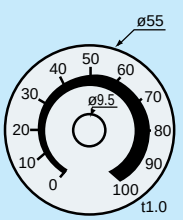
•Rating
Type: RV30YN20S
Characteristics / Resistance: B 10kΩ 1W

•External dimension and mounting
Lead: Vinyl lead wire 1 meter
Panel / Knob: 1 ea

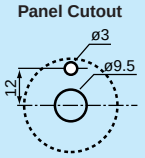
Names and scale
•External power / 0~100%
•Manual power / the same as above
•Base power / the same as above
•High / Low power / the same as above
•Current Limitrer / 50~100%







Panel Cutout



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.)

⚠ Caution

• 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.

ISO 9001

(The contents of this brochure are subject to change without notice.)

Temperature and Humidity Control Specialists

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