

Shinko

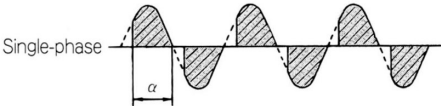
PA-3000-HZ Series (Single phase)



The PA-3000-HZ series includes a phase control system function for efficient control and a frequency division control system function for noise reduction.

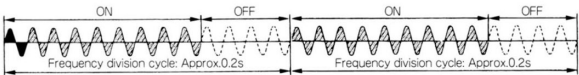
Phase control system

This control system allows infinite resolution. Power to the load can be smoothly adjusted by varying α (conduction angle) modulation depending on the input signal.



Frequency division control system

This control system suppresses noise. Power to the load can be adjusted by varying ON/OFF time ratio depending on the input signal.



Features

- Compact and lightweight
- Phase control/frequency division control selectable
- Automatic frequency detecting function
- Linearization of Input/Output characteristics
- Programmable soft start time

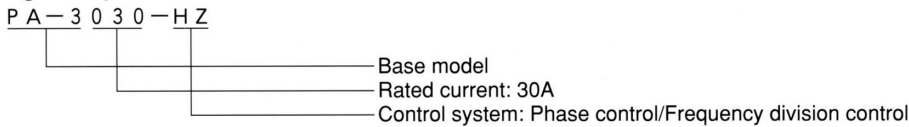
PA-3000-HZ series is compact and lightweight, which allows for ease of mounting in an instrumentation panel. Six models for current ratings of 20A, 30A, 40A, 50A, 75A and 100A are available for the regulation of AC power in conjunction with a controller. Two control systems, phase control (H) for continuous power control and frequency division control (Z) with zero-cross switching, can be selected by the built-in switch and available for various applications and power environments.

Model name

P A - 3 □ □ □ - H Z		Single phase	
Rated current	0 2 0	2 0 A	W48×H172×D143mm
	0 3 0	3 0 A	
	0 4 0	4 0 A	W68×H188×D148mm
	0 5 0	5 0 A	
	0 7 5	7 5 A	W116×H200×D157mm
	1 0 0	1 0 0 A	
Control system		H Z	H: Phase control (Default), Z: Frequency division control

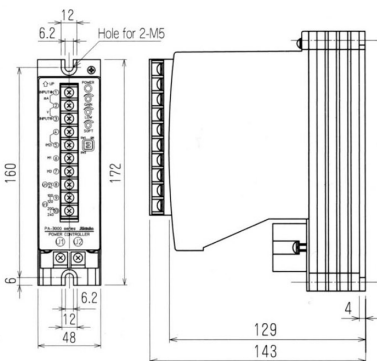
Please specify the specifications from the above □ □ □ column.
For further details, consult the agent or us.

Ordering example

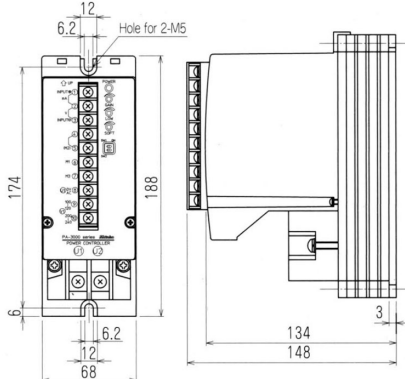


External dimensions

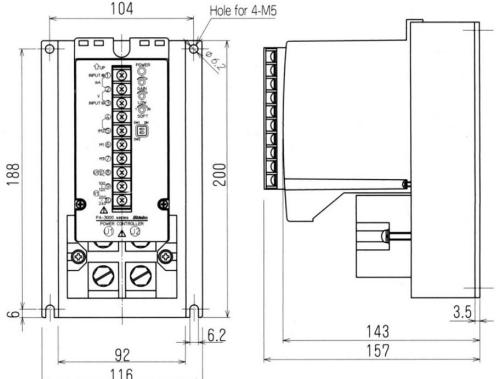
PA-3020-HZ, PA-3030-HZ



PA-3040-HZ, PA-3050-HZ



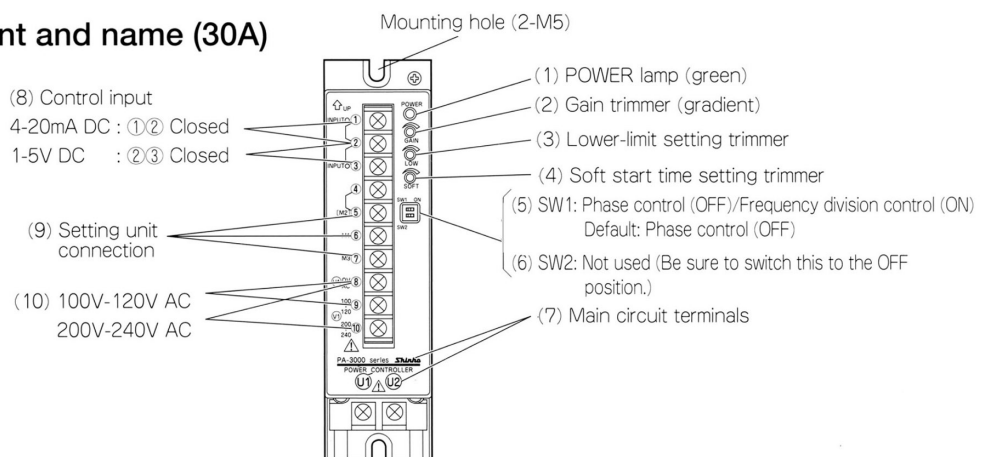
PA-3075-HZ, PA-3100-HZ



Standard specifications

Rated current	PA-3020-HZ----- 20A PA-3030-HZ----- 30A PA-3040-HZ----- 40A PA-3050-HZ----- 50A PA-3075-HZ----- 75A PA-3100-HZ----- 100A
Input signal	DC current: 4 to 20mA DC DC voltage: 1 to 5V DC or ON/OFF contact signal (selectable by terminals)
Input resistance	100Ω (4 to 20mA DC), 25kΩ (1 to 5V DC)
Rated voltage	100 to 120V AC, 200 to 240V AC Common to 100V line and 200V line (selectable by terminals) Allowable voltage fluctuation range: 90 to 110% of the rated voltage
Rated frequency	50/60Hz (automatic selection) Allowable frequency fluctuation: ± 2 Hz of the rated frequency (operation guarantee) ± 1 Hz of the rated frequency (performance guarantee)
Output range	0 to 98% of the rated voltage
Minimum load current	0.5A (At 98% output)
Applicable load	Resistive load Inductive load (transformer primary control, Gauss: 1.25T or less for Phase control system only)
Control system	Phase control/Frequency division control (Selectable by built-in DIP switch)
Output setting range	Gradient setting (0 to 100%) Lower-limit setting (0 to 100%)
Other functions	Soft start, Soft up/down (approx. 1 to 20 seconds) Soft start at reset of power interruption
Mounting method	Surface mounting
Isolation resistance	Between power terminal and case: 20MΩ or greater at 500V DC
Dielectric strength	Between power terminal and ground (radiation fin): 2000V AC for 1 minute
Attached functions	<ul style="list-style-type: none"> Soft start time setting The Soft start time and Soft up/down time are programmable. This function can handle a rapid change of load voltage and input signal, and reduces overloading of loads like overcurrent. Gradient setting function The output gradient according to input signal can be adjusted by a built-in trimmer. A gradient setting unit can also be connected externally. Lower-limit setting function By the built-in lower-limit setting unit, the variation band of output according to ON/OFF contact input signal can be adjusted, so efficient control can be performed. A Lower-limit setting unit can also be connected externally.
Ambient temperature	-15 to 55°C (Operation guarantee) 0 to 40°C (Performance guarantee)
Ambient humidity	30 to 90%RH
Weight	20A, 30A : Approx. 1.0kg 40A, 50A : Approx. 1.3kg 75A, 100A : Approx. 1.9kg
Accessories	Instruction manual, 1 copy

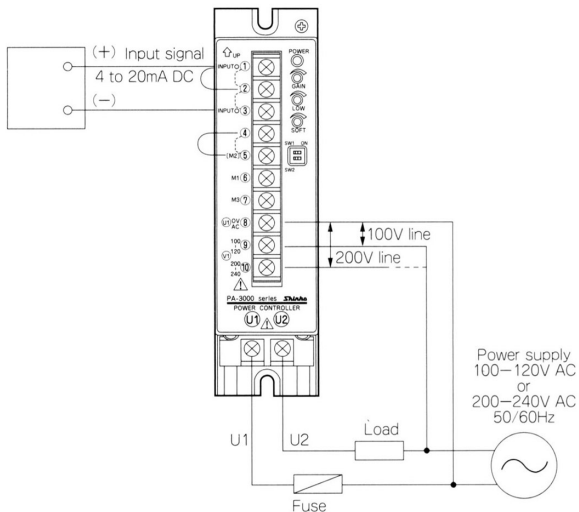
Terminal arrangement and name (30A)



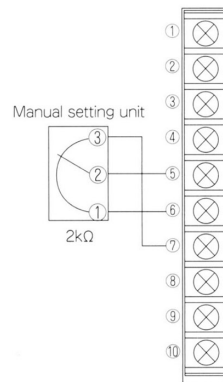
Name	Functions
(1) POWER lamp	Lights up (green) when the power is supplied to terminals ⑧, ⑨ and ⑩. Flashes while identifying the frequency after the power is turned on.
(2) Gain trimmer (gradient)	Gradient setting is possible. 100% when turned fully to the right (↗). Generally used at 100%. For Current/Voltage input, the gradient setting unit is installed externally.
(3) Lower limit setting trimmer	Output value when control input is 0% (Terminal ④ is connected to ③) can be set. The output value becomes 0% when it is turned fully to the left (↖). Generally used at 0% position. For the contact input, the lower-limit setting unit is also installed externally.
(4) Soft start setting trimmer	Soft start time can be set. When it is turned fully to the left (↖): Approx. 1 second. When it is turned fully to the right (↗): Approx. 20 seconds
(5) SW1	Switches frequency division control (ON) or phase control (OFF).
(6) SW2	Not used. Be sure to switch this to the OFF position.
(7) Main circuit terminals	Terminals for main circuit (U1, U2) running to the thyristor element.
(8) Control input	Input terminals for current (4 to 20mA DC) or voltage (1 to 5V DC) signal to control the output
(9) Setting unit connection	For Current/Voltage input: Terminals to connect the gradient setting unit and manual setting unit externally For Contact input: Terminals to connect output signals (④, ③, ⑤) from the controller with upper-limit and lower-limit setting units
(10) Power supply	Terminals to supply power to the power controller 100 to 120V AC: Terminals ⑧ and ⑨, 200 to 240V AC: Terminals ⑧ and ⑩

■ Wiring example

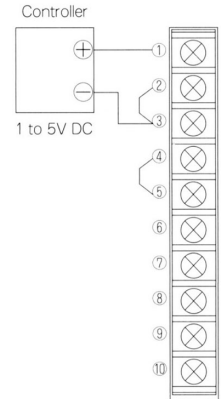
● Current signal 4 to 20mA DC



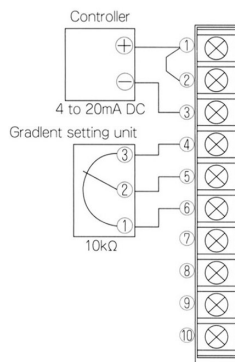
● Manual setting unit



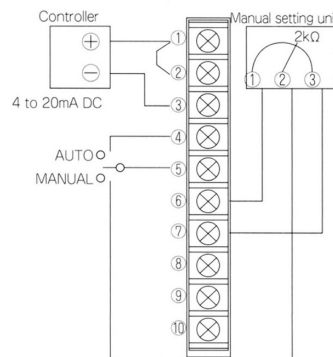
● Voltage signal 1 to 5V DC



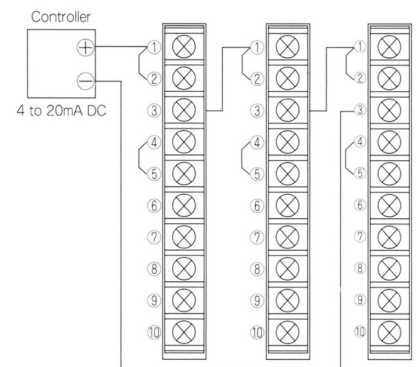
● Current signal 4 to 20mA DC with gradient setting unit



● Current signal 4 to 20mA DC with manual setting unit

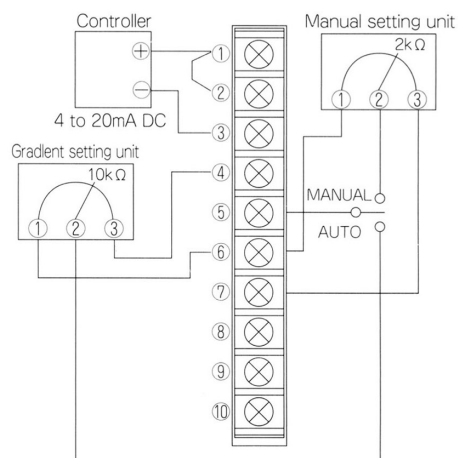


● Parallel running of 3 units by 4 to 20mA DC

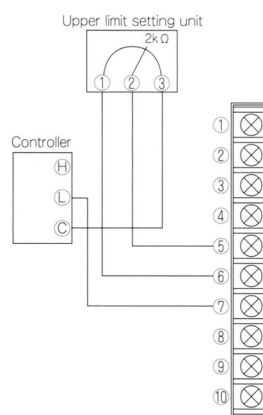


Contact input signal

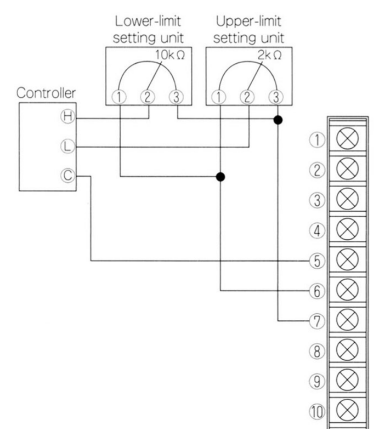
● Current signal 4 to 20mA DC with gradient setting unit and manual setting unit



● With upper-limit setting unit only



● With upper-limit setting unit and lower-limit setting unit



PA-3000-H3 series (Three-phase)



Phase control system for efficient control

To ensure enhanced input/output characteristics, partial feedback of outputs is provided with the phase control system. The power controllers based on the phase control system are available with voltage feedback, current feedback, power feedback and no feedback type. The optimal power controllers can be selected according to the particular characteristics of the heating element (nichrome wire, silicon carbide or other materials).

■ Features

- Compact and lightweight
- 12 types of current ratings
- Optimal model selection according to the characteristics of the heating element
- Various types of protection function

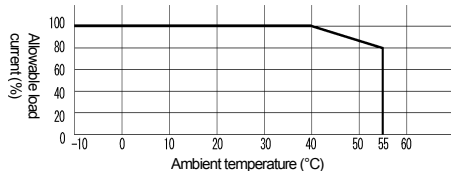
■ Model

Control system	Rated current									
	30A	50A	75A	100A	150A	200A	250A	300A	400A	500A
Phase control, Voltage feedback	PA-3030-VH3	PA-3050-VH3	PA-3075-VH3	PA-3100-VH3	PA-3150-VH3	PA-3200-VH3	PA-3250-VH3	PA-3300-VH3	PA-3400-VH3	PA-3500-VH3
Phase control, Current feedback	PA-3030-AH3	PA-3050-AH3	PA-3075-AH3	PA-3100-AH3	PA-3150-AH3	PA-3200-AH3	PA-3250-AH3	PA-3300-AH3	PA-3400-AH3	PA-3500-AH3
Phase control, Power feedback	PA-3030-PH3	PA-3050-PH3	PA-3075-PH3	PA-3100-PH3	PA-3150-PH3	PA-3200-PH3	PA-3250-PH3	PA-3300-PH3	PA-3400-PH3	PA-3500-PH3
Phase control, No feedback	PA-3030-H3	PA-3050-H3	PA-3075-H3	PA-3100-H3	PA-3150-H3	PA-3200-H3	PA-3250-H3	PA-3300-H3	PA-3400-H3	PA-3500-H3

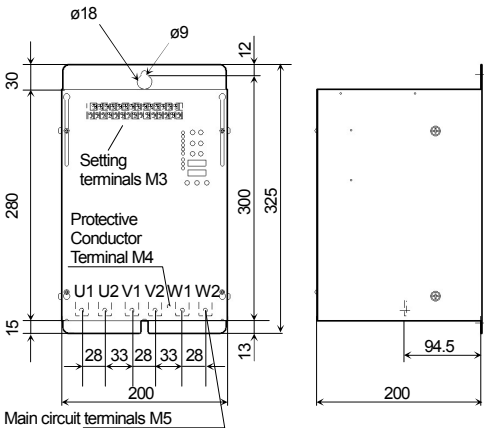
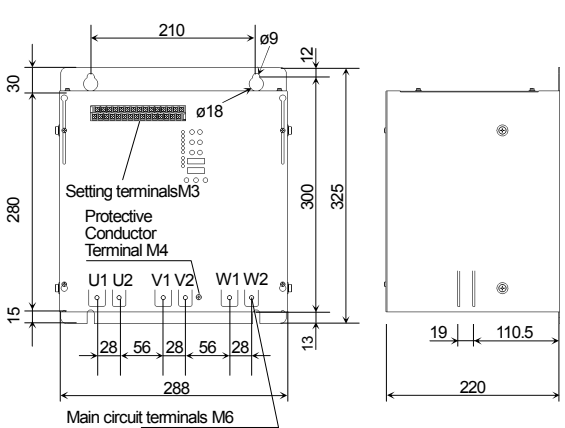
For a feedback type, 3 pieces of CT (Current transformer) are required for detection of load current and over-current.

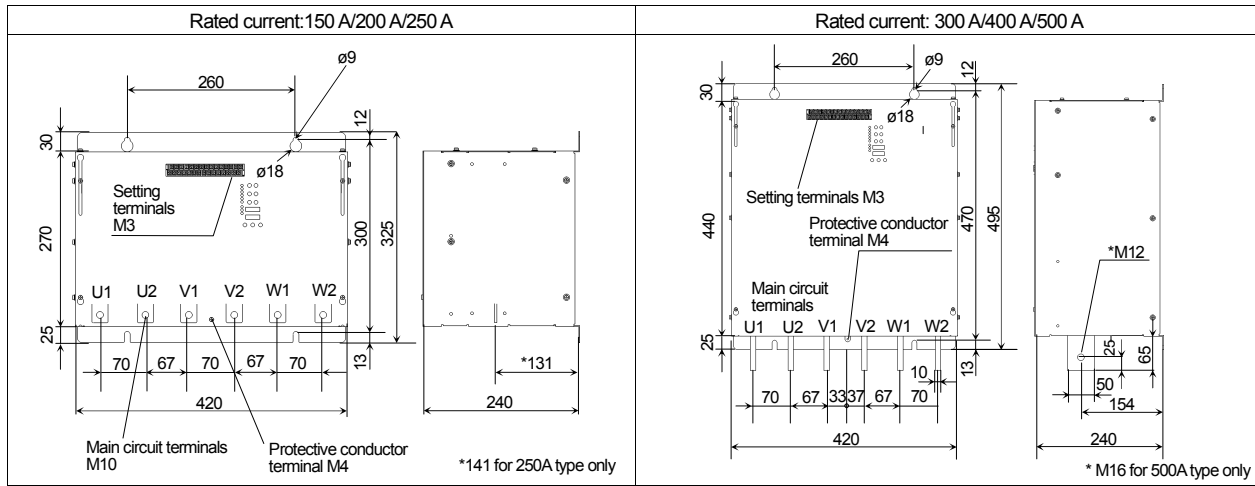
■ Specifications

Phases	3 phases
Rated voltage	200V AC (Selection with the 200V/220V/240V switch) 400V AC (Selection with the 380V/400V/440V switch), to be specified * With the standard specifications, the power supply to the main circuit and control circuit is common. A special type using separate power supplies for the circuits can also be manufactured as an option.
Rated current	30A, 50A, 75A, 100A, 150A, 200A, 250A, 300A, 400A, 500A to be specified
Rated frequency	50/60 Hz (Automatic switching)
Allowable voltage fluctuation	±10% of the rated voltage
Allowable frequency fluctuation	±2 Hz of the rated frequency
Control system	Phase angle control, zero-cross control
Arms	6-arm
Feedback type	Voltage, current, power
Control input signal	4 to 20mA DC (input resistance approx. 100 Ω, max. allowable current 25mA DC) 1 to 5V DC (input resistance approx. 50 kΩ, max. allowable voltage 10V DC)
Remote setting input	Trimmer signal (10 kΩ recommended, 2 to 20 kΩ allowable)
Remote contact input	Non-voltage contact signal or open-collector signal (External contact capacity 1mA, 5V DC or more)
Remote CT input	0 to 5A AC of the rated current
Slope	0% to 100% of the output range
Elevation	0% to 100% of the output range
Soft start time	Approx. 1 to 20 sec.
Current limit	0% to 100% of the output range
Imbalance rate adjustment	Output balance adjustment in the range of approx. 40% is enabled.
Output range	0 to 98% of the supply voltage
Output accuracy	Without feedback: ±10% of the rated voltage With voltage feedback: ±3% of the rated voltage (when rated voltage fluctuation is within ±10% and the load resistance fluctuation is within 1 to 10 times) With current feedback: ±3% of the rated current (when rated voltage fluctuation is within ±10% and the load resistance fluctuation is within 1 to 10 times) With power feedback: ±3% of the rated power (when rated voltage fluctuation is within ±10% and the load resistance fluctuation is within 1 to 3 times) The accuracy is under the reference operating condition and in the range of 10% to 90% of the ratings and is not specified under other conditions. The error of the CT is not included.
Applied load	Resistive load, inductive load The inductive load is applicable only in the control of the primary side of a transformer in the phase angle control method. The flux density recommended for the transformer is 1.2 T or less.
Minimum load current	0.5A or more (at 98% output at the rated voltage)
Alarm types	Over-current alarm (Alarm output: AL1) Rapid-break fuse meltdown alarm (Alarm output: AL1) Radiation fin over-heat alarm (Alarm output: AL1) Heater disconnection alarm (Alarm output: AL2) Thyristor element abnormality alarm (Alarm output: AL2) Imbalance alarm (Alarm output: AL2) Running abnormality alarm Phase-sequence abnormality alarm (Alarm output: AL3) Open-phase abnormality alarm (Alarm output: AL3) Frequency abnormality alarm (Alarm output: AL3)
Alarm output points	3 points (AL1, AL2, AL3) Alarm output AL1, AL2 ... When the alarm is activated, the output is turned on. Alarm output AL3 ... When the alarm is activated, the output is turned off.
Alarm output	Mechanical relay, Form A contact Max. load 240V AC/1A, 30V DC/1A, min. load 5V DC/10mA or more
Electrical life	100,000 cycles or more
Contact protection element	Not built in

Over-current protection device	Rapid-break fuse is melted down when the load is short-circuited. Output 0% (gate OFF) at approx. 120% of the rated current The current limit function can set the upper current limit arbitrarily. On the condition that a CT matching the rated current should be connected																						
Remote setting types	Slope (AI1), Elevation (AI2), Current limit (AI3)																						
Remote contact types	Running status (DI1: Run/Stop) Control system (DI2: Phase angle control/zero-cross control) Setting method (DI3: Front panel/Remote setting)																						
Cooling system	Rated current 75 A or less: Natural air cooling Rated current 100 A or more: Forced air cooling																						
Working temperature	<div>-10°C to 55°C</div> <div>The following derating characteristic is applicable at 40°C or more.</div> <div></div>																						
Working humidity	30% to 90%RH, No condensation.																						
Insulation resistance	Between power supply terminal and protective conductor (GND) terminals: 500V DC/50MΩ or more																						
Withstanding voltage	Between power supply terminal and protective conductor (GND) terminals: 2000V AC/1 min. (200V type) Between power supply terminal and protective conductor (GND) terminals: 2500V AC/1 min. (400V type) With the instrument with the cooling fan(s) (i.e. rated current 100A or more), the fan power cord should be unplugged (the cooling fan has a withstanding voltage of 2000V AC and should be eliminated).																						
Power consumption	<table><tr><td></td><td>200V supply type</td><td>400V supply type</td></tr><tr><td>Rated current 30A, 50A, 75A</td><td>15VA</td><td>20VA</td></tr><tr><td>Rated current 100A</td><td>40VA</td><td>55VA</td></tr><tr><td>Rated current 150A, 300A</td><td>65VA</td><td>90VA</td></tr><tr><td>Rated current 200A, 250A, 400A, 500A</td><td>90VA</td><td>125VA</td></tr></table>				200V supply type	400V supply type	Rated current 30A, 50A, 75A	15VA	20VA	Rated current 100A	40VA	55VA	Rated current 150A, 300A	65VA	90VA	Rated current 200A, 250A, 400A, 500A	90VA	125VA					
	200V supply type	400V supply type																					
Rated current 30A, 50A, 75A	15VA	20VA																					
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Rated current 150A, 300A	65VA	90VA																					
Rated current 200A, 250A, 400A, 500A	90VA	125VA																					
Generated heat	<table><tr><td>Rated current</td><td>Max. heat generation</td><td>Rated current</td><td>Max. heat generation</td></tr><tr><td>30A</td><td>140W</td><td>250A</td><td>920W</td></tr><tr><td>50A</td><td>180W</td><td>300A</td><td>1100W</td></tr><tr><td>75A</td><td>260W</td><td>400A</td><td>1530W</td></tr><tr><td>100A</td><td>380W</td><td>500A</td><td>1980W</td></tr></table>			Rated current	Max. heat generation	Rated current	Max. heat generation	30A	140W	250A	920W	50A	180W	300A	1100W	75A	260W	400A	1530W	100A	380W	500A	1980W
Rated current	Max. heat generation	Rated current	Max. heat generation																				
30A	140W	250A	920W																				
50A	180W	300A	1100W																				
75A	260W	400A	1530W																				
100A	380W	500A	1980W																				
External Dimensions	325 (H) x 200 (W) x 200 (D) (Rated current 30A/50A types) 325 (H) x 420 (W) x 240 (D) (Rated current 150A to 250A types) 325 (H) x 288 (W) x 220 (D) (Rated current 75A/100A types) 495 (H) x 420 (W) x 240 (D) (Rated current 300A to 500A types) Excluding projections																						
Weight	Approx. 8 kg (Rated current 30A/50A types) Approx. 22 kg (Rated current 150A to 250A types) Approx. 13 kg (Rated current 75A/100A types) Approx. 36 kg (Rated current 300A to 500A types)																						
Case assembly material	Ordinary steel sheets																						
Color	Gray																						
Installation instruction	Panel installation																						
Reference operation condition	Ambient temperature : 23°C ± 2°C Operating humidity : 55% ± 5%RH (No condensation) Power voltage : Rated voltage ± 1% Power frequency : Rated frequency Installation posture : 0° Front, rear, left and right.																						
Normal operation condition	Ambient temperature : -10 to 55°C Operating humidity : 30% to 90%RH (No condensation) Power voltage : Rated voltage ± 10% Power frequency : Rated frequency ± 2 Hz Installation posture : 5° Front, rear, left and right Vibration/impact : None. Altitude : 2000 m or less																						
Storage condition	Ambient temperature : -20 to 60°C Operating humidity : 5% to 90%RH (No condensation) Under the shipment packing from factory																						

■ External dimensions (Scale: mm)

Rated current: 30 A/50 A	Rated current: 75 A/100 A
	

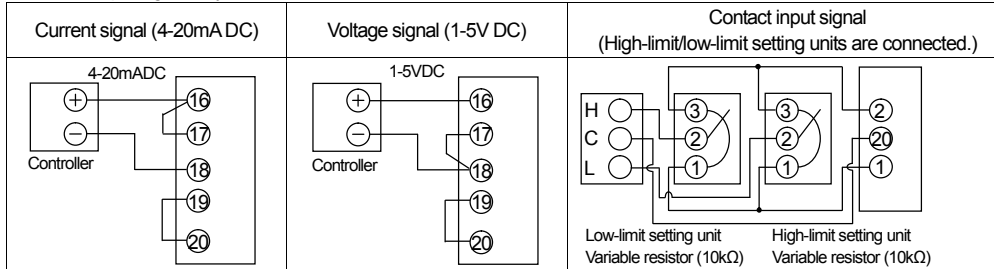


■ Connection of Setting Terminals



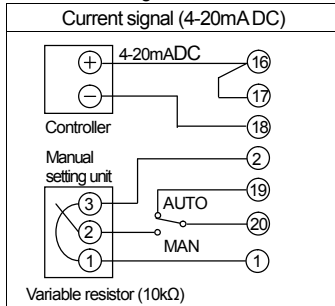
- To prevent accidents, be sure to turn this instrument off before proceeding to the following operations.
- The connection should be performed by Shinko or other qualified service personnel.

● Control input signal only

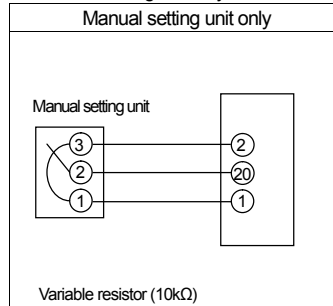


* Setting units: low-limit value < high-limit value

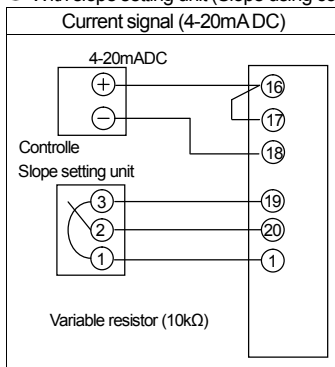
● Manual setting unit and with auto/man switching



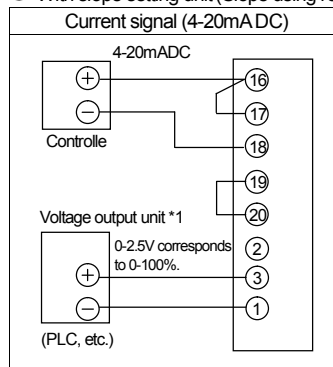
● Manual setting unit only



● With slope setting unit (Slope using control input signal)



● With slope setting unit (Slope using remote setting input)

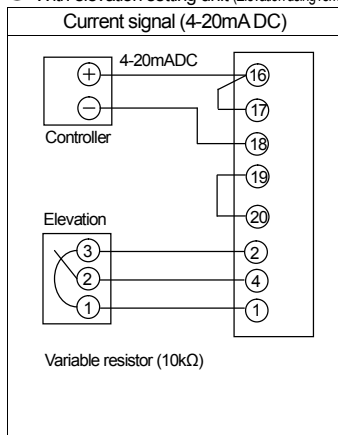


* Use the two short-circuit plates, which are provided for the connections between (16) and (17) (or (17) and (18)), and between (19) and (20), as required. Be sure to check the terminal numbers when connecting them.

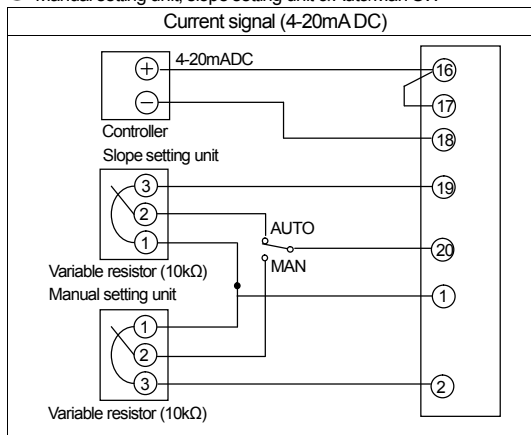
*1: When voltage output units are used for the remote setting inputs (AI1 to AI3),

It is necessary to isolate each output from the voltage output units when plural PA-3000-H3 are connected. In addition, the output from 1 set of the voltage output unit cannot be connected to plural PA-3000-H3 in parallel.

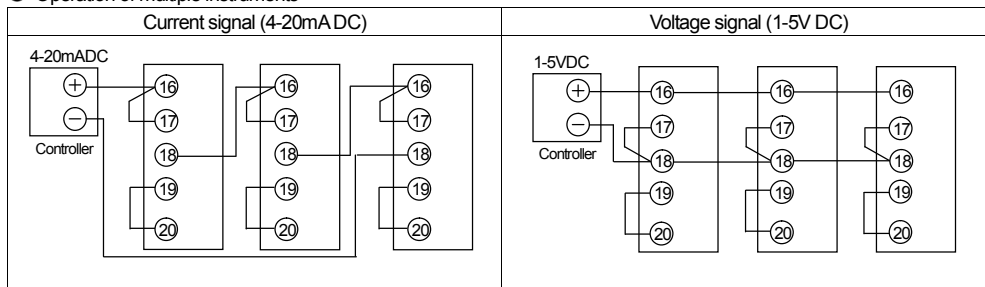
● With elevation setting unit (Elevation using remote setting input)



● Manual setting unit, slope setting unit & Auto/Man SW



● Operation of multiple instruments



* Connectable quantity of the PA-3000-H3 series in case of plural-unit operation is limited by the output capacity of a controller.



(1) After completing connections, be sure to reattach the setting terminal cover.

(2) The internal circuitry may be destroyed if an over-current or over-voltage is applied to the control input signal terminal. Be careful when applying a signal to this terminal.

■ Glossary

● Control Systems

• Phase angle control

The phase angle control system controls the output by varying the conducting angle θ (ON timing) within 210° (3-arm operation) or 150° (6-arm operation) of the power frequency. Most thyristor regulators employ this system.

This control is continuous compared to the zero-cross control and can be used in the primary side control of the transformer.

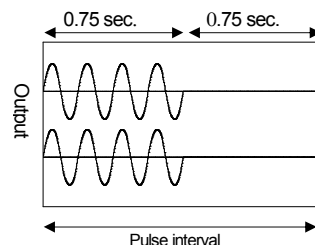
• Zero-cross control

The zero-cross control system controls the output by defining ON/OFF for each power waveform cycle.

It generates less noise than the phase angle control. However, as the maximum current flows during the ON period and it is intermittent, the flickering phenomena (Example: Lighting flicker) may be generated.

The zero-cross control can use only a Nichrome heater. Do not use it for the purposes other than the primary side control of the transformer and Nichrome heater, otherwise, the over-current alarm will activate or the rapid-break fuse will be melted down.

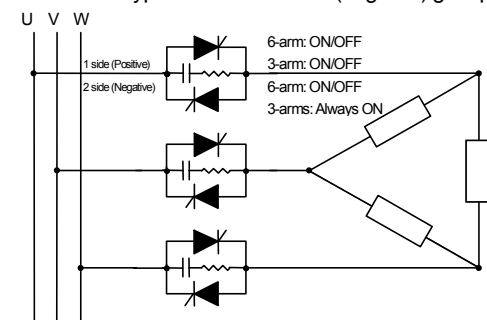
The pulse interval corresponds to the output updating interval. For example, when the pulse interval is 1.5 sec. (default value) and the output is 50%, the ON/OFF waveform becomes as shown on the right.



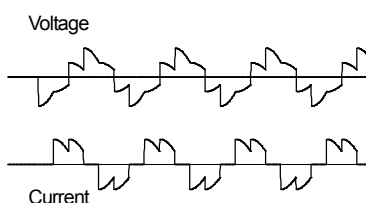
• 6-arm and 3-arm types

The "6-arm" type performs ON/OFF control of both the 1-side (positive) and 2-side (negative) gates of 1-power phase at the thyristor gate control.

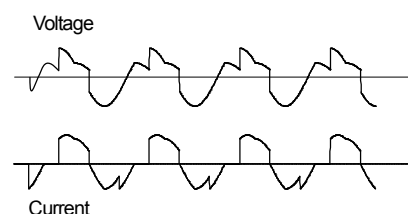
The "3-arm" type leaves the 2-side (negative) gate permanently ON. This instrument adopts the "6-arm".



[6-arm control waveform]



[3-arm control waveform]



● Feedback Type

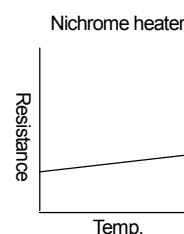
• Voltage feedback type

This is a type to control with the feedback of the voltage of the load, and is optimum for a heater with a low resistance-temperature characteristic as shown on the right (Nichrome heater, etc.).

Such a heater can be controlled stably by maintaining the output voltage from the thyristor regulator to a constant level.

This feedback can be used only with the phase angle control type.

Note) The voltage feedback type controls the average value of three-phase load voltage values. This type cannot control each phase individually.



• Current feedback type

This is a type to control with the feedback of the current of the load, and is optimum for a heater with a high resistance-temperature characteristic as shown on the right (Molybdenum disilicide heater, etc.).

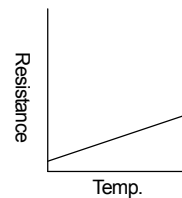
Such a heater can be controlled stably by setting the maximum output of the thyristor regulator to the maximum rated current of the heater because this makes it possible to output the current in proportion to the control input signal regardless of changes in the resistance value.

This feedback can be used only with the phase angle control type.

(Note) • A CT is needed for using the current feedback type. Connect a CT matching the rated current.

• The current feedback type controls the average value of three-phase load current values. This type cannot control each phase individually

Molybdenum disilicide heater



• Power feedback type

This is a type to control with the feedback of the power of the load and is optimum for a heater, the resistance of which varies according to the generated heat temperature and varies by nearly 4 times the initial resistance value across the ages (silicon carbide heater, etc.).

Such a heater can be controlled stably by detecting both the voltage and current applied to the load and by feeding back the power multiplying them.

This feedback can be used only with the phase angle control type.

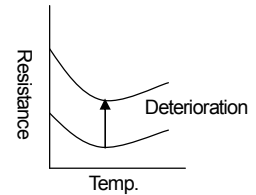
(Note) • A CT is needed for using the power feedback type. Connect a CT matching the rated current.

• The power feedback type controls the power consumption of a load (whole power of three phases).

[$\sqrt{3}$ x Average of three-phase load voltage values x Average of three-phase load current values]

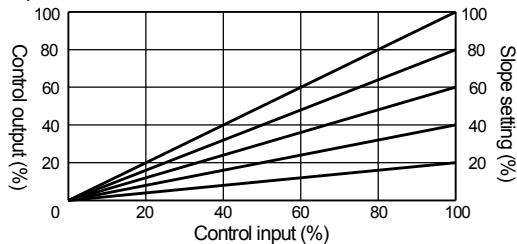
This type cannot control each phase individually

Silicon carbide (SiC) heater

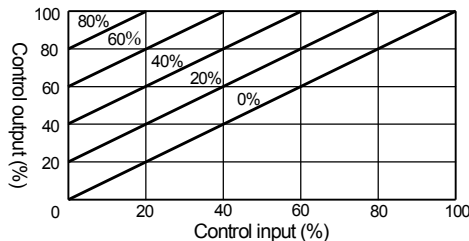


● Settings

• Slope



The slope setting provides the output (actually the internal SV used for processing) with a slope (inclination). It is effective for example in a electric furnace with 3-zone control which 3 sets of the thyristor regulator is operated by one set of controller.



The elevation setting provides the output (actually the internal SV used for processing) with a bias. For example, even when the controller output becomes minimum, a constant base power can be applied to an electric furnace, etc.

• Soft start

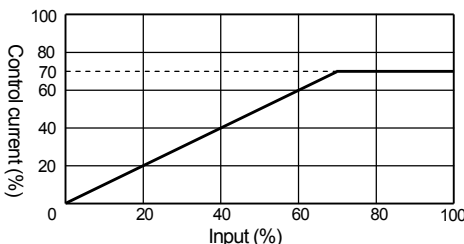
This function varies the output (actually the internal SV used for processing) gradually in order to prevent sudden change in the control output when this instrument is turned on or when the control input changes drastically. For example, a rush current can be suppressed in case of the primary side control of transformer. With this instrument, the reaching time of the SV from 0% to 100% can be set arbitrarily from about 1 to 20 seconds.

In the models without feedback, the change of output (reaching time of the SV 0% to 100%) by the soft start becomes faster slightly since the actual change of output includes the operation time of the feedback control, etc. added.

• Current limit

This function sets the maximum limit to the control current. For example, when the voltage feedback is used, the current flows according to the resistance of the load and the rated current of the power controller may be exceeded if only the voltage control it used. The current limit function is used in such cases. The judgment value is the average value of three-phase load current values. This function cannot control each phase individually

The following chart shows an example of current limit.



Current Limit 70%

(Note)

- A CT is needed for using the current limit.
Connect a CT matching the rated current.

• Imbalance adjustment

For the 3-phase control, although it is desirable that the voltage and current values of the three phases are the same values (balanced status), they are actually not the same values due to the reliability of the power supply and the imbalanced load (imbalanced status). When the imbalanced status is serious, the controllability is deteriorated as well as the overall reliability of the system.

The PA-3000-H3 Series incorporates the imbalance adjustment function adjusting the output value of each phase in certain range in case of the imbalanced status. This function solves the imbalanced status in a simulated manner and enables stable control. The imbalance adjustment is performed based on either the voltage or current.

• This catalog is as of February 2009, and specifications are subject to change without notice.

• If you have any inquiries, please consult us or our agency.

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