**INSTRUCTION MANUAL**

# POWER CONTROLLER PA-3000-HZ SERIES

No.PA32E3 2020.06

Thank you for purchasing our Single-phase Power Controller PA-3000-HZ series.
This manual contains instructions for the mounting , functions, operations and notes when operating the PA-3000-HZ.
To prevent accidents arising from the misuse of this instrument, please ensure the operator receives this manual.

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## ■ Model Label

The model label is attached to the upper side of this unit.

**Label**

MODEL
PA-3030-HZ — Model
No.005A001 — Serial number

**PA − 3□□□ − HZ**

Rated current:
020: 20 A
030: 30 A
040: 40 A
050: 50 A
075: 75 A
100: 100 A

## ■ Accessories Included

Instruction manual: 1 copy

# ⚠ SAFETY PRECAUTIONS

## 1. Preconditions for Use

This unit is designed to be used in an indoor instrumentation panel.

## 2. Symbols Used for This Unit and Manual

● **Used in this unit** ● **Used in this manual**

| Label | Meaning | Label | Meaning |
|---|---|---|---|
| ⚠ **Alert symbol mark** | Caution when handling for prevention of an electrical shock, accidents or injuries | ⚠ **Warning** | Procedures which may lead to dangerous conditions, death or serious injury |
| **Caution high temperature** | Caution for a hot point (heat radiation fin) – for burn prevention | ⚠ **Caution** | Procedures which may lead to dangerous conditions, superficial to medium injury or physical damage or damage to the product |
| **Grounding terminal** | To avoid an electrical shock, connect grounding section (mounting hole) to the protective conductor terminal of the power supply equipment. | | |
| **RATING □□A** **Rated current** | Indicates rated current. Please make sure that max. load current is lower than the rated current. | **Note** | Notes useful for handling and operation of this unit |

## 3. Overview

This compact and light weight single-phase power controller is designed for high density panel installation, and can be applied to a wide range of heating control applications with its various functions including phase-angle firing system/zero-cross firing system selection, soft start time setting and lower limit setting.

# ⚠ Warnings / Cautions

**(1) Mounting direction**

Mount your unit vertically with its main circuit terminals (U1, U2) placed downward to ensure air-cooling effects are ventilated through the air duct structure.

**(2) Do not use this unit on any desk.**

Make sure to mount this unit on a panel to prevent malfunction or injury through it falling down.

**(3) Mounting environment**

Do not operate this unit at a place where explosive, inflammable gas or other dangerous vapors exist.

**(4) Only Shinko or qualified service personnel may handle the inner assembly.**

To prevent an electrical shock, accident, fire or other problems, repair, modification or disassembly of the unit may only be undertaken by Shinko or qualified service personnel.

**(5) Turn the power supply OFF in case of any abnormal events.**

If there are abnormal odors, heat, or other abnormal events, turn the power supply OFF, and inform the nearest agent of Shinko Technos Co., Ltd.

# ■ For Safety and Security

**(1) Use your unit at lower than the rated current.**

Confirm the rated current on the label attached on the upper side of the unit.

**(2) Connect a load before turning the power supply on**.

Never turn the power supply on without connecting a load in advance to prevent problems.

**(3) Applicable load**

A resistive load is applicable. An inductive load (transformer primary control, maximum magnetic flux density 1.25T) is applicable only when the phase-angle firing system is selected.

**(4) Mounting of a rapid fuse**

Mount a rapid fuse (sold separately) for protecting thyristor elements.

**(5) Countermeasures for digital units**

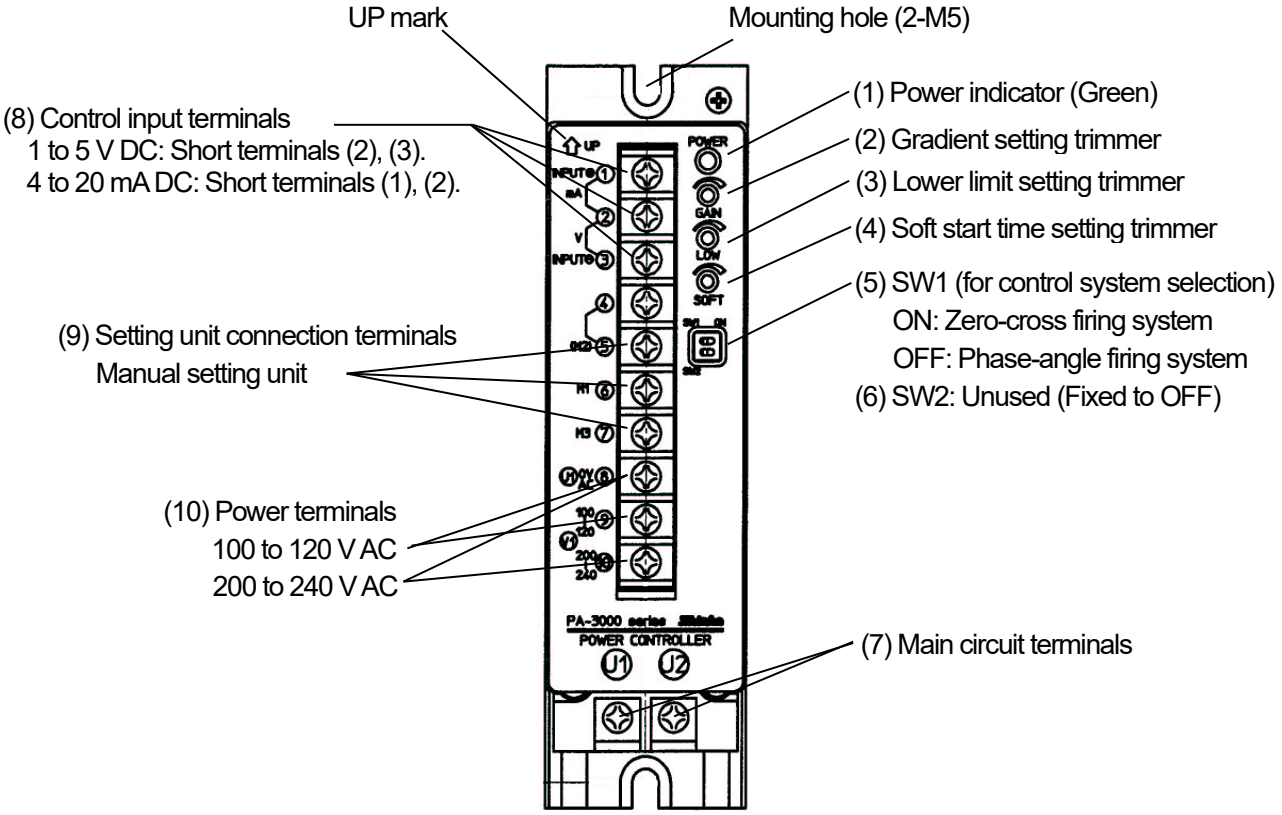
Higher harmonic noises are generated when this unit is used with the phase-angle firing system. Use an insulation transformer, separate your unit from a drive power line, or take other countermeasures.

**(6) Do not use unused terminals**.

Do not connect signals to any unused terminals to prevent problems.

# 1. Name of the Sections

The units' appearance is sorted into 3 kinds according to the rated current. The following appearance is the 30 A type. The appearance of other types is almost the same as this 30 A type.




**(1) Power indicator**

Lights (green) when power is supplied to power terminals (8) (9) and (10).
Flashes while identifying the frequency after the power is turned on.

**(2) Gradient setting trimmer**

Gradient setting is possible. 100% when turned fully to the right (clockwise) ↷.
Generally used at 100%.
For Current/Voltage input, the gradient setting unit is also installed externally.

**(3) Lower limit setting trimmer**

Output value when control input is 0% (terminal Ⓗ is connected to Ⓒ) can be set.
The output value becomes 0% when it is turned fully to the left (counterclockwise) ↶.
Generally used at 0% position.
For the contact input, the lower limit setting unit is also installed externally.

**(4) Soft start time setting trimmer**

Soft start time can be set. When it is turned fully to the left (counterclockwise) ↶: Approx. 1 second
When it is turned fully to the right (clockwise) ↷: Approx. 20 seconds

**(5) SW1**: Switches Zero-cross firing system (ON) or Phase-angle firing system (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 terminals**: Input terminals for current (4 to 20 mA DC) or voltage (1 to 5 V DC) signal to control the output

**(9) Setting unit connection terminals**:

For Current/Voltage input: Terminals to connect the gradient setting unit or manual setting unit externally
For Contact input: Terminals to connect output signals (Ⓗ, Ⓒ, Ⓛ) from the indicating controller to upper limit and lower limit setting units

**(10) Power terminals**:

Terminals for supplying power to the power controller
100 to 120 V AC: Terminals 8 and 9
200 to 240 V AC: Terminals 8 and 10

# 2. Installation

## ⚠ Warning

**Turn the power supply to the instrument OFF before installation.**
**Working on or touching the terminal with the power switched on may result in severe injury or death due to electrical shock.**

**This instrument is a back panel type which is designed to be mounted inside a panel except for accessories such as setting units.**

## 2.1 Precautions for Installation

(1) Mount the unit with the UP mark (⇧) facing upward.

(2) Mount the unit in a clean and well-ventilated place free of dust particles.

(3) Separate this unit from a high temperature generating unit or similar unit.

(4) Keep space for heat radiation (more than 200 mm) above and below this unit.

(5) Do not mount this unit in a place subject to vibrations and shocks.

(6) Do not mount this unit in a corrosive gas atmosphere.

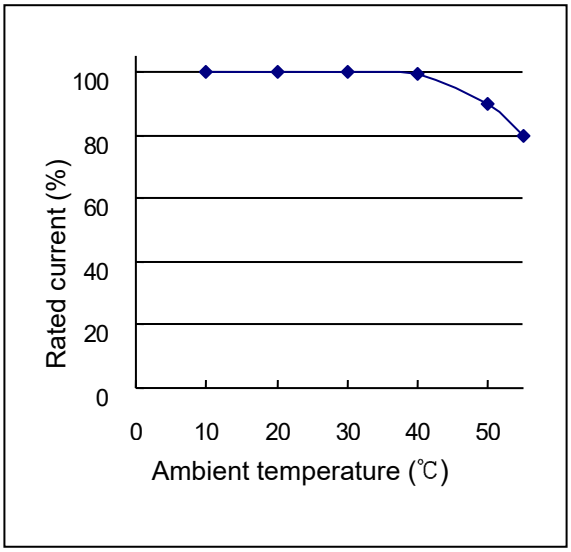
(7) The rated current is specified at an ambient temperature of 40℃ as a reference. If the ambient temperature exceeds 40℃, reduce the load current, referring to the right figure. (The maximum operating temperature is 55℃. Use this unit at a current lower than 80% of the rated current in this case.)

(8) Ensure a secure and sufficiently strong mounting plate (panel) is used.
(More than 1 mm thickness is required for an iron plate.)

**Note** **Mounting of accessories**

Refer to "8. Accessories Sold Separately".

● **Ambient Temperature and Allowable Current**

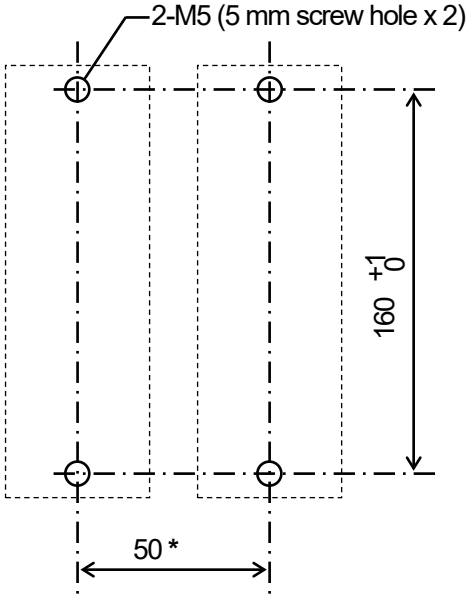



● **Rated Current and Weight**

| Rated Current | Weight |
|---|---|
| 20 A | Approx. 1.0 kg |
| 30 A | Approx. 1.0 kg |
| 40 A | Approx. 1.3 kg |
| 50 A | Approx. 1.3 kg |
| 75 A | Approx. 1.9 kg |
| 100 A | Approx. 1.9 kg |

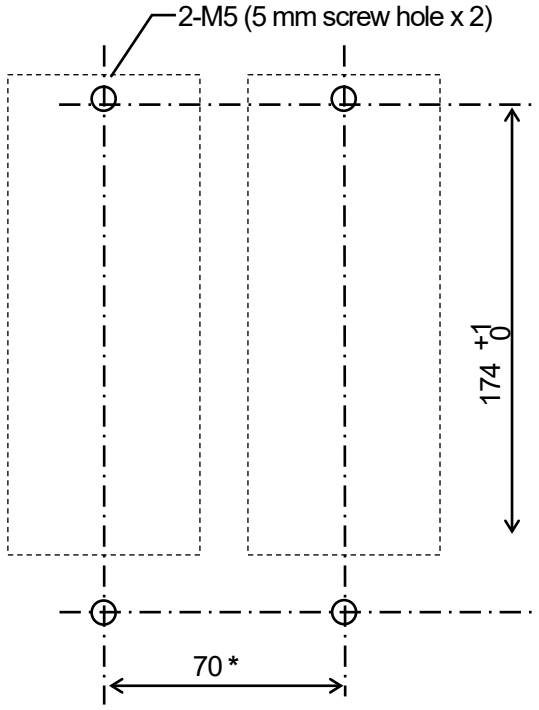
## 2.2 Mounting Dimensions (Scale: mm)

**20 A, 30 A**



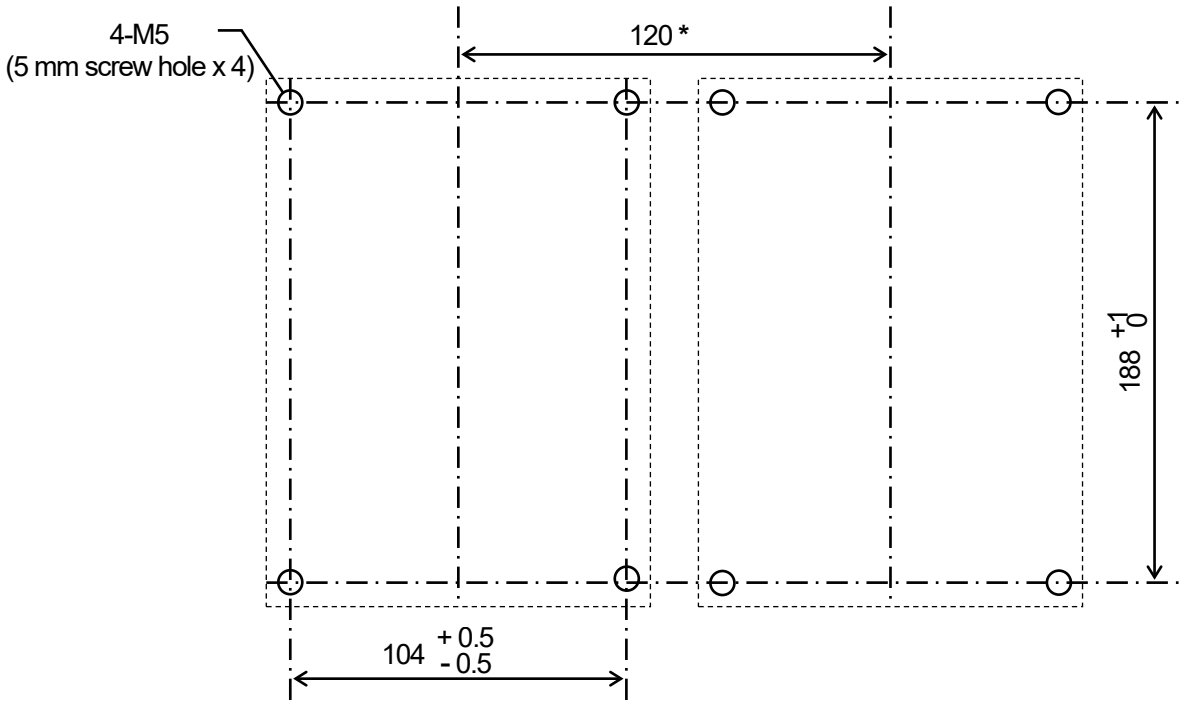

* Minimum interval for horizontal mounting

**40 A, 50 A**




* Minimum interval for horizontal mounting

**75 A, 100 A**

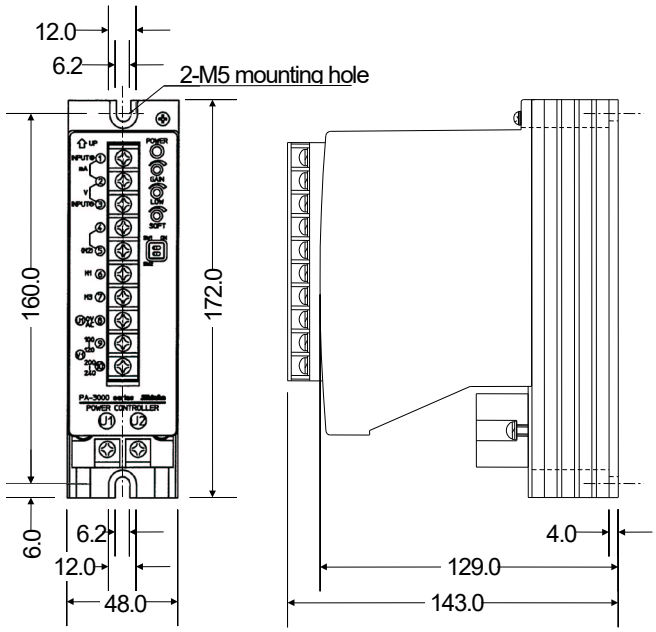



* Minimum interval for horizontal mounting

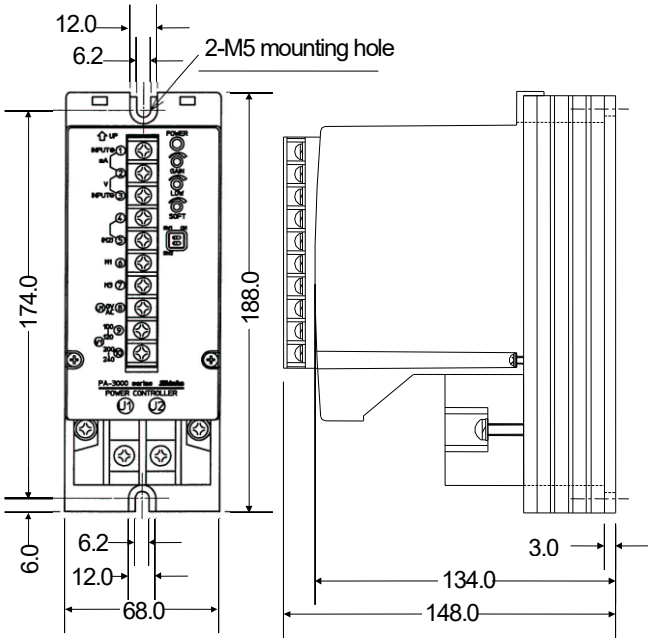
**Note: Keep space for heat radiation of more than 200 mm above and below this unit.**

# 3. External Dimensions (Scale: mm)

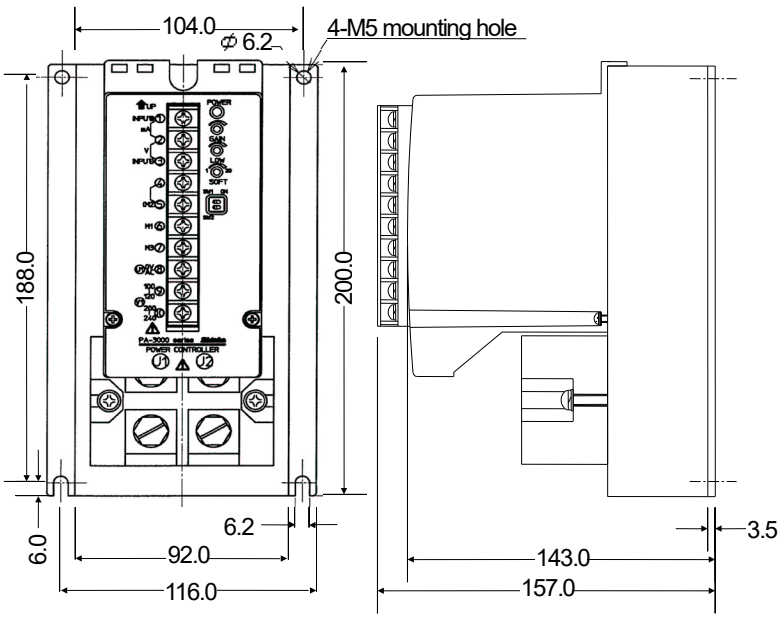
**20 A, 30 A**




**40 A, 50 A**



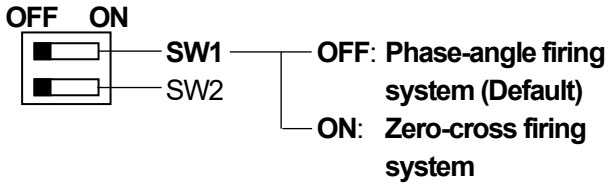

**75 A, 100 A**



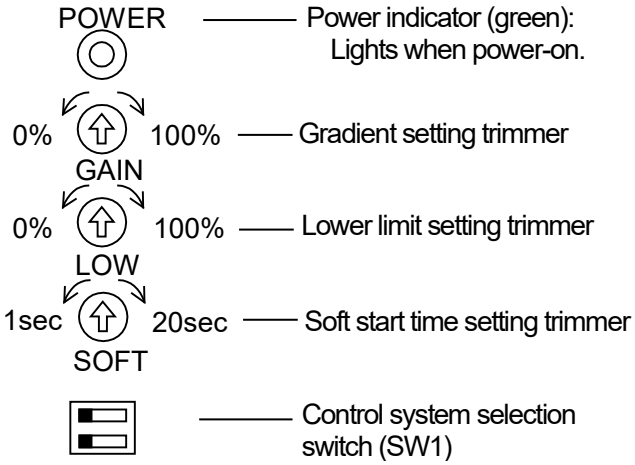
# 4. Settings

> **⚠ Caution**
>
> When changing the control system, it is recommended to turn the power source OFF.
> For the gradient setting and the lower limit setting, change the settings gradually to avoid effecting the load or peripheral units by an abrupt change of output.

## 4.1 Control System Selection (SW1)

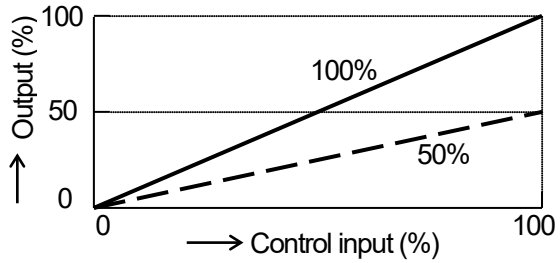



SW2: Not used (Fixed to OFF)



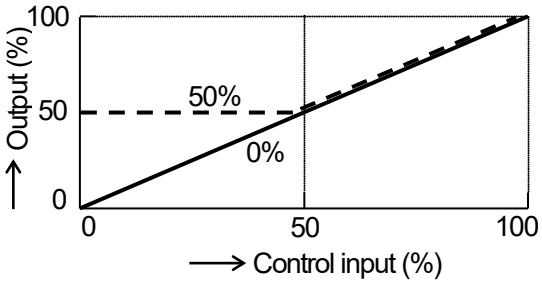

## 4.2 Gradient Setting (GAIN)

| External gradient setting unit | |
|---|---|
| **Not connected** | **Connected** |
| Set the gradient with this trimmer. | Set this trimmer to 100%, and set the gradient with an external gradient setting unit. |




## 4.3 Lower Limit Setting (LOW)

This trimmer is used to set the output value when the control input is 0%, Set this trimmer to 0% by turning it fully counterclockwise usually.




The above figure shows the lower limit setting when the gradient is set to 100%.

## 4.4 Soft Start Time Setting (SOFT)

The soft start time becomes approx. 1 second when turning this trimmer fully counterclockwise, and becomes approx. 20 seconds when turning this trimmer fully clockwise.

**Control System**

- **Phase-angle Firing System**

  The system for controlling the output by changing the conductive angle $\theta$ (ON timing) in the half cycle (180°) of the power supply. The control becomes continuous as compared with the zero-cross firing system. This control system is also used for transformer primary control. However, since the output contains higher harmonics, it may cause external noise.

- **Zero-cross firing system**

  The system for controlling the output by deciding ON/OFF in every cycle of the power supply. Since the power sypply is turned on from 0 V (zero cross point) voltage, noise is recuded as compared with the phase-angle firing system. However, since the maximum current flows during each ON cycle it may cause flickering.

**Soft Start**

This function is provided to increase the output gradually up to the specified output when the power supply is turned on or when the control input value changes abruptly. This function can prevent a surge current from being generated due to an abrupt change of the primary control output of transformer. You can set the time (from 0% to 100% output) from about 1 second to 20 seconds.

# 5. Wiring

## ⚠ Warning

- Turn the power source OFF before wiring to prevent an electrical shock.
- Wiring should be undertaken by the experienced person who has a good knowledge of wiring.

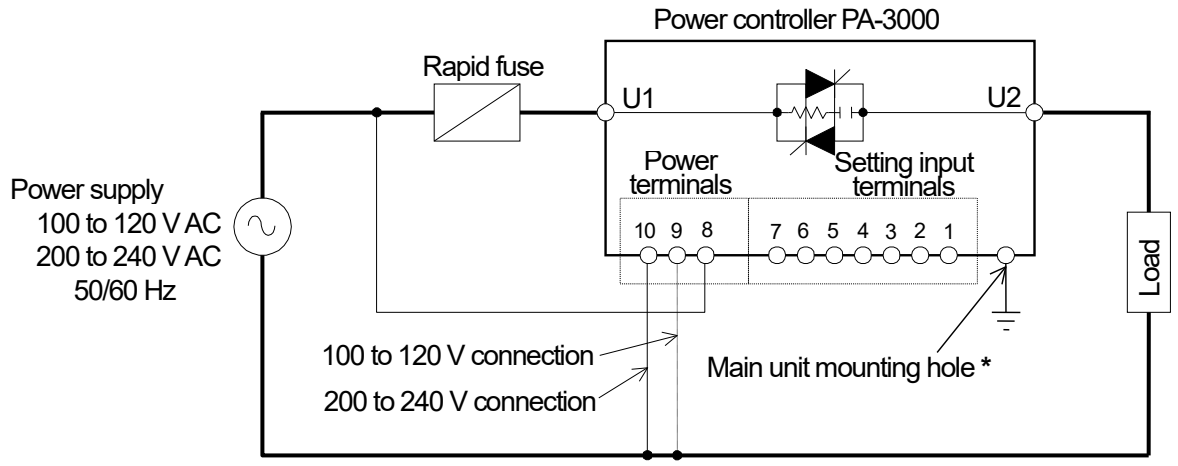
## 5.1 Wiring Precautions

- For the main circuit wiring, use a cable which has a sufficient allowance for load current.
- For wiring of the other terminals, twist 0.3 to 0.75 $mm^2$ cables.

## 5.2 Main Circuit Terminals / Power Terminals (U1, U2 / 8, 9, 10)

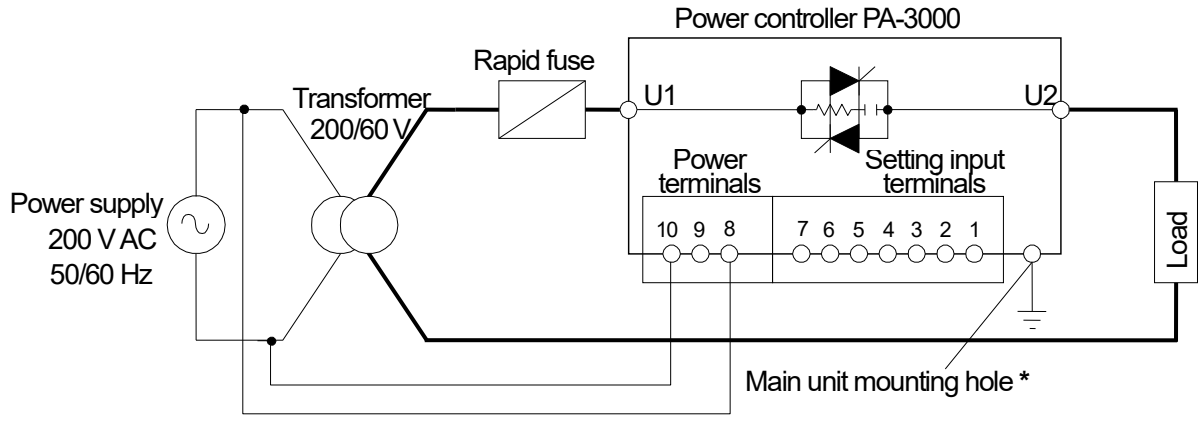
Make sure that the phase of the main circuit (U1, U2) is the same as the phase of the power supply (8, 9, 10). (U1 and 8, U2 and 9 or 10). If the phases do not match, normal output cannot be obtained.

**(1) Main circuit voltage: 100 to 120 V AC or 200 to 240 V AC**




*** This is used as a grounding terminal of this unit.**
**Connect this to the protective conductor terminal of the power supply equipment.**

**(2) Main circuit voltage: Voltages other than "100 to 120 V AC" or "200 to 240 V AC"**

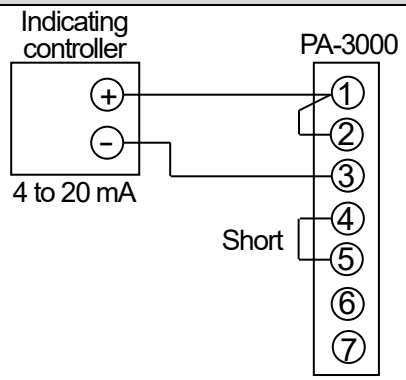
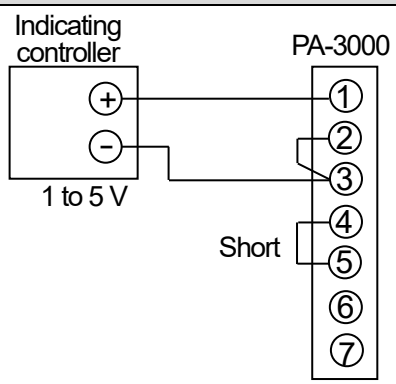



*** This is used as a grounding terminal of this unit.**
**Connect this to the protective conductor terminal of the power supply equipment.**

# 5.3 Setting Input Terminals (1 to 7)

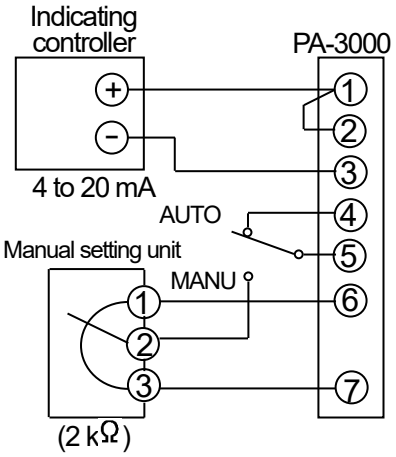
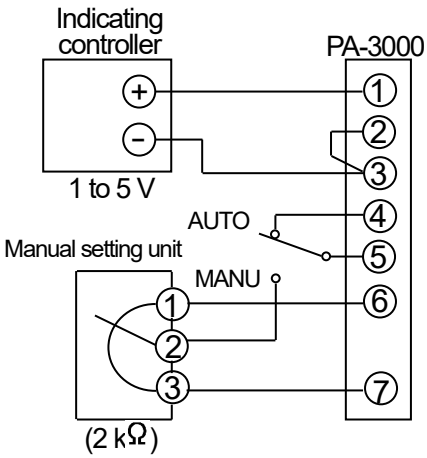
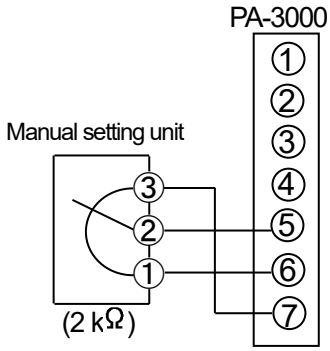
## 5.3.1 Current / Voltage Input Signal

**(1) Without a setting unit**

| Current Signal (4 to 20 mA DC) | Voltage Signal (1 to 5 V DC) |
|---|---|
|  |  |

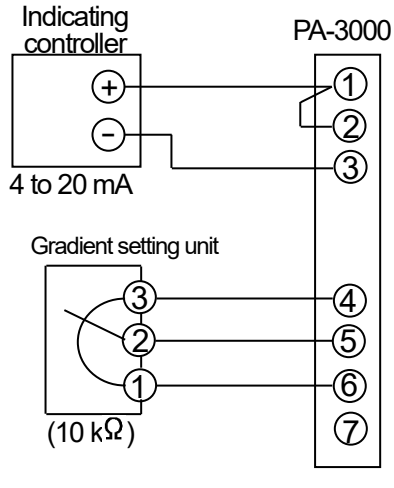
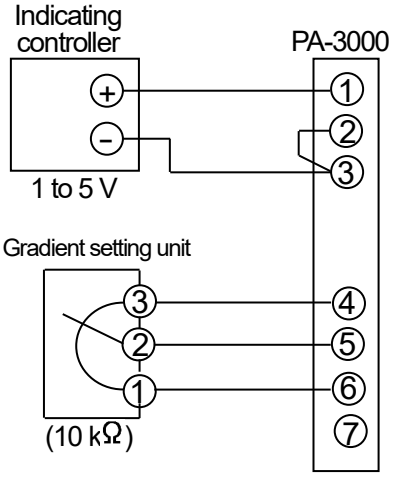


**(2) Manual setting unit**

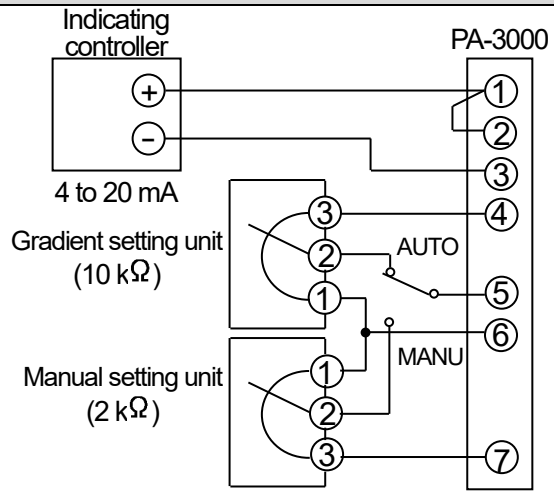
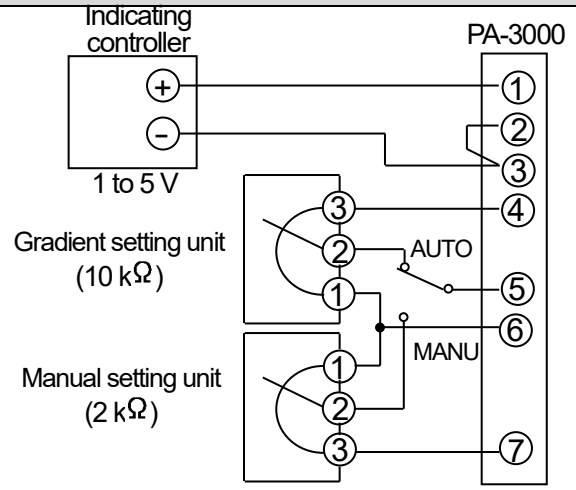
| Current Signal (4 to 20 mA DC) | Voltage Signal (1 to 5 V DC) | Manual Setting Unit Only |
|---|---|---|
|  |  |  |



**(3) Gradient setting unit**

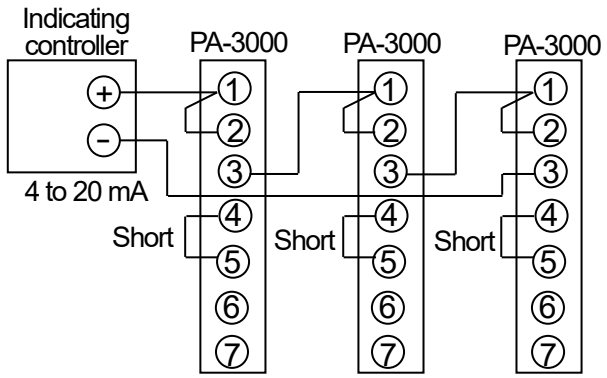
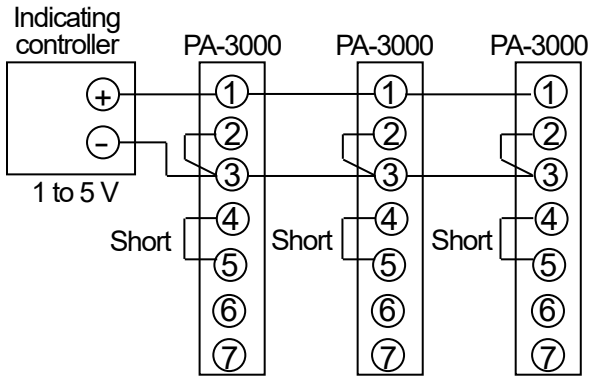
| Current Signal (4 to 20 mA DC) | Voltage Signal (1 to 5 V DC) |
|---|---|
|  |  |

**(4) Manual setting unit with gradient setting unit**

| Current Signal (4 to 20 mA DC) | Voltage Signal (1 to 5 V DC) |
|---|---|
|  |  |

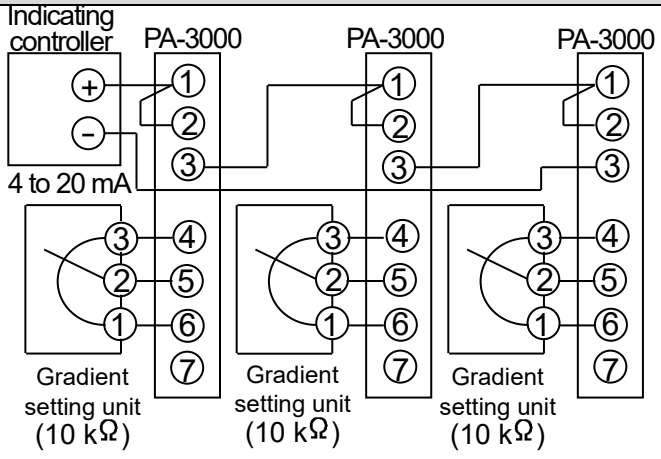
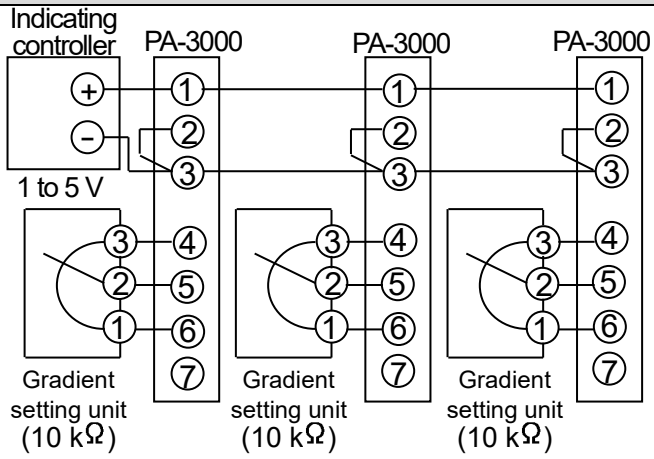


**(5) 3 units running parallel (without setting units)**

| Current Signal (4 to 20 mA DC) | Voltage Signal (1 to 5 V DC) |
|---|---|
|  |  |

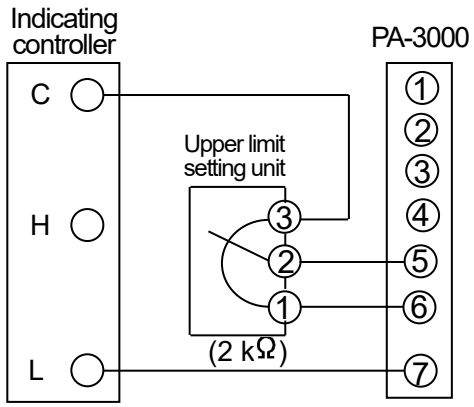


**(6) 3 units running parallel with gradient setting units**

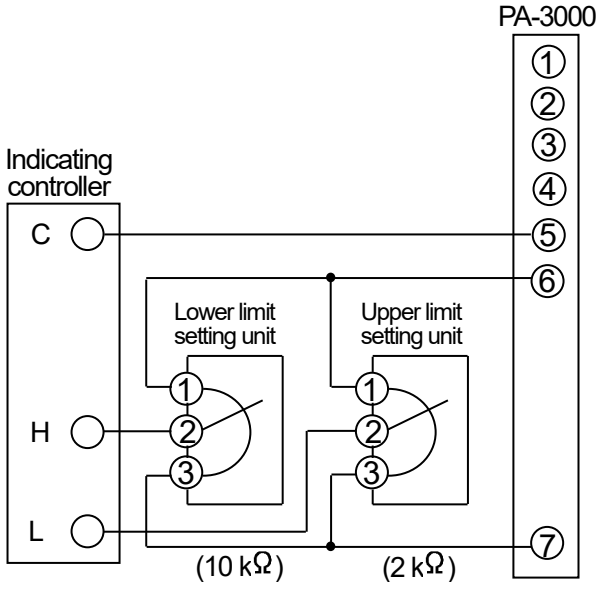
| Current Signal (4 to 20 mA DC) | Voltage Signal (1 to 5 V DC) |
|---|---|
|  |  |

### 5.3.2 Contact Input Signal

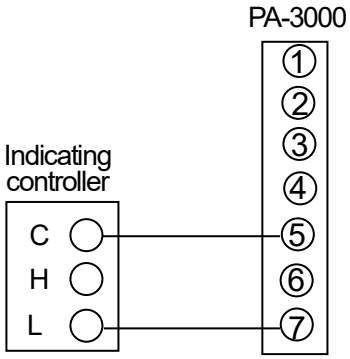
**Upper limit setting unit connection**




**Lower limit and Upper limit setting units connection**




**Using only setting trimmers of PA-3000**




- Lower limit setting: Use the lower limit setting trimmer of this unit.
- Upper limit setting: Use the gradient setting trimmer of this unit.

# 6. Operation

## 6.1 Checking before Operation

### ⚠ Warning

**Turn the power supply to the instrument OFF before checking. Working on or touching the terminal with the power switched on may result in severe injury or death due to electrical shock.**

(1) Check the connections again.
(2) Check the power voltage and the load capacity again.
(3) Measure the insulation resistance with a 500 V megger.
Short main circuit terminals U1 and U2 for the dielectric strength test.
(4) This unit becomes hot due to being a self-cooling type.
Make sure to mount the unit with the UP mark (⇧) facing upward so as not to interrupt the heat radiation effect. If the unit is mounted in a direction other than specified, the interior becomes hot and could cause malfunction or other problems.
(5) Check the control system selection again.

## 6.2 Operation

**In the case of Auto running**
(1) Set the desired value (SV) on the indicating controller.
(2) If an Auto/Manual switch is connected, select it to “AUTO”.
(3) Set the gradient.
(4) Make sure that a stable control is performed.
If the control is unstable, change the parameters (PID constants in particular) on the indicating controller, or adjust the gradient to an appropriate value.

**In the case of Manual running**
(1) If an Auto/Manual switch is connected, select it to “MANUAL”.
(2) Set the desired output manually.
(3) Change the setting manually while monitoring the temperature.

# 7. Maintenance

### ⚠ Warning

**Turn the power supply to the instrument OFF before checking, cleaning or maintenance work. Working on or touching the terminal with the power switched on may result in severe injury or death due to electrical shock.**

## 7.1 Daily Check and Maintenance

The checking and inspection of the following points are required to keep this unit running under the best conditions at all times.

| Items | Contents |
|---|---|
| Fastening of bolts and screws on the terminal board | If the bolts for the main circuit terminals (U1, U2), in which a large current flows, are loose, they may become hot and cause wiring damage. |
| Cleaning | If the unit is mounted in a dusty place with conductive dust particles like iron powder, dust particles attached to the unit, this may cause failure or problems due to poor insulation. Remove dust particles attached using a cleaner. |

## 7.2 Consumable Parts

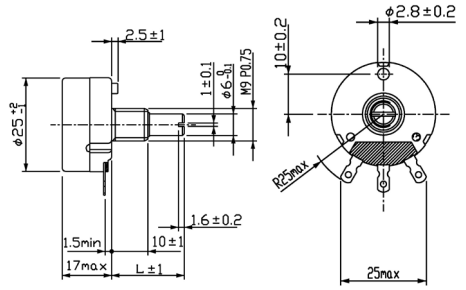
### ⚠ Caution

- To prevent an electrical shock or fire, only Shinko or qualified service personnel may handle the inner assembly.
- To prevent an electrical shock, fire or damage to the instrument, parts replacement may only be undertaken by Shinko or qualified service personnel.
- For replacing consumable parts or other parts, please contact the nearest sales agent of Shinko Technos Co., Ltd.

| Parts | Exchange Intervals | Working Conditions |
|---|---|---|
| Control PCB | 5 to 8 years | The higher the ambient temperature the shorter the life span. In addition, life span depends largely upon atmospheric conditions (kinds of gases, kinds and degree of dust particles, etc.) |

# 8. Accessories Sold Separately

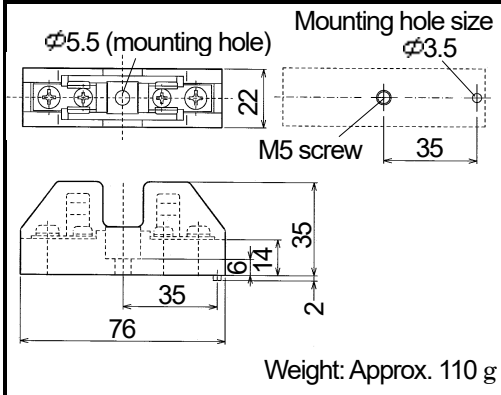
## 8.1 Setting Unit (Scale: mm)

| Model | Potentiometer |
|---|---|
| External dimensions |  |



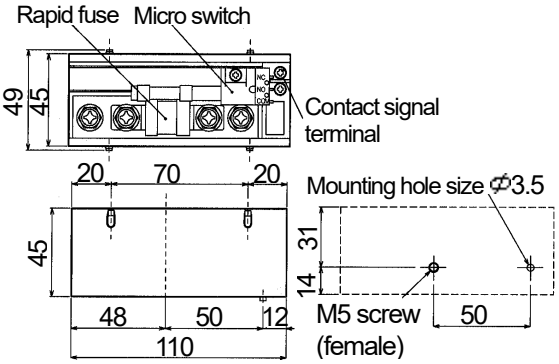
## 8.2 Fuse Unit (Scale: mm)

| Applicable current | 20 A | Applicable current | 30 to 100 A |
|---|---|---|---|
| Specification | Rapid fuse + holder | Specification | Rapid fuse + holder with cover |





Weight: Approx. 110 g





Weight: Approx. 250 g

## 8.3 Rapid Fuse

We can provide various types of rapid fuse.
Please consult us.

# 9. Troubleshooting

### (1) Output continues

| Problem | Possible Cause and Solution |
|---|---|
| ① The load is open. | Connect the load correctly. |
| ② The lower limit value is set to 100%. | Set the lower limit value to be near 0% and monitor the condition. |

If this unit is not restored to normal condition as a result of the above remedial measures, the thyristor element may be defective.
Please contact our main office or dealers.

### (2) Output is not proportional to the control input.

| Problem | Possible Cause and Solution |
|---|---|
| ① The lower limit value is set to a higher value. | Set the lower limit value to near 0% and check the condition. |
| ② The gradient is set low. | Set the gradient to near 100% and check the condition. |
| ③ The phases of the power supply and main circuit are not the same. | The phases should be the same. Refer to Section 5.2. |
| ④ The power supply is distorted. | If the power waveform is distorted, the output is not proportional to the input.<br>Use a power supply without a distorted waveform and check the condition. |

If this unit is not restored to normal condition as a result of the above remedial measures, the unit may be defective.
Please contact our main office or dealers.

### (3) No output

| Problem | Possible Cause and Solution |
|---|---|
| ① The Power indicator (green) does not light. | Power terminals (8 to 10) are not connected correctly.<br>Please connect them correctly. |
| | The main circuit and/or the load are not connected correctly.<br>Please connect them correctly. |
| ② The Power indicator (green) lights. | The phases of the power supply and the main circuit are not the same.<br>The phases should be the same. Refer to Section 5.2. |
| | Gradient is set to 0%.<br>Set it to near 100% and check the condition. |
| | Input connections (1 to 7 terminals) are not correct.<br>Please connect them correctly. |
| | Input signal is not normal.<br>Apply normal input signal. |
| ③ The Power indicator (green) is flashing. | The power supply is distorted.<br>Refer to (2) ④ above. |

If this unit is not restored to normal condition as a result of the above remedial measures, the unit may be defective.
Please contact our main office or dealers.

# 10. General Specifications

| | |
|---|---|
| Phase | Single phase |
| Rated current | 20, 30, 40, 50, 75, 100A AC |
| Input signal | 4 to 20 mA DC, 1 to 5 V DC, or ON/OFF contact signal |
| Input resistance | 100 Ω (4 to 20 mA DC), 25 kΩ (1 to 5 V DC) |
| Rated voltage | 100 to 120 V AC, 200 to 240 V AC (100 V system and 200 V system are selectable by terminals.) |
| Allowable voltage fluctuation range | -10 to +10% of the rated voltage |
| Rated frequency | 50/60 Hz (automatic selection) |
| Allowable frequency fluctuation | ±2 Hz of the rated frequency (operation guarantee),<br>±1 Hz of the rated frequency (performance guarantee) |
| Output range | 0 to 98% of the rated voltage |
| Minimum load current | 0.5 A (at 98% output) |
| Applicable load | Resistive load,<br>Inductive load (Transformer primary control: Phase-angle firing system only, Magnetic flux density 1.25T max.) |
| Control system | Phase-angle firing system without feedback (Selectable by DIP switch) |
| | Zero-cross firing system without feedback (Selectable by DIP switch) |
| Output setting range | Gradient setting: 0 to 100% of the output range (Setting trimmer built-in) |
| | Lower limit setting: 0 to 100% of the output range (Setting trimmer built-in) |
| Other functions | Soft start, soft up-down (1 to 20 seconds variable),<br>Soft start at recovery from momentary interruption |
| Operating temperature range | -15 to 55℃ (operation guarantee),<br>0 to 40℃ (performance guarantee) |
| Operating humidity range | 30 to 90 %RH (Non condensing) |
| Insulation resistance | Between power terminals and case: 20 MΩ minimum, at 500 V DC |
| Dielectric strength | Between power terminals and Earth (Heat radiation fin): 2000 V AC for 1 minute |

**SHINKO TECHNOS CO., LTD.**
**OVERSEAS DIVISION**

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