

# Three-phase Voltage Relay

## K8AK-PW

**Ideal for Monitoring 3-phase Power Supplies for Industrial Facilities and Equipment.**



- Greater resistance to inverter noise. **NEW**
- Monitor overvoltages and undervoltages for three-phase 3-wire or 4-wire power supplies.  
DIP switch setting for 3-phase 3-wire or 3-phase 4-wire power supply.
- Two SPDT output relays, 5 A at 250 VAC (resistive load).  
Separate outputs possible for overvoltages and undervoltages.
- World-wide power specifications supported by one Unit (switchable using DIP switch).
- Relay status can be monitored using LED indicator.

Refer to *Safety Precautions* on page 9.  
Refer to 8 for commonly asked questions.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

## Ordering Information

### List of Models

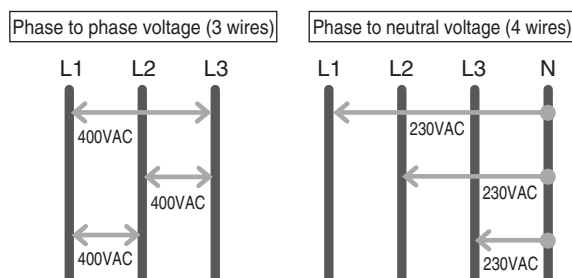
Rated input*		Model
3-phase 3-wire mode	200, 220, 230, 240 VAC	K8AK-PW1
3-phase 4-wire mode	115, 127, 133, 138 VAC	
3-phase 3-wire mode	380, 400, 415, 480 VAC	K8AK-PW2
3-phase 4-wire mode	220, 230, 240, 277 VAC	

**Note:** Three-phase, three-wire or four-wire and the input range are switched using a DIP switch.

\* The power supply voltage is the same as the rated input voltage.

### ● Single K8AK Monitors 3-phase Power Supply with 3 or 4 Wires

Monitoring Relays can be used to monitor 3-phase power supplies with 3 or 4 wires simply by changing DIP switch settings.



**A Single K8AK Can Monitor a 3-phase Power Supply Anywhere in the World**

Reduces Maintenance Parts Inventory

	SW3		ON	OFF	ON	OFF	
	SW4		ON	ON	OFF	OFF	
K8AK-PW1	SW2	ON	P-N	138 V	133 V	127 V	115 V
		OFF	P-P	240V	230 V	220 V	200 V
K8AK-PW2	SW2	ON	P-N	277 V	240 V	230 V	220 V
		OFF	P-P	480 V	415 V	400 V	380 V

# K8AK-PW

## Ratings and Specifications

### Ratings

Rated input voltage	K8AK-PW1	Three-phase, three-wire Mode: 200, 220, 230 and 240 VAC Three-phase, four-wire Mode: 115, 127, 133 and 138 VAC
	K8AK-PW2	Three-phase, three-wire Mode: 380, 400, 415 and 480 VAC Three-phase, four-wire Mode: 220, 230, 240 and 277 VAC
Input load	K8AK-PW1: Approx. 4.4 VA K8AK-PW2: Approx. 4.4 VA	
Operating value setting range (OVER, UNDER)	Overvoltage -30% to 25% of rated input voltage Undervoltage -30% to 25% of rated input voltage <b>Note:</b> The rated input voltage can be switched using the DIP switch.	
Operating value	100% operation at set value	
Reset value	5% of operating value (fixed)	
Reset method	Automatic reset	
Operating time setting range (T)	Overvoltage and undervoltage: 0.1 to 30 s	
Power ON lock time (LOCK)	1 s/5 s (Changed with the DIP switch.)	
Indicators	Power (PWR): Green, Relay output (RY): Yellow, OVER/UNDER: Red	
Output relays	Two SPDT relays (NC operation)	
Output relay ratings	Rated load Resistive load 5 A at 250 VAC 5 A at 30 VDC Maximum switching capacity: 1,250 VA, 150 W Minimum load: 5 VDC, 10 mA (reference values) Mechanical life: 10 million operations min. Electrical life: 5 A at 250 VAC or 30 VDC:50,000 operations 3 A at 250 VAC/30 VDC:100,000 operations	
Ambient operating temperature	-20 to 60°C (with no condensation or icing)	
Storage temperature	-25 to 65°C (with no condensation or icing)	
Ambient operating humidity	25% to 85% (with no condensation)	
Storage humidity	25% to 85% (with no condensation)	
Altitude	2,000 m max.	
Terminal screw tightening torque	0.49 to 0.59 N·m	
Terminal wiring method	Recommended wire Solid wire: 2.5 mm <sup>2</sup> Twisted wires: AWG16, AWG18 <b>Note:</b> 1. Ferrules with insulating sleeves must be used with twisted wires. 2. Two wires can be twisted together. Recommended ferrules Al 1,5-8BK (for AWG16) manufactured by Phoenix Contact Al 1-8RD (for AWG18) manufactured by Phoenix Contact Al 0,75-8GY (for AWG18) manufactured by Phoenix Contact	
Case color	N1.5	
Case material	PC and ABS, UL 94 V-0	
Weight	Approx. 150 g	
Mounting	Mounts to DIN Track.	
Dimensions	22.5 × 90 × 100 mm (W×H×D)	

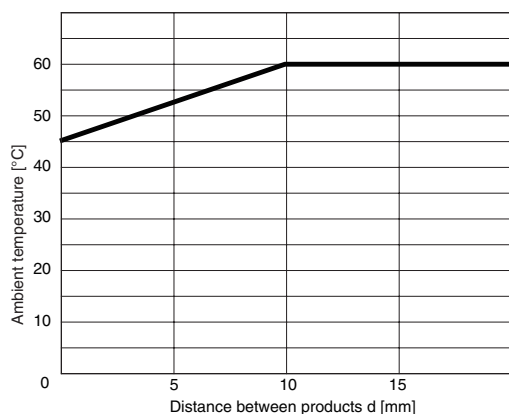
## Specifications

<b>Input frequency range</b>		50/60 Hz
<b>Overload capacity</b>		Continuous input at 115% of maximum input. 10 s at 125%. (up to 600 VAC)
<b>Repeat accuracy</b>	<b>Operating value</b>	±0.5% full scale (at 25°C and an ambient humidity of 65% at the rated power supply voltage, DC and 50/60 Hz sine wave input)
	<b>Operating time</b>	±50 ms (at 25°C and 65% humidity, rated power supply voltage)
<b>Applicable standards</b>	<b>Conforming standards</b>	EN 60947-5-1 Installation environment (pollution level 2, installation category III)
	<b>EMC</b>	EN 60947-5-1
	<b>Safety standards</b>	UL 508 (Recognition), Korean Radio Waves Act (Act 10564), CSA: C22.2 No.14, CCC: GB14048.5
<b>Insulation resistance</b>		20 MΩ Between all external terminals and the case Between all input terminals and all output terminals
<b>Dielectric strength</b>		2,000 VAC for 1 min Between all external terminals and the case Between all input terminals and all output terminals
<b>Noise immunity</b>		1,500 V power supply terminal common/normal mode Square-wave noise of ±1 μs/100 ns pulse width with 1-ns rise time
<b>Vibration resistance</b>		Frequency: 10 to 55 Hz, acceleration 50 m/s <sup>2</sup> 10 sweeps of 5 min each in X, Y, and Z directions
<b>Shock resistance</b>		100 m/s <sup>2</sup> , 3 times each in 6 directions along 3 axes
<b>Degree of protection</b>		Terminals: IP20

### ● Relationship of Mounting Distance between K8AK-PW Relays and Ambient Temperature (Reference Values)

The following diagram shows the relationship between the mounting distances and the ambient temperature.

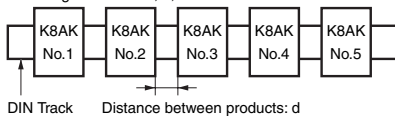
If the relay is used with an ambient temperature that exceeds these values, the temperature of the K8AK may rise and shorten the life of the internal components.



#### Test method

Sample: K8AK-PW

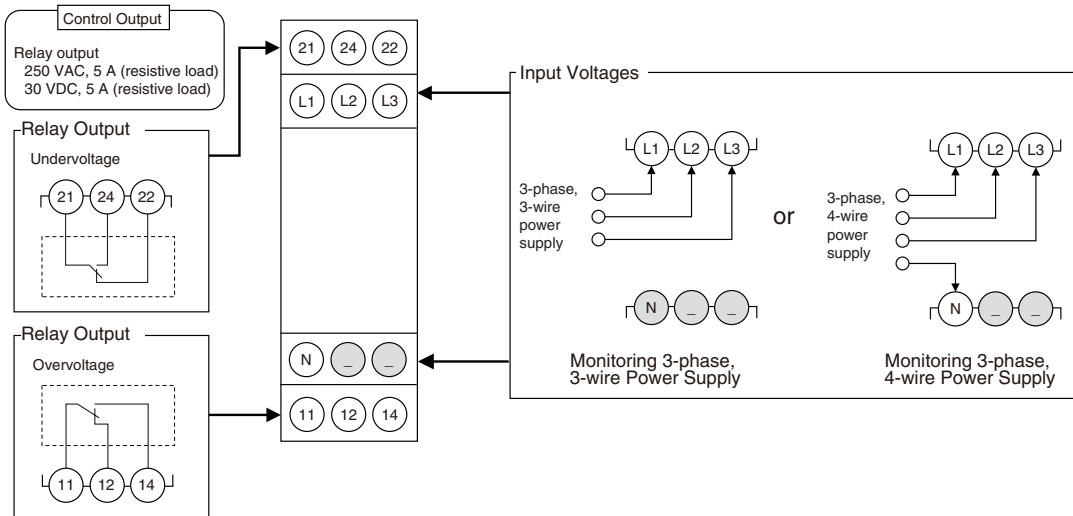
Mounting distances: 0, 5, and 10 mm min.



# K8AK-PW

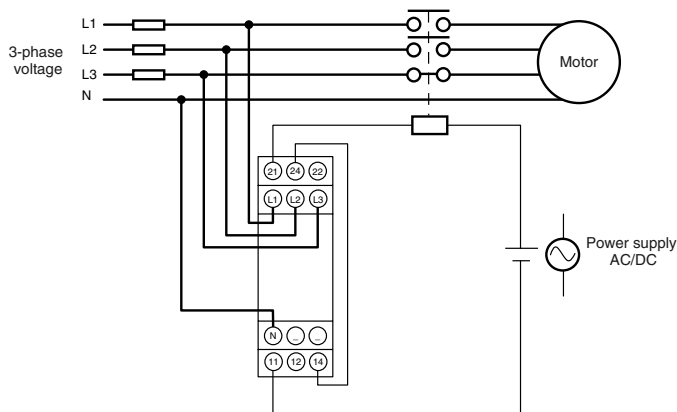
## Connections

### Terminal Diagram



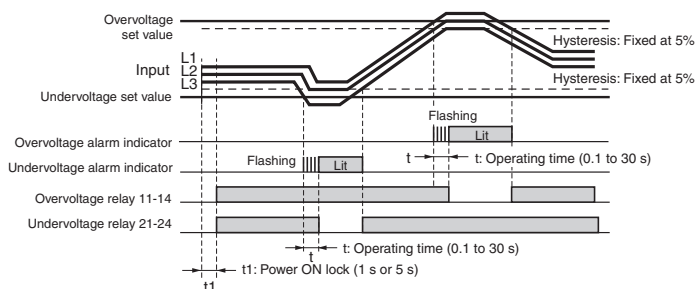
- Note:**
- Do not connect anything to terminals that are shaded in gray.
  - Use the recommended ferrules if you use twisted wires.

### Wiring Example



### Timing Charts

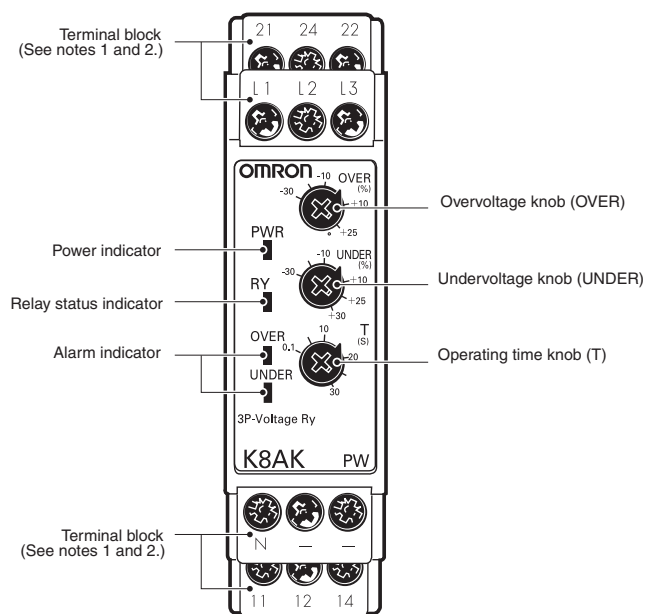
#### ● Overvoltage and Undervoltage Operation Diagram



- Note:**
- K8AK-PW□ output relay is normally operative.
  - The power ON lock function prevents unnecessary alarms from being generated during the unstable period when the power is first turned ON. There is no relay output during timer operation.
  - L1 and L2 use the same power supply and will not operate due to an undervoltage if they drop below the rated input of 60%.

# Nomenclature

## Front



## Indicators

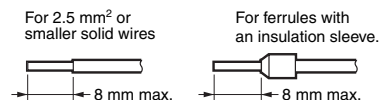
Item	Meaning
Power indicator (PWR: Green)	Lit when power is being supplied*
Relay status indicator (RY: Yellow)	Lit when relay is operating (normally lit).
Alarm indicator (ALM: Red)	Overvoltage: Red Lit when there is an overvoltage. The indicator flashes to indicate the error status after the overvoltage has exceeded the set value while the operating time is being clocked.
	Undervoltage: Red Lit when there is an undervoltage or phase loss. The indicator flashes to indicate the error status after the undervoltage has exceeded the set value while the operating time is being clocked.

\* The input across L1 and L2 is used for the internal power supply. Therefore, the power indicator will not be lit if there is no input across L1 and L2.

## Setting Knobs

Item	Usage
Overvoltage knob (OVER)	Can be set between -30% and 25% of the rated input.
Undervoltage knob (UNDER)	Can be set between -30% and 25% of the rated input.
Operating time knob (T)	Used to set the operating time to 0.1 to 30 s.

**Note: 1.** Use either a solid wire of 2.5 mm<sup>2</sup> maximum or a ferrule with insulating sleeve for the terminal connection. The length of the exposed current-carrying part inserted into the terminal must be 8 mm or less to maintain dielectric strength after connection.



Recommended ferrules  
Phoenix Contact

- AI 1,5-8BK (for AWG16)
- AI 1-8RD (for AWG18)
- AI 0,75-8GY (for AWG18)

2. Screw tightening torque: 0.49 to 0.59 N·m

# K8AK-PW

## Operation Methods

### Connections

#### ●Input

Connect to L1, L2, and L3 (for three-phase three-wire mode) or L1, L2, L3, and N (for three-phase four-wire mode), depending on the mode selected using pin 2 on the DIP switch.

The Unit will not operate correctly if the DIP switch setting and the wiring do not agree.

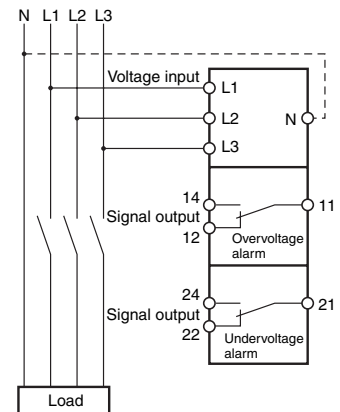
Make sure the phase sequence is wired correctly. The Unit will not operate normally if the phase sequence is incorrect.

#### ●Outputs

Terminals 11, 12, and 14 are the output terminals for overvoltage (SPDT).

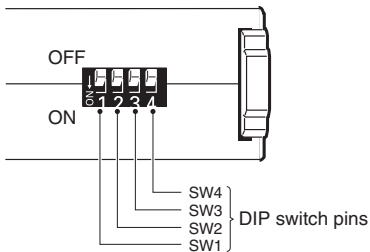
Terminals 21, 22, and 24 are the output terminals for undervoltage (SPDT).

\* Use the recommended ferrules if you use twisted wires.



### DIP Switch Settings

The Startup lock time, number of wires, and rated voltage are set using the DIP switch located on the bottom of the Unit.



#### ●DIP Switch Functions

##### K8AK-PW1

Pin		OFF ● ↑			
		1	2	3	4
Power ON lock time	1 s	●	---	---	---
	5 s	○	---	---	---
Number of wires	3-wire 3-phase	---	●	---	---
	4-wire 3-phase	---	○	---	---
Rated voltage	3-wire 3-phase				
	200 V	---	---	●	●
	220 V	---	---	○	●
	230 V	---	---	●	○
	240 V	---	---	○	○

**Note:** All pins are set to OFF at the factory.

##### K8AK-PW2

Pin		OFF ● ↑			
		1	2	3	4
Power ON lock time	1 s	●	---	---	---
	5 s	○	---	---	---
Number of wires	3-wire 3-phase	---	●	---	---
	4-wire 3-phase	---	○	---	---
Rated voltage	3-wire 3-phase				
	380 V	---	---	●	●
	400 V	---	---	○	●
	415 V	---	---	●	○
	480 V	---	---	○	○

**Note:** All pins are set to OFF at the factory.

## Setting Method

### ●Overvoltage

The overvoltage knob (OVER) is used to set the overvoltage.

The overvoltage can be set to between -30% and 25% of the rated input voltage.

Turn the knob while there is an input to the input terminals until the alarm indicator flashes (when the set value and the input have reached the same level.)

Use this as a guide to set the voltage.

The rated input depends on the model and DIP switch setting.

Example: K8AK-PW1 with Pin 2 Turned OFF (Three-phase, Three-wire Mode) and Pins 3 and 4 Turned OFF (Rated Voltage of 200 V)  
The rated input voltage is 200 VAC and the setting range is 140 to 250 V.

### ●Undervoltage

Undervoltage is set using the undervoltage knob (UNDER).

The undervoltage can be set to between -30% and 25% of the rated input.

Turn the knob while there is an input to the input terminals until the alarm indicator flashes (when the set value and the input have reached the same level.)

Use this as a guide to set the voltage.

The rated input depends on the model and DIP switch setting.

Example: K8AK-PM1 with Pin 2 Turned OFF (Three-phase, Three-wire Mode) and Pins 3 and 4 Turned OFF (Rated Voltage of 200 V)  
The rated input voltage is 200 VAC and the setting range is 140 to 250 V.

### ●Operating Time

The operating time is set using the operating time knob (T).

The operating time can be set to between 0.1 and 30 s.

Turn the knob while there is an input to the input terminals until the alarm indicator flashes (when the set value and the input have reached the same level.)

Use this as a guide to set the current.

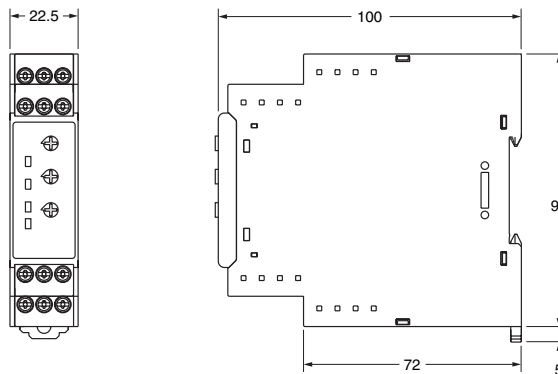
If the input exceeds (or drops lower than) the voltage set value, the alarm indicator will start flashing for the set period and then stay lit.

## Dimensions

(Unit: mm)

### Three-phase Voltage Relays

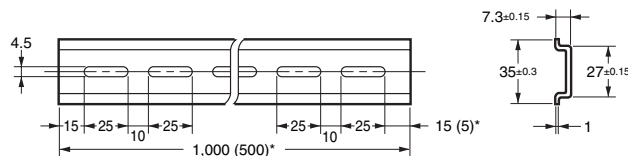
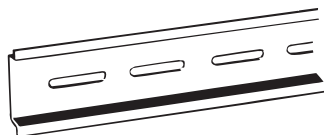
K8AK-PW1  
K8AK-PW2



### Optional Parts for DIN Track Mounting

#### ●DIN Tracks

PFP-100N  
PFP-50N



\*Dimensions in parentheses are for the PFP-50N.

## Questions and Answers

**Q** Checking Operation

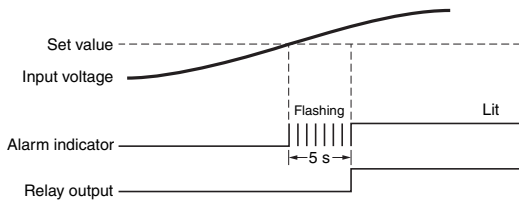
**A** **Overvoltage**  
Gradually increase the input from 80% of the set value. The input value will equal the operating value when the input exceeds the set value and the alarm indicator starts flashing. Operation can be checked by the relay output that will start after the operating time has passed.

**Undervoltage**

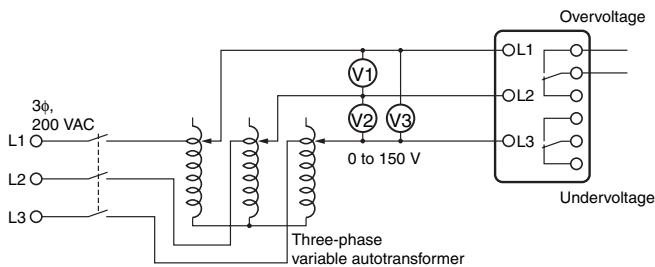
Gradually decrease the input from 120% of the set value and check the operation using the same method as for overvoltage.

**Example:** For monitoring mode set to three-phase three-wire monitoring, a rated voltage of 200 V, and an operating time of 5 s.

**Note:** K8AK-PW□ output relays are normally operative.



Connection Diagram



**Q** How to Measure the Operating Time

**A** **Overvoltage**  
Change the input suddenly from 0% to 120% of the set value and measure the time until the Unit operates.

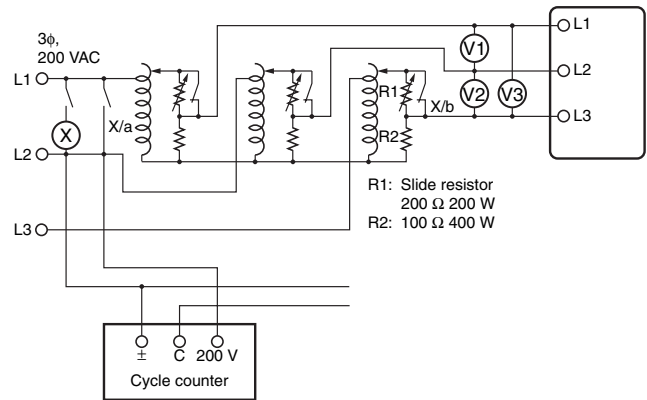
**Undervoltage**

Change the input suddenly from 120% to 0% of the set value and measure the time until the Unit operates.

**Operating Time**

Adjust the slide resistor so that the voltage applied to the K8AK terminals is 120% of the overvoltage set value or 80% of the undervoltage set value when the auxiliary relay operates in a test circuit. Close the switch and use the cycle counter to measure the operating time.

Connection Diagram



**Q** Overvoltage Detection When Only One Phase Exceeds the Overvoltage Set Value



**A** The K8AK monitors each of the three-phase voltages. This means an overvoltage is detected even if only one phase exceeds the set value. The same applies to undervoltages.







## Safety Precautions

Be sure to read the precautions for all models in the website at the following URL: <http://www.ia.omron.com/>.

### Warning Indications

 <b>WARNING</b>	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
 <b>CAUTION</b>	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.
<b>Precautions for Safe Use</b>	Supplementary comments on what to do or avoid doing, to use the product safely.
<b>Precautions for Correct Use</b>	Supplementary comments on what to do or avoid doing, to prevent failure to operate, malfunction, or undesirable effects on product performance.

### Meaning of Product Safety Symbols

	Used to warn of the risk of electric shock under specific conditions.
	Used for general prohibitions for which there is no specific symbol.
	Used to indicate prohibition when there is a risk of minor injury from electrical shock or other source if the product is disassembled.
	Used for general mandatory action precautions for which there is no specified symbol.

### **WARNING**

Electrical shock may occasionally cause serious injury. Confirm that the input voltage is OFF before starting any wiring work and wire all connections correctly.



### **CAUTION**

Electrical shock may cause minor injury. Do not touch terminals while electricity is being supplied.



There is a risk of minor electrical shock, fire, or device failure. Do not allow any pieces of metal, conductors, or cutting chips that occur during the installation process to enter the product.



Explosions may cause minor injuries. Do not use the product in locations with inflammable or explosive gases.

There is a risk of minor electrical shock, fire, or device failure. Do not disassemble, modify, repair, or touch the inside of the product.



Loose screws may cause fires. Tighten terminal screws to the specified torque of 0.49 to 0.59 N·m.



Use of excessive torque may damage the terminal screws. Tighten terminal screws to the specified torque of 0.49 to 0.59 N·m.



Use of the product beyond its life may result in contact welding or burning. Make sure to consider the actual operating conditions and use the product within its rated load and electrical life count. The life of the output relay varies significantly with the switching capacity and switching conditions.



## Precautions for Safe Use

1. Do not use or store the product in the following locations.
  - Locations subject to water or oil
  - Outdoor locations or under direct sunlight
  - Locations subject to dust or corrosive gases (particularly sulfurizing gases, ammonia, etc.)
  - Locations subject to rapid temperature changes
  - Locations prone to icing and dew condensation
  - Locations subject to excessive vibration or shock
  - Locations subject to wind and rain
  - Locations subject to static electricity and noise
  - Habitats of insects or small animals
2. Use and store the product in a location where the ambient temperature and humidity are within the specified ranges. If applicable, provide forced cooling.
3. Mount the product in the correct direction.
4. Do not wire the input and output terminals incorrectly.
5. Make sure the input voltage and loads are within the specifications and ratings for the product.
6. Make sure the crimp terminals for wiring are of the specified size.
7. Do not connect anything to terminals that are not being used.
8. Use a power supply that will reach the rated voltage within 1 second after the power is turned ON.
9. Keep wiring separate from high voltages and power lines that draw large currents.  
Do not place product wiring in parallel with or in the same path as high-voltage or high-current lines.
10. Do not install the product near equipment that generates high frequencies or surges.
11. The product may cause incoming radio wave interference. Do not use the product near radio wave receivers.
12. Install an external switch or circuit breaker and label it clearly so that the operator can quickly turn OFF the power supply.
13. Make sure the indicators operate correctly. Depending on the application environment, the indicators may deteriorate prematurely and become difficult to see.
14. Do not use the product if it is accidentally dropped. The internal components may be damaged.
15. Be sure you understand the contents of this catalog and handle the product according to the instructions provided.
16. Do not install the product in any way that would place a load on it.
17. When discarding the product, properly dispose of it as industrial waste.
18. The product must be handled only by trained electrician.
19. Prior to operation, check the wiring before you supply power to the product.
20. Do not install the product immediately next to heat sources.
21. Perform periodic maintenance.

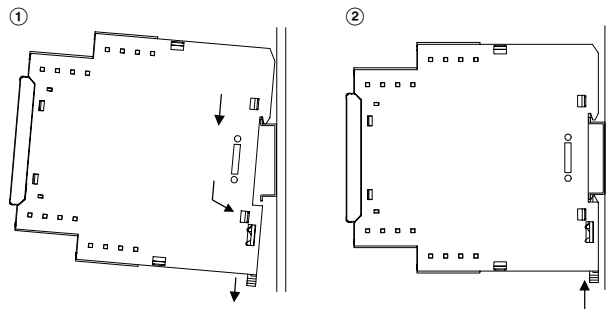
## Precautions for Correct Use

### Observe the following operating methods to prevent failure and malfunction.

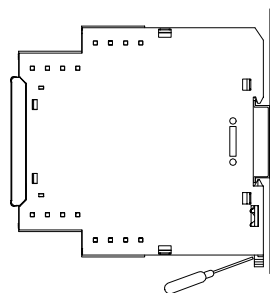
1. Use the input power and other power supplies and converters with suitable capacities and rated outputs.
2. Use a precision screwdriver or similar tool to adjust the setting knobs.
3. The product cannot be used for thyristor control or on the secondary side of an inverter. To use this product on the secondary side of an inverter, install a noise filter on the primary side of the inverter.
4. To reduce the error in the setting knob, always turn the setting knob from the minimum setting toward the maximum setting.
5. When cleaning the product, do not use thinners or solvents. Use commercial alcohol.

### Mounting and Removing

- Mounting to DIN Track
  1. Catch the upper hook on the DIN Track.
  2. Push the product onto the Track until the hooks lock into place.



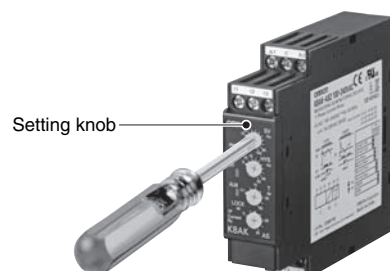
- Removing from the DIN Track  
Pull down on the bottom hook with a flat-blade screwdriver and lift up on the product.



Applicable DIN Tracks:  
PFP-100N (100 cm)  
PFP-50N (50 cm)

### Adjusting the Setting Knobs

- Use a screwdriver to adjust the setting knobs. The knobs have a stopper that prevents them from turning beyond the full right or left position. Do not force a knob beyond these points.



# Terms and Conditions of Sale

1. **Offer; Acceptance.** These terms and conditions (these "**Terms**") are deemed part of all quotes, agreements, purchase orders, acknowledgments, price lists, catalogs, manuals, brochures and other documents, whether electronic or in writing, relating to the sale of products or services (collectively, the "**Products**") by Omron Electronics LLC and its subsidiary companies ("**Omron**"). Omron objects to any terms or conditions proposed in Buyer's purchase order or other documents which are inconsistent with, or in addition to, these Terms.
2. **Prices; Payment Terms.** All prices stated are current, subject to change without notice by Omron. Omron reserves the right to increase or decrease prices on any unshipped portions of outstanding orders. Payments for Products are due net 30 days unless otherwise stated in the invoice.
3. **Discounts.** Cash discounts, if any, will apply only on the net amount of invoices sent to Buyer after deducting transportation charges, taxes and duties, and will be allowed only if (i) the invoice is paid according to Omron's payment terms and (ii) Buyer has no past due amounts.
4. **Interest.** Omron, at its option, may charge Buyer 1-1/2% interest per month or the maximum legal rate, whichever is less, on any balance not paid within the stated terms.
5. **Orders.** Omron will accept no order less than \$200 net billing.
6. **Governmental Approvals.** Buyer shall be responsible for, and shall bear all costs involved in, obtaining any government approvals required for the importation or sale of the Products.
7. **Taxes.** All taxes, duties and other governmental charges (other than general real property and income taxes), including any interest or penalties thereon, imposed directly or indirectly on Omron or required to be collected directly or indirectly by Omron for the manufacture, production, sale, delivery, importation, consumption or use of the Products sold hereunder (including customs duties and sales, excise, use, turnover and license taxes) shall be charged to and remitted by Buyer to Omron.
8. **Financial.** If the financial position of Buyer at any time becomes unsatisfactory to Omron, Omron reserves the right to stop shipments or require satisfactory security or payment in advance. If Buyer fails to make payment or otherwise comply with these Terms or any related agreement, Omron may (without liability and in addition to other remedies) cancel any unshipped portion of Products sold hereunder and stop any Products in transit until Buyer pays all amounts, including amounts payable hereunder, whether or not then due, which are owing to it by Buyer. Buyer shall in any event remain liable for all unpaid accounts.
9. **Cancellation; Etc.** Orders are not subject to rescheduling or cancellation unless Buyer indemnifies Omron against all related costs or expenses.
10. **Force Majeure.** Omron shall not be liable for any delay or failure in delivery resulting from causes beyond its control, including earthquakes, fires, floods, strikes or other labor disputes, shortage of labor or materials, accidents to machinery, acts of sabotage, riots, delay in or lack of transportation or the requirements of any government authority.
11. **Shipping; Delivery.** Unless otherwise expressly agreed in writing by Omron:
  - a. Shipments shall be by a carrier selected by Omron; Omron will not drop ship except in "break down" situations.
  - b. Such carrier shall act as the agent of Buyer and delivery to such carrier shall constitute delivery to Buyer;
  - c. All sales and shipments of Products shall be FOB shipping point (unless otherwise stated in writing by Omron), at which point title and risk of loss shall pass from Omron to Buyer; provided that Omron shall retain a security interest in the Products until the full purchase price is paid;
  - d. Delivery and shipping dates are estimates only; and
  - e. Omron will package Products as it deems proper for protection against normal handling and extra charges apply to special conditions.
12. **Claims.** Any claim by Buyer against Omron for shortage or damage to the Products occurring before delivery to the carrier must be presented in writing to Omron within 30 days of receipt of shipment and include the original transportation bill signed by the carrier noting that the carrier received the Products from Omron in the condition claimed.
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