

Thermistor Motor Protection Relay

K8AK-TS/-PT

Monitor Temperature Rise through Internal Motor Loss

- Temperature, phase sequence, and phase loss monitoring with the DIN 22.5-mm-sized K8AK-PT Relays.
- Side-by-side mounting of K8AK-PT Relays.
- Specially designed for internal motor monitoring; no setting required.
- Test/Reset Button for confirmation of output operation.
- Monitoring also performed for thermistor disconnections and short circuits.
- Manual or automatic resetting with the same Relay.



Refer to *Safety Precautions* on page 8.
Refer to page 7 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

| Function | Power supply voltage | Model |
|--|----------------------|-----------------------------|
| Phase sequence, phase loss, and temperature monitoring | 100 to 240 VAC | K8AK-PT1 100-240 VAC |
| | | K8AK-TS1 100-240 VAC |
| Temperature monitoring | 24 VAC/DC | K8AK-TS1 24 VAC/DC |

K8AK-TS/-PT

Ratings and Specifications

Ratings

| | | |
|---|--|---|
| Power supply voltage | Isolated power supply | 24 VAC/DC 100 to 240 VAC |
| Power consumption | | 24 VAC/DC: 1.8 VA/1.0 W max. 100 to 240 VAC: 3.5 VA max. |
| Rated input voltage | | 3-phase, 200 to 480 VAC (3-wire) |
| Operating time | Phase sequence on three-phase voltage input | 0.1 s ±0.05 s |
| | Phase loss on three-phase voltage input | 0.1 s max. (when the voltage changes rapidly from 100% to 0% of rated voltage) |
| | PTC thermistor input | 0.2 s max. |
| Reset method | | Manual reset/automatic reset (switchable) Note: Manual reset method: Press the TEST/RESET button. |
| Indicators | | Power (PWR): Green, PH_Alarm outputs (ALM): Red, TS_Alarm outputs (ALM): Red |
| Output relays | | One SPDT relay output (normally closed 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 or 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 ² Twisted wires: AWG16, AWG18 Note: 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

| | | |
|--|--|--|
| Allowable operating voltage range | | 85% to 110% of rated power supply voltage |
| Allowable operating frequency range | | 50/60 Hz \pm 5 Hz |
| Input frequency | | 50/60 Hz |
| Input overload capacity | | Continuous 528 V |
| Phase loss detection level | | 80% \pm 10% of rated input If any phase-to-phase voltage drops to 80% \pm 10% of the other phase-to-phase voltages, voltage asymmetry is detected and the phase loss function is performed. |
| PTC thermistor | Operating value precision | 3,100 Ω \pm 5% |
| | Reset value precision | 1,650 Ω \pm 5% |
| | Short circuit detection value precision | 0 to 10 Ω \pm 5 Ω |
| | Temperature drift | \pm 0.1%/°C max. |
| Operating time repeatability | | \pm 50 ms |
| Applicable standards | Conforming standards | EN 60947-5-1 Installation environment (pollution level 2, installation category III) |
| | EMC | EN 60947-5-1 |
| | Safety standards | UL 508 (Recognition), Korean Radio Waves Act (Act 10564), CSA: C22.2 No.14, CCC: GB14048.5 |
| Insulation resistance | | 20 M Ω min. Between external terminals and case Between power supply terminals and input terminals Between power supply terminals and output terminals Between input terminals and output terminals |
| Dielectric strength | | 2,000 VAC for one minute Between external terminals and case Between power supply terminals and input terminals Between power supply terminals and output terminals Between input terminals and output terminals |
| Noise immunity | | 1,500 V power supply terminal common/normal mode Square-wave noise of \pm 1 μ s/100 ns pulse width with 1-ns rise time |
| Vibration resistance | | Frequency: 10 to 55 Hz, acceleration 50 m/s ² 10 sweeps of 5 min each in X,Y, and Z directions |
| Shock resistance | | 100 m/s ² , 3 times each in 6 directions along 3 axes |
| Degree of protection | | Terminals: IP20 |

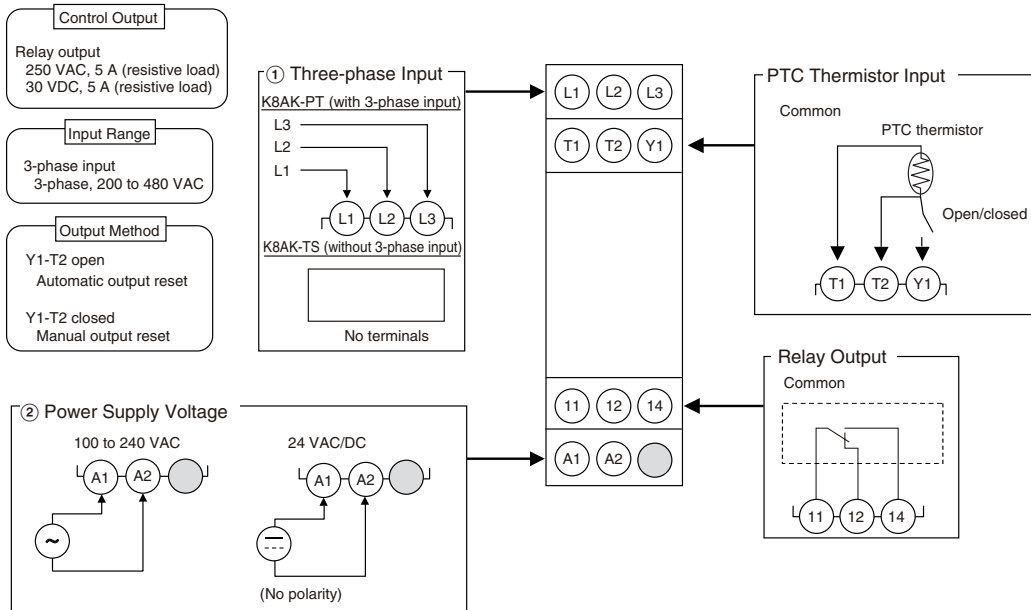
K8AK-TS/-PT

Connections

Terminal Diagram

K8AK-PT1 100-240VAC

① ②



Note: 1. Terminal application depends on the model.

2. Do not connect anything to terminals that are shaded in gray.

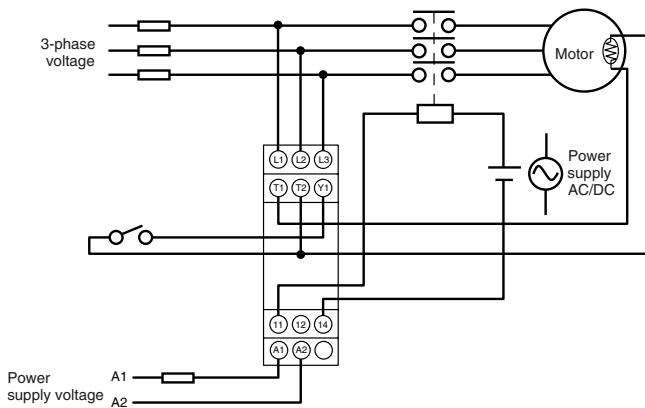
3. The T1, T2, and Y1 terminals are not isolated from the three-phase voltage input (L1, L2, and L3), which carries a hazardous voltage (480 V max.). Use cables with reinforced insulation for wiring and connect a class II device (e.g., switch).

Class II: Double or reinforced insulation is used to provide protection from electric shock, and a ground is not required.

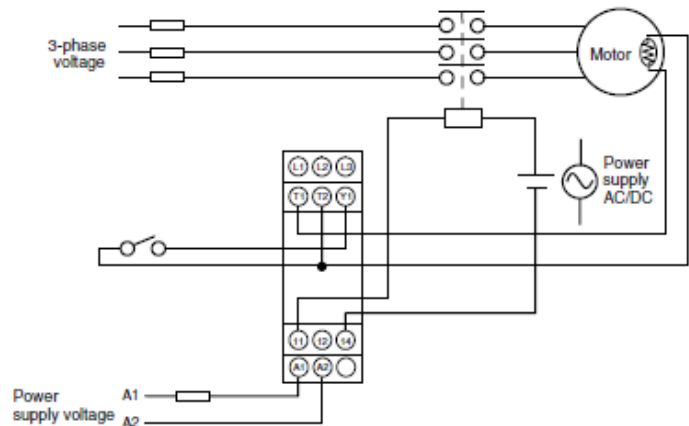
4. Use the recommended ferrules if you use twisted wires.

Wiring Examples

K8AK-PT



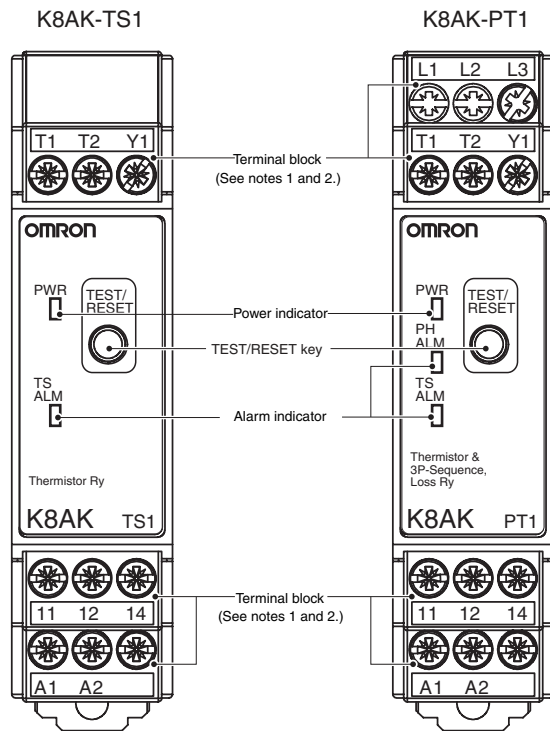
K8AK-TS



Note: There is no polarity for the DC voltage input.

Nomenclature

Front



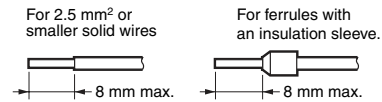
●Indicators

| Item | Meaning |
|-------------------------------------|---|
| Power indicator (PWR: Green) | Lit when power is being supplied. |
| Alarm indicator | PH_ALM = Red Lit for phase loss on 3-phase input. Flashing for phase sequence on 3-phase input. Lit in Test Mode. |
| | TS_ALM = Red Lit for error in PTC thermistor input. Lit in Test Mode. |

●Keys

| Item | Meaning |
|-----------------------|---|
| TEST/RESET key | Press with your finger to perform tests and resets. |

Note: 1. Use either a solid wire of 2.5 mm² 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

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

2. Tightening torque: 0.49 to 0.59 N·m

Operation Methods

Setting the Output Reset Method

Use the Y1 and T2 terminals to set the output reset method.

Y1-T2 Terminal Operation

| Y1-T2 terminals | Output reset method |
|-----------------|---------------------|
| Open | Automatic reset |
| Closed | Manual reset |

TEST/RESET Key Operation

●Testing

Automatic Output Reset

If the key is pressed during normal status, the relay output and alarm indicator will go to error status but only while the key is held in.

Manual Output Reset

If the key is pressed during normal status, the relay output and alarm indicator will go to error status.

●Resetting

Manual Output Reset

If the key is pressed when the output and alarm indicator are in alarm status and the input is normal, the output and alarm indicator will return to normal status.

●PTC Thermistor Input Hysteresis

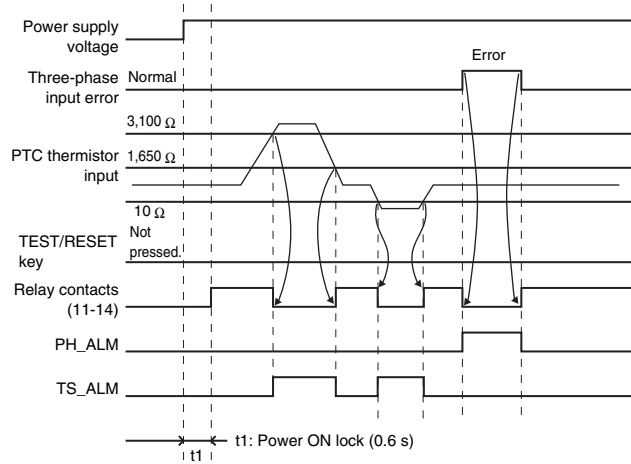
There is hysteresis between the operating value and the reset value.

If the input value exceeds the operating value and an error is detected, normal status is not restored until the input value goes below the reset value.

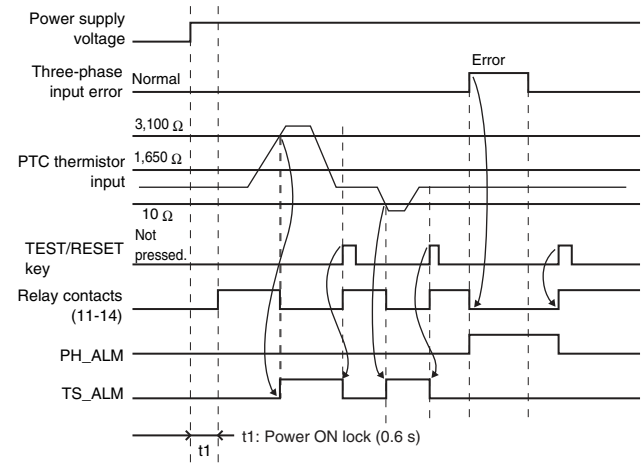
However, if the input value is between the operating value and reset value and an error is being detected, normal status is restored if the control power supply is cycled.

Timing Charts

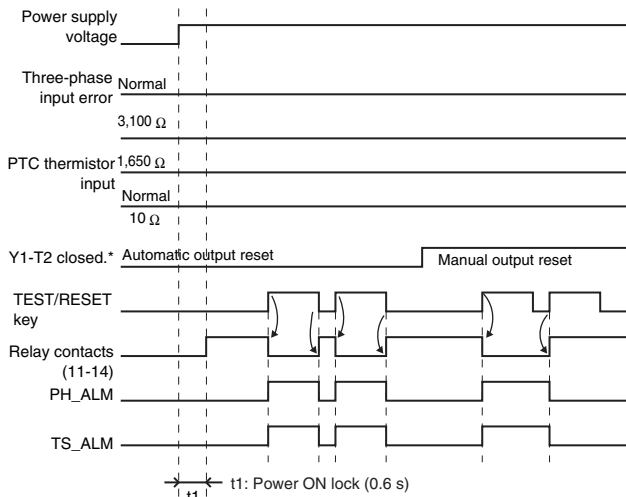
●Automatic Output Reset (Y1-T2: Open)



●Manual Output Reset (Y1-T2: Closed)

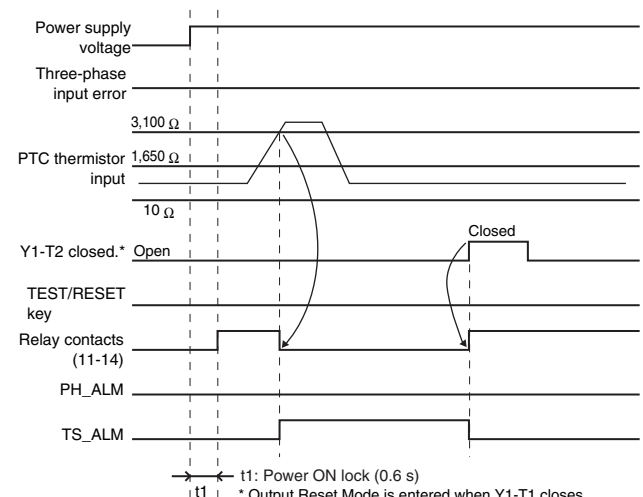


●Test Mode



* Test Mode can be used during normal status.
Error status is entered when the TEST/RESET key is pressed.
The method to restore normal status is linked to the output reset method.

●Using Y1-T2 as Remote Reset Terminals



* Output Reset Mode is entered when Y1-T1 closes.
The latched error status is cleared.
When Y1-T2 opens again, the initial status is restored.

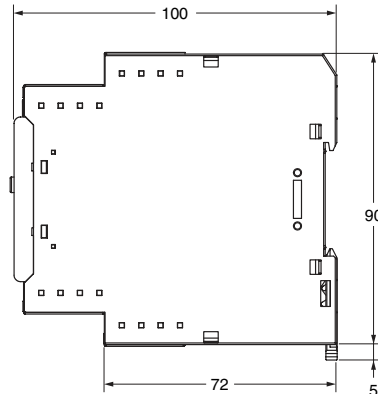
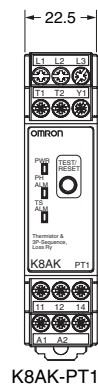
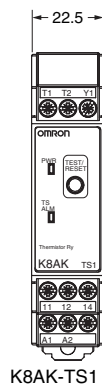
- Note:**
1. It requires 0.1 s for the contacts to switch after the input status is detected. This is not shown in the diagram.
 2. There are two types of error detection for the three-phase input. The indicator behavior changes accordingly.
Phase loss detected: PH_ALM lights.
Phase sequence detected: PH_ALM flashes.
If both a phase loss and phase sequence are detected at the same time, phase loss takes priority.

Dimensions

(Unit: mm)

Thermistor Motor Protection Relays

K8AK-TS1
K8AK-PT1



Questions and Answers

Q Checking Operation

A PTC Thermistor Input Operation
Operating Value

The input resistance gradually increases from around 1 kΩ. The operating value is the input value for which the alarm indicator (TS_ALM) lights. The contact outputs switch simultaneously so that you can confirm operation.

Note: Refer to the timing charts for the operating methods for reference.

Q Can phase loss be detected on the load side?

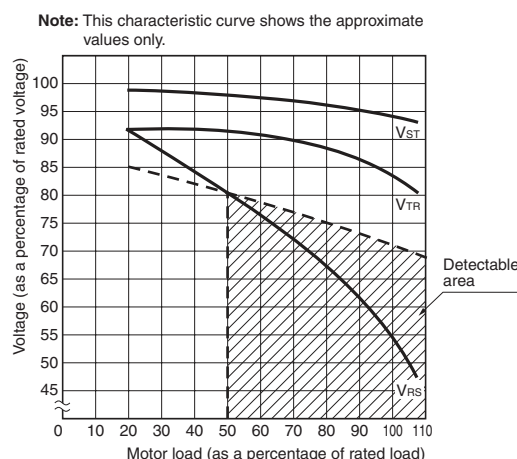
A In principle, phase loss cannot be detected on the load side because the K8AK-PT1 measures three-phase voltage to determine phase loss.

Q Is it possible to detect phase losses for motor loads while the motor is operating?

A Phase loss can be detected while the motor is operating. However, the detection conditions depend on the load conditions that are shown in the following figure. Understand these characteristics when using this feature.

Normally, three-phase motors will continue to rotate even if one phase is open. The three-phase voltage will be induced at the motor terminals when phase R has been lost with a load applied to a three-phase motor. The horizontal axis shows the motor load as a percentage of the rated load, and the vertical axis shows voltage as a percentage of the rated voltage. The solid line in the graph shows the voltage that is induced at the motor terminals when a phase loss occurs while the motor is operating under various loads. The figure below shows how a phase loss that occurs while the motor is operating causes an imbalance in the voltage across each motor terminal. The K8AK-PT1 detects phase loss when the motor is operating when the voltage is unbalanced. (Detection occurs when the imbalance is 80% of the maximum phase). The K8AK-PT1 cannot detect phase loss with light motor loads because the voltage imbalance is too small. The detectable range is shown by the diagonal lines.

Characteristic Curve Diagram





Note: For phase loss of phase R. V_{ST}, V_{TR}, and V_{RS} indicate the motor terminal voltage at phase loss.





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

| | |
|---|--|
|  WARNING | 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. |
|  CAUTION | Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage. |
| Precautions for Safe Use | Supplementary comments on what to do or avoid doing, to use the product safely. |
| Precautions for Correct Use | 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. Check terminal polarity when wiring and wire all connections correctly. The power supply terminals do not have polarity.
5. Do not wire the input and output terminals incorrectly.
6. Make sure the power supply voltage and loads are within the specifications and ratings for the product.
7. Make sure the crimp terminals for wiring are of the specified size.
8. Do not connect anything to terminals that are not being used.
9. Use a power supply that will reach the rated voltage within 1 second after the power is turned ON.
10. 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.
11. Do not install the product near equipment that generates high frequencies or surges.
12. The product may cause incoming radio wave interference. Do not use the product near radio wave receivers.
13. Install an external switch or circuit breaker and label it clearly so that the operator can quickly turn OFF the power supply.
14. Make sure the indicators operate correctly. Depending on the application environment, the indicators may deteriorate prematurely and become difficult to see.
15. Do not use the product if it is accidentally dropped. The internal components may be damaged.
16. Be sure you understand the contents of this catalog and handle the product according to the instructions provided.
17. Do not install the product in any way that would place a load on it.
18. When discarding the product, properly dispose of it as industrial waste.
19. When using the product, remember that the power supply terminals carry a high voltage.
20. The product must be handled only by trained electrician.
21. Prior to operation, check the wiring before you supply power to the product.
22. Do not install the product immediately next to heat sources.
23. Perform periodic maintenance.

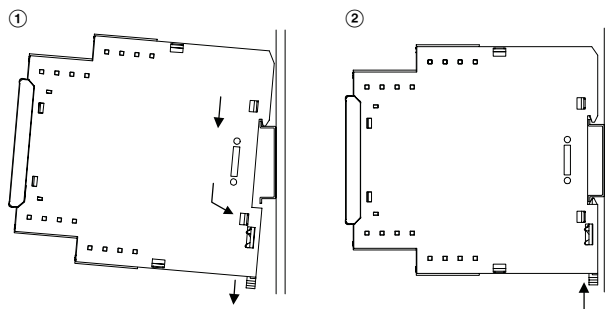
Precautions for Correct Use

Observe the following operating methods to prevent failure and malfunction.

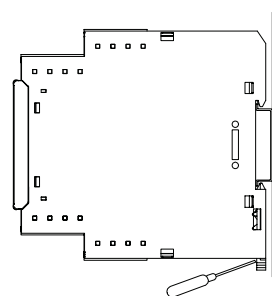
1. Use the power supply voltage, input power, and other power supplies and converters with suitable capacities and rated outputs.
2. When cleaning the product, do not use thinners or solvents. Use commercial alcohol.
3. The distortion in the input waveform must be 30% max. If the input waveform is distorted beyond this level, it may cause unnecessary operation.
4. The product cannot be used for thyristor control or on the secondary side of an inverter. To use the product on the secondary side of an inverter, install a noise filter on the primary side of the inverter.

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)

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.
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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.
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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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15. **Indemnities.** Buyer shall indemnify and hold harmless Omron Companies and their employees from and against all liabilities, losses, claims, costs and expenses (including attorney's fees and expenses) related to any claim, investigation, litigation or proceeding (whether or not Omron is a party) which arises or is alleged to arise from Buyer's acts or omissions under these Terms or in any way with respect to the Products. Without limiting the foregoing, Buyer (at its own expense) shall indemnify and hold harmless Omron and defend or settle any action brought against such Companies to the extent based on a claim that any Product made to Buyer specifications infringed intellectual property rights of another party.
16. **Property; Confidentiality.** Any intellectual property in the Products is the exclusive property of Omron Companies and Buyer shall not attempt to duplicate it in any way without the written permission of Omron. Notwithstanding any charges to Buyer for engineering or tooling, all engineering and tooling shall remain the exclusive property of Omron. All information and materials supplied by Omron to Buyer relating to the Products are confidential and proprietary, and Buyer shall limit distribution thereof to its trusted employees and strictly prevent disclosure to any third party.
17. **Export Controls.** Buyer shall comply with all applicable laws, regulations and licenses regarding (i) export of products or information; (iii) sale of products to "forbidden" or other proscribed persons; and (ii) disclosure to non-citizens of regulated technology or information.
18. **Miscellaneous.** (a) **Waiver.** No failure or delay by Omron in exercising any right and no course of dealing between Buyer and Omron shall operate as a waiver of rights by Omron. (b) **Assignment.** Buyer may not assign its rights hereunder without Omron's written consent. (c) **Law.** These Terms are governed by the law of the jurisdiction of the home office of the Omron company from which Buyer is purchasing the Products (without regard to conflict of law principles). (d) **Amendment.** These Terms constitute the entire agreement between Buyer and Omron relating to the Products, and no provision may be changed or waived unless in writing signed by the parties. (e) **Severability.** If any provision hereof is rendered ineffective or invalid, such provision shall not invalidate any other provision. (f) **Setoff.** Buyer shall have no right to set off any amounts against the amount owing in respect of this invoice. (g) **Definitions.** As used herein, "including" means "including without limitation"; and "Omron Companies" (or similar words) mean Omron Corporation and any direct or indirect subsidiary or affiliate thereof.

Certain Precautions on Specifications and Use

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