

Single-phase Overcurrent/Undercurrent Relay

K8AK-AW

Ideal for Current Monitoring for Industrial Facilities and Equipment.

- Monitor for overcurrents and undercurrents simultaneously. Separate settings and outputs supported for overcurrents and undercurrents.
- Use commercially available CTs (CT current on secondary side: 0 to 1 A or 0 to 5 A).
- Manual resetting and automatically resetting supported by one Relay.
- Startup lock and operating time can be set separately.
- Two sets of SPDT output contacts, 5 A at 250 VAC (resistive load).
- Output status can be monitored using LED indicator.
- Inputs are isolated from the power supply.



Refer to *Safety Precautions* on page 11.
Refer to page 10 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

Setting range	Power supply voltage	Model
2 to 20 mA AC/DC 10 to 100 mA AC/DC 50 to 500 mA AC/DC	24 VAC/DC	K8AK-AW1 24 VAC/DC
	100 to 240 VAC	K8AK-AW1 100-240 VAC
0.1 to 1 A AC/DC 0.5 to 5 A AC/DC	24 VAC/DC	K8AK-AW2 24 VAC/DC
	100 to 240 VAC	K8AK-AW2 100-240 VAC
10 to 100 A AC* 20 to 200 A AC*	24 VAC/DC	K8AK-AW3 24 VAC/DC
	100 to 240 VAC	K8AK-AW3 100-240 VAC

* The K8AK-AW3 is designed to be used in combination with an OMRON K8AC-CT200L Current Transformer (CT). (Direct input is not possible.)

Accessory (Order Separately)

●OMRON CT

Appearance	Input range	Applicable Relay	Model
	10 to 100 A AC, 20 to 200 A AC	K8AK-AW3	K8AC-CT200L

●Commercially Available CTs*

Appearance	CT current on secondary side	Applicable Relay
	0 to 1 A AC, 0 to 5 A AC	K8AK-AW2

* If you use a commercially available CT, do not exceed the overload capacity of the K8AK-AW2.

K8AK-AW

Ratings and Specifications

Input Range

Model	Range ^{*1}	Connection terminals	Setting range	Input impedance	Input type	Overload capacity
K8AK-AW1	0 to 20 mA AC/DC	I1-COM	2 to 20 mA AC/DC	Approx. 5 Ω	Direct input	Continuous input at 120% of maximum input. 1 s at 150%
	0 to 100 mA AC/DC	I2-COM	10 to 100 mA AC/DC	Approx. 1 Ω	Direct input	
	0 to 500 mA AC/DC	I3-COM	50 to 500 mA AC/DC	Approx. 0.2 Ω	Direct input	
K8AK-AW2	0 to 1 A AC/DC	I1-COM	0.1 to 1 A AC/DC 0.5 to 5 A AC/DC	Approx. 0.12 Ω (Load: 0.5 VA)	Direct input or commercially available CT	
	0 to 5 A AC/DC	I2-COM		Approx. 0.02 Ω (Load: 1.5 VA)		
K8AK-AW3	0 to 100 A AC	I2-COM	10 to 100 A AC ^{*2} 20 to 200 A AC ^{*2}	---	OMRON CT	Continuous input at 120% with an OMRON CT (K8AC-CT200L). 30 s at 200% 1 s at 600% * CT capacity on primary side.
	0 to 200 A AC	I3-COM		---	OMRON CT	

*1 The range is selected using connected terminals.

*2 The K8AK-AW3 is designed to be used in combination with an OMRON K8AC-CT200L Current Transformer (CT). (Direct input is not possible.)

Ratings

Power supply voltage	Isolated power supply	24 VAC/DC 100 to 240 VAC
Power consumption		24 VAC/DC: 2.0 VA/1.1 W max. 100 to 240 VAC: 4.6 VA max.
Operating value setting range (SV)		10% to 100% of the maximum value of the setting range K8AK-AW1: 2 to 20 mA AC/DC 10 to 100 mA AC/DC 50 to 500 mA AC/DC K8AK-AW2: 0.1 to 1 A AC/DC (Compatible with commercially available CTs.) 0.5 to 5 A AC/DC (Compatible with commercially available CTs.) K8AK-AW3: When used with the OMRON CT (K8AC-CT200L). 10 to 100 A AC 20 to 200 A AC
Operating value		100% operation at set value
Reset value		5% of operating value (fixed)
Reset method		Manual reset/automatic reset (switchable) Note: Manual reset: Turn OFF power supply for 1 s or longer.
Operating time setting range (T)		0.1 to 30 s
Startup lock time setting range (LOCK) Note: Enabled only for overcurrent operation.		0 to 30 s (The startup lock timer starts when the input has reached approximately 30% or more of the set value.) Note: Enabled only for overcurrent operation.
Indicators		Power (PWR): Green, Relay output (RY): Yellow, Alarm outputs (ALM): Red
Input impedance		Refer to <i>Input Range</i> on previous page.
Output relays		Two SPDT relay outputs (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/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)

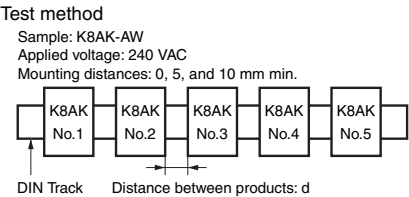
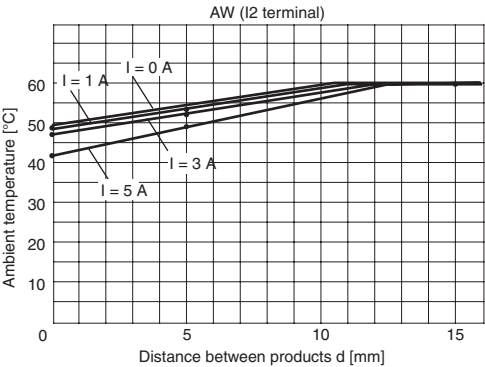
Specifications

Allowable operating voltage range		85% to 110% of power supply voltage
Allowable operating frequency range		50/60 Hz ±5 Hz
Input frequency range		K8AK-AW1 and K8AK-AW2: DC input or AC input (45 to 65 Hz) K8AK-AW3: AC input (45 to 65 Hz)
Overload capacity		K8AK-AW1 and K8AK-AW2: Continuous input at 120% of maximum input, 1 s at 150% K8AK-AW3: Continuous input at 120%, 30 s at 200%, and 1 s at 600% with an OMRON CT (K8AC-CT200L). Note: CT capacity on primary side.
Repeat accuracy	Operating value	±0.5% full scale (at 25°C and 65% humidity, rated power supply voltage, DC or 50/60 Hz sine wave input)
	Operating time	±50 ms (at 25°C and 65% humidity, rated power supply voltage)
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 MΩ 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 ±1 μs/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

●Relationship of Mounting Distance between K8AK-AW Relays and Input Current (Reference Values)

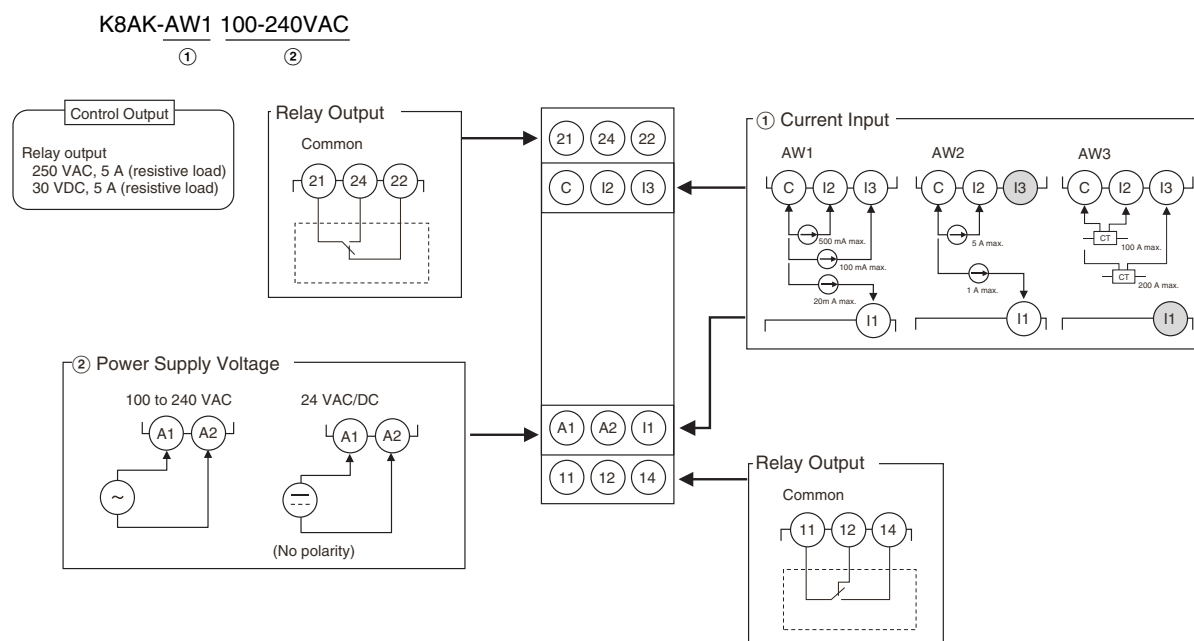
The following diagram shows the relationship between the mounting distances and the input current.

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



Connections

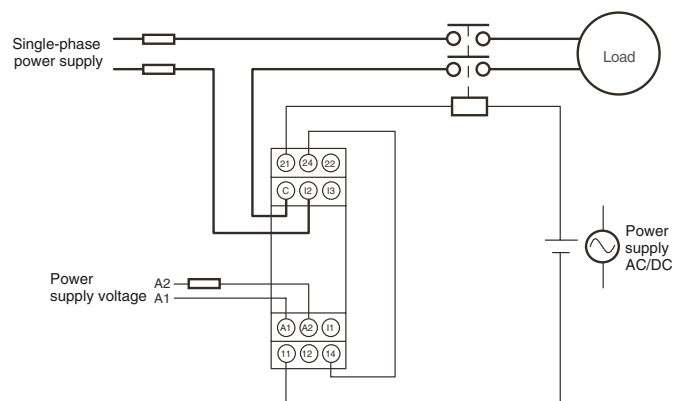
Terminal Diagram



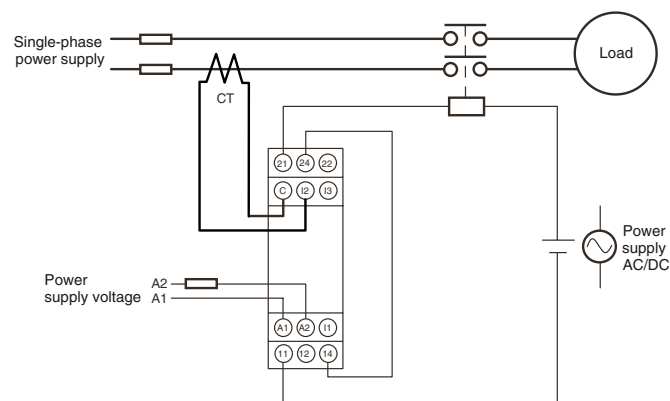
- Note:**
1. Do not connect anything to terminals that are shaded in gray.
 2. There is no polarity for the DC power supply input.
 3. For the current input, you can input only from the C terminal and one other terminal.
 4. Refer to *Setting Ranges and Wiring Connections* on the I1, I2, and I3 current input terminals.
 5. Use the recommended ferrules if you use twisted wires.
 6. The K8AK-AW3 is designed to be used in combination with the OMRON K8AC-CT200L Current Transformer (CT).

Wiring Example

Directly Inputting a Current



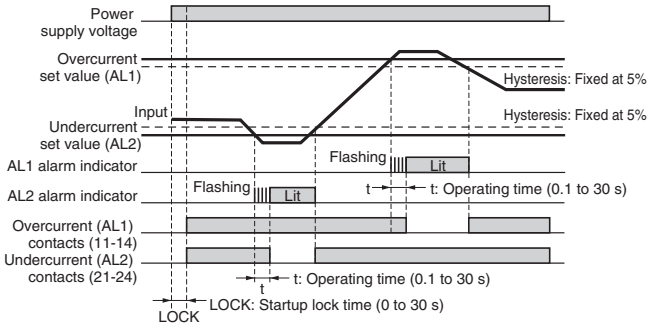
Using a CT



Timing Charts

●Overcurrent and Undercurrent Operation Diagram

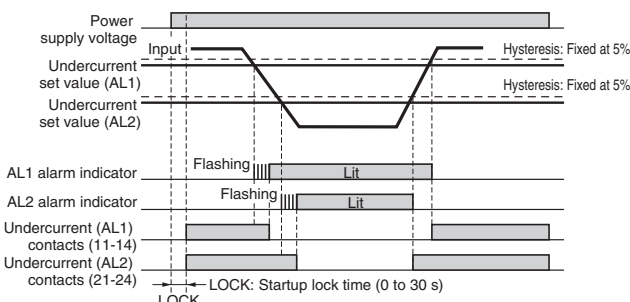
DIP switch settings: SW3 ON and SW4 ON, or SW3 OFF and SW4 OFF



- Note 1. The K8AK-AW□ output contacts are normally operative.
Note 2. The startup lock prevents unnecessary alarms from being generated during the unstable period when the power is first turned ON. There is no contact output during timer operation.

●Undercurrent and Undercurrent Operation Diagram (Undercurrent Pre-alarm Mode)

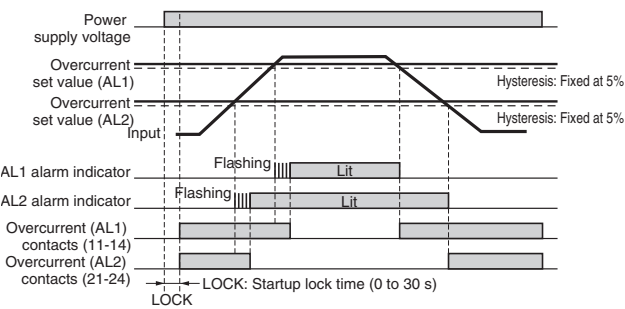
DIP switch settings: SW3 OFF and SW4 ON.



- Note 1. The K8AK-AW□ output contacts are normally operative.
Note 2. The startup lock prevents unnecessary alarms from being generated during the unstable period when the power is first turned ON. There is no contact output during timer operation.

●Overcurrent and Overcurrent Operation Diagram (Overcurrent Pre-alarm Mode)

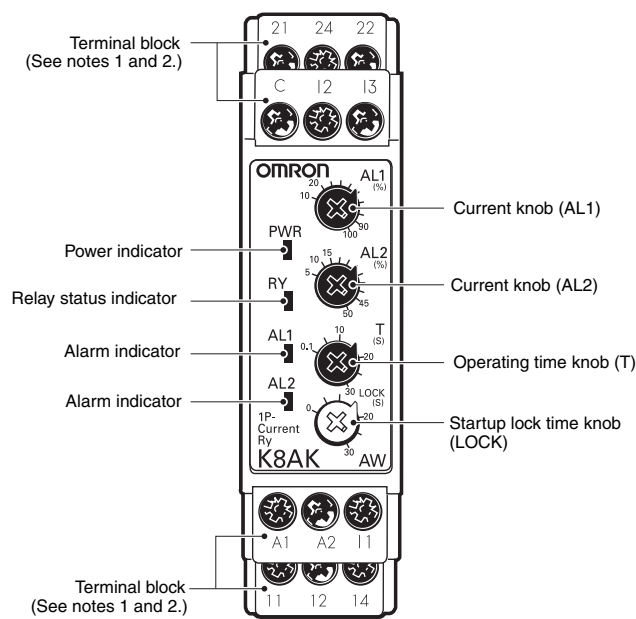
DIP switch settings: SW3 ON and SW4 OFF.



- Note 1. The K8AK-AW□ output contacts are normally operative.
Note 2. The startup lock prevents unnecessary alarms from being generated during the unstable period when the power is first turned ON. There is no contact output during timer operation.

Nomenclature

Front



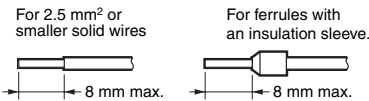
●Indicators

Item	Meaning
Power indicator (PWR: Green)	Lit when power is being supplied.
Relay status indicator (RY: Yellow)	Lit when relay is operating.
Alarm indicator (ALM: Red)	Lit when there is an overcurrent or undercurrent. The indicator flashes to indicate the error status after the input has exceeded the set value while the operating time is being clocked.

●Setting Knobs

Item	Usage
Current knob (AL1)	Used to set the current to 10% to 100% of maximum setting range.
Current knob (AL2)	Used to set the current to 10% to 100% of maximum setting range.
Operating time knob (T)	Used to set the operating time to 0.1 to 30 s.
Startup lock time knob (LOCK)	Used to set the startup lock time to 0 to 30 s.

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

K8AK-AW

Operation Methods

Setting Ranges and Wiring Connections

Model	Setting range	Input type	Wiring connections
K8AK-AW1	2 to 20 mA AC/DC	Direct input	I1-COM
	10 to 100 mA AC/DC	Direct input	I2-COM
	50 to 500 mA AC/DC	Direct input	I3-COM
K8AK-AW2	0.1 to 1 A AC/DC	Direct input or commercially available CT	I1-COM
	0.5 to 5 A AC/DC		I2-COM
K8AK-AW3	10 to 100 A AC*	OMRON CT	I2-COM
	20 to 200 A AC*	OMRON CT	I3-COM

Note: The DC input terminals have no polarity.
* The K8AK-AW3 is designed to be used in combination with the OMRON K8AC-CT200L Current Transformer (CT). (Direct input is not possible.)

Connections

●Input

Connect the input between the I1-COM, I2-COM, or I3-COM terminals, according to the input current. Malfunctions may occur if the input is connected to unused terminals and the Unit will not operate correctly.
Terminal I1 is not used by the K8AK-AW3.
If using the OMRON K8AC-CT200L CT, connect to terminals k and l on the K8AC-CT200L. (Terminals kt and lt are not used.)

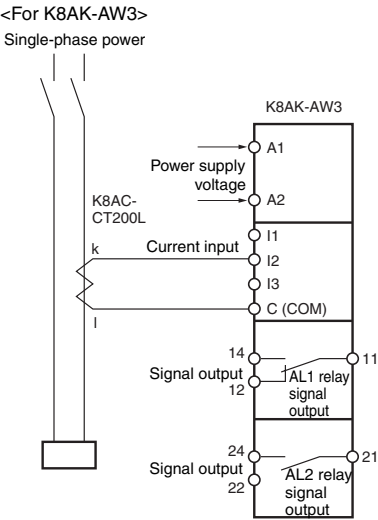
●Power Supply

Connect the power supply to terminals A1 and A2.

●Outputs

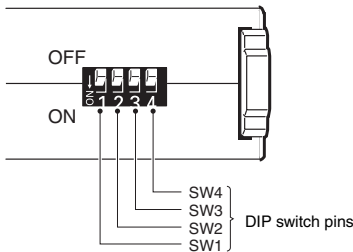
AL1 (SPDT relay) is output to terminals 11, 12, and 14.
AL2 (SPDT relay) is output to terminals 21, 22, and 24.

Note: Use the recommended ferrules if using twisted wires.



DIP Switch Settings

The resetting method, relay drive method, and operating mode are set using the DIP switch located on the bottom of the Unit.
K8AK-AW□ does not use SW1.



●DIP Switch Functions

Pin	OFF ● ↑ ON ○ ↓	1 OFF ON	2	3	4
Resetting method	Manual reset	●	---	---	---
	Automatic reset	○	---	---	---
Operating mode	AL1	Not used.	---	●	●
	Overcurrent		---	○	●
	Undercurrent		---	●	○
	Overcurrent		---	○	○
	Undercurrent		---	○	○

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

Setting Method

●Setting Current

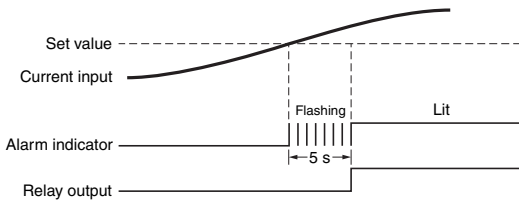
The current knob (SV) is used to set the current.
The current can be set to 10% to 100% of the maximum setting range.
Turn the knob while there is an input to the input terminals until the alarm indicator flashes (when the set value and the input have reached the same level.)
Use this as a guide to set the current.
The maximum setting range will differ depending on the model and the input terminal.
Example: K8AK-AW3 Using Input Terminals I3-COM
The maximum measuring current will be 200 A AC and the setting range will be 20 to 200 A.

Questions and Answers

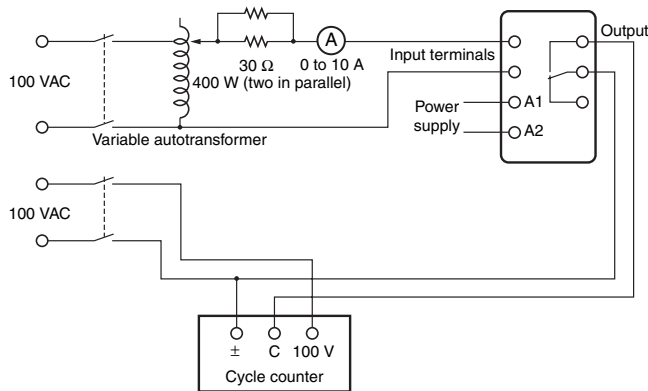
Q Checking Operation

- A** Overcurrents
Gradually increase the input from 80% of the set value. The input 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 outputs that will start after the operating time has passed.
- Undercurrent
Gradually decrease the input from 120% of the set value and check the operation using the same method as for overcurrent.

Example: Overcurrent Operating Mode, Normally Closed Relay Drive, and an Operating Time of 5 s.



Connection Diagram



Q How to Measure the Operating Time

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

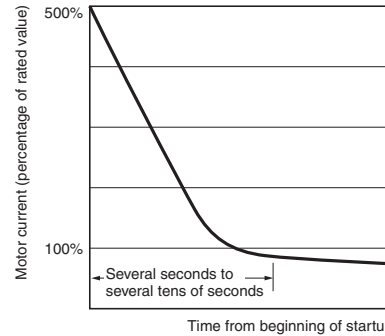
Q Monitoring Switch-mode Power Supplies

- A** Switch-mode Power Supplies cannot be monitored. In circuits with a capacitor input, including switch-mode power supplies, the input capacitor recharge current flows in pulse form as the load current. The K8AK-AW□ has a built-in filter as a countermeasure against high frequencies and cannot be used to remove pulse current.

Q Can a motor with a rated current of 5 A be monitored using the K8AK?

Are there any application precautions?

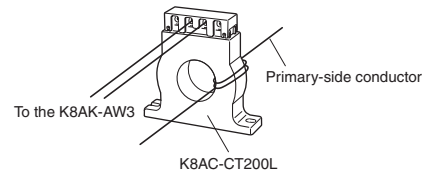
The K8AK-AW1 and K8AK-AW2 cannot be used with motor loads. Use the K8AK-AW3 in combination with the K8AC-CT200L Current Transformer (CT). With motor loads, the startup current and stall current will cause a current of many times the rated current to flow. Refer to the following figure for information on the motor startup current.



For a motor with a rating of 5 A, the startup current will be approximately 30 A. The startup current will exceed the overload capacity (rating: 150% for 1 s) of the K8AK-AW1 and K8AK-AW2 and result in failure of the Relay.

To monitor the motor load, use the K8AK-AW3. (Overload capacity: 120% of rating for continuous load, 200% of rating for 30 s, and 600% of rating for 1 s).

The K8AK-AW3 has a large input range. Pass the conductors multiple times through the special CT.



Concept behind Passing Conductor through the CT When Using the K8AK-AW3

Example: Monitoring Overload of a Motor with a Rated Current of 5 A

K8AK set value:

Overcurrent detection, operating value setting: 25%, operating time: 0.1 s
Startup lock timer: 0.1 to 30 s (Set the timer according to the duration of the startup current.)

The setting range for the K8AK-AW3 is 10% to 100% of the rated current (i.e., 10 to 100 A). Pass the conductors through the CT five times so that at least 10 A of current flows. The input current to the K8AK will be 25 A (i.e., 5 A x 5 loops).

If a startup current of six times the rated current is generated, it will be 150 A (i.e., 25 A x 6). The overload capacity for the K8AK-AW3 is 200% of the rating for 30 s. The Relay will not fail even if the startup current continues for 30 s, and it is possible to perform overload detection.

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

 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.

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

- 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
- Use and store the product in a location where the ambient temperature and humidity are within the specified ranges. If applicable, provide forced cooling.
- Mount the product in the correct direction.
- Check terminal polarity when wiring and wire all connections correctly. The power supply terminals do not have polarity.
- Do not wire the input and output terminals incorrectly.
- Make sure the power supply voltage and loads are within the specifications and ratings for the product.
- Make sure the crimp terminals for wiring are of the specified size.
- Do not connect anything to terminals that are not being used.
- Use a power supply that will reach the rated voltage within 1 second after the power is turned ON.
- 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.
- Do not install the product near equipment that generates high frequencies or surges.
- The product may cause incoming radio wave interference. Do not use the product near radio wave receivers.
- Install an external switch or circuit breaker and label it clearly so that the operator can quickly turn OFF the power supply.
- Make sure the indicators operate correctly. Depending on the application environment, the indicators may deteriorate prematurely and become difficult to see.
- Do not use the product if it is accidentally dropped. The internal components may be damaged.
- Be sure you understand the contents of this catalog and handle the product according to the instructions provided.
- Do not install the product in any way that would place a load on it.
- When discarding the product, properly dispose of it as industrial waste.
- When using the product, remember that the power supply terminals carry a high voltage.
- The product must be handled only by trained electrician.
- Prior to operation, check the wiring before you supply power to the product.
- Do not install the product immediately next to heat sources.
- Perform periodic maintenance.

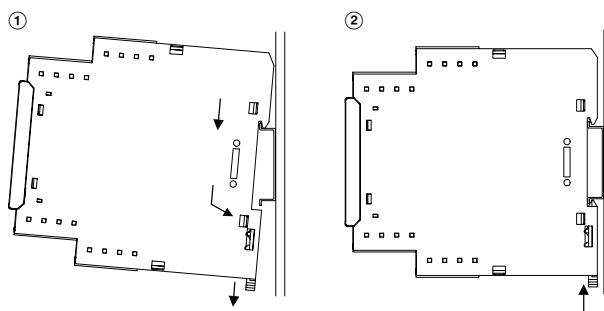
Precautions for Correct Use

Observe the following operating methods to prevent failure and malfunction.

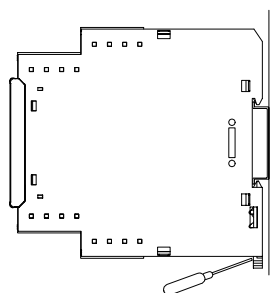
- Use the power supply voltage, input power, and other power supplies and converters with suitable capacities and rated outputs.
- Use a precision screwdriver or similar tool to adjust the setting knobs.
- The distortion in the input waveform must be 30% max. If the input waveform is distorted beyond this level, it may cause unnecessary operation.
- Error will be large if the product is used for thyristor or inverter control.
- To reduce the error in the setting knob, always turn the setting knob from the minimum setting toward the maximum setting.
- When cleaning the product, do not use thinners or solvents. Use commercial alcohol.

Mounting and Removing

- Mounting to DIN Track
 - Catch the upper hook on the DIN Track.
 - 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.



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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.
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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.
13. **Warranties.** (a) **Exclusive Warranty.** Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied. (b) **Limitations.** OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. Omron further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Products or otherwise of any intellectual property right. (c) **Buyer Remedy.** Omron's sole obligation hereunder shall be, at Omron's election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Omron's analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty. See <http://www.omron247.com> or contact your Omron representative for published information.
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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; (ii) sale of products to "forbidden" or other proscribed persons; and (iii) 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.

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