New Product

OMRON

Phase-sequence Phase-loss Relay
K8DT-PH

Protect motors and other equipment from unstable voltages in the power supply system.
Protect motors and other equipment by detecting phase sequence and phase loss for three-phase power supplies.

- Phase loss detection while the motor is operating.
- Global application with power supply range of 200 to 480 V with one Relay.
- Greater resistance to inverter noise.
- Width of 17.5 mm to reduce space required in panels.
- Push-In Plus Terminal Blocks that reduce wiring work.
- Models added with transistor outputs for superior contact reliability.

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

⚠ Refer to *Safety Precautions* on page 7.
Refer to page 6 for commonly asked questions.

Ordering Information

Phase-sequence Phase-loss Relay

Function	Rated input voltage ✻	Relay output	Model
Phase sequence and phase loss monitoring	3-phase, 3-wire 200 to 480 VAC	Relay: SPDT contact output	**K8DT-PH1CN**
		Transistor: NPN output	**K8DT-PH1TN**

✻ The power supply voltage is the same as the rated input voltage.

Accessory (Order Separately)

Front Cover

Appearance	Model
	Y92A-D1A

Ratings and Specifications

Ratings

Rated input voltage		3-phase, 200 to 480 VAC (3-wire)
Input load		Approx. 2.6 VA
Rated insulation voltage		528 VAC
Operating time	**Phase sequence**	0.1 s±0.05 s
	Phase loss	0.1 s max. (when the voltage changes rapidly from 100% to 0% of rated voltage)
Reset method		Automatic reset
Indicators		Power (PWR): Green, Output (OUT): Yellow
Output form		Relay: SPDT contact output Transistor: NPN output
Output relay ratings		Rated load 5 A at 250 VAC (Resistive load) 5 A at 30 VDC (Resistive load) 1 A at 250 VAC (Inductive load) 0.2 A at 48 VDC (Inductive load) **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
Transistor output ratings		Contact form: SPST-NO (NPN transistor) Rated voltage: 24 VDC (maximum voltage: 26.4 VDC) Maximum current: 50 mA DC
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% RH (with no condensation)
Storage humidity		25% to 85% RH (with no condensation)
Altitude		2,000 m max.
Applicable wires		Stranded wires or ferrules
Applicable wire size		0.25 to 1.5 mm^2 (AWG24 to AWG16)
Wire insertion force		8 N max. for AWG20 wire
Screwdriver insertion force		15 N max.
Wire stripping length		8 mm
Ferrule length		8 mm
Recommended flat-blade screwdriver		XW4Z-00B (Omron) SZF 0.4 × 2.5 (Phoenix Contact) 210-719 (Wago) SDI 0.4 × 2.5 × 75 (Weidmuller)
Current capacity		10 A (per pole)
Number of insertions		50 times
Case color		N1.5
Case material		PC, UL 94 V-0
Weight		Approx. 100 g
Mounting		Mounts to DIN Track, or screw mounting
Dimensions		17.5 × 90 × 90 mm (W×D×H)

Specifications

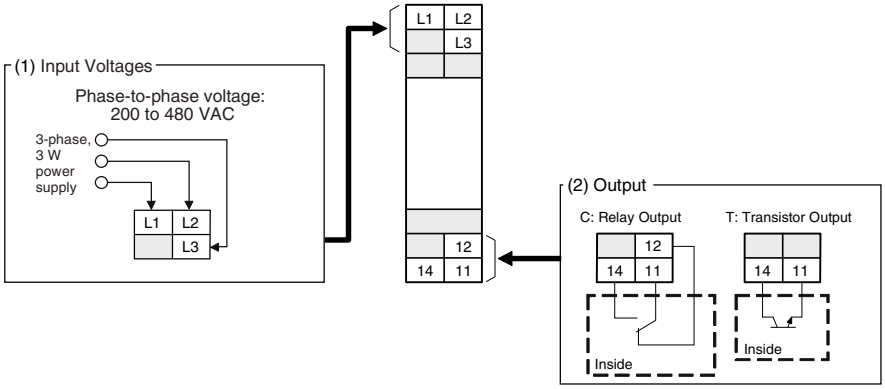
Input frequency range		45 to 65 Hz
Overload capacity		Continuous 528 V
Phase loss detection level		80%±10% of rated input Calculation Formula = 1 – ((Highest phase-to-phase voltage – Lowest phase-to-phase voltage)/ Average three-phase phase-to-phase voltage)
Applicable standards	**Conforming standards**	EN 60947-5-1 Installation environment (pollution level 2, Overvoltage category III)
	EMC	EN 60947-5-1
	Safety standards	UL 60947-5-1 (Listing), Korean Radio Waves Act (Act 10564), CCC (GB14048.5), LR (Category ENV1.2) ✻
Insulation resistance		20 MΩ min. Between external terminals and case Between input terminals and output terminals
Dielectric strength		2,000 VAC for one minute Between external terminals and case Between input terminals and output terminals
Impulse withstand voltage		6 kV (between live terminals and exposed, non-charged metal parts)
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, 0.35-mm single amplitude, 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

✻ Certification is pending for LR.

Connections

Terminal Diagram

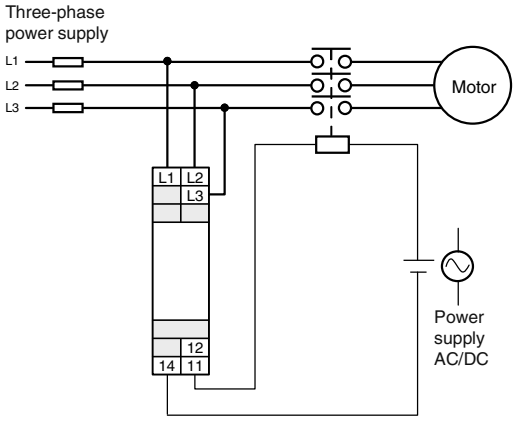
K8DT-PH1 C N
(1) (2)



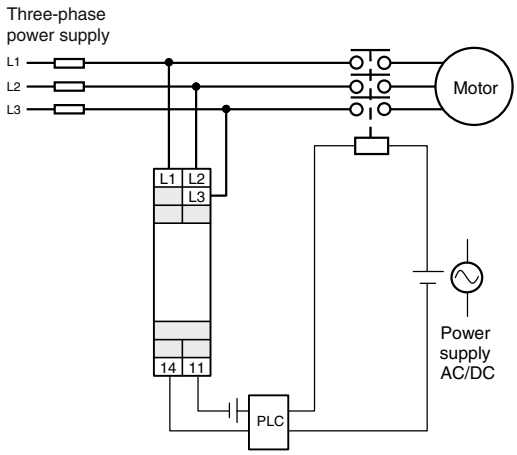
Note: Do not connect anything to terminals that are shaded in gray.

Wiring Example

Relay Output



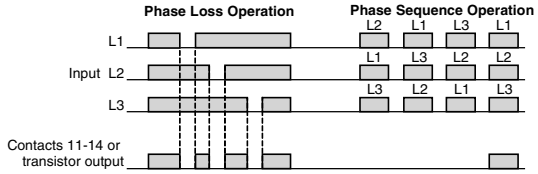
Transistor Output



Note: Use copper wires with a rating of 75°C or an equivalent rating.

Timing Charts

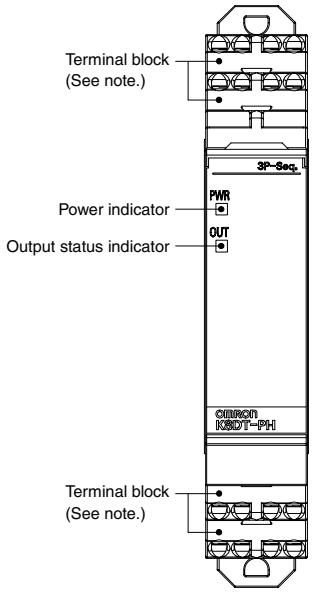
Phase Sequence and Phase Loss Operation Diagram



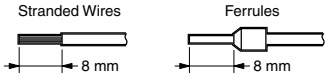
Note: 1. The K8DT-PH1 outputs are normally operative.
2. The Relay will not operate if the input voltage drops below 80% of the minimum input value because L1 and L2 are also used to provide power.
3. Phase loss cannot be detected on the load side because this detection is based on the voltage.

Nomenclature

Front



Note: Use stranded wires, with or wiihout or ferrules to connect to the terminals.
To maintain the withstand voltage after connecting the terminals, insert 8 mm of exposed conductor into the terminal.



Indicators

Item	Meaning
Power indicator (PWR: Green)	Lit when power is being supplied ✻.
Output status indicator (Output: Yellow)	Lit when there is an output (lit for normal operation)

✻ This indicator uses the input across L1 and L2 as the internal power supply. It will not light unless there is an input across L1 and L2.

Operation Methods

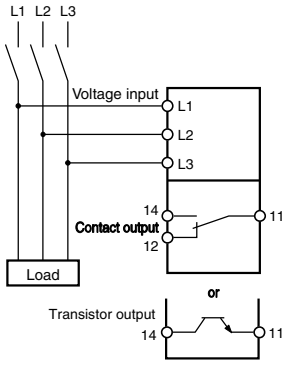
Connections

Input

Connect using L1, L2, and L3.
Make sure the phase sequence is wired correctly. The Unit will not operate normally if the phase sequence is incorrect.

Outputs

For a relay output, the SPDT contacts are output on terminals 11, 12, and 14. For a transistor output, the NPN output is on terminals 11 and 14.
Do not use the transistor output for control applications. It is designed only to output a signal when an error is detected.

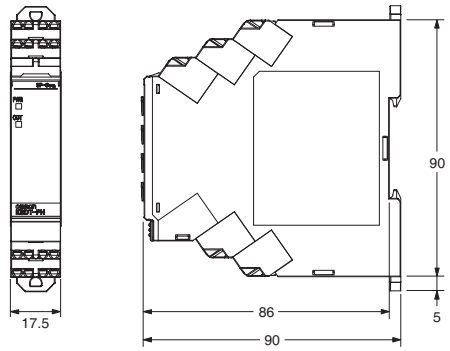


Dimensions

(Unit: mm)

Phase-sequence Phase-loss Relay

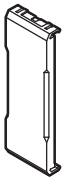
K8DT-PH1

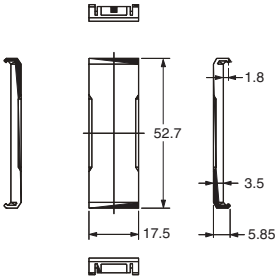


Accessories (Order Separately)

Front Cover

Y92A-D1A



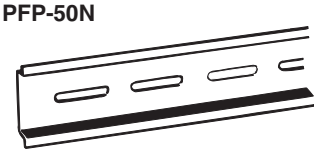


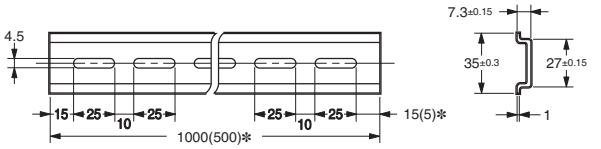
Din Track Mounting

DIN Tracks

PFP-100N

PFP-50N





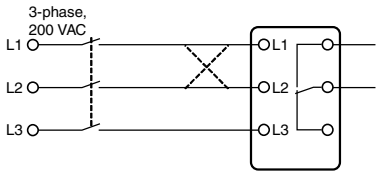
* Dimensions in parentheses are for the PFP-50N.

Questions and Answers

Q **Checking Operation**

A Phase Sequence
Switch the wiring, as shown by the dotted lines in the connection diagram, to reverse the phase sequence and check that the K8DT operates.
Phase Loss
Create a phase loss for any input phase and check that the K8DT operates.

Connection Diagram



Q **Can phase loss be detected on the load side?**

A In principle, phase loss cannot be detected on the load side because the K8DT-PH measures three-phase voltage to determine phase loss.

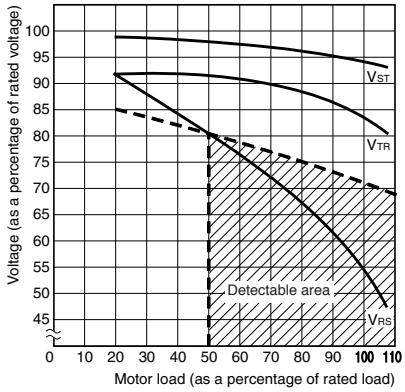
Q **Is it possible to detect phase losses for motor loads while the motor is operating?**

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. The diagram shows voltage induction 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 this 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 K8DT-PH1 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 K8DT-PH1 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: This characteristic curve shows the approximate values only.



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

Doing so may occasionally result in minor injury due to electric shock. Do not touch the Relay while the power supply is ON.

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.

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.

If the Relay is used with incorrect wiring, fire may occasionally occur, possibly resulting in physical damage. Check the wiring for mistakes before you turn ON the power supply.

If the Relay fails, monitoring and alarm outputs may fail to operate. This may result in physical damage to the facilities, equipment, or other devices that are connected to it. To reduce this risk, inspect the Relay regularly. To maintain safety in the event of malfunction of the Relay, take appropriate safety measures, such as installing a monitoring device on a separate line.

If the wire insertion length is insufficient, fire may occasionally occur, possibly resulting in physical damage. Insert the wires all the way to the back.

The terminal block may be damaged if you insert a flat-blade screwdriver in the release hole with excessive force. Insert the flat-blade screwdriver into the release holes with a force of 15 N or less.

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 (sulfurizing gases, ammonia gases, etc.)
   - Locations subject to rapid temperature changes
   - Locations prone to icing and dew condensation
   - Locations subject to vibration and large shocks
   - Locations subject to wind and rain
   - Locations subject to static electricity or noise
   - Locations subject to insects or small animals
   - Locations subject to direct radiant heat from heating equipment
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. Check terminal polarity when wiring and wire all connections correctly.
4. Do not wire the input and output terminals incorrectly.
5. Make sure the power supply voltage and loads are within the specifications and ratings for the product.
6. Make sure the ferrule terminals for wiring are of the specified size.
7. Make sure the stripping length is 8 mm. insert the wires all the way to the back.
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. The product must be handled only by trained electricians.
20. Prior to operation, check the wiring before you supply power to the product.
21. Do not install the product immediately next to heat sources.
22. Perform periodic maintenance.
23. Do not wire anything to the release holes.
24. When you insert a flat-blade screwdriver into a release hole, do not tilt or twist the screwdriver. The terminal block may be damaged.
25. Insert a flat-blade screwdriver into the release holes at an angle. The terminal block may be damaged if the screwdriver is inserted straight in.
26. Do not allow the flat-blade screwdriver to fall when you are holding it in a release hole.
27. Do not bend a wire past its natural bending radius or pull in it with excessive force. Doing so may break the wires.
28. To prevent wire materials from smoking or igniting, use the wiring materials given in the following table.

Recommended wire	Stripping length	
	With Ferrules	Without Ferrules
0.25 to 1.5mm²/Equivalent to AWG24 to 16	10 mm	8 mm

Note: Please use Ferrules with UL certification (R/C).

29. Do not insert more than one wire into each terminal insertion hole.
30. Use only the specified wires for wiring.
31. When wiring the terminals, allow some leeway in the wire length.

Precautions for Correct Use

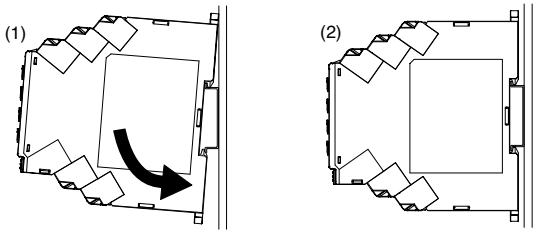
Observe the following operating methods to prevent failure and malfunction.

1. Use the power supply voltage, input power, and other power supplies and converters with suitable capacities and rated outputs.
2. The distortion in the input waveform must be 30% max. If the input waveform is distorted beyond this level, it may cause unnecessary operation.
3. The product cannot be used for thyristor control or on the secondary side of an inverter. To use this product on the primary side of an inverter, install a noise filter on the primary side of the inverter.
4. Phase loss can be detected only from the input contacts to the power supply side. Phase loss cannot be detected from the input contacts to the load side.
5. When cleaning the product, do not use thinners or solvents. Use commercial alcohol.
6. If you use stranded wires, make sure that there are no loose wire strands.
7. If you wire crossovers and connect terminal blocks in parallel, a large current will flow. Make sure that the current does not exceed 10 A.
8. The terminal block may be damaged if the recommended tool is not used. Use the recommended flat-blade screwdriver to operate the release holes.

Correct Mounting Direction, Mounting, and Removing

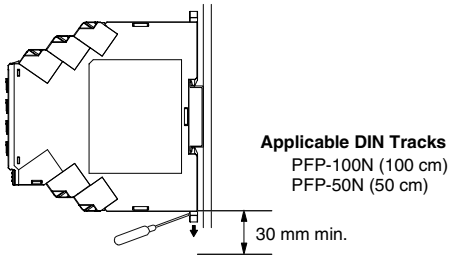
Mounting to DIN Track

To mount the Relay to a DIN Track, hook the Relay onto the DIN Track and press the Relay in the direction of the arrow until you hear it lock into place.



Removing from the DIN Track

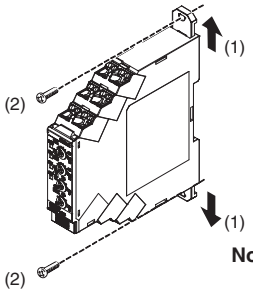
To remove the Relay, insert a screwdriver into the hook on the top or bottom and pull out the hook to release the Relay.

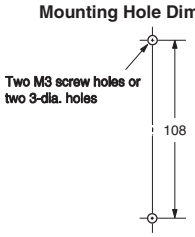


- Leave at least 30 mm of space between the product and other devices to allow easy installation and removal.

Screw Mounting

1. Pull out the two hooks on the back of the Relay to the outside until you hear them click in place.
2. Insert M3 screws into the hook holes and secure the Relay.

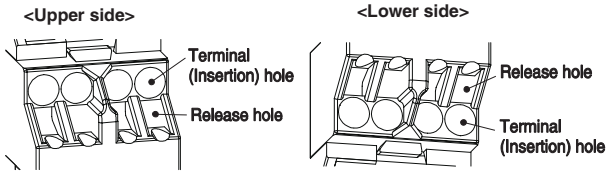




Note: 1. Pull out the hooks to mount the Relay with screws.
2. Recommended tightening torque: 0.5 to 0.6 N·m.

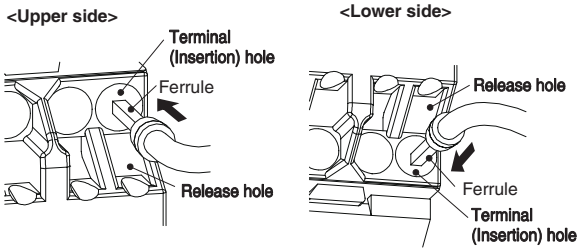
Connecting Wires to the Push-In Plus Terminal Block

Part Names of the Terminal Block



Connecting Wires with Ferrules

Insert the ferrule straight into the terminal block until the end strikes the terminal block.

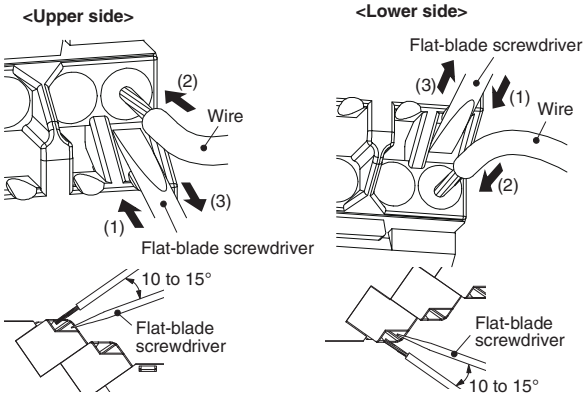


If a wire is difficult to connect because it is too thin, use a flat-blade screwdriver in the same way as when connecting stranded wire.

Connecting Stranded Wires

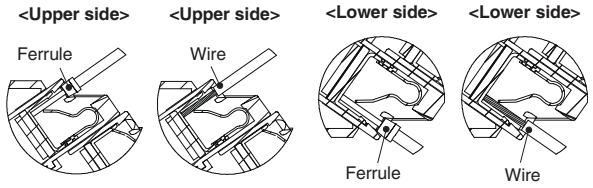
Use the following procedure to connect the wires to the terminal block.

1. Hold a flat-blade screwdriver at an angle and insert it into the release hole. The angle should be between 10° and 15°. If the flat-blade screwdriver is inserted correctly, you will feel the spring in the release hole respond.
2. **With the flat-blade screwdriver still inserted into the release hole, insert the wire into the terminal hole until it strikes the terminal block.**
3. Remove the flat-blade screwdriver from the release hole.



Checking Connections

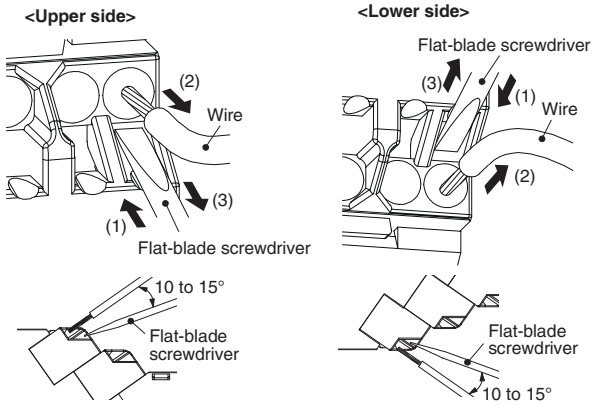
- After the insertion, pull gently on the wire to make sure that it will not come off and the wire is securely fastened to the terminal block.
- To prevent short circuits, insert the stripped part of a stranded wire or the conductor part of a ferrule until it is hidden inside the terminal insertion hole. (See the following diagram.)



Removing Wires from the Push-In Plus Terminal Block

Use the following procedure to remove wires from the terminal block. The same method is used to remove stranded wires and ferrules.

1. Hold a flat-blade screwdriver at an angle and insert it into the release hole.
2. With the flat-blade screwdriver still inserted into the release hole, remove the wire from the terminal insertion hole.
3. Remove the flat-blade screwdriver from the release hole.



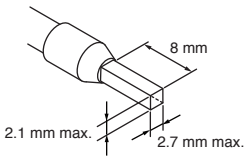
Recommended Ferrules and Tools

Recommended Ferrules

Wire		Ferrule length (mm)	Recommended ferrules		
(mm^2)	(AWG)		Manufactured by Phoenix Contact	Manufactured by Weidmuller	Manufactured by Wago
0.25	24	8	AI0.25-8	H0.25/12	FE-0.25-8N-YE
0.34	22	8	AI0.34-8	H0.34/12	FE-0.34-8N-TQ
0.5	20	8	AI0.5-8	H0.5/14	FE-0.5-8N-WH
0.75	18	8	AI0.75-8	H0.75/14	FE-0.75-8N-GY
1	18	8	AI1-8	H1.0/14	FE-1.0-8N-RD
1.5	16	8	AI1.5-8	H1.5/14	FE-1.5-8N-BK
Recommended crimp tool			CRIMPFOX6 CRIMPFOX6T-F CRIMPFOX10S	PZ6 roto	Variocrimp4

Note: 1. Make sure that the outer diameter of the wire coating is smaller than the inner diameter of the insulation sleeve of the recommended ferrule.

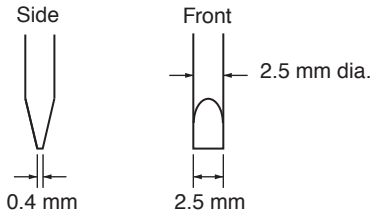
2. Make sure that the ferrule processing dimensions conform to the following figures.



Recommended Flat-blade Screwdriver

Use a flat-blade screwdriver to connect and remove wires.

The following table shows manufacturers and models as of 2015/Dec.



Model	Manufacturer
XW4Z-00B	Omron
ESD0.40×2.5	Wera
SZF 0.4×2.5	Phoenix Contact
0.4×2.5×75 302	Wiha
AEF.2.5×75	Facom
210-719	Wago
SDI 0.4×2.5×75	Weidmuller

⚠ EN/IEC Standard Compliance

- Refer to the contents of this datasheet for cable selection and other conditions for compliance with EMC standards.

Precaution on EN Standard Compliance

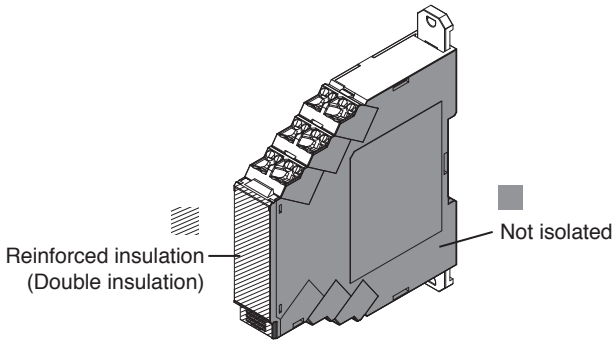
The K8DT complies with EN 60947-5-1 when it is built into a panel, but observe the following handling methods to ensure compliance with the requirements of this standard.

Wiring

Overvoltage category III

Pollution degree 2

- Open-frame Device
- If basic, double, or reinforced insulation is required, use the basic, double, or reinforced insulation defined in IEC 60664 that is suitable for the maximum applied voltage for the clearance, solid insulation, and other factors.
- There is basic insulation between the power supply terminals and input terminals.
- There is basic insulation between the power supply terminals and output terminals.
- There is basic insulation between the input terminals and output terminals.
- Operating section must have reinforced or double insulation.
- The sides of the case are not isolated.
- Connect the output contacts (contacts with different polarity) so that they reach the same potential.



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