

Varistors (ZNR Surge Absorber) Type D, Series E, E-S1

Handling Precautions**⚠ Safety Precautions**

In case that a Varistors (ZNR Surge Absorber) (hereafter referred to as the ZNR, or product name) is used, if an abnormality takes place because of peripheral conditions of the ZNR(material, environments, power source conditions, circuit conditions, etc. in equipment design), fire, electric shock, burn, or product failure may occur. The precautions for this product are described below, understand the content thoroughly before usage. For more questions, contact us.

If there's any uncertainty/doubt/products safety items, please contact us. When a dogma shall be occurred about safety for this products, be sure to inform us rapidly, operate your technical examination.

1. ⚠ Precautions to be strictly observed**1.1 Confirmation of performance ratings**

Use the ZNR within its rated range of performance such as the Max. allowable voltage, withstanding surge current, withstanding energy, impulse life(surge life), average pulse power, and operating temperature range. If used outside the range, the ZNR can be degrade and have element fracture, which may result in smoking and ignition.

1.2 To avoid accidents due to unexpected phenomena, take the following measures

- 1) In the event of fracture of the ZNR, its pieces may scatter ; hence, put the case or cover of the set product in place.
- 2) Do not install the ZNR near combustible substances(polyvinyl chloride wires, resin moldings, etc.).
If it is difficult to do, install a nonflammable cover.
- 3) Across-the-line use
When the ZNR is used across a line, put a current fuse in series with the ZNR(Refer to Item 2.1.1). (4) .
- 4) Use between line to ground
 - (1) If the case that the ZNR is used between a line to the ground, the short-circuit of the ZNR may not blow the current fuse because of grounding resistance, which may cause smoking and ignition of the ZNR's exterior resin.
As the measure against it, install an earth leakage breaker on the power supply side of the ZNR position. If no earth leakage breaker is installed, use a thermal fuse together with a current fuse in series. (Refer to Table 1.)
 - (2) If the case that the ZNR is used between a live part to metal case, an electric shock may develop at a shortcircuit of the ZNR ; hence, ground the metal case to the ground or keep it from the human body.

1.3 If ZNR is shorted out and happen smoke or ignition, please cut provided current to ZNR immediately.**2. Application notes****2.1 Pay attention to the following items to avoid the shortened life and failure of the ZNR**

- 1) Circuit conditions
 - (1) Select a ZNR of which the maximum voltage including fluctuations in source voltage allows for the maximum permissible circuit voltage. (Refer to Table 1.)
 - (2) In cases that surges are intermittently applied at short intervals(for example, in case that the voltage of the noise simulator test is implemented etc.), do not let them exceed the ZNR's rated power.
 - (3) Select a ZNR recommended in Table 1.
 - <1> Across-the-line use
If possible, use a Part No. marked with * in case of voltage temporarily rises load unbalance of separately-wired loads, short between hot and neutral-line, open of neutral line in single-phase-three-wired system, and due to resonance at switching for a capacitive, inductive load.

<2> Used between line to ground

Use a different Part No. from "Across-the-line use" as table 1, because of raising voltage in case of "Line to Ground Fault".

Use a Part No. marked with **in table 1, in case of the insulation resistance test(500 VDC) for equipment. When using a Part of the varistor voltage that the insulation efficiency examination can not be cleared, there is a case where the surge absorber can be done by removing it from the circuit depending on the circuit condition(Refer examination of Japan Domestic Safety Regulations).

Use a Part No. marked with *** in table 1, in case of the withstanding voltage test (1000 VAC or 1200 VAC) for equipment.

(4) Concerning current fuse

<1> We recommend selecting a ZNR and the rated current of a current fuse as follows.

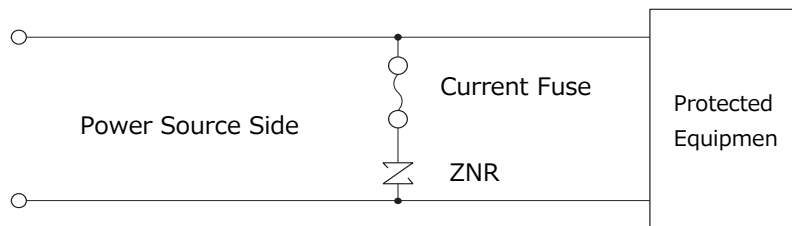
Finally, please be sure that there is no danger if the ZNR mounted on the equipment breaks.

●Type D, Series E, E-S1

Standard Part No.	ERZE05A□□□	ERZE07A□□□	ERZE08A□□□	ERZE10A□□□	ERZE11A□□□	ERZE14A□□□
Fuse rated current	5 A max.	7 A max.	7 A max.	10 A max.	10 A max.	10 A max.

◆ Fuses shall use rated voltages appropriate for circuits.

<2> The recommended fuse position is shown in table 1, "Example of ZNR application", however, if the load current of protected equipment is larger than that of the above recommended fuse rated current, install a current fuse at the position shown below.



(5) Concerning thermal fuse

Set a thermal fuse to get high thermal

Table 1 Example of ZNR application

Connections example	Across-the-Line use		Use between Line to ground		
	<p>DC/AC Single-phase</p>	<p>DC/AC Single-phase</p>			
<p>AC 3-phase</p>	<p>AC 3-phase</p>				
Example of varistor voltage	ZNR	Source Voltage	Nominal varistor voltage		
	ZNR 1 ZNR 3	AC 100 V	201 to 361*		
AC 120 V		241 to 431*			
AC 200 V		471 to 621*			
AC 220 V		471 to 621*			
AC 380 V		751, 821*			
	ZNR	Source Voltage	Nominal varistor voltage		
ZNR 2 ZNR 4	AC 100 V AC 220 V	471	471	-	
		511	-	-	
		621*	-	-	
			821 and more**	-	-
	AC 230 V AC 240 V AC 380 V	511	-	-	
		621*	-	-	
821 and more**		-	-		
		112**	-	-	

Note : Element size is selected by impulse Condition.

(6) On use for equipment

The catalog guarantees the quality as individual component.

Before you use the products, please make sure to check and evaluate the products in the circumstance where they are installed in your product.

2) Operating environments

- (1) The ZNR is designed to be used indoors. Do not use it exposed outdoors.
- (2) Do not use the ZNR in places exposed to temperatures beyond the operating temperature range, such as places exposed to sunlight and vicinities of heating equipment.
- (3) Do not use the ZNR in places exposed to high temperatures and high humidity, such as places exposed directly to rain, wind, dew condensation, and vapor.
- (4) Do not use the ZNR in dusty and salinity environment and atmospheres polluted by corrosive gases, in liquids such as water, oil, chemical, organic solvent.

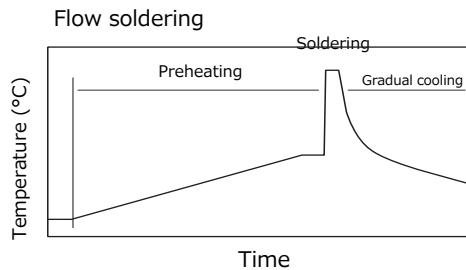
3) Processing conditions

- (1) Do not wash the ZNR by such solvents(thinner, acetone, etc.) as its exterior resin deteriorates.
- (2) Do not apply a strong vibration or shock (by falling, etc.) to the ZNR, cracking to its exterior resin and element may occur.
- (3) When coating the ZNR with resin(including molding), do not use such resin.
- (4) Do not bend the ZNR type D lead wires at the position close to its ZNR type D exterior resin, or apply external force to the position.
- (5) When soldering the ZNR lead wires, follow the recommended conditions and do not melt the solder and insulating materials constituting the ZNR.
- (6) When designing lead-wire-terminal land-hole of circuit board, please check actual ZNR by reference specification about center value of lead-wire terminal pitch.

	Soldering Method	Recommended Condition	Attention Item
Type D	Flow soldering	260 °C, within 10 seconds.	Type D is not Refl ow soldering object part.

- * 1 Soldering iron temperature should not exceed 400 °C and should not be applied for mor than 5 seconds.
- * 2 Profile be careful because there is a margin of error in the way of measuring.
- * 3 The temperature depend on the size and the package density of the substrate.
Therefore, confirm every kind of the substrate.

●Soldering temperature-time profile to recommend



Preheating	The normal to 130 °C	max. 120 s
Soldering	max. 260 °C	max. 10 s
Gradual cooling	Gradual cooling	

4) Long-term storage

- (1) Do not store the ZNR under high temperature and high humidity. Store it indoor environment at a temperature up to 40 °C and at humidity below 75 %RH, and use it within two years.
Before using the ZNR that has been stored for a long period(two years or longer), confirm the solderability.
- (2) Avoid atmospheres full of corrosive gases (hydrogen sulfide, sulfurous acid, chlorine, ammonia, etc.).
- (3) Avoid direct sunlight and dew condensation.

5) Rated Voltage for UL or other safety certifications

Our ZNR define “ Max. Allowable Voltage” and “Rated Voltage “ to keep leakage current specification and others. If you getting certificate of safety approval about your equipment with our ZNR, please follow our “Rated Voltage”.

6) Dropped product

Do not drop this product on the floor. If this product is dropped, it can be damaged mechanically or electrically. Avoid using the dropped product.

3. Notices

- 3.1 Our ZNR was designed and manufactured for standard applications such as general electronics devices, office equipment, information and communications equipment, measuring instruments, household appliances and audio-video equipment. For applications in which special quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or cause threat of personal injury (such as for aircraft and aerospace equipment, traffic and transport equipment, combustion equipment, medical equipment, accident prevention and anti-theft devices, and safety equipment), please be sure to consult with our sales representative in advance and to exchange product specifications which conform to such applications. applications in which special quality and reliability are required, or if the failure or malfunction of the products may.
- 3.2 Note that we do not take any responsibility for faults and abnormalities resulting from the use not in conformity with the contents of entries in the delivery specification.
- 3.3 There is a possibility that the ZNR will unexpectedly cause smoke or ignite because of an abnormal rise of the circuit voltage and invasion of excessive surge. To prevent that accident from spreading over the equipment and not to expand the damage, use multiplex protection such as the adoption of flame-retardant materials for housing parts and structural parts.

4. Applicable laws and regulations , others

- 4.1 This product not been manufactured with any ozone depleting chemical controlled under the Montreal Protocol.
- 4.2 This product comply with RoHS(Restriction of the use of certain Hazardous Substance in electrical and electronic equipment) (DIRECTIVE 2011/65/EU and (EU)2015/863).
- 4.3 All the materials used in this part are registered material under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substance.
- 4.4 If you need the notice by letter of "A preliminary judgement on the Laws of Japan foreign exchange and Foreign Trade Control", be sure to let us know.
- 4.5 These products are not dangerous goods on the transportation as identified by UN(United nations) numbers or UN classification.

5. Others

- 5.1 As to the disposal of ZNR, check the method of disposal in each country or origin where the ZNR are incorporated in your products to be used.
- 5.2 The technical information in this specification provides example of our products' typical operations and application circuit. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right or interest in our intellectual property.

Varistors (ZNR Surge Absorber) Type D, Series V

Varistors (ZNR Surge Absorber) Type SMD, Series HF, VF

Handling Precautions

Safety Precautions

In case that a Varistors (ZNR Surge Absorber) (hereafter referred to as the ZNR, or product name) is used, if an abnormality takes place because of peripheral conditions of the ZNR(material, environments, power source conditions, circuit conditions, etc. in equipment design), fire, electric shock, burn, or product failure may occur. The precautions for this product are described below, understand the content thoroughly before usage. For more questions, contact us.

If there's any uncertainty/doubt/products safety items, please contact us. When a dogma shall be occurred about safety for this products, be sure to inform us rapidly, operate your technical examination.

1. Precautions to be strictly observed

1.1 Confirmation of performance ratings

Use the ZNR within its rated range of performance such as the Max. allowable voltage, withstanding surge current, withstanding energy, impulse life(surge life), average pulse power, and operating temperature range. If used outside the range, the ZNR can be degrade and have element fracture, which may result in smoking and ignition.

1.2 To avoid accidents due to unexpected phenomena, take the following measures

- 1) In the event of fracture of the ZNR, its pieces may scatter ; hence, put the case or cover of the set product in place.
- 2) Do not install the ZNR near combustible substances(polyvinyl chloride wires, resin moldings, etc.).
If it is difficult to do, install a nonflammable cover.
- 3) Across-the-line use
When the ZNR is used across a line, put a current fuse in series with the ZNR(Refer to Item 2.1.1). (4) .
- 4) Use between line to ground
 - (1) If the case that the ZNR is used between a line to the ground, the short-circuit of the ZNR may not blow the current fuse because of grounding resistance, which may cause smoking and ignition of the ZNR's exterior resin.
As the measure against it, install an earth leakage breaker on the power supply side of the ZNR position. If no earth leakage breaker is installed, use a thermal fuse together with a current fuse in series. (Refer to Table 1.)
 - (2) If the case that the ZNR is used between a live part to metal case, an electric shock may develop at a shortcircuit of the ZNR ; hence, ground the metal case to the ground or keep it from the human body.

1.3 If ZNR is shorted out and happen smoke or ignition, please cut provided current to ZNR immediately.

2. Application notes

2.1 Pay attention to the following items to avoid the shortened life and failure of the ZNR

- 1) Circuit conditions
 - (1) Select a ZNR of which the maximum voltage including fluctuations in source voltage allows for the maximum permissible circuit voltage. (Refer to Table 1.)
 - (2) In cases that surges are intermittently applied at short intervals(for example, in case that the voltage of the noise simulator test is implemented etc.), do not let them exceed the ZNR's rated power.
 - (3) Select a ZNR recommended in Table 1.
<1> Across-the-line use
If possible, use a Part No. marked with * in case of voltage temporarily rises load unbalance of separately-wired loads, short between hot and neutral-line, open of neutral line in single-phase-three-wired system, and due to resonance at switching for a capacitive, inductive load.

<2> Used between line to ground

Use a different Part No. from "Across-the-line use" as table 1, because of raising voltage in case of "Line to Ground Fault".

Use a Part No. marked with ** in table 1, in case of the insulation resistance test(500 VDC) for equipment. When using a Part of the varistor voltage that the insulation efficiency examination can not be cleared, there is a case where the surge absorber can be done by removing it from the circuit depending on the circuit condition(Refer examination of Japan Domestic Safety Regulations).

Use a Part No. marked with *** in table 1, in case of the withstanding voltage test (1000 VAC or 1200 VAC) for equipment.

(4) Concerning current fuse

<1> We recommend selecting a ZNR and the rated current of a current fuse as follows.

Finally, please be sure that there is no danger if the ZNR mounted on the equipment breaks.

●Type D, Series V

Standard Part No.	ERZV05D□□□	ERZV07D□□□	ERZV09D□□□	ERZV10D□□□	ERZV14D□□□	ERZV20D□□□
Fuse rated current	3 A max.	5 A max.	7 A max.	7 A max.	10 A max.	10 A max.

◆ Fuses shall use rated voltages appropriate for circuits.

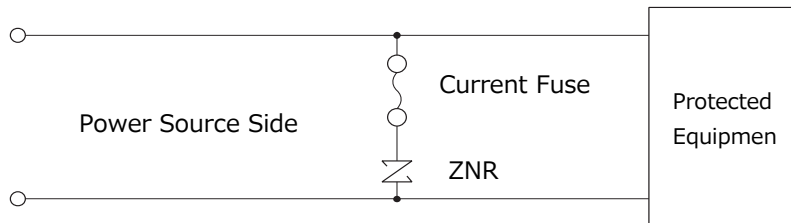
●Type SMD, Series VF

Standard Part No.	ERZVF□M□□□
Fuse rated current	5 A max.

◆ Fuses shall use rated voltages appropriate for circuits.

◆ Concerning HF series, please confirm adjusted to load dump surge and protection cooperation.

<2> The recommended fuse position is shown in table 1, "Example of ZNR application", however, if the load current of protected equipment is larger than that of the above recommended fuse rated current, install a current fuse at the position shown below.



(5) Concerning thermal fuse

Set a thermal fuse to get high thermal

Table 1 Example of ZNR application

Connections example	Across-the-Line use		Use between Line to ground			
	<p>DC/AC Single-phase</p>	<p>DC/AC Single-phase</p>				
<p>AC 3-phase</p>	<p>AC 3-phase</p>					
Example of varistor voltage	ZNR	Source voltage	Nominal varistor voltage			
			Type D	SMD Mold Type		
ZNR 1	ZNR 1	AC 100 V	201 to 361*	201 to 361*		
		AC 120 V	241 to 431*	241 to 431*		
	ZNR 3	AC 200 V	471 to 621*	471		
		AC 220 V	471 to 621*	471		
		AC 240 V	511, 621*	-		
		AC 380 V	821	-		
ZNR 2	ZNR 2	AC 100 V	471	471		
		AC 220 V	511	-		
	ZNR 4	ZNR 4	AC 230 V	621*	-	
			AC 240 V	821 and more**	-	
		ZNR 4	ZNR 4	AC 230 V	621*	-
				AC 240 V	821 and more**	-
ZNR 4	ZNR 4	AC 380 V	112**	-		
		AC 380 V	182***	-		

Note : Element size is selected by impulse Condition.

(6) On use for equipment

The catalog guarantees the quality as individual component.

Before you use the products, please make sure to check and evaluate the products in the circumstance where they are installed in your product.

2) Operating environments

- (1) The ZNR is designed to be used indoors. Do not use it exposed outdoors.
- (2) Do not use the ZNR in places exposed to temperatures beyond the operating temperature range, such as places exposed to sunlight and vicinities of heating equipment.
- (3) Do not use the ZNR in places exposed to high temperatures and high humidity, such as places exposed directly to rain, wind, dew condensation, and vapor.
- (4) Do not use the ZNR in dusty and salinity environment and atmospheres polluted by corrosive gases, in liquids such as water, oil, chemical, organic solvent.

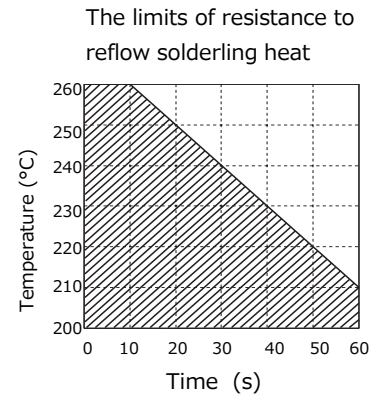
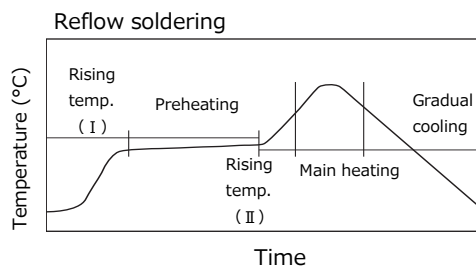
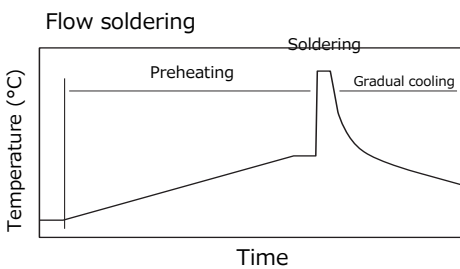
3) Processing conditions

- (1) Do not wash the ZNR by such solvents(thinner, acetone, etc.) as its exterior resin deteriorates.
- (2) Do not apply a strong vibration or shock (by falling, etc.) to the ZNR, cracking to its exterior resin and element may occur.
- (3) When coating the ZNR with resin(including molding), do not use such resin.
- (4) Do not bend the ZNR type D lead wires at the position close to its ZNR type D exterior resin, or apply external force to the position.
- (5) When soldering the ZNR lead wires, follow the recommended conditions and do not melt the solder and insulating materials constituting the ZNR.

	Soldering Method	Recommended Condition	Attention Item
Type D	Flow soldering	260 °C, within 10 seconds.	Type D is not Reflow soldering object part.
SMD Type	Flow soldering	260 °C, within 10 seconds.	When the package density of the part is high pill out gas because the solderability sometimes becomes bad.
	Reflow soldering	Refer to Reflow soldering profile	When Land is too big compared with the size of the terminal surface of the part, be careful because the part sometimes upset when solder fuses.

- * 1 Soldering iron temperature should not exceed 400 °C and should not be applied for more than 5 seconds.
- * 2 Profile be careful because there is a margin of error in the way of measuring.
- * 3 The temperature depend on the size and the package density of the substrate. Therefore, confirm every kind of the substrate.

● Soldering temperature-time profile to recommend



Preheating	The normal to 130 °C	max. 120 s
Soldering	max. 260 °C	max. 10 s
Gradual cooling	Gradual cooling	

Rising temperature I	The normal to preheating temperature	30 to 60 s
Preheating	150 °C to 180 °C	60 to 120 s
Rising temperature II	Preheating to 200 °C	2 to 6 °C / s
Main heating	(cf. The limit of resistance to reflow soldering heat)	
Gradual cooling	200 °C to 100 °C	1 to 4 °C / s

(Reflow soldering shall be within two times)

(6) Lead-wire terminal land-hole (only for Type D)

When designing lead-wire-terminal land-hole of circuit board, please check actual ZNR by reference specification about center value of lead-wire terminal pitch.

(7) Mounting (only for Type SMD)

In case of mounting ZNR on a Printed Circuit Board, be careful not to put excessive impact load, such as pressure from adsorption nozzle, and mechanical impact/stress of position-shifting or positioning. Also, we recommend you to fix a Printed Circuit Board to sheathing resin with an adhesive in case of position-shifting of ZNR when mounting.

4) Long-term storage

- (1) Do not store the ZNR under high temperature and high humidity. Store it indoor environment at a temperature up to 40 °C and at humidity below 75 %RH, and use it within two years. Before using the ZNR that has been stored for a long period(two years or longer), confirm the solderability.
- (2) Avoid atmospheres full of corrosive gases (hydrogen sulfide, sulfurous acid, chlorine, ammonia, etc.).
- (3) Avoid direct sunlight and dew condensation.

5) Rated Voltage for UL or other safety certifications

Our ZNR define " Max. Allowable Voltage" and "Rated Voltage " to keep leakage current specification and others. If you getting certificate of safety approval about your equipment with our ZNR, please follow our "Rated Voltage".

6) Dropped product

Do not drop this product on the floor. If this product is dropped, it can be damaged mechanically or electrically. Avoid using the dropped product.

3. Notices

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- 3.2 Note that we do not take any responsibility for faults and abnormalities resulting from the use not in conformity with the contents of entries in the delivery specification.
- 3.3 There is a possibility that the ZNR will unexpectedly cause smoke or ignite because of an abnormal rise of the circuit voltage and invasion of excessive surge. To prevent that accident from spreading over the equipment and not to expand the damage, use multiplex protection such as the adoption of flame-retardant materials for housing parts and structural parts.

4. Applicable laws and regulations , others

- 4.1 This product not been manufactured with any ozone depleting chemical controlled under the Montreal Protocol.
- 4.2 This product comply with RoHS(Restriction of the use of certain Hazardous Substance in electrical and electronic equipment) (DIRECTIVE 2011/65/EU and (EU)2015/863).
- 4.3 All the materials used in this part are registered material under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substance.
- 4.4 If you need the notice by letter of "A preliminary judgement on the Laws of Japan foreign exchange and Foreign Trade Control", be sure to let us know.
- 4.5 These products are not dangerous goods on the transportation as identified by UN(United nations) numbers or UN classification.

5. Others

- 5.1 As to the disposal of ZNR, check the method of disposal in each country or origin where the ZNR are incorporated in your products to be used.
- 5.2 The technical information in this specification provides example of our products' typical operations and application circuit. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right or interest in our intellectual property.

6. AEC-Q200 Compliant (Type SMD, Series HF)

The products are tested based on all or part of the test conditions and methods defined in AEC-Q200. Please consult with Panasonic for the details of the product specification and specific evaluation test results, etc., and please review and approve Panasonic's product specification before ordering.

Varistors (ZNR Surge Absorber) Type E, CK, SC

Handling Precautions

! Safety Precautions

In case that a Varistors (ZNR Surge Absorber) (hereafter referred to as the ZNR, or product name) is used, if an abnormality takes place because of peripheral conditions of the ZNR(material, environments, power source conditions, circuit conditions, etc. in equipment design), fire, electric shock, burn, or product failure may occur. The precautions for this product are described below, understand the content thoroughly before usage. For more questions, contact us.

If there's any uncertainty/doubt/products safety items, please contact us. When a dogma shall be occurred about safety for this products, be sure to inform us rapidly, operate your technical examination.

1. ! Operating Conditions precautions to be strictly observed**1.1 Confirmation of performance ratings**

Use the ZNR within its rated range of performance such as the Max. allowable voltage, withstanding surge current, withstanding energy, impulse life(surge life), average pulse power, and operating temperature range. If used outside the range, the ZNR can be degrade and have element fracture, which may result in smoking and ignition.

1.2 To avoid accidents due to unexpected phenomena, take the following measures

1) Across-the-line use

When the ZNR is used across a line, put a current fuse in series with the ZNR (Refer to Table 1).

2) Use between line to ground

(1) If the case that the ZNR is used between a line to the ground, the short-circuit of the ZNR may not blow the current fuse because of grounding resistance, which may cause smoking and ignition of the ZNR's exterior resin.

As the measure against it, install an earth leakage breaker on the power supply side of the ZNR position. If no earth leakage breaker is installed, use a thermal fuse together with a current fuse in series. (Refer to Table 1.)

(2) If the case that the ZNR is used between a live part to metal case, an electric shock may develop at a shortcircuit of the ZNR ; hence, ground the metal case to the ground or keep it from the human body.

3) In the event of fracture of the ZNR, its pieces may scatter ; hence, put the case or cover of the set product in place.

4) Do not install the ZNR near combustible substances(polyvinyl chloride wires, resin moldings, etc.).

If it is difficult to do, install a nonflammable cover.

1.3 The live part shall be equipped with a protective cover for preventing electric shock.**1.4 If ZNR is shorted out and happen smoke or ignition, please cut provided current to ZNR immediately.**

● Recommendation fuse

Series	ERZC20EK□□□	ERZC32EK□□□	ERZVS34C□□□	ERZC40CK□□□
Current Fuse (Line - Line)	10 A max.	20 A max.	20 A max.	20 A max.
Thermal. Fuse (Line - Ground)	100 to 120 °C 5 A	100 to 120 °C 10 A	100 to 120 °C 10 A	100 to 120 °C 10 A

◆ Fuses shall use rated voltages appropriate for circuits.

◆ Finally, confirm that the secondary disaster does not occur even if the ZNR mounted on equipment breaks.

◆ Set a thermal fuse to get high thermal conductivity with ZNR.

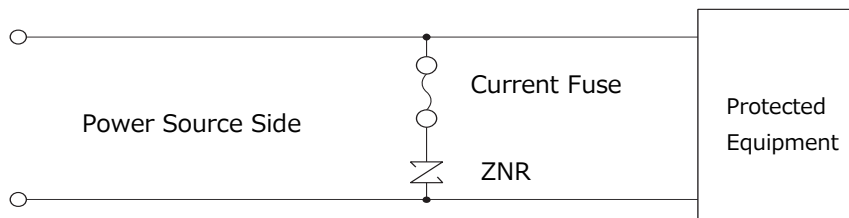
2. Application notes**2.1 Pay attention to the following items to avoid the shortened life and failure of the ZNR**

1) Circuit conditions

(1) Select a ZNR of which the maximum voltage including fluctuations in source voltage allows for the

- (2) In cases that surges are intermittently applied at short intervals (for example, in the case that the voltage of the noise simulator test is impressed), do not cause them to exceed the ZNR's rated pulse power.
- (3) Select a ZNR recommended in Table 1.
- ① Across-the-Line Use
Because the primary line voltage temporarily rises due to load unbalance of separately wired loads, short circuit between the live line and the neutral line or LC resonance at switching for a capacitate load, ZNR with * are recommended for AC100V or AC120V applications.
- ② Line to ground Use
·When DC500V insulation resistance test of the circuits employing ZNR is conducted, the ZNR shall be removed after getting approval from the customer, or the ZNR ** with the Maximum Allowable voltage exceeding to the test voltage shall be applied.
·When AC1000V dielectric with standing test is conducted, ZNR shall be removed after getting approval from the customer according to the relevant regulations, or the ZNR *** with the Maximum Allowable voltage exceeding to the test voltage shall be applied.
- 2) Operating environments
- (1) The ZNR is designed and manufactured for application in general purpose electronic devices.
The ZNR shall not be exposed to the weather, except for usage inside unit.
- (2) Do not use the ZNR in places exposed to temperatures beyond the operating temperature range, such as places exposed to sunlight and vicinities of heating equipment.
- (3) Do not use the ZNR in places exposed to high temperatures and high humidity, such as places exposed directly to rain, wind, dew condensation, and vapor.
- (4) Do not use the ZNR in dusty and salinity environment and atmospheres polluted by corrosive gases, in liquids such as water, oil, chemical, organic solvent.
- 3) Processing conditions
- (1) Do not wash the ZNR by such solvents(thinner, acetone, etc.) as its exterior resin deteriorates.
- (2) Do not apply a strong vibration or shock (by falling, etc.) to the ZNR, cracking to its exterior resin and element may occur.
- (3) When coating the ZNR with resin(including molding), do not use such resin.
- (4) Do not bend the ZNR lead wires at the position close to its ZNR exterior resin, or apply external force to the position.
- (5) When soldering the ZNR lead wires, follow the recommended condition and do not melt the solder and insulating materials constituting the ZNR.
- (6) Keep the wiring of the ZNR as short and straight as possible.
- 4) Long-term storage
- (1) Do not store the ZNR under high temperature and high humidity. Store it indoor environment at a temperature up to 40 °C and at humidity below 75 %RH, and use it within two years.
Before using the ZNR that has been stored for a long period(two years or longer), confirm the solderability.
- (2) Avoid atmospheres full of corrosive gases (hydrogen sulfide, sulfurous acid, chlorine, ammonia, etc.).
- (3) Avoid direct sunlight and dew condensation.

2.2 The recommended fuse position is shown in Table.1, "Example of ZNR application", however, if the load current of protected equipment is larger than that of the above recommended fuse rated current, install a current fuse at the position shown below.



3. Notices

- 3.1 In cases that the ZNR is used in equipment (aerospace equipment, medical equipment, etc.) requiring extremely high reliability, ask us for selection of part No., and protection coordination, etc. in advance.
- 3.2 There is possibility that the ZNR will unexpectedly smoke or ignite because of abnormal rise of the circuit voltage and invasion of excessive surge. To prevent that accident from spreading over the equipment and not to expand the damage, use multiplex protection such as the adoption of flame-retardant materials for housing parts and structural parts.
- 3.3. We don't bear any responsibility for product malfunction or abnormal conditions which caused by using beyond the descriptions in this product specification.
- 3.4 Package marking includes the product number, quantity, and country of origin. As a rule, country of origin should be indicated in English.

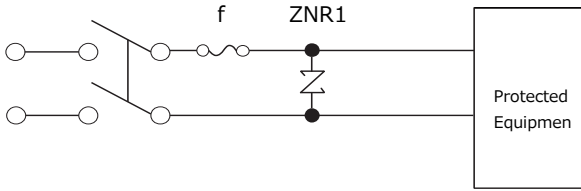
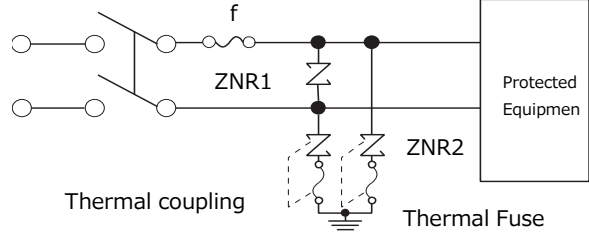
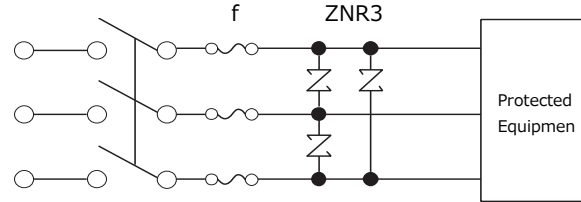
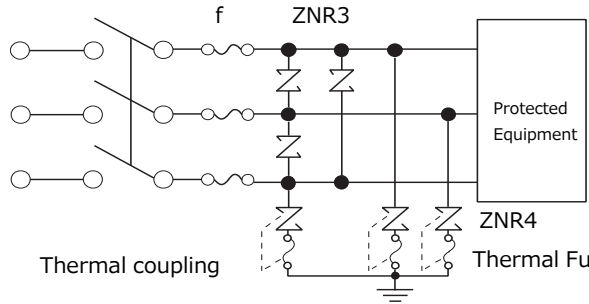
4. Applicable laws and regulations , others

- 4.1 This product not been manufactured with any ozone depleting chemical controlled under the Montreal Protocol.
- 4.1 Specified brominated flame retardants (including PBB (polybromobiphenyl) and PBDE (polybromodiphenyl ether)) are not intentionally used in the components of this product.
- 4.3 This product comply with RoHS(Restriction of the use of certain Hazardous Substance in electrical and electronic equipment) (DIRECTIVE 2011/65/EU and 2015/863/EU).
- 4.4 All the materials used in this part are registered material under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substance.
- 4.5 If you need the notice by letter of "A preliminary judgement on the Laws of Japan foreign exchange and Foreign Trade Control", be sure to let us know.
- 4.6 These products are not dangerous goods on the transportation as identified by UN(United nations) numbers or UN classification.

5. Others

- 5.1 As to the disposal of ZNR, check the method of disposal in each country or origin where the ZNR are incorporated in your products to be used.
- 5.2 The technical information in this specification provides example of our products' typical operations and application circuit. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right or interest in our intellectual property.

Table 1 Example of ZNR application

	Across-the-Line/Line to Line Protection			Line to Line and Line to Ground Protection			
	Connections example	DC/AC Single-phase			DC/AC Single-phase		
							
f : fuse			f : fuse				
AC 3-phase			AC 3-phase				
							
f : fuse			f : fuse				
Selection Examples	Across the Line Use/Line to Line			Line to Ground Use			
	ZNR	Nominal Line Voltage	Part Number of ZNR Type E, CK, SC	ZNR	Nominal Line Voltage	Part Number of ZNR Type E, CK, SC	
	ZNR 1 ZNR 3	AC 100 V	ERZC□□EK ERZC□□CK ERZVS34C	201 241 271	ZNR 2 ZNR 4	AC 100 V ~ AC 220 V	471 511 821 and more **
		AC 120 V		241 271*			
	AC 200 V ~ AC 220 V		471		AC 240 V	511 821 and more **	
	AC 240 V		511				

Varistors (ZNR Surge Absorber) Type P/J/G

Varistors (ZNR Surge Absorber) Units

Varistors (ZNR Surge Absorber) For Thyristor Protection Type E/J

Handling Precautions

Safety Precautions

In case that a Varistors (ZNR Surge Absorber) (hereafter referred to as the ZNR, or product name) is used, if an abnormality takes place because of peripheral conditions of the ZNR (material, environments, power source conditions, circuit conditions, etc. in equipment design), fire, electric shock, burn, or product failure may occur. The precautions for this product are described below, understand the content thoroughly before usage. For more questions, contact us.

If there's any uncertainty/doubt/products safety items, please contact us. When a dogma shall be occurred about safety for this products, be sure to inform us rapidly, operate your technical examination.

1. Operating Conditions precautions to be strictly observed

1.1 Confirmation of performance ratings

Use the ZNR within its rated range of performance such as the Max. allowable voltage, withstanding surge current, withstanding energy, impulse life (surge life), average pulse power, and operating temperature range. If used outside the range, the ZNR can be degrade and have element fracture, which may result in smoking and ignition.

1.2 To avoid accidents due to unexpected phenomena, take the following measures

1) Across-the-line use

- (1) When the ZNR is used across a line, put a current fuse in series with the ZNR .
- (2) ZNR Surge Absorbers Type P has a built-in thermal fuse, however, since the breaking capacity is low (0.3A), put a current fuse in series with ZNR.

2) Use between line to ground

- (1) If the case that the ZNR is used between a line to the ground, the short-circuit of the ZNR may not blow the current fuse because of grounding resistance, which may cause smoking and ignition of the ZNR's exterior resin.

As the measure against it, install an earth leakage breaker on the power supply side of the ZNR position. If no earth leakage breaker is installed, use a thermal fuse together with a current fuse in series.

- (2) If the case that the ZNR is used between a live part to metal case, an electric shock may develop at a shortcircuit of the ZNR ; hence, ground the metal case to the ground or keep it from the human body.

3) In the event of fracture of the ZNR, its pieces may scatter ; hence, put the case or cover of the set product in place.

4) Do not install the ZNR near combustible substances (polyvinyl chloride wires, resin moldings, etc.). If it is difficult to do, install a nonflammable cover.

1.3 The live part shall be equipped with a protective cover for preventing electric shock.

1.4 If ZNR is shorted out and happen smoke or ignition, please cut provided current to ZNR immediately.

2. Application notes

2.1 Pay attention to the following items to avoid the shortened life and failure of the ZNR

1) Circuit conditions

- (1) Select a ZNR of which the maximum voltage including fluctuations in source voltage allows for the maximum permissible circuit voltage.
- (2) In cases that surges are intermittently applied at short intervals (for example, in the case that the voltage of the noise simulator test is impressed), do not cause them to exceed the ZNR's rated pulse power.
- (3) ZNR Surge Absorber Units for a power supply, use the specified power distribution system.
- (4) Turn off the breaker (or knife switch) built in ZNR Surge Absorber Units before conducting an insulation resistance test or withstand voltage test on the circuit to which the ZNR Surge Absorber Units is connected. For ZNR Surge Absorber Units that do not have a built-in breaker (or knife switch), remove them from the circuit and test.

2) Operating environments

- (1) The ZNR is designed and manufactured for application in general purpose electronic devices.
The ZNR shall not be exposed to the weather, except for usage inside unit.
- (2) Do not use the ZNR in places exposed to temperatures beyond the operating temperature range, such as places exposed to sunlight and vicinities of heating equipment.
- (3) Do not use the ZNR in places exposed to high temperatures and high humidity, such as places exposed directly to rain, wind, dew condensation, and vapor.
- (4) Do not use the ZNR in dusty and salinity environment and atmospheres polluted by corrosive gases, in liquids such as water, oil, chemical, organic solvent.

3) Processing conditions

- (1) Do not wash the ZNR by such solvents(thinner, acetone, etc.) as its exterior resin deteriorates.
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- (5) When soldering the ZNR lead wires, follow the recommended condition and do not melt the solder and insulating materials constituting the ZNR.
- (6) Keep the wiring of the ZNR as short and straight as possible.

4) Long-term storage

- (1) Do not store the ZNR under high temperature and high humidity. Store it indoor environment at a temperature up to 40 °C and at humidity below 75 %RH, and use it within two years.
Before using the ZNR that has been stored for a long period(two years or longer), confirm the solderability.
- (2) Avoid atmospheres full of corrosive gases (hydrogen sulfide, sulfurous acid, chlorine, ammonia, etc.).
- (3) Avoid direct sunlight and dew condensation.

5) Maintenance inspection

We recommend that you perform maintenance inspections every two years and measure the varistor voltage. The ZNR replacement period is when the varistor voltage (V1mA) exceeds $\pm 10\%$ from the initial value.

3. Notices

- 3.1 In cases that the ZNR is used in equipment (aerospace equipment, medical equipment, etc.) requiring extremely high reliability, ask us for selection of part No., and protection coordination, etc. in advance.
- 3.2 There is possibility that the ZNR will unexpectedly smoke or ignite because of abnormal rise of the circuit voltage and invasion of excessive surge. To prevent that accident from spreading over the equipment and not to expand the damage, use multiplex protection such as the adoption of frame-retardant materials for housing parts and structural parts.
- 3.3. We don't bear any responsibility for product malfunction or abnormal conditions which caused by using beyond the descriptions in this product specification.
- 3.4 Package marking includes the product number, quantity, and country of origin. As a rule, country of origin should be indicated in English.

4. Applicable laws and regulations , others

- 4.1 This product not been manufactured with any ozone depleting chemical controlled under the Montreal Protocol.
- 4.1 Specified brominated flame retardants (including PBB (polybromobiphenyl) and PBDE (polybromodiphenyl ether)) are not intentionally used in the components of this product.
- 4.3 This product comply with RoHS(Restriction of the use of certain Hazardous Substance in electrical and electronic equipment) (DIRECTIVE 2011/65/EU and 2015/863/EU).
*Exemption ZNR Surge Absorber Units (Part No. ERZAxxxxxxx)
- 4.4 All the materials used in this part are registered material under the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substance.
- 4.5 If you need the notice by letter of "A preliminary judgement on the Laws of Japan foreign exchange and Foreign Trade Control", be sure to let us know.
- 4.6 These products are not dangerous goods on the transportation as identified by UN(United nations) numbers or UN classification.

5. Others

- 5.1 As to the disposal of ZNR, check the method of disposal in each country or origin where the ZNR are incorporated in your products to be used.
- 5.2 The technical information in this specification provides example of our products' typical operations and application circuit. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right or interest in our intellectual property.