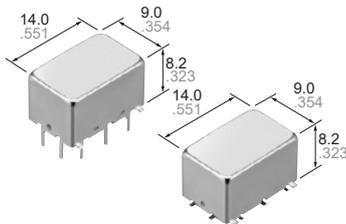


**8 GHz max. capable,
1 W carrying power
(at 5 GHz), 50Ω impedance
and 2 Form C relays**

RJ RELAYS (ARJ)



mm inch

Protective construction: Sealed type

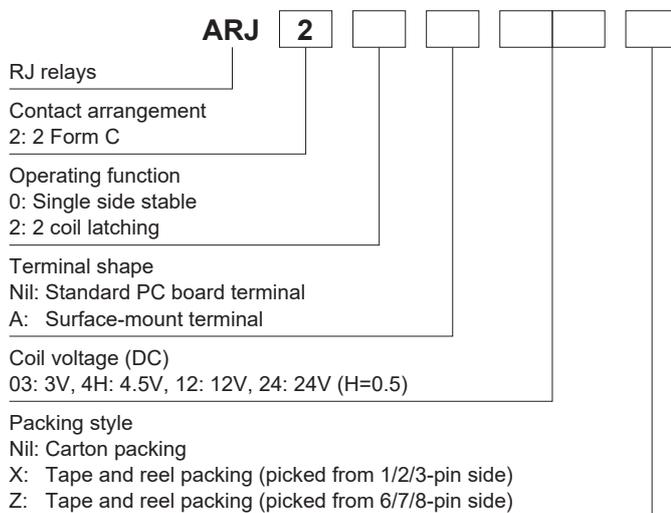
FEATURES

- **Excellent high frequency characteristics (50Ω, at 5GHz)**
V.S.W.R.: Max. 1.25
Insertion loss: Max. 0.5dB
Isolation: Min. 35dB
(Between open contacts)
Min. 30dB
(Between contact sets)
- **Surface mount terminal**
Surface mount terminals are now standard so there is much less work in designing PC boards.
- **Small size**
Size: 14.00 (L)×9.00 (W)×8.20 (H) mm
.551 (L) ×.354 (W) ×.323 (H) inch

TYPICAL APPLICATIONS

- **Measuring equipment market**
Attenuator circuits, spectrum analyzer, oscilloscope, Telecommunication equipment and tester inspection.
 - **Network communications market**
Microwave communication
 - **Medical instrument market**
- If you consider using applications with low level loads or with high frequency switching, please consult us.

ORDERING INFORMATION



TYPES

1. Standard PC board terminal

Contact arrangement	Rated voltage	Part No.		Standard packing	
		Single side stable	2 coil latching	Carton	Case
2 Form C	3 V DC	ARJ2003	ARJ2203	50 pcs.	500 pcs.
	4.5 V DC	ARJ204H	ARJ224H		
	12 V DC	ARJ2012	ARJ2212		
	24 V DC	ARJ2024	ARJ2224		

2. Surface-mount terminal

1) Carton packing

Contact arrangement	Rated voltage	Part No.		Standard packing	
		Single side stable	2 coil latching	Carton	Case
2 Form C	3 V DC	ARJ20A03	ARJ22A03	50 pcs.	500 pcs.
	4.5 V DC	ARJ20A4H	ARJ22A4H		
	12 V DC	ARJ20A12	ARJ22A12		
	24 V DC	ARJ20A24	ARJ22A24		

2) Tape and reel packing

Contact arrangement	Rated voltage	Part No.		Standard packing	
		Single side stable	2 coil latching	Tape and reel	Case
2 Form C	3 V DC	ARJ20A03Z	ARJ22A03Z	500 pcs.	1,000 pcs.
	4.5 V DC	ARJ20A4HZ	ARJ22A4HZ		
	12 V DC	ARJ20A12Z	ARJ22A12Z		
	24 V DC	ARJ20A24Z	ARJ22A24Z		

Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/2/3-pin side) is also available. Suffix "X" instead of "Z".

RATING

1.Coil data

- Operating characteristics such as 'Operate voltage' and 'Release voltage' are influenced by mounting conditions, ambient temperature, etc. Therefore, please use the relay within $\pm 5\%$ of rated coil voltage.
- 'Initial' means the condition of products at the time of delivery.

1) Single side stable

Rated voltage	Pick-up voltage* (at 20°C 68°F)	Drop-out voltage* (at 20°C 68°F)	Rated operating current [$\pm 10\%$] (at 20°C 68°F)	Coil resistance [$\pm 10\%$] (at 20°C 68°F)	Rated operating power	Max. allowable voltage (at 70°C 158°F)
3 V DC	75%V or less of rated voltage (Initial)	10%V or more of rated voltage (Initial)	66.6 mA	45 Ω	200 mW	110%V of rated voltage
4.5 V DC			44.4 mA	101.2 Ω		
12 V DC			16.6 mA	720 Ω		
24 V DC			8.3 mA	2,880 Ω		

* Square, pulse drive (JIS C5442)

2) 2 coil latching

Rated voltage	Set voltage* (at 20°C 68°F)	Reset voltage* (at 20°C 68°F)	Rated operating current [$\pm 10\%$] (at 20°C 68°F)	Coil resistance [$\pm 10\%$] (at 20°C 68°F)	Rated operating power	Max. allowable voltage (at 70°C 158°F)
3 V DC	75%V or less of rated voltage (Initial)	75%V or less of rated voltage (Initial)	50 mA	60 Ω	150 mW	110%V of rated voltage
4.5 V DC			33.3 mA	135 Ω		
12 V DC			12.5 mA	960 Ω		
24 V DC			6.3 mA	3,840 Ω		

* Square, pulse drive (JIS C5442)

2. Specifications

Characteristics	Item	Specifications	
Contact data	Arrangement	2 Form C	
	Contact resistance (initial)	Max. 150mΩ (By voltage drop 10V DC 10mA)	
	Contact material	Gold plating	
	Contact rating (resistive)	1W (at 5GHz, Impedance 50Ω, V.S.W.R. ≤ 1.25) 10mA 10V DC	
	Contact input power	1W (at 5GHz, Impedance 50Ω, V.S.W.R. ≤ 1.25)	
	Max. switching voltage	30V DC	
	Max. switching current	0.3A DC	
High frequency characteristics (Initial) (~5GHz, Impedance 50Ω)	V.S.W.R.	Max. 1.25	
	Insertion loss (without D.U.T. board's loss)		Max. 0.5dB
		Isolation	Between open contacts Min. 35dB Between contact sets Min. 30dB
	Input power	1W (at 5GHz, impedance 50Ω, V.S.W.R. ≤ 1.25, at 20°C)	
Insulation resistance (Initial)		Min. 500MΩ (at 500V DC, Measured portion is the same as the case of dielectric voltage.)	
Breakdown voltage (Initial)	Between open contacts	500 Vrms for 1min. (detection current: 10mA)	
	Between contact sets	500 Vrms for 1min. (detection current: 10mA)	
	Between contact and coil	500 Vrms for 1min. (detection current: 10mA)	
	Between coil and earth terminal	500 Vrms for 1min. (detection current: 10mA)	
	Between contact and earth terminal	500 Vrms for 1min. (detection current: 10mA)	
Time characteristics	Operate [Set] time (initial)	Max. 5ms (at 20°C 68°F, at rated voltage, without bounce)	
	Release [Reset] time (initial)	Max. 5ms (at 20°C 68°F, at rated voltage, without bounce, without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 500 m/s ² (half-sine shock pulse: 6ms; detection time: 10μs)
		Destructive	Min. 1,000 m/s ² (half-sine shock pulse: 11ms)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3mm (detection time: 10μs)
		Destructive	10 to 55 Hz at double amplitude of 5mm
Expected life	Mechanical	Min. 10 ⁷ (at 180 times/min.)	
	Electrical	Min. 10 ⁶ (at 20 times/min.) (1W, at 5GHz, V.S.W.R.≤1.25) Min. 10 ⁶ (at 20 times/min.) (10mA 10V DC resistive)	
Conditions	Conditions for operation, transport and storage*	Ambient temperature: -30 to +70°C -22 to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
Unit weight		Approx. 3 g .11 oz	

Note: * The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to "AMBIENT ENVIRONMENT" in GENERAL APPLICATION GUIDELINES

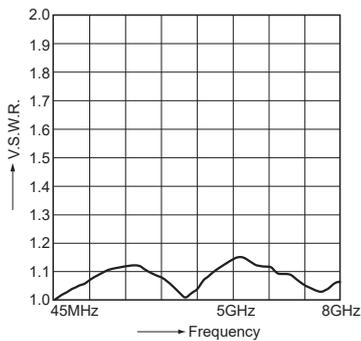
REFERENCE DATA

1. High frequency characteristics

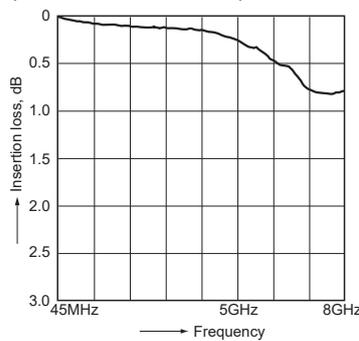
Sample: ARJ20A12

Measuring method: Measured by using our PC board for measurement and HP network analyzer (HP8510C).

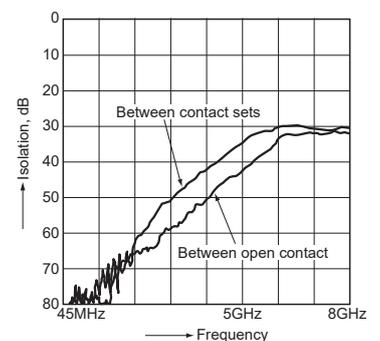
• V.S.W.R. characteristics



• Insertion loss characteristics (without D.U.T. board's loss)



• Isolation characteristics

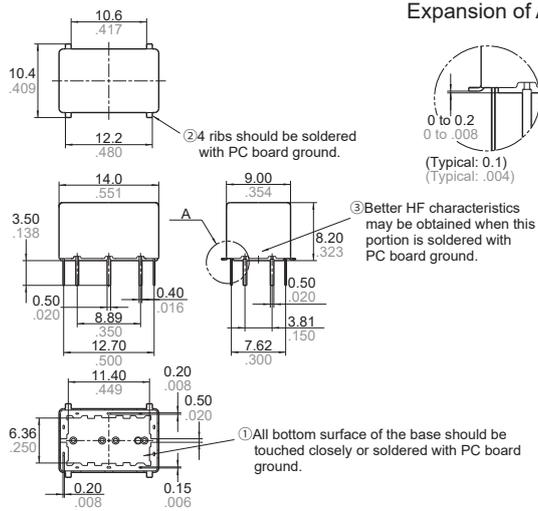


DIMENSIONS (mm inch)

The CAD data of the products with a **CAD Data** mark can be downloaded from <https://industrial.panasonic.com/ac/e/>

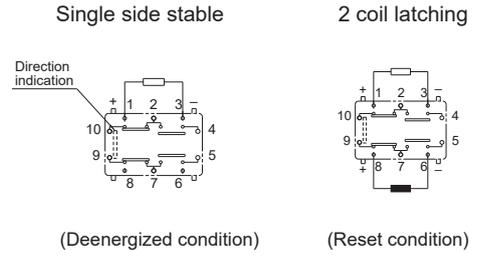
1. Standard PC board terminal

CAD Data

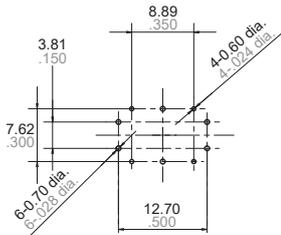


Tolerance: $\pm 0.3 \pm 0.12$

Schematic (Bottom view)



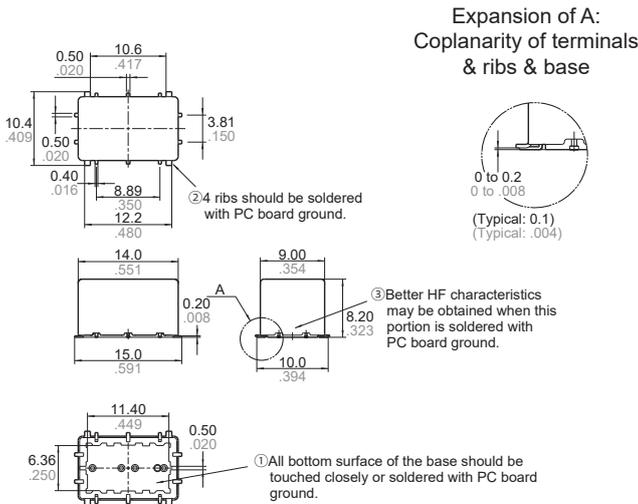
PC board pattern



Tolerance: $\pm 0.1 \pm 0.04$

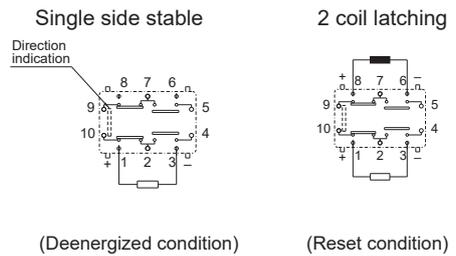
2. Surface mount terminal

CAD Data

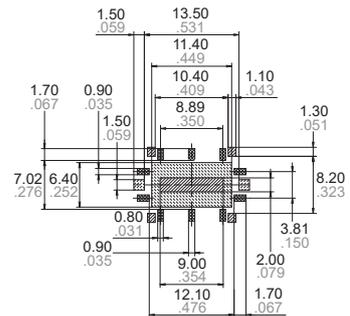


Tolerance: $\pm 0.3 \pm 0.12$

Schematic (Top view)



PC board pattern



Tolerance: $\pm 0.1 \pm 0.04$

Note: Please consult us regarding recommended PC board patterns.

- Relay terminals.
- Ground. Note that soldering is required.
- Ground. Note that you must determine the necessity of solder based on effect of heat when soldering.
- Ground. Note that some extra work is required due to the effect of lifting when soldering.

NOTES

1. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.

However, check it with the actual circuit since the characteristics may be slightly different. The nominal operating voltage should be applied to the coil for more than 20 ms to set/reset the latching type relay.

2. Coil connection

When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. External magnetic field

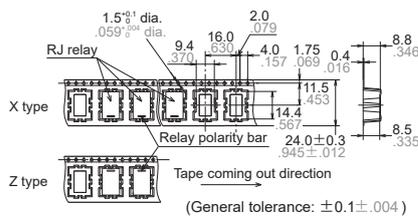
Since RJ relays are highly sensitive polarized relays, their characteristics will be affected by a strong external magnetic field. Avoid using the relay under that condition.

4. Cleaning

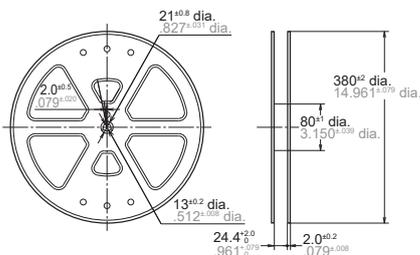
For automatic cleaning, the boiling method is recommended. Avoid ultrasonic cleaning which subjects the relays to high frequency vibrations, which may cause the contacts to stick. It is recommended that alcoholic solvents be used.

5. Tape and reel packing

1) Tape dimensions



2) Dimensions of plastic reel



6. Conditions for operation, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:

(1) Temperature:

−30 to +70°C −22 to +158°F

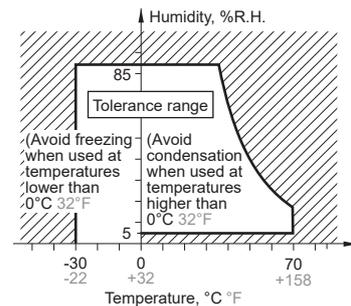
(However, tolerance range is −30 to +60°C −22 to +140°F if package is carried as is.)

(2) Humidity: 5 to 85% RH

(Avoid freezing and condensation.)

The humidity range varies with the temperature. Use within the range indicated in the graph below.

(3) Atmospheric pressure: 86 to 106 kPa Temperature and humidity range for usage, transport, and storage:



2) Condensation

Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.

3) Freezing

Condensation or other moisture may freeze on the relay when the temperature is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.

4) Low temperature, low humidity environments

The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

5) Storage procedures for surface-mount terminal types

Since the relay is very sensitive to humidity, it is packed in humidity-free, hermetically sealed packaging. When storing the relay, be careful of the following points:

(1) Be sure to use the relay immediately after removing it from its sealed package.

(2) When storing the relay for long periods of time after removing it from its sealed package, we recommend using a humidity-free bag with silica gel to prevent subjecting the relay to humidity.

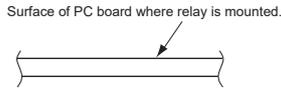
Furthermore, if the relay is solder mounted when it has been subjected to excessive humidity, cracks and leaks can occur. Be sure to mount the relay under the required mounting conditions.

7. Soldering

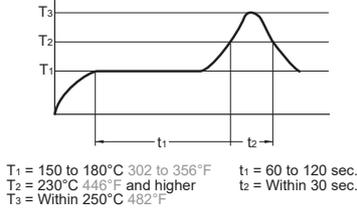
1) Surface-mount terminal

In case of automatic soldering, the following conditions should be observed

(1) Position of measuring temperature



(2) IR (infrared reflow) soldering method



Temperature rise of relay itself may vary according to the mounting level or the heating method of reflow equipment. Therefore, please set the temperature of soldering portion of relay terminal and the top surface of the relay case not to exceed the above mentioned soldering condition.

It is recommended to check the temperature rise of each portion under actual mounting condition before use.

2) Standard PC board terminal

Please meet the following conditions if this relay is to be automatically soldered.

(1) Preheating: Max. $120^\circ\text{C } 248^\circ\text{F}$ (terminal solder surface) for max. 120 seconds

(2) Soldering: Max. $260 \pm 5^\circ\text{C } 500 \pm 9^\circ\text{F}$ for max. 6 seconds
 The effect on the relay depends on the actual substrate used. Please verify the substrate to be used.

Moisture-proof packaging enables RJ relay's standard PCB type capable for reflow soldering.

Please contact us in the case of reflow soldering considerations.

3) Hand soldering

Please meet the following conditions if this relay is to be soldered by hand.

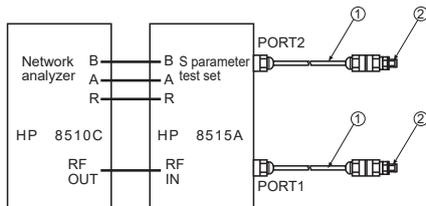
(1) Wattage: 30 to 60 W

(2) Tip temperature/time: $280 \text{ to } 300^\circ\text{C } 536 \text{ to } 572^\circ\text{F}$ for max. 5 seconds

The effect on the relay depends on the actual substrate used. Please verify the substrate to be used.

4) Avoid high frequency cleaning since this may adversely affect relay characteristics. Use alcohol-based cleaning solutions when cleaning relays.

8. Measuring method (50Ω type)



Connect connectors 1 and 2 respectively to PORT 1 and PORT 2. Perform calibration using the 3.5 mm .138 inch calibration kit (HP85052B).

No.	Part number	Description
1	HP 85131	3.5 mm .138 inch Test port, Extension cable
2	HP 83059	3.5 mm .138 inch Coaxial Adapter

After calibration, connect the D.U.T board and measure. Non measure terminals: 50Ω termination

*Isolation (Between contact sets): Measured between open contact (4-5 terminal, 9-10 terminal)

Notes:

1. All bottom surface of the base should be touched closely or soldered with PC board ground.

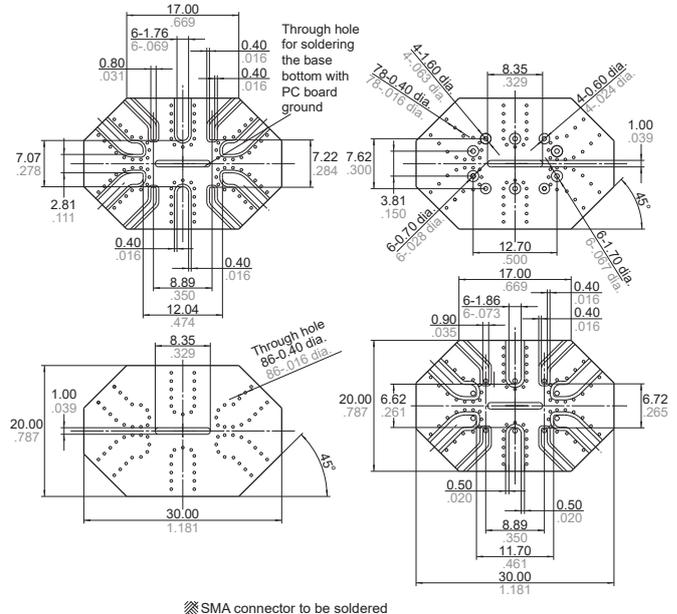
2. 4 ribs should be soldered with PC board ground.

D.U.T board

Dimensions (mm inch)

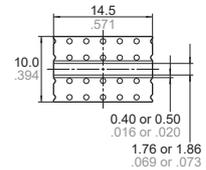
<Surface mount terminal>

<Standard PC board terminal>



☒ SMA connector to be soldered

<Calibration board>



Material: Glass PTFE double-sided through hole PC board R-4737 (manufactured by our company)

Board thickness: $t = 0.8 \text{ mm}$

Copper plating: $18 \mu\text{m}$

Connector (SMA type receptacle)

Product name: R125 510 (RADIALL)

Insertion loss compensation;

The insertion loss of relay itself is given by subtracting the insertion loss of short-circuit the Com and the NC (or NO). (signal path and two connectors)

9. Others

1) The switching lifetime is defined under the standard test condition specified in the JIS* C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.

Also, be especially careful of loads such as those listed below.

- When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.

- High-frequency load-operating

When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO₃ is formed. This can corrode metal materials.

Three countermeasures for these are listed here.

(1) Incorporate an arc-extinguishing circuit.

(2) Lower the operating frequency

(3) Lower the ambient humidity

2) Use the relay within specifications such as coil rating, contact rating and on/off service life. If used beyond limits, the relay may overheat, generate smoke or catch fire.

3) Be careful not to drop the relay. If accidentally dropped, carefully check its appearance and characteristics before use.

4) Be careful to wire the relay correctly. Otherwise, malfunction, overheat, fire or other trouble may occur.

5) If a relay stays on in a circuit for many months or years at a time without being activated, circuit design should be reviewed so that the relay can remain non-excited. A coil that receives current all the time heats, which degrades insulation earlier than expected. A latching type relay is recommended for such circuits.

6) The latching type relay is shipped in the reset position. But jolts during transport or impacts during installation can change the reset position. It is, therefore, advisable to build a circuit in which the relay can be initialized (set and reset) just after turning on the power.

7) If silicone materials (e.g., silicone rubbers, silicone oils, silicone coating agents, silicone sealers) are used in the vicinity of the relay, the gas emitted from the silicone may adhere to the contacts of the relay during opening and closing and lead to improper contact. If this is the case, use a material other than silicone.

8) We recommend latching type when using in applications which involve lengthy duty cycles.

* Japanese Industrial Standards

Please refer to **"the latest product specifications"**

when designing your product.

- Requests to customers :

<https://industrial.panasonic.com/ac/e/salespolicies/>

GUIDELINES FOR MICROWAVE DEVICES USAGE

For cautions for use, please read "GUIDELINES FOR RELAY USAGE".

https://industrial.panasonic.com/ac/e/control/relay/cautions_use/index.jsp

Precautions for Coil Input

■ Long term current carrying

A circuit that will be carrying a current continuously for long periods without relay or microwave device switching operation. (circuits for emergency lamps, alarm devices and error inspection that, for example, revert only during malfunction and output warnings with form B contacts) Continuous, long-term current to the coil will facilitate deterioration of coil insulation and characteristics due to heating of the coil itself.

For circuits such as these, please use a magnetic-hold type latching relay. If you need to use a single stable relay, use a sealed type relay that is not easily affected by ambient conditions and make a failsafe circuit design that considers the possibility of contact failure or disconnection.

■ DC Coil operating power

Steady state DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%.

However, please check with the actual circuit since the electrical characteristics may vary. The rated coil voltage should be applied to the coil and the set/reset pulse time of latching type relay differs for each relays, please refer to the relay's individual specifications.

■ Coil connection

When connecting coils of polarized relays, please check coil polarity (+,-) at the internal connection diagram (Schematic). If any wrong connection is made, it may cause unexpected malfunction, like abnormal heat, fire and so on, and circuit do not work. Avoid impressing voltages to the set coil and reset coil at the same time.

■ Maximum allowable voltage and temperature rise

Proper usage requires that the rated coil voltage be impressed on the coil. Note, however, that if a voltage greater than or equal to the maximum continuous voltage is impressed on the coil, the coil may burn or its layers short due to the temperature rise. Furthermore, do not exceed the usable ambient temperature range listed in the catalog.

● Maximum allowable voltage for coil

In addition to being a requirement for relay operation stability, the maximum continuous impressed coil voltage is an important constraint for the prevention of such problems as thermal deterioration or deformity of the insulation material, or the occurrence of fire hazards.

Ambient Environment

● Dew condensation

Condensation occurs when the ambient temperature drops suddenly from a high temperature and humidity, or the relay and microwave device is suddenly transferred from a low ambient temperature to a high temperature and humidity. Condensation causes the failures like insulation deterioration, wire disconnection and rust etc.

Panasonic Corporation does not guarantee the failures caused by condensation.

The heat conduction by the equipment may accelerate the cooling of device itself, and the condensation may occur.

Please conduct product evaluations in the worst condition of the actual usage. (Special attention should be paid when high temperature heating parts are close to the device. Also please consider the condensation may occur inside of the device.)

● Icing

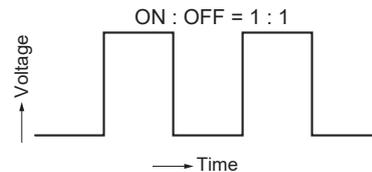
Condensation or other moisture may freeze on relays when the temperature become lower than 0°C. This icing causes the sticking of movable portion, the operation delay and the contact conduction failure etc. Panasonic Corporation does not guarantee the failures caused by the icing.

The heat conduction by the equipment may accelerate the cooling of relay itself and the icing may occur. Please conduct product evaluations in the worst condition of the actual usage.

● Temperature rise due to pulse voltage

When a pulse voltage with ON time of less than 2 minutes is used, the coil temperature rise bears no relationship to the ON time. This varies with the ratio of ON time to OFF time, and compared with continuous current passage, it is rather small. The various relays are essentially the same in this respect.

Current passage time	(%)
For continuous passage	Temperature rise value is 100%
ON : OFF = 3 : 1	About 80%
ON : OFF = 1 : 1	About 50%
ON : OFF = 1 : 3	About 35%



■ Operate voltage change due to coil temperature rise (Hot start)

In DC relays, after continuous passage of current in the coil, if the current is turned OFF, then immediately turned ON again, due to the temperature rise in the coil, the pick-up voltage will become somewhat higher. Also, it will be the same as using it in a higher temperature atmosphere. The resistance/temperature relationship for copper wire is about 0.4% for 1°C, and with this ratio the coil resistance increases. That is, in order to operate of the relay, it is necessary that the voltage be higher than the pick-up voltage and the pick-up voltage rises in accordance with the increase in the resistance value. However, for some polarized relays, this rate of change is considerably smaller.

● Low temperature and low humidity

The plastic becomes brittle if the switch is exposed to a low temperature, low humidity environment for long periods of time.

● High temperature and high humidity

Storage for extended periods of time (including transportation periods) at high temperature or high humidity levels or in atmospheres with organic gases or sulfide gases may cause a sulfide film or oxide film to form on the surfaces of the contacts and/or it may interfere with the functions. Check out the atmosphere in which the units are to be stored and transported.

● Package

In terms of the packing format used, make every effort to keep the effects of moisture, organic gases and sulfide gases to the absolute minimum.

GUIDELINES FOR MICROWAVE DEVICES USAGE

●Storage requirements

Since the SMD type is sensitive to humidity it is packaged with tightly sealed anti-humidity packaging. However, when storing, please be careful of the following.

1) Please use promptly once the anti-humidity pack is opened. (within 72 hours, Max. 30°C/70% R.H.). If left with the pack open, the relay will absorb moisture which will cause thermal stress when reflow mounting and thus cause the case to expand. As a result, the seal may break.

*For RE relays, after this bag is opened, the product must be used within 24 hours.

2) If relays will not be used within 72 hours, please store relays in a humidity controlled desiccator or in an anti-humidity bag to which silica gel has been added.

*If the relay is to be soldered after it has been exposed to excessive humidity atmosphere, cracks and leaks can occur. Be sure to mount the relay under the required mounting conditions

*For RE relays, after this bag is opened, the product must be used within 24 hours.

3) The following cautionary label is affixed to the anti-humidity pack.

●Silicon

When a source of silicone substances (silicone rubber, silicone oil, silicone coating materials and silicone filling materials etc.) is used around the relay, the silicone gas (low molecular siloxane etc.) may be produced.

This silicone gas may penetrate into the inside of the relay. When the relay is kept and used in this condition, silicone compound may adhere to the relay contacts which may cause the contact failure. Do not use any sources of silicone gas around the relay (Including plastic seal types).

●NOx Generation

When relay is used in an atmosphere high in humidity to switch a load which easily produces an arc, the NOx created by the arc and the water absorbed from outside the relay combine to produce nitric acid. This corrodes the internal metal parts and adversely affects operation. Avoid use at an ambient humidity of 85%RH or higher (at 20°C). If use at high humidity is unavoidable, please contact our sales representative.

*RE Relays only

C a u t i o n

This vacuum-sealed bag contains

Moisture Sensitive Products

After this bag is opened, the product must be used

within 7 2 h o u r s

If product is not used within 72 hours, baking is necessary.

For baking conditions please contact us.

C a u t i o n

This vacuum-sealed bag contains

Moisture Sensitive Products

After this bag is opened, the product must be used

within 2 4 h o u r s

If product is not used within 24 hours, baking is necessary.

For baking conditions please contact us.

Others

■Cleaning

- 1) Although the environmentally sealed type relay (plastic sealed type, etc.) can be cleaned, avoid immersing the relay into cold liquid (such as cleaning solvent) immediately after soldering. Doing so may deteriorate the sealing performance.
- 2) Surface mount terminal type relay is sealed type and it can be cleaned by immersion. Use pure water or alcohol-based cleaning solvent.
- 3) Cleaning with the boiling method is recommended (The temperature of cleaning liquid should be 40°C or lower).
Avoid ultrasonic cleaning on relays. Use of ultrasonic cleaning may cause breaks in the coil or slight sticking of the contacts due to the ultrasonic energy.

■Other handling precautions

- Expected switching life is defined under the standard test conditions (temperature 15 to 35°C, humidity: 25 to 75%) specified in JIS C 5442.
Expected switching life is depend on usage conditions; coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors. Please check relays and microwave devices on the actual circuit.
Also, pay special attention loads such as those listed below.
- When used for AC load-operating and the operating phase is synchronous, rocking and fusing can easily occur due to contact shifting.

- Frequent switching under load condition
When high frequently switched under load condition that can cause arc at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO³ is formed. This can corrode metal materials. Countermeasures for these are.
 1. Incorporate an arc-extinguishing circuit.
 2. Lower the operating frequency
 3. Lower the ambient humidity
- When used for "Dry switching" without load current, please contact our sales representative.
- Please avoid relays to be used outside of the specification ranges such as the coil rating, contact rating and switching life that may cause abnormal heating, smoke, and fire.
- In case relays and microwave devices are dropped, please do not use.

Please refer to "**the latest product specifications**" when designing your product.

•Requests to customers:
<https://industrial.panasonic.com/ac/e/salespolicies/>

Please contact

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