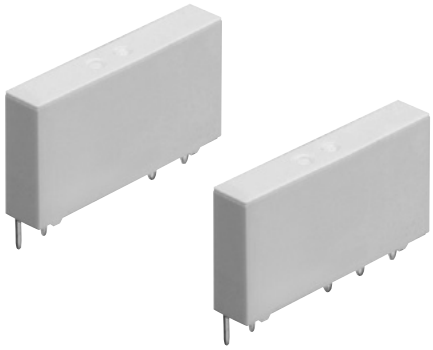
Compliant with European standards 1a/1c 6A Slim power relays

PF RELAYS (APF)



Protective construction: Sealed type

FEATURES

1. **High density mounting with 5 mm .197 inch width**
   Space saved with 5 mm .197 inch slim type with 28 mm 1.102 inch length. Allows high density mounting and use in compact devices.
2. **Satisfies reinforced insulation standard (EN/IEC 61810-1)**
3. **High switching capacity**
   Supports 6A 250 V AC nominal switching capacity (resistive load) and AC15 and DC13 (inductive load).
4. **1 Form A and 1 Form C contact arrangements with options for a variety of applications**
5. **4,000 V high breakdown voltage and 6,000 V high surge breakdown voltage**
   Controller protection against surges and noise with a breakdown voltage of 4,000 Vrms for 1 min. between contacts and coil, and 6,000 V surge breakdown voltage between contacts and coil.
6. **Resistance to heat and fire; EN60335-1, clause 30 (GWT) approved**
7. **Sealed construction allows automatic washing**
8. **Complies with all safety standards**
   UL/C-UL, VDE certified.
9. **High insulation resistance**
   Creepage distance between contact and coil terminal: Min. 8.0 mm .315 inch
   Clearance distance between contact and coil terminal: Min. 6.0 mm .236 inch

TYPICAL APPLICATIONS

1. **Interface relays for programmable controllers**
2. **Output relays for measuring equipment, timers, counters and temperature controllers**
3. **Industrial equipment, office equipment**
4. **Household appliances for Europe**

ORDERING INFORMATION

APF □ **0** □ □□

Contact arrangement
1: 1 Form A
3: 1 Form C

Contact type
0: Single contact

Contact material
2: AgNi type
3: AgNi type/Au-plated

Nominal coil voltage (DC)
4H: 4.5 V 05: 5 V 06: 6 V 09: 9 V 12: 12 V 18: 18 V
24: 24 V 48: 48 V 60: 60 V

Notes: 1. $AgSnO_2$ type contact is available. Please contact us for details.
2. Bent pins type is available. Please contact us for details.

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TYPES

Contact arrangement	Nominal coil voltage	Part No.
1 Form A (AgNi type)	4.5V DC	APF1024H
	5V DC	APF10205
	6V DC	APF10206
	9V DC	APF10209
	12V DC	APF10212
	18V DC	APF10218
	24V DC	APF10224
	48V DC	APF10248
	60V DC	APF10260
1 Form A (AgNi type/Au-plated)	4.5V DC	APF1034H
	5V DC	APF10305
	6V DC	APF10306
	9V DC	APF10309
	12V DC	APF10312
	18V DC	APF10318
	24V DC	APF10324
	48V DC	APF10348
	60V DC	APF10360

Contact arrangement	Nominal coil voltage	Part No.
1 Form C (AgNi type)	4.5V DC	APF3024H
	5V DC	APF30205
	6V DC	APF30206
	9V DC	APF30209
	12V DC	APF30212
	18V DC	APF30218
	24V DC	APF30224
	48V DC	APF30248
	60V DC	APF30260
1 Form C (AgNi type/Au-plated)	4.5V DC	APF3034H
	5V DC	APF30305
	6V DC	APF30306
	9V DC	APF30309
	12V DC	APF30312
	18V DC	APF30318
	24V DC	APF30324
	48V DC	APF30348
	60V DC	APF30360

Standard packing: Tube: 20 pcs.; Case: 1,000 pcs.

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 ± 5% of rated coil voltage.
- 'Initial' means the condition of products at the time of delivery.

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
4.5V DC	Max. 70%V nominal voltage (Initial)	Min. 5%V nominal voltage (Initial)	37.8mA	119Ω	170mW	120%V of nominal voltage
5V DC			34.0mA	147Ω		
6V DC			28.3mA	212Ω		
9V DC			18.9mA	476Ω		
12V DC			14.2mA	847Ω		
18V DC			9.4mA	1,906Ω		
24V DC			7.1mA	3,388Ω		
48V DC			4.5mA	10,618Ω	217mW	
60V DC			2.9mA	20,570Ω	175mW	

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2. Specifications

Characteristic	Item		Specifications	
Contact	Arrangement		1 Form A	1 Form C
	Contact resistance (Initial)		Max. 100 mΩ (AgNi type), Max. 30 mΩ (AgNi type/Au-plated) (By voltage drop 6 V DC 1A)	
	Contact material		AgNi type, AgNi type/Au-plated	
Rating	Nominal switching capacity (resistive load)		6 A 250 V AC	
	Max. switching power (resistive load)		1,500 VA	
	Max. switching voltage		250V AC	
	Max. switching current		6 A (AC)	
	Min. switching capacity (Reference value)*1		100 mA 5 V DC (AgNi type), 1 mA 1 V DC (AgNi type/Au-plated)	
Electrical characteristics	Insulation resistance (Initial)		Min. 1,000MΩ (at 500V DC) Measurement at same location as “Breakdown voltage” section.	
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1 min. (Detection current: 10 mA)	
		Between contact and coil	4,000 Vrms for 1 min. (Detection current: 10 mA)	
	Surge breakdown voltage*2 (Between contact and coil) (Initial)		6,000 V	
	Operate time (at 20°C 68°F)		Max. 8 ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)	
	Release time (at 20°C 68°F)		Max. 4 ms (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 98 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs)	Min. 49 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 11 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1 mm (Detection time: 10μs.)	
		Destructive	10 to 55 Hz at double amplitude of 1.5 mm	
Expected life	Mechanical		Min. 5×10^6 (at 180 times/min.)	
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +85°C –40°F to +185°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
Unit weight			Approx. 5 g .18 oz	

Notes: *1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*2. Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981
*3. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to “Usage, transport and storage conditions” in NOTES.

3. Electrical life

Condition: Resistive load, at 6 times/min.

Type		Switching capacity	No. of operations
1 Form A		6A 250V AC	min. 5×10^4
1 Form C	N.O.	6A 250V AC	min. 5×10^4
	N.C.		min. 3×10^4

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REFERENCE DATA

1. Electrical life

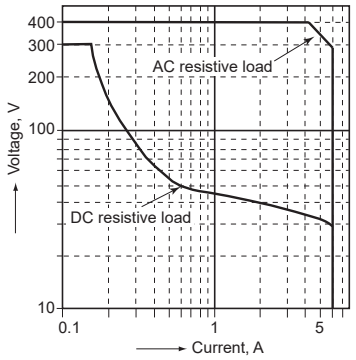
Tested sample: APF30224

Load type		Voltage	Current	Ambient temperature	No. of ops.
Resistive load		250V AC	6 A	85°C 185°F	30,000
Inductive load	AC15	250V AC	3 A	25°C 77°F	20,000
	DC13	24V DC	2 A	25°C 77°F	6,000

Notes: 1. Switch contacts are all on N.O. side.
2. AC15 and DC13 comply with IEC-60947-5-1 testing conditions.

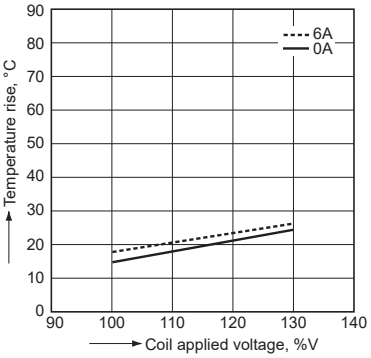
2. Max. switching capacity

Tested sample: APF30224



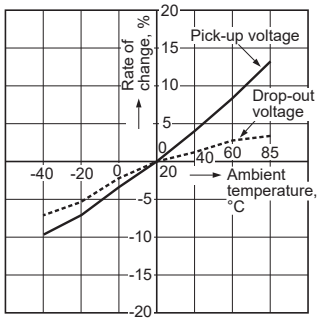
3. Coil temperature rise

Tested sample: APF30224
Measured portion: Inside the coil
Ambient temperature: 28°C 82°F



4. Ambient temperature characteristics

Tested sample: APF30224, 6 pcs.



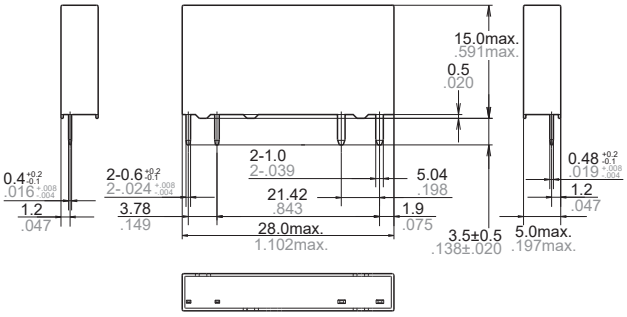
DIMENSIONS (mm inch)

CAD The CAD data of the products with a "CAD" mark can be downloaded from our Website.

1. 1 Form A type

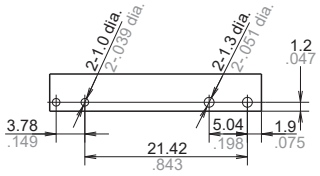
CAD

External dimensions



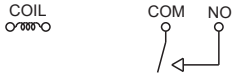
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

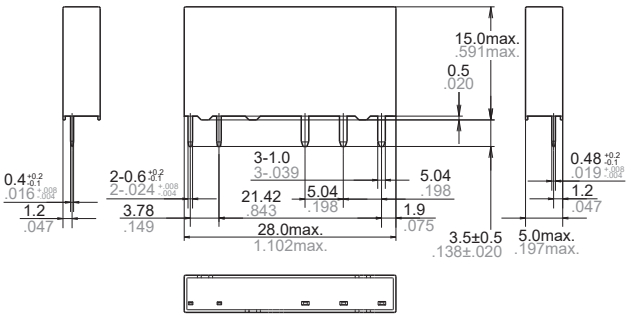
Schematic (Bottom view)



2. 1 Form C type

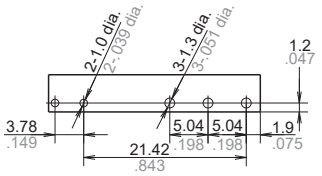
CAD

External dimensions



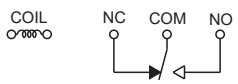
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



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SAFETY STANDARDS

Types	UL/C-UL (Recognized)*1				VDE(Certified)*2			
	File No.	Contact rating	Tempreture	Cycles	File No.	Contact rating	Tempreture	Cycles
1 FormA, 1 FormC	E120782	6A 277V AC General use	85°C 185°F	6×10^3	40027672 (IEC/EN61810-1)	6A 250V AC (cosφ =1.0) (N.O.)	25°C 77°F	8×10^4
		8A 277V AC General use (N.O.)	–	6×10^3		6A 250V AC (cosφ =1.0) (N.C.)	25°C 77°F	5×10^4
		4A 277V AC General use	–	3×10^4		6A 250V AC (cosφ =1.0) (N.O.)	85°C 185°F	4×10^4
		6A 24V DC General use (N.O.)	85°C 185°F	6×10^3		6A 250V AC (cosφ =1.0) (N.C.)	85°C 185°F	3×10^4
		B300 (Pilot Duty) (N.O.)	–	–		8A 250V AC (cosφ =1.0) (N.O.)	25°C 77°F	2.5×10^4
		R300 (Pilot Duty)	–	–		–	–	–
		Class I Division2 Groups A,B,C,D Hazardous Location (ANSI/ISA 12.12.01)				–	–	–

*1. CSA standard: Certified by C-UL
*2. Insulation: Reinforced insulation between contact and coil. Resistance to heat and fire; EN60335-1, clause 30 (GWT) approved.

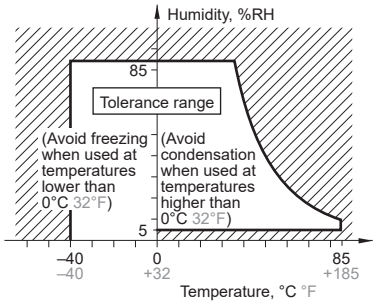
EN/IEC VDE Certified INSULATION CHARACTERISTICS (IEC61810-1)

Item	Characteristics
Clearance/Creepage distance (IEC61810-1)	Min. 6.0/8.0mm
Category of protection (IEC61810-1)	RT III
Tracking resistance (IEC60112)	PTI 175
Insulation material group	III a
Over voltage category	III
Rated voltage	250V
Pollution degree	2
Type of insulation (Between contact and coil)	Reinforced insulation
Type of insulation (Between open contacts)	Micro disconnection

NOTES

1. **For cautions for use, please read "GENERAL APPLICATION GUIDELINES".**
2. **Usage, transport and storage conditions**
   1) Temperature:
   –40 to +85°C –40 to +185°F
   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



4) 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.
5) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
6) 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.

Please refer to **"the latest product specifications"** when designing your product.
• Requests to customers :
https://industrial.panasonic.com/ac/e/salespolicies/

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GUIDELINES FOR POWER RELAYS AND HIGH-CAPACITY DC CUT OFF RELAYS 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 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.

■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.

Ambient Environment

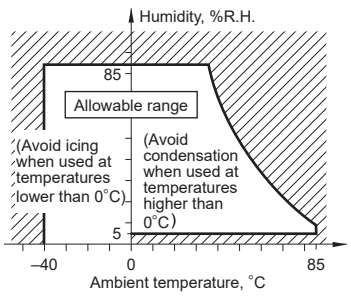
●Usage, Transport, and Storage Conditions

During usage, storage, or transportation, avoid locations subjected to direct sunlight and maintain normal temperature, humidity and pressure conditions.

●Temperature/Humidity/Pressure

When transporting or storing relays while they are tube packaged, there are cases the temperature may differ from the allowable range. In this case be sure to check the individual specifications. Also allowable humidity level is influenced by temperature, please check charts shown below and use relays within mentioned conditions. (Allowable temperature values differ for each relays, please refer to the relay's individual specifications.)

1) Temperature:
The tolerance temperature range differs for each relays, please refer to the relay's individual specifications
2) Humidity:
5 to 85 % RH
3) Pressure:
86 to 106 kPa



●Dew condensation

Condensation occurs when the ambient temperature drops suddenly from a high temperature and humidity, or the relay 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.

●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.

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●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.

●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.

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) 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 ultrasonic energy.

Please refer to **"the latest product specifications"** when designing your product.
•Requests to customers:
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Please contact .....

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