SFN4D Relay

Low profile safety relay with forcibly guided double contacts

Features

- Relay complies with IEC 61810-3, Type B
- Polarized magnet system with snap action function
- Extremely small total power loss
  - Nominal coil power consumption of 390mW
  - Double contacts with low contact resistance, e.g. [(6A)² x 2.5mΩ] x 4NO = 360mW
- Relay height, 14.5mm
- Reinforced insulation according to IEC61810-1
  - between coil-contacts and contacts-contacts
  - rated voltage of the circuits 230/400V or 277/480Vrms
  - rated impulse voltage of 6kV → clearance ≥ 5.5mm
  - pollution degree 2 → creepage distance ≥ 5.5mm

Ordering information (example)

SFN4D-DC12V AG 7 0 4

Coil voltage (DC)	Operating function	Contact arrangement
5, 9, 12, 16, 18, 21 24, 36, 48, 60	0: Single side stable	4:4 Form A 2 Form B

Rated coil voltage (DC)
9: 5V, 5: 9V, 1: 12V,
410: 16V, 110: 18V,
310:21V, 2:24V,
210: 36V, 3: 48V, 8:60V

Notes:
1) Standard packing; Tube: 10 pcs. Case 100 pcs.
2) Other coil voltage available upon request

Specifications

Contact	
Contact configuration (a = normally open / NO, b = normally closed / NC)	4a2b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A) Typical contact resistance	≤30mΩ ≤2.5mΩ
Max. switching capacity	6A/8A*1 250V AC
Max. switching voltage	500V AC / DC
Min. switching voltage / min. switching current	Reference 10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	23 / 6*2 / 2ms
Mechanical life	10^7 ops
Coil	
Operate / release and holding at 20°C (% of $U_{nominal}$)*3	75% / 25% min. 48%
Pick-up/nominal power consumption	219-236 / 390-420mW

Characteristics	
Max. switching frequency (without load)	5Hz
Permissible ambient temperature at nominal power consumption *3	-25°C to 92°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 4000 / 5000Vrms
Insulation resistance at 500V DC (initial)	10^9Ω
Shock resistance (11ms) NO/NC*4	20 / 15G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*4	10G
Degree of protection	RT III*5
Unit weight	42g

Important: Relay characteristics may be influenced by:
- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

1 See "ELECTRICAL LIFE (Reference Data)" on page 2. / *2 Without diode / *3 See also "REFERENCE DATA" on page 3. / *4 Contact interruption <10µs / *5 According to EN 61810-1: 2015, table 2

Coil data (at 20°C)

Part No.	Coil nominal voltage V DC	Operate voltage *1 V DC	Release voltage *1 V DC	Coil resistance Ω (± 10%, 20°C)
SFN4D-DC5V	5	3.75	1.25	64.1
SFN4D-DC9V	9	6.75	2.25	207.7
SFN4D-DC12V	12	9.00	3.00	369.2
SFN4D-DC16V	16	12.00	4.00	656.4
SFN4D-DC18V	18	13.5	4.50	830.8
SFN4D-DC21V	21	15.75	5.25	1130.8
SFN4D-DC24V	24	18.00	6.00	1476.9
SFN4D-DC36V	36	27.00	9.00	3085.7
SFN4D-DC48V	48	36.00	12.00	5485.7
SFN4D-DC60V	60	45.00	15.00	8571.4

*1 Operate and release voltage at different temperatures, see "REFERENCE DATA" on page 3, coil voltage characteristics

Switching capability

- Making / breaking capacities according to EN 60947-5-1: 2017, table 4 / 5; AC15: 6A 230V AC / DC13: 6A 24V DC
- Endurance / overload test according to UL 508 16 edition, sections 42 / 43; 6A 250V AC / 6A 24V DC; B300 / R300; File E120782

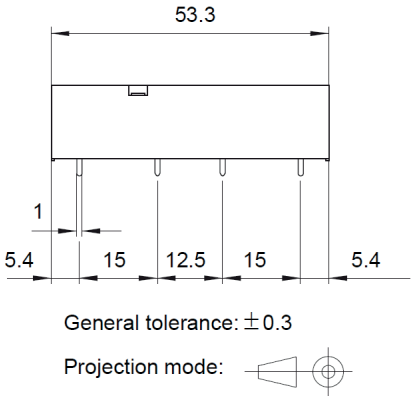
Electrical life (reference data)

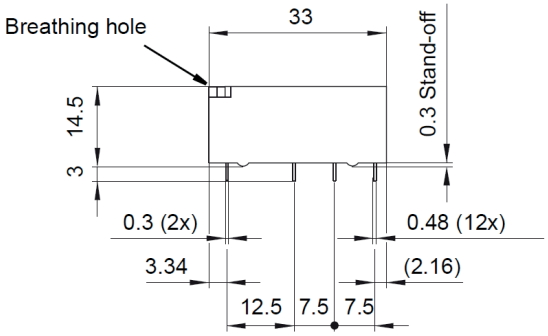
Voltage	Current (A)	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
230V AC	8	AC 1	0.25Hz	25%	4	85,000
230V AC	6	AC 1	0.25Hz	25%	4	200,000
230V AC	2.5	AC 1	0.25Hz	25%	4	1,500,000
230V AC	60 / 6	AC 15	0.20Hz	20%	3	40,000
24V AC	6	DC 1	0.25Hz	25%	4	2,000,000
250V AC	0.27	DC 13	0.10Hz	10%	4	1,000,000

*Test conditions: Room temperature, breathing hole closed, dielectric strength according to EN61810-1:2015.

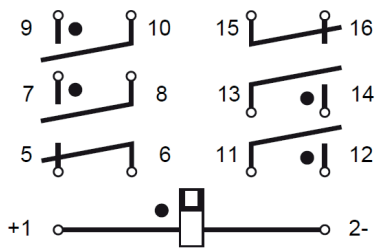
Outer dimensions

Download CAD Data from our Website.

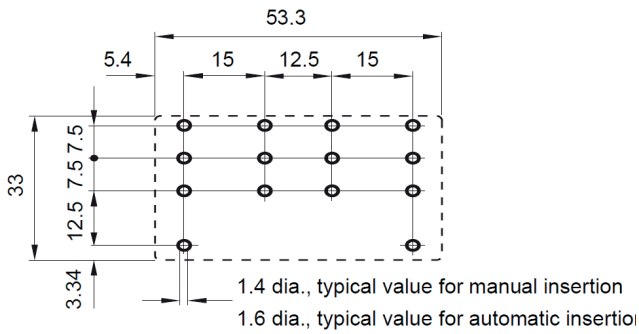




Schematic (Bottom view)

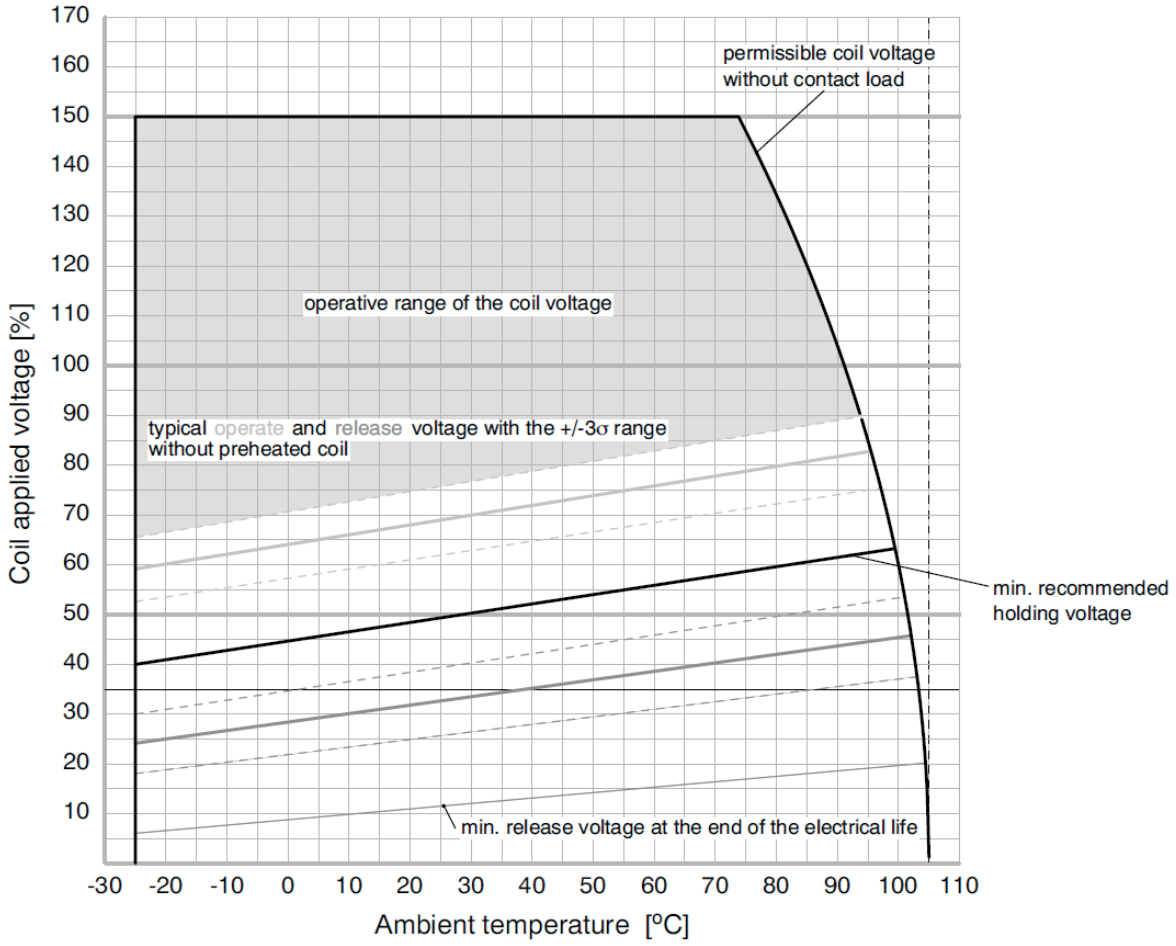


PC board pattern (Bottom view)

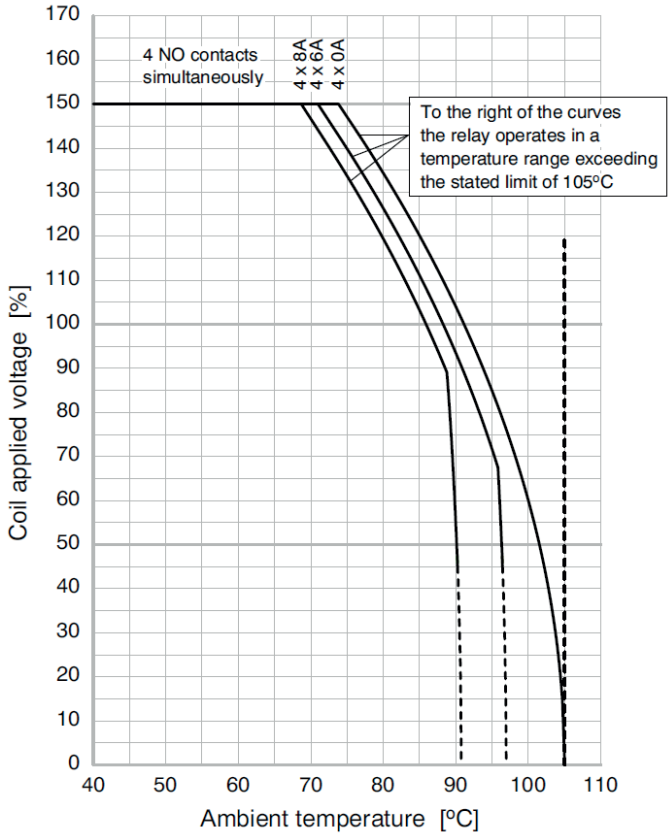


Reference Data

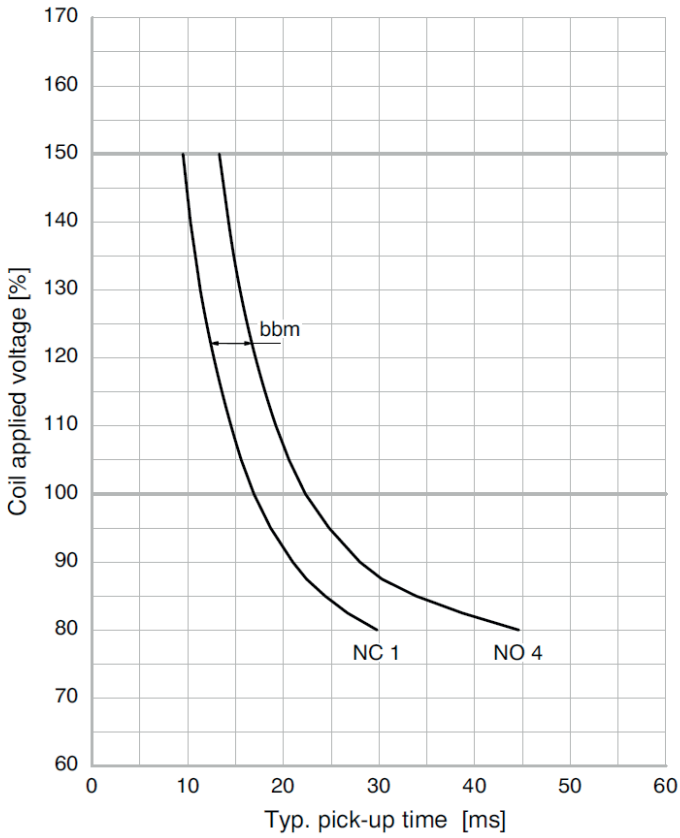
Coil voltage characteristics



Thermic operating range

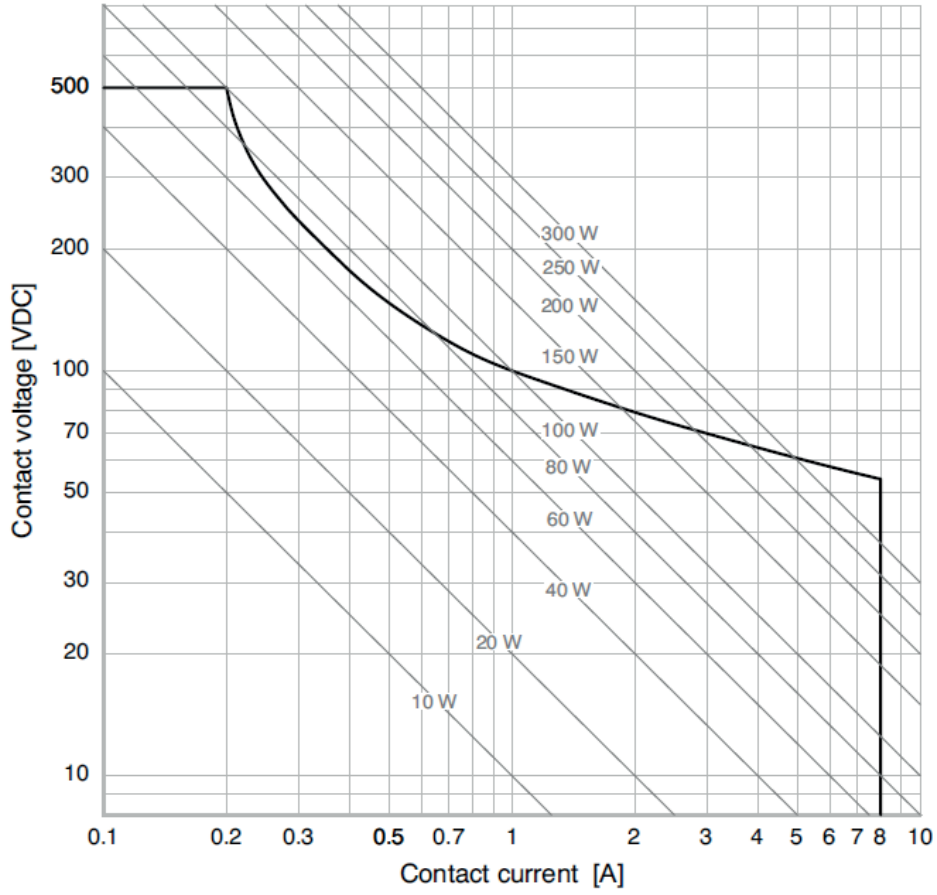


Switching time in relation to coil excitement at 20°C

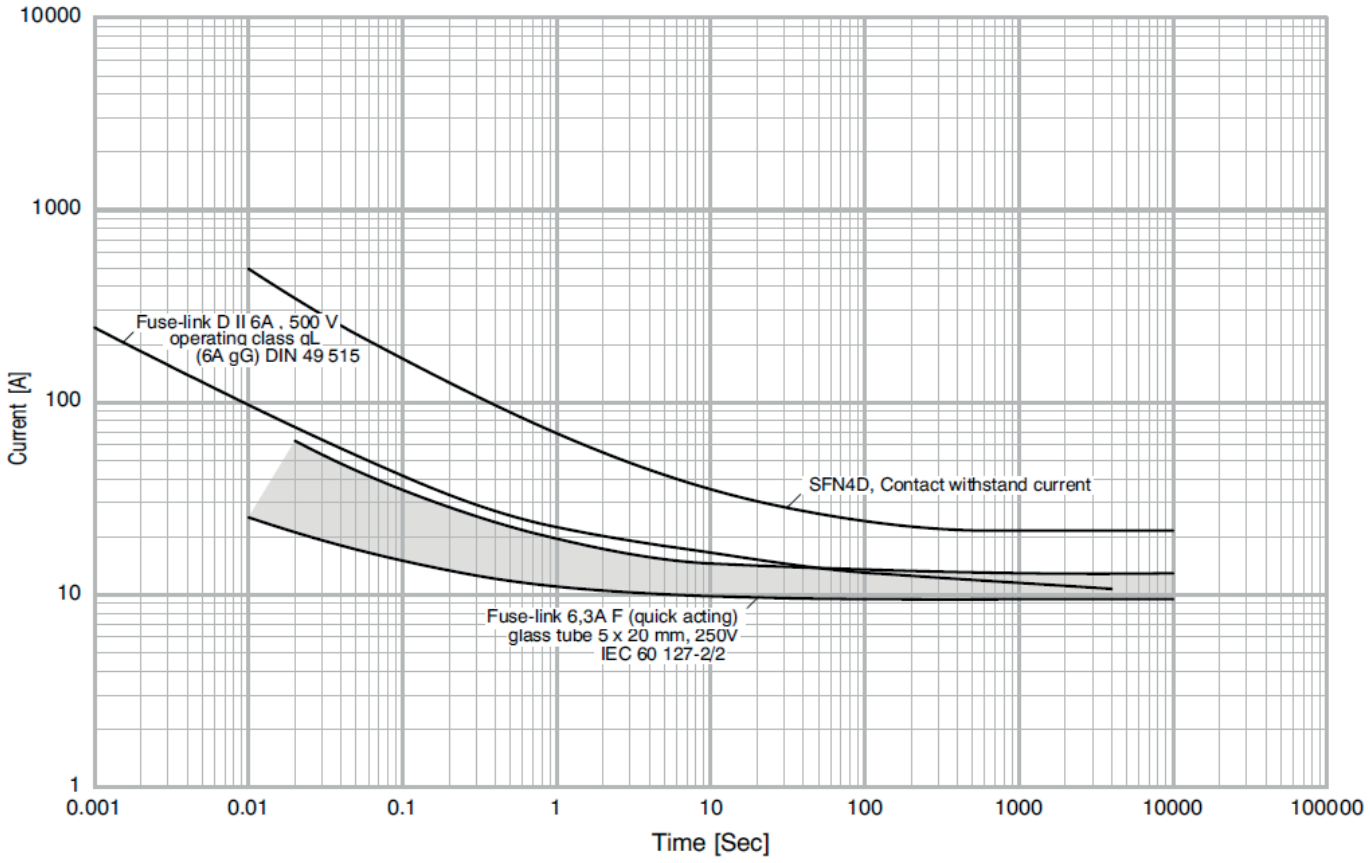


Reference Data, continued

Load limit curve

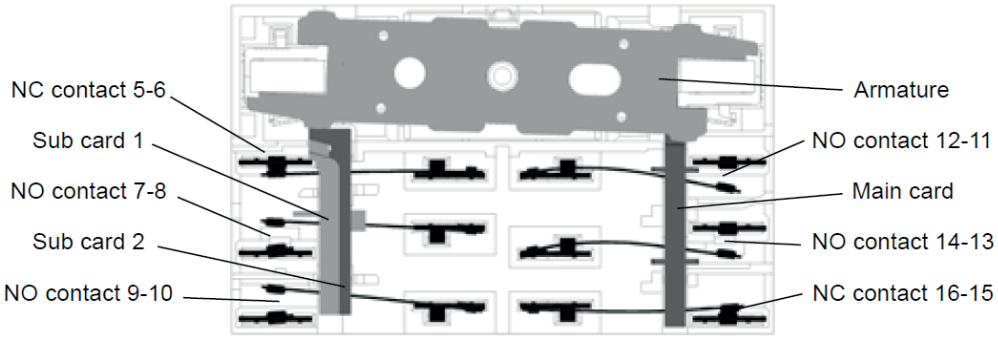


Time / current characteristic

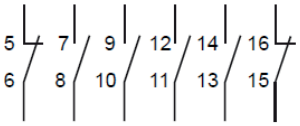


Application Notes

SFN4D Safety Relay



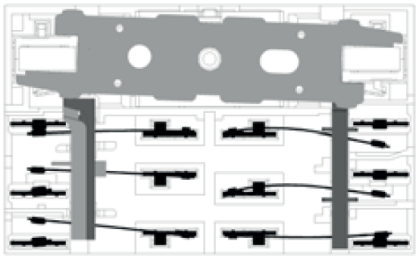
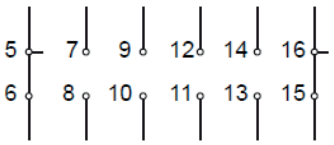
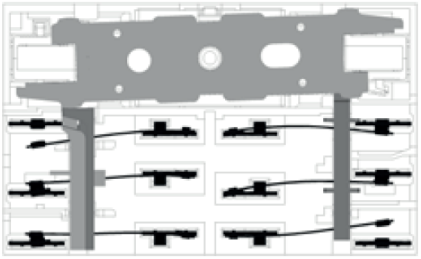
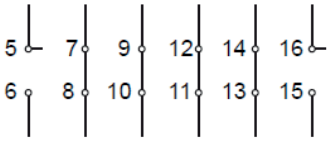
Remark:
Only NC 5-6 monitors all NO contacts!



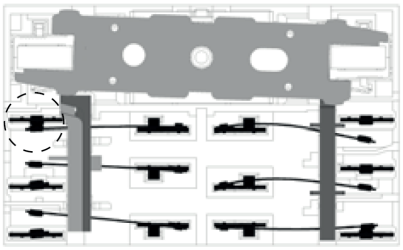
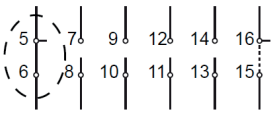
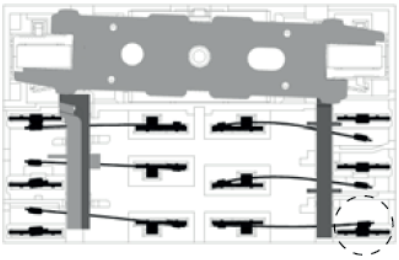
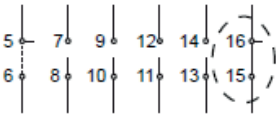
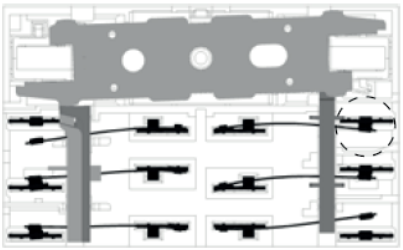
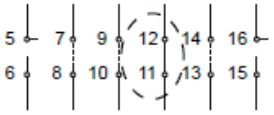
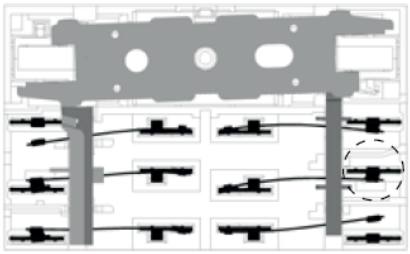
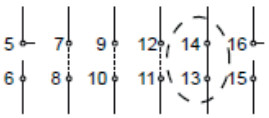
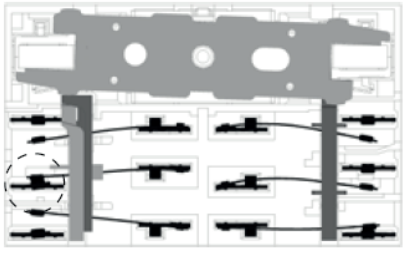
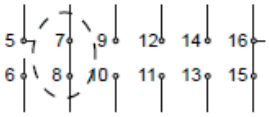
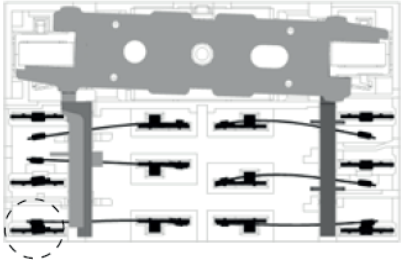
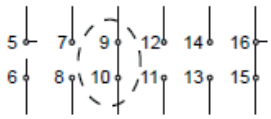
Legend for interpreting contact conditions

Contact	NC (Normally Closed)				NO (Normally Open)			
Condition	Closed	Fully open	Open	Open or closed	Closed	Fully open	Open	Open or closed
Symbol								
Contact gap	0	Maximum (~1.5mm)	>0.5mm (forcibly guided)	Not defined	0	Maximum (~1.5mm)	>0.5mm (forcibly guided)	Not defined

SFN4D under normal operating conditions

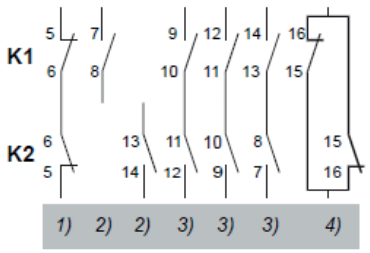
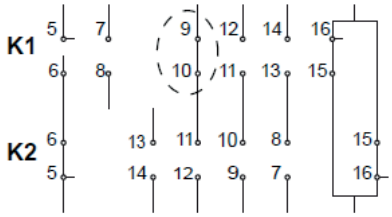
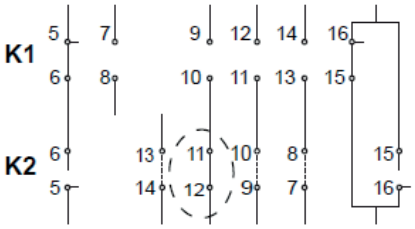
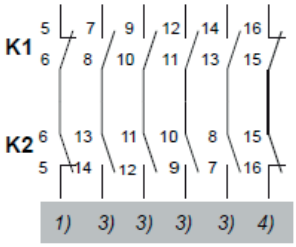
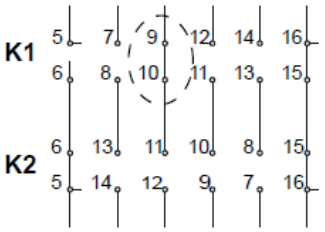
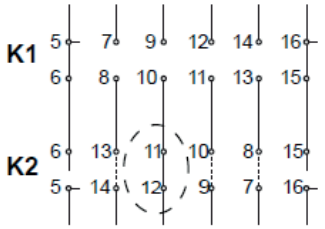
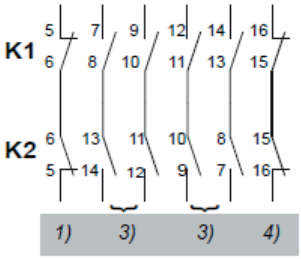
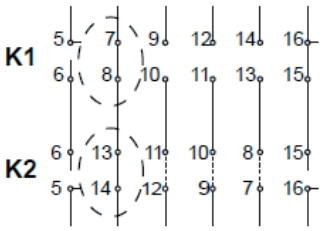
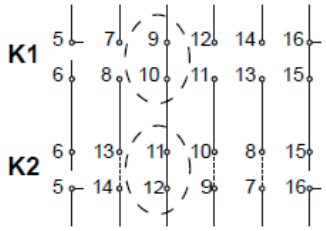
Condition	Illustration of relay state	Condition of contacts
- Coil deenergized - Armature in deenergized position - NC contacts closed - NO contacts have a contact gap of approx. 1.5mm		
- Coil energized - Armature in energized position - NO contacts closed - NC contacts have a contact gap of approx. 1.5mm		

SFN4D safety relay with welded contacts

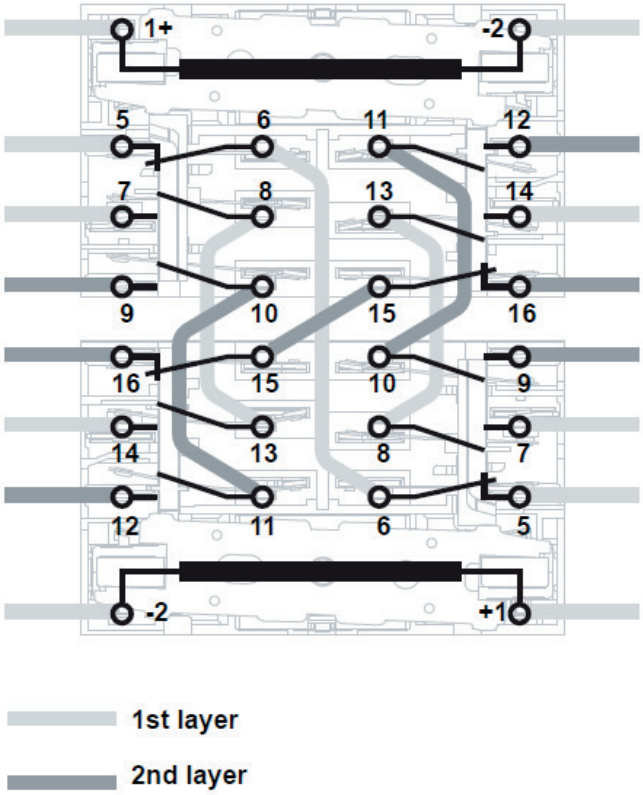
Condition	Illustration of relay state	Condition of contacts
- NC 5-6 welded - Coil energized - Armature nearly in deenergized position		 - All NO contacts are forcibly guided - The NO contact gaps are min. 0.5mm - For NC 16-15, the contact condition is not defined
- NC 16-15 welded - Coil energized - Armature nearly in deenergized position		 - All NO contacts are forcibly guided - The NO contact gaps are min. 0.5mm - For NC 5-6, the contact condition is not defined
- NO 12-11 welded - Coil deenergized - Armature nearly in energized position		 - All (both) NC contacts are forcibly guided - The NC contact gaps are min. 0.5mm - For all NO contacts, the contact condition is not defined
- NO 14-13 welded - Coil deenergized - Armature in nearly energized position		 - All (both) NC contacts are forcibly guided - The NC contact gaps are min. 0.5mm - For all NO contacts, the contact condition is not defined
- NO 7-8 welded - Coil deenergized - Armature in deenergized position		 - NC 16-15 is closed!! - All non-welded NO contacts show their max. contact gap - NC 5-6 forcibly guided to the welded contact by sub card 1 - The contact gap is min. 0.5mm
- NO 9-10 welded - Coil deenergized - Armature in deenergized position		 - NC 16-15 is closed!! - All non-welded NO contacts show their max. contact gap - NC 5-6 forcibly guided to the welded contact by sub card 2. The contact gap is min. 0.5mm

SFN4D Failure modes, application examples

1) Feedback loop, 2) Self-holding circuit, 3) Safety circuit, 4) Auxiliary contacts

1. Self-holding circuit, three safety circuits 	One contact welded, e.g. NO 9-10 of K1	Condition of contacts at deenergized coil 
	One contact welded, e.g. NO 12-11 of K2	Condition of contacts at deenergized coil 
2.1. Four safety circuits  (see wiring example, p.8)	One contact welded, e.g. NO 9-10 of K1	Condition of contacts at deenergized coil 
	One contact welded, e.g. NO 12-11 of K2	Condition of contacts at deenergized coil 
2.2. Two safety circuits  (see wiring example, p.8)	Both contacts of one path are welded, e.g. NO 7-8 and NO 14-13. A safety circuit needs two paths in this failure mode. The contacts 9-10, 12-11, and 14-13 of K1 interrupt the load	Condition of contacts at deenergized coil 
	Both contacts of one path are welded, e.g. NO 9-10 and NO 12-11. A safety circuit needs two paths in this failure mode. The contacts 7-8, 12-11, and 14-13 of K1 interrupt the load	Condition of contacts at deenergized coil 

Wiring for application examples 2.1 and 2.2



Cautions for use SFN4D relays (please see also Guidlines for relay usage)

Coil drive power supply

Pure DC current should be applied to the coil. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual use since the characteristics may be slightly different. Also, the power wave form should be rectangular.

Connection of coil

The positive (+9 and negative (-9 connections of polarized relay to the coil should be done as indicated on the schematic diagram. If connected incorrectly, it may malfunction, abnormal heat, fire or fail to operate.

Soldering

When using automatic soldering, the following conditions are recommended
19 Preheating: 120°C, within 120 sec
29 Soldering: 260 ±5°C, within 6 sec

Cautions for use SFN4D relays (please see also Guidlines for relay usage)

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 contacts9 Continuous, longterm 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 (+, -9 at the internal connection diagram (Schematic9. 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

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 operate 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 operate voltage and the operate 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

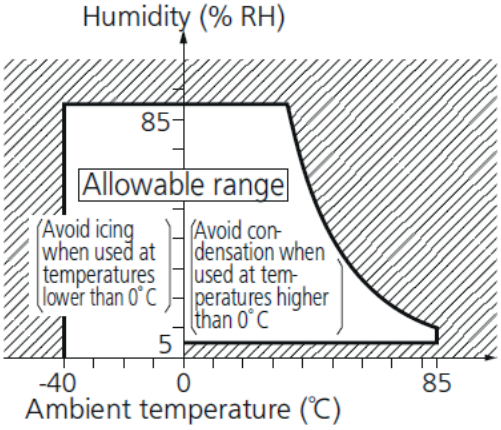
Usage, transport and storage conditions

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 b low 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

Cautions for use SFN4D relays (please see also Guidlines for relay usage)

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 Industry Co., Ltd. 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 Industry Co., Ltd. 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 relay 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 periods9 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.

Silicon
When a source of silicone substances (silicone rubber, silicone oil, silicone coating materials and silicone filling materials etc.9 is used around the relay, the silicone gas (low molecular siloxane etc.9 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 sealed types9.

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

- Although the environmentally sealed type relay (plastic sealed type, etc.9 can be cleaned, avoid immersing the relay into cold liquid (such as cleaning solvent9 immediately after soldering. Doing so may deteriorate the sealing performance.

- Cleaning with the boiling method is recommended (The temperature of cleaning liquid should be 40°C or lower9. 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:
https://industrial.panasonic.com/ac/e/salespolicies/

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