| Slim type safety relays | SF RELAYS
Slim type |

FEATURES

1. Acquisition of Korean safety certification ("S" mark)
Excluding with diode type
2. Forcibly guided contact structure
3. Slim profile (mm inch)
40/50 (L) × 13 (W) × 24 (H)
1.575/1.969 (L) × .512 (W) × .945 (H)
4. Fast response time is achieved (8 ms or less).
5. With diode and LED indication type available
6. Sockets and terminal sockets (spade and ring tongue terminal compatible) are available.

TYPICAL APPLICATIONS

1. Machine tools
2. Robots
3. Safety PLCs
4. Circuits with stringent safety standard requirements such as those in motor vehicle production equipment.

RoHS compliant

Protective construction: Flux-resistant type

ORDERING INFORMATION

SF | S | ☐ | – | ☐ | – | ☐ | – | ☐

S: Slim type

Contact arrangement
2: 2 Form A 2 Form B
3: 3 Form A 1 Form B
4: 4 Form A 2 Form B
5: 5 Form A 1 Form B
6: 3 Form A 3 Form B

Operation indication
Nil: Without LED indication
L: With LED indication

Nominal coil voltage
12, 24, 48V DC

Function
Nil: None
D: With diode

Notes: 1. Please consult us about other coil voltages.
2. LED indication color is green.

TYPES

1. Standard type

Contact arrangement		Nominal coil voltage	Without LED indication	With LED indication
			Part No.	Part No.
4 poles	2 Form A 2 Form B	12 V DC	SFS2-DC12V	SFS2-L-DC12V
		24 V DC	SFS2-DC24V	SFS2-L-DC24V
		48 V DC	SFS2-DC48V	SFS2-L-DC48V
	3 Form A 1 Form B	12 V DC	SFS3-DC12V	SFS3-L-DC12V
		24 V DC	SFS3-DC24V	SFS3-L-DC24V
		48 V DC	SFS3-DC48V	SFS3-L-DC48V
6 poles	4 Form A 2 Form B	12 V DC	SFS4-DC12V	SFS4-L-DC12V
		24 V DC	SFS4-DC24V	SFS4-L-DC24V
		48 V DC	SFS4-DC48V	SFS4-L-DC48V
	5 Form A 1 Form B	12 V DC	SFS5-DC12V	SFS5-L-DC12V
		24 V DC	SFS5-DC24V	SFS5-L-DC24V
		48 V DC	SFS5-DC48V	SFS5-L-DC48V
	3 Form A 3 Form B	12 V DC	SFS6-DC12V	SFS6-L-DC12V
		24 V DC	SFS6-DC24V	SFS6-L-DC24V
		48 V DC	SFS6-DC48V	SFS6-L-DC48V

Standard packing: Carton: 50 pcs.; Case: 200 pcs.

* Sockets and terminal sockets available.

2. With diode and LED indication type

Contact arrangement		Nominal coil voltage	Part No.
4 poles	2 Form A 2 Form B	12 V DC	SFS2-L-DC12V-D
		24 V DC	SFS2-L-DC24V-D
		48 V DC	SFS2-L-DC48V-D
	3 Form A 1 Form B	12 V DC	SFS3-L-DC12V-D
		24 V DC	SFS3-L-DC24V-D
		48 V DC	SFS3-L-DC48V-D
6 poles	4 Form A 2 Form B	12 V DC	SFS4-L-DC12V-D
		24 V DC	SFS4-L-DC24V-D
		48 V DC	SFS4-L-DC48V-D
	5 Form A 1 Form B	12 V DC	SFS5-L-DC12V-D
		24 V DC	SFS5-L-DC24V-D
		48 V DC	SFS5-L-DC48V-D
	3 Form A 3 Form B	12 V DC	SFS6-L-DC12V-D
		24 V DC	SFS6-L-DC24V-D
		48 V DC	SFS6-L-DC48V-D

Standard packing: Carton: 50 pcs.; Case: 200 pcs.

* Sockets and terminal sockets available.

RATING

1. Coil data

Contact arrangement		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 (at 20°C 68°F)	Max. applied voltage (at 20°C 68°F)
4 poles	2 Form A 2 Form B	12V DC			30 mA	400Ω	Approx. 360mW	
		24V DC			15 mA	1,600Ω		
		48V DC			7.5mA	6,400Ω		
	3 Form A 1 Form B	12V DC			30 mA	400Ω		
		24V DC	75%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	15 mA	1,600Ω		110%V of nominal voltage
		48V DC			7.5mA	6,400Ω		
6 poles	4 Form A 2 Form B	12V DC			41.7mA	288Ω		
		24V DC			20.8mA	1,152Ω		
		48V DC			10.4mA	4,608Ω		
	5 Form A 1 Form B	12V DC			41.7mA	288Ω	Approx. 500mW	
		24V DC			20.8mA	1,152Ω		
		48V DC			10.4mA	4,608Ω		
	3 Form A 3 Form B	12V DC			41.7mA	288Ω		
		24V DC			20.8mA	1,152Ω		
		48V DC			10.4mA	4,608Ω		

Note: The nominal operating current will increase by approximately 2mA due to the LED on the LED indication type.

2. Specifications (relay)

Characteristics	Item		Specifications				
			4 poles		6 poles		
Contact	Contact arrangement		2 Form A 2 Form B	3 Form A 1 Form B	4 Form A 2 Form B	5 Form A 1 Form B	3 Form A 3 Form B
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 6 V DC 1A)				
	Contact material		Au flashed AgSnO$_2$ type				
Rating	Nominal switching capacity (resistive load)		6A 250V AC, 6A 30V DC				
	Max. switching power (resistive load)		1,500VA, 180W				
	Max. switching voltage		250V AC, 125V DC				
	Max. switching current		6 A (Reduce by 0.1 A/°C for temperatures 70 to 85°C 158 to 185°F)				
	Min. switching capacity (Reference value)*1		1mA 5V DC				
	Nominal operating power		Approx. 360mW		Approx. 500mW		
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	1,500 Vrms for 1 min. (Detection current: 10mA)				
		Between contact sets	2,500 Vrms for 1 min. (Detection current: 10mA); 7-8/9-10 between open contacts		2,500 Vrms for 1 min. (Detection current: 10mA); 7-8/11-12 between open contacts 9-10/13-14 between open contacts 11-12/13-14 between open contacts		
			4,000 Vrms for 1 min. (Detection current: 10mA); 3-4/5-6 between open contacts 3-4/7-8 between open contacts 5-6/9-10 between open contacts		4,000 Vrms for 1 min. (Detection current: 10mA); 3-4/5-6 between open contacts 3-4/7-8 between open contacts 5-6/9-10 between open contacts 7-8/9-10 between open contacts		
		Between contact and coil	4,000 Vrms for 1min (Detection current: 10mA)				
	Operate time (at 20°C 68°F)		Max. 20ms (Nominal coil voltage applied to the coil, excluding contact bounce time)				
	Response time (at 20°C 68°F)*2		Max. 8ms (Nominal coil voltage applied to the coil, excluding contact bounce time and without diode)*4				
	Release time (at 20°C 68°F)		Max. 20ms (Nominal coil voltage applied to the coil, excluding contact bounce time)				
Mechanical characteristics	Shock resistance	Functional	200 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10μs)				
		Destructive	1,000 m/s^2 (Half-wave pulse of sine wave: 6 ms)				
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.5 mm (Detection time: 10μs)				
		Destructive	10 to 55 Hz at double amplitude of 1.5 mm				
Expected life	Mechanical		Min. 10^7 (at 180 times/min.)				
	Electrical		250 V AC 6 A resistive load: Min. 10^5 (at 20 times/min.)				
			30 V DC 6 A resistive load: Min. 10^5 (at 20 times/min.)				
			250 V AC 1 A resistive load: Min. 5×10^5 (at 30 times/min.)				
			30 V DC 1 A resistive load: Min. 5×10^5 (at 30 times/min.)				
			[AC 15] 240 V AC 2 A inductive load: Min. 10^5 (at 20 times/min., cosφ = 0.3)				
			[DC 13] 24 V DC 1 A inductive load: Min. 10^5 (at 20 times/min., L/R = 48 ms)				
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)				
	Max. operating speed		20 times/min. (at max. rating)				
Unit weight			Approx. 20 g .71 oz		Approx. 23 g .81 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. Response time is the time after the coil voltage turns off until the time when "a" contact turns off.
*3. The upper limit of the ambient temperature is the maximum temperature that can satisfy the coil temperature rise value. Refer to Usage, transport and storage conditions in NOTES.
*4. Response time of built-in diode type is 12 ms or less (excluding contact bounce time when nominal coil voltage is applied to the coil).
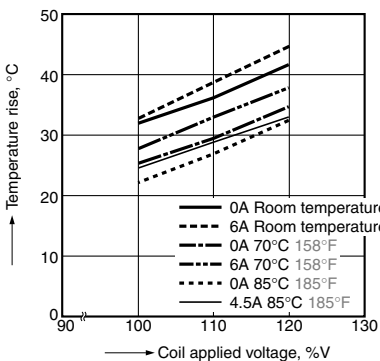
REFERENCE DATA

1. Operate/response/release time
Tested sample: SFS4-DC24V (4 Form A 2 Form B),
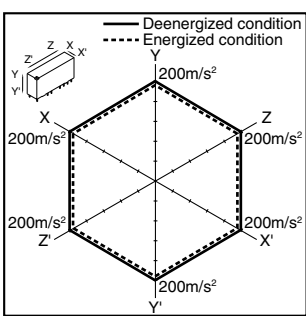20pcs. (a contacts: 80, b contacts: 40)
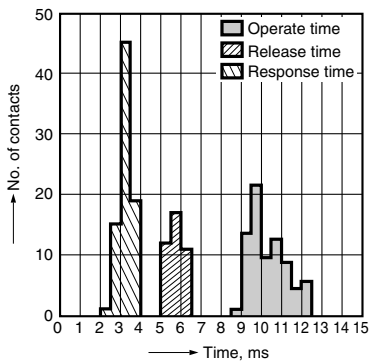
2. Coil temperature rise
Tested sample: SFS4-DC24V (4 Form A 2 Form B),
3pcs.
Measured portion: Inside the coil
Ambient temperature: Room temperature
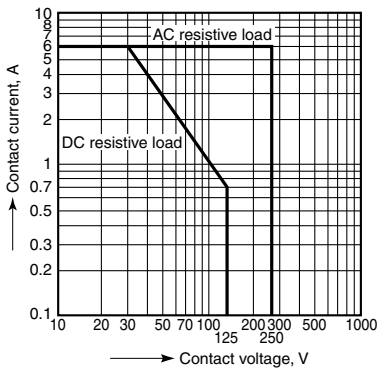(27°C 80.6°F), 70°C 158°F, 85°C 185°F

3. Malfunctional shock
Tested sample: SFS4-DC24V (4 Form A 2 Form B),
3pcs.

### 4. Max, switching capacity

Other contact gaps when contacts are welded
Sample: SFS4-DC24V (4 Form A 2 Form B)
The table below shows the state of the other contacts.
In case of form "NO" contact weld the coil applied voltage is 0 V.
In case of form "NC" contact weld the coil applied voltage is nominal.

		State of other contacts					
		3-4 (NC)	5-6 (NC)	7-8 (NO)	9-10 (NO)	11-12 (NO)	13-14 (NO)
Welded contact No.	3-4 (NC)			>0.5	>0.5	>0.5	>0.5
	5-6 (NC)			>0.5	>0.5	>0.5	>0.5
	7-8 (NO)	>0.5	>0.5				
	9-10 (NO)	>0.5	>0.5				
	11-12 (NO)	>0.5	>0.5				
	13-14 (NO)	>0.5	>0.5				

 >0.5: contact gap is kept at min. 0.5 mm .020inch
Empty cells: either ON or OFF
Note: Contact gaps are shown at the initial state.
     If the contact transfer is caused by load switching, it is necessary to check the actual loading.

DIMENSIONS (mm inch)

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

1. 4 poles (2 Form A 2 Form B, 3 Form A 1 Form B)

CAD Data
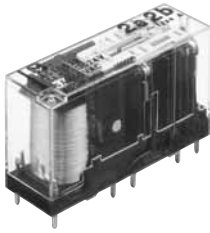
External dimensions
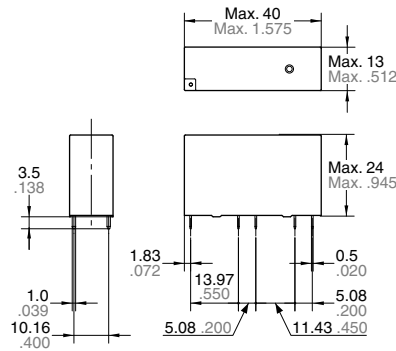
PC board pattern (Bottom view)
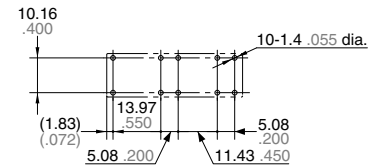
Tolerance: ±0.1 ±.004

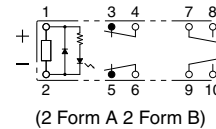General tolerance: ±0.3 ±.012
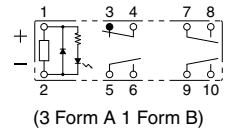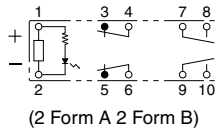
Schematic (Bottom view)
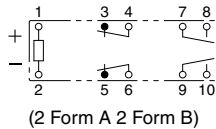
Standard — (2 Form A 2 Form B) — (3 Form A 1 Form B)
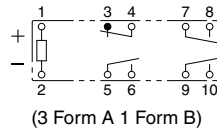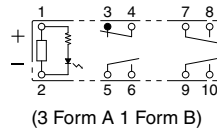
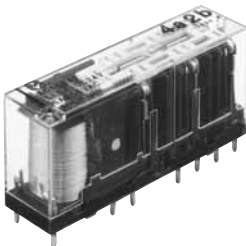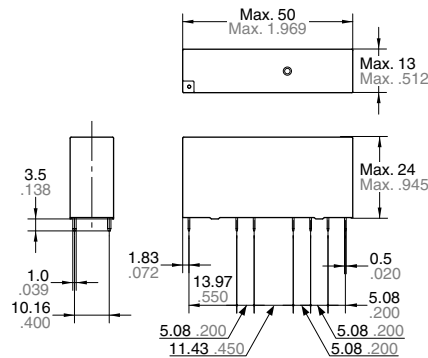With diode and LED indication type — (2 Form A 2 Form B) — (3 Form A 1 Form B)
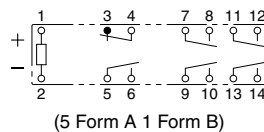
With LED indication — (2 Form A 2 Form B) — (3 Form A 1 Form B)

2. 6 poles (4 Form A 2 Form B, 5 Form A 1 Form B, 3 Form A 3 Form B)

CAD Data

External dimensions

PC board pattern (Bottom view)
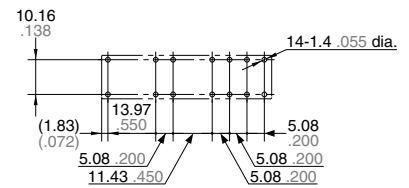
Tolerance: ±0.1 ±.004

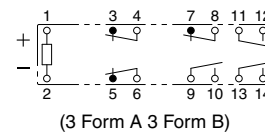General tolerance: ±0.3 ±.012

Schematic (Bottom view)
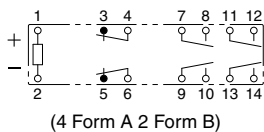
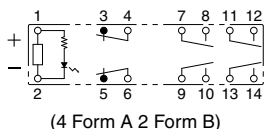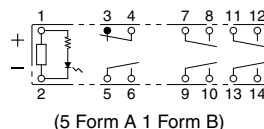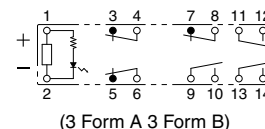Standard — (4 Form A 2 Form B) — (5 Form A 1 Form B) — (3 Form A 3 Form B)
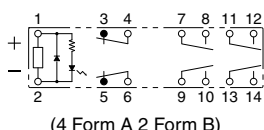
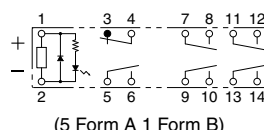With LED indication — (4 Form A 2 Form B) — (5 Form A 1 Form B) — (3 Form A 3 Form B)
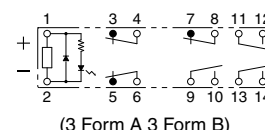
With diode and LED indication type — (4 Form A 2 Form B) — (5 Form A 1 Form B) — (3 Form A 3 Form B)

SAFETY STANDARDS

Certification authority	File No.	
UL/C-UL	E43149*	6A 277V AC, 6A 30V DC
TÜV	B 15 05 13461 346	6A 250V AC (cosφ=1.0), 6A 30V DC (0ms), AC15: 2A 240V AC (cosφ=0.3), DC13: 1A 24V DC (L/R 48ms)

* CSA standard: Certified by C-UL

NOTES

1. For cautions for use, please read "GENERAL APPLICATION GUIDELINES".

2. Coil operating power
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 circuit since the characteristics may be slightly different.
The wave form should be rectangular.

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

4. Cleaning
This relay is not sealed, therefore, immersion may cause failure. Be careful that flux does not overflow onto the PC board or penetrate inside the relay.

5. Soldering
When using automatic soldering, the following conditions are recommended
1) Preheating: 120°C 248°F, within 120 Sec (PC board solder surface)
2) Soldering: 260°C±5°C 500°F±41°F, within 6 Sec

6. Other
1) If the relay has been dropped, the appearance and characteristics should always be checked before use.
2) 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 actual product as it is affected by the coil driving circuit, load type, activation frequency, activation phase, ambient conditions and other factors.
Also, be especially careful with loads such as those listed below.
(1) When used for AC load-operation and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.
(2) During high frequency on/off operation with certain loads, arcing may occur at the contacts. This can cause fusion to Oxygen and Nitrogen gas in the air creating Nitric Acid (HNO_3) which can cause corrosion to the contacts.
Please see the following countermeasure examples:
    1. Incorporate an arc-extinguishing circuit.
    2. Lower the operating frequency
    3. Lower the ambient humidity
3) For secure operations, nominal coil voltage should be applied. In addition, please note that pick-up and drop-out voltage will vary according to the ambient temperature and operating conditions.
4) Heat, smoke, and/or fire may occur if the relay is used outside the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded. Also, make sure that the relay is wired correctly.
5) Incorrect wiring may cause false operation or generate heat or flames.
6) Check the ambient conditions when storing or transporting the relays and devices containing the relays. Freezing or condensation may occur in the relay causing damage. Avoid exposing the relays to heavy loads, or strong shock and vibration.

7. Usage, transport and storage conditions
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:
(1) Temperature: –40 to +85°C –40 to +185°F
(When the temperature is 70 to 85°C 158 to 185°F, reduce the 6 A max. switching current by 0.1 A/°C.)
(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
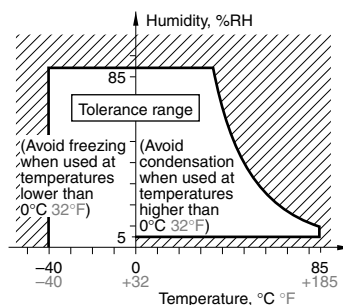
2) Condensation
Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.
3) Freezing
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.
4) Low temperature and low humidity
At low temperature, low humidity environments, the plastic becomes brittle.
Please note corrections.
8. Please connect DC coil types with LED and built-in diode correctly by verifying the coil polarity ("+" and "−"). Connecting with reverse polarity will cause the LED not to light and damage the built-in diode due to its specification.

| ACCESSORIES | SF RELAYS Slim type (Sockets and DIN rail terminal sockets) |

TYPES

1. Sockets

Type	No. of poles	Part No.
PC board sockets	4 poles	SFS4-PS
	6 poles	SFS6-PS

Standard packing: Carton: 10 pcs.; Case: 100 pcs.

2. DIN rail terminal socket

Type	No. of poles	Part No.
New Terminal sockets for spade and ring tongue terminals	4 poles	SFS4-SFD-R
	6 poles	SFS6-SFD-R

Standard packing: Carton: 10 pcs.; Case: 100 pcs.
Note: For previous products (spade tongue terminal dedicated terminal sockets), please order SFS4-SFD for 4 poles and SFS6-SFD for 6 poles.

RATING

Specifications

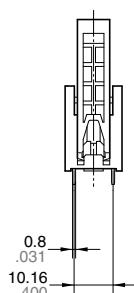| Item	Specifications
Breakdown voltage (Initial)	Between each terminal: 2,500 Vrms for 1 min. (Detection current: 10mA)
Insulation resistance (Initial)	Min. 1,000MΩ (at 500V DC) Measurement at same location as "Breakdown voltage" section.
Max. carrying current	6 A (Reduce by 0.1 A/°C for temperatures 70 to 85°C 158 to 185°F)

DIMENSIONS (mm inch)

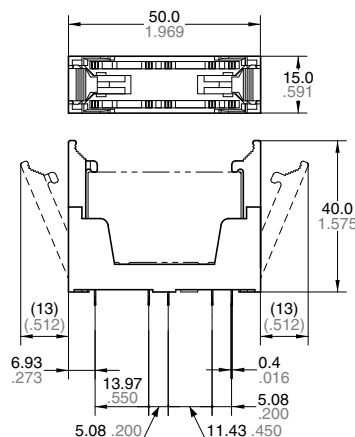The CAD data of the products with a **CAD Data** mark can be downloaded from: http://industrial.panasonic.com/ac/e/

1. PC board sockets (4 poles)
(SFS4-PS)

CAD Data

External dimensions

PC board pattern (Bottom view)

50.0 1.969
15.0 .591
40.0 1.575
(13) (.512)
(13) (.512)
6.93 .273
13.97 .550
0.4 .016
5.08 .200
5.08 .200
11.43 .450
0.8 .031
10.16 .400

10.16 .400
4.1 .161
24.8 .976
39.9 1.571
3-3.2 .126 dia. (For M3 screw)
Please use the screw with a stem length of 8 mm .315 inch.
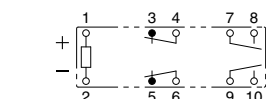10-1.1 .043 dia.
(6.93) (.273)
13.97 .550
5.08 .200
5.08 .200
11.43 .450
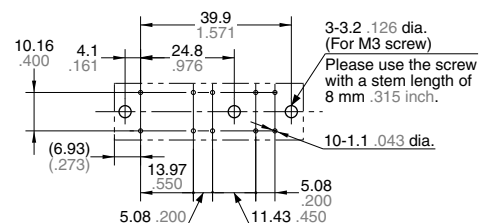
Tolerance: ±0.1 ±.004
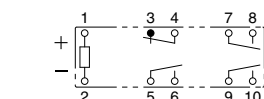
General tolerance: ±0.3 ±.012
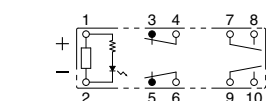
Schematic (Bottom view)

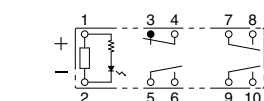Standard
(When 2 Form A 2 Form B mounted)   (When 3 Form A 1 Form B mounted)
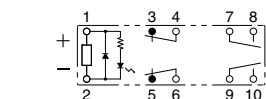
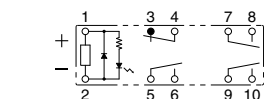With LED indication
(When 2 Form A 2 Form B mounted)   (When 3 Form A 1 Form B mounted)

With diode and LED indication type
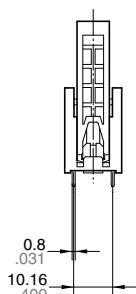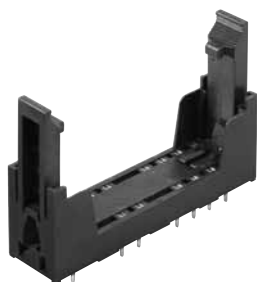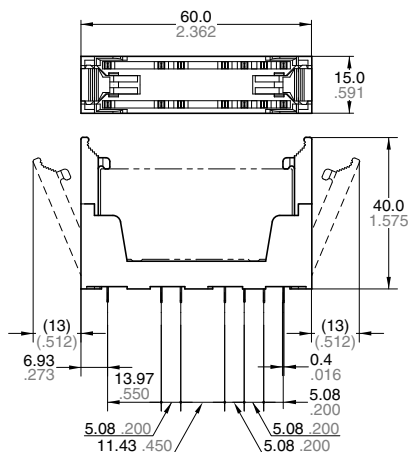(When 2 Form A 2 Form B mounted)   (When 3 Form A 1 Form B mounted)

SFS ACCESSORIES

2. PC board sockets (6 poles)
(SFS6-PS)

`CAD Data`

External dimensions

60.0
2.362

15.0
.591

40.0
1.575

(13)
(.512)

(13)
(.512)

0.8
.031

10.16
.400

6.93
.273

13.97
.550

0.4
.016

5.08
.200

5.08 .200
11.43 .450

5.08 .200
5.08 .200

PC board pattern (Bottom view)

10.16
.400

4.1
.161

24.8
.976

49.9
1.965

3-3.2 .126 dia.
(For M3 screw)
Please use the screw
with a stem length of
8 mm .315 inch.

14-1.1 .043 dia.

(6.93)
(.273)

13.97
.550

5.08
.200

5.08 .200
11.43 .450

5.08 .200
5.08 .200
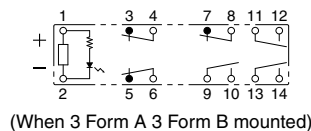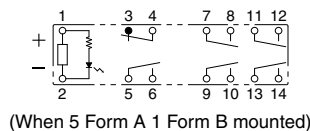
Tolerance: ±0.1 ±.004

General tolerance: ±0.3 ±.012

Schematic (Bottom view)

Standard

+
−

1   3 4   7 8 11 12
2   5 6   9 10 13 14

(When 4 Form A 2 Form B mounted)

1   3 4   7 8 11 12
2   5 6   9 10 13 14

(When 5 Form A 1 Form B mounted)

1   3 4   7 8 11 12
2   5 6   9 10 13 14

(When 3 Form A 3 Form B mounted)

With LED indication

+
−

1   3 4   7 8 11 12
2   5 6   9 10 13 14

(When 4 Form A 2 Form B mounted)

1   3 4   7 8 11 12
2   5 6   9 10 13 14

(When 5 Form A 1 Form B mounted)

1   3 4   7 8 11 12
2   5 6   9 10 13 14

(When 3 Form A 3 Form B mounted)

With diode and
LED indication type

+
−

1   3 4   7 8 11 12
2   5 6   9 10 13 14

(When 4 Form A 2 Form B mounted)

1   3 4   7 8 11 12
2   5 6   9 10 13 14

(When 5 Form A 1 Form B mounted)

1   3 4   7 8 11 12
2   5 6   9 10 13 14

(When 3 Form A 3 Form B mounted)

3. Terminal socket for spade and ring tongue terminals (For 4 poles finger protect type)
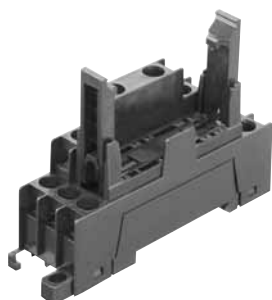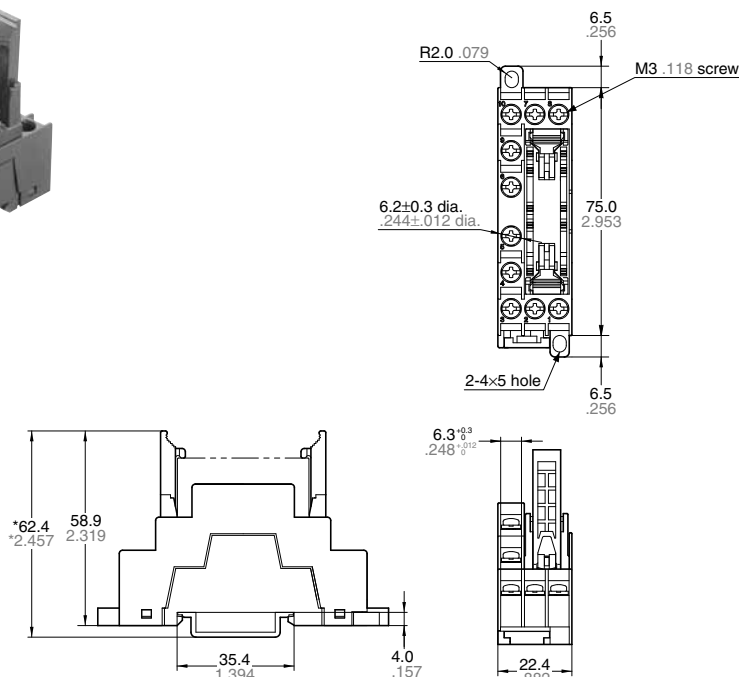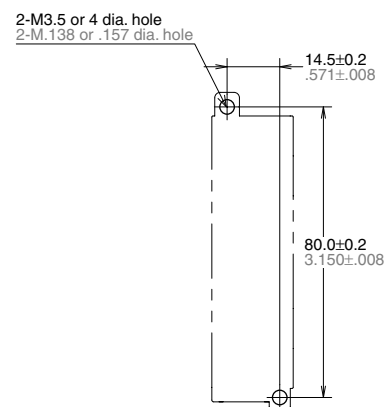
`CAD Data`

External dimensions

6.5
.256

R2.0 .079

M3 .118 screw

6.2±0.3 dia.
.244±.012 dia.

75.0
2.953

2-4×5 hole

6.5
.256

6.3 +0.3 / 0
.248 +.012 / 0

*62.4
*2.457

58.9
2.319

35.4
1.394

4.0
.157

22.4
.882

Mounting hole dimensions

2-M3.5 or 4 dia. hole
2-M.138 or .157 dia. hole

14.5±0.2
.571±.008

80.0±0.2
3.150±.008

Tolerance: ±0.1 ±.004

Schematic (Top view)

10 7 8
9
6
5
4
3 2 1
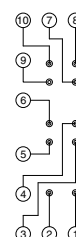
General tolerance: ±0.5 ±.020

* Reference value (when using DIN rail ATA48011)

Note: Ring tongue terminals cannot be used with conventional DIN rail terminal socket (SFS4-SFD).
In use of a ring tongue terminals, please use SFS4-SFD-R.

4. Terminal socket for spade and ring tongue terminals (For 6 poles finger protect type)

CAD Data

External dimensions

6.5 .256

R2.0 .079

M3 .118 screw

6.2±0.3 dia.
.244±.012 dia.

75.0 2.953

2-4×5 hole

6.5 .256

*62.4 *2.457   58.9 2.319

35.4 1.394

4.0 .157

6.3 +0.3 0 .248 +.012 0

29.8 1.173
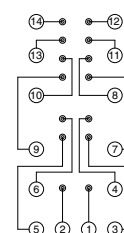
General tolerance: ±0.5 ±.020

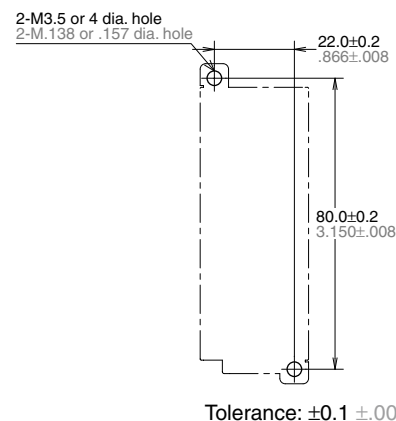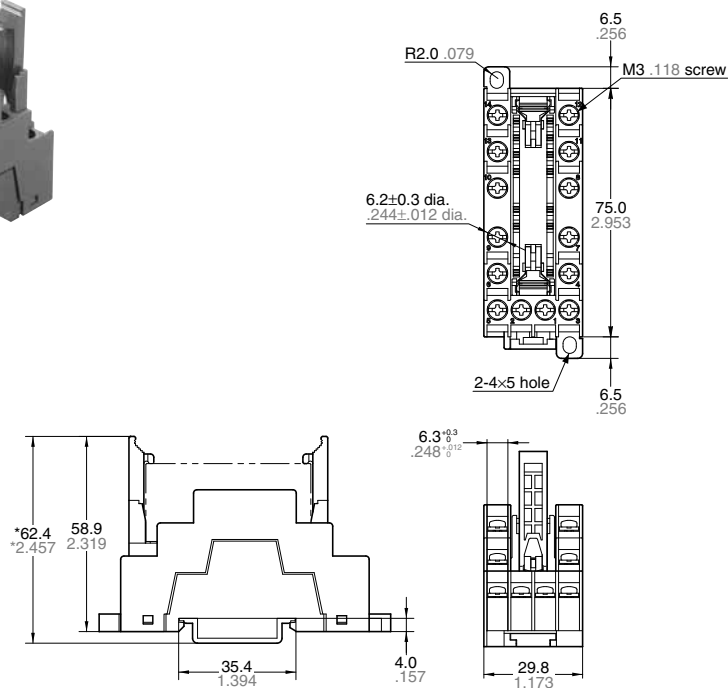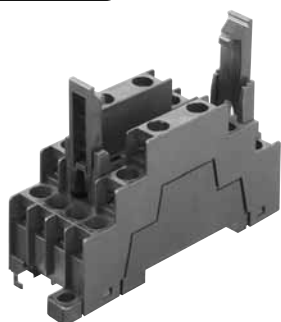* Reference value (when using DIN rail ATA48011)

Note: Ring tongue terminals cannot be used with conventional DIN rail terminal socket (SFS6-SFD).
In use of a ring tongue terminals, please use SFS6-SFD-R.

Mounting hole dimensions

2-M3.5 or 4 dia. hole
2-M.138 or .157 dia. hole

22.0±0.2 .866±.008

80.0±0.2 3.150±.008

Tolerance: ±0.1 ±.004

Schematic (Top view)

NOTES

Installation

1) Attach directly to the chassis or use a DIN rail.

(1) When attaching directly to chassis

• Use a M3.5 screw, spring washer, and hex nut.

• For the mounting pitch, refer to the dimensions.

(2) When installing on a DIN rail

• Use a 35 mm 1.378 inch wide DIN rail (DIN46277).

• Install and remove as shown in the figures below.

<When installing>

Push

DIN rail

<When removing>

Pull

Screwdriver
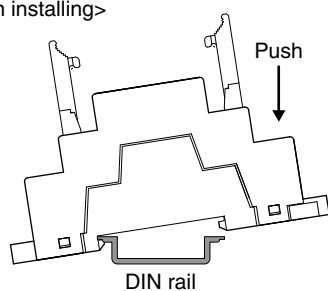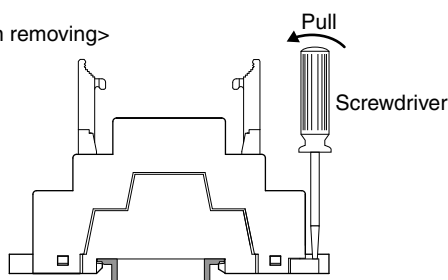
2) Refer to the figure below for applicable wire-pressed terminals.

Spade tongue terminal
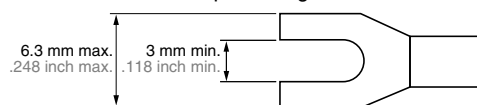
6.3 mm max.
.248 inch max.   3 mm min.
.118 inch min.

Ring tongue terminal

6.3 mm max.
.248 inch max.   3 mm min.
.118 inch min.
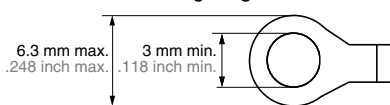
GUIDELINES FOR POWER, HIGH-CAPACITY DC CUT OFF AND SAFETY RELAYS USAGE

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
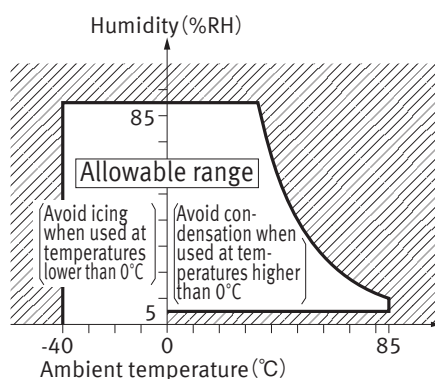
●Dew condensation

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.

GUIDELINES FOR POWER, HIGH-CAPACITY DC CUT OFF AND SAFETY RELAYS USAGE

●**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:
  https://industrial.panasonic.com/ac/e/salespolicies/

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