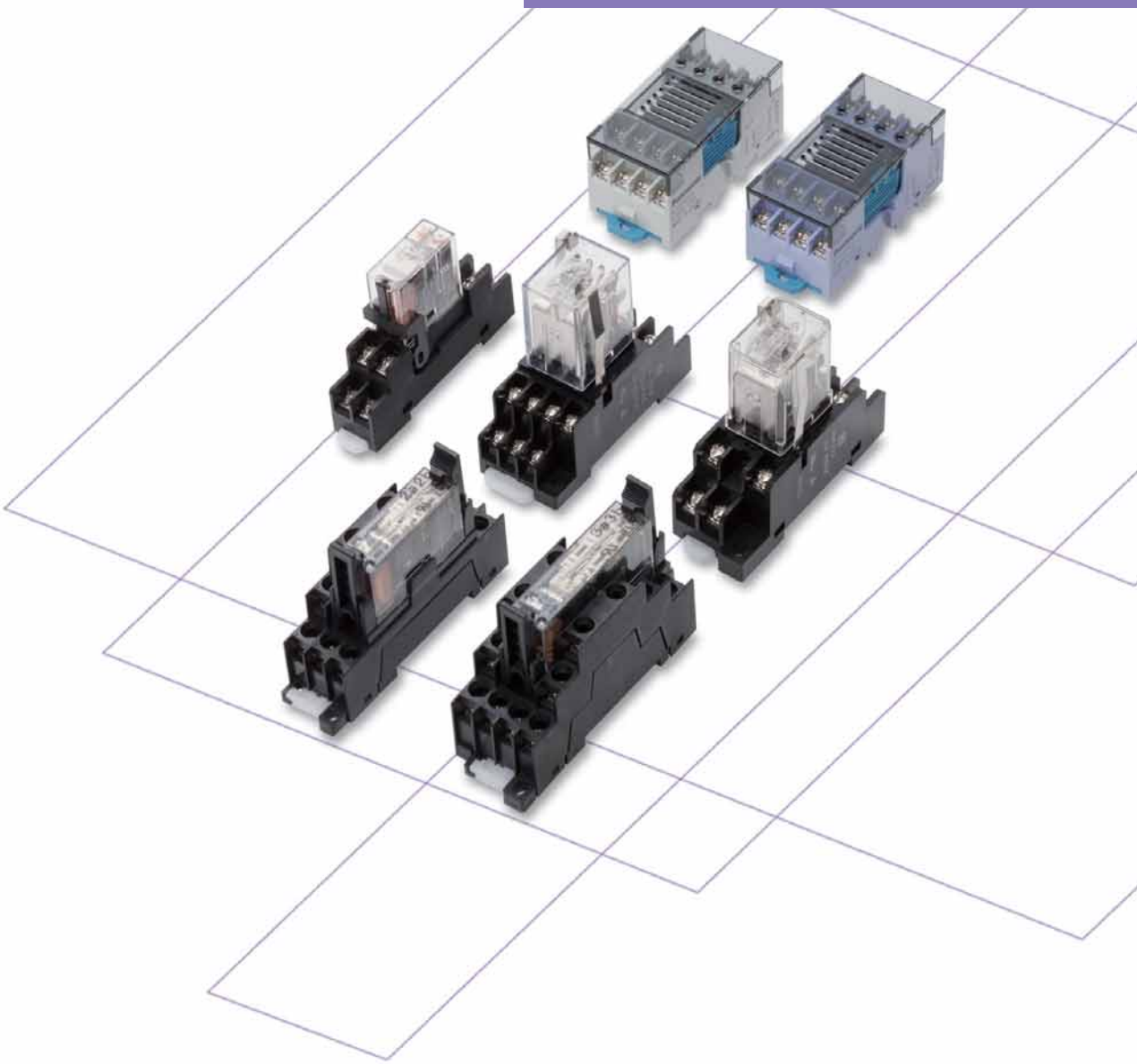
Panasonic
ideas for life

Automation Controls Group Catalog

Control Panel Relays
Safety Relays
Interface Terminal
2010-2011

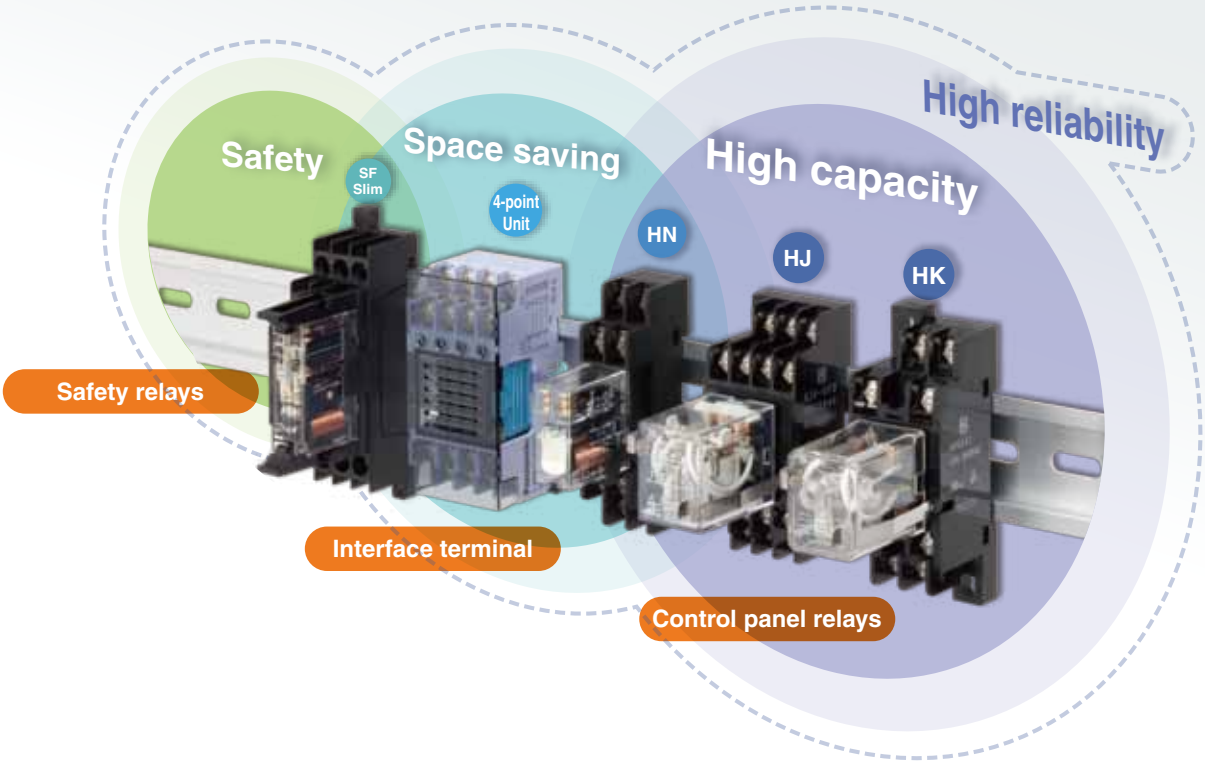
panasonic-electric-works.net/ac



Panasonic Electric Works

TABLE OF CONTENTS

Choose From a Broad Lineup
Panasonic Electric Works Relays



Control panel relays

High reliability, high capacity

Control panel relays

HJ Relay
- Standard type
- Economical price

Standard

HK Relay
- Best for power loading
- 1 pole 15 A/2 pole 10 A

Power

HN Relay
- Slim 17.5 mm width (terminal socket)
- Gold-plated high reliability (2 pole)

Slim

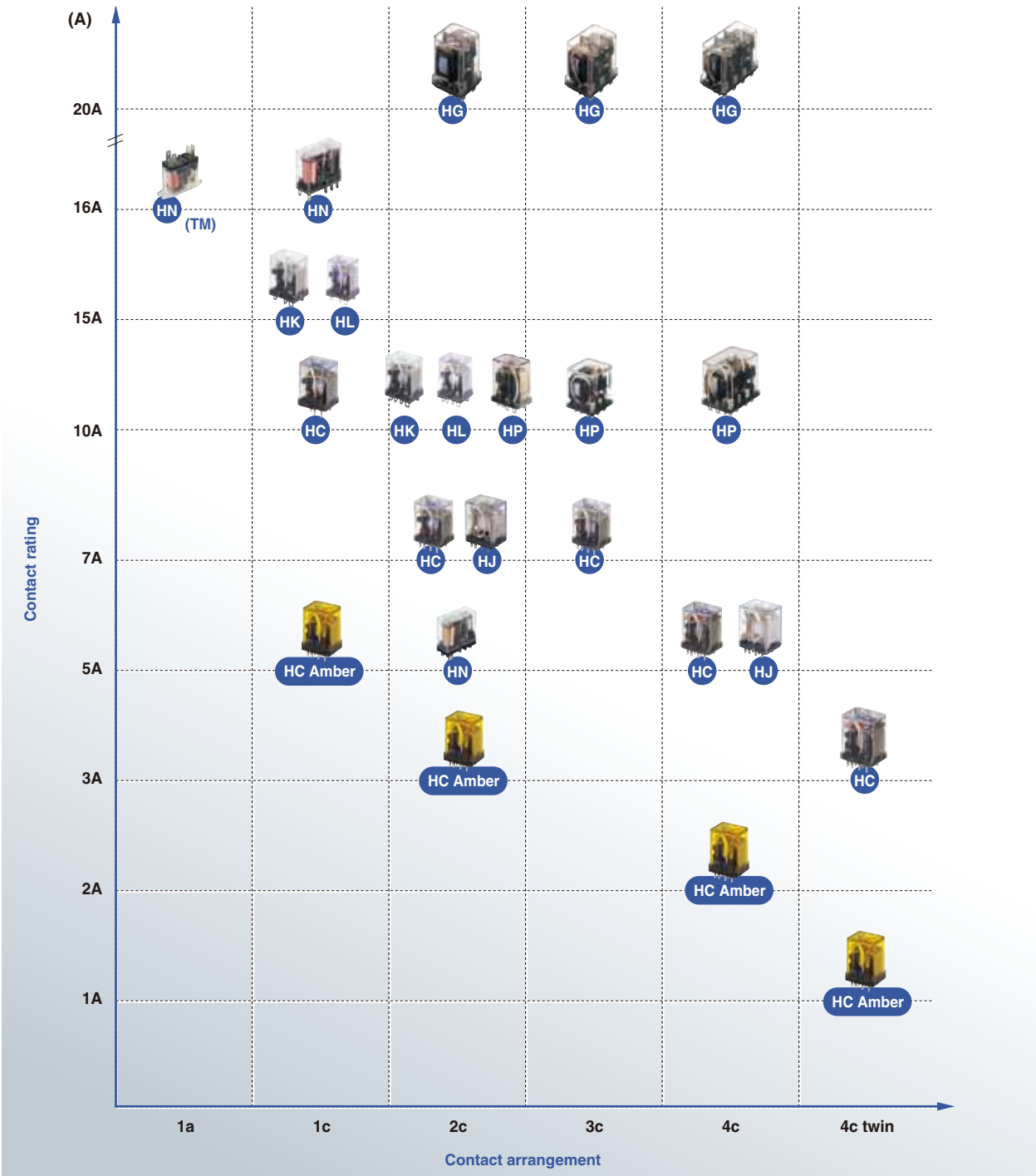
For customers looking for other relays such as high capacity power relays

HE

NC

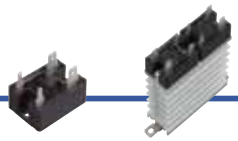
Further information is available in the power relay (Over 2 A) group catalog or website.

Control panel relay lineup



For customers looking for SSRs

AQ-J



Further information is available in the SSR group catalog or website.

SF Relay Slim Type

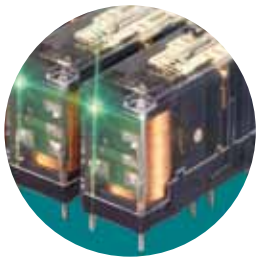
Complies with safety standards

Forcibly guided contact structure
(EN50205 classA TÜV recognized)

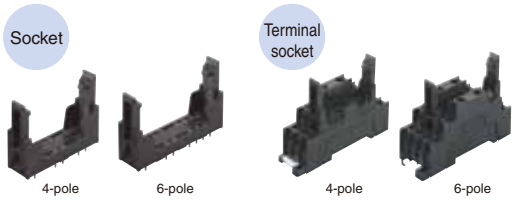
Fast response time is achieved.

8ms or less. Circuit is quickly opened to ensure safety.

Built-in LED indication type available



Socket and terminal socket are also available.

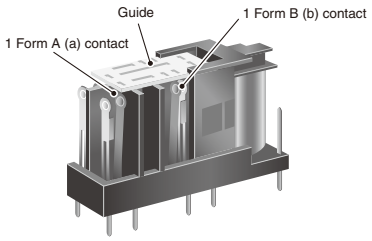


Forcibly guided contact structure

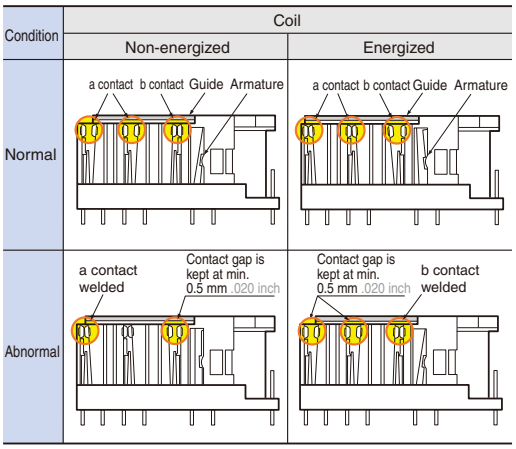
(EN50205 classA TÜV recognized)

Equipped with forcibly guided contact structure that enables detection of contact welding and construction of safety circuit.

- Designed so that contacts 1 Form A (a) and 1 Form B (b) will not close at the same time.
- Designed with at least 0.5 mm space between contacts.



Example –4a2b type–



Other contact gaps when contacts are welded

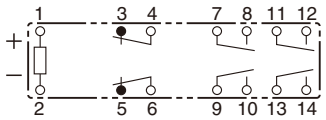
		State of other contacts					
		3-4 (b contact)	5-6 (b contact)	7-8 (a contact)	9-10 (a contact)	11-12 (a contact)	13-14 (a contact)
Welded contact No.	3-4 (b contact)	–		>0.5	>0.5	>0.5	>0.5
	5-6 (b contact)		–	>0.5	>0.5	>0.5	>0.5
	7-8 (a contact)	>0.5	>0.5	–			
	9-10 (a contact)	>0.5	>0.5		–		
	11-12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

>0.5: contact gap is kept at min. 0.5 mm .020 inch
Empty cells: either ON or OFF –: welded contact

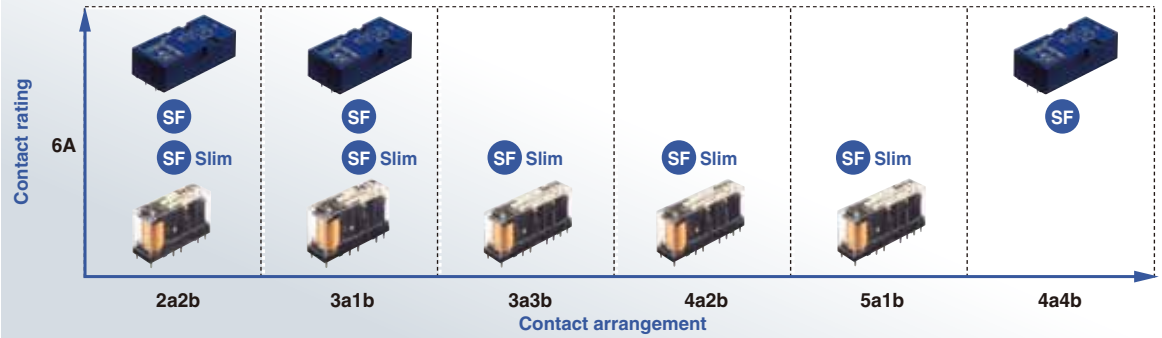
Note: The table above shows the state of the other contacts.
In case of form a contact weld the coil applied voltage is "Non-energized".
In case of form b contact weld the coil applied voltage is nominal (energized).

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.

Schematic
(BOTTOM VIEW)
Standard



Lineup of safety relay



4-point Unit Relay

Slim
Space-saving
Easy

Save space in control panels

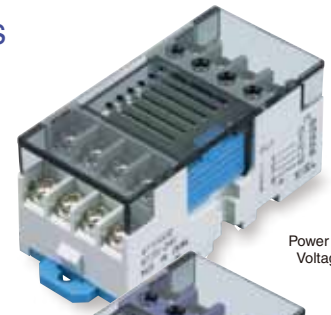
33 mm width with 4 point output
Ideal for compact control panels

Reduce maintenance burden

Power PhotoMOS relay type has
long life and no maintenance
Easy inspection with LED operation lamp

Save time when wiring

3a1b and 2a2b circuit makeup is easy when using b contact type power PhotoMOS relay. Convenient short circuit board available for common line.



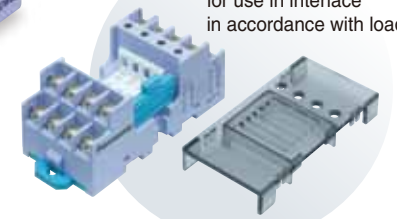
PA Relay/
Power PhotoMOS Relay
Voltage sensitive type

Power PhotoMOS Relay
type

Without relay

4-point Terminal

Possible to select relay
for use in interface
in accordance with load.



	4-point Unit Relay		4-point Terminal	
	Power PhotoMOS Relay type	**PA Relay/ Power PhotoMOS Relay Voltage sensitive type**	**Power PhotoMOS Relay type**	**PA Relay/ Power PhotoMOS Relay Voltage sensitive type**
			NEW 	
Possible relays	Power PhotoMOS Relay 	PA Relay/ Power PhotoMOS Relay Voltage sensitive 	Choose from 9 types of power PhotoMOS relays.	Choose between PA relay (APA331*) or voltage sensitive type Power PhotoMOS Relay (AQZ***D).

Output of 16 points or more

Relay Terminal/Connector Terminal

RT-2 Relay Terminal	RT-1 PC Relay Terminal/RT-1 PC Terminal	CT-2 Connector Terminal
16 points pressure connector contact, DIN rail mounting type*1	**16 points S type connector*2**	**20 pole pressure connector contact, DIN rail mounting type*3**
		

*1 Wire-direct and direct mounting types are also available. *2 2, 4, 8 points and M types are also available. *3 Wire-direct type is also available.

Guide for our Automation Controls Website

Front page of the Automation Controls Website

Access the FAQ section 24 hours a day and send inquiries by email.

Check discontinued products.

Check on RoHS compliance of automation control products by conducting a search or via a quick reference chart and environmental activities.

Technology Information: Introduces our microscopic processing technology and our advanced products.

Current as of March, 2010

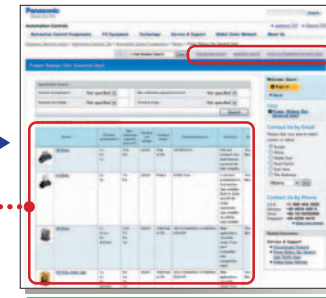
Product pages

Each product category has a dedicated front page with a variety of available search functions.

Power Relay Top Page

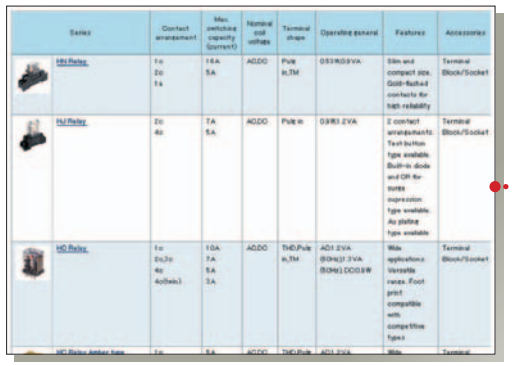
Automation Controls TOP

Relays TOP

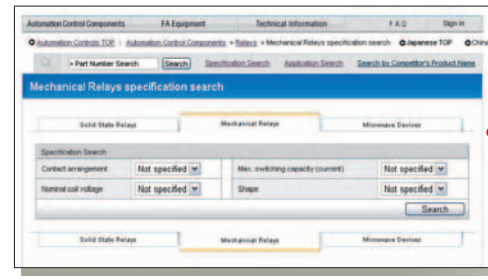


Power Relays (for General Use) TOP

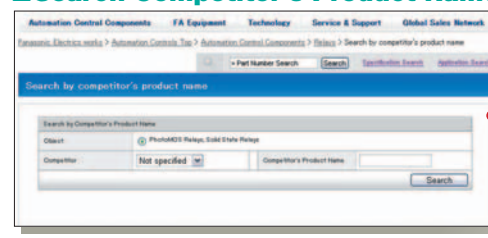
■Product list



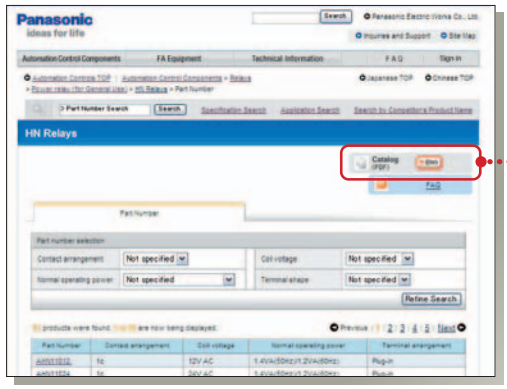
■Specification Search



■Search Competitor's Product Name



■Product Page



■Application Search

PDF catalogs and CAD data can be downloaded*.

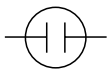
*Registration is required to download CAD data.

CONTROL PANEL RELAY CATEGORIES

Type	Product name	Features
Standard relay	 Standard type HJ relay  Standard type HC relay	Standard relays with international compatibility Rich selection includes LED indicator type, relays for PC boards, and TM types. A rich variety of connecting parts is also available, such as DIN terminal sockets, ordinary terminal sockets, and sockets.
Sealed type Amber sealed type	 Amber sealed type HC relay	Sealed structure relays High reliability ensured in challenging environments. Recommended for conditions where corrosive gas or excessive dust are present. Also good for low level load and safety circuits.
Surge absorbing type	 HJ relay with diode type  HJ relay with CR circuit type	Absorbs surge current at coil-off operation. DC type with diode and AC type with CR circuit As well as protecting relay driver circuits, noise is suppressed.
High capacity switching relay	 HK (AHK) relay  HL relay  HP relay  HG relay	General-purpose relays for high capacity switching
Keep relay	 HC keep relay	Latching types that maintain the operating state Good for memory circuits and for nominal operating power saving.
Compact type	 HN relay	Relays to help reduce the size of PC boards and control panels

• LED or lamp lights when the relay operates.
• HC keep relay mechanically indicates operating state.
• Inspection and detection of trouble is easy.

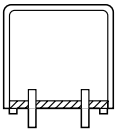
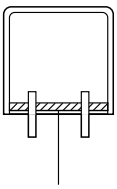
HC relay
With LED indicator

Type		Description	Target products
Operating indication	With LED indicator	 LED lights when relay is operating.	HN (AHN) relay, HJ relay, HC relay, HL relay, HK (AHK) relay, HP relay
	With neon lamp indicator	 Neon lamp lights when relay is operating.	HP relay
	With mechanical indicator	Geared to armature motion, mechanical signal changes position to indicate operation.	HC keep relay

HC relay
4-pole bifurcated (twin) contact

Type	Description	Target products
Single contact	 Suitable for high capacity switching	HN (AHN) relay, HJ relay, HC relay, HL relay, HK (AHK) relay, HP relay, HG relay
Bifurcated (twin) contact	 Highly reliable bifurcated (twin) contact structure Suitable for low load circuits	HC relay 4-pole bifurcated (twin) contact, HC relay amber sealed type 4-pole bifurcated (twin) contact

HC relay
Amber sealed type

Type	Description	Target products
Dust cover type 	For dust protection, comes with plastic case or other enclosure. Suitable for use in normal environments and for high capacity switching	HN (AHN) relay, HJ relay, HC relay, HL relay, HK (AHK) relay, HP relay, HG relay
Sealed type (Amber sealed type)  Sealing resin	Sealed construction with terminals, case and base sealed shut with sealing resin. High reliability ensured in severe environmental conditions, such as corrosive gas or excessive dust. Suitable for low load circuits and safety circuits	Amber sealed type HC relay

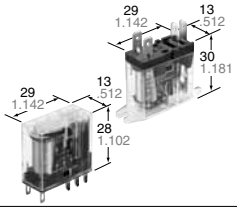
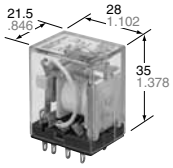
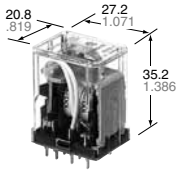
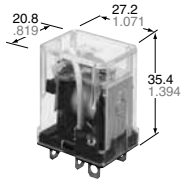
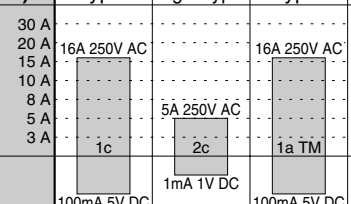
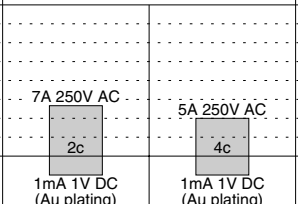
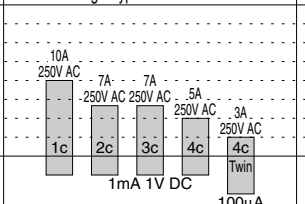
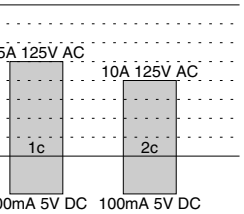
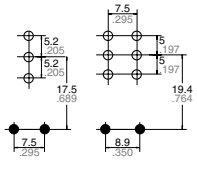
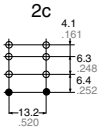
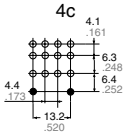
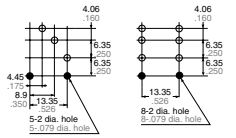
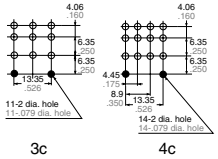
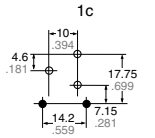
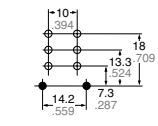
Control Panel Relay Selector Chart

Product name	Contact arrangement	Plug-in type with LED	PC board type with LED	Top mounting type TM type	CR or Diode	Bifurcated (Twin) contact	Au contact	With a test button	Finger protect type terminal socket	PC board terminal socket
HN relay (AHN)	1 Form A			A						
	1 Form C	A			A				A	A
	2 Form C	A			A		Au flash		A	A
HJ relay	2 Form C	A		∗	A		Au plating	A	A	A
	4 Form C	A		∗	A		Au plating	A	A	A
HC relay	1 Form C	A	A	A	A		Au flash			A
	2 Form C	A	A	A	A		Au flash			A
	3 Form C	A	A	A	A		Au flash			A
	4 Form C	A	A	A	A	A	Au clad			A
HK relay (AHK)	1 Form C	A		∗	A				A	A
	2 Form C	A		∗	A				A	A
HL relay	1 Form C	A	A	A						A
	2 Form C	A	A	A						A
HP relay	2 Form C	A		A						
	3 Form C	A		A						
	4 Form C	A								
HG relay	2 Form C									
	3 Form C									
	4 Form C									

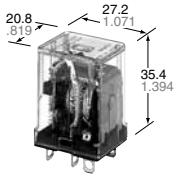
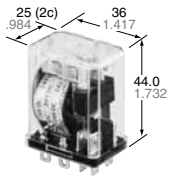
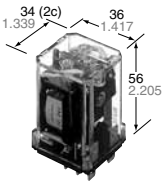
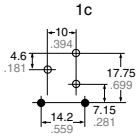
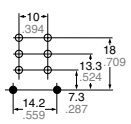
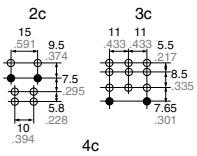
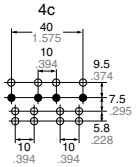
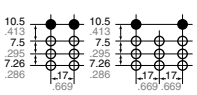
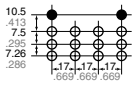
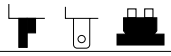
A: Available ∗: Please contact us.

Relay Selector Chart

Order of products: Max. contact rating (small to large)

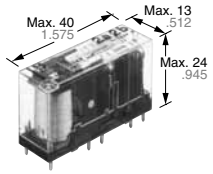
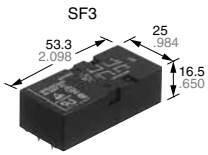
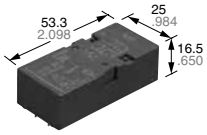
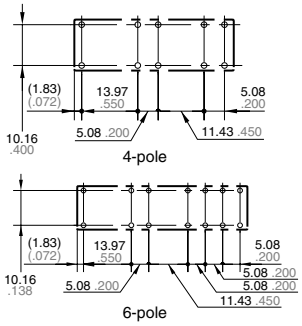
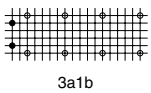
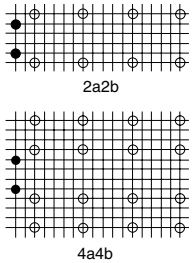
• Products	Control Panel Relays			
	HN RELAY (AHN)	**HJ RELAY**	**HC RELAY**	**HK RELAY (AHK)**
• Type of relay mm inch				
• Features	• Relay for control panel of 1c 10A, 2c 5A and 1a 16A	• Relay for control panel of 2c 7A and 4c 5A	• Relay for control panel of 1A to 10A (1c/2c/3c/4c)	• Relay for control panel of 1c 15A, and 2c 10A
• Sealed types availability	—	—	●	—
• Latching types availability	—	—	(Keep)	—
• Contact material (Optional material)	$AgSnO_2$ type / Au flashed AgNi type / $AgSnO_2$ type	Ag	1c, 2c, 3c: Au flashed Ag alloy (Cadmium free) 4c: Au clad AgNi type	$AgSnO_2$ type
• Contact rating chart Maximum (cos φ = 1) 30 A / 20 A / 15 A / 10 A / 8 A / 5 A / 3 A				
Minimum (For Reference)	100mA 5V DC / 1mA 1V DC / 100mA 5V DC	1mA 1V DC (Au plating) / 1mA 1V DC (Au plating)	1mA 1V DC / 100µA 1V DC	100mA 5V DC / 100mA 5V DC
• Max. switching voltage	250V AC, 30V DC	250V AC	250V AC	125V DC, 250V AC
• Contact arrangement	1c, 2c, 1a (TM type)	2c, 4c	1c, 2c, 3c, 4c, 4c twin	1c, 2c
• Life (Min. operation) — Electrical	10^5	10^5	2×10^5 (1c, 2c, 4c) 10^5 (3c)	2×10^5 (1c) 5×10^5 (2c)
• Life (Min. operation) — Mechanical	(DC) 2×10^7 (AC) 10^7	2×10^7	(DC) 10^8 (AC) 5×10^7	(DC) 10^8 (AC) 5×10^7
• Breakdown voltage — Between open contacts	1,000Vrms	1,000Vrms	700Vrms	1,000Vrms
• Breakdown voltage — Between contacts sets	3,000Vrms (2c)	2,000Vrms	700Vrms	2,000Vrms
• Breakdown voltage — Between contacts and coil	5,000Vrms	2,000Vrms	2,000Vrms	2,000Vrms
• Breakdown voltage — Between live parts and ground	—	—	—	—
• Surge withstand voltage	—	—	—	—
• Coil voltage	(AC) 12, 24, 100/110, 200/220V (DC) 5, 6, 12, 24, 48, 100, 110V	(AC) 12, 24, 48, 100/110, 200/220V (DC) 12, 24, 48, 100/110V	(AC) 6, 12, 24, 48, 100/110, 110/120, 200/220, 220/240V (DC) 6, 12, 24, 48 100/110V	(AC) 12, 24, 48, 100/110, 110/120, 200/220, 220/240V (DC) 6, 12, 24, 48 100/110V
• Nominal operating power	(AC) 1.2 to 1.4VA (DC) 0.53W	(AC) 1.2 to 1.3VA (DC) 0.9W	(AC) 1.2 to 1.3VA (DC) 0.9 to 1.1W	(AC) 1.2 to 1.3VA (DC) 0.9W
• Terminal layout (Bottom View) •: coil terminal (.100 inch grid) mm inch	Plug-in type 	Plug-in type 2c  4c 	 	 
• Standards	UL/C-UL, VDE (TM type is pending)	UL, C-UL, TÜV	UL, CSA, VDE (1c, 2c, 4c single only)	UL, C-UL, TÜV
• Mounting method				
• Page	47	57	69	94

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

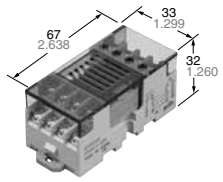
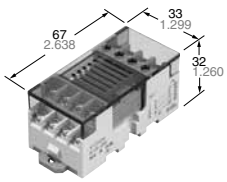
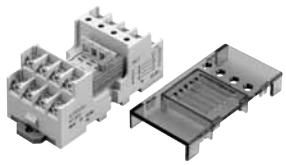
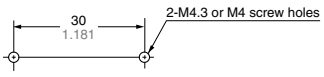
• Products		Control Panel Relays		
		HL RELAY	HP RELAY	HG RELAY
• Type of relay mm inch				
• Features		• Relay for control panel of 1c 15A, and 2c 10A	• Relay for control panel of 10A (2c/3c/4c)	• Relay for control panel of 20A (2c/3c/4c)
• Sealed types availability		—	—	—
• Latching types availability		—	—	—
• Contact material (Optional material)		$AgSnO_2$ type	2c, 3c: Ag 4c: Ag alloy (Cadmium-free)	$AgSnO_2$ type
• Contact rating chart Maximum (cos φ = 1)		30 A 20 A 15 A 10 A 8 A 5 A 3 A 10A MAX. 250V AC 15A MAX. 125V AC 10A MAX. 250V AC	10A MAX. 250V AC	20A MAX. 250V AC
Minimum (For Reference)		100mA 5V DC 100mA 5V DC	100mA 5V DC	100mA 5V DC
• Max. switching voltage		30V DC, 250V AC	—	—
• Contact arrangement		1c, 2c	2c, 3c, 4c	2c, 3c, 4c
• Life (Min. operation)	Electrical	5×10^5	2×10^5	2×10^5
	Mechanical	(DC) 10^8 (AC) 5×10^7	10^7	(DC) 10^6 (AC) 10^7
• Breakdown voltage	Between open contacts	1,000Vrms	(2c, 4c) 1,000Vrms (3c) 2,000Vrms	2,000Vrms
	Between contacts sets	1,500Vrms	(2c, 4c) 1,500Vrms (3c) 2,000Vrms	2,000Vrms
	Between contacts and coil	2,000Vrms	(2c,4c) 1,500Vrms (3c) 2,000Vrms	2,000Vrms
	Between live parts and ground	—	—	—
• Surge withstand voltage		—	—	—
• Coil voltage		(AC) 6, 12, 24, 48, 100/110, 110/120, 200/220, 240V (DC) 6, 12, 24, 48 100/110V	(AC) 24, 48, 100, 115, 200, 220, 240V (DC) 12, 24, 48, 100, 110V	(AC) 24, 48, 100, 115, 200, 220, 240V (DC) 12, 24, 48, 100, 110, 200V
• Nominal operating power		(AC) 1.2 to 1.3VA (DC) 0.9W	(2c) Approx. 2.0VA (AC) Approx. 1.5W (DC) (3c) Approx. 3.1VA (AC) Approx. 1.5W (DC) (4c) Approx. 4.8VA (AC) Approx. 1.5W (DC)	(2c) Approx. 3.6VA (AC) Approx. 1.4W (DC) (3c) Approx. 5.2VA (AC) Approx. 1.6W (DC) (4c) Approx. 7.6VA (AC) Approx. 2.0W (DC)
• Terminal layout (Bottom View) •: coil terminal (.100 inch grid) mm inch		1c  2c 	Plug-in terminal type 2c 3c  4c 	Plug-in type  2c 3c 4c 
• Standards		UL, CSA	UL, CSA (With operation indication type is excluded)	UL, CSA
• Mounting method				
• Page		102	110	121

Note: Meaning of symbol marks : PC board terminal; :Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

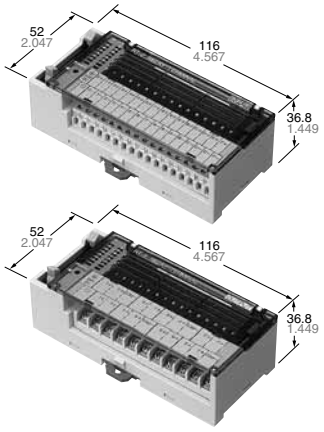
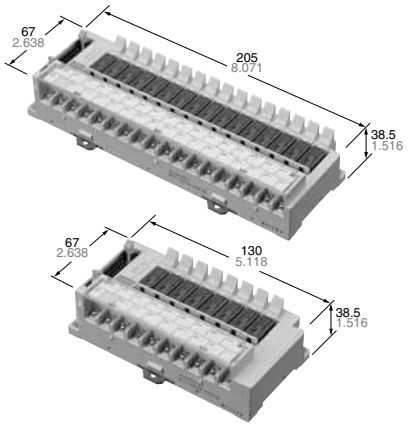
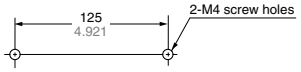
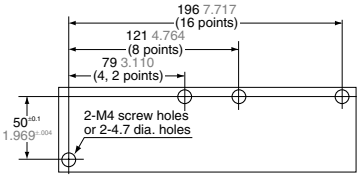
Relay Selector Chart

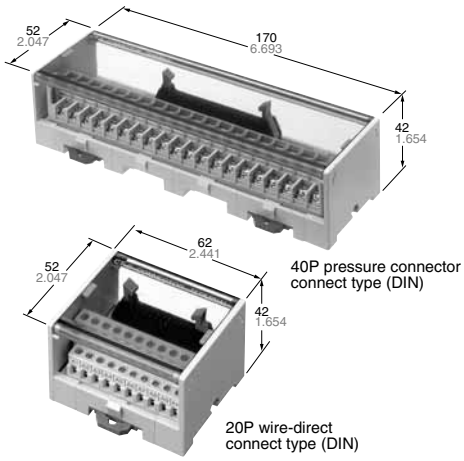
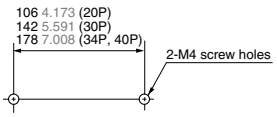
• Products		Safety Relays		
		SF RELAY Slim type	SF RELAY	SF RELAY Double Contact Type
• Type of relay mm inch				
• Features		• Slim type safety relays	• Flat type safety relays	• Flat type safety relays (double contact)
• Sealed types availability		—	●	●
• Latching types availability		—	—	—
• Contact material (Optional material)		Au flashed $AgSnO_2$ type	$AgSnO_2$ type + Au flashed	$AgSnO_2$ type + Au flashed
• Contact rating chart Maximum (cos φ = 1)		30 A 20 A 15 A 10 A 8 A 5 A 3 A 6A 250V AC 6A 30V DC	6A 250V AC 6A 30V DC	6A 250V AC 6A 30V DC
Minimum (For Reference)		1mA 5V DC	100mA 5V DC	100mA 5V DC
• Max. switching voltage		30V DC, 250V AC	30V DC, 250V AC	440V AC, 30V DC
• Contact arrangement		2a2b, 3a1b (4-pole) 4a2b, 5a1b, 3a3b (6-pole)	3a1b	2a2b, 4a4b
• Life (Min. operation)	Electrical	10^5	3×10^4	10^5
	Mechanical	10^7	10^7	10^7
• Breakdown voltage	Between open contacts	1,500Vrms	2,500Vrms	1,300Vrms
	Between contacts sets	2,500Vrms, 4,000Vrms	2,500Vrms	2,500Vrms
	Between contacts and coil	4,000Vrms	2,500Vrms	2,500Vrms
	Between live parts and ground	—	—	—
• Surge withstand voltage		—	—	—
• Coil voltage		(DC) 12, 24, 48V	(DC) 5, 12, 24, 48, 60V	(DC) 5, 12, 24, 48, 60V
• Nominal operating power		360mW (4-pole) 500mW (6-pole)	500mW	500mW
• Terminal layout (Bottom View) •: coil terminal (.100 inch grid) mm inch				
• Standards		UL/C-UL, TÜV	UL, CSA, TÜV, SEV	UL, CSA, TÜV, SEV
• Mounting method				
• Page		130	138	142

Note: Meaning of symbol marks : PC board terminal; :Plug-in; : Top-mounting; : Top-mounting with PC board terminals; : Surface-mounting

• Products		Interface Terminal						
		RT-3 UNIT RELAY (Power PhotoMOS type)		RT-3 UNIT RELAY (PA Relay type)		4 point terminal		
• Types mm inch								
• Features		• Slim, Space-saving, 4-point Unit Relay		• Slim, Space-saving, 4-point Unit Relay		• Possible to select relay for use in interface in accordance with load [Possible relays: PA relay and Power PhotoMOS (voltage sensitive type)]		
• I/O points		4 points		4 points		4 points		
• Contact rating		**Recommended voltage**	AQZ102 type: 0 to 30V DC AQZ204 type: 0 to 200V DC, 0 to 125V AC	**Rated control capacity (resistive load)**	3A 250V AC 3A 30V DC	PA relay	**Rated control capacity (resistive load)**	3A 250V AC, 3A 30V DC
		Continuous load current	AQZ102 type: 2A (DC) AQZ204 type: 0.3A (DC, AC peak value)			PhotoMOS	**Continuous load current**	AQZ102D type: 1.8A, AQZ202D type: 1.35A AQZ105D type: 1.15A, AQZ205D type: 0.9A AQZ107D type: 0.55A, AQZ207D type: 0.45A AQZ104D type: 0.3A, AQZ204D type: 0.225A
		Peak load current (100ms 1shot)	AQZ102 type: 9A AQZ204 type: 1.5A	**Min. switching capacity (ref. value)**	100mV 100μA	PhotoMOS	**Peak load current (100ms 1shot)**	AQZ102D type: 9A, AQZ202D type: 9A AQZ105D type: 6A, AQZ205D type: 6A AQZ107D type: 3A, AQZ207D type: 3A AQZ104D type: 1.5A, AQZ204D type: 1.5A
• Life (Min. operation)	**Mechanical**	—		2×10^7		**PA relay**		2×10^7
						PhotoMOS		—
	Electrical (resistive load)	—		3A 250V AC : 3×10^4 3A 30V DC : 3×10^4 2A 250V AC : 10^5 2A 30V DC : 10^5		**PA relay**		3A 250V AC, 3A 30V DC: 3×10^4 2A 250V AC, 2A 30V DC: 10^5
						PhotoMOS		—
• Rated input voltage		12, 24V DC		12, 24V DC		12, 24V DC		
• Break-down voltage	**Between input and output**	2,000Vrms for 1 min.		2,000Vrms for 1 min.		2,000Vrms for 1 min.		
	Between different terminals (between relays, both ways)	1,500Vrms for 1 min.		1,500Vrms for 1 min.		1,500Vrms for 1 min.		
	Between contacts	**Max. load voltage**	AQZ102 type: 60V (DC) AQZ204 type: 400V (DC, AC peak value)	1,000Vrms for 1 min.		PA relay		1,000Vrms for 1 min.
						PhotoMOS		AQZ102D type: 60V (DC) AQZ202D type: 60V (AC/DC) AQZ105D type: 100V (DC) AQZ205D type: 100V (AC/DC) AQZ107D type: 200V (DC) AQZ207D type: 200V (AC/DC) AQZ104D type: 400V (DC) AQZ204D type: 400V (AC/DC)
• Ambient temperature		–20°C to +55°C –4°F to +131°F		–20°C to +55°C –4°F to +131°F		–20°C to +55°C –4°F to +131°F		
• Terminal layout (Bottom View) mm inch								
• Option		Power PhotoMOS Relays internal varister type, Power PhotoMOS Relays 1b type, short circuit plate		Power PhotoMOS Relays voltage sensitive type, short circuit plate		PA Relay, Power PhotoMOS Relays voltage sensitive type, short circuit plate		
• Page		148		151		148, 151		

Relay Selector Chart

• Products		Interface Terminal			
		RT-2 RELAY TERMINAL		RT-1 PC RELAY TERMINAL RT-1 PC TERMINAL	
• Types mm inch					
• Features		• Palm-sized, 16-channel Relay Terminals		• Wide variation relay terminal	
• I/O type		Input device	Output device	Input device	Output device
• I/O points		16 points	16 points	16, 8, 4 points	16, 8, 4, 2 points
• Rating	Nominal switching capacity (resistive)	2A 250V AC, 2A 30V DC		5A 250V AC, 5A 30V DC	
	Min. switching capacity (ref. value)	100mV 100μA		100mV 100μA	
• Expected life (Min. operation)	Mechanical	2×10^7		10^6	
	Electrical (resistive load)	1A 250V AC: 3×10^5 2A 250V AC: 10^5	1A 30V DC: 3×10^5 2A 30V DC: 10^5	5A 250V AC: 10^5	5A 30V DC: 10^5
• Rated input voltage		12, 24V DC		12, 24V DC	
• Break-down voltage	Between connector terminals	2,000Vrms for 1 min. (excluding battery)		2,000Vrms for 1 min. (excluding battery)	
	Between unlike poles on the terminals	1,500Vrms for 1 min.		1,500Vrms for 1 min.	
	Between connector unlike poles (for input)	—	—	250Vrms for 1 min.	
	Between like poles on the terminals (for output)	—	1,000Vrms for 1 min.	1,000Vrms for 1 min.	
• Ambient temperature		0°C to +55°C +32°F to +131°F		0°C to +55°C +32°F to +131°F	
• Terminal layout (Bottom View) mm inch		 DIN rail mounting type and direct mounting type		 2 way type of DIN rail mounting and direct mounting are available	
• Option		Power PhotoMOS Relays voltage sensitive type, various cables		AQ-C Solid State Relays, jumper relay, short circuit plate, various cables	
• Page		156		164	

• Products	Interface Terminal **CT-2 CONNECTOR TERMINAL**
• Types mm inch	
• Features	• Connector terminal for PLCs, PCs and various controllers
• No. of poles	20P, 30P, 34P, 40P
• Rated voltage	125V AC
• Rated current	1A
• Breakdown voltage	250Vrms for 1 min.
• Insulation resistance	100MΩ (at 500V DC megger)
• Fasten torque	Pressure connector connect type: 0.3 to 0.5 N·m {3 to 5 kgf·cm} Wire-direct connect type: 0.2 to 0.4 N·m {2 to 4 kgf·cm}
• Ambient temperature	0°C to +55°C +32°F to +131°F
• Terminal layout (Bottom View) mm inch	 Direct mounting type DIN rail mounting, and direct mounting type available
• Option	Various cables
• Page	182

CONFIGURATION AND CONSTRUCTION

PROTECTIVE CONSTRUCTION

1. Dust Cover Type
To protect from dust, these types are covered, for example, with a plastic case. We recommend hand soldering, because these relays are not constructed to prevent flux and cleaning fluid from entering during automatic soldering.

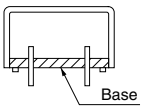
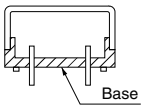
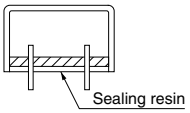
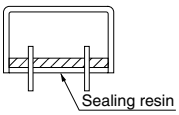
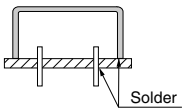
2. Flux-Resistant Type
The relay is constructed so that flux will not enter inside the relay during automatic soldering. However, cleaning is not possible.

3. Sealed Type
Construction is designed to prevent seeping of flux when soldering and cleaning fluid when cleaning. Harmful substances on the contacts are removed by gas purging before sealing with.

4. Sealed capsule type
This type is hermetically sealed with ceramic and metal plating. No harmful gas or humidity will ever reach the contacts. This type cannot be washed.

CONSTRUCTION AND CHARACTERISTIC

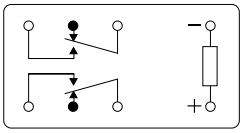
(○: Yes, ×: No, △: Care)

Type	Construction	Characteristics	Automatic Soldering	Automatic Cleaning	Dust Resistance	Harmful Gas Resistance
Dust Cover Type		Most basic construction where the case and base (or body) are fitted together.	△	×	△	×
Flux-Resistant Type		Terminals are sealed or molded simultaneously. The joint between the case and base is higher than the surface of the PC board.	○	×	△	×
		Terminals, case, and base are filled with sealing resin.	○	×	△	×
Sealed Type		Sealed construction with terminals, case and base sealed shut with sealing resin.	○	○	○	○*
Sealed capsule type (EP and EV relays only)		Hermetically sealed construction by sealing the metal case and plate, and the terminal and ceramic part, with solder.	×	×	○	○

*Since the plastic breathes, please do not use in an atmosphere that contains silicon.

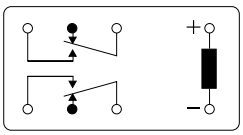
OPERATIONAL FUNCTION

1. Single Side Stable Type
Relay which turns on when the coil is energized and turns off when de-energized.



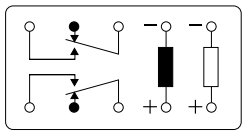
(Schematic example: DS relay)

2. 1 Coil Latching Type
Relay with latching construction that can maintain the on or off state with a pulse input. With one coil, the relay is set or reset by applying signals of opposite polarities.



(Schematic example: DS relay)

3. 2 Coil Latching Type
Relay with latching construction composed of 2 coils: set coil and reset coil. The relay is set or reset by alternately applying pulse signals of the same polarity. The HC latching (keep) relay also has the same function.

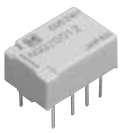
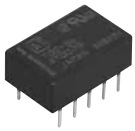
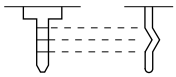


(Schematic example: DS relay)

4. Operation Indication
Indicates the set and reset states either electrically or mechanically for easy maintenance. An LED type (HC relay with LED), lamp type (HP relay with lamp), and a mechanical display type (HC latching (keep) relay) in which the display panel moves using the movement of the armature, are available.

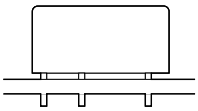
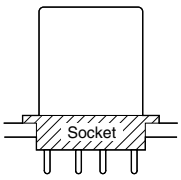
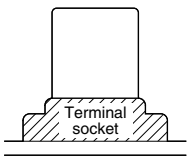
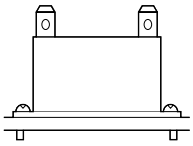
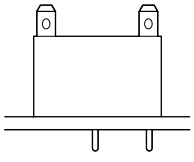
LED type
HC relay

TERMINAL CONFIGURATION

Type	PC board through hole terminal	PC board self-clinching terminal	Plug-in terminal	Quick connect terminal	Screw terminal
Typical relay					
Terminal configuration					
Typical relay type	GQ(AGQ), TX, DS relay	TQ, TX, TN relay	HJ, HN, HP relay	LF, JM relay	HE, EP relay

Note: A plug-in solder dual type (HG relay) is also available.

MOUNTING METHOD

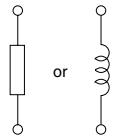
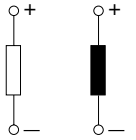
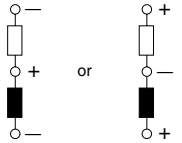
Type	Insertion mount	Socket mount	Terminal socket mount	TM type	TMP type
Mounting configuration					
Typical relay type	TQ, DS, S relay	NC, HC relay	HJ, HP, HG relay	HC, LF relay	LE, LF relay

Notes: 1. Sockets are available for certain PC board relays. (S relay, ST relay, etc.)
2. M type (solder type) for direct screw mounting of case is also available. (HG relay)

DEFINITION OF RELAY TERMINOLOGY

COIL (also referred to as primary or input)

1. Coil Designation

Single side stable type		1 coil latching type	2 coil latching type	
Non-polarized	Polarized		4-terminal	3-terminal
				

A black coil represents the energized state. For latching relays, schematic diagrams generally show the coil in its reset state. Therefore, the coil symbol is also shown for the reset coil in its reset state.

2. Nominal Coil Voltage (Rated Coil Voltage)
A single value (or narrow range) of source voltage intended by design to be applied to the coil or input.

3. Nominal Operating Current
The value of current flow in the coil when nominal voltage is impressed on the coil

4. Nominal Operating Power
The value of power used by the coil at nominal voltage. For DC coils expressed in watts; AC expressed as volt amperes. Nominal Power (W or VA) = Nominal Voltage × Nominal Current.

5. Coil Resistance
This is the DC resistance of the coil in DC type relays for the temperature conditions listed in the catalog. (Note that for certain types of relays, the DC resistance may be for temperatures other than the standard 20°C 68°F.)

6. Pick-Up Voltage (Pull-In Voltage or Must Operate Voltage)
As the voltage on an unoperated relay is increased, the value at or below which all contacts must function (transfer).

7. Drop-Out Voltage (Release or Must Release Voltage)
As the voltage on an operated relay is decreased, the value at or above which all contacts must revert to their unoperated position.

8. Maximum Applied Voltage
The maximum voltage that can be applied continuously to the coil without causing damage. Short duration spikes of a higher voltage may be tolerable, but this should not be assumed without first checking with the manufacturer.

CONTACTS (secondary or output)

1. Contact Forms
Denotes the contact mechanism and number of contacts in the contact circuit.

2. Contact Symbols

Form A contacts (normally open contacts)	
Form B contacts (normally closed contacts)	
Form C contacts (changeover contacts)	

Form A contacts are also called N.O. contacts or make contacts.
Form B contacts are also called N.C. contacts or break contacts.
Form C contacts are also called changeover contacts or transfer contacts.

3. MBB Contacts
Abbreviation for make-before-break contacts. Contact mechanism where Form A contacts (normally open contacts) close before Form B contacts open (normally closed contacts).

4. Rated Switching Power
The design value in watts (DC) or volt amperes (AC) which can safely be switched by the contacts. This value is the product of switching voltage x switching current, and will be lower than the maximum voltage and maximum current product.

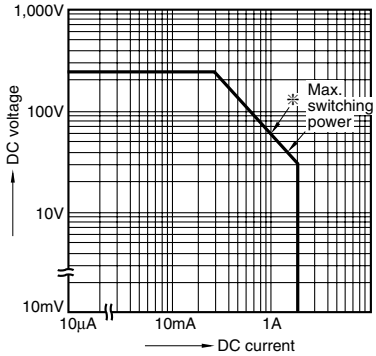
5. Maximum Switching Voltage
The maximum open circuit voltage which can safely be switched by the contacts. AC and DC voltage maximums will differ in most cases.

6. Maximum Switching Current
The maximum current which can safely be switched by the contacts. AC and DC current maximums may differ.

7. Maximum Switching Power
The upper limit of power which can be switched by the contacts. Care should be taken not to exceed this value.

8. Maximum Switching Capacity
This is listed in the data column for each type of relay as the maximum value of the contact capacity and is an interrelationship of the maximum switching power, maximum switching voltage, and maximum switching current. The switching current and switching voltage can be obtained from this graph. For example, if the switching voltage is fixed in a certain application, the maximum switching current can be obtained from the intersection between the voltage on the axis and the maximum switching power.

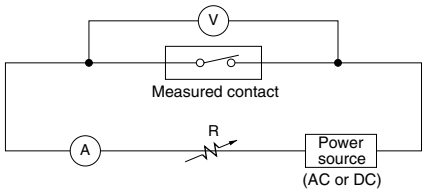
Maximum switching capacity



Example: Using TX relay at a switching voltage of 60V DC, the maximum switching current is 1A.
(*Maximum switching capacity is given for a resistive load. Be sure to carefully check the actual load before use.)

9. Minimum switching capability
This value is a guideline as to the lowest possible level at which it will be possible for a low level load to allow switching. The level of reliability of this value depends on switching frequency, ambient conditions, change in the desired contact resistance, and the absolute value. Please use a relay with AgPd contacts if your needs analog low level loads, control, or a contact resistance of 100 mΩ or less. We recommend that you verify with one of our sales offices regarding usage.

10. Contact Resistance
This value is the combined resistance of the resistance when the contacts are touching each other, the resistance of the terminals and contact spring. The contact resistance is measured using the voltage-drop method as shown below. The measuring currents are designated.



Ⓐ: Ammeter Ⓥ: Voltmeter Ⓡ: Variable resister

Test Currents

Rated Contact Current or Switching Current (A)	Test Current (mA)
Less than 0.01	1
0.01 or more and less than 0.1	10
0.1 or more and less than 1	100
1 or more	1,000

The resistance can be measured with reasonable accuracy on a YHP 4328A milliohmmeter.
In general, for relays with a contact rating of 1A or more, measure using the voltage-drop method at 1A 6V DC.

11. Maximum Carrying Current
The maximum current which after closing or prior to opening, the contacts can safely pass without being subject to temperature rise in excess of their design limit, or the design limit of other temperature sensitive components in the relay (coil, springs, insulation, etc.). This value is usually in excess of the maximum switching current.

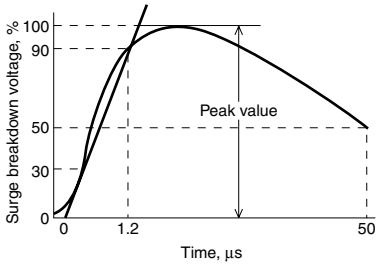
12. Capacitance
This value is measured between the terminals at 1kHz and 20°C 68°F.

ELECTRICAL PERFORMANCE

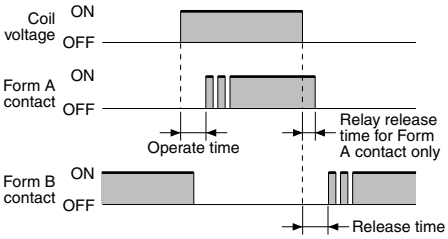
1. Insulation Resistance
The resistance value between all mutually isolated conducting sections of the relay, i.e. between coil and contacts, across open contacts and between coil or contacts to any core or frame at ground potential. This value is usually expressed as “initial insulation resistance” and may decrease with time, due to material degradation and the accumulation of contaminants.
- Between coil and contacts
- Between open contacts
- Between contact sets
- Between set coil and reset coil

2. Breakdown Voltage (Hi-Pot or Dielectric Strength)
The maximum voltage which can be tolerated by the relay without damage for a specified period of time, usually measured at the same points as insulation resistance. Usually the stated value is in VAC (RMS) for one minute duration.

3. Surge Breakdown Voltage
The ability of the device to withstand an abnormal externally produced power surge, as in a lightning strike, or other phenomenon. An impulse test waveform is usually specified, indicating rise time, peak value and fall time.



4. Operate Time (Set Time)
The elapsed time from the initial application of power to the coil, until the closure of the Form A (normally open) contacts. (With multiple pole devices the time until the last contact closes.) This time does not include any bounce time.



5. Release Time (Reset Time)
The elapsed time from the initial removal of coil power until the reclosure of the Form B (normally closed) contacts (last contact with multi-pole). This time does not include any bounce time.

6. Contact Bounce (Time)
Generally expressed in time (ms), this refers to the intermittent switching phenomenon of the contacts which occurs due to the collision between the movable metal parts or contacts, when the relay is operated or released.

MECHANICAL PERFORMANCE AND LIFE

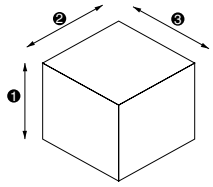
1. Shock Resistance

1) Functional

The acceleration which can be tolerated by the relay during service without causing the closed contacts to open for more than the specified time. (usually 10 μs)

2) Destructive

The acceleration which can be withstood by the relay during shipping or installation without it suffering damage, and without causing a change in its operating characteristics. Usually expressed in "G"s. However, test was performed a total of 18 times, six times each in three-axis directions.



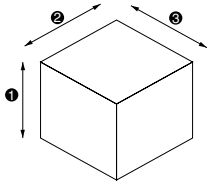
2. Vibration Resistance

1) Functional

The vibration which can be tolerated by the relay during service, without causing the closed contacts to open for more than the specified time.

2) Destructive

The vibration which can be withstood by the relay during shipping, installation or use without it suffering damage, and without causing a change in its operating characteristics. Expressed as an acceleration in G's or displacement, and frequency range. However, test was performed a total of six hours, two hours each in three-axis directions.



3. Mechanical Life

The minimum number of times the relay can be operated under nominal conditions (coil voltage, temperature, humidity, etc.) with no load on the contacts.

4. Electrical Life

The minimum number of times the relay can be operated under nominal conditions with a specific load being switched by the contacts.

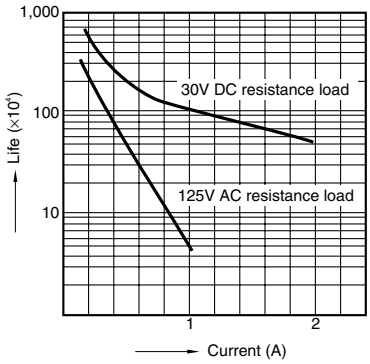
5. Maximum Switching Frequency

This refers to the maximum switching frequency which satisfies the mechanical life or electrical life under repeated operations by applying a pulse train at the rated voltage to the operating coil.

6. Life Curve

This is listed in the data column for each type of relay. The life (number of operations) can be estimated from the switching voltage and switching current. For example, for a DS relay operating at:
Switching voltage = 125V AC
Switching current = 0.6A
The life expectancy is 300,000 operations. However, this value is for a resistive load. Be sure to carefully check the actual load before use.

Life Curve



HIGH FREQUENCY CHARACTERISTICS

1. Isolation

High frequency signals leak through the stray capacitance across contacts even if the contacts are separated. This leak is called isolation. The symbol dB (decibel) is used to express the magnitude of the leak signal. This is expressed as the logarithm of the magnitude ratio of the signal generated by the leak with respect to the input signal. The larger the magnitude, the better the isolation.

2. Insertion Loss

At the high frequency region, signal disturbance occurs from self-induction, resistance, and dielectric loss as well as from reflection due to impedance mismatching in circuits. Loss due to any of these types of disturbances is called insertion loss. Therefore, this refers to the magnitude of loss of the input signal. The smaller the magnitude, the better the relay.

3. V.S.W.R. (Voltage Standing Wave Ratio)

High frequency resonance is generated from the interference between the input signal and reflected (wave) signal. V.S.W.R. refers to the ratio of the maximum value to minimum value of the waveform. The V.S.W.R. is 1 when there is no reflected wave. It usually becomes greater than 1.

Notes:

1. Except where otherwise specified, the tests above are conducted under standard temperature and humidity (15°C to 35°C 59°F to 95°F, 25 to 75%).
2. The coil impressed voltage in the switching tests is a rectangular wave at the rated voltage.
3. The phase of the AC load operation is random.

GENERAL APPLICATION GUIDELINES

A relay may encounter a variety of ambient conditions during actual use resulting in unexpected failure. Therefore, testing over a practical range under actual operating conditions is necessary. Application considerations should be reviewed and determined for proper use of the relay.

SAFETY PRECAUTIONS

• Use that exceeds the specification ranges such as the coil rating, contact rating and switching life should be absolutely avoided. Doing so may lead to abnormal heating, smoke, and fire.
• Never touch live parts when power is applied to the relay. Doing so may cause electrical shock. When installing, maintaining, or troubleshooting a relay (including connecting parts such as terminals and sockets) be sure that the power is turned off.
• When connecting terminals, please follow the internal connection diagrams in the catalog to ensure that connections are done correctly. Be warned that an incorrect connection may lead to unexpected operation error, abnormal heating, and fire.
• If the possibility exists that faulty adhesion or contact could endanger assets or human life, take double safety precautions and make sure that operation is foolproof.

[1] METHOD OF DETERMINING SPECIFICATIONS

In order to use the relays properly, the characteristics of the selected relay should be well known, and the conditions of use of the relay should be investigated to determine whether they are matched to the environmental conditions, and at the same time, the coil conditions, contact conditions, and the ambient conditions for the relay that is actually used must be sufficiently known in advance. In the table below, a summary has been made of the points of consideration for relay selection. It may be used as a reference for investigation of items and points of caution.

Specification item		Consideration points regarding selection
Coil	a) Rating b) Pick-up voltage/current c) Drop-out voltage/current d) Maximum applied voltage/ current e) Coil resistance f) Impedance g) Temperature rise	1) Select relay with consideration for power source ripple. 2) Give sufficient consideration to ambient temperature, for the coil temperature rise and hot start. 3) When used in conjunction with semiconductors, additional attention to the application should be taken. Be careful of voltage drops when starting up.
Contacts	a) Contact arrangement b) Contact rating c) Contact material d) Life e) Contact resistance	1) It is desirable to use a standard product with more than the required number of contacts. 2) It is beneficial to have the relay life balanced with the life of the device it is used in. 3) Is the contact material matched to the type of load? It is necessary to take care particularly with low level usage. 4) The rated life may become reduced when used at high temperatures. Life should be verified in the actual atmosphere used. 5) Depending on the circuit, the relay drive may synchronize with the AC load. As this will cause a drastic shortening of life should be verified with the actual machine.
Operate time	a) Operate time b) Release time c) Bounce time d) Switching frequency	1) It is beneficial to make the bounce time short for sound circuits and similar applications.
Mechanical characteristics	a) Vibration resistance b) Shock resistance c) Ambient temperature d) Life	1) Give consideration to performance under vibration and shock in the use location. 2) In particular, when used in high temperature applications, relay with class B or class F coil insulation may be required.
Other items	a) Breakdown voltage b) Mounting method c) Size d) Protective construction	1) Selection can be made for connection method with plug-in type, PC board type, soldering, tab terminals, and screw fastening type. 2) For use in an adverse atmosphere, sealed construction type should be selected. 3) When used in adverse environments, use the sealed type. 4) Are there any special conditions?

BASICS ON RELAY HANDLING

• To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
• Under normal use, the relay is designed so that the case will not detach. To maintain initial performance, the case should not be removed. Relay characteristics cannot be guaranteed if the case is removed.
• Use of the relay in an atmosphere at standard temperature and humidity with minimal amounts of dust, SO_2, H_2S, or organic gases is recommended.
For installation in adverse environments, one of the sealed types should be considered.
Please avoid the use of silicon-based resins near the relay, because doing so may result in contact failure. (This applies to plastic sealed type relays, too.)
• Care should be taken to observe correct coil polarity (+, –) for polarized relays.
• Proper usage requires that the rated voltage be impressed on the coil. Use rectangular waves for DC coils and sine waves for AC coils.
• Be sure the coil impressed voltage does not continuously exceed the maximum allowable voltage.
• The rated switching power and life are given only as guides. The physical phenomena at the contacts and contact life greatly vary depending on the type of load and the operating conditions. Therefore, be sure to carefully check the type of load and operating conditions before use.
• Do not exceed the usable ambient temperature values listed in the catalog.
• Use the flux-resistant type or sealed type if automatic soldering is to be used.
• Use alcohol based cleaning solvents when cleaning is to be performed using a sealed type relay. Avoid ultrasonic cleaning of all types of relays.
• As a guide, use a Faston mounting pressure of 40 to 70N {4 to 7kgf} for relays with tab terminals.
• Avoid bending terminals, because it may cause malfunction.
• For proper use, read the main text for details.

[2] PRECAUTIONS REGARDING COIL INPUT

Application of the rated voltage is the most basic requirement for accurate relay operation. Although the relay will work if the voltage applied exceeds the pick-up voltage, it is required that only the rated voltage be applied to the coil out of consideration for changes in coil resistance, etc., due to differences in power supply type, voltage fluctuations, and rises in temperature. Also, caution is required, because problems such as layer shorts and burnout in the coil may occur if the voltage applied exceeds the maximum that can be applied. The following section contains precautions regarding coil input. Please refer to it in order to avoid problems.

1. Basic Precautions Regarding Coil

• AC operation type

For the operation of AC relays, the power source is almost always a commercial frequency (50 or 60Hz) with standard voltages of 6, 12, 24, 48, 100, and 200V AC. Because of this, when the voltage is other than the standard voltage, the product is a special order item, and the factors of price, delivery, and stability of characteristics may create inconveniences. To the extent that it is possible, the standard voltages should be selected.
Also, in the AC type, shading coil resistance loss, magnetic circuit eddy current loss, and hysteresis loss exit, and because of lower coil efficiency, it is normal for the temperature rise to be greater than that for the DC type.
Furthermore, because humming occurs when below the pick-up voltage and when above the rated voltage, care is required with regard to power source voltage fluctuations.
For example, in the case of motor starting, if the power source voltage drops, and during the humming of the relay, if it reverts to the restored condition, the contacts suffer a burn damage and welding, with the occurrence of a false operation self-maintaining condition.
For the AC type, there is an inrush current during the operation time (for the separated condition of the armature, the impedance is low and a current greater than rated current flows; for the adhered condition of the armature, the impedance is high and the rated value of current flows), and because of this, for the case of several relays being used in parallel connection, it is necessary to give consideration to power consumption.

• DC operation type

For the operation of DC relays, standards exist for power source voltage and current, with DC voltage standards set at 5, 6, 12, 24, 48, and 100V, but with regard to current, the values as expressed in catalogs in milliamperes of pick-up current.
However, because this value of pick-up current is nothing more than a guarantee of just barely moving the armature, the variation in energizing voltage and resistance values, and the increase in coil resistance due to temperature rise, must be given consideration for the worst possible condition of relay operation, making it necessary to consider the current value as 1.5 to 2 times the pick-up current. Also, because of the extensive use of relays as limit devices in place of meters for both voltage and current, and because of the gradual increase or decrease of current impressed on the coil causing possible delay in movement of the contacts, there is the possibility that the designated control capacity may not be satisfied. Thus it is necessary to exercise care. The DC type relay coil resistance varies due to ambient temperature as well as to its own heat generation to the extent of about 0.4%/°C, and accordingly, if the temperature increases, because of the increase in pic k-up and drop-out voltages, care is required.
(However, for some polarized relays, this rate of change is considerably smaller.)

2. Power Source for Coil Input

• Energizing voltage of AC coil

In order to have stable operation of the relay, the energizing voltage should be basically within the range of +10%/-15% of the rated voltage. However, it is necessary that the waveform of the voltage impressed on the coil be a sine wave. There is no problem if the power source is commercially provided power, but when a stabilized AC power source is used, there is a waveform distortion due to that equipment, and there is the possibility of abnormal overheating. By means of a shading coil for the AC coil, humming is stopped, but with a distorted waveform, that function is not displayed. Fig. 1 below shows an example of waveform distortion.

If the power source for the relay operating circuit is connected to the same line as motors, solenoids, transformers, and other loads, when these loads operate, the line voltage drops, and because of this the relay contacts suffer the effect of vibration and subsequent burn damage. In particular, if a small type transformer is used and its capacity has no margin of safety, when there is long wiring, or in the case of household used or small sales shop use where the wiring is slender, it is necessary to take precautions because of the normal voltage fluctuations combined with these other factors. When trouble develops, a survey of the voltage situation should be made using a synchroscope or similar means, and the necessary counter-measures should be taken, and together with this determine whether a special relay with suitable excitation characteristics should be used, or make a change in the DC circuit as shown in Fig. 2 in which a capacitor is inserted to absorb the voltage fluctuations.

In particular, when a magnetic switch is being used, because the load becomes like that of a motor, depending upon the application, separation of the operating circuit and power circuit should be tried and investigated.

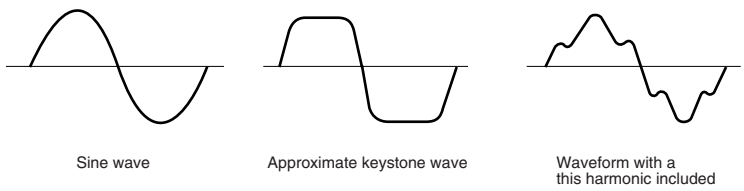


Fig. 1 Distortion in an AC stabilized power source

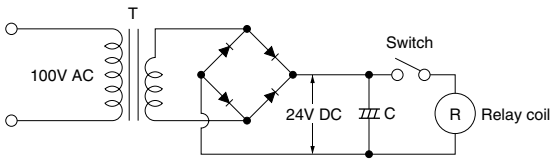


Fig. 2 Voltage fluctuation absorbing circuit using a condenser

• Power source for DC input

We recommend that the voltage applied to both ends of the coil in DC type relays be within ±5% of the rated coil voltage. As a power source for the DC type relay, a battery or either a half wave or full wave rectifier circuit with a smoothing capacitor is used. The characteristics with regard to the pick-up voltage of the relay will change depending upon the type of power source, and because of this, in order to display stable characteristics, the most desirable method is perfect DC.

In the case of ripple included in the DC power source, particularly in the case of half wave rectifier circuit with a smoothing capacitor, if the capacity of the capacitor is too small, due to the influence of the ripple, humming develops and an unsatisfactory condition is produced. With the actual circuit to be used, it is absolutely necessary to confirm the characteristics.

It is necessary to give consideration to the use of a DC power source with less than a 5% ripple. Also ordinarily the following must be given thought.

(1) It is desirable to have less than a 5% ripple for the reed type relay.

(2) For the hinge type relay, a half wave rectifier cannot be used, alone unless you use a smoothing capacitor. The ripple and the characteristics must be evaluated for proper usage.

(3) For the hinge type relay, there are certain applications that may or maynot use the full wave rectifier on it's own. Please check specifications with the original manufacture.

(4) Coil applied voltage and the drop in voltage

Shown on the right, is a circuit driven by the same power supply (battery, etc.) for both the coil and contact.

Electrical life will be affected by the drop in voltage in the coil when load is turned on.

Please verify that the actual voltage is applied to the coil at the actual load.

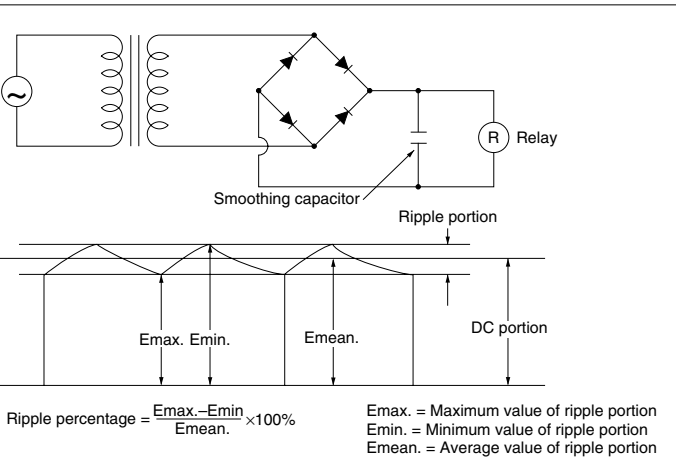
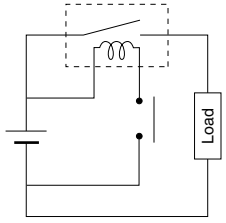


Fig. 3



3. Maximum Applied Voltage and Temperature Rise

Proper usage requires that the rated voltage be impressed on the coil. Note, however, that if a voltage greater than or equal to the maximum applied 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 applied voltage

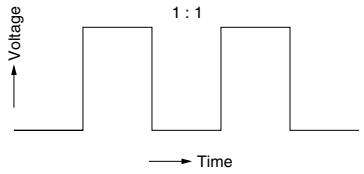
In addition to being a requirement for relay operation stability, the maximum applied voltage is an important constraint for the prevention of such problems as thermal deterioration or deformity of the insulation material, or the occurrence of fire hazards.

In actual use with E-type insulation, when the ambient temperature is 40°C 104°F, a temperature rise limit of 80°C 176°F is thought to be reasonable according to the resistance method. However, when complying with the Electrical Appliance and Material Safety Law, this becomes 75°C 167°F.

• Temperature rise due to pulse voltage

When a pulse voltage with ON time of less than 2 minutes is used, the coil temperature rise bares 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%



• Pick-up 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.

4. Coil Applied Voltage and Operate Time

In the case of AC operation, there is extensive variation in operate time depending upon the point in the phase at which the switch is turned ON for coil excitation, and it is expressed as a certain range, but for miniature types it is for the most part 1/2 cycle. However, for the somewhat large type relay where bounce is large, the operate time is 7 to 16ms, with release time in the order of 9 to 18ms. Also, in the case of DC operation, to the extent of large coil input, the operating time is rapid, but if it is too rapid, the “Form A” contact bounce time is extended.

Please be warned that load conditions (in particular when inrush current is large or load is close to the load rating) may cause the working life to shorten and slight welding.

5. Stray Circuits (Bypass Circuits)

In the case of sequence circuit construction, because of bypass flow or alternate routing, it is necessary to take care not to have erroneous operation or abnormal operation. To understand this condition while preparing sequence circuits, as shown in Fig. 4, with 2 lines written as the power source lines, the upper line is always ⊕ and the lower line ⊖ (when the circuit is AC, the same thinking applies). Accordingly the ⊕ side is necessarily the side for making contact connections (contacts for relays, timers and limit switches, etc.), and the ⊖ side is the load circuit side (relay coil, timer coil, magnet coil, solenoid coil, motor, lamp, etc.).

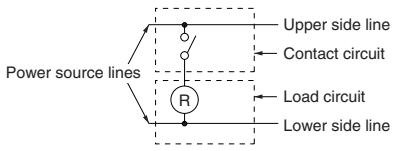


Fig. 4 Example of a vertically written sequence circuit

Fig. 5 shows an example of stray circuits. In Fig. 5 (a), with contacts A, B, and C closed, after relays R_1, R_2, and R_3 operate, if contacts B and C open, there is a series circuit through A, R_1, R_2, and R_3, and the relays will hum and sometimes not be restored to the drop out condition.

The connections shown in Fig. 5 (b) are correctly made. In addition, with regard to the DC circuit, because it is simple by means of a diode to prevent stray circuits, proper application should be made.

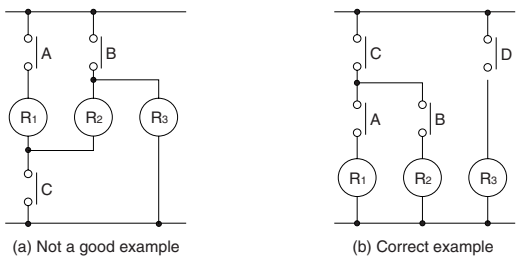


Fig. 5 Stray circuits

6. Gradual Increase of Coil Applied Voltage and Suicide Circuit

When the voltage applied on the coil is increased slowly, the relay transferring operation is unstable, the contact pressure drops, contact bounce increases, and an unstable condition of contact occurs. This method of applying voltage to the coil should not be used, and consideration should be given to the method of impressing voltage on the coil (use of switching circuit). Also, in the case of latching relays, using self "Form B" contacts, the method of self coil circuit for complete interruption is used, but because of the possibility of trouble developing, care should be taken.

The circuit shown in Fig. 6 causes a timing and sequential operation using a reed type relay, but this is not a good example with mixture of gradual increase of impressed voltage for the coil and a sucide circuit. In the timing portion for relay R_1, when the timing times out, chattering occurs causing trouble. In the initial test (trial production), it shows favorable operation, but as the number of operations increases, contact blackening (carbonization) plus the chattering of the relay creates instability in performance.

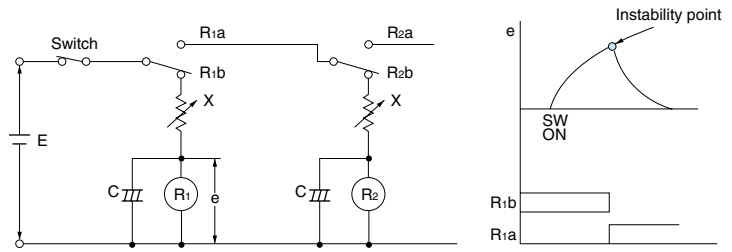


Fig. 6 "Not a good example": A timing and sequential operation using a reed type relay

7. Phase Synchronization in AC Load Switching

If switching of the relay contacts is synchronized with the phase of the AC power, reduced electrical life, welded contacts, or a locking phenomenon (incomplete release) due to contact material transfer may occur. Therefore, check the relay while it is operating in the actual system. When driving relays with timers, micro computers and thyristors, etc., there may be synchronization with the power supply phase.

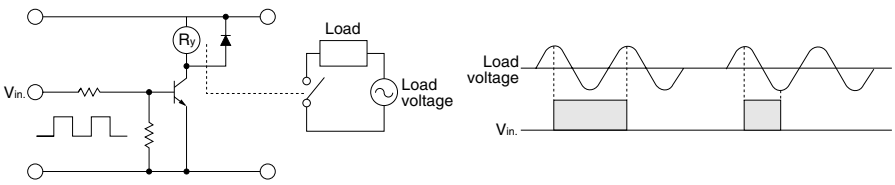


Fig. 7

8. Erroneous Operation due to Inductive Interference

For long wire runs, when the line for the control circuit and the line for electric power use a single conduit, induction voltage, caused by induction from the power line, will be applied to the operation coil regardless of whether or not the control signal is off. In this case the relay and timer may not revert. Therefore, when wiring spans a long distance please remember that along with inductive interference, connection failure may be caused by a problem with distribution capacity or the device might break down due to the influence of externally caused surges, such as that caused by lightning.

9. Long Term Current Carrying

A circuit designed for non-excitation when left running is desirable for circuits (circuits for emergency lamps, alarm devices and error inspection that, for example, revert only during malfunction and output warnings with form B contacts) that will be carrying a current continuously for long periods without relay switching operation.

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 must use a single stable relay, use a sealed type relay that is not easily affected by ambient conditions and provide a failsafe circuit design that considers the possibility of contact failure or disconnection.

10. Usage with Infrequent Switching

Please carry out periodic contact conductivity inspections when the frequency of switching is once or fewer times per month. When no switching of the contacts occurs for long periods, organic membrane may form on the contact surfaces and lead to contact instability.

11. Regarding Electrolytic Corrosion of Coils

In the case of comparatively high voltage coil circuits, when such relays are used in high temperature and high humidity atmospheres or with continuous passage of current, the corrosion can be said to be the result of the occurrence of electrolytic corrosion. Because of the possibility of open circuits occurring, attention should be given to the following points.

1) The ⊕ side of the power source should be connected to the chassis. (Refer to Fig. 8) (Common to all relays)

2) In the case where unavoidably the ⊖ side is grounded, or in the case where grounding is not possible.

(1) Insert the contacts (or switch) in the ⊕ side of the power source. (Refer to Fig. 9) (Common to all relays)

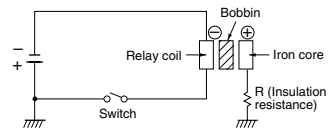
(2) When a grounding is not required, connect the ground terminal to the ⊕ side of the coil. (Refer to Fig. 10) (NF and NR with ground terminal)

3) When the ⊖ side of the power source is grounded, always avoid interting the contacts (and switches) in the ⊖ side. (Refer to Fig. 11) (Common to all relays)

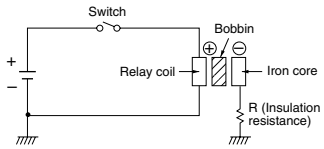
4) In the case of relays provided with a ground terminal, when the ground terminal is not considered effective, not making a connection to ground plays an important role as a method for preventing electrolytic corrosion.

Note: The designation on the drawing indicates the insertion of insulation between the iron core and the chassis. In relays where a ground terminal is provided, the iron core can be grounded directly to the chassis, but in consideration of electrolytic corrosion, it is more expedient not to make the connection.

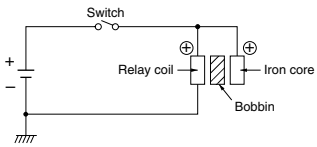
Judgement: Good (Fig. 8)



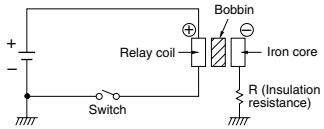
Judgement: Good (Fig. 9)



Judgement: Good (Fig. 10)



Judgement: No good (Fig. 11)



[3] PRECAUTIONS REGARDING CONTACT

• Contact

The contacts are the most important elements of relay construction. Contact performance conspicuously influenced by contact material, and voltage and current values applied to the contacts (in particular, the voltage and current waveforms at the time of application and release), the type of load, frequency of switching, ambient atmosphere, form of contact, contact switching speed, and of bounce.

Because of contact transfer, welding, abnormal wear, increase in contact resistance, and the various other damages which bring about unsuitable operation, the following items require full investigation.

*We recommend that you verify with one of our sales offices.

1. Basic Precautions Regarding Contact

[Voltage, AC and DC]

When there is inductance included in the circuit, a rather high counter emf is generated as a contact circuit voltage, and since, to the extent of the value of that voltage, the energy applied to the contacts causes damage with consequent wear of the contacts, and transfer of the contacts, it is necessary to exercise care with regard to control capacity. In the case of DC, there is no zero current point such as there is with AC, and accordingly, once a cathode arc has been generated, because it is difficult to quench that arc, the extended time of the arc is a major cause. In addition, due to the direction of the current being fixed, the phenomenon of contact shift, as noted separately below, occurs in relation to the contact wear. Ordinarily, the approximate control capacity is mentioned in catalogs or similar data sheets, but this alone is not sufficient. With special contact circuits, for the individual case, the maker either estimates from the past experience or makes test on each occasion. Also, in catalogs and similar data sheets, the control capacity that is mentioned is limited to resistive load, but there is a broad meaning indicated for that class of relay, and ordinarily it is proper to think of current capacity as that for 125V AC circuits.

Minimum applicable loads are given in the catalog; however, these are only provided as a guide to the lower limit that the relay is able to switch and are not guaranteed values. The level of reliability of these values depends on switching frequency, ambient conditions, change in the desired contact resistance, and the absolute value. Please use relays with AgPd contacts when minute analog load control or contact resistance no higher than 100 mΩ is desired (for measurement and wireless applications, etc.).

[Current]

The current at both the closing and opening time of the contact circuit exerts important influence. For example, when the load is either a motor or a lamp, to the extent of the inrush current at the time of closing the circuit, wear of the contacts, and the amount of contact transfer increase, and contact welding and contact transfer make contact separation impossible.

2. Characteristics of Common Contact Materials

Characteristics of contact materials are given below. Refer to them when selecting a relay.

Contact Material	Ag (silver)	Electrical conductivity and thermal conductivity are the highest of all metals. Exhibits low contact resistance, is inexpensive and widely used. A disadvantage is it easily develops a sulfide film in a sulfide atmosphere. Care is required at low voltage and low current levels.
	$AgSnO_2$ (silver-tin)	Exhibits superior welding resistance characteristics equal or better than AgCdO. Like silver, it easily develops a sulfide film in a sulfide atmosphere.
	AgW (silver-tungsten)	Hardness and melting point are high, arc resistance is excellent, and it is highly resistant to material transfer. However, high contact pressure is required. Furthermore, contact resistance is relatively high and resistance to corrosion is poor. Also, there are constraints on processing and mounting to contact springs.
	AgNi (silver-nickel)	Equals the electrical conductivity of silver. Excellent arc resistance.
	AgPd (silver-palladium)	At standard temperature, good corrosion resistance and good sulfidation resistance. However, in dry circuits, organic gases adhere and it easily develops a polymer. Gold clad is used to prevent polymer buildup. Expensive.
Surface Finish	Rh plating (rhodium)	Combines perfect corrosion resistance and hardness. As plated contacts, used for relatively light loads. In an organic gas atmosphere, care is required as polymers may develop. Therefore, it is used in hermetic sealed relays (reed relays, etc.) . Expensive.
	Au clad (gold clad)	Au with its excellent corrosion resistance is pressure welded onto a base metal. Special characteristics are uniform thickness and the nonexistence of pinholes. Greatly effective especially for low level loads under relatively adverse atmospheres. Often difficult to implement clad contacts in existing relays due to design and installation.
	Au plating (gold plating)	Similar effect to Au clad. Depending on the plating process used, supervision is important as there is the possibility of pinholes and cracks. Relatively easy to implement gold plating in existing relays.
	Au flash plating (gold thin-film plating) 0.1 to 0.5μm	Purpose is to protect the contact base metal during storage of the switch or device with built-in switch. However, a certain degree of contact stability can be obtained even when switching loads.

3. Contact Protection

• Counter EMF

When switching inductive loads with a DC relay such as relay sequence circuits, DC motors, DC clutches, and DC solenoids, it is always important to absorb surges (e.g. with a diode) to protect the contacts.

When these inductive loads are switched off, a counter emf of several hundred to several thousand volts develops which can severely damage contacts and greatly shorten life. If the current in these loads is relatively small at around 1A or less, the counter emf will cause the ignition of a glow or arc discharge. The discharge decomposes organic matter contained in the air and causes black deposits (oxides, carbides) to develop on the contacts. This may result in contact failure.

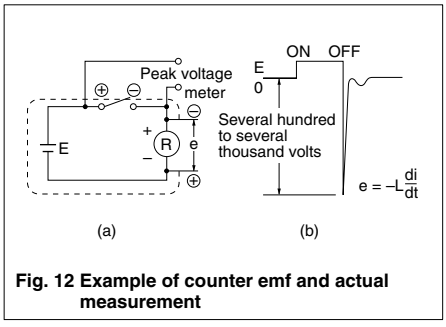


Fig. 12 Example of counter emf and actual measurement

In Fig. 12 (a), a counter emf (e = –L di/dt) with a steep waveform is generated across the coil with the polarity shown in Fig. 12 (b) at the instant the inductive load is switched off. The counter emf passes through the power supply line and reaches both contacts.

Generally, the critical dielectric breakdown voltage at standard temperature and pressure in air is about 200 to 300 volts. Therefore, if the counter emf exceeds this, discharge occurs at the contacts to dissipate the energy ($1/2Li^2$) stored in the coil. For this reason, it is desirable to absorb the counter emf so that it is 200V or less.

• Material transfer phenomenon

Material transfer of contacts occurs when one contact melts or boils and the contact material transfers to the other contact. As the number of switching operations increases, uneven contact surfaces develop such as those shown in Fig. 13. After a while, the uneven contacts lock as if they were welded together. This often occurs in circuits where sparks are produced at the moment the contacts "make" such as when the DC current is large for DC inductive or capacitive loads or when the inrush current is large (several amperes or several tens of amperes).

Contact protection circuits and contact materials resistant to material transfer such as $AgSnO_2$, AgW or AgCu are used as countermeasures. Generally, a concave formation appears on the cathode and a convex formation appears on the anode. For DC capacitive loads (several amperes to several tens of amperes), it is always necessary to conduct actual confirmation tests.

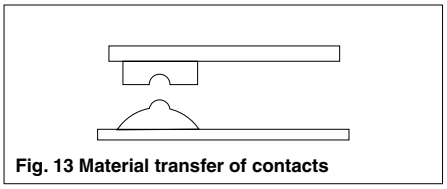


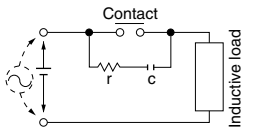
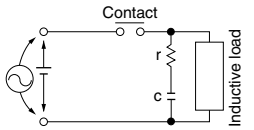
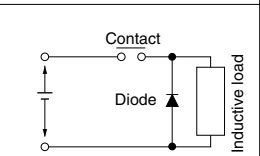
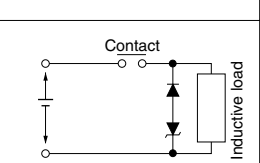
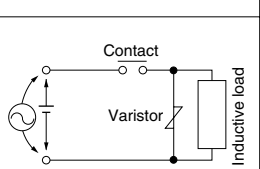
Fig. 13 Material transfer of contacts

GENERAL APPLICATION GUIDELINES

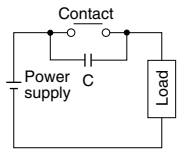
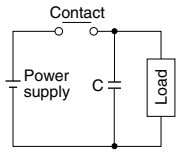
• Contact protection circuit

Use of contact protective devices or protection circuits can suppress the counter emf to a low level. However, note that incorrect use will result in an adverse effect. Typical contact protection circuits are given in the table below.

(G: Good, NG: No Good, C: Care)

Circuit		Application AC	Application DC	Features/Others	Devices Selection
CR circuit		C*	G	If the load is a timer, leakage current flows through the CR circuit causing faulty operation. * If used with AC voltage, be sure the impedance of the load is sufficiently smaller than that of the CR circuit	As a guide in selecting c and r, c: 0.5 to 1μF per 1A contact current r: 0.5 to 1Ω per 1V contact voltage Values vary depending on the properties of the load and variations in relay characteristics. Capacitor "c" acts to suppress the discharge the moment the contacts open. Resistor "r" acts to limit the current when the power is turned on the next time. Test to confirm. Use a capacitor "c" with a breakdown voltage of 200 to 300V. Use AC type capacitors (non-polarized) for AC circuits.
		G	G	If the load is a relay or solenoid, the release time lengthens. Effective when connected to both contacts if the power supply voltage is 24 or 48V and the voltage across the load is 100 to 200V.	
Diode circuit		NG	G	The diode connected in parallel causes the energy stored in the coil to flow to the coil in the form of current and dissipates it as joule heat at the resistance component of the inductive load. This circuit further delays the release time compared to the CR circuit. (2 to 5 times the release time listed in the catalog)	Use a diode with a reverse breakdown voltage at least 10 times the circuit voltage and a forward current at least as large as the load current. In electronic circuits where the circuit voltages are not so high, a diode can be used with a reverse breakdown voltage of about 2 to 3 times the power supply voltage.
Diode and zener diode circuit		NG	G	Effective when the release time in the diode circuit is too long.	Use a zener diode with a zener voltage about the same as the power supply voltage.
Varistor circuit		G	G	Using the stable voltage characteristics of the varistor, this circuit prevents excessively high voltages from being applied across the contacts. This circuit also slightly delays the release time. Effective when connected to both contacts if the power supply voltage is 24 to 48V and the voltage across the load is 100 to 200V.	———

• Avoid using the protection circuits shown in the figures on the right. Although DC inductive loads are usually more difficult to switch than resistive loads, use of the proper protection circuit will raise the characteristics to that for resistive loads.

No good 	No good 
Although extremely effective in arc suppression as the contacts open, the contacts are susceptible to welding since energy is stored in "C" when the contacts open and short-circuit current flows from "C" when the contacts close.	Although extremely effective in arc suppression as the contacts open, the contacts are susceptible to welding since charging current flows to "C" when the contacts close.

• Mounting the protective device

In the actual circuit, it is necessary to locate the protective device (diode, resistor, capacitor, varistor, etc.) in the immediate vicinity of the load or contact. If located too far away, the effectiveness of the protective device may diminish. As a guide, the distance should be within 50cm.

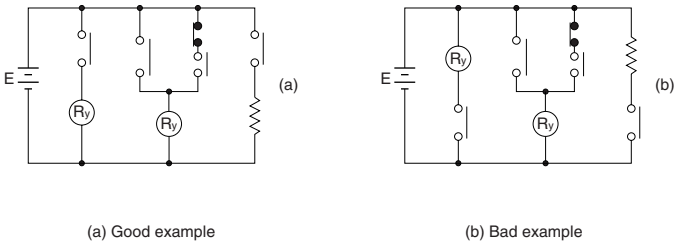
• Abnormal corrosion during high frequency switching of DC loads (spark generation)

If, for example, a DC valve or clutch is switched at a high frequency, a blue-green corrosion may develop. This occurs from the reaction with nitrogen and oxygen in the air when sparks (arc discharge) are generated during switching. Therefore, care is required in circuits where sparks are generated at a high frequency.

4. Cautions on Use Related to Contacts

• Connection of load and contacts

Connect the load to one side of the power supply as shown in Fig. 14 (a). Connect the contacts to the other side. This prevents high voltages from developing between contacts. If contacts are connected to both side of the power supply as shown in Fig. 14 (b), there is a risk of shorting the power supply when relatively close contacts short.



(a) Good example (b) Bad example

Fig. 14

• Dummy Resistor

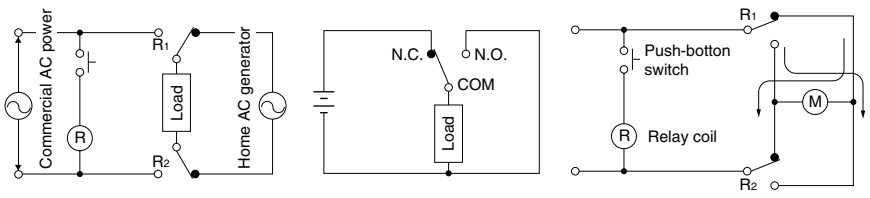
Since voltage levels at the contacts used in low current circuits (dry circuits) are low, poor conduction is often the result. One method to increase reliability is to add a dummy resistor in parallel with the load to intentionally raise the load current reaching the contacts.

• Avoid circuits where shorts occur between Form A and B contacts

1) The clearance between form A and B contacts in compact control components is small. The occurrence of shorts due to arcing must be assumed.

2) Even if the three N.C., N.O., and COM contacts are connected so that they short, a circuit must never be designed to allow the possibility of burning or generating an overcurrent.

3) A forward and reverse motor rotation circuit using switching of form A and B contacts must never be designed.



1) R_1, R_2 : Contacts for R
R : Double pole relay

2)

3) R_1, R_2 : Contacts for R
R : Double pole relay

Fig. 15 Bad example of Form A and B use

• Shorts between different electrodes

Although there is a tendency to select miniature control components because of the trend toward miniaturizing electrical control units, care must be taken when selecting the type of relay in circuits where different voltages are applied between electrodes in a multi-pole relay, especially when switching two different power supply circuits. This is not a problem that can be determined from sequence circuit diagrams. The construction of the control component itself must be examined and sufficient margin of safety must be provided especially in creepage between electrodes, space distance, presence of barrier, etc.

• Type of load and inrush current

The type of load and its inrush current characteristics, together with the switching frequency, are important factors which cause contact welding. Particularly for loads with inrush currents, measure the steady state and inrush current. Then select a relay which provides an ample margin of safety. The table on the right shows the relationship between typical loads and their inrush currents.

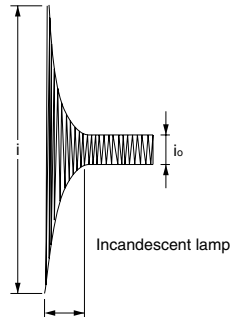
Also, verify the actual polarity used since, depending on the relay, electrical life is affected by the polarity of COM and NO.

Type of load	Inrush current
Resistive load	Steady state current
Solenoid load	10 to 20 times the steady state current
Motor load	5 to 10 times the steady state current
Incandescent lamp load	10 to 15 times the steady state current
Mercury lamp load	Approx. 3 times the steady state current
Sodium vapor lamp load	1 to 3 times the steady state current
Capacitive load	20 to 40 times the steady state current
Transformer load	5 to 15 times the steady state current

GENERAL APPLICATION GUIDELINES

Load Inrush Current Wave and Time

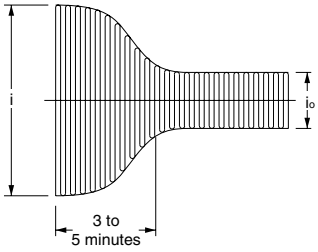
(1) Incandescent Lamp Load



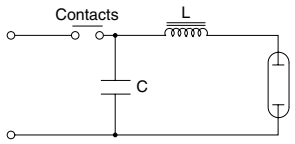
Approx. 1/3 second

Inrush current/rated current:
i/io ≒ 10 to 15 times

(2) Mercury Lamp Load
i/io ≒ 3 times

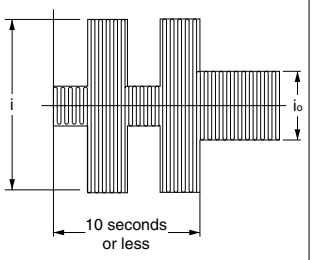


The discharge tube, transformer, choke coil, capacitor, etc., are combined in common discharge lamp circuits. Note that the inrush current may be 20 to 40 times, especially if the power supply impedance is low in the high power factor type.

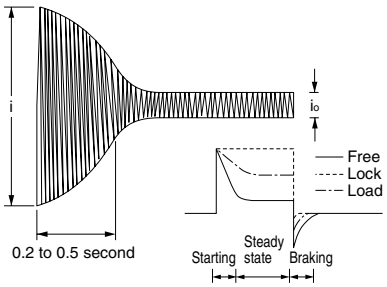


(for high power factor type)

(3) Fluorescent Lamp Load
i/io ≒ 5 to 10 times

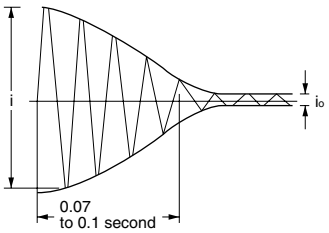


(4) Motor Load i/io ≒ 5 to 10 times



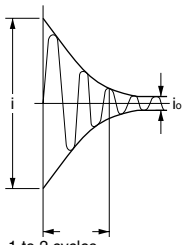
- Conditions become more harsh if plugging or inching is performed since state transitions are repeated.
- When using a relay to control a DC motor and brake, the on time inrush current, steady-state current and off time brake current differ depending on whether the load to the motor is free or locked. In particular, with non-polarized relays, when using from B contact of from contact for the DC motor brake, mechanical life might be affected by the brake current. Therefore, please verify current at the actual load.

(5) Solenoid Load
i/io ≒ 10 to 20 times



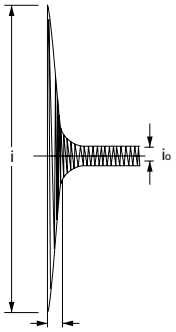
Note that since inductance is great, the arc lasts longer when power is cut. The contact may become easily worn.

(6) Electromagnetic Contact Load
i/io ≒ 3 to 10 times



1 to 2 cycles
(1/60 to 1/30 seconds)

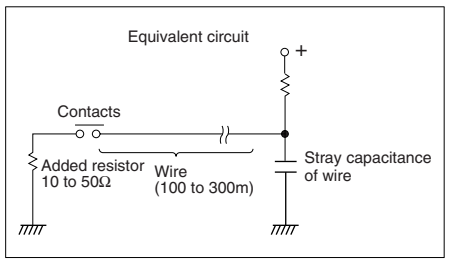
(7) Capacitive Load
i/io ≒ 20 to 40 times



1/2 to 2 cycles (1/120 to 1/30 seconds)

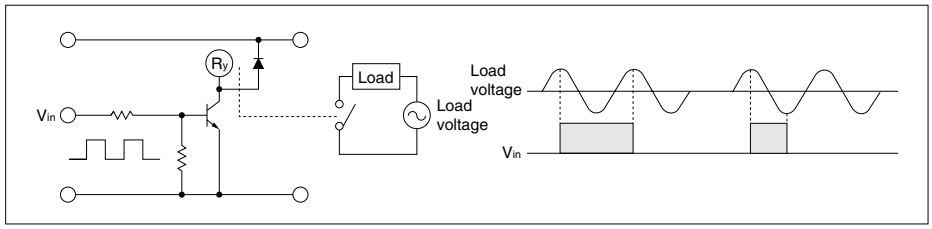
• When using long wires

If long wires (100 to 300m) are to be used in a relay contact circuit, inrush current may become a problem due to the stray capacitance existing between wires. Add a resistor (approx. 10 to 50Ω) in series with the contacts.



• Phase synchronization in switching AC loads

If switching of the relay contacts is synchronized with the phase of the AC power, reduced electrical life, welded contacts, or a locking phenomenon (incomplete release) due to contact material transfer may occur. Therefore, check the relay while it is operating in the actual system. When driving relays with timers, micro computers and thyristors, etc., there may be synchronization with the power supply phase.

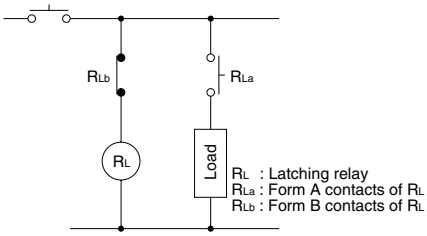


• Electrical life at high temperatures

Verify at the actual load since electrical life may be affected by use at high temperatures.

[4] PPRECAUTIONS REGARDING LATCHING RELAYS

• Latching relays are shipped from the factory in the reset state. A shock to the relay during shipping or installation may cause it to change to the set state. Therefore, it is recommended that the relay be used in a circuit which initializes the relay to the required state (set or reset) whenever the power is turned on.
• Avoid impressing voltages to the set coil and reset coil at the same time.
• Connect a diode as shown since latching may be compromised when the relay is used in the following circuits.
- If set coils or reset coils are to be connected together in parallel, connect a diode in series to each coil. Fig. 16 (a), (b)
- Also, if the set coil of a relay and the reset coil of another relay are connected in parallel, connect a diode to the coils in series. Fig. 16 (c)
- If the set coil or reset coil is to be connected in parallel with an inductive load (e.g. another electromagnetic relay coil, motor, transformer, etc.), connect a diode to the set coil or reset coil in series. Fig. 16 (d)
• Use a diode having an ample margin of safety for repeated DC reverse voltage and peak reverse voltage applications and having an average rectified current greater than or equal to the coil current.
• Avoid applications in which conditions include frequent surges to the power supply.
• Avoid using the following circuit since self-excitation at the contacts will inhibit the normal keep state.



Bad example

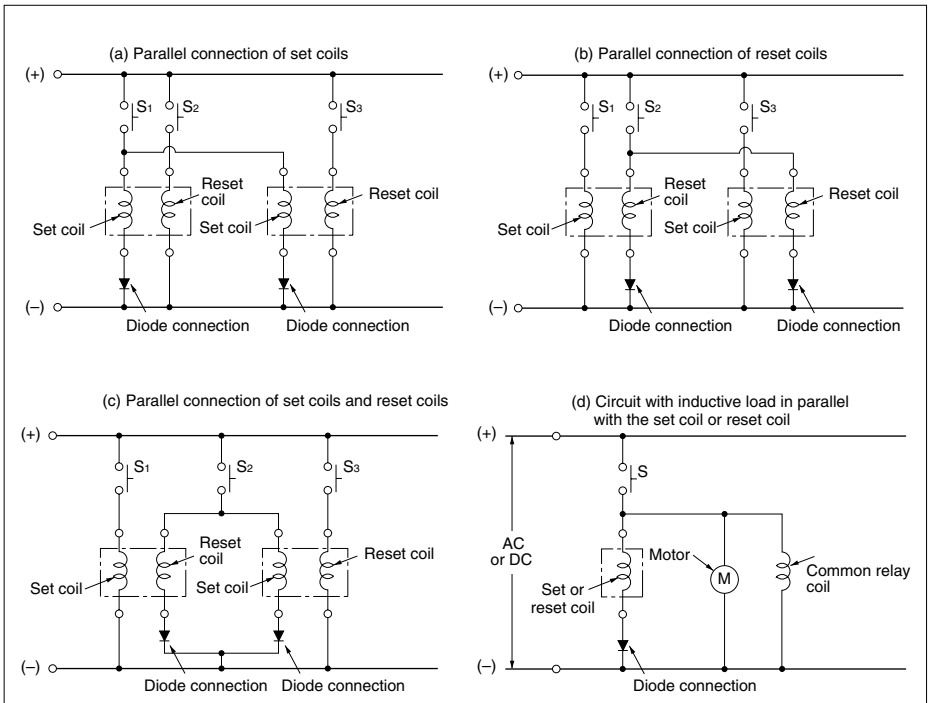
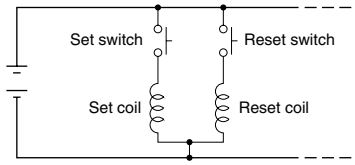


Fig. 16

• Four-terminal latching relay
In the 2-coil latching type circuit as shown below, one terminal at one end of the set coil and one terminal at one end of the reset coil are connected in common and voltages of the same polarity are applied to the other side for the set and reset operations. In this type of circuit, short 2 terminals of the relay as noted in the right table. This helps to keep the insulation high between the two winding.



• Minimum pulse width
As a guide, make the minimum pulse width in order to set or reset a latching relay at least 5 times the set time or reset time of each product and apply a rectangular-wave rated voltage. Also, please verify operation. Please inquire if you cannot obtain a pulse width of at least 5 times the set (reset) time. Also, please inquire regarding capacitor drive.

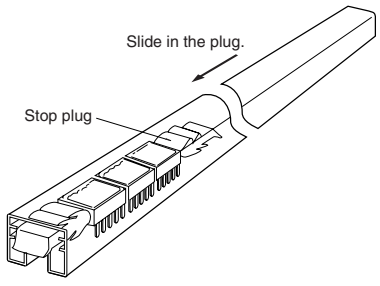
Relay Type		Terminal Nos.
DS	1c	—
	2c	15 & 16
NC	Flat	5 & 6
	Slim	3 & 4
ST		*
SP		2 & 4

Notes: 1. *ST relays are constructed so that the set coil and reset coil are separated for high insulation resistance.
2. DSP, TQ, TN, S relays are not applicable due to polarity.

• Two Coil Latch Induction Voltage
Each coil in a 2-coil latch relay is wound with a set coil and a reset coil on the same iron cores. Accordingly, induction voltage is generated on the reverse side coil when voltage is applied and shut off to each coil. Although the amount of induction voltage is about the same as the rated relay voltage, you must be careful of the reverse bias voltage when driving transistors.

[5] HANDLING CAUTIONS FOR TUBE PACKAGING

Some types of relays are supplied in tube packaging. If you remove any relays from the tube packaging, be sure to slide the stop plug at one end to hold the remaining relays firmly together so they would not move in the tube. Failing to do this may lead to the appearance and/or performance being damaged.



[6] AMBIENT ENVIRONMENT

1. Ambient Temperature and Atmosphere

Be sure the ambient temperature at the installation does not exceed the value listed in the catalog. Furthermore, environmentally sealed types (plastic sealed type) should be considered for applications in an atmosphere with dust, sulfur gases (SO_2, H_2S), or organic gases.

2. Silicon Atmosphere

Silicon-based substances (silicon rubber, silicon oil, silicon-based coating material, silicon caulking compound, etc.) emit volatile silicon gas. Note that when silicon is used near relay, switching the contacts in the presence of its gas causes silicon to adhere to the contacts and may result in contact failure (in plastic sealed types, too).

In this case, use a substitute that is not silicon-based.

3. NOx Generation

When a 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 68°F). If use at high humidity is unavoidable, consult us.

4. Vibration and Shock

If a relay and magnetic switch are mounted next to each other on a single plate, the relay contacts may separate momentarily from the shock produced when the magnetic switch is operated and result in faulty operation.

Countermeasures include mounting them on separate plates, using a rubber sheet to absorb the shock, and changing the direction of the shock to a perpendicular angle.

Also, if the relay will be subject to continual vibration (trains, etc.), do not use it with a socket. We recommend that you solder directly to the relay terminals.

5. Influence of External Magnetic Fields

Permanent magnets are used in reed relays and polarized relays, and their movable parts are constructed of ferrous materials. For this reason, when a magnet or permanent magnet in any other large relay, transformer, or speaker is located nearby, the relay characteristics may change and faulty operations may result. The influence depends on the strength of the magnetic field and it should be checked at the installation.

6. Usage, Storage, and Transport Conditions

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

The allowable specifications for environments suitable for usage, storage, and transportation are given below.

(1) Temperature: The allowable temperature range differs for each relay, so refer to the relay's individual specifications.

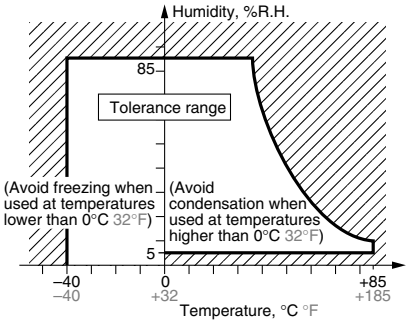
In addition, when transporting or storing relays while they are tube packaged, there are cases when the temperature may differ from the allowable range.

In this situation, be sure to consult the individual specifications.

(2) Humidity: 5 to 85 % R.H.

(3) Pressure: 86 to 106 kPa

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



(The allowable temperature depends on the relays.)

• Condensation will occur inside the switch if there is a sudden change in ambient temperature when used in an atmosphere of high temperature and high humidity. This is particularly likely to happen when being transported by ship, so please be careful of the atmosphere when shipping. Condensation is the phenomenon whereby steam condenses to cause water droplets that adhere to the switch when an atmosphere of high temperature and humidity rapidly changes from a high to low temperature or when the switch is quickly moved from a low humidity location to one of high temperature and humidity. Please be careful because condensation can cause adverse conditions such as deterioration of insulation, coil cutoff, and rust.

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

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

• Storage for extended periods of time (including transportation periods) at high temperatures 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.

• 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.

• 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 (Signal relay: with in 3 days, Max. 30°C 86°F/60%RH). 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.

(2) When storing for a long period after opening the anti-humidity pack, you must take measures to prevent humidity, for example, by storing in the open location of a promptly re-sealed anti-humidity pack after it is used or in a humidity-controlled desicator. You may also store it in an anti-humidity bag to which silica gel has been added.

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

CAUTION

This vacuum-sealed bag contains

Moisture Sensitive Products

1. After this bag is opened, products that will be subjected to reflow solder or other high temperature process shall be mounted as soon as possible. Please refer to Cautions for Use(storage).
2. As for factory-recommended reflow soldering condition, please refer to the product specifications.

7. Vibration, Impact and Pressure when Shipping

When shipping, if strong vibration, impact or heavy weight is applied to a device in which a relay is installed, functional damage may occur. Therefore, please package in a way, using shock absorbing material, etc., so that the allowable range for vibration and impact is not exceeded.

[7] ENVIRONMENTALLY SEALED TYPE RELAYS

Sealed type (plastic sealed type, etc.) relays are available. They are effective when problems arise during PC board mounting (e.g. automatic soldering and cleaning). They also, of course, feature excellent corrosion resistance. Note the cautions below regarding the features and use of environmentally sealed type relays to avoid problems when using them in applications.

1. Operating Environment

Plastic sealed type relays are not suited for use in environments that especially require air tightness. Although there is no problem if they are used at sea level, avoid atmospheric pressures beyond 96±10kPa. Also avoid using them in an atmosphere containing flammable or explosive gases.

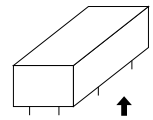
2. Cleaning

When cleaning a printed circuit board after soldering, we recommend using alcohol based cleaning fluids. Please avoid ultrasonic cleaning. The ultrasonic energy from this type of cleaning may cause coil line breakage and light sticking of contacts.

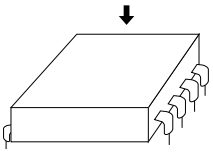
[8] MOUNTING CONSIDERATIONS

1. Top View and Bottom View

Relays used for PC boards, especially the flat type relays, have their top or bottom surface indicated in the terminal wiring diagrams.



Relay with terminals viewed from the bottom (terminals cannot be seen from the top)



Relay with terminals viewed from the top (all terminals can be seen from the top) Note during PC board pattern design (NC relay)

2. Mounting Direction

Mounting direction is important for optimum relay characteristics.

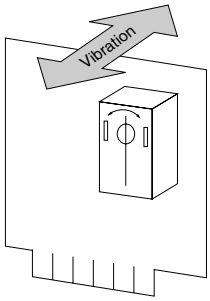
• Shock resistance

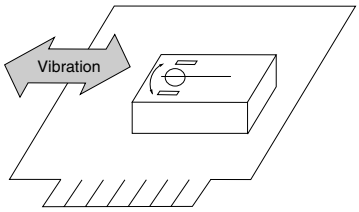
It is ideal to mount the relay so that the movement of the contacts and movable parts is perpendicular to the direction of vibration or shock. Especially note that the vibration and shock resistance of Form B contacts while the coil is not excited is greatly affected by the mounting direction of the relay.

• Contact reliability

Mounting the relay so the surfaces of its contacts (fixed contacts or movable contacts) are vertical prevents dirt and dust as well as scattered contact material (produced due to large loads from which arcs are generated) and powdered metal from adhering to them.

Furthermore, it is not desirable to switch both a large load and a low level load with a single relay. The scattered contact material produced when switching the large load adheres to the contacts when switching the low level load and may cause contact failure. Therefore, avoid mounting the relay with its low level load contacts located below the large load contacts.





The installation direction is specified for some models. Please check with the product catalog and make sure to use the correct installation direction.

3. Adjacent Mounting

When many relays are mounted close together, abnormally high temperatures may result from the combined heat generated. Mount relays with sufficient spacing between them to prevent heat buildup.

This also applies when a large number of boards mounted with relays are installed as in a card rack. Be sure the ambient temperature of the relay does not exceed the value listed in the catalog.

• Influence of adjacent mounting of polarized relays

When polarized relays are mounted close together, their characteristics change. Since the affect of adjacent mounting differs according to the type of relay, refer to the data for the particular type.

4. Panel Mounting

• Do not remove the cover. It has a special function. (It will not come off under normal handling.)

• When installing please use washers to prevent damage and deformation. Please keep the tightening torque to within 0.49 to 68.6 N·m (5 to 7 kgf·cm). Also, please use a spring washer to prevent it from coming loose.

5. Tab Terminals

As a guide, use a quick connect mounting pressure of 40 to 70N {4 to 7 kgf} for relays with tab terminals.

[9] METHOD OF MOUNTING AND LEAD WIRES CONNECTION

1. Mounting Method

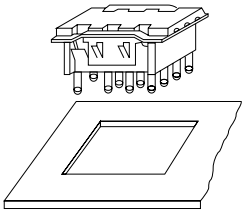
• The direction of mounting is not specifically designated, but to the extent possible, the direction of contact movement should be such that vibration and shock will not be applied.

When a terminal socket is used

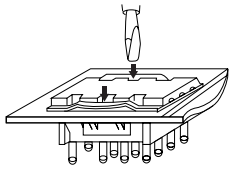
• After drilling the mounting holes, the terminal socket should be mounted making certain the mounting screws are not loose. DIN standard sockets are available for one-touch mounting on DIN rail of 35mm 1.378 inch width.

When reversible terminal sockets are used

• The reversible terminal sockets (HC, HL socket) are for one-touch mounting. (A panel thickness of 1 to 2mm .039 to .079 inch should be used.)



• The socket should be pushed through the opening in the mounting panel until the projections on the side of the mounting bracket extend out over the back surface.



• When all four of the projections are visible from the back side of the mounting panel, the mounting is completed and the socket is fastened.

• To remove the socket, the projections on the side of the mounting bracket should be pushed inward and at the same time the body of the socket should be pushed lightly from the back side. The socket can then be removed from the panel.

2. Connection of Lead Wires

• When making the connections, depending upon the size of load, the wire cross-section should be at least as large as the values shown in the table below.

Permissible current (A)	Cross-section (mm^2)
2	0.2
3	0.3
5	0.5
7.5	0.75
12.5	1.25
15	2
20	2
30	3.5

• When the terminal socket uses screw fastening connections, either pressure terminals or other means should be used to make secure fastening of the wire.

• To prevent damage and deformity, please use a torque within the following range when tightening the push screw block of the terminal socket.

M4.5 screw: 1.47 to 1.666 N·m (15 to 17 kgf·cm)
M4 screw: 1.176 to 1.37 N·m (12 to 14 kgf·cm)
M3.5 screw: 0.784 to 0.98 N·m (8 to 10 kgf·cm)
M3 screw: 0.49 to 0.69 N·m (5 to 7 kgf·cm)

[10] CAUTIONS FOR USE–CHECK LIST

	Check Item
Coil Drive Input	1. Is the correct rated voltage applied? 2. Is the applied coil voltage within the allowable continuous voltage limit? 3. Is the ripple in the coil voltage within the allowable level? 4. For voltage applied to a polarized coil, is polarity observed? 5. When hot start is required, is the increase in coil resistance resulting from coil temperature rise taken into account in setting coil voltage? 6. Is the coil voltage free from momentary drop caused by load current? (Pay special attention for self-holding relays.) 7. Is supply voltage fluctuation taken into account when setting the rated coil voltage? 8. The relay status may become unstable if the coil voltage (current) is gradually increased or decreased. Was the relay tested in a real circuit or with a real load? 9. When driving with transistors, did you consider voltage drops?
Load (Relay contacts)	1. Is the load rated within the contact ratings? 2. Does the load exceed the contacts' minimum switching capacity? 3. Special attention is required for contact welding when the load is a lamp, motor, solenoid, or electromagnetic contractor. Was the relay tested with a real load? 4. A DC load may cause contact lock-up due to large contact transfer. Was the relay tested with a real load? 5. For an inductive load, is a surge absorber used across the contacts? 6. When an inductive load causes heavy arc discharge across the relay contacts, the contacts may be corroded by chemical reaction with nitrogen in the atmosphere. Was the relay tested with a real load? 7. Platinum contacts may generate brown powder due to a catalyzer effect or vibration energy. Was the relay tested with a real load? 8. Is the contact switching frequency below the specification? 9. When there are more than two sets of contacts (2T) in a relay, metallic powder shed from one set of contacts may cause a contact failure on the other set (particularly for light loads). Was the relay tested in a real load? 10. A delay capacitor used across relay contacts may cause contact welding. Was the relay tested with a real load? 11. For an AC relay, a large contact bounce may cause contact welding. Was the relay tested in a real circuit or with a real load? 12. A high voltage may be induced at transformer load. Was the relay tested with a real load?
Circuit Design	1. Does circuit design take into account electrolytic corrosion of the coil? 2. Are transistors and other circuit components protected rom counter electromotive force that develops across the relay coil? 3. Is the circuit designed so the relay coil is left deenergized while the relay is inactive for long period of time? 4. Is the relay operated within the ratings approved by the relevant international standard (if compliance is required)? 5. Is the circuit protected from malfunction when the relay's activation and/or deactivation time varies considerably? 6. Is the circuit protected from malfunctions that might result from relay contact bounce? 7. Is the circuit protected from malfunction when a high-sensitivity latching type relay is to be used? 8. When there are two or more sets of contacts (2T) in a relay, arc discharges from load switching may cause short circuits across the two or more sets of contacts. Is the circuit designed to suppress such arc discharges? 9. Item 8 above also requires special attention when loads are supplied from separate power sources. 10. Does the post-installation insulation distance comply with the requirement of the relevant international standard or the Electrical Appliance and Material Control Law? 11. Is the circuit protected from malfunction when the relay is to be driven by transistors? 12. When the SCR is used for on/off control, the relay activation tends to synchronize with the line frequency, resulting in an extremely shortened life. Was the relay tested in a real circuit or with a real load? 13. Does the PC board design take into account use of on-board relay? 14. RF signals may leak across relay's open contacts. Check for adequate contact isolation and use RF relays as needed.

GENERAL APPLICATION GUIDELINES

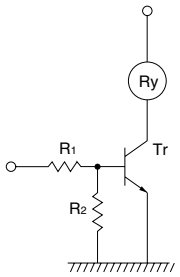
	Check Item
Operating Environment	1. Is the ambient temperature in the allowable operating temperature range? 2. Is the humidity in the allowable humidity range? 3. Is the operating atmosphere free from organic and sulfide gases? 4. Is the operating atmosphere free from silicon gas? Depending on the load type, silicon gas may cause a black substance to from on the contacts, leading to contact failure. 5. Is the operating atmosphere free from excessive airborne dust? 6. Is the relay protected from oil and water splashes? 7. Is the relay protected from vibration and impact which may cause poor contact with the socket? 8. Is ambient vibration and impact below the level allowable for the relay? 9. Is the relay free from mechanical resonance after it is installed in position? 10. Is insulation coating applied to the relay along with the PC board? Depending on the load type, a black substance may form to cause contact failure.
Installation and Connection	1. Is the relay protected from solder chips and flux when it is manually soldered? 2. Are preparations for flux application and automatic soldering complete? 3. Is the PC board cleaning process designed to minimize adverse affects to the relays? 4. Are adequate separations provided between polarized or reed relays to prevent magnetic coupling? 5. Are the relay terminals free from stress in the socket? 6. Polarized relay's characteristics may be affected by strong external magnetic field. Are the relays installed away from such fields? 7. If very long leads (several 10m more) are used to connect the load, the stray capacity existing across the leads may cause the inrush current. Was the relay tested with a real load? 8. Unless otherwise specified, all relay terminals should be soldered at 250°C 482°F within 5 sec. or at 350°C 662°F within 3 sec. 9. A badly warped PC board can cause stress to the relay terminals which may lead to degraded relay characteristics. 10. Glass shot should not be used to clean the PC board of solder flux. This may cause relay malfunction due to glass powder becoming lodged in the relay's internal structure. 11. Relays should always be used with their plastic shields installed, or degraded relay performance may result. 12. Do not cut away any relay terminal as the stress may cause degraded relay performance.
Storage and Transport	1. Is the relay subject to freezing or condensation (especially when shipping)? 2. Is the temperature in the allowable temperature range? 3. Is the humidity in the allowable humidity range? 4. Is the storing atmosphere free from organic and sulfide gases? 5. Is the storing atmosphere free from excessive airborne dust? 6. Is the relay protected from oil and water splashes? 7. Is the relay subject to the application of heavy weight? 8. When shipping does vibration and impact exceed the allowable range?

APPLICATIONS OF RELAYS IN ELECTRONIC CIRCUITS

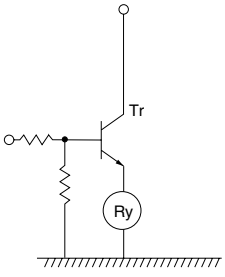
[1] RELAY DRIVE BY MEANS OF A TRANSISTOR

1. Connection Method

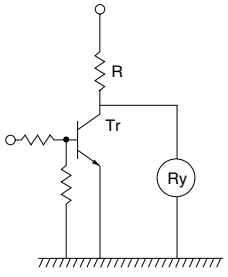
If the relay is transistor driven, we recommend using it with a collector connection.
The voltage impressed on the relay is always full rated coil voltage, and in the OFF time, the voltage is completely zero for avoidance of trouble in use.



(Good) Collector connection
With this most common connection, operation is stable.



(Care) Emitter connection
When the circumstances make the use of this connection unavoidable, if the voltage is not completely impressed on the relay, the transistor does not conduct completely and operation is uncertain.

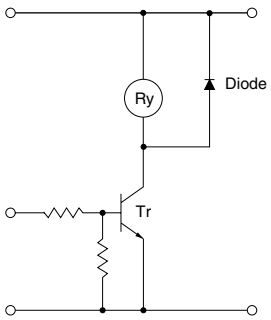


(Care) Parallel connection
When the power consumed by the complete circuit becomes large, consideration of the relay voltage is necessary.

2. Countermeasures for Surge Breakdown Voltage of Relay Control Transistor

If the coil current is suddenly interrupted, a sudden high voltage pulse is developed in the coil. If this voltage exceeds the breakdown voltage of the transistor, the transistor will be degraded, and this will lead to damage. It is absolutely necessary to connect a diode in the circuit as a means of preventing damage from the counter emf.
As suitable ratings for this diode, the current should be equivalent to the average rectified current to the coil, and the reverse blocking voltage should be about 3 times the value of the power source voltage.

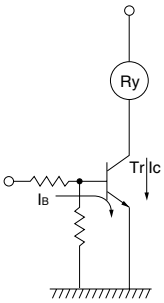
Connection of a diode is an excellent way to prevent voltage surges, but there will be a considerable time delay when the relay is open. If you need to reduce this time delay you can connect between the transistor's collector and emitter a Zener diode that will make the Zener voltage somewhat higher than the supply voltage.

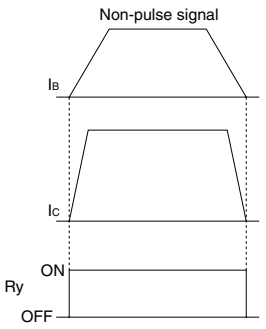


Take care of "Area of Safe Operation (ASO)".

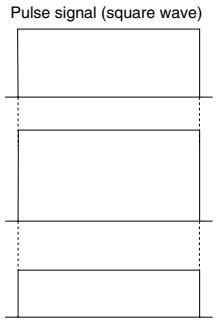
3. Snap Action

(Characteristic of relay with voltage rise and fall of voltage)
Unlike the characteristic when voltage is impressed slowly on the relay coil, this is the case where it is necessary to impress the rated voltage in a short time and also to drop the voltage in a short time.





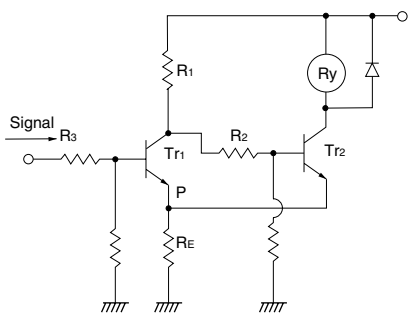
(No Good) Without snap action



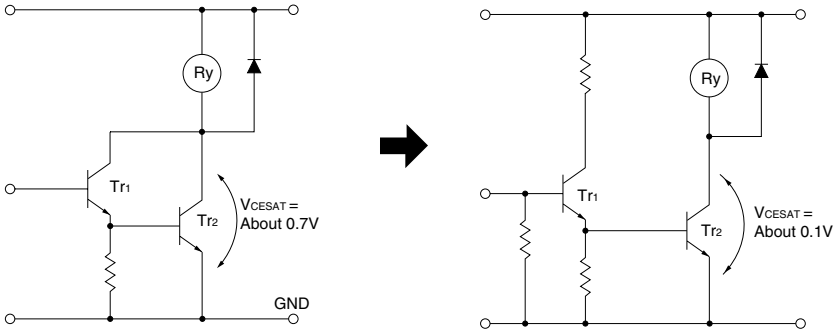
(Good) Snap action

4. Schmidt Circuit (Snap Action Circuit)

(Wave rectifying circuit)
When the input signal does not produce a snap action, ordinarily a Schmidt circuit is used to produce safe snap action.
Characteristic points
1) The common emitter resistor R_E must have a value sufficiently small compared with the resistance of the relay coil.
2) Due to the relay coil current, the difference in the voltage at point P when Tr_2 is conducting and at point P when Tr_1 is conducting creates hysteresis in the detection capability of Schmidt circuit, and care must be taken in setting the values.
3) When there is chattering in the input signal because of waveform oscillation, an CR time constant circuit should be inserted in the stage before the Schmidt trigger circuit. (However, the response speed drops.)



5. Avoid Darlington Connections.
(High amplification)
This circuit is a trap into which it is easy to fall when dealing with high circuit technology. This does not mean that it is immediately connected to the defect, but it is linked to troubles that occur after long periods of use and with many units in operation.

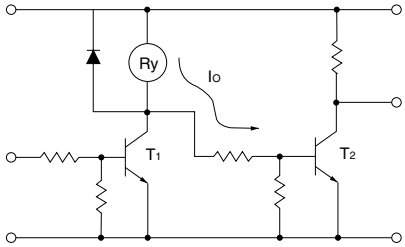


(No good) Darlington connection
(• Due to excessive consumption of power, heat is generated.)
(• A strong Tr_1, is necessary.)

(Good) Emitter connection
(Tr_2 conducts completely.)
(Tr_1 is sufficient for signal use.)

6. Residual Coil Voltage
In switching applications where a semiconductor (transistor, UJT, etc.) is connected to the coil, a residual voltage is retained at the relay coil which may cause incomplete restoration and faulty operation. By using DC coils, there may be a reduction in; the danger of incomplete restoration, the contact pressure, and the vibration resistance. This is because the drop-out voltage is 10% or more of the rated voltage, a low value compared to that for AC coil, and also there is a tendency to increase the life by lowering the drop-out voltage. When the signal from the transistor's collector is taken and used to drive another circuit as shown in the figure on the right, a minute dark current flows to the relay even if the transistor is off. This may cause the problems described above.

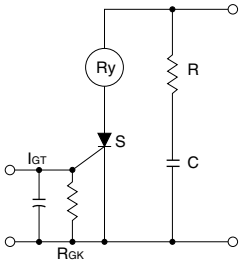
Connection to the next stage through collector



Io: dark current (No good)

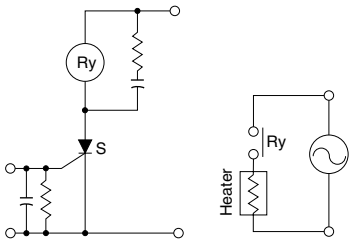
[2] RELAY DRIVE BY MEANS OF SCR

1. Ordinary Drive Method
For SCR drive, it is necessary to take particular care with regard to gate sensitivity and erroneous operation due to noise.



I_{GT} : There is no problem even with more than 3 times the rated current.
R_{GK} : 1K ohms must be connected.
R,C : This is for prevention of ignition error due to a sudden rise in the power source or to noise. (dv/dt countermeasure)

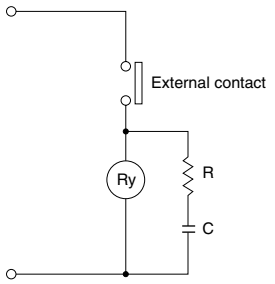
2. Caution points regarding ON/OFF control circuits
(When used for temperature or similar control circuits)
When the relay contacts close simultaneously with an AC single phase power source, because the electrical life of the contacts suffers extreme shortening, care is necessary.
1) When the relay is turned ON and OFF using a SCR, the SCR serves as a half wave power source as it is, and there are ample cases where the SCR is easily restored.
2) In this manner the relay operation and restoration timing are easily synchronized with the power source frequency, and the timing of the load switching also is easily synchronized.
3) When the load for the temperature control is a high current load such as a heater, the switching can occur only at peak values and it can occur only at zero phase values as a phenomenon of this type of control. (Depending upon the sensitivity and response speed of the relay)
4) Accordingly, either an extremely long life or an extremely short life results with wide variation, and it is necessary to take care with the initial device quality check.



[3] RELAY DRIVE FROM EXTERNAL CONTACTS

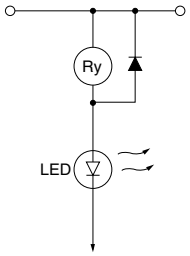
Relays for PC board use have high sensitivity and high speed response characteristics, and because they respond sufficiently to chattering and bouncing, it is necessary to take care in their drive.

When the frequency of use is low, with the delay in response time caused by a condenser, it is possible to absorb the chattering and bouncing.
(However, it is not possible to use only a condenser. A resistor should also be used with the capacitor.)



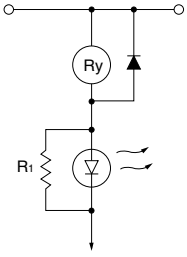
[4] LED SERIES AND PARALLEL CONNECTIONS

1) In series with relay



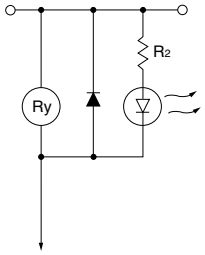
Power consumption:
In common with relay (Good)
Defective LED:
Relay does not operate (No good)
Low voltage circuit:
With LED, 1.5V down (No good)
No. of parts: (Good)

2) R in parallel with LED



Power consumption:
In common with relay (Good)
Defective LED:
Relay operate (Good)
Low voltage circuit:
With LED, 1.5V down (No good)
No. of parts: R_1 (Care)

3) In parallel connection with relay

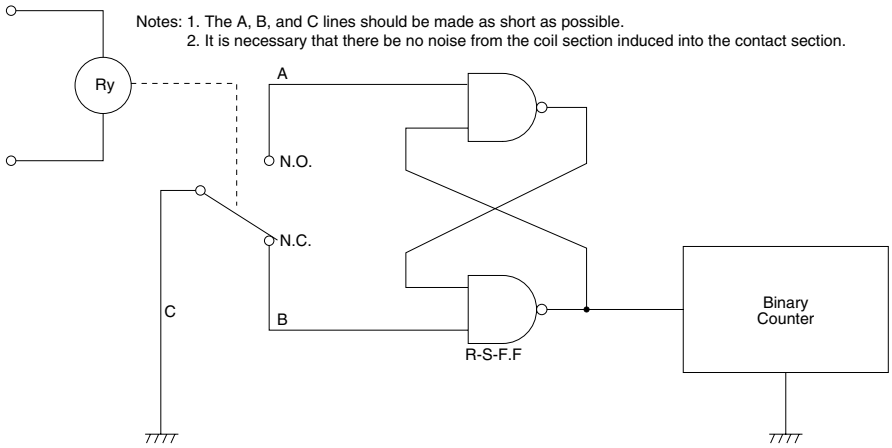


Power consumption:
Current limiting resistor R_2 (Care)
Defective LED:
Relay operate stable (Good)
Low voltage circuit: (Good)
No. of parts: R_2 (Care)

[5] ELECTRONIC CIRCUIT DRIVE BY MEANS OF A RELAY

1. Chatterless Electronic Circuit

Even though a chatterless characteristic is a feature of relays, this is to the fullest extent a chatterless electrical circuit, much the same as a mercury relay. To meet the requirement for such circuits as the input to a binary counter, there is an electronic chatterless method in which chattering is absolutely not permissible. Even if chattering develops on one side, either the N.O. side contacts or the N.C. side contacts, the flip flop does not reverse, and the counter circuit can be fed pulsed without a miss. (However, bouncing from the N.O. side to N.C. side must be absolutely avoided.)

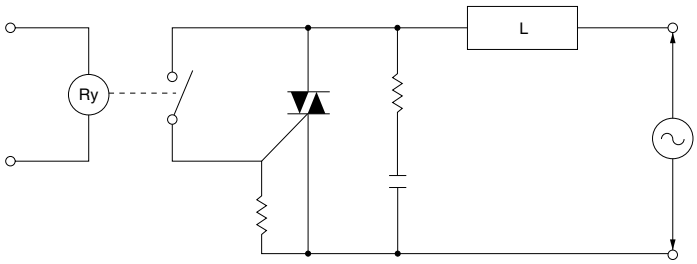


2. Triac Drive

When an electronic circuit using a direct drive from a triac, the electronic circuit will not be isolated from the power circuit, and because of this, troubles due to erroneous operation and damage can develop easily. The introduction of a relay drive is the most economical and most effective solution. (Photo coupler and pulse transformer circuits are complicated.)

Also, compared to switching a direct load with a relay, long life and reduced arc noise can be achieved.

When a zero cross switching characteristic is necessary, a solid state relay (SSR) should be used.



[6] POWER SOURCE CIRCUIT

1. Constant Voltage Circuit

In general, electronic circuits are extremely vulnerable to such phenomena as power supply ripples and voltage fluctuations. Although relay power supplies are not as vulnerable as electronic circuits, please keep both ripples and the regulation within the specification.

If power supply voltage fluctuations are large, please connect a stabilized circuit or constant-voltage circuit as shown in Fig. 1.

If the relay power consumption is great, satisfactory results can be achieved by implementing a circuit configuration as shown in Fig. 2.

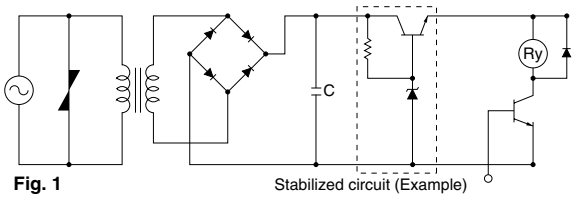


Fig. 1

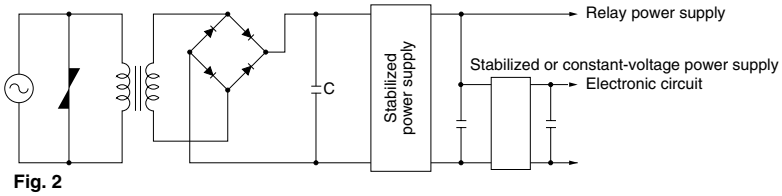


Fig. 2

2. Prevention of Voltage Drop Due to Rush Current

In the circuit shown in Fig. 3, rush current flows from the lamp or capacitor. The instant the contacts close, the voltage drops and the relay releases or chatters. In this case it is necessary to raise the transformer's capacity or add a smoothing circuit.

Fig. 4 shows an example of the modified circuit.

Fig. 5 shows a battery-powered version.

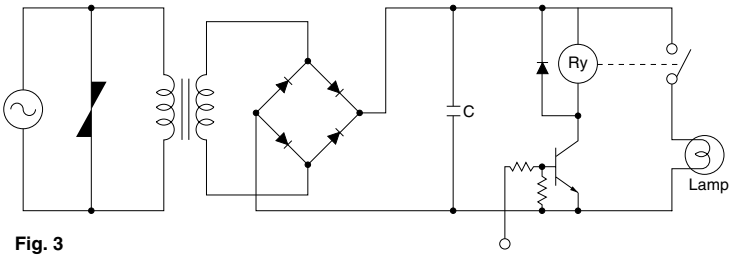


Fig. 3

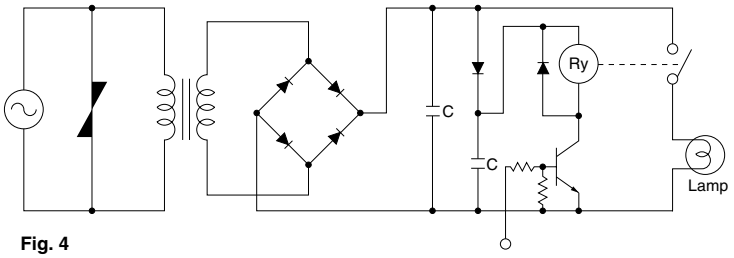


Fig. 4

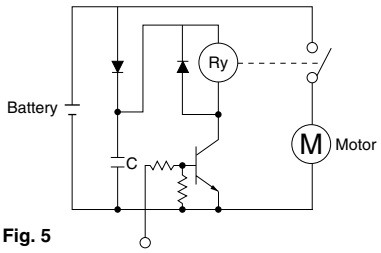


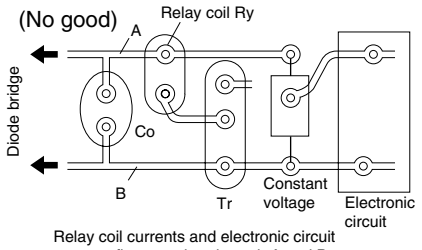
Fig. 5

[7] PC BOARD DESIGN CONSIDERATIONS

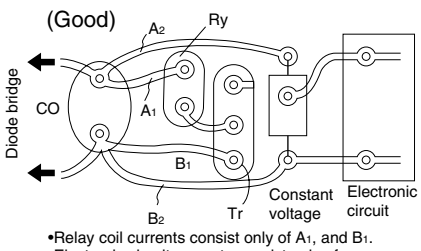
• Pattern Layout for Relays

Since relays affect electronic circuits by generating noise, the following points should be noted.

Keep relays away from semiconductor devices. Design the pattern traces for shortest lengths. Place the surge absorber (diode, etc.) near the relay coil. Avoid routing pattern traces susceptible to noise (such as for audio signals) underneath the relay coil section. Avoid through-holes in places which cannot be seen from the top (e.g. at the base of the relay). Solder flowing up through such a hole may cause damage such as a broken seal. Even for the same circuit, pattern design considerations which minimize the influence of the on/off operations of the relay coil and lamp on other electronic circuits are necessary.



Relay coil currents and electronic circuit currents flow together through A and B.



•Relay coil currents consist only of A_1, and B_1.
•Electronic circuit currents consist only of A_2 and B_2. A simple design consideration can change the safety of the operation.

• Hole and land diameter

The hole diameter and land are made with the hole slightly larger than the lead wire so that the component may be inserted easily. Also, when soldering, the solder will build up in an eyelet condition, increasing the mounting strength. The standard dimensions for the hole diameter and land are shown in the table.

Standard dimensions for hole and land diameter mm inch

Standard hole diameter	Tolerance	Land diameter
0.8 .031	±0.1 ±.039	2.0 to 3.0 .079 to .118
1.0 .039		
1.2 .047		3.5 to 4.5 .138 to .177
1.6 .063		

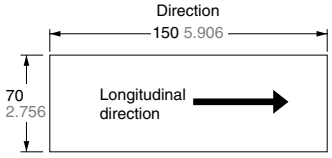
Remarks

1. The hole diameter is made 0.2 to 0.5mm .008 to .020inch larger than the lead diameter. However, if the jet method (wave type, jet type) of soldering is used, because of the fear of solder passing through to the component side, it is more suitable to make the hole diameter equal to the lead diameter +0.2mm.
2. The land diameter should be 2 to 3 times the hole diameter.
3. Do not put more than 1 lead in one hole.

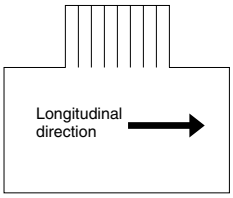
• Expansion and shrinkage of copperclad laminates

Because copperclad laminates have a longitudinal and lateral direction, the manner of punching fabrication and layout must be observed with care. The expansion and shrinkage in the longitudinal direction due to heat is 1/15 to 1/2 that in the lateral, and accordingly, after the punching fabrication, the distortion in the longitudinal direction will be 1/15 to 1/2 that of the lateral direction. The mechanical strength in the longitudinal direction is 10 to 15% greater than that in the lateral direction. Because of this difference between the longitudinal and lateral directions, when products having long configurations are to be fabricated, the lengthwise direction of the configuration should be made in the longitudinal direction, and PC boards having a connector section should be made with the connector along the longitudinal side.

Example : As shown is the drawing below, the 150mm 5.906 inch direction is taken as the longitudinal direction.

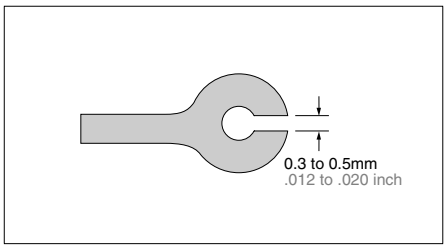


Also, as shown in the drawing below, when the pattern has a connector section, the direction is taken as shown by the arrow in the longitudinal direction



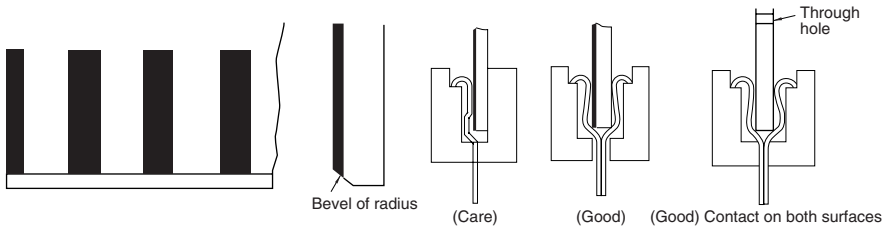
2. When it is necessary to use hand soldering for one part of a component after dip soldering has been done

By providing a narrow slot in the circular part of the foil pattern, the slot will prevent the hole from being plugged with solder.



3. When the PC board itself is used as a connector

1) The edge should be beveled. (This prevents peeling of the foil when the board is inserted into its socket.)
2) When only a single side is used as the connector blade, if there is distortion in the PC board, contact will be defective. Care should be taken.



4. PC Board Reference Data

(This data has been derived from samples of this company's products. Use this data as a reference when designing PC boards.)

• Conductor width

The allowable current for the conductor was determined from the safety aspect and the effect on the performance of the conductor due to the rise in saturation temperature when current is flowing. (The narrower the conductor width and the thinner the copper foil, the larger the temperature rise.) For example, too high a rise in temperature causes degradation of the characteristic and color changes of the laminate. In general, the allowable current of the conductor is determined so that the rise is temperature is less than 10°C. It is necessary to design the conductor width from this allowable conductor current.

Fig. 1, Fig. 2, Fig. 3 show the relationship between the current and the conductor width for each rise in temperature for different copper foils. It is also necessary to give consideration to preventing abnormal currents from exceeding the destruction current of the conductor.

Fig. 4 shows the relationship between the conductor width and the destruction current.

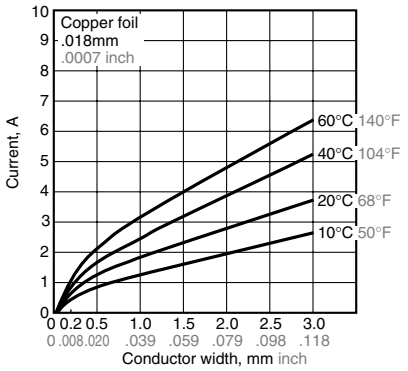


Fig. 1

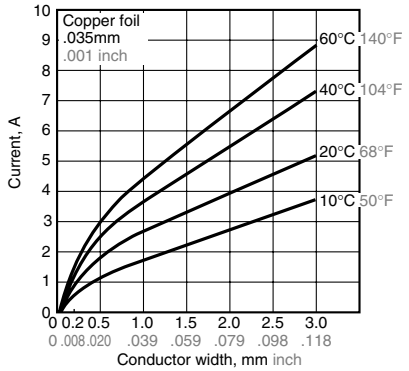


Fig. 2

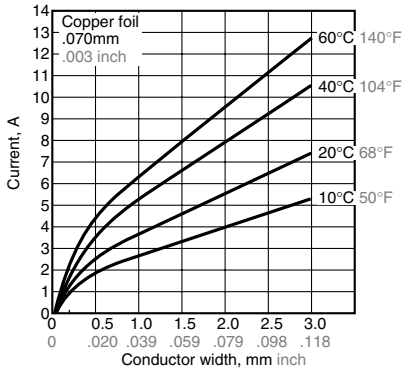


Fig. 3

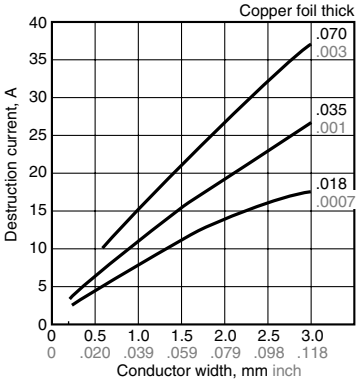


Fig. 4

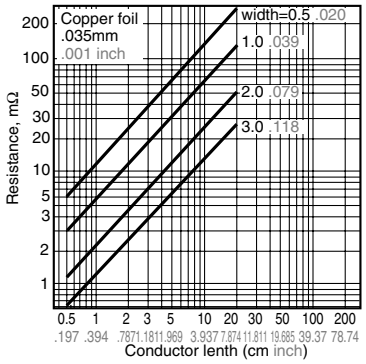


Fig. 5

• Space between conductors

Fig. 6 shows the relationship between the spacing between conductors and the destruction voltage. This destruction voltage is not the destruction voltage of the PC board; it is the flash over voltage (insulation breakdown voltage of the space between circuits.) Coating the surface of the conductor with an insulating resin such as a solder resist increases the flash over voltage, but because of the pin holes of the solder resist, it is necessary to consider the conductor destruction voltage without the solder resist. In fact, it is necessary to add an ample safety factor when determining the spacing between conductors. Table shows an example of a design for the spacing between conductors. (Taken from the JIS C5010 standards.) However, when the product is covered by the electrical products control law, UL standards or other safety standards, it is necessary to conform to the regulations.

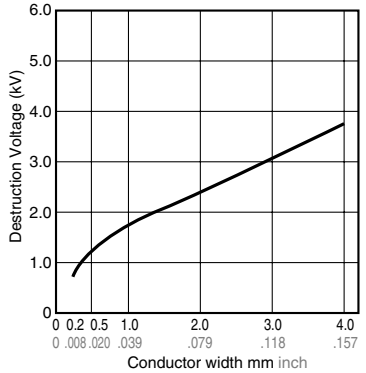


Fig. 6

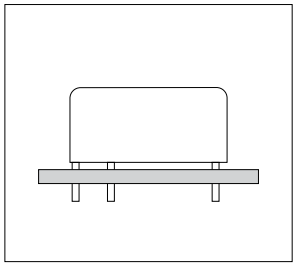
Example of conductor spacing design

Maximum DC and AC Voltage Between Conductors (V)	Minimum Conductor Spacing (mm inch)
0 to 50	0.381 .015
51 to 150	0.635 .025
151 to 300	1.27 .050
301 to 500	2.54 .100
500 or more	Calculated at 0.00508 mm/V

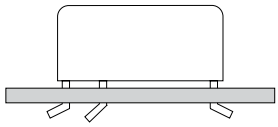
RELAY SOLDERING AND CLEANING GUIDELINES

In keeping with making devices compact, it is becoming more common to weld the relay to a PC board along with the semiconductors instead of using the previous plug-in type in which relays were plugged into sockets. With this style, loss of function may occur because of seepage into the relay of flux, which is applied to the PC board. Therefore, the following precautions are provided for soldering a relay onto a PC board. Please refer to them during installation in order to avoid problems.
The type of protective structure will determine suitability for automatic soldering or automatic cleaning. Please review the parts on construction and characteristics in the previous section, “Configuration and Construction”.

[1] MOUNTING OF RELAY

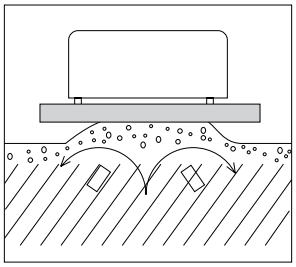


• Avoid bending the terminals to make the relay self-clinching. Relay performance cannot be guaranteed if the terminals are bent. Self-clinching terminal types are available depending on the type of relay.
• Correctly drill the PC board according to the given PC board pattern illustration.
• Stick packaging is also available for automatic mounting, depending on the type of relay. (Be sure that the relays don’t rattle.) Interference may occur internally if the gripping force of the tab of the surface mounting machine is too great. This could impair relay performance.

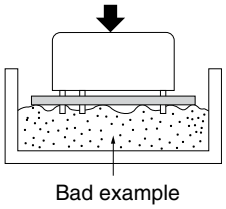


Bad example

[2] FLUX APPLICATION

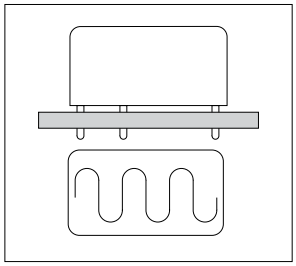


• Adjust the position of the PC board so that flux does not overflow onto the top of it. This must be observed especially for dust-cover type relays.
• Use rosin-based non-corrosive flux.
• If the PC board is pressed down into a flux-soaked sponge as shown on the right, the flux can easily penetrate a dust-cover type relay. Never use this method. Note that if the PC board is pressed down hard enough, flux may even penetrate a flux-resistant type relay.



Bad example

[3] PREHEATING



• Be sure to preheat before using automatic soldering. For dust-cover type relays and flux-resistant type relays, preheating acts to prevent the penetration of flux into the relay when soldering. Solderability also improves.

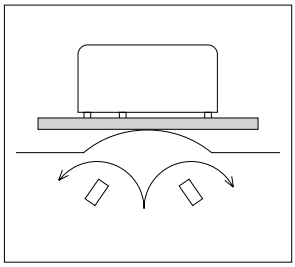
• Preheat according to the following conditions.

Temperature	120°C 248°F or less
Time	Within approx. 2 minutes

• Note that long exposure to high temperatures (e.g. due to a malfunctioning unit) may affect relay characteristics.

RELAY SOLDERING AND CLEANING GUIDELINES

[4] SOLDERING



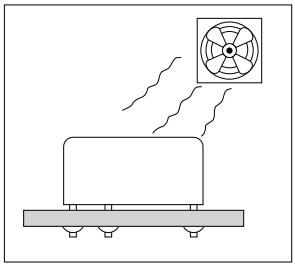
Automatic Soldering	Hand Soldering
• Flow solder is the optimum method for soldering. • Adjust the level of solder so that it does not overflow onto the top of the PC board. • Unless otherwise specified, solder under the following conditions depending on the type of relay.	• Keep the tip of the soldering iron clean.

Automatic Soldering	
Solder Temperature	260°C±5°C 500°F±41°F
Soldering Time	Within approx. 6 seconds

Hand Soldering	
Soldering Iron	30W to 60W
Iron Tip Temperature	350°C 662°F
Soldering Time	Within approx. 3 seconds

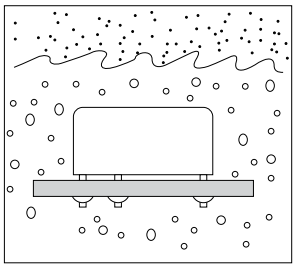
• Please take caution with multi-layer boards. Relay performance may degrade due to the high thermal capacity of these boards.

[5] COOLING



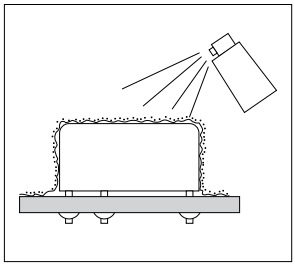
Automatic Soldering	Hand Soldering
• Immediate air cooling is recommend to prevent deterioration of the relay and surrounding parts due of soldering heat. • Although the environmentally sealed type relay (plastic sealed type, etc.) can be cleaned, avoid immersing the relay into cold liquid (such as cleaning solvent) immediately after soldering. Doing so may deteriorate the sealing performance.	—

[6] CLEANING



• Do not clean dust-cover type relays and flux-resistant type relays by immersion. Even if only the bottom surface of the PC board is cleaned (e.g. with a brush), careless cleaning may cause cleaning solvent to penetrate the relay.
• Plastic sealed type relays can be cleaned by immersion. Use a Freon- or alcohol-based cleaning solvent. Use of other cleaning solvents (e.g. Trichlene, chloroethene, thinner, benzyl alcohol, gasoline) may damage the relay case.
• Cleaning with the boiling method is recommended. 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.
• Do not cut the terminals. When terminals are cut, breaking of coil wire and slight sticking of the contacts may occur due to vibration of the cutter.

[7] COATING



• If the PC board is to be coated to prevent the insulation of the PC board from deteriorating due to corrosive gases and high temperatures, note the following.
• Do not coat dust-cover type relays and flux-resistant type relays, since the coating material may penetrate the relay and cause contact failure. Or, mount the relay after coating.
• Depending on the type, some coating materials may have an adverse affect on relays. Furthermore, solvents (e.g. xylene, toluene, MEK, I.P.A.) may damage the case or chemically dissolve the epoxy and break the seal. Select coating materials carefully.

Type	Suitability for Relays	Features
Epoxy-base	Good	• Good electrical insulation. • Although slightly difficult to apply, does not affect relay contacts.
Urethane-base	Care	• Good electrical insulation, easy to apply. • Solvent may damage case. Check before use.
Silicon-base	No Good	• Silicon gas becomes the cause of contact failure. Do not use the silicon-base type.

• If the relay and all components (e.g. ICs) are to be coated, be sure to carefully check the flexibility of the coating material. The solder may peel off from thermal stress.

RELIABILITY

[1] WHAT IS RELIABILITY?

1. Reliability in a Narrow Sense of the Term

In the industrial world, reliability is an index of how long a particular product serves without failure.

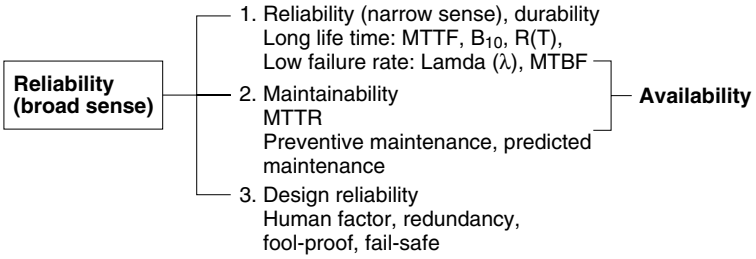
2. Reliability in a Broad Sense of the Term

Every product has a finite service lifetime. This means that no product can continue normal service infinitely. When a product has broken down, the user may throw it away or repair it. The reliability of repairable products is recognized as "reliability in a broad sense of the term". For repairable products, their serviceability or maintainability is another problem. In addition, reliability of product design is becoming a serious concern for the manufacturing industry. In short, reliability has three senses: i.e. reliability of the product itself, serviceability of the product, and reliability of product design.

3. Intrinsic Reliability and Reliability of Use

Reliability is "built" into products. This is referred to as intrinsic reliability which consists mainly of reliability in the narrow sense.

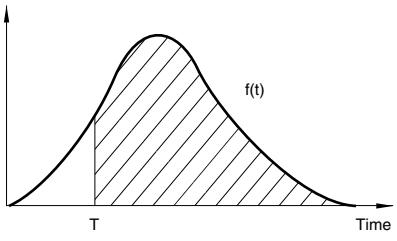
Product reliability at the user's site is called "reliability of use", which consists mainly of reliability in the broad sense. In the relay industry, reliability of use has a significance in aspects of servicing.



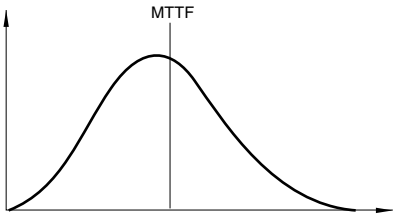
[2] RELIABILITY MEASURES

The following list contains some of the most popular reliability measures:

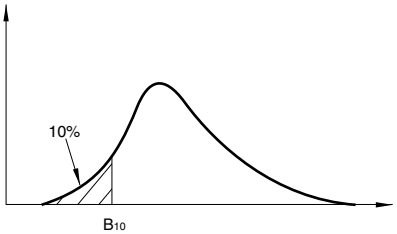
Reliability measure	Sample representation
Degree of reliability R(T)	99.9%
MTBF	100 hours
MTTF	100 hours
Failure rate λ	20 fit, 1%/hour
Safe life B_{10}	50 hours



(a) R(T)



(b) MTTF



(c) Safe life

1. Degree of Reliability

Degree of reliability represents percentage ratio of reliability. For example, if none of 10 light bulbs has failed for 100 hours, the degree of reliability defined in, 100 hours of time is 10/10 = 100%. If only three bulbs remained alive, the degree of reliability is 3/10 = 30%.

The JIS Z8115 standard defines the degree of reliability as follows:

The probability at which a system, equipment, or part provides the specified functions over the intended duration under the specified conditions.

2. MTBF

MTBF is an acronym of mean time between failures. It indicates the mean time period in which a system, equipment, or part operates normally between two incidences of repair. MTBF only applies to repairable products. MTBF tells how long a product can be used without the need for repair. Sometimes MTBF is used to represent the service lifetime before failure.

3. MTTF

MTTF is an acronym of mean time to failure. It indicates the mean time period until a product becomes faulty MTTF normally applies to unrepairable products such as parts and materials.

The relay is one of such objective of MTTF.

4. Failure Rate

Failure rate includes mean failure rate and momentary failure rate.

Mean failure rate is defined as follows:

Mean failure rate = Total failure count/ total operating hours

In general, failure rate refers to momentary failure rate. This represents the probability at which a system, equipment, or part, which has continued normal operation to a certain point of time, becomes faulty in the subsequent specified time period.

Failure rate is often represented in the unit of percent/hours. For parts with low failure rates, "failure unit (Fit) = 10^{-9} / hour" is often used instead of failure rate. Percent/count is normally used for relays.

5. Safe Life

Safe life is an inverse of degree of reliability. It is given as value B which makes the following equation true:

$1 - R(B) = t\,\%$

In general, "B[1 – R(B)] = 10%" is more often used. In some cases this represents a more practical value of reliability than MTTF.

[3] FAILURE

1. What is Failure?

Failure is defined as a state of system, equipment, or component in which part of all of its functions are impaired or lost.

2. Bathtub Curve

Product's failure rate throughout its lifetime is depicted as a bathtub curve, as shown below. Failure rate is high at the beginning and end of its service lifetime.

(I) Initial failure period

The high failure rate in the initial failure period is derived from latent design errors, process errors, and many other causes. Initial failures are screened at manufacturer's site through burn-in process. This process is called debugging, performing aging or screening.

(II) Accidental failure period

The initial failure period is followed by a long period with low, stable failure rate. In this period, called accidental failure period, failures occurs at random along the time axis. While zero accidental failure rate is desirable, this is actually not practical in the real world.

(III) Wear-out failure period

In the final stage of the product's service lifetime comes the wear-out failure period, in which the life of the product expires due to wear of fatigue. Preventive maintenance is effective for this type of failure. The timing of a relay's wear-out failure can be predicted with a certain accuracy from the past record of uses. The use of a relay is intended only in the accidental failure period, and this period virtually represents the service lifetime of the relay.

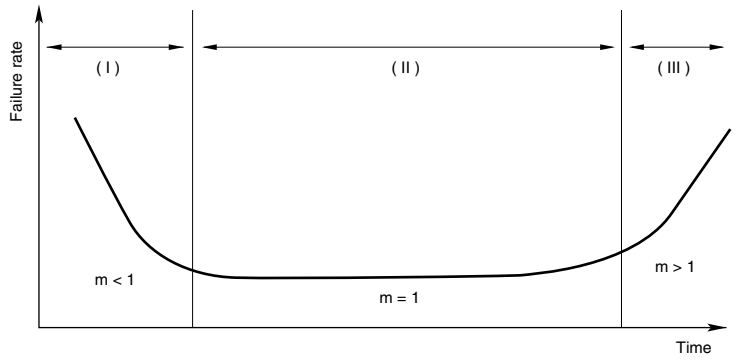
3. Weibull Analysis

Weibull analysis is often used for classifying a product's failure patterns and to determine its lifetime. Weibull distribution is expressed by the following equation:

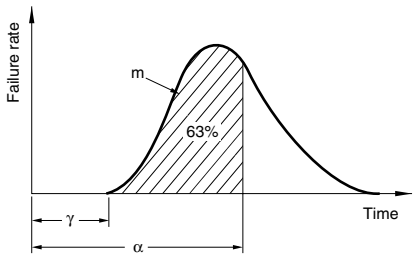
$$f(x) = \frac{m}{\alpha}(\chi-\gamma)^{m-1} e - \frac{(\chi-\gamma)^m}{\alpha}$$

where

m : Figure parameter
α : Measurement parameter
γ : Position parameter



Weibull distribution can be adopted to the actual failure rate distribution if the three variables above are estimated.



The Weibull probability chart is a simpler alternative of complex calculation formulas. The chart provides the following advantages:

(1) The Weibull distribution has the closest proximity to the actual lifetime distribution.

(2) The Weibull probability chart is easy to use.

(3) Different types of failures can be identified on the chart.

The following describes the correlation with the bathtub curve. The value of the figure parameter "m" represents the type of the failure.

(1) When $m < 1$: Initial failures

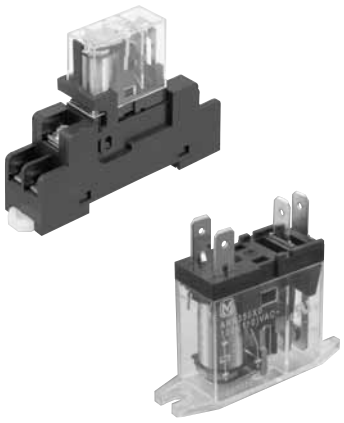
(2) When $m = 1$: Accidental failures

(3) When $m > 1$: Wear-out failures

Panasonic
ideas for life

Relay for control panel of 1c 10A, 2c 5A and 1a 16A

HN RELAYS (AHN)



Compliance with RoHS Directive

FEATURES

1. Slim and compact size
20% smaller (width and height) than existing model* (with the condition of screw terminal socket for DIN rail)
*Compared with our HC/HJ relay.

2. High-capacity and high reliability
Max. switching current:
16 A (for 1 Form C type at AC load)
Uses gold-flashed contacts for highly reliable contact (for 2 Form C type).

3. Environmentally friendly
Cadmium-free contacts and lead-free solder are used.

4. Slim screw terminal socket and PC board terminal socket
Utilizes relay-securing hook for easy relay removal.
One-touch relay removal possible.
Terminal sockets with finger protect function available.

5. Full lineup
We added a TM type that can be built into devices.

6. Sockets and terminal sockets are available.

TYPICAL APPLICATIONS

Control panels
Power supply units
Molding machines
Machine tools
Welding equipment
Agricultural equipment
Office equipment
Vending machines
Communications equipment
Amusement machines, etc.

ORDERING INFORMATION

AHN □ □ □ □□

HN relays

Contact arrangement
1: 1 Form C
2: 2 Form C
3: 1 Form A (TM type only)

Terminal arrangement
1: AC plug-in type
2: DC plug-in type
5: AC TM type
6: DC TM type

Type classification
0: Standard
1: With LED indication
2: With diode
3: With diode and LED indication

Nominal coil voltage
05: 5 V, 06: 6 V, 12: 12 V, 24: 24 V, 48: 48 V
X0: 100/110 V AC, 100 V DC
X1: 110/120 V AC, 110 V DC
Y0: 200/220 V AC
Y2: 220/240 V AC

Note: Certified by UL/C-UL and VDE
(Please consult us for VDE approved TM type.)

TYPES

1. Plug-in type

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12005	AHN22005
6V DC	AHN12006	AHN22006
12V DC	AHN12012	AHN22012
24V DC	AHN12024	AHN22024
48V DC	AHN12048	AHN22048
100V DC	AHN120X0	AHN220X0
110V DC	AHN120X1	AHN220X1
12V AC	AHN11012	AHN21012
24V AC	AHN11024	AHN21024
100/110V AC	AHN110X0	AHN210X0
110/120V AC	AHN110X1	AHN210X1
200/220V AC	AHN110Y0	AHN210Y0
220/240V AC	AHN110Y2	AHN210Y2

Standard packing: Carton: 50 pcs.; Case: 500 pcs.

2. Plug-in type (with LED indication)

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12105	AHN22105
6V DC	AHN12106	AHN22106
12V DC	AHN12112	AHN22112
24V DC	AHN12124	AHN22124
48V DC	AHN12148	AHN22148
100V DC	AHN121X0	AHN221X0
110V DC	AHN121X1	AHN221X1
12V AC	AHN11112	AHN21112
24V AC	AHN11124	AHN21124
100/110V AC	AHN111X0	AHN211X0
110/120V AC	AHN111X1	AHN211X1
200/220V AC	AHN111Y0	AHN211Y0
220/240V AC	AHN111Y2	AHN211Y2

Standard packing: Carton: 50 pcs.; Case: 500 pcs.

3. Plug-in type (with diode)

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12205	AHN22205
6V DC	AHN12206	AHN22206
12V DC	AHN12212	AHN22212
24V DC	AHN12224	AHN22224
48V DC	AHN12248	AHN22248
100V DC	AHN122X0	AHN222X0
110V DC	AHN122X1	AHN222X1

Standard packing: Carton: 50 pcs.; Case: 500 pcs.

4. Plug-in type (with diode and LED indication)

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12305	AHN22305
6V DC	AHN12306	AHN22306
12V DC	AHN12312	AHN22312
24V DC	AHN12324	AHN22324
48V DC	AHN12348	AHN22348
100V DC	AHN123X0	AHN223X0
110V DC	AHN123X1	AHN223X1

Standard packing: Carton: 50 pcs.; Case: 500 pcs.

5. TM type

Nominal coil voltage	1 Form A
	Part No.
5V DC	AHN36005
6V DC	AHN36006
12V DC	AHN36012
24V DC	AHN36024
48V DC	AHN36048
100V DC	AHN360X0
110V DC	AHN360X1
12V AC	AHN35012
24V AC	AHN35024
100/110V AC	AHN350X0
110/120V AC	AHN350X1
200/220V AC	AHN350Y0
220/240V AC	AHN350Y2

Standard packing: Carton: 50 pcs.; Case: 500 pcs.

* For sockets and terminal sockets, see page 53.

RATING

1. Coil data

1) DC coils

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±20%]	Coil resistance (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 20°C 68°F)
5V DC	70%V or less of nominal voltage (Initial)	15%V or more of nominal voltage (Initial)	106.4mA	47Ω [±10%]	0.53W	170%V of nominal voltage
6V DC			88.2mA	68Ω [±10%]		
12V DC			44.4mA	270Ω [±10%]		
24V DC			22.0mA	1,090Ω [±10%]		
48V DC			11.0mA	4,350Ω [±10%]		
100V DC			5.3mA	18,870Ω [±10%]		
110V DC			4.8mA	22,830Ω [±10%]		

2) AC coils (50/60Hz)

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±20%]		Nominal operating power		Max. applied voltage (at 20°C 68°F)
			50Hz	60Hz	50Hz	60Hz	
12V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	93mA	75mA	Approx. 1.1 to 1.4 V A	Approx. 0.9 to 1.2 V A	140%V of nominal voltage
24V AC			46.5mA	37.5mA			
100/110V AC			11.0/13.0mA	9.0/10.6mA			
110/120V AC			10.0/11.8mA	8.2/9.7mA			
200/220V AC			5.5/6.5mA	4.5/5.3mA			
220/240V AC			5.0/5.9mA	4.1/4.8mA			

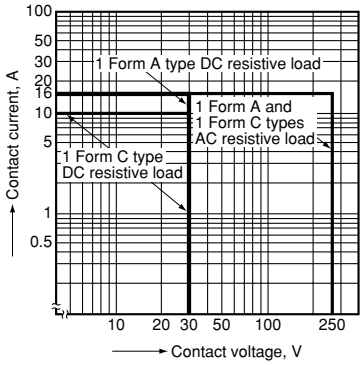
2. Specifications (Plug-in Standard type and TM type)

Characteristics	Item		Specifications		
Contact	Arrangement		1 Form C	2 Form C	1 Form A (TM type)
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 6 V DC 1A)	Max. 50 mΩ (By voltage drop 6 V DC 1A)	Max. 100 mΩ (By voltage drop 6 V DC 1A)
	Contact material		$AgSnO_2$ type	Au-flashed AgNi type	$AgSnO_2$ type
Rating	Nominal switching capacity (resistive load)		10A 250V AC, 10A 30V DC	5A 250V AC, 5A 30V DC	16A 250V AC, 16A 30V DC
	Max. switching power (resistive load)		4,000VA, 300W	1,250VA, 150W	4,000VA, 480W
	Max. switching voltage		250V AC, 30V DC		
	Max. switching current		16A (at AC load), 10A (at DC load)	5A	16A
	Nominal operating power		0.53W, 0.9VA		
	Min. switching capacity (Reference value)*1		100mA 5V DC	1mA 1V DC	100mA 5V DC
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 1min. (Detection current: 10mA.)		
		Between contact sets	—	3,000 Vrms for 1min. (Detection current: 10mA.)	—
		Between contact and coil	5,000 Vrms for 1min. (Detection current: 10mA.)		
	Temperature rise (coil) (at 70°C 158°F)		Max. 60°C 140°F (By resistive method, nominal coil voltage)		
	Operate time (at 20°C 68°F)*2		Max. 15ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)		
	Release time (at 20°C 68°F)*2		Max. 5ms (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)/Max. 20ms (with diode)		
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)		
		Destructive	Min. 1,000 m/s² (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		AC: Min. 10^7; DC: Min. 2×10^7 (at 300 times/min.)		
	Electrical (at nominal switching capacity)		Min. 10^5 (at 20 times/min.)		Min. 10^5 (at 10 times/min.)
Conditions	Conditions for operation, transport and storage*3 (Not freezing and condensing at low temperature)		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)		
	Max. Operating speed		20 times/min. (at nominal switching capacity)		10 times/min. (at nominal switching capacity)
Unit weight			Approx. 19 g .67 oz	Approx. 17 g .60 oz	Approx. 19 g .67 oz

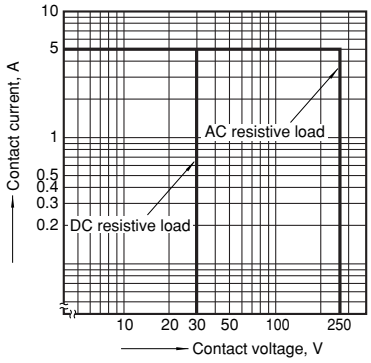
Notes: *1. This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2. For the AC coil types, the operate/release time will differ depending on the phase.
*3. The upper limit of the ambient temperature is the maximum temperature that can satisfy the coil temperature rise value. Refer to Usage, transport and storage conditions in NOTES.

REFERENCE DATA

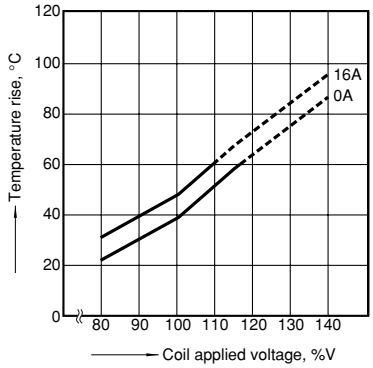
1-(1). Max. switching capacity
(1 Form C and 1 Form A)



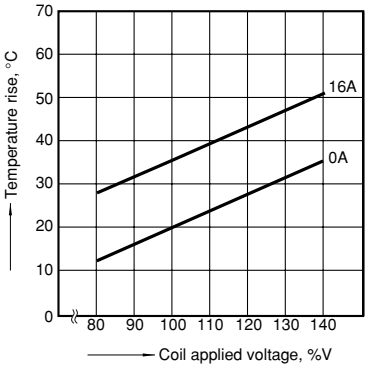
1-(2). Max. switching capacity (2 Form C)



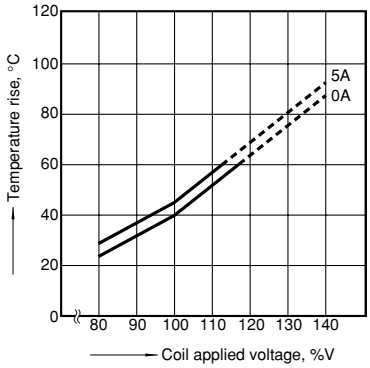
2-(1). Coil temperature rise (1 Form C/AC and 1 Form A/AC types)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



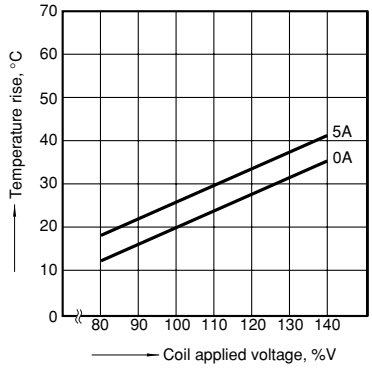
2-(2). Coil temperature rise (1 Form C/DC and 1 Form A/DC types)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



2-(3). Coil temperature rise (2 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



2-(4). Coil temperature rise (2 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F

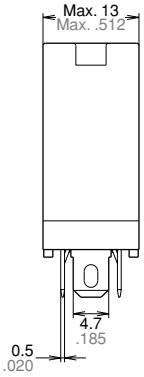


DIMENSIONS (mm inch)

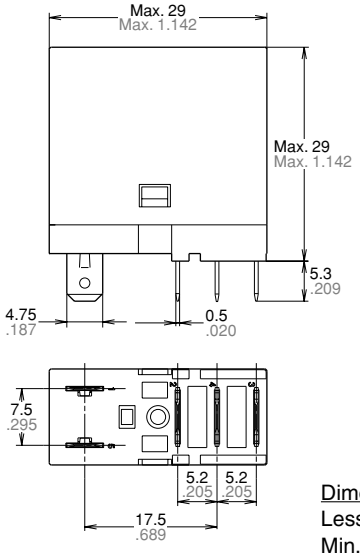
The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

1. Plug-in type 1 Form C

CAD Data

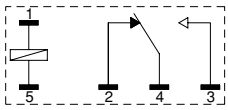


External dimensions

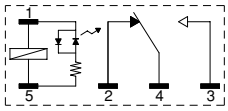


Schematic (Bottom view)

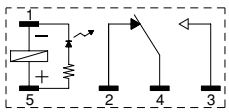
Standard type



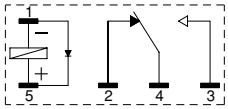
With LED AC type



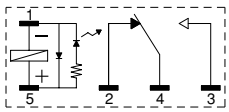
With LED DC type



With Diode type



With Diode and LED type

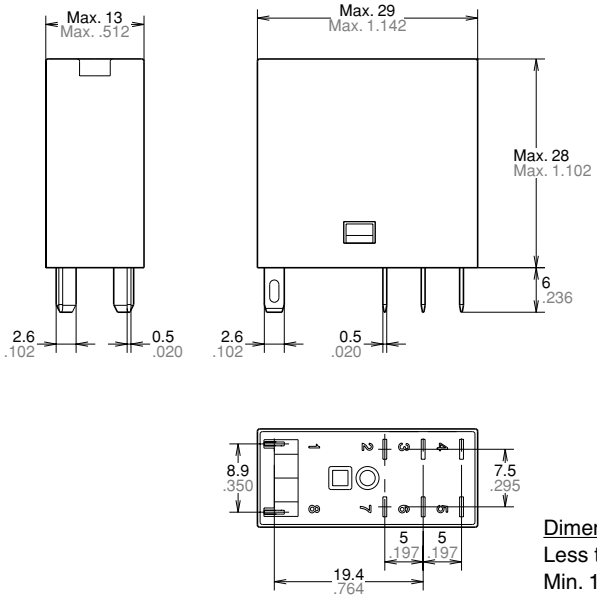


Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. Plug-in type 2 Form C

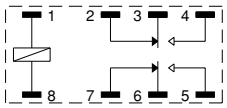
CAD Data

External dimensions

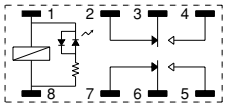


Schematic (Bottom view)

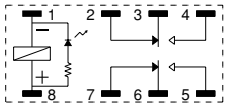
Standard type



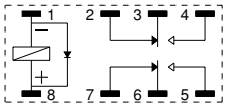
With LED AC type



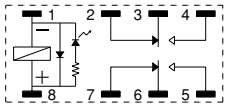
With LED DC type



With Diode type



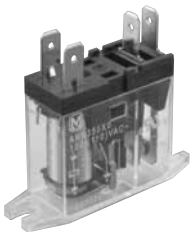
With Diode and LED type

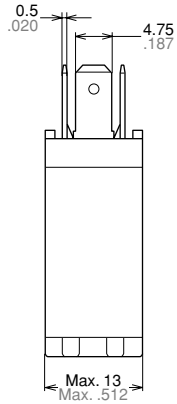


Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

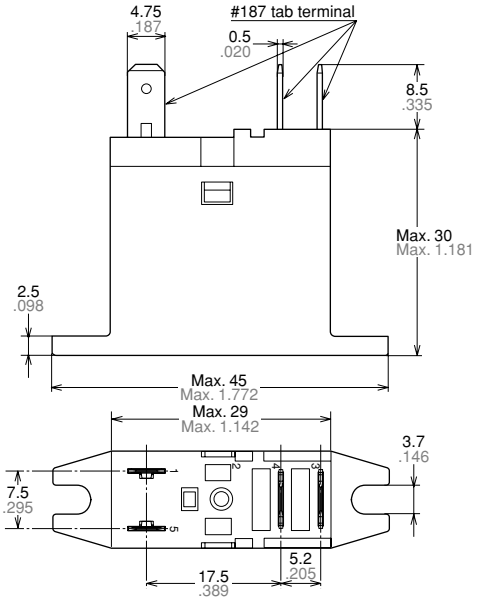
3. TM type 1 Form A

CAD Data



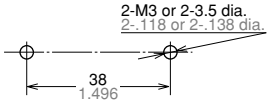


External dimensions



Schematic

Mounting hole dimensions



Notes: 1. When mounting the TM type, since the cover is made from polycarbonate, please use a washer in order to prevent damage, deformation, and loosening.
2. Suitable tightening torque is 0.3 to 0.5 N·m.

Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

SAFETY STANDARDS

	File No.	Certification authority: UL/C-UL	File No.	Certification authority: VDE
1 Form C	E43149*	10A 277V AC, 10A 30V DC	40012003	10A 250V AC (cosϕ=1.0), 10A 30V DC (0ms)
2 Form C	E43149*	5A 277V AC, 5A 30V DC	40012003	5A 250V AC (cosϕ=1.0), 5A 30V DC (0ms)
1 Form A (TM type)	E43149*	16A 277V AC, 16A 30V DC, TV-5	—	**

* CSA standard: Certified by C-UL
** Please consult us.

NOTES

1. Coil applied voltage

To ensure proper operation, the voltage applied to both terminals of the coil should be ±5% (at 20°C 68°F) the rated operating voltage of the coil.

Also, be aware that the pick-up and drop-out voltages will fluctuate depending on the ambient temperature and operating conditions.

2. LED indications

The light of the light emitting diode is what displays operation. If voltage remains after relay dropout, the LED might illuminate briefly.

3. Switching lifetime

The switching lifetime is defined under the standard test condition specified in the JIS C 5442(*2) standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75% R.H.). 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.

1) When used for AC load-operating and the operating phase is synchronous.

Rocking and fusing can easily occur due to contact shifting.

2) 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 HNO_3 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

4. Direct mount type (TM type)

If the current to the connection terminal will exceed 10 A, we recommend connecting with solder. If you are going to use a tab terminal when the current will exceed 10 A, make sure to verify the temperature rise on the receptacle side under actual conditions before using.

5. Conditions for operation, transport and storage

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

(1) Temperature:

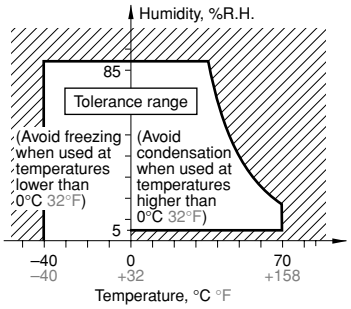
–40 to +70°C – 40 to +158°F

(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.

Temperature and humidity range for usage, transport, and storage



(3) Atmospheric pressure: 86 to 106 kPa

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, low humidity environments

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

6. Diode characteristics

1) Reverse breakdown voltage:

Min. 1,000V (with diode type)

Min. 400V (with diode and LED indication type)

7. Diode type

Since the diode inside the relay coil are designed to absorb the counter emf, the element may be damaged if a large surge, etc., is applied to the diode.

If there is the possibility of a large surge voltage from the outside, please implement measures to absorb it.

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.

9. Installation

If you will be installing adjacent to other relays, please keep a distance of at least 5 mm from the relay.

For Cautions for Use, see Page 21.

TYPES

Type	No. of poles	Item	Part No.
PC board terminal socket	1-pole	HN1 PC board terminal socket	AHNA13
	2-pole	HN2 PC board terminal socket	AHNA23
DIN rail terminal socket	1-pole	HN1 screw terminal socket	AHNA11
		HN1 screw terminal socket (Finger protect type)	AHNA11P
	2-pole	HN2 screw terminal socket	AHNA21
		HN2 screw terminal socket (Finger protect type)	AHNA21P

Standard packing: Carton: 10 pcs.; Case: 100 pcs.
Note: Certified by UL/C-UL

RATING

Specifications (PC board terminal sockets and terminal sockets)

Item		Performance					
Type		HN1 screw terminal socket	HN1 screw terminal socket (Finger protect type)	HN1 PC board terminal socket	HN2 screw terminal socket	HN2 screw terminal socket (Finger protect type)	HN2 PC board terminal socket
Contact arrangement		1 Form C			2 Form C		
Max. continuous current (Ambient temperature: –40 to +70°C –40 to +158°F)		16A*	10A	10A	5A	5A	5A
Breakdown voltage (Initial)	Between open contacts	1, 000 Vrms for 1 min. (Detection current: 10mA)					
	Between contact sets	—			3, 000 Vrms for 1 min. (Detection current: 10mA)		
	Between contact and coil	5, 000 Vrms for 1 min. (Detection current: 10mA)					
Initial insulation resistance		1, 000 MΩ between each terminal (500V DC)					

* When using with current of 16 A (for HN1 screw terminal socket), the maximum ambient temperature is 50°C 122°F.
When using between 50°C and 70°C, please reduce by 0.1 A/°C.
Note: In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.5 to 0.8 N·m.

DIMENSIONS (mm inch)

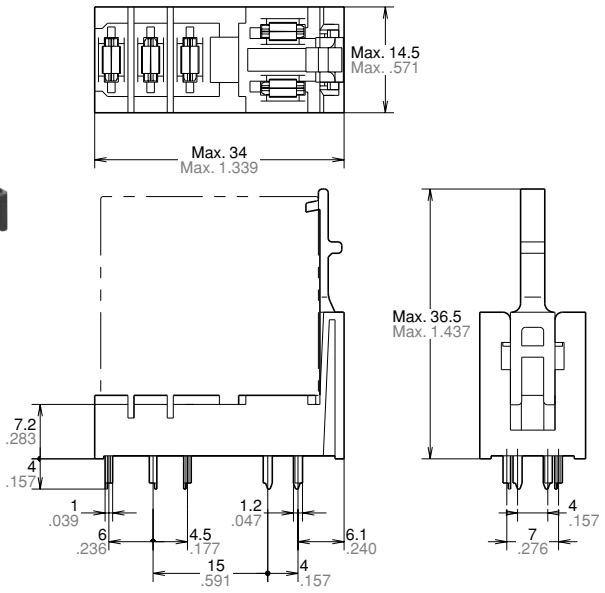
The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

1. HN1 PC board terminal socket

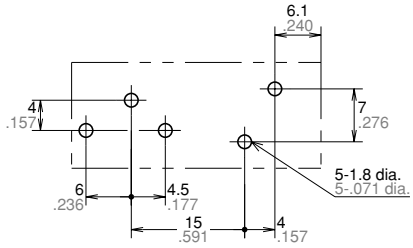
(AHNA13)

CAD Data

External dimensions



PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

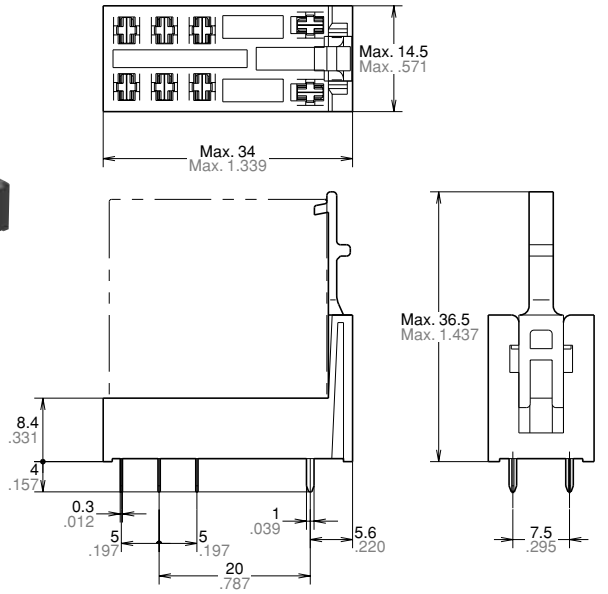
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. HN2 PC board terminal socket

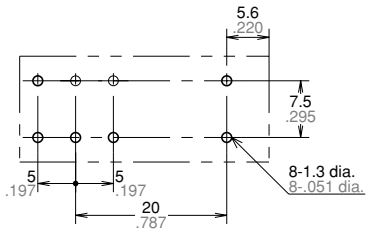
(AHNA23)

CAD Data

External dimensions



PC board pattern (Bottom view)



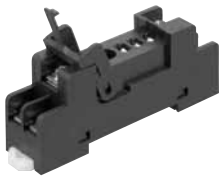
Tolerance: ±0.1 ±.004

Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

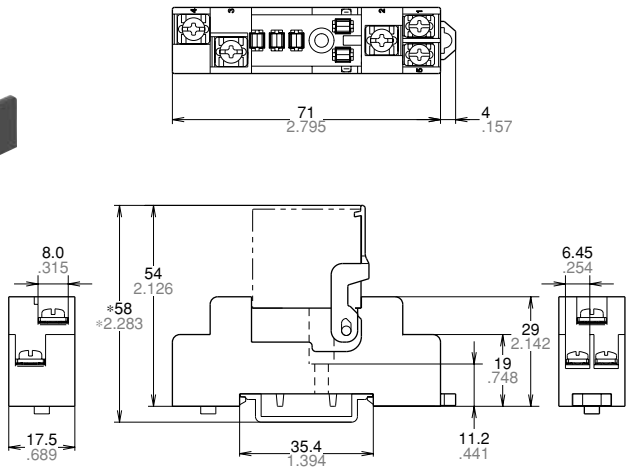
3. HN1 Screw terminal socket

(AHNA11)

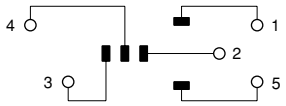
CAD Data



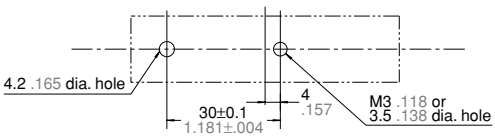
External dimensions



Schematic (Top view)



Mounting hole dimensions



Tolerance: ±0.5 ±.020

* Reference in case of using DIN rail (ATA48011)

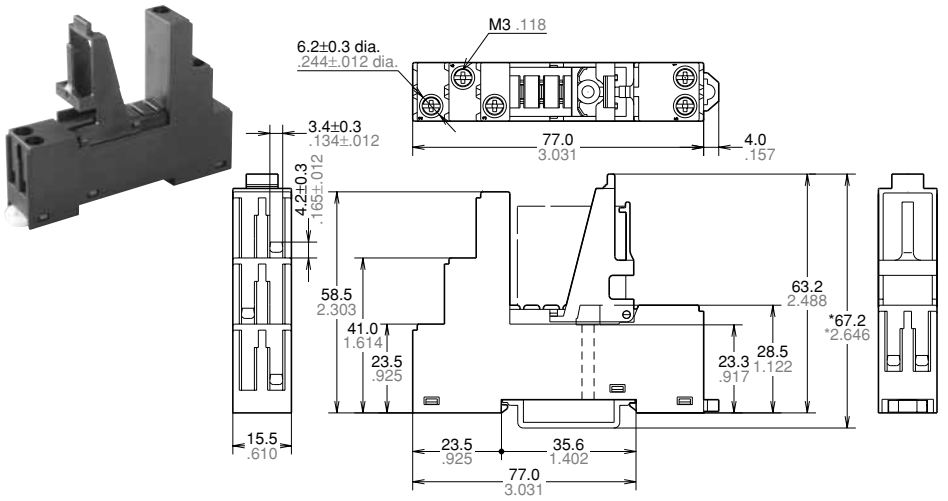
Notes: 1. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.5 to 0.8 N·m.
2. When attaching the terminal socket directly to a chassis, please use the metric coarse thread screw M3 × 16.

4. HN1 Screw terminal socket (Finger protect type)

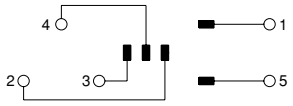
(AHNA11P)

CAD Data

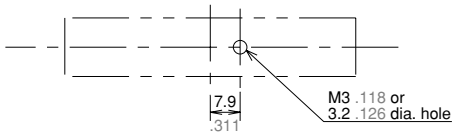
External dimensions



Schematic (Top view)



Mounting hole dimensions



Tolerance: ±0.5 ±.020

* Reference in case of using DIN rail (ATA48011)

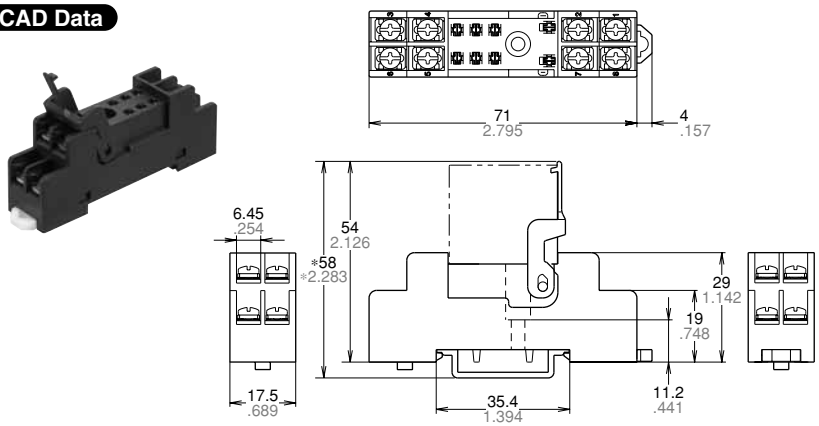
Notes: 1. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.5 to 0.8 N·m.
2. When attaching the terminal socket directly to a chassis, please use the metric coarse thread screw M3 × 30.
3. Use rod or plate terminals, etc. (You cannot use Y-shape or round terminals.)

5. HN2 Screw terminal socket

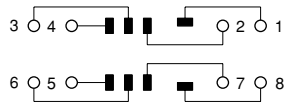
(AHNA21)

CAD Data

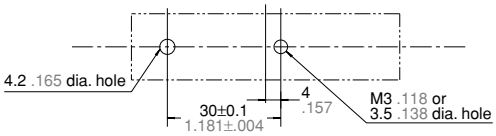
External dimensions



Schematic (Top view)



Mounting hole dimensions



Tolerance: ±0.5 ±.020

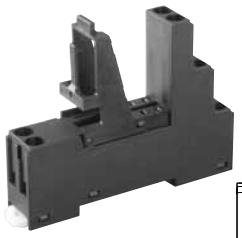
* Reference in case of using DIN rail (ATA48011)

Notes: 1. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.5 to 0.8 N·m.
2. When attaching the terminal socket directly to a chassis, please use the metric coarse thread screw M3 × 16.

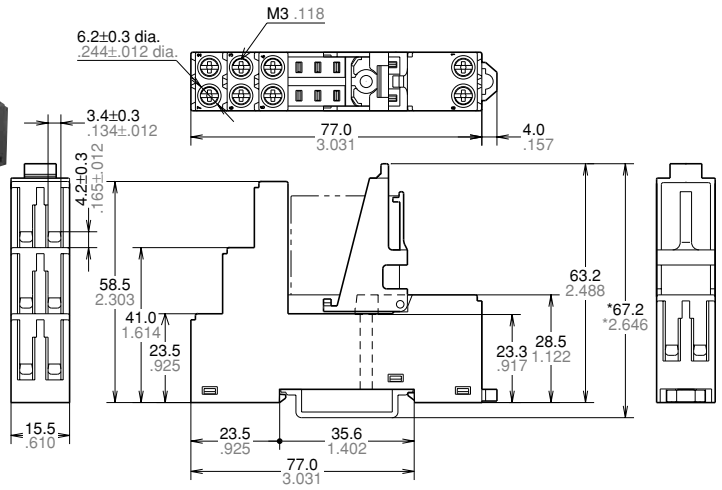
6. HN2 Screw terminal socket (Finger protect type)

(AHNA21P)

CAD Data



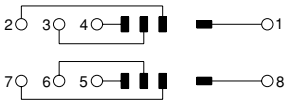
External dimensions



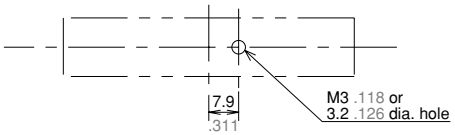
Tolerance: ±0.5 ±.020

* Reference in case of using DIN rail (ATA48011)

Schematic (Top view)



Mounting hole dimensions



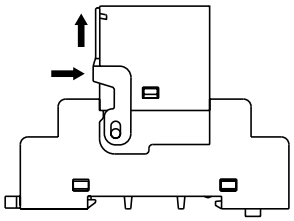
Notes: 1. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.5 to 0.8 N·m.
2. When attaching the terminal socket directly to a chassis, please use the metric coarse thread screw M3 × 30.
3. Use rod or plate terminals, etc. (You cannot use Y-shape or round terminals.)

NOTES

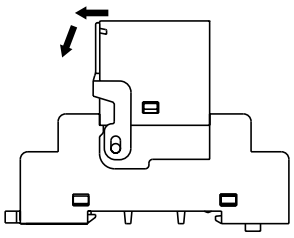
About the relay-securing hook

• Screw terminal socket

1) Installation of the securing hook is easily performed by pressing upward in the direction of the arrows.

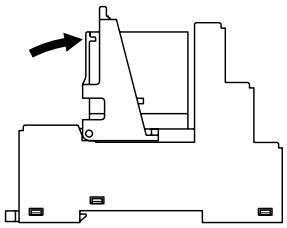


2) Removal of the securing hook is easily performed by releasing the hook and pressing down, as shown in the figure.

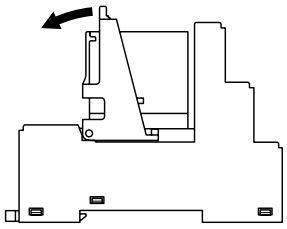


• Screw terminal socket
(Finger protect type)

1) Install the securing hook by pressing the parts with arrows after inserting the relay.

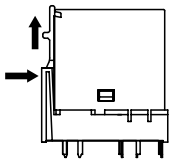


2) Removal of the relay is easily performed by pressing the parts with arrows.

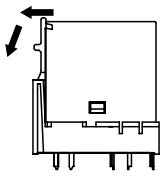


• PC board terminal socket

1) Installation of the securing hook is easily performed by pressing upward in the direction of the arrows.



2) Removal of the securing hook is easily performed by releasing the hook and pressing down, as shown in the figure.



* To prevent damage and deformity, please use the relay-securing hook at 10 N or less.

Panasonic
ideas for life

Relay for control panel of 2c 7A and 4c 5A

HJ RELAYS

FEATURES

1. Economical prices achieved

2. Useful for wide range of applications

Gold-plated contact types are capable of switching under low level (1mA: reference value) to powerful high level (7A: 2-pole) loads.

3. Wide range of types available

The lineup includes 2-pole and 4-pole products, relays with operating indicator lights, and push-button types. You will also find relays that absorb surge when the coil goes to the off state with diodes (for DC type) or CR circuits (for AC type). Moreover, the availability of a broad range of coil voltages meets a wide range of needs.

4. Coil cutoff detection

The LED that is fitted to AC coils goes off when the coil is inoperative and so provides a cutoff detection function.

5. Finger protection

Terminal sockets with finger protection, designed to prevent fingers from touching the terminals, are also available.

6. Sockets and terminal sockets are available.

TYPICAL APPLICATIONS

Control panels
Power supply units
Molding machines
Machine tools
Welding equipment
Agricultural equipment
Office equipment
Vending machines
Communications equipment
Amusement machines

Compliance with RoHS Directive

ORDERING INFORMATION

HJ □ - □ - □ - □ - □ - □

Contact arrangement
2: 2 Form C
4: 4 Form C

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

Test button
Nil: Without a test button
T: With a test button

Nominal coil voltage
AC 12, 24, 48, 100, 120, 200, 220/240 V
DC 12, 24, 48, 110 V

Surge suppression
Nil: Without
D: With diode
R: With CR circuit

Contact surface
Nil: Without Au plating
6: With Au plating

Note: Certified by UL/C-UL and TÜV

TYPES

1. Au plating type

1) Plug-in type

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-6	HJ4-DC 12V-6
24V DC	HJ2-DC 24V-6	HJ4-DC 24V-6
48V DC	HJ2-DC 48V-6	HJ4-DC 48V-6
100/110V DC	HJ2-DC110V-6	HJ4-DC110V-6
12V AC	HJ2-AC 12V-6	HJ4-AC 12V-6
24V AC	HJ2-AC 24V-6	HJ4-AC 24V-6
48V AC	HJ2-AC 48V-6	HJ4-AC 48V-6
100/110V AC	HJ2-AC100V-6	HJ4-AC100V-6
110/120V AC	HJ2-AC120V-6	HJ4-AC120V-6
200/220V AC	HJ2-AC200V-6	HJ4-AC200V-6
220/240V AC	HJ2-AC220/240V-6	HJ4-AC220/240V-6

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2) Plug-in type (with LED indication)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-6	HJ4-L-DC 12V-6
24V DC	HJ2-L-DC 24V-6	HJ4-L-DC 24V-6
48V DC	HJ2-L-DC 48V-6	HJ4-L-DC 48V-6
100/110V DC	HJ2-L-DC110V-6	HJ4-L-DC110V-6
12V AC	HJ2-L-AC 12V-6	HJ4-L-AC 12V-6
24V AC	HJ2-L-AC 24V-6	HJ4-L-AC 24V-6
48V AC	HJ2-L-AC 48V-6	HJ4-L-AC 48V-6
100/110V AC	HJ2-L-AC100V-6	HJ4-L-AC100V-6
110/120V AC	HJ2-L-AC120V-6	HJ4-L-AC120V-6
200/220V AC	HJ2-L-AC200V-6	HJ4-L-AC200V-6
220/240V AC	HJ2-L-AC220/240V-6	HJ4-L-AC220/240V-6

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

3) Plug-in type (with diode)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-D-6	HJ4-DC 12V-D-6
24V DC	HJ2-DC 24V-D-6	HJ4-DC 24V-D-6
48V DC	HJ2-DC 48V-D-6	HJ4-DC 48V-D-6
100/110V DC	HJ2-DC110V-D-6	HJ4-DC110V-D-6

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

4) Plug-in type (with diode and LED indication)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-D-6	HJ4-L-DC 12V-D-6
24V DC	HJ2-L-DC 24V-D-6	HJ4-L-DC 24V-D-6
48V DC	HJ2-L-DC 48V-D-6	HJ4-L-DC 48V-D-6
100/110V DC	HJ2-L-DC110V-D-6	HJ4-L-DC110V-D-6

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

5) Plug-in type (with CR)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-AC100V-R-6	HJ4-AC100V-R-6
110/120V AC	HJ2-AC120V-R-6	HJ4-AC120V-R-6
200/220V AC	HJ2-AC200V-R-6	HJ4-AC200V-R-6
220/240V AC	HJ2-AC220/240V-R-6	HJ4-AC220/240V-R-6

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

6) Plug-in type (with CR and LED indication)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-L-AC100V-R-6	HJ4-L-AC100V-R-6
110/120V AC	HJ2-L-AC120V-R-6	HJ4-L-AC120V-R-6
200/220V AC	HJ2-L-AC200V-R-6	HJ4-L-AC200V-R-6
220/240V AC	HJ2-L-AC220/240V-R-6	HJ4-L-AC220/240V-R-6

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2. Without Au plating type

1) Plug-in type

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V	HJ4-DC 12V
24V DC	HJ2-DC 24V	HJ4-DC 24V
48V DC	HJ2-DC 48V	HJ4-DC 48V
100/110V DC	HJ2-DC110V	HJ4-DC110V
12V AC	HJ2-AC 12V	HJ4-AC 12V
24V AC	HJ2-AC 24V	HJ4-AC 24V
48V AC	HJ2-AC 48V	HJ4-AC 48V
100/110V AC	HJ2-AC100V	HJ4-AC100V
110/120V AC	HJ2-AC120V	HJ4-AC120V
200/220V AC	HJ2-AC200V	HJ4-AC200V
220/240V AC	HJ2-AC220/240V	HJ4-AC220/240V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2) Plug-in type (with LED indication)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V	HJ4-L-DC 12V
24V DC	HJ2-L-DC 24V	HJ4-L-DC 24V
48V DC	HJ2-L-DC 48V	HJ4-L-DC 48V
100/110V DC	HJ2-L-DC110V	HJ4-L-DC110V
12V AC	HJ2-L-AC 12V	HJ4-L-AC 12V
24V AC	HJ2-L-AC 24V	HJ4-L-AC 24V
48V AC	HJ2-L-AC 48V	HJ4-L-AC 48V
100/110V AC	HJ2-L-AC100V	HJ4-L-AC100V
110/120V AC	HJ2-L-AC120V	HJ4-L-AC120V
200/220V AC	HJ2-L-AC200V	HJ4-L-AC200V
220/240V AC	HJ2-L-AC220/240V	HJ4-L-AC220/240V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

3) Plug-in type (with a test button)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-T-DC 12V	HJ4-T-DC 12V
24V DC	HJ2-T-DC 24V	HJ4-T-DC 24V
100/110V AC	HJ2-T-AC100V	HJ4-T-AC100V
200/220V AC	HJ2-T-AC200V	HJ4-T-AC200V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

4) Plug-in type (with LED indication and a test button)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-T-DC 12V	HJ4-L-T-DC 12V
24V DC	HJ2-L-T-DC 24V	HJ4-L-T-DC 24V
100/110V AC	HJ2-L-T-AC100V	HJ4-L-T-AC100V
200/220V AC	HJ2-L-T-AC200V	HJ4-L-T-AC200V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

5) Plug-in type (with diode)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-D	HJ4-DC 12V-D
24V DC	HJ2-DC 24V-D	HJ4-DC 24V-D
48V DC	HJ2-DC 48V-D	HJ4-DC 48V-D
100/110V DC	HJ2-DC110V-D	HJ4-DC110V-D

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

6) Plug-in type (with diode and LED indication)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-D	HJ4-L-DC 12V-D
24V DC	HJ2-L-DC 24V-D	HJ4-L-DC 24V-D
48V DC	HJ2-L-DC 48V-D	HJ4-L-DC 48V-D
100/110V DC	HJ2-L-DC110V-D	HJ4-L-DC110V-D

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

7) Plug-in type (with CR)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-AC100V-R	HJ4-AC100V-R
110/120V AC	HJ2-AC120V-R	HJ4-AC120V-R
200/220V AC	HJ2-AC200V-R	HJ4-AC200V-R
220/240V AC	HJ2-AC220/240V-R	HJ4-AC220/240V-R

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

8) Plug-in type (with CR and LED indication)

Nominal coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-L-AC100V-R	HJ4-L-AC100V-R
110/120V AC	HJ2-L-AC120V-R	HJ4-L-AC120V-R
200/220V AC	HJ2-L-AC200V-R	HJ4-L-AC200V-R
220/240V AC	HJ2-L-AC220/240V-R	HJ4-L-AC220/240V-R

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

* For sockets and terminal sockets, see page 65.

RATING

1. Coil data

1) AC coils (50/60Hz)

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±20%]		Nominal operating power		Max. applied voltage (at 70°C 158°F)
			50Hz	60Hz	50Hz	60Hz	
12V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	102.9mA	85.4mA	Approx. 1.2 to 1.5 V A	Approx. 1.0 to 1.3 V A	110%V of nominal voltage
24V AC			54.5mA	45.6mA			
48V AC			30.7mA	25.9mA			
100/110V AC			11.8mA/13.9mA	10.0mA/11.6mA			
110/120V AC			10.9mA/12.5mA	9.1mA/10.3mA			
200/220V AC			6.8mA/8.1mA	5.7mA/6.7mA			
220/240V AC			6.8mA/7.8mA	5.6mA/6.4mA			

2) DC coils

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current	Coil resistance (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 70°C 158°F)
12V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	75mA [±10%]	160Ω	0.9W	110%V of nominal voltage
24V DC			37mA [±10%]	650Ω		
48V DC			18mA [±15%]	2,600Ω		
100/110V DC			9.1mA/10mA [±15%]	11,000Ω	1.1W	

2. Specifications

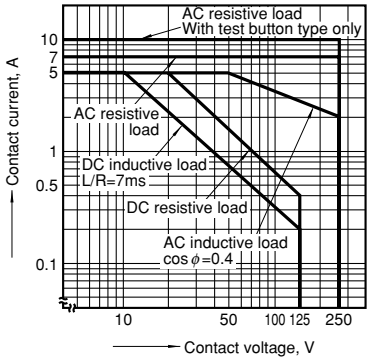
Characteristics	Item		Specifications	
Contact	Arrangement		2 Form C	4 Form C
	Contact resistance (Initial)		Max. 50 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		Au plating type: Au plating Ag Without Au plating type: Ag	
Rating	Nominal switching capacity (resistive load)		7 A 250V AC	5 A 250V AC
	Max. switching power (resistive load)		1,750 VA	1,250 VA
	Max. switching voltage		250V AC, 125V DC	
	Max. switching current		7 A	5 A
	Nominal operating power		0.9W 1.2 VA	
	Min. switching capacity (Reference value)*1	Au plating type	1mA 1V DC	
		Without Au plating type	1mA 5V DC	
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as “Breakdown voltage” section.	
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA.)	
		Between contact sets	2,000 Vrms for 1min. (Detection current: 10mA.)	
		Between contact and coil	2,000 Vrms for 1min. (Detection current: 10mA.)	
	Temperature rise (coil) (at 70°C 158°F)		Max. 60°C 140°F (By resistive method, nominal coil voltage)	
	Operate time*2		Max. 20ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)	
	Release time*2		Max. 20ms (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 100 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)	
		Destructive	Min. 1,000 m/s² (Half-wave pulse of sine wave: 6 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 1.0 mm (Detection time: 10μs.)	
		Destructive	10 to 55 Hz at double amplitude of 1.0 mm	
Expected life	Mechanical		Min. 2×10^7 (at 180 times/min.)	
	Electrical (resistive load) (at 20 times/min.)		Min. 10^5 (7A 250V AC) Min. 5×10^5 (5A 250V AC)	Min. 10^5 (5A 250V AC) Min. 2×10^5 (3A 250V AC)
Conditions	Conditions for operation, transport and storage*3 (Not freezing and condensing at low temperature)		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. Operating speed		20 times/min. (at nominal switching capacity)	
Unit weight			Approx. 34g 1.20 oz	

Notes: In accordance with the Electrical Appliance and Material Safety Law, you cannot exceed a voltage of 150V AC when using the 4 Form C type.
For more information, please inquire.
When using low level loads, contact instability may result depending on conditions of use (switching frequency and ambient conditions, etc.); therefore, please use the Au plating type.

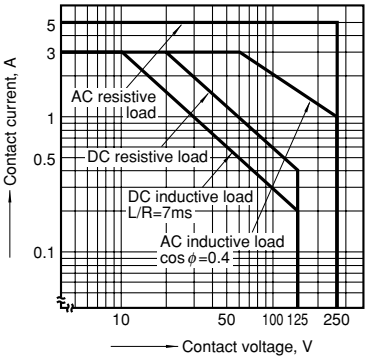
*1. This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2. For the AC coil types, the operate/release time will differ depending on the phase.
*3. The upper limit of the ambient temperature is the maximum temperature that can satisfy the coil temperature rise value. Refer to Usage, transport and storage conditions in NOTES.

REFERENCE DATA

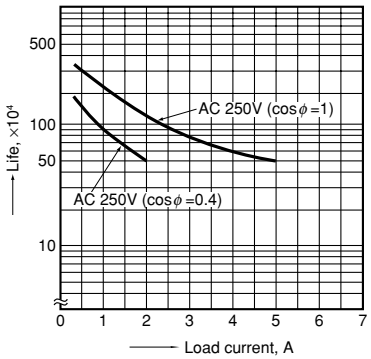
1-(1). Max. switching capacity (2 Form C type)



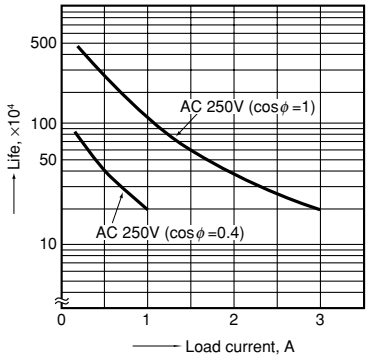
1-(2). Max. switching capacity (4 Form C type)



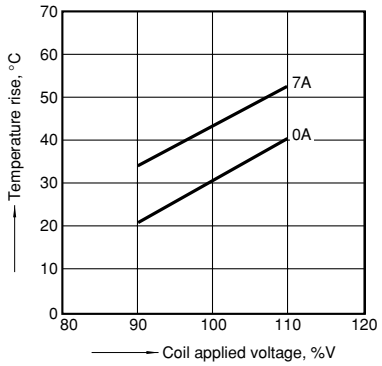
2-(1). Life curve (2 Form C)



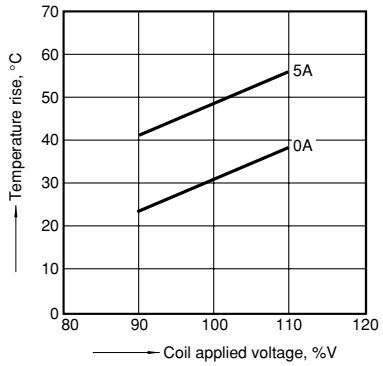
2-(2). Life curve (4 Form C)



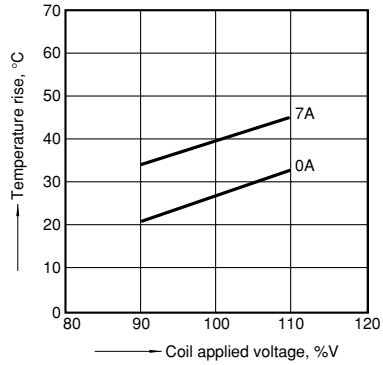
3-(1). Coil temperature rise (2 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



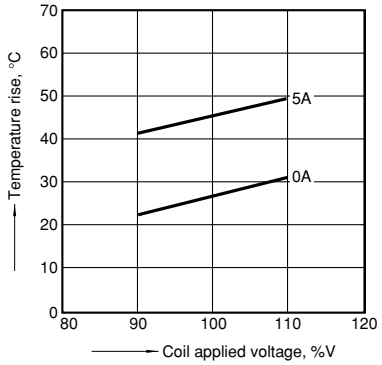
3-(2). Coil temperature rise (2 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



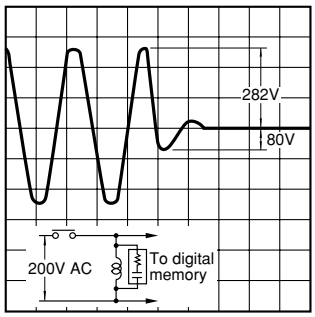
3-(3). Coil temperature rise (4 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



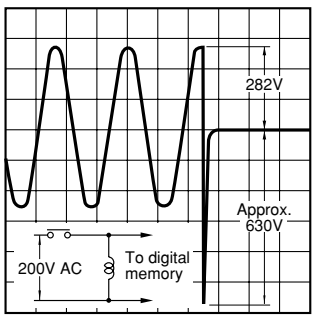
3-(4). Coil temperature rise (4 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



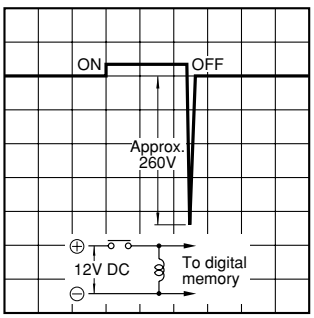
4-(1). AC coil surge voltage waveform (With CR circuit)
Tested sample: HJ4-AC200V-R



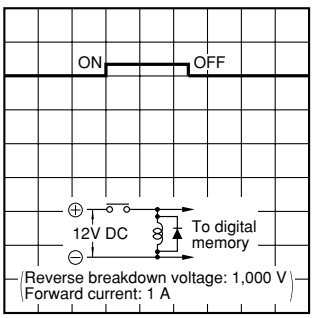
4-(2). AC coil surge voltage waveform (Without CR circuit)
Tested sample: HJ4-AC200V



5-(1). DC coil surge voltage waveform (Without diode)



5-(2). DC coil surge voltage waveform (With diode)
Diode characteristics:
Reverse breakdown voltage: 1,000 V
Forward current: 1 A



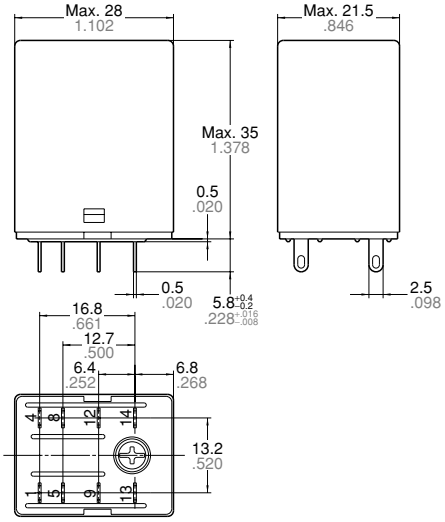
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

1. Plug-in type (2 Form C) (including diode/CR)

CAD Data

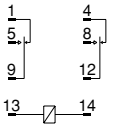
External dimensions



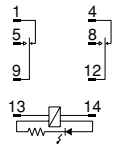
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

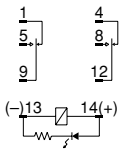
Standard type



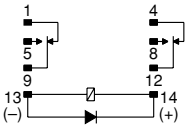
LED AC type



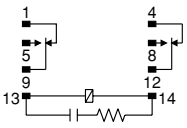
LED DC type



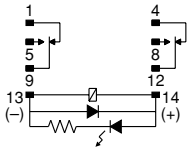
Diode DC type



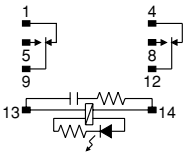
CR AC type



Diode/LED DC type



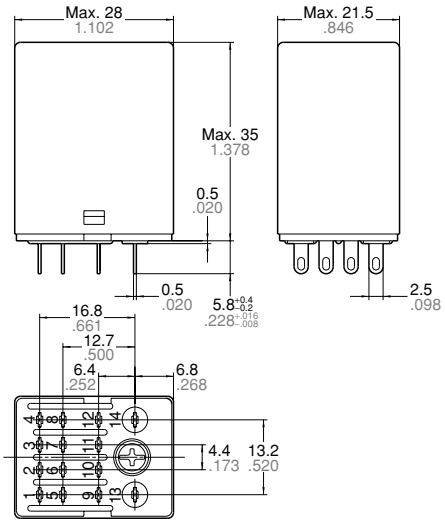
CR/LED AC type



2. Plug-in type (4 Form C) (including diode/CR)

CAD Data

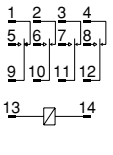
External dimensions



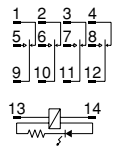
Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

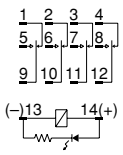
Standard type



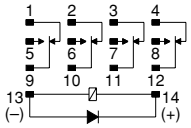
LED AC type



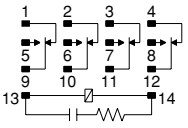
LED DC type



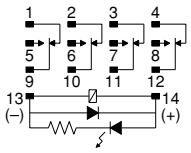
Diode DC type



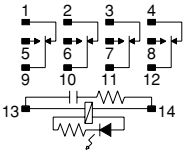
CR AC type



Diode/LED DC type



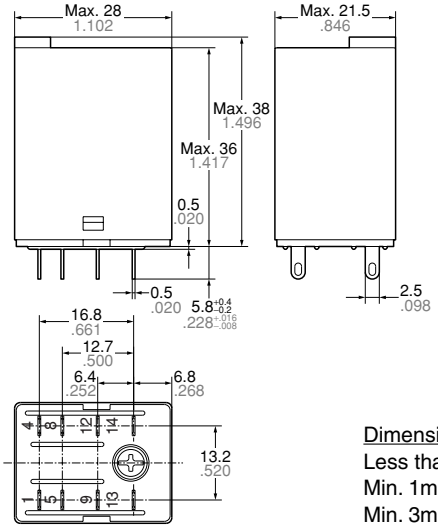
CR/LED AC type



3. Plug-in type with a test button (2 Form C)

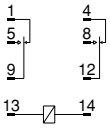
CAD Data

External dimensions

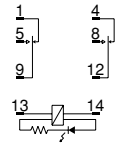


Schematic (Bottom view)

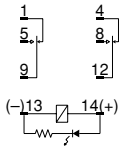
Standard type



LED AC type



LED DC type

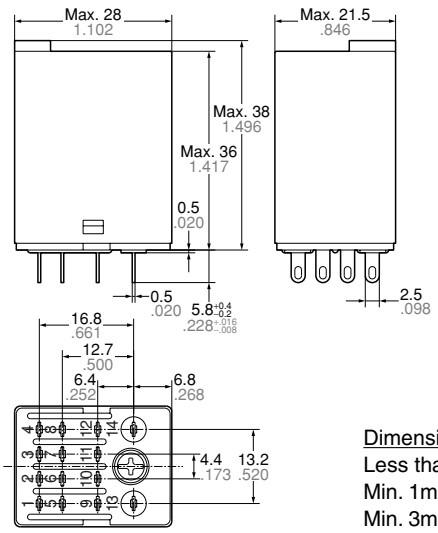


Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

4. Plug-in type with a test button (4 Form C)

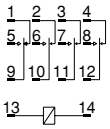
CAD Data

External dimensions

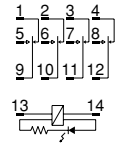


Schematic (Bottom view)

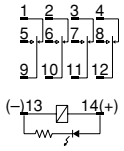
Standard type



LED AC type



LED DC type



Dimension:	Tolerance
Less than 1mm .039inch:	±0.1 ±.004
Min. 1mm .039inch less than 3mm .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

SAFETY STANDARDS

	File No.	Certification authority: UL/C-UL	File No.	Certification authority: TÜV
2 Form C	E43149*	7A 250V AC, 7A 30V DC	R2024382 (Standard) R2-50006950, R50049126 (Except standard)	7A 250V AC (cosϕ=1.0), 7A 30V DC (0ms) Test button type: 10A 250V AC (cosϕ=1.0), 10A 30V DC (0ms)
4 Form C	E43149*	5A 250V AC, 5A 30V DC	R2024382 (Standard) R50049126 (Except standard)	5A 250V AC (cosϕ=1.0), 5A 30V DC (0ms)

* CSA standard: Certified by C-UL

NOTES

1. Coil applied voltage

Please refer to “RATING” about coil input power supply.

2. LED display

Operation is displayed by the light emitted from the LED. The LED may remain briefly lit if voltage remains after the relay opens.

3. Switching lifetime

The switching lifetime is defined under the standard test condition specified in the JIS* C 5442 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.

1) When used for AC load-operating and the operating phase is synchronous.

Rocking and fusing can easily occur due to contact shifting.

2) 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 HNO_3 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

4. Usage, transport and storage conditions

1) Temperature, humidity and pressure during usage, storage and transport

(1) Temperature:

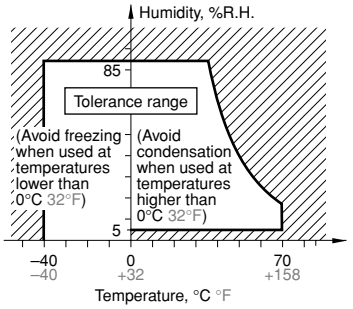
–40 to +70°C –40 to +158°F

(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.

Temperature and humidity range for usage, transport, and storage



(3) Atmospheric pressure: 86 to 106 kPa

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

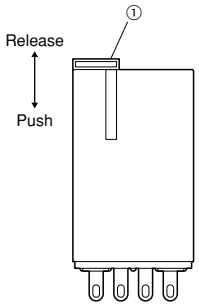
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.

4) Low temperature, low humidity environments

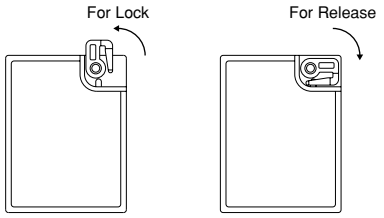
The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

5. Operation method for test button

1) Push and release ① gently to confirm relay switching.



2) To lock to one side turn 90° counter-clockwise while pushing lock and turn 90° clockwise to release.



3) Do not use the test button for anything other than testing, such as when checking the circuit.

6. Diode characteristics

1) Reverse breakdown voltage: 1,000 V

2) Forward current: 1 A

7. Diode and CR built-in type

Since the diode and CR inside the relay coil are designed to absorb the counter emf, the element may be damaged if a large surge, etc., is applied to the diode and CR. If there is the possibility of a large surge voltage from the outside, please implement measures to absorb it.

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.

For Cautions for Use, see Page 21.

TYPES

Type	No. of poles	Product name	Part No.
Plug-in socket	2-pole	HC2-socket (for HJ relay)	HC2-SS-K-H105
	2/4-pole (common)	HC4-socket (for HJ relay)	HC4-SS-K-H105
PC board socket	2-pole	HC2-PC board socket (for HJ relay)	HC2-PS-K-H105
	2/4-pole (common)	HC4-PC board socket (for HJ relay)	HC4-PS-K-H105
DIN rail terminal socket	2-pole	HJ2 terminal socket	HJ2-SFD
		HJ2 terminal socket (Finger protect type)	HJ2-SFD-S
	2/4-pole (common)	HJ4 terminal socket	HJ4-SFD
		HJ4 terminal socket (Finger protect type)	HJ4-SFD-S

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

Notes: 1. Use the hold-down clip that is shipped with the terminal socket or socket.
2. DIN rail terminal sockets conform to UL/C-UL and TÜV, as standard. Sockets conform to UL and CSA, as standard.
3. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.49 to 0.69 N·m (5 to 7 kgf·cm).
4. When attaching directly to a chassis, please use an M4 × 10 metric coarse screw thread, a spring washer, and a hexagonal nut.
5. For S1DX/S1DXM timer, use the leaf holding clip (Part No. ADX18012).
6. HC relay sockets/terminal sockets are not adaptive for HJ relays. Use dedicated sockets/terminal sockets.

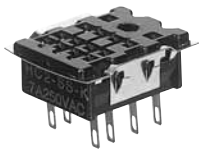
DIMENSIONS (mm inch)

The CAD data of the products with a CAD Data mark can be downloaded from: http://panasonic-electric-works.net/ac

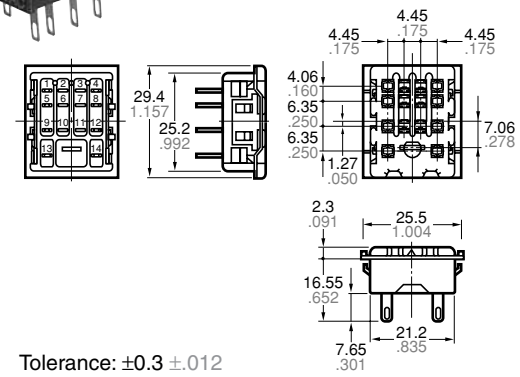
1. Plug-in socket

HC2 - Socket for HJ relay (HC2-SS-K-H105)

CAD Data



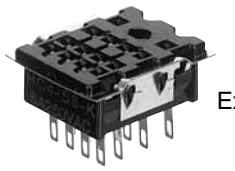
External dimensions



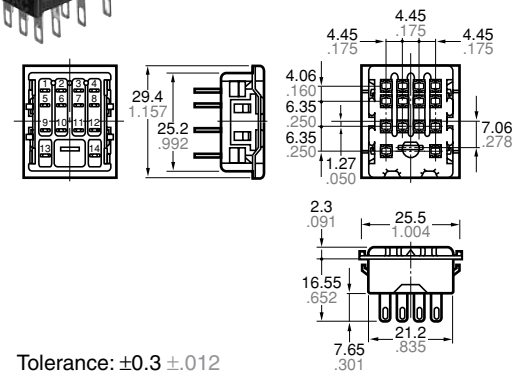
Tolerance: ±0.3 ±.012

HC4 - Socket for HJ relay (HC4-SS-K-H105)

CAD Data

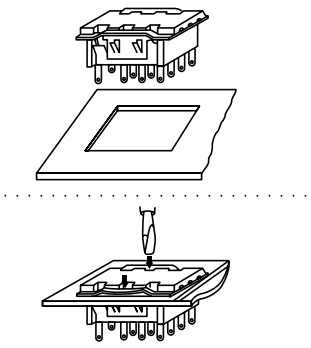


External dimensions

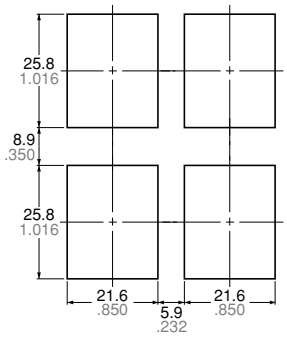


Tolerance: ±0.3 ±.012

Mounting hole diagram



Chassis cutout (Side-by-side installation)



Tolerance: ±0.2 ±.008

Notes: 1. Applicable chassis board thickness is 1.0 to 2.0 mm.
2. Installation is easy by inserting the socket from the top into the holes and by depressing the two down arrows on the retention fitting from the front.

With a relay mounted (HC2-SS-K-H105)

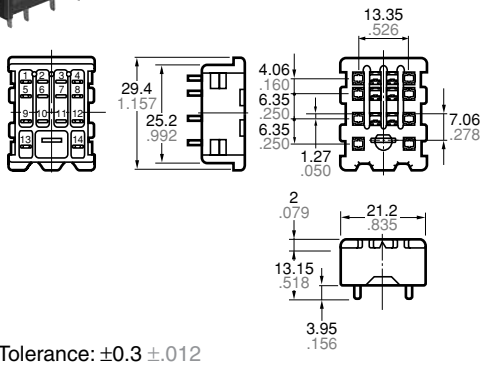
Hold-down clip is packaged with the socket. (Same product as plug-in socket (Part No.: HC2-SS-K) for HC relay except that hold-down clip shape is different.)

2. PC board socket

HC2 - PC board socket for HJ relay (HC2-PS-K-H105)

CAD Data

External dimensions

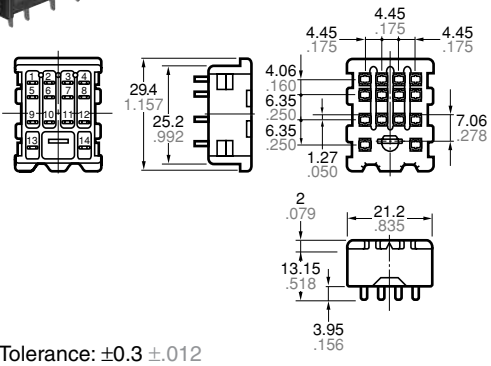


Tolerance: ±0.3 ±.012

HC4 - PC board socket for HJ relay (HC4-PS-K-H105)

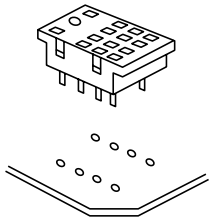
CAD Data

External dimensions

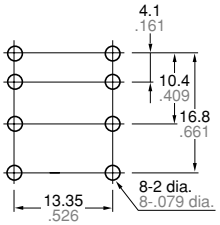


Tolerance: ±0.3 ±.012

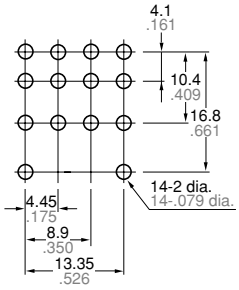
PC board pattern (BOTTOM VIEW)



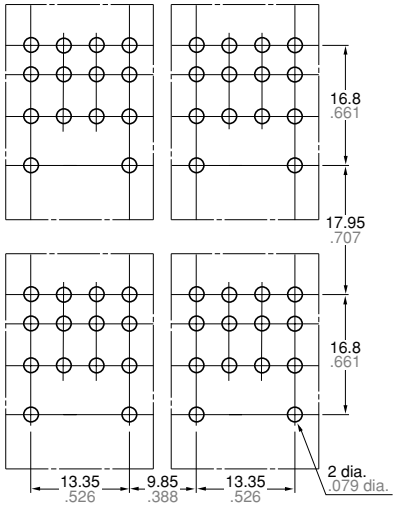
2 Form C



4 Form C



Chassis cutout (Side-by-side installation)



Tolerance: ±0.1 ±.004

With a relay mounted (HC2-PS-K-H105)

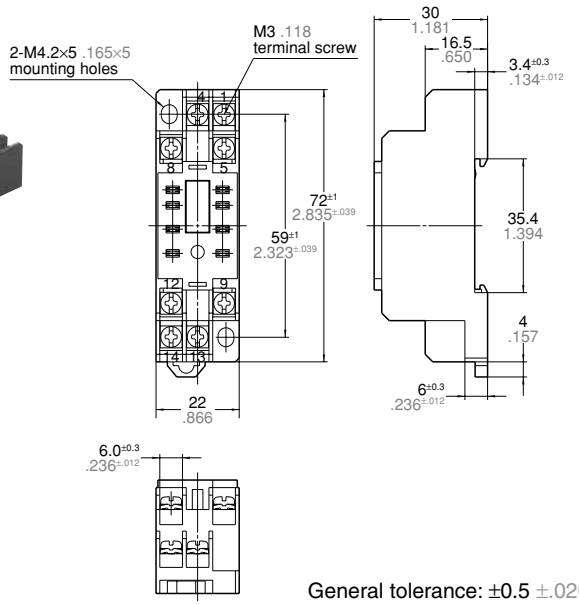
Hold-down clip is packaged with the socket. (Same product as PC board socket (Part No.: HC2-PS-K) for HC relay except that hold-down clip shape is different.)

3. Terminal socket

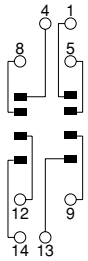
HJ2 terminal socket (HJ2-SFD)

CAD Data

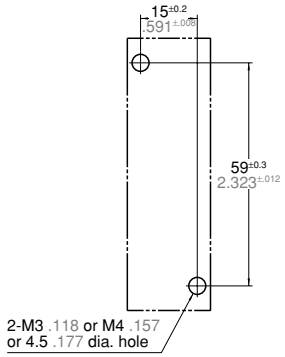
External dimensions



Schematic (Bottom view)



Mounting hole dimensions

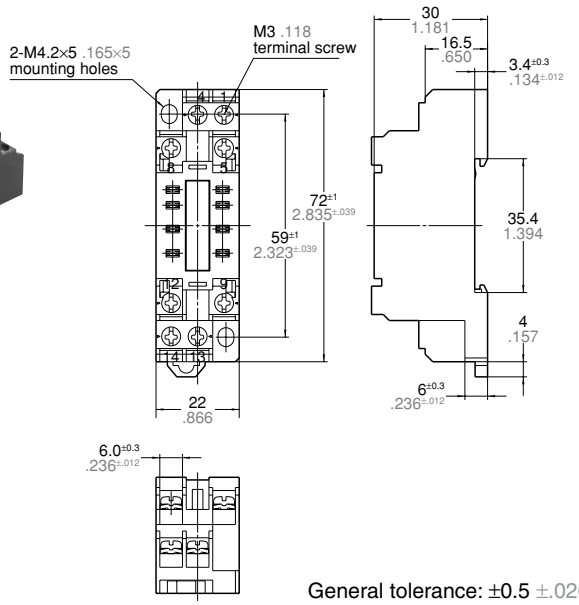


General tolerance: ±0.5 ±.020

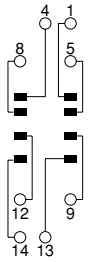
HJ2 terminal socket (Finger protect type) (HJ2-SFD-S)

CAD Data

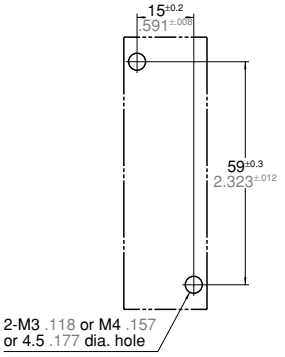
External dimensions



Schematic (Bottom view)



Mounting hole dimensions



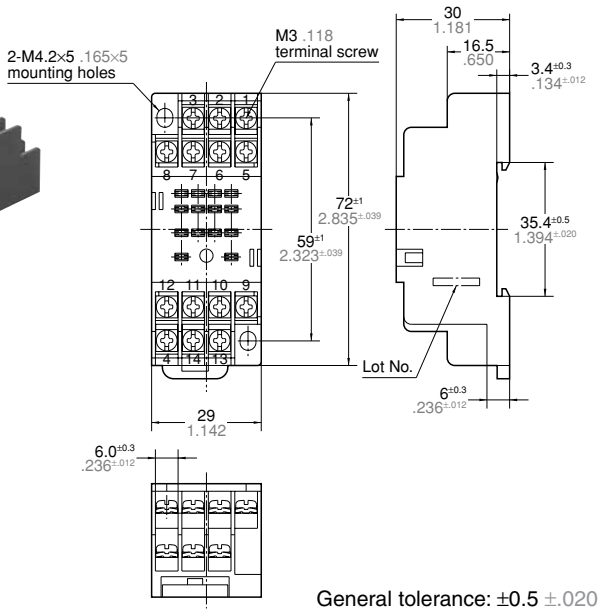
General tolerance: ±0.5 ±.020

Note: Round type terminal is unable to attach.

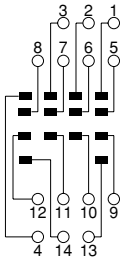
HJ4 terminal socket (HJ4-SFD)

CAD Data

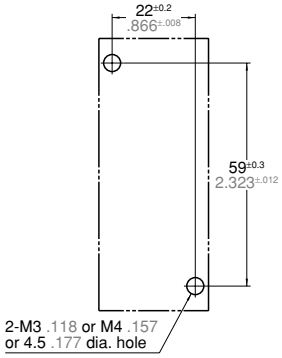
External dimensions



Schematic (Bottom view)



Mounting hole dimensions

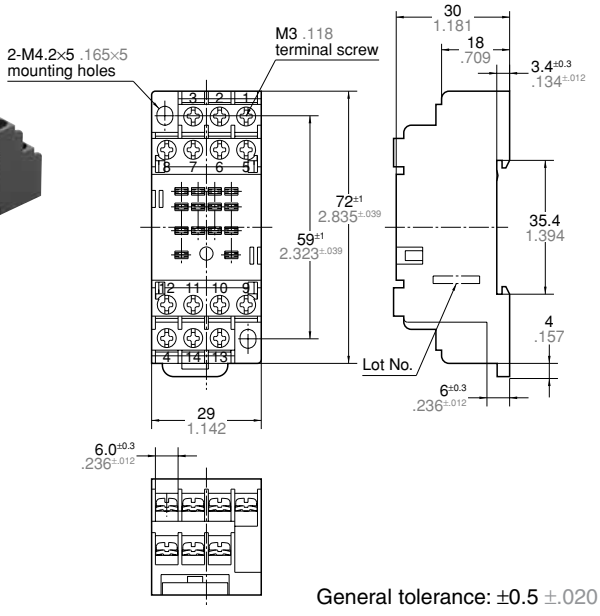


General tolerance: ±0.5 ±.020

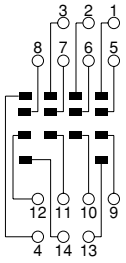
HJ4 terminal socket (Finger protect type) (HJ4-SFD-S)

CAD Data

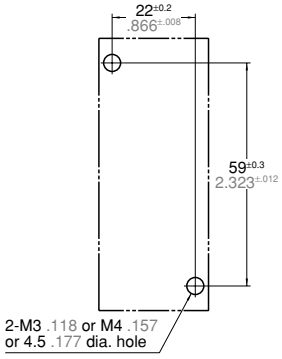
External dimensions



Schematic (Bottom view)



Mounting hole dimensions



General tolerance: ±0.5 ±.020

Note: Round type terminal is unable to attach.

VDE
1c, 2c, 4c

Panasonic
ideas for life

Relay for control panel of 1A to 10A (1c/2c/3c/4c)

HC RELAYS


Standard type


Amber sealed type


With CR circuit type


Keep relay


With diode type

FEATURES

1. Standard type, Amber sealed type and Keep type
2. Rich lineup includes relays with operating indication, with diode and with CR circuit
3. Full range of types
Plug-in type, PC board type and TM type
4. Sockets and terminal sockets are available.

TYPICAL APPLICATIONS

1. Factory automation equipment and automotive devices
2. Control panels, power supply equipment, molding equipment, machine tools, welding equipment, agricultural equipment, etc.
3. Office equipment, automatic vending machines, telecommunications equipment, disaster prevention equipment, copiers, measuring devices, medical equipment, amusement devices, etc.
4. All types of household appliance

Compliance with RoHS Directive

ORDERING INFORMATION

HC □ - □ - □ - □ - □ - □

Contact arrangement
1: 1 Form C
2: 2 Form C
3: 3 Form C
4: 4 Form C
4D: Bifurcated contact (twin)

Nil: Standard type
E: Amber sealed type (Only 1 Form C and 2 Form C)
ED: Amber sealed type bifurcated contact (twin) (Only 4 Form C)
K: Keep type

Terminal arrangement
H: Plug-in type
HL: Plug-in with LED indication
L: Plug-in with LED indication (Amber sealed type)
HP: PC board type
PL: PC board with LED indication
HPL: PC board with LED indication (Amber sealed type)
HTM: TM type

Nominal coil voltage
AC 6, 12, 24, 48, 100 (100/110), 120 (110/120), 200 (200/220), 240 (220/240) V
DC 6, 12, 24, 48, 100 (100/110) V

Surge suppression
D: With diode R: With CR curcuit

Contact material

Contact arrangement \ Contact material	$AgSnO_2$ type	AgNi type
1 Form C	F	
2 Form C	F	
3 Form C	F	
4 Form C		Nil
4-pole bifurcated (twin)		Nil

Notes: Certified by UL and CSA (except for keep type)
Please consult us about VDE (1 Form C, 2 Form C, and 4 Form C only) and TV-3 (1 Form C and 2 Form C only) approved products.

LINEUP

Type	Contact arrangement		Plug-in terminal type		PC board terminal type		Top mounting type (TM type)	Remarks
			Without LED	With LED	Without LED	With LED		
HC relay Standard type	Single side stable	1 Form C	A	A	A	A	A	
		2 Form C	A	A	A	A	A	
		3 Form C	A	A	A	A	A	
		4 Form C	A	A	A	A	A	
	Bifurcated (Twin)	4 Form C	A	A	A	A	A	
HC relay Amber sealed type	Single side stable	1 Form C	A	A	A	A	A	
		2 Form C	A	A	A	A	A	
		4 Form C	A	A	A	A	A	
	Bifurcated (Twin)	4 Form C	A	A	A	A	A	
HC keep (latching) relay	Single side stable	2 Form C	A (With operating indication)	—	A (With operating indication)	—	—	
DC type with surge absorbing diode	Single side stable	1 Form C	A	A	—	—	—	Amber sealed type also available
		2 Form C	A	A	—	—	—	
		3 Form C	A	A	—	—	—	
		4 Form C	A	A	—	—	—	
	Bifurcated (Twin)	4 Form C	A	A	—	—	—	
AC type with surge absorbing CR circuit	Single side stable	1 Form C	A	A	—	—	—	17 mm higher than standard type
		2 Form C	A	A	—	—	—	
		3 Form C	A	A	—	—	—	
		4 Form C	A	A	—	—	—	
	Bifurcated (Twin)	4 Form C	A	A	—	—	—	

A: Available

Notes: 1. HC relays with ground terminals also available.
2. HC relays with 0.9 mm wide PC board terminals also available.

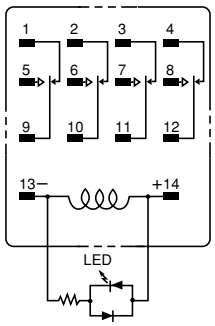
HC RELAY CONTACT ARRANGEMENT

Type	Single side stable contact	4-pole bifurcated (twin) contact
Part number	HC□	HC4D
Features	Suitable for high-capacity load switching Standard type HC relays have high single-contact capacity; 1 Form C: 10 A 2 Form C and 3 Form C: 7 A 4 Form C: 5 A	Bifurcated (twin) contact ensures high contact reliability Suitable for low level loads Minimum switching capability: 100 μA 100m V DC (reference value)

LED INDICATION TYPE

Type	With LED indication type
Part number	HC□-HL
Features	LED lights up when relay is operating Inspection and detection of trouble is easy. LEDs are green for DC types and red for AC types. All types are available with LED indication.

• LED colors indicate the type of relay: red for AC type and green for DC type.



Protection diode (Bottom view)

HC RELAY SERIES PRODUCT TYPES

Type	Amber sealed type HC relay	HC keep (Latching) relay	HC relay with diode type (for DC)
Part number	HC□E	HC2K	HC□-□-□V-D
Features	Relay is completely sealed with resin. Provides high reliability in adverse surroundings. Suitable for use in dusty conditions or where organic gases are present	Magnetic latching relay Suitable for nominal operating power saving of operating circuits and for memory circuits Has operating indication (mechanical indicator).	Has built-in diode to absorb surge when the coil goes to the off state (for DC type). Suitable for protecting relay driver circuits and for noise suppression Diode characteristics: Reverse breakdown voltage 1,000 V Forward current 1 A
Type	HC relay with CR circuit (for AC)	—	—
Part number	HC□-□-□V-R	—	—
Features	Has built-in CR circuit to absorb surge when the coil goes to the off state (for AC). Relay with CR circuit is 17 mm higher than standard type relay.	—	—

4-pole bifurcated (twin) type and Relay with LED indication are available.

TYPES

1. Standard type

1) Plug-in type

Nominal coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V AC	HC1-H-AC6V-F	HC2-H-AC6V-F	HC3-H-AC6V-F	HC4-H-AC6V	HC4D-H-AC6V
12V AC	HC1-H-AC12V-F	HC2-H-AC12V-F	HC3-H-AC12V-F	HC4-H-AC12V	HC4D-H-AC12V
24V AC	HC1-H-AC24V-F	HC2-H-AC24V-F	HC3-H-AC24V-F	HC4-H-AC24V	HC4D-H-AC24V
48V AC	HC1-H-AC48V-F	HC2-H-AC48V-F	HC3-H-AC48V-F	HC4-H-AC48V	HC4D-H-AC48V
100/110V AC	HC1-H-AC100V-F	HC2-H-AC100V-F	HC3-H-AC100V-F	HC4-H-AC100V	HC4D-H-AC100V
110/120V AC	HC1-H-AC120V-F	HC2-H-AC120V-F	HC3-H-AC120V-F	HC4-H-AC120V	HC4D-H-AC120V
200/220V AC	HC1-H-AC200V-F	HC2-H-AC200V-F	HC3-H-AC200V-F	HC4-H-AC200V	HC4D-H-AC200V
220/240V AC	HC1-H-AC240V-F	HC2-H-AC240V-F	HC3-H-AC240V-F	HC4-H-AC240V	HC4D-H-AC240V
6V DC	HC1-H-DC6V-F	HC2-H-DC6V-F	HC3-H-DC6V-F	HC4-H-DC6V	HC4D-H-DC6V
12V DC	HC1-H-DC12V-F	HC2-H-DC12V-F	HC3-H-DC12V-F	HC4-H-DC12V	HC4D-H-DC12V
24V DC	HC1-H-DC24V-F	HC2-H-DC24V-F	HC3-H-DC24V-F	HC4-H-DC24V	HC4D-H-DC24V
48V DC	HC1-H-DC48V-F	HC2-H-DC48V-F	HC3-H-DC48V-F	HC4-H-DC48V	HC4D-H-DC48V
100/110V DC	HC1-H-DC100V-F	HC2-H-DC100V-F	HC3-H-DC100V-F	HC4-H-DC100V	HC4D-H-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2) Plug-in type (with LED indication)

Nominal coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V AC	HC1-HL-AC6V-F	HC2-HL-AC6V-F	HC3-HL-AC6V-F	HC4-HL-AC6V	HC4D-HL-AC6V
12V AC	HC1-HL-AC12V-F	HC2-HL-AC12V-F	HC3-HL-AC12V-F	HC4-HL-AC12V	HC4D-HL-AC12V
24V AC	HC1-HL-AC24V-F	HC2-HL-AC24V-F	HC3-HL-AC24V-F	HC4-HL-AC24V	HC4D-HL-AC24V
100/110V AC	HC1-HL-AC100V-F	HC2-HL-AC100V-F	HC3-HL-AC100V-F	HC4-HL-AC100V	HC4D-HL-AC100V
110/120V AC	HC1-HL-AC120V-F	HC2-HL-AC120V-F	HC3-HL-AC120V-F	HC4-HL-AC120V	HC4D-HL-AC120V
200/220V AC	HC1-HL-AC200V-F	HC2-HL-AC200V-F	HC3-HL-AC200V-F	HC4-HL-AC200V	HC4D-HL-AC200V
220/240V AC	HC1-HL-AC240V-F	HC2-HL-AC240V-F	HC3-HL-AC240V-F	HC4-HL-AC240V	HC4D-HL-AC240V
6V DC	HC1-HL-DC6V-F	HC2-HL-DC6V-F	HC3-HL-DC6V-F	HC4-HL-DC6V	HC4D-HL-DC6V
12V DC	HC1-HL-DC12V-F	HC2-HL-DC12V-F	HC3-HL-DC12V-F	HC4-HL-DC12V	HC4D-HL-DC12V
24V DC	HC1-HL-DC24V-F	HC2-HL-DC24V-F	HC3-HL-DC24V-F	HC4-HL-DC24V	HC4D-HL-DC24V
48V DC	HC1-HL-DC48V-F	HC2-HL-DC48V-F	HC3-HL-DC48V-F	HC4-HL-DC48V	HC4D-HL-DC48V
100/110V DC	HC1-HL-DC100V-F	HC2-HL-DC100V-F	HC3-HL-DC100V-F	HC4-HL-DC100V	HC4D-HL-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

3) PC board type

Nominal coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V AC	HC1-HP-AC6V-F	HC2-HP-AC6V-F	HC3-HP-AC6V-F	HC4-HP-AC6V	HC4D-HP-AC6V
12V AC	HC1-HP-AC12V-F	HC2-HP-AC12V-F	HC3-HP-AC12V-F	HC4-HP-AC12V	HC4D-HP-AC12V
24V AC	HC1-HP-AC24V-F	HC2-HP-AC24V-F	HC3-HP-AC24V-F	HC4-HP-AC24V	HC4D-HP-AC24V
48V AC	HC1-HP-AC48V-F	HC2-HP-AC48V-F	HC3-HP-AC48V-F	HC4-HP-AC48V	HC4D-HP-AC48V
100/110V AC	HC1-HP-AC100V-F	HC2-HP-AC100V-F	HC3-HP-AC100V-F	HC4-HP-AC100V	HC4D-HP-AC100V
110/120V AC	HC1-HP-AC120V-F	HC2-HP-AC120V-F	HC3-HP-AC120V-F	HC4-HP-AC120V	HC4D-HP-AC120V
200/220V AC	HC1-HP-AC200V-F	HC2-HP-AC200V-F	HC3-HP-AC200V-F	HC4-HP-AC200V	HC4D-HP-AC200V
220/240V AC	HC1-HP-AC240V-F	HC2-HP-AC240V-F	HC3-HP-AC240V-F	HC4-HP-AC240V	HC4D-HP-AC240V
6V DC	HC1-HP-DC6V-F	HC2-HP-DC6V-F	HC3-HP-DC6V-F	HC4-HP-DC6V	HC4D-HP-DC6V
12V DC	HC1-HP-DC12V-F	HC2-HP-DC12V-F	HC3-HP-DC12V-F	HC4-HP-DC12V	HC4D-HP-DC12V
24V DC	HC1-HP-DC24V-F	HC2-HP-DC24V-F	HC3-HP-DC24V-F	HC4-HP-DC24V	HC4D-HP-DC24V
48V DC	HC1-HP-DC48V-F	HC2-HP-DC48V-F	HC3-HP-DC48V-F	HC4-HP-DC48V	HC4D-HP-DC48V
100/110V DC	HC1-HP-DC100V-F	HC2-HP-DC100V-F	HC3-HP-DC100V-F	HC4-HP-DC100V	HC4D-HP-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Note: Please add “-31” before “-F” in the part number when ordering the PC board type 0.9 mm width terminal (ex) HC1-HP-AC6V-31-F.

4) PC board type (with LED indication)

Nominal coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V AC	HC1-HPL-AC6V-F	HC2-HPL-AC6V-F	HC3-HPL-AC6V-F	HC4-HPL-AC6V	HC4D-HPL-AC6V
12V AC	HC1-HPL-AC12V-F	HC2-HPL-AC12V-F	HC3-HPL-AC12V-F	HC4-HPL-AC12V	HC4D-HPL-AC12V
24V AC	HC1-HPL-AC24V-F	HC2-HPL-AC24V-F	HC3-HPL-AC24V-F	HC4-HPL-AC24V	HC4D-HPL-AC24V
100/110V AC	HC1-HPL-AC100V-F	HC2-HPL-AC100V-F	HC3-HPL-AC100V-F	HC4-HPL-AC100V	HC4D-HPL-AC100V
110/120V AC	HC1-HPL-AC120V-F	HC2-HPL-AC120V-F	HC3-HPL-AC120V-F	HC4-HPL-AC120V	HC4D-HPL-AC120V
200/220V AC	HC1-HPL-AC200V-F	HC2-HPL-AC200V-F	HC3-HPL-AC200V-F	HC4-HPL-AC200V	HC4D-HPL-AC200V
6V DC	HC1-HPL-DC6V-F	HC2-HPL-DC6V-F	HC3-HPL-DC6V-F	HC4-HPL-DC6V	HC4D-HPL-DC6V
12V DC	HC1-HPL-DC12V-F	HC2-HPL-DC12V-F	HC3-HPL-DC12V-F	HC4-HPL-DC12V	HC4D-HPL-DC12V
24V DC	HC1-HPL-DC24V-F	HC2-HPL-DC24V-F	HC3-HPL-DC24V-F	HC4-HPL-DC24V	HC4D-HPL-DC24V
48V DC	HC1-HPL-DC48V-F	HC2-HPL-DC48V-F	HC3-HPL-DC48V-F	HC4-HPL-DC48V	HC4D-HPL-DC48V
100/110V DC	HC1-HPL-DC100V-F	HC2-HPL-DC100V-F	HC3-HPL-DC100V-F	HC4-HPL-DC100V	HC4D-HPL-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Note: Please add “-31” before “-F” in the part number when ordering the PC board type 0.9 mm width terminal (ex) HC1-HPL-AC6V-31-F.

5) TM type

Nominal coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V AC	HC1-HTM-AC6V-F	HC2-HTM-AC6V-F	HC3-HTM-AC6V-F	HC4-HTM-AC6V	HC4D-HTM-AC6V
12V AC	HC1-HTM-AC12V-F	HC2-HTM-AC12V-F	HC3-HTM-AC12V-F	HC4-HTM-AC12V	HC4D-HTM-AC12V
24V AC	HC1-HTM-AC24V-F	HC2-HTM-AC24V-F	HC3-HTM-AC24V-F	HC4-HTM-AC24V	HC4D-HTM-AC24V
48V AC	HC1-HTM-AC48V-F	HC2-HTM-AC48V-F	HC3-HTM-AC48V-F	HC4-HTM-AC48V	HC4D-HTM-AC48V
100/110V AC	HC1-HTM-AC100V-F	HC2-HTM-AC100V-F	HC3-HTM-AC100V-F	HC4-HTM-AC100V	HC4D-HTM-AC100V
110/120V AC	HC1-HTM-AC120V-F	HC2-HTM-AC120V-F	HC3-HTM-AC120V-F	HC4-HTM-AC120V	HC4D-HTM-AC120V
200/220V AC	HC1-HTM-AC200V-F	HC2-HTM-AC200V-F	HC3-HTM-AC200V-F	HC4-HTM-AC200V	HC4D-HTM-AC200V
6V DC	HC1-HTM-DC6V-F	HC2-HTM-DC6V-F	HC3-HTM-DC6V-F	HC4-HTM-DC6V	HC4D-HTM-DC6V
12V DC	HC1-HTM-DC12V-F	HC2-HTM-DC12V-F	HC3-HTM-DC12V-F	HC4-HTM-DC12V	HC4D-HTM-DC12V
24V DC	HC1-HTM-DC24V-F	HC2-HTM-DC24V-F	HC3-HTM-DC24V-F	HC4-HTM-DC24V	HC4D-HTM-DC24V
48V DC	HC1-HTM-DC48V-F	HC2-HTM-DC48V-F	HC3-HTM-DC48V-F	HC4-HTM-DC48V	HC4D-HTM-DC48V
100/110V DC	HC1-HTM-DC100V-F	HC2-HTM-DC100V-F	HC3-HTM-DC100V-F	HC4-HTM-DC100V	HC4D-HTM-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2. Amber sealed type

1) Plug-in type

Nominal coil voltage	1 Form C	2 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.
6V AC	HC1E-H-AC6V-F	HC2E-H-AC6V-F	HC4E-H-AC6V	HC4ED-H-AC6V
12V AC	HC1E-H-AC12V-F	HC2E-H-AC12V-F	HC4E-H-AC12V	HC4ED-H-AC12V
24V AC	HC1E-H-AC24V-F	HC2E-H-AC24V-F	HC4E-H-AC24V	HC4ED-H-AC24V
48V AC	HC1E-H-AC48V-F	HC2E-H-AC48V-F	HC4E-H-AC48V	HC4ED-H-AC48V
100/110V AC	HC1E-H-AC100V-F	HC2E-H-AC100V-F	HC4E-H-AC100V	HC4ED-H-AC100V
110/120V AC	HC1E-H-AC120V-F	HC2E-H-AC120V-F	HC4E-H-AC120V	HC4ED-H-AC120V
200/220V AC	HC1E-H-AC200V-F	HC2E-H-AC200V-F	HC4E-H-AC200V	HC4ED-H-AC200V
220/240V AC	HC1E-H-AC240V-F	HC2E-H-AC240V-F	HC4E-H-AC240V	HC4ED-H-AC240V
6V DC	HC1E-H-DC6V-F	HC2E-H-DC6V-F	HC4E-H-DC6V	HC4ED-H-DC6V
12V DC	HC1E-H-DC12V-F	HC2E-H-DC12V-F	HC4E-H-DC12V	HC4ED-H-DC12V
24V DC	HC1E-H-DC24V-F	HC2E-H-DC24V-F	HC4E-H-DC24V	HC4ED-H-DC24V
48V DC	HC1E-H-DC48V-F	HC2E-H-DC48V-F	HC4E-H-DC48V	HC4ED-H-DC48V
100/110V DC	HC1E-H-DC100V-F	HC2E-H-DC100V-F	HC4E-H-DC100V	HC4ED-H-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2) Plug-in type (With LED indication)

Nominal coil voltage	1 Form C	2 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.
6V AC	HC1E-L-AC6V-F	HC2E-L-AC6V-F	HC4E-L-AC6V	HC4ED-L-AC6V
12V AC	HC1E-L-AC12V-F	HC2E-L-AC12V-F	HC4E-L-AC12V	HC4ED-L-AC12V
24V AC	HC1E-L-AC24V-F	HC2E-L-AC24V-F	HC4E-L-AC24V	HC4ED-L-AC24V
48V AC	HC1E-L-AC48V-F	HC2E-L-AC48V-F	HC4E-L-AC48V	HC4ED-L-AC48V
100/110V AC	HC1E-L-AC100V-F	HC2E-L-AC100V-F	HC4E-L-AC100V	HC4ED-L-AC100V
110/120V AC	HC1E-L-AC120V-F	HC2E-L-AC120V-F	HC4E-L-AC120V	HC4ED-L-AC120V
200/220V AC	HC1E-L-AC200V-F	HC2E-L-AC200V-F	HC4E-L-AC200V	HC4ED-L-AC200V
220/240V AC	HC1E-L-AC240V-F	HC2E-L-AC240V-F	HC4E-L-AC240V	HC4ED-L-AC240V
6V DC	HC1E-L-DC6V-F	HC2E-L-DC6V-F	HC4E-L-DC6V	HC4ED-L-DC6V
12V DC	HC1E-L-DC12V-F	HC2E-L-DC12V-F	HC4E-L-DC12V	HC4ED-L-DC12V
24V DC	HC1E-L-DC24V-F	HC2E-L-DC24V-F	HC4E-L-DC24V	HC4ED-L-DC24V
48V DC	HC1E-L-DC48V-F	HC2E-L-DC48V-F	HC4E-L-DC48V	HC4ED-L-DC48V
100/110V DC	HC1E-L-DC100V-F	HC2E-L-DC100V-F	HC4E-L-DC100V	HC4ED-L-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

3) PC board type

Nominal coil voltage	1 Form C	2 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.
6V AC	HC1E-HP-AC6V-F	HC2E-HP-AC6V-F	HC4E-HP-AC6V	HC4ED-HP-AC6V
12V AC	HC1E-HP-AC12V-F	HC2E-HP-AC12V-F	HC4E-HP-AC12V	HC4ED-HP-AC12V
24V AC	HC1E-HP-AC24V-F	HC2E-HP-AC24V-F	HC4E-HP-AC24V	HC4ED-HP-AC24V
48V AC	HC1E-HP-AC48V-F	HC2E-HP-AC48V-F	HC4E-HP-AC48V	HC4ED-HP-AC48V
100/110V AC	HC1E-HP-AC100V-F	HC2E-HP-AC100V-F	HC4E-HP-AC100V	HC4ED-HP-AC100V
110/120V AC	HC1E-HP-AC120V-F	HC2E-HP-AC120V-F	HC4E-HP-AC120V	HC4ED-HP-AC120V
200/220V AC	HC1E-HP-AC200V-F	HC2E-HP-AC200V-F	HC4E-HP-AC200V	HC4ED-HP-AC200V
220/240V AC	HC1E-HP-AC240V-F	HC2E-HP-AC240V-F	HC4E-HP-AC240V	HC4ED-HP-AC240V
6V DC	HC1E-HP-DC6V-F	HC2E-HP-DC6V-F	HC4E-HP-DC6V	HC4ED-HP-DC6V
12V DC	HC1E-HP-DC12V-F	HC2E-HP-DC12V-F	HC4E-HP-DC12V	HC4ED-HP-DC12V
24V DC	HC1E-HP-DC24V-F	HC2E-HP-DC24V-F	HC4E-HP-DC24V	HC4ED-HP-DC24V
48V DC	HC1E-HP-DC48V-F	HC2E-HP-DC48V-F	HC4E-HP-DC48V	HC4ED-HP-DC48V
100/110V DC	HC1E-HP-DC100V-F	HC2E-HP-DC100V-F	HC4E-HP-DC100V	HC4ED-HP-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Note: Please add “-31” in the suffix of part number when ordering the PC board type 0.9 mm width terminal. (4 Form C, 4 Form C (twin) only)

4) PC board type (With LED indication)

Nominal coil voltage	1 Form C	2 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.
6V AC	HC1E-PL-AC6V-F	HC2E-PL-AC6V-F	HC4E-PL-AC6V	HC4ED-PL-AC6V
12V AC	HC1E-PL-AC12V-F	HC2E-PL-AC12V-F	HC4E-PL-AC12V	HC4ED-PL-AC12V
24V AC	HC1E-PL-AC24V-F	HC2E-PL-AC24V-F	HC4E-PL-AC24V	HC4ED-PL-AC24V
48V AC	HC1E-PL-AC48V-F	HC2E-PL-AC48V-F	HC4E-PL-AC48V	HC4ED-PL-AC48V
100/110V AC	HC1E-PL-AC100V-F	HC2E-PL-AC100V-F	HC4E-PL-AC100V	HC4ED-PL-AC100V
110/120V AC	HC1E-PL-AC120V-F	HC2E-PL-AC120V-F	HC4E-PL-AC120V	HC4ED-PL-AC120V
200/220V AC	HC1E-PL-AC200V-F	HC2E-PL-AC200V-F	HC4E-PL-AC200V	HC4ED-PL-AC200V
220/240V AC	HC1E-PL-AC240V-F	HC2E-PL-AC240V-F	HC4E-PL-AC240V	HC4ED-PL-AC240V
6V DC	HC1E-PL-DC6V-F	HC2E-PL-DC6V-F	HC4E-PL-DC6V	HC4ED-PL-DC6V
12V DC	HC1E-PL-DC12V-F	HC2E-PL-DC12V-F	HC4E-PL-DC12V	HC4ED-PL-DC12V
24V DC	HC1E-PL-DC24V-F	HC2E-PL-DC24V-F	HC4E-PL-DC24V	HC4ED-PL-DC24V
48V DC	HC1E-PL-DC48V-F	HC2E-PL-DC48V-F	HC4E-PL-DC48V	HC4ED-PL-DC48V
100/110V DC	HC1E-PL-DC100V-F	HC2E-PL-DC100V-F	HC4E-PL-DC100V	HC4ED-PL-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Note: Please add “-31” in the suffix of part number when ordering the PC board type 0.9 mm width terminal. (4 Form C, 4 Form C (twin) only)

5) TM type

Nominal coil voltage	1 Form C	2 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.
6V AC	HC1E-HTM-AC6V-F	HC2E-HTM-AC6V-F	HC4E-HTM-AC6V	HC4ED-HTM-AC6V
12V AC	HC1E-HTM-AC12V-F	HC2E-HTM-AC12V-F	HC4E-HTM-AC12V	HC4ED-HTM-AC12V
24V AC	HC1E-HTM-AC24V-F	HC2E-HTM-AC24V-F	HC4E-HTM-AC24V	HC4ED-HTM-AC24V
48V AC	HC1E-HTM-AC48V-F	HC2E-HTM-AC48V-F	HC4E-HTM-AC48V	HC4ED-HTM-AC48V
100/110V AC	HC1E-HTM-AC100V-F	HC2E-HTM-AC100V-F	HC4E-HTM-AC100V	HC4ED-HTM-AC100V
110/120V AC	HC1E-HTM-AC120V-F	HC2E-HTM-AC120V-F	HC4E-HTM-AC120V	HC4ED-HTM-AC120V
200/220V AC	HC1E-HTM-AC200V-F	HC2E-HTM-AC200V-F	HC4E-HTM-AC200V	HC4ED-HTM-AC200V
220/240V AC	HC1E-HTM-AC240V-F	HC2E-HTM-AC240V-F	HC4E-HTM-AC240V	HC4ED-HTM-AC240V
6V DC	HC1E-HTM-DC6V-F	HC2E-HTM-DC6V-F	HC4E-HTM-DC6V	HC4ED-HTM-DC6V
12V DC	HC1E-HTM-DC12V-F	HC2E-HTM-DC12V-F	HC4E-HTM-DC12V	HC4ED-HTM-DC12V
24V DC	HC1E-HTM-DC24V-F	HC2E-HTM-DC24V-F	HC4E-HTM-DC24V	HC4ED-HTM-DC24V
48V DC	HC1E-HTM-DC48V-F	HC2E-HTM-DC48V-F	HC4E-HTM-DC48V	HC4ED-HTM-DC48V
100/110V DC	HC1E-HTM-DC100V-F	HC2E-HTM-DC100V-F	HC4E-HTM-DC100V	HC4ED-HTM-DC100V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

3. Keep relay

Nominal coil voltage	Plug-in type (2c)	PC board type (2c)
	Part No.	Part No.
6V AC	HC2K-AC6V-F	HC2K-P-AC6V-F
12V AC	HC2K-AC12V-F	HC2K-P-AC12V-F
24V AC	HC2K-AC24V-F	HC2K-P-AC24V-F
48V AC	HC2K-AC48V-F	HC2K-P-AC48V-F
100V AC	HC2K-AC100V-F	HC2K-P-AC100V-F
6V DC	HC2K-DC6V-F	HC2K-P-DC6V-F
12V DC	HC2K-DC12V-F	HC2K-P-DC12V-F
24V DC	HC2K-DC24V-F	HC2K-P-DC24V-F
48V DC	HC2K-DC48V-F	HC2K-P-DC48V-F
100/110V DC	HC2K-DC100V-F	HC2K-P-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Note: Please refer to the “Standards Chart” for product certification.

4. With diode type (For DC)

1) Plug-in type

Nominal coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V DC	HC1-DC6V-D-F	HC2-DC6V-D-F	HC3-DC6V-D-F	HC4-DC6V-D	HC4D-DC6V-D
12V DC	HC1-DC12V-D-F	HC2-DC12V-D-F	HC3-DC12V-D-F	HC4-DC12V-D	HC4D-DC12V-D
24V DC	HC1-DC24V-D-F	HC2-DC24V-D-F	HC3-DC24V-D-F	HC4-DC24V-D	HC4D-DC24V-D
48V DC	HC1-DC48V-D-F	HC2-DC48V-D-F	HC3-DC48V-D-F	HC4-DC48V-D	HC4D-DC48V-D
100/110V DC	HC1-DC100V-D-F	HC2-DC100V-D-F	HC3-DC100V-D-F	HC4-DC100V-D	HC4D-DC100V-D

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2) Plug-in type (with LED indication)

Nominal coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
6V DC	HC1-L-DC6V-D-F	HC2-L-DC6V-D-F	HC3-L-DC6V-D-F	HC4-L-DC6V-D	HC4D-L-DC6V-D
12V DC	HC1-L-DC12V-D-F	HC2-L-DC12V-D-F	HC3-L-DC12V-D-F	HC4-L-DC12V-D	HC4D-L-DC12V-D
24V DC	HC1-L-DC24V-D-F	HC2-L-DC24V-D-F	HC3-L-DC24V-D-F	HC4-L-DC24V-D	HC4D-L-DC24V-D
48V DC	HC1-L-DC48V-D-F	HC2-L-DC48V-D-F	HC3-L-DC48V-D-F	HC4-L-DC48V-D	HC4D-L-DC48V-D
100/110V DC	HC1-L-DC100V-D-F	HC2-L-DC100V-D-F	HC3-L-DC100V-D-F	HC4-L-DC100V-D	HC4D-L-DC100V-D

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

5. With CR circuit type

1) Plug-in type

Nominal coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
100/110V AC	HC1-AC100V-R-F	HC2-AC100V-R-F	HC3-AC100V-R-F	HC4-AC100V-R	HC4D-AC100V-R
110/120V AC	HC1-AC120V-R-F	HC2-AC120V-R-F	HC3-AC120V-R-F	HC4-AC120V-R	HC4D-AC120V-R
200/220V AC	HC1-AC200V-R-F	HC2-AC200V-R-F	HC3-AC200V-R-F	HC4-AC200V-R	HC4D-AC200V-R
220/240V AC	HC1-AC240V-R-F	HC2-AC240V-R-F	HC3-AC240V-R-F	HC4-AC240V-R	HC4D-AC240V-R

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2) Plug-in type (with LED indication)

Nominal coil voltage	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Part No.	Part No.	Part No.	Part No.	Part No.
100/110V AC	HC1-L-AC100V-R-F	HC2-L-AC100V-R-F	HC3-L-AC100V-R-F	HC4-L-AC100V-R	HC4D-L-AC100V-R
110/120V AC	HC1-L-AC120V-R-F	HC2-L-AC120V-R-F	HC3-L-AC120V-R-F	HC4-L-AC120V-R	HC4D-L-AC120V-R
200/220V AC	HC1-L-AC200V-R-F	HC2-L-AC200V-R-F	HC3-L-AC200V-R-F	HC4-L-AC200V-R	HC4D-L-AC200V-R
220/240V AC	HC1-L-AC240V-R-F	HC2-L-AC240V-R-F	HC3-L-AC240V-R-F	HC4-L-AC240V-R	HC4D-L-AC240V-R

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

* For sockets and terminal sockets, see page 87.

RATING

1. Standard type

1) Coil data

(1) AC coils (50/60Hz)

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±20%] (at 20°C 68°F)		Coil inductance		Nominal operating power		Max. applied voltage (at 70°C 158°F)
				50Hz	60Hz	N.C. condition	N.O. condition	50Hz	60Hz	
Standard	6V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	224mA	200mA	0.078H	0.074H	1.3VA	1.2VA	110%V of nominal voltage
	12V AC			111mA	100mA	0.312H	0.295H			
	24V AC			56mA	50mA	1.243H	1.181H			
	48V AC			28mA	25mA	4.974H	4.145H			
	100/110V AC			13.4/14.7mA	12/13.2mA	23.75H	20.63H			
	110/120V AC			12.2/13.5mA	10.9/11.9mA	27.19H	25.57H			
	200/220V AC			6.7/7.4mA	6/6.6mA	85.98H	81.76H			

Notes: 1. The relay operates in a range of 80% to 110% V of the voltage rating, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the rated voltage. In particular, for AC operation, if the applied voltage drops to 80% V or more below the rated voltage, humming will occur and a large current will flow leading possibly to coil burnout.

2. The maximum applied voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.)

(2) DC coils

Type	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal coil current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage (at 70°C 158°F)
Standard	6V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	150mA	40Ω	0.9W	110%V of nominal voltage
	12V DC			75mA	160Ω		
	24V DC			37mA	650Ω		
	48V DC			18.5mA	2,600Ω		
	100/110V DC			10/11mA	10,000Ω	1.0W	

Notes: 1. The coil resistance for DC operation is the value measured when the coil temperature is 20°C 68°F. Compensate ±0.4% for every ±1°C change in temperature.
2. The relay operates in a range of 80% to 110% V of the voltage rating, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the rated voltage.
3. For use with 200 V DC, connect a 10 KΩ (5W) resistor, in series, to the 100 V DC relay.
4. The maximum applied voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.)

2) Specifications

Characteristics	Item		Specifications				
Contact	Arrangement		1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)
	Contact resistance (Initial)		Max. 30 mΩ (By voltage drop 6 V DC 1A)				
	Contact material		Ag alloy (cd free) + Au flash			AgNi type + Au clad	
Rating	Nominal switching capacity (resistive load)		10A 250V AC	7A 250V AC	7A 250V AC	5A 250V AC	3A 250V AC
	Max. switching power (resistive load)		2,500VA	1,750VA	1,750VA	1,250VA	750VA
	Max. switching voltage		250VAC				
	Max. switching current		10A	7A	7A	5A	3A
	Nominal operating power		AC (50Hz): 1.3VA, AC (60Hz): 1.2VA, DC: 0.9 to 1.1W				
	Min. switching capacity (Reference value)*1		1mA 1V DC				100μA 1V DC
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	700 Vrms for 1min. (Detection current: 10mA.)				
		Between contact sets	700 Vrms for 1min. (Detection current: 10mA.)				
		Between contact and coil	2,000 Vrms for 1min. (Detection current: 10mA.)				
	Temperature rise (coil) (at 70°C 158°F)		Max. 80°C 176°F (By resistive method, nominal coil voltage)				
	Operate time (at 20°C 68°F)*2		Max. 20ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)				
	Release time (at 20°C 68°F)*2		Max. 20ms (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)				
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)				
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 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 2 mm				
Expected life	Mechanical		Min. 5×10^7: AC coil type (at 180 times/min.); Min. 10^8: DC coil type (at 180 times/min.)				
	Electrical		Min. 2×10^5 resistive load (at 20 times/min.)	Min. 2×10^5 resistive load (at 20 times/min.)	Min. 10^5 resistive load (at 20 times/min.)	Min. 2×10^5 resistive load (at 20 times/min.)	Min. 2×10^5 resistive load (at 20 times/min.)
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –50°C to +70°C –58°F to +158°F (without LED); –50°C to +60°C –58°F to +140°F (with LED) 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. 30g 1.06 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. For the AC coil types, the operate/release time will differ depending on the phase.
*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.

3) Switching capacity and expected life
(1) Electrical (at 20 times/min.)

Load	AC				DC		Expected life
	Resistive (cos φ = 1)		Inductive (cos φ ≒ 0.4)		Resistive	Inductive	
Voltage	125V AC	250V AC	125V AC	250V AC	30V DC	30V DC	
1 Form C	10A	10A	5A	3A	—	—	Min. 2×10^5
	7A	7A	3A	2.5A	3A	1A	Min. 5×10^5
	5A	5A	2A	1.5A	—	—	Min. 10^6
2 Form C	7A	7A	3.5A	2A	—	—	Min. 2×10^5
	5A	5A	2.5A	1.5A	3A	0.6A	Min. 5×10^5
	3A	3A	1.5A	1A	—	—	Min. 10^6
3 Form C	7A	7A	—	—	—	—	Min. 10^5
	—	—	3.5A	2A	—	—	Min. 2×10^5
	5A	5A	—	—	3A	0.4A	Min. 5×10^5
4 Form C	5A	5A	2A	1A	—	—	Min. 2×10^5
	3A	3A	1A	0.8A	3A	0.4A	Min. 5×10^5
	2A	2A	0.5A	0.4A	—	—	Min. 10^6
4 Form C (twin)	3A	3A	1A	0.8A	3A	—	Min. 2×10^5

(2) Mechanical (at 180 times/min.)
AC coil type: Min. 5×10^7; DC coil type: Min. 10^8

2. Amber sealed type

1) Coil data
Same coil data as HC relay standard type. Please refer to standard type information.

2) Specifications

Characteristics	Item	Specifications			
		1 Form C	2 Form C	4 Form C	4 Form C (twin)
Contact	Arrangement	1 Form C	2 Form C	4 Form C	4 Form C
Rating	Nominal switching capacity (resistive load)	5A 250V AC	3A 250V AC	2A 250V AC	1A 250V AC
	Max. switching power (resistive load)	1,250VA	700VA	500VA	250VA
	Max. switching voltage	250VAC	250VAC	250VAC	250VAC
	Max. switching current	5A	3A	2A	1A
	Min. switching capacity (Reference value)*1	1mA 100mV DC			100μA 100mV DC
Electrical characteristics	Temperature rise (coil) (at 60°C 140°F)	Max. 90°C 194°F (By resistive method, nominal voltage)			
Expected life	Electrical	Min. 2×10^5 resistive load (at 20 times/min.)			
Conditions	Conditions for operation, transport and storage*2	Ambient temperature: –40°C to +60°C –40°F to +140°F; Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)			
	Ambient air pressure	760mmHg±20% (1,013mb±20%)			

Notes: Other specifications are same as standard types.
*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. 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.

3) Switching capacity and expected life
(1) Electrical (at 20 times/min.)

Load	AC				DC		Expected life
	Resistive (cos φ = 1)		Inductive (cos φ ≒ 0.4)		Resistive	Inductive	
Voltage	125V AC	250V AC	125V AC	250V AC	30V DC	30V DC	
HC1E	5A	5A	—	—	3A	1A	Min. 2×10^5
HC2E	3A	3A	—	—	2A	0.7A	Min. 2×10^5
HC4E	2A	2A	—	—	2A	0.6A	Min. 2×10^5
HC4ED (4 Form C twin)	1A	1A	—	—	—	—	Min. 2×10^5

(2) Mechanical (at 180 times/min.)
AC coil type: Min. 5×10^7; DC coil type: Min. 10^8

3. Keep relay

1) Coil data

(1) AC coils (50/60Hz)

Contact arrangement	Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset voltage (at 20°C 68°F)	Nominal operating current [±10%] (at 20°C 68°F)		Nominal operating power		Max. applied voltage (at 50°C 122°F)
				Set coil	Reset coil	Set coil	Reset coil	
2 Form C	6V AC	80%V or less of nominal voltage (Initial)	80%V or less of nominal voltage (Initial)	206mA	103mA	1.23VA	0.62VA	110%V of nominal voltage
	12V AC			100mA	52mA	1.20VA	0.62VA	
	24V AC			51mA	21.4mA	1.22VA	0.51VA	
	48V AC			25.2mA	18.5mA	1.20VA	0.88VA	
	100V AC			13.3mA	7.1mA	1.33VA	0.71VA	

(2) DC coils

Contact arrangement	Nominal coil voltage	Set voltage (at 20°C 68°F)	Reset 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 50°C 122°F)
				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
2 Form C	6V DC	80%V or less of nominal voltage (Initial)	80%V or less of nominal voltage (Initial)	207mA	107mA	29Ω	56Ω	1.24W	0.64W	110%V of nominal voltage
	12V DC			100mA	52.2mA	120Ω	230Ω	1.20W	0.63W	
	24V DC			51.1mA	25.5mA	470Ω	941Ω	1.23W	0.61W	
	48V DC			25.3mA	13.7mA	1,897Ω	3,504Ω	1.21W	0.66W	
	100V DC			15.6mA	5.8mA	6,410Ω	17,241Ω	1.56W	0.58W	

Notes: 1. The allowable coil resistance range is ±10% when within 1,000Ω and ±15% when. 1,000Ω or higher.
2. The maximum applied voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.)

2) Specifications

Characteristics	Item		Specifications
Contact	Contact resistance (Initial)		Max. 50 mΩ (By voltage drop 6 V DC 1A)
Rating	Nominal switching capacity (resistive load)		3A 250V AC
	Max. switching power (resistive load)		750VA
	Max. switching current		3A
	Nominal operating power		Set coil: 1.20VA to 1.33VA; Reset coil: 0.51VA to 0.88VA
	Min. switching capacity (Reference value)*1		100μA 100mV DC
Electrical characteristics	Breakdown voltage (Initial)	Between contact and coil	1,500 Vrms for 1min.
	Temperature rise (coil)		Set coil: Max. 80°C 176°F; Reset coil: Max. 50°C 122°F (at nominal coil voltage)
	Set time/Reset time (at 20°C 68°F)		Approx. 20ms/30ms (at nominal coil voltage)
Mechanical characteristics	Shock resistance	Functional	Min. 98m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
Expected life	Mechanical		Min. 10^7 (at 180 times/min.)
	Electrical		Min. 2×10^5 rated load (at 20 times/min.)
Conditions	Ambient temperature		–40°C to +50°C –40°F to +122°F (Not freezing and condensing at low temperature)

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. Other specifications are same as standard type HC relay. Please see the standard type HC relay.
*3. Please maintain (reset) the relay more than once a year. Leaving it in the set position for long periods of time will cause the magnet to attenuate over the years. This will decrease the holding power and cause failure of the set position.

4. With diode type (For DC)

1) Coil data

Same coil data as HC relay standard type for DC. Please refer to standard type information.
Please connect DC coil type built-in diode correctly by verifying the coil polarity.

2) Specifications

Characteristics	Item	Specifications
Conditions	Conditions for operation, transport and storage*	Ambient temperature: –50°C to +60°C –58°F to +140°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)

Notes: Other specifications are same as standard type HC relay. Please see the standard type HC relay.
* 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.

5. With CR circuit type

1) Coil data

Same coil data as HC relay standard type for AC. Please refer to standard type information.

2) Specifications

Characteristics	Item	Specifications
Electrical characteristics	Temperature rise (coil)	Max. 90°C 194°F (By resistive method, nominal voltage, rated current at 60°C 140°F)
Conditions	Conditions for operation, transport and storage*	Ambient temperature: –50°C to +60°C –58°F to +140°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)

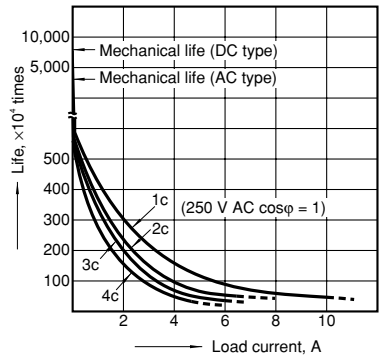
Notes: Other specifications are same as standard type HC relay. Please see the standard type HC relay.
* The upper limit of the ambient temperature is the maximum temperature that can satisfy the coil temperature rise value. Refer to Usage, transport and storage conditions in NOTES.

REFERENCE DATA

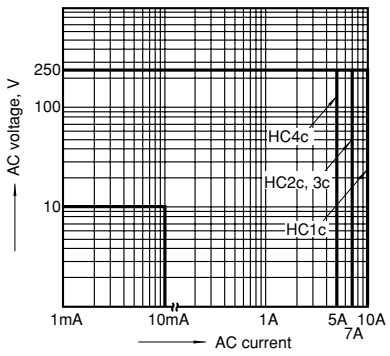
Standard type

1. Life curve

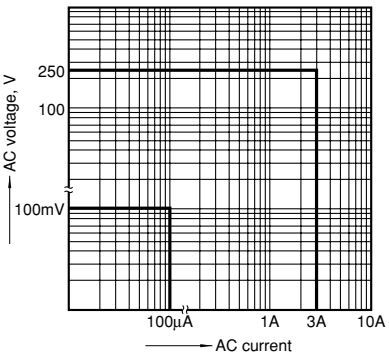
Load: 250 V AC resistive load



2.-(1) Switching capacity range
(single contact type)

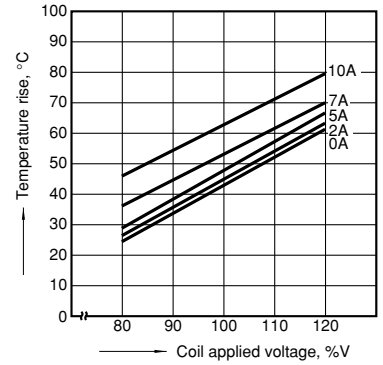


2.-(2) Switching capacity range
(4-pole bifurcated (twin) contact type)



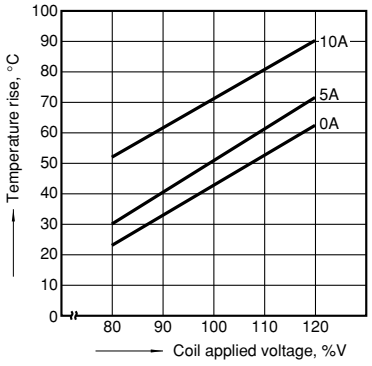
3.-(1) Coil temperature rise
(1 Form C, AC type)

Measured portion: Inside the coil
Ambient temperature: 25°C 77°F (See note.)



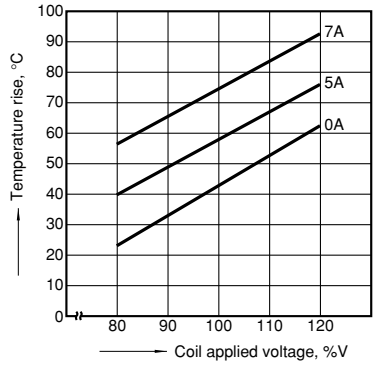
3.-(2) Coil temperature rise
(2 Form C, AC type)

Measured portion: Inside the coil
Ambient temperature: 30°C 86°F (See note.)



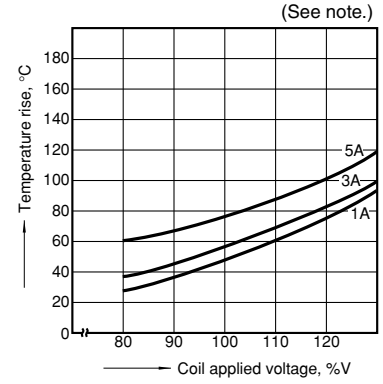
3.-(3) Coil temperature rise
(3 Form C, AC type)

Measured portion: Inside the coil
Ambient temperature: 18°C 64°F (See note.)



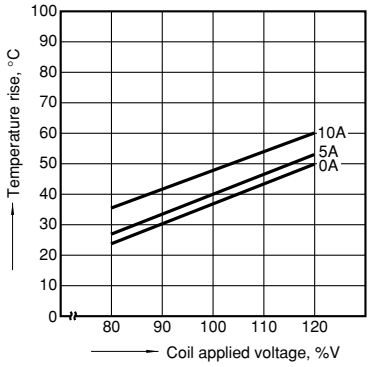
3.-(4) Coil temperature rise
(4 Form C, AC type)

Measured portion: Inside the coil
Ambient temperature: 15 to 21°C 59 to 70°F
(See note.)



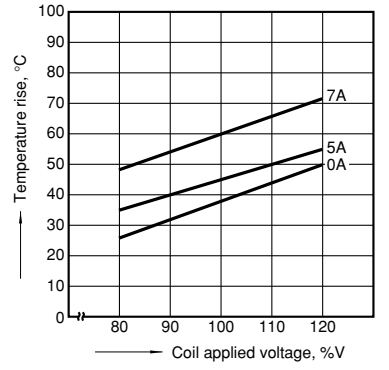
3.-(5) Coil temperature rise
(1 Form C, DC type)

Measured portion: Inside the coil
Ambient temperature: 29°C 84°F



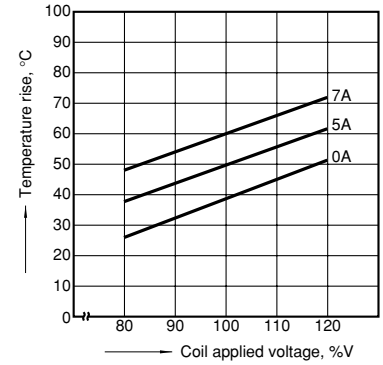
3.-(6) Coil temperature rise
(2 Form C, DC type)

Measured portion: Inside the coil
Ambient temperature: 29°C 84°F



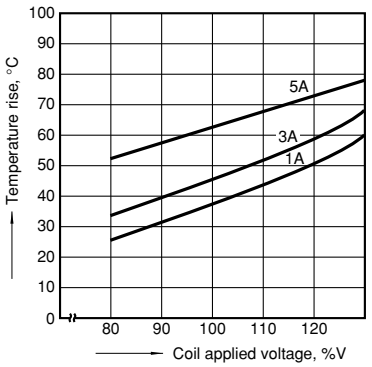
3.-(7) Coil temperature rise
(3 Form C, DC type)

Measured portion: Inside the coil
Ambient temperature: 29°C 84°F



3.-(8) Coil temperature rise
(4 Form C, DC type)

Measured portion: Inside the coil
Ambient temperature: 17 to 18°C 62 to 64°F

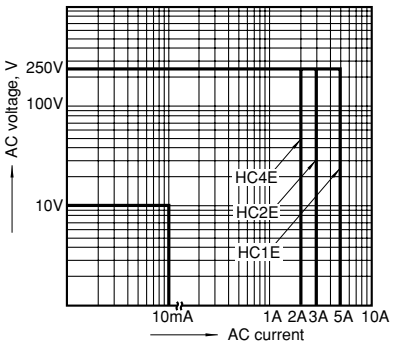


Note: Coil temperature rise

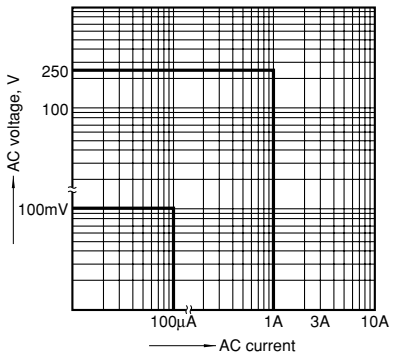
When the nominal voltage is applied to AC 120 or 240 V coil types respectively, the figures of coil temperature rise increase by approx. 10 degrees to the ones shown on each graph.

Amber sealed type

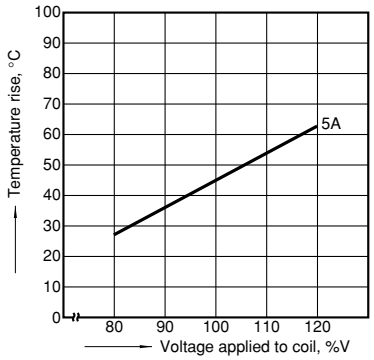
1.-(1) Switching capacity range
(single contact type)



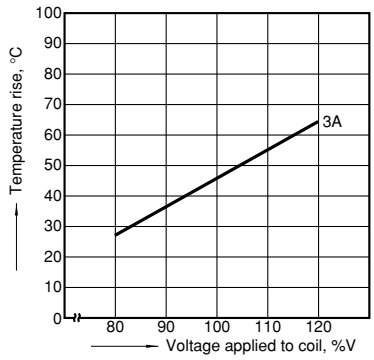
1.-(2) Switching capacity range
(4-pole bifurcated (twin) contact type)



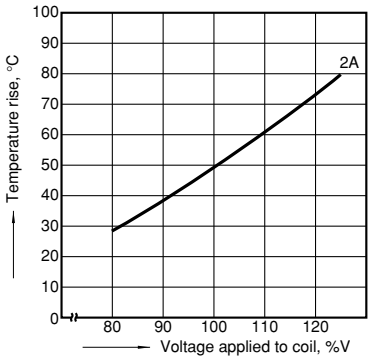
2.-(1) Coil temperature rise (1 Form C AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



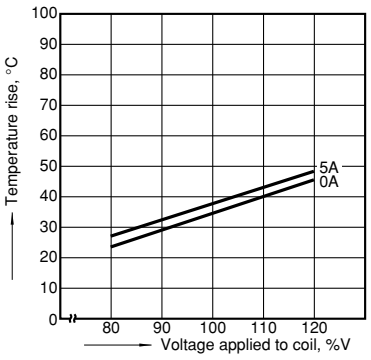
2.-(2) Coil temperature rise (2 Form C AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F (See note.)



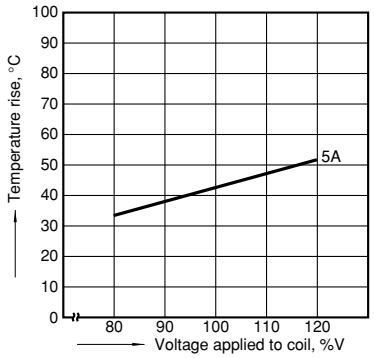
2.-(3) Coil temperature rise (4 Form C AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F (See note.)



2.-(4) Coil temperature rise (1 Form C DC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



2.-(5) Coil temperature rise (2 Form C DC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F

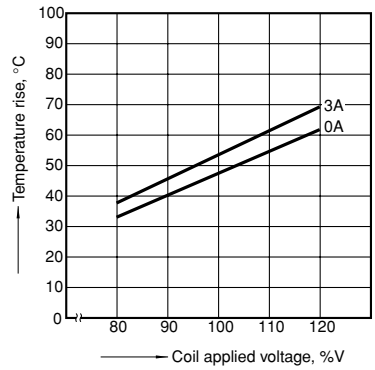


Note: Coil temperature rise

When the nominal voltage is applied to AC 120 or 240 V coil types respectively, the figures of coil temperature rise increase by approx. 10 degrees to the ones shown on each graph.

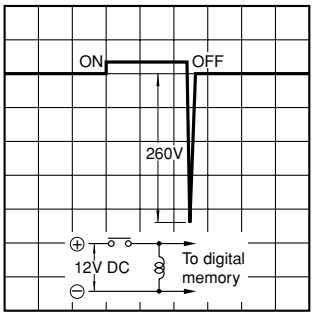
Keep relay

Coil temperature rise
Tested sample: HC2K-DC12V, 2 pcs
Measured portion: Inside the coil
Ambient temperature: 28°C 82.4°F



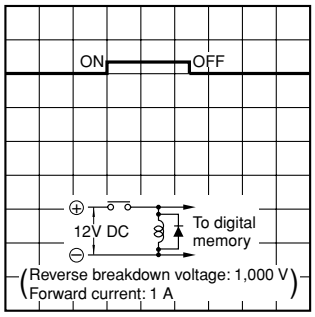
With diode type (For DC)

1.-(1) DC coil surge voltage waveform (without diode)



1.-(2) DC coil surge voltage waveform (with diode)

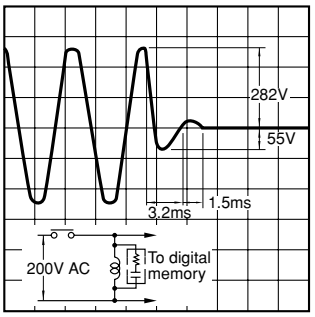
Diode characteristics;
Reverse breakdown voltage: 1,000V,
Forward current: 1A



With CR circuit type

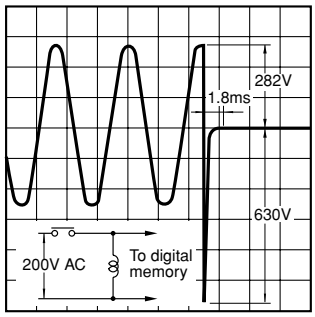
1.-(1) AC coil surge voltage waveform (with CR circuit)

Tested sample: HC4-AC200V-R



1.-(2) AC coil surge voltage waveform (without CR circuit)

Tested sample: HC4-AC200V



DIMENSIONS (mm inch)

The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

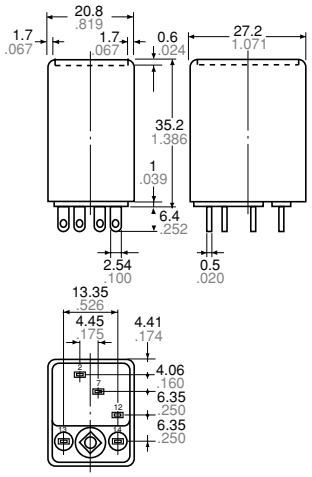
Standard and Amber sealed types

1) Plug-in type

1 Form C

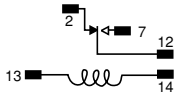
CAD Data

External dimensions

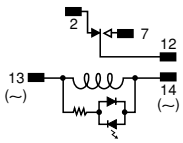


Schematic (Bottom view)

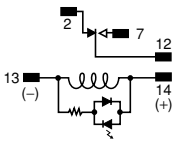
Standard type



LED AC type



LED DC type

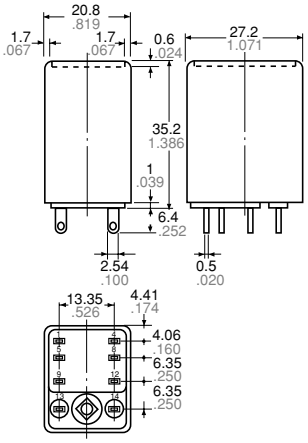


General tolerance: ±0.3 ±.012

2 Form C

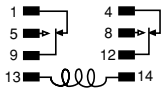
CAD Data

External dimensions

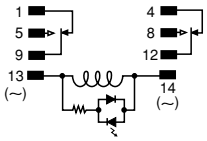


Schematic (Bottom view)

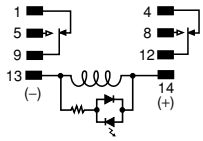
Standard type



LED AC type



LED DC type

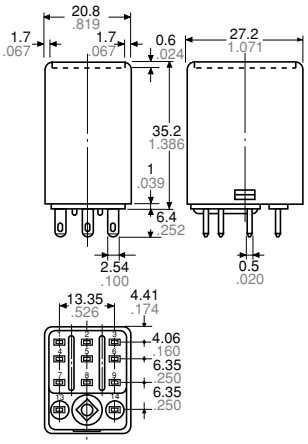


General tolerance: ±0.3 ±.012

3 Form C

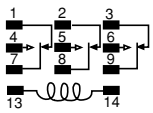
CAD Data

External dimensions

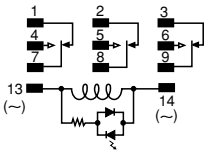


Schematic (Bottom view)

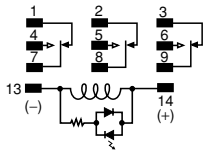
Standard type



LED AC type



LED DC type

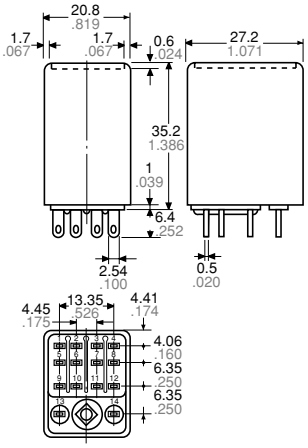


General tolerance: ±0.3 ±.012

4 Form C and 4-pole bifurcated (twin)

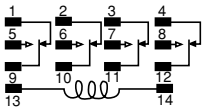
CAD Data

External dimensions

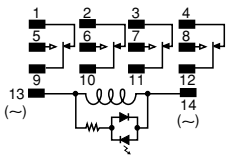


Schematic (Bottom view)

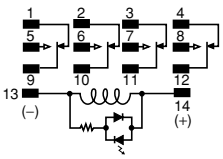
Standard type



LED AC type



LED DC type

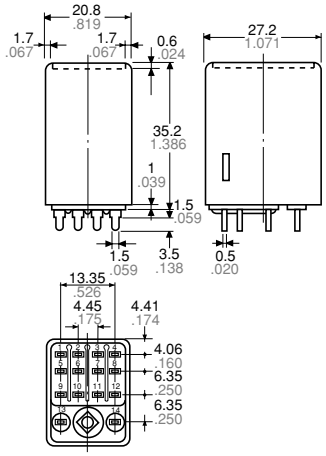


General tolerance: ±0.3 ±.012

2) PC board type
4 Form C

CAD Data

External dimensions

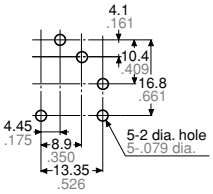


General tolerance: ±0.3 ±.012

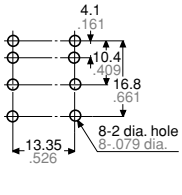
The diagrams show the external dimensions of the 4 Form C and 4-pole bifurcated (twin) types. For 1 Form C, 2 Form C, and 3 Form C, see diagrams at plug-in types (only the terminals are different).
Types with 0.9 mm terminal width are also available.

PC board pattern

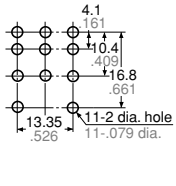
1 Form C



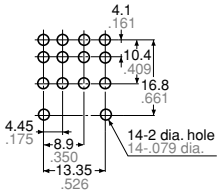
2 Form C



3 Form C



4 Form C



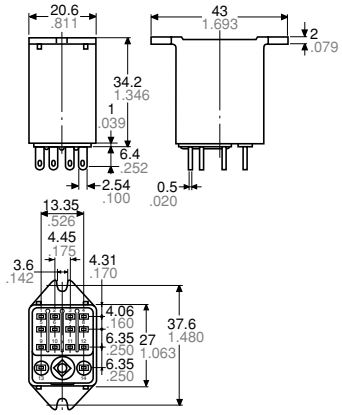
Tolerance: ±0.1 ±.004

Schematic
Same schematic as plug-in type HC relay

3) TM type
4 Form C

CAD Data

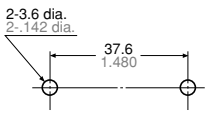
External dimensions



General tolerance: ±0.3 ±.012

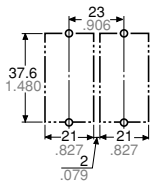
The diagrams show the external dimensions of the 4 Form C and 4-pole bifurcated (twin) types. For 1 Form C, 2 Form C, and 3 Form C, see diagrams at plug-in types (only the terminals are different).

Chassis (Panel) cutout



Tolerance: ±0.1 ±.004

Chassis (Panel) cutout in tandem mounting



Schematic
Same schematic as plug-in type HC relay
Be aware that there is no LED indicator with CR circuit and built-in diode types.

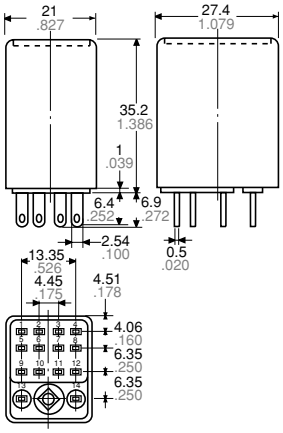
Notes: 1. In mounting, use M3 screws and M3 washers.
2. When mounting TM types, use washers to prevent damage or distortion to the polycarbonate cover.
3. When tightening fixing screws, the optimum torque range should be 0.294 to 0.49 N·m, (3 to 5 kgf·cm). Moreover, use washers to prevent loosening.

Keep relay

Plug-in type (2 Form C)

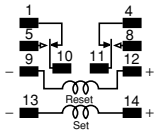
CAD Data

External dimensions

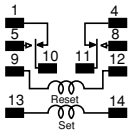


Schematic (Bottom view)

DC type



AC type

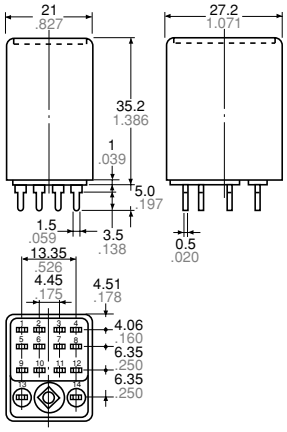


General tolerance: ±0.3 ±.012

PC board type (2 Form C)

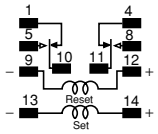
CAD Data

External dimensions

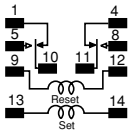


Schematic (Bottom view)

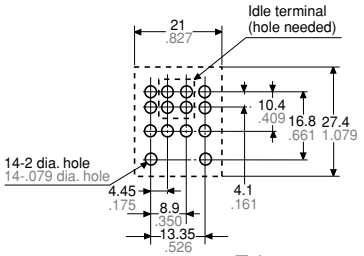
DC type



AC type



PC board pattern (Bottom view)



General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

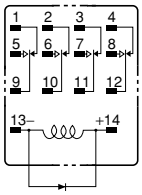
With diode type (For DC)

Same dimensions as HC relay standard/plug-in type

CAD Data

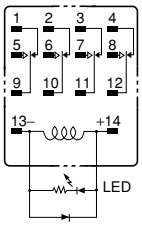
Schematic

Without LED indicator



Protection (surge-absorbing) diode

With LED indicator

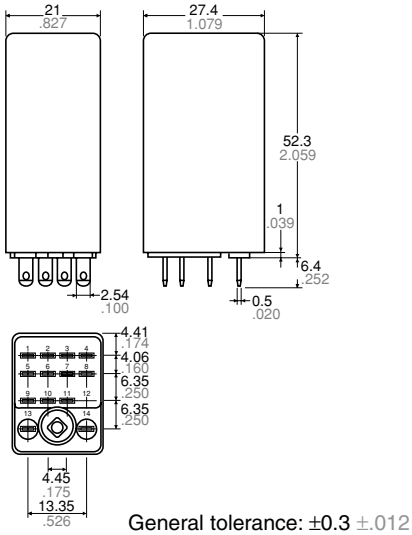


Protection (surge-absorbing) diode

With CR circuit type
Plug-in type

CAD Data

4 Form C External dimensions

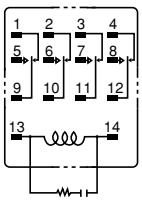


Diagrams show the external dimensions and schematic of the 4 Form C and 4-pole bifurcated (twin) types. For the 1 Form C, 2 Form C, and 3 Form C types, only the terminals differ. The dimensions of the terminal are the same as for standard type HC relays.

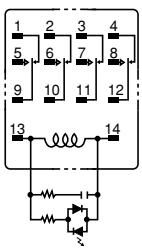
General tolerance: ±0.3 ±.012

Schematic

Without LED indicator



With LED indicator



SAFETY STANDARDS

Item		UL/C-UL (Recognized)		CSA (Certified)		VDE (Certified)		TV rating (UL/CSA)		Remarks
		File No.	Contact rating	File No.	Contact rating	File No.	Contact rating	File No.	Rating	
HC Standard	1 Form C	E43028	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	LR26550 etc.	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	40017406	10A 250V AC (cosϕ=1.0) 3A 250V AC (cosϕ=0.4) 3A 30V DC (0ms)	UL E43149 CSA LR26550	TV-3	
	2 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	40017406	7A 250V AC (cosϕ=1.0) 2A 250V AC (cosϕ=0.4) 3A 30V DC (0ms)	UL E43149 CSA LR26550	TV-3	
	3 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—	
	4 Form C	E43028	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	LR26550 etc.	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	40017406	5A 65V AC (cosϕ=1.0) 3A 65V AC (cosϕ=0.4) 3A 30V DC (0ms)	—	—	
	4 Form C twin	E43149	3A 250V AC 3A 30V DC	LR26550 etc.	3A 250V AC 3A 30V DC	—	—	—	—	
HC Amber	1 Form C	E43028	6A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	6A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—	
	2 Form C	E43028	4A 250V AC 1/10HP 125, 250V AC 3A 30V DC	LR26550 etc.	4A 250V AC 1/10HP 125, 250V AC 3A 30V DC	—	—	—	—	
	4 Form C	E43028	2A 250V AC 1/20HP 125, 250V AC 2A 30V DC	LR26550 etc.	2A 250V AC 1/20HP 125, 250V AC 2A 30V DC	—	—	—	—	
	4 Form C twin	E43149	1A 250V AC 1A 30V DC	LR26550 etc.	1A 250V AC 1A 30V DC	—	—	—	—	
HC keep		E43149	3A 250V AC 3A 30V DC	LR26550 etc.	3A 250V AC 3A 30V DC	—	—	—	—	Approved (DC type only)

Item		UL/C-UL (Recognized)		CSA (Certified)		VDE (Certified)		TV rating (UL/CSA)		Remarks
		File No.	Contact rating	File No.	Contact rating	File No.	Contact rating	File No.	Rating	
HC with diode type (For DC)	1 Form C	E43028	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	LR26550 etc.	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	—	—	—	—	
	2 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—	
	3 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—	
	4 Form C	E43028	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	LR26550 etc.	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	—	—	—	—	
	4 Form C twin	E43149	3A 250V AC 3A 30V DC	LR26550 etc.	3A 250V AC 3A 30V DC	—	—	—	—	
HC with CR circuit	1 Form C	E43028	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	LR26550 etc.	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	—	—	—	—	
	2 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—	
	3 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—	
	4 Form C	E43028	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	LR26550 etc.	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	—	—	—	—	
	4 Form C twin	E43149	3A 250V AC 3A 30V DC	LR26550 etc.	3A 250V AC 3A 30V DC	—	—	—	—	

NOTES

1. Amber sealed type

When mounting TM types, use washers to prevent damage or distortion to the polycarbonate cover. When tightening fixing screws, the optimum torque range should be 0.294 to 0.49 N·m, (3 to 5 kgf·cm). If screws are over tightened, the cover may distort, resulting in poor sealing. Moreover, to prevent loosening, use washers.

2. Keep relay

1) The schematic differs from that in the standard type 4 Form C HC relay. Follow the schematic on the cover sticker.

2) Conform with the schematic for the DC type, which has a polarized coil.

3) Because retention characteristics vary according to the waveform of the voltage applied to the coil, do your best to avoid capacitor driving.

In capacitor driving, use a capacitor of 300 μF or more.

4) Ensure that the minimum pulse width of voltage applied to coil is greater than 150 ms.

3. Diode characteristics

1) Reverse breakdown voltage: 1,000 V

2) Forward current: 1 A

4. Diode and CR built-in type

Since the diode and CR inside the relay coil are designed to absorb the counter emf, the element may be damaged if a large surge, etc., is applied to the diode and CR.

If there is the possibility of a large surge voltage from the outside, please implement measures to absorb it.

5. 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.

For Cautions for Use, see Page 21.

FEATURES

1. HC Relay Sockets

In the table below, the socket suitable for each type of HC relay is indicated by a black dot.

1) Plug-in type sockets, PC board type sockets, and wrapping type sockets are available for HC relays.
2) Certified by UL and CSA
3) A hold-down clip is included in the package.

The fixing method is the same as for HC sockets, ordinary HC terminal sockets and HL sockets.

HC/HL-LEAF-SPRING-MK

Note: Not compatible with HJ relays.
Please use the HJ relay dedicated socket.

2. HC Relay Terminal sockets

In the table below, the terminal socket suitable for each type of HC relay is indicated by a black dot.

1) Ordinary terminal sockets and terminal sockets for DIN rail assembly are available.
2) Certified by UL/C-UL
3) A hold-down clip is included in the package.

The fixing method is the same as for sockets.

Ordinary terminal socket
HC/HL-LEAF-SPRING-MK

The fixing method is the same as for the HC DIN rail terminal sockets and the HL DIN rail terminal sockets.

DIN rail Terminal sockets
HC/HL-LEAF-SPRING-K

Note: Not compatible with HJ relays.
Please use the HJ relay dedicated terminal socket.

SELECTOR CHART

1. Sockets

Type	No. of pole	Product name	Part No.	Applicable HC relay (Plug-in type)									
				Standard type/With diode type (for DC)					Amber type				Keep relay
				1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)	1 Form C	2 Form C	4 Form C	4 Form C (twin)	2 Form C
Plug-in	1-pole	HC1-socket	HC1-SS-K	●					●				
	2-pole	HC2-socket	HC2-SS-K		●					●			
	3-pole	HC3-socket	HC3-SS-K		●	●				●			
	1/2/4-pole (common)	HC4-socket	HC4-SS-K	●	●		●	●	●	●	●	●	●
PC board	1-pole	HC1-socket for PC board	HC1-PS-K	●					●				
	2-pole	HC2-socket for PC board	HC2-PS-K		●					●			
	3-pole	HC3-socket for PC board	HC3-PS-K		●	●				●			
	1/2/4-pole (common)	HC4-socket for PC board	HC4-PS-K	●	●		●	●	●	●	●	●	●
Wrapping	1/2/4-pole (common)	HC4-wrapping socket	HC4-WS-K	●	●		●	●	●	●	●	●	●
		HC4-wrapping socket (spring)	HC4-WS	●	●		●	●	●	●	●	●	●

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Notes: 1. Use the hold-down clip that is shipped with the socket. (The hold-down clip for HC relay with CR circuit is included in the package.)
2. Certified by UL and CSA (except for wrapping socket).
3. Not compatible with HJ relays.

2. Terminal sockets

Type	No. of pole	Item	Part No.	Standard packing		Applicable HC relay (Plug-in type)									
						Standard type/With diode type (for DC)					Amber type				Keep relay
				Carton	Case	1 Form C	2 Form C	3 Form C	4 Form C	4 Form C (twin)	1 Form C	2 Form C	4 Form C	4 Form C (twin)	2 Form C
For DIN rail	2-pole	HC2-slim type DIN terminal socket	HC2-SFD-S	20 pcs.	100 pcs.		●					●			
	2-pole	HC2-DIN	HC2-SFD-K	10 pcs.	100 pcs.		●					●			
	3-pole	HC3-DIN	HC3-SFD-K	5 pcs.	50 pcs.		●	●				●			
	1/2/4-pole (common)	HC4-DIN high terminal socket	HC4-SFD-K	10 pcs.	100 pcs.	●	●		●	●	●	●	●	●	●
	1/2/4-pole (common)	HC vertical terminal socket	HC4-TSF-K	20 pcs.	200 pcs.	●	●		●	●	●	●	●	●	●
For general	2-pole	HC2-terminal socket	HC2-SF-K	10 pcs.	100 pcs.		●					●			
	3-pole	HC3-high terminal socket	HC3-HSF-K	5 pcs.	50 pcs.		●	●				●			
	1/2/4-pole (common)	HC-high terminal socket	HC4-HSF-K	5 pcs.	50 pcs.	●	●		●	●	●	●	●	●	●

Notes: 1. Use the hold-down clip that is shipped with the socket. (The hold-down clip for HC relay with CR circuit is included in the package.)
2. Certified by UL/C-UL (except for HC4-TSF-K).
3. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.49 to 0.69 N·m {5 to 7kgf·cm}.
4. Not compatible with HJ relays.

DIMENSIONS (mm inch)

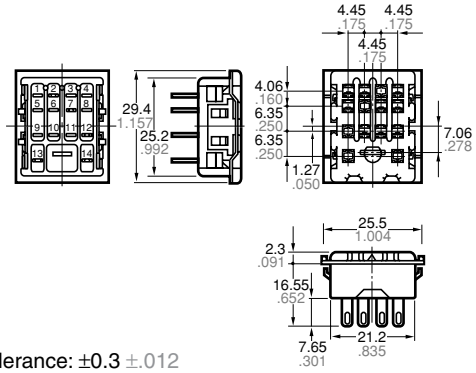
The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

1. Plug-in type sockets

HC1-Socket (HC1-SS-K)

CAD Data

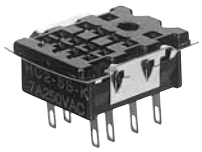
External dimensions



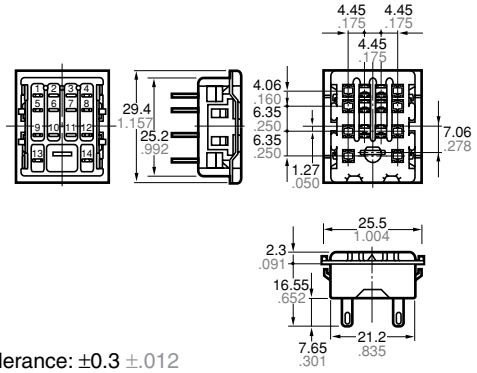
General tolerance: ±0.3 ±.012

HC2-Socket (HC2-SS-K)

CAD Data



External dimensions

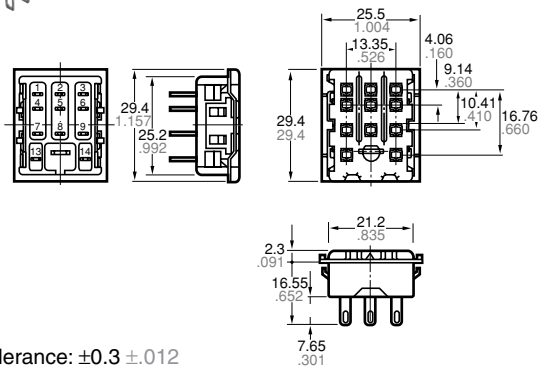


General tolerance: ±0.3 ±.012

HC3-Socket (HC3-SS-K)

CAD Data

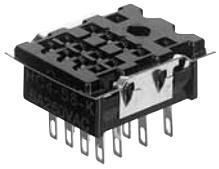
External dimensions



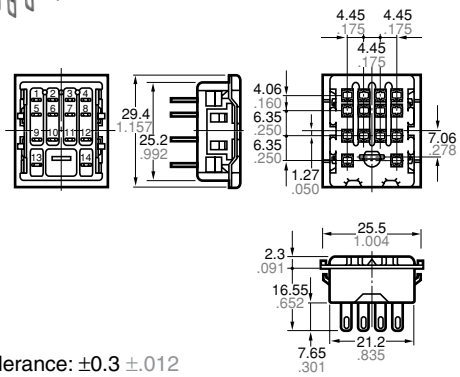
General tolerance: ±0.3 ±.012

HC4-Socket (HC4-SS-K)

CAD Data

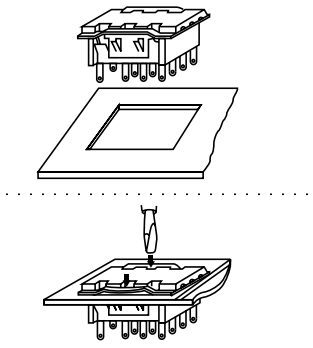


External dimensions

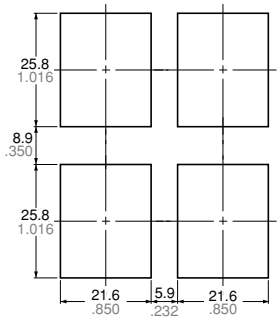


General tolerance: ±0.3 ±.012

Mounting hole diagram



Side-by-side installation



General tolerance: ±0.2 ±.008

With a relay mounted (HC2-SS-K)

Hold-down clip is packaged with the socket.

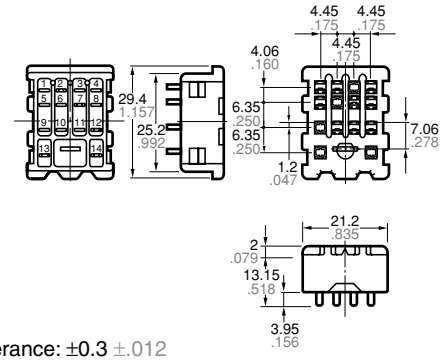
Notes: 1. Applicable chassis board thickness is 1.0 to 2.0 mm.
2. Installation is easy by inserting the socket from the top into the holes and by depressing the two down arrows on the retention fitting from the front.

2. PC board type sockets

HC1- PC board type socket (HC1-PS-K)

CAD Data

External dimensions

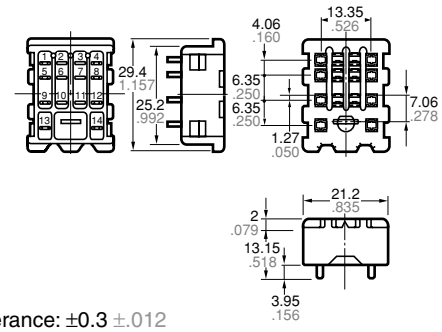


General tolerance: ±0.3 ±.012

HC2- PC board type socket (HC2-PS-K)

CAD Data

External dimensions

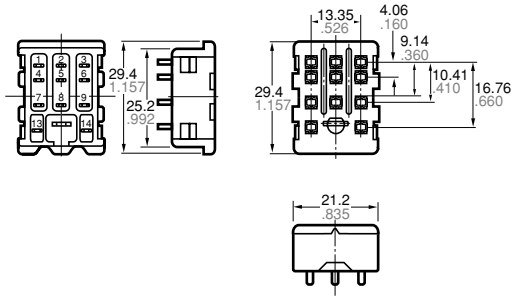


General tolerance: ±0.3 ±.012

HC3- PC board type socket (HC3-PS-K)

CAD Data

External dimensions

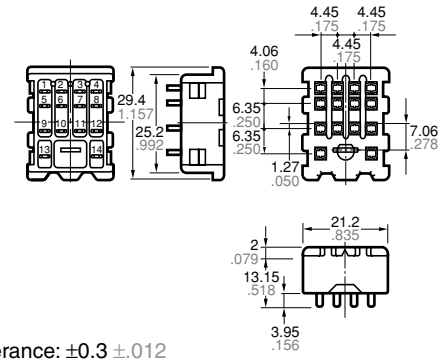


General tolerance: ±0.3 ±.012

HC4- PC board type socket (HC4-PS-K)

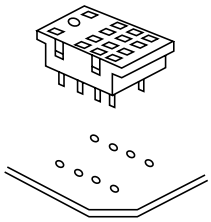
CAD Data

External dimensions



General tolerance: ±0.3 ±.012

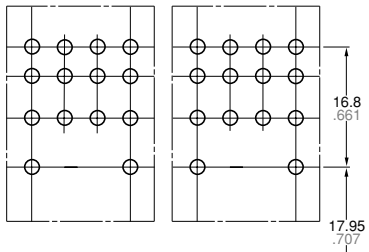
PC board pattern (Bottom view)



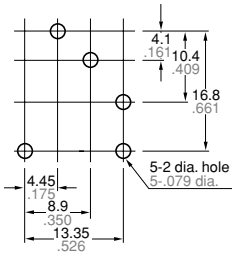
With a relay mounted

Hold-down clip is packaged with the socket.

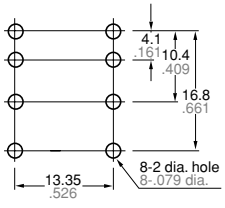
Side-by-side installation



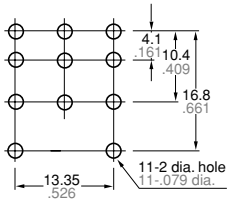
1 Form C



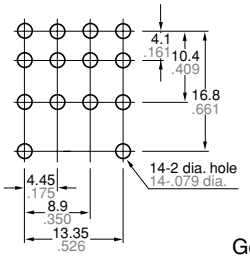
2 Form C

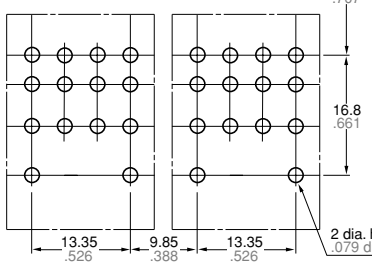


3 Form C



4 Form C





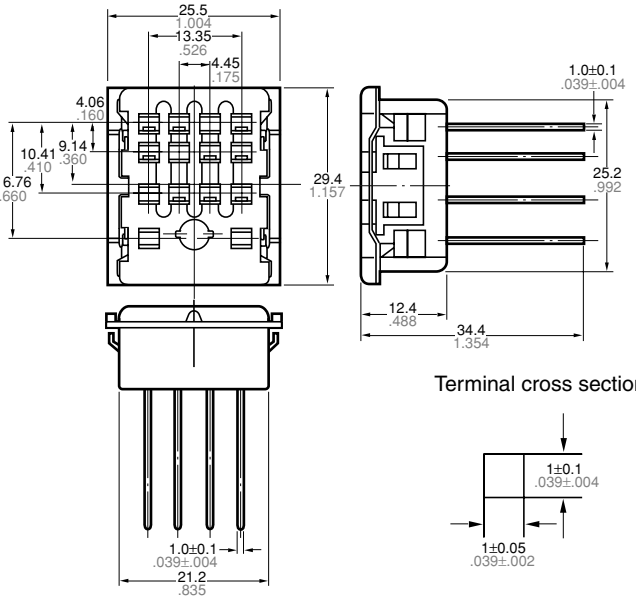
General tolerance: ±0.1 ±.004

3. Wrapping type sockets

Standard wrapping type sockets (HC4-WS-K)

CAD Data

External dimensions



Terminal cross section

Hold-down clip

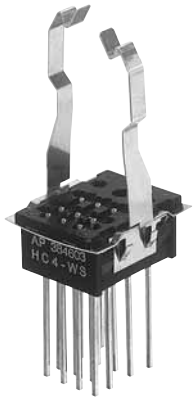
(Hold-down clip is packaged with the socket)

General tolerance: ±0.3 ±.012

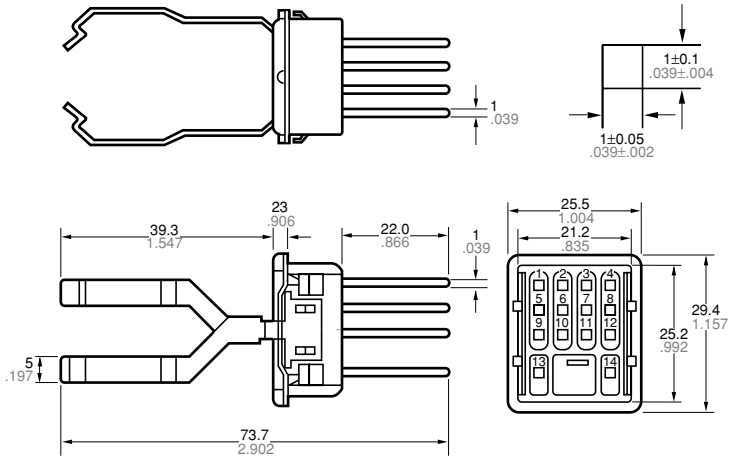
Note: The external and mounting dimensions are the same for 1-pole (HC1-WS-K), 2-pole (HC2-WS-K), and 3-pole (HC3-WS-K) types. Only the number of terminals varies.

Wrapping type sockets with hold-down clip (HC4-WS)

CAD Data



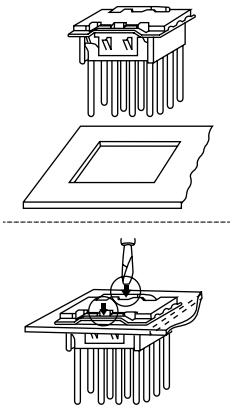
External dimensions



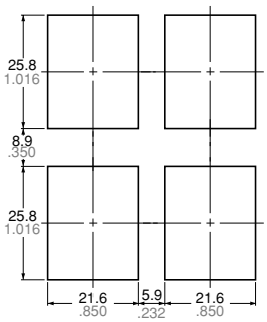
Terminal cross section

General tolerance: ±0.7 ±.028

Mounting hole diagram



Side-by-side installation



General tolerance: ±0.2 ±.008

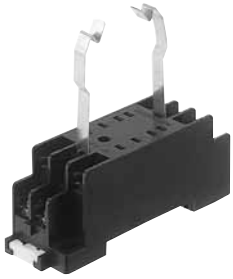
Notes: 1. Applicable chassis board thickness is 1.0 to 2.0 mm.
2. Installation is easy by inserting the socket from the top into the holes and by depressing the two down arrows on the retention fitting from the front.

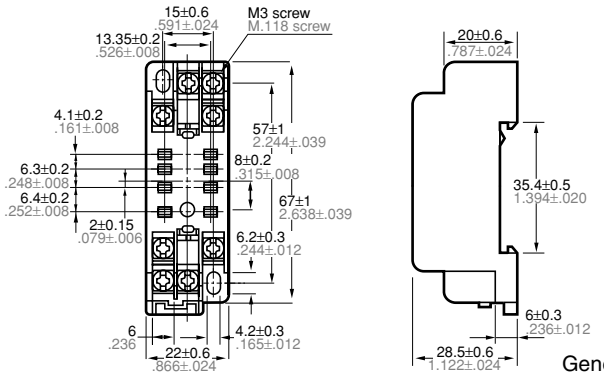
4. DIN rail Terminal sockets

HC2-Slim type DIN rail terminal sockets (HC2-SFD-S)

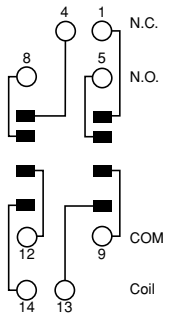
CAD Data

External dimensions





Schematic

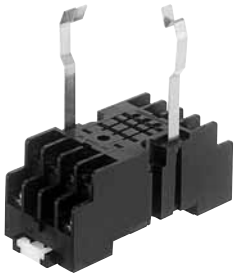


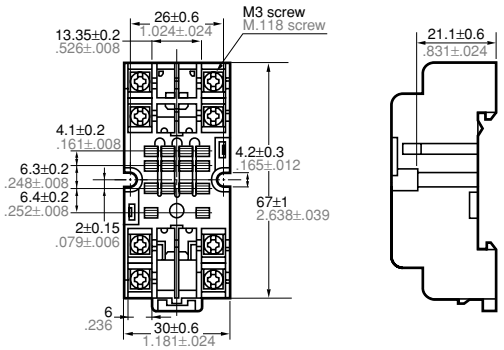
General tolerance: ±0.5 ±.020

HC2-high DIN rail terminal socket (HC2-SFD-K)

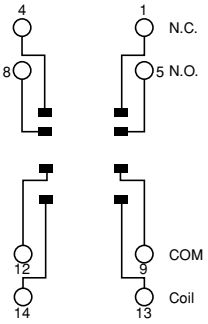
CAD Data

External dimensions





Schematic

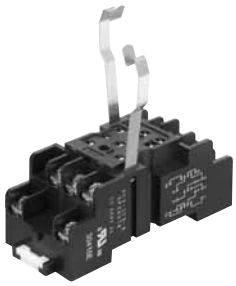


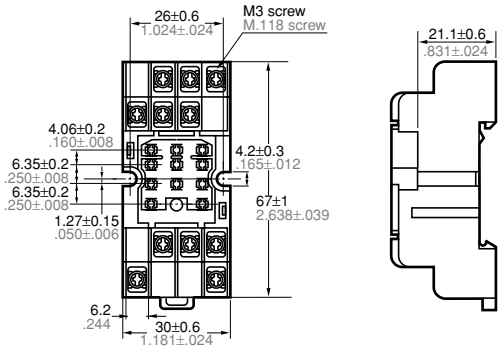
General tolerance: ±0.5 ±.020

HC3-high DIN rail terminal socket (HC3-SFD-K)

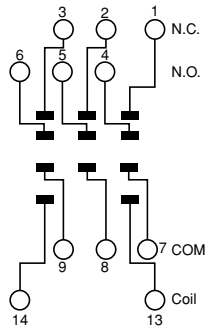
CAD Data

External dimensions





Schematic

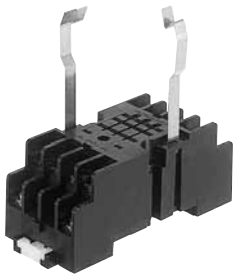


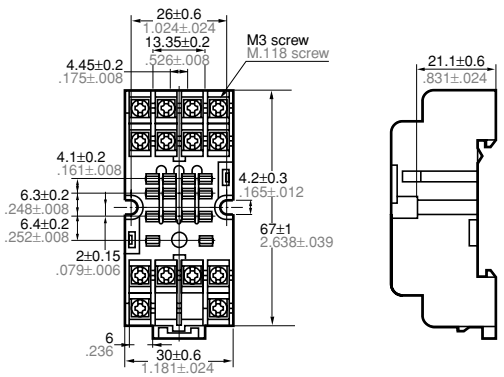
General tolerance: ±0.5 ±.020

HC4-high DIN rail terminal socket (HC4-SFD-K)

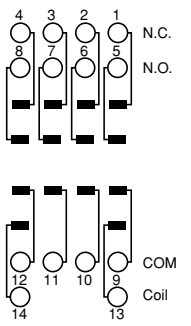
CAD Data

External dimensions





Schematic



General tolerance: ±0.5 ±.020

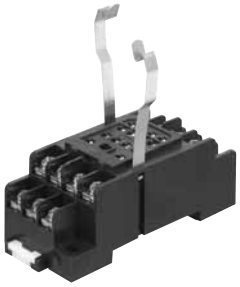
HC RELAY ACCESSORIES

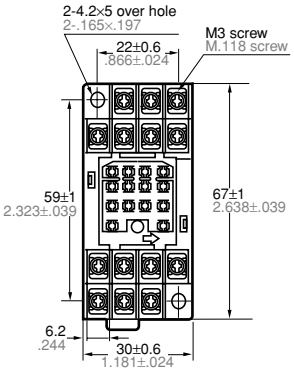
HC vertical type terminal socket (HC4-TSF-K)

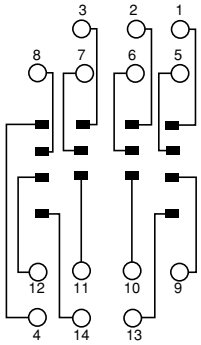
CAD Data

External dimensions

Schematic



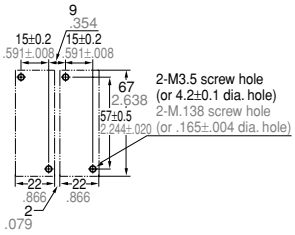




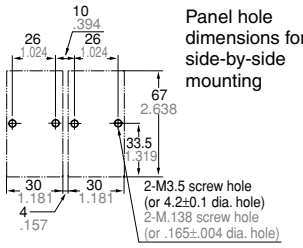
General tolerance: ±0.5 ±.020

Mounting hole diagram

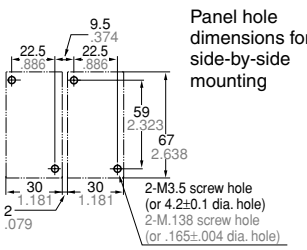
HC2-Slim type



HC2, HC3 and HC4

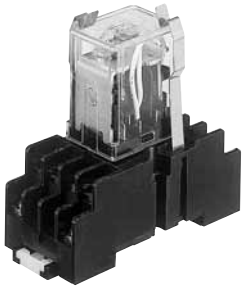


HC vertical type



General tolerance: ±0.1 ±.004

With a relay mounted (HC4-SFD-K)



Hold-down clip is packaged with the terminal socket.

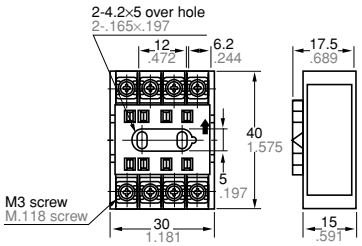
5. Ordinary terminal sockets

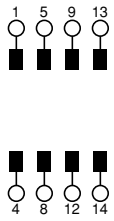
HC2-terminal socket (HC2-SF-K for HC2)

CAD Data

External dimensions

Schematic





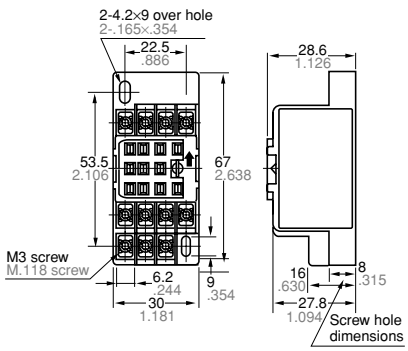
General tolerance: ±0.5 ±.020

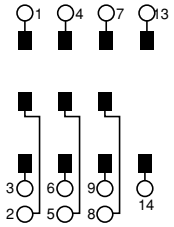
HC3-high terminal socket (HC3-HSF-K) suitable for both HC2 and HC3

CAD Data

External dimensions

Schematic



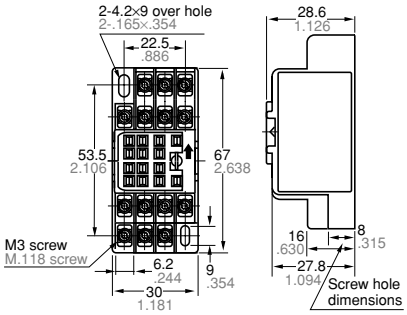


General tolerance: ±0.5 ±.020

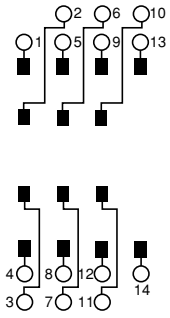
HC4-high terminal socket (HC4-HSF-K) suitable for HC 1, 2 and 4

CAD Data

External dimensions



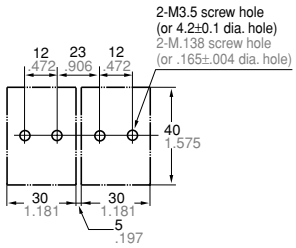
Schematic



General tolerance: ±0.5 ±.020

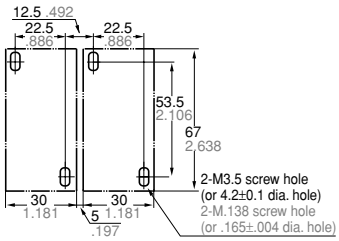
Mounting hole diagram

HC2-SF-K



Panel hole dimensions for side-by-side mounting

HC3-HSF-K and HC4-HSF-K



Panel hole dimensions for side-by-side mounting

With a relay mounted (HC2-SF-K)

Hold-down clip is packaged with the terminal socket.

General tolerance: ±0.1 ±.004

Panasonic
ideas for life

Relay for control panel of 1c 15A, and 2c 10A

HK RELAYS (AHK)

Compliance with RoHS Directive

FEATURES

1. Economical prices achieved
To assist rationalization, prices reduced to about half the price of previous products.
2. Compact with high-capacity
Enables high-capacity control:
15 A for 1 Form C, 10 A for 2 Form C
3. Types for wide range of applications
Range includes relays with operation indicators, built-in diodes to absorb relay coil surge, and built-in CR circuits.
4. Sockets and terminal sockets are available.

TYPICAL APPLICATIONS

Control panels
Power supply units
Molding machines
Machine tools
Welding equipment
Agricultural equipment
Office equipment
Vending machines
Communications equipment
Amusement machines, etc.

ORDERING INFORMATION

AHK □ □ □ □ □

HK relays

Contact arrangement
1: 1 Form C
2: 2 Form C

Terminal arrangement
1: AC plug-in type
2: DC plug-in type

Type classification
0: Standard
1: With LED indication
2: With diode
3: With LED indication and diode
4: With CR circuit
5: With LED indication and CR circuit

Nominal coil voltage
06: 6, 12: 12, 24: 24, 48: 48 V
X0: 100/110 V AC, 100/110 V DC
X1: 110/120 V AC
Y0: 200/220 V AC
Y2: 220/240 V AC

Note: Certified by UL/C-UL and TÜV

TYPES

1. Plug-in type

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V DC	AHK12006	AHK22006
12V DC	AHK12012	AHK22012
24V DC	AHK12024	AHK22024
48V DC	AHK12048	AHK22048
100/110V DC	AHK120X0	AHK220X0
12V AC	AHK11012	AHK21012
24V AC	AHK11024	AHK21024
48V AC	AHK11048	AHK21048
100/110V AC	AHK110X0	AHK210X0
110/120V AC	AHK110X1	AHK210X1
200/220V AC	AHK110Y0	AHK210Y0
220/240V AC	AHK110Y2	AHK210Y2

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2. Plug-in type (with LED indication)

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V DC	AHK12106	AHK22106
12V DC	AHK12112	AHK22112
24V DC	AHK12124	AHK22124
48V DC	AHK12148	AHK22148
100/110V DC	AHK121X0	AHK221X0
12V AC	AHK11112	AHK21112
24V AC	AHK11124	AHK21124
48V AC	AHK11148	AHK21148
100/110V AC	AHK111X0	AHK211X0
110/120V AC	AHK111X1	AHK211X1
200/220V AC	AHK111Y0	AHK211Y0
220/240V AC	AHK111Y2	AHK211Y2

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

3. Plug-in type (with diode)

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V DC	AHK12206	AHK22206
12V DC	AHK12212	AHK22212
24V DC	AHK12224	AHK22224
48V DC	AHK12248	AHK22248
100/110V DC	AHK122X0	AHK222X0

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

4. Plug-in type (with diode and LED indication)

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V DC	AHK12306	AHK22306
12V DC	AHK12312	AHK22312
24V DC	AHK12324	AHK22324
48V DC	AHK12348	AHK22348
100/110V DC	AHK123X0	AHK223X0

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

5. Plug-in type (with CR circuit)

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
100/110V AC	AHK114X0	AHK214X0
110/120V AC	AHK114X1	AHK214X1
200/220V AC	AHK114Y0	AHK214Y0
220/240V AC	AHK114Y2	AHK214Y2

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

6. Plug-in type (with CR circuit and LED indication)

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
100/110V AC	AHK115X0	AHK215X0
110/120V AC	AHK115X1	AHK215X1
200/220V AC	AHK115Y0	AHK215Y0
220/240V AC	AHK115Y2	AHK215Y2

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

* For sockets and terminal sockets, see page 100.

RATING

1. Coil data

1) AC coils

Nominal coil voltage	Nominal coil current, mA		Nominal operating power, V A		Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Inductance, H		Max. applied voltage
	50Hz	60Hz	50Hz	60Hz			When drop-out	When operating	
12V AC	111	100	1.3	1.2	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	0.312	0.295	110%V of nominal voltage
24V AC	56	50					1.243	1.181	
48V AC	28	25					4.974	4.145	
100/110V AC	13.4/14.7	12/13.2					23.75	20.63	
110/120V AC	12.2/13.5	10.9/11.9					27.19	25.57	
200/220V AC	6.7/7.4	6/6.6					85.98	81.76	

Notes: 1. The relay operates in a range of 80% to 110 % V of the nominal coil voltage, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the nominal coil voltage. In particular, for AC operation, if the impressed voltage drops to 80% V or more below the nominal coil voltage, humming will occur and a large current will flow leading possibly to coil burnout.
2. The maximum applied voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.)

2) DC coils (at 20°C 68°F)

Nominal coil voltage	Nominal coil current, mA	Nominal operating power, W	Coil resistance, Ω	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Max. applied voltage (at 70°C 158°F)
6V DC	150	0.9	40	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	110%V of nominal voltage
12V DC	75		160			
24V DC	37		650			
48V DC	18.5		2,600			
100/110V DC	10	1.0	10,000			

Notes: 1. The rated excitation current is ±10% (20°C 68°F).
2. The coil resistance for DC operation is the value measured when the coil temperature is 20°C 68°F. Compensate ±0.4% for every ±1°C change in temperature.
3. The relay operates in a range of 80% to 110 % V of the nominal coil voltage, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the nominal coil voltage.
4. For use with 200 V DC, connect a 10 KΩ (5W) resistor, in series, to the 100 V DC relay.
5. The maximum applied voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.)

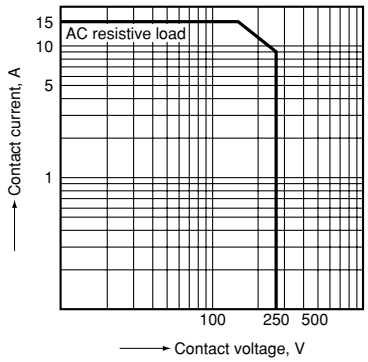
2. Specifications

Characteristics	Item		Specifications
Contact	Contact resistance (Initial)		Max. 50 mΩ (By voltage drop 6 V DC 1A)
	Contact material		$AgSnO_2$ type
Rating	Nominal switching capacity		1 Form C: 15A 125V AC (resistive load), 2 Form C: 10A 125V AC (resistive load)
	Max. switching voltage		250V AC, 125V DC
	Max. switching current		15A (1 Form C), 10A (2 Form C)
	Min. switching capacity (Reference value)*1		100mA 5V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as “Breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA.)
		Between contact sets	2,000 Vrms for 1min. (Detection current: 10mA.)
		Between contact and coil	2,000 Vrms for 1min. (Detection current: 10mA.)
	Temperature rise (coil)		Max. 80°C 176°F (By resistive method, nominal voltage)
	Operate time (at 20°C 68°F)*2		Max. 25ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time (at 20°C 68°F)*2		Max. 25ms (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 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 2 mm
Expected life	Mechanical		AC type: 5×10^7 (at 180 times/min.), DC type: 10^8 (at 180 times/min.)
	Electrical	AC load	1 Form C: 15A 125V AC (resistive load) ($\cos\varphi$=1), Min. 2×10^5 2 Form C: 10A 125V AC (resistive load) ($\cos\varphi$=1), Min. 5×10^5
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –50°C to +70°C –58°F to +158°F (Without LED indication); –50°C to +60°C –58°F to +140°F (With LED indication) 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. 35g 1.23 oz

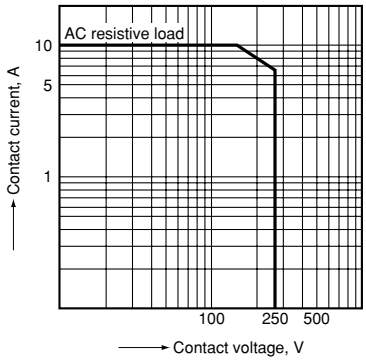
Notes: If integrating into electrical appliances that will be subject to compliance to the Electrical Appliance and Material Safety Law, please use in an ambient temperature between –50°C to +40°C –58°F to +104°F (AC type).
*1. This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2. For the AC coil types, the operate/release time will differ depending on the phase.
*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.

REFERENCE DATA

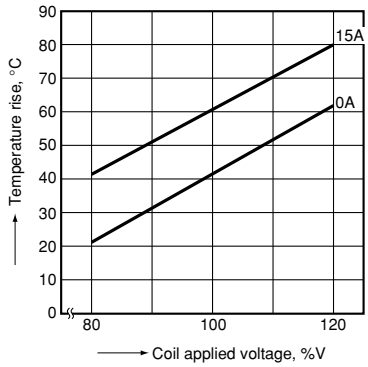
1-(1). Max. switching capacity (1 Form C type)



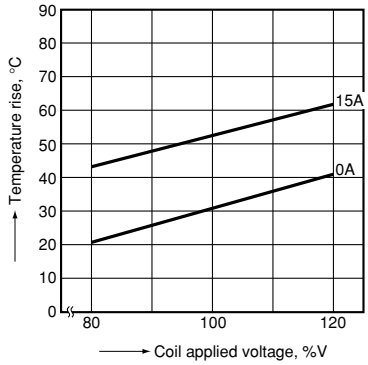
1-(2). Max. switching capacity (2 Form C type)



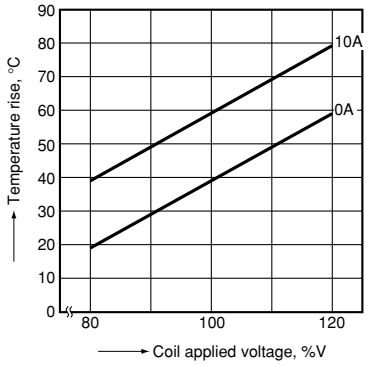
2-(1). Coil temperature rise (1 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



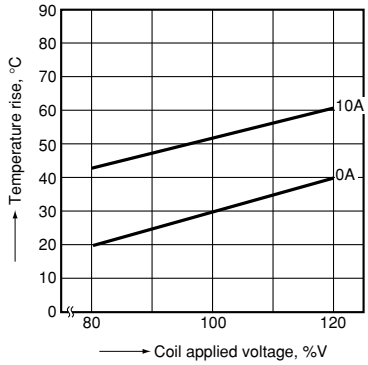
2-(2). Coil temperature rise (1 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



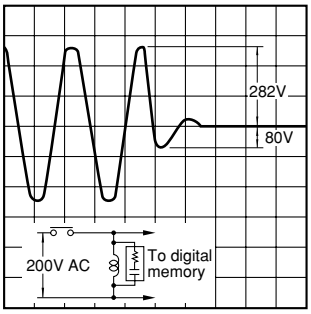
2-(3). Coil temperature rise (2 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



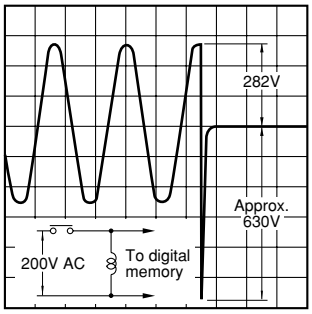
2-(4). Coil temperature rise (2 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



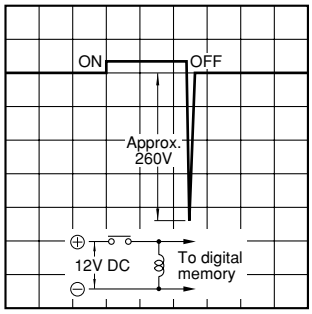
3-(1). AC coil surge voltage waveform
(With CR circuit)



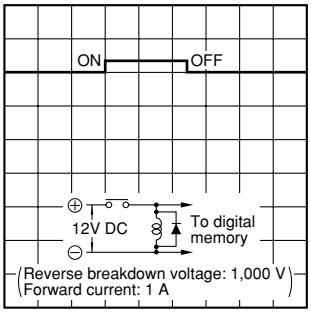
3-(2). AC coil surge voltage waveform
(Without CR circuit)



4-(1). DC coil surge voltage waveform
(Without diode)



4-(2). DC coil surge voltage waveform
(With diode)
Diode characteristics:
Reverse breakdown voltage: 1,000 V
Forward current: 1 A



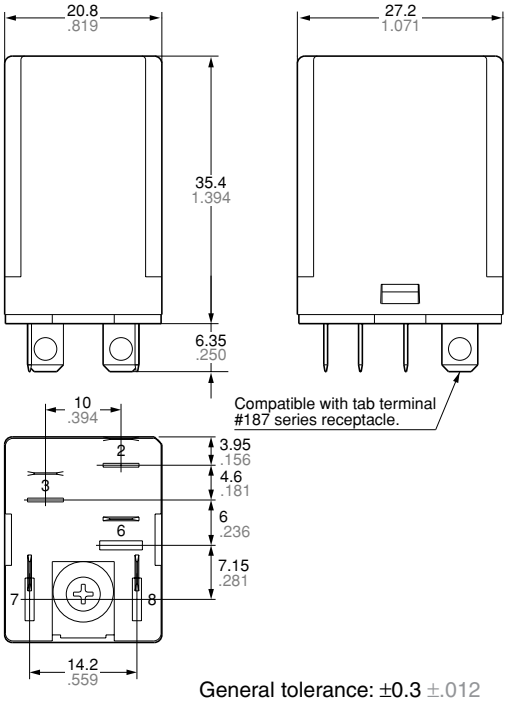
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

1. Plug-in type (1 Form C) including diode/CR

CAD Data

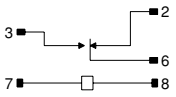
External dimensions



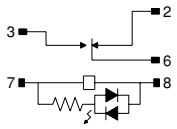
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

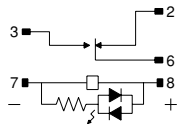
Standard type



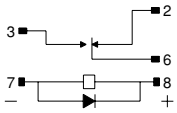
LED AC type



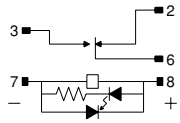
LED DC type



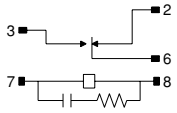
Diode DC type



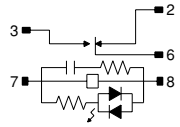
Diode/LED DC type



CR AC type



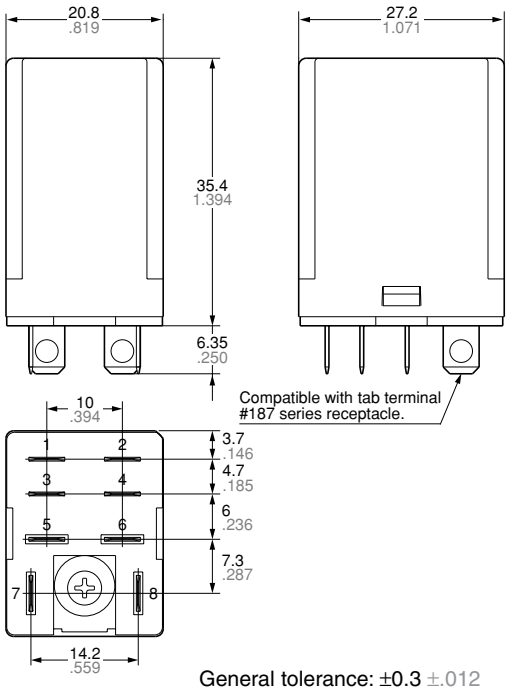
CR/LED AC type



2. Plug-in type (2 Form C) including diode/CR

CAD Data

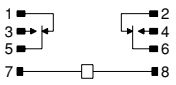
External dimensions



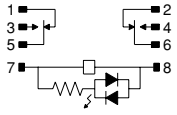
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

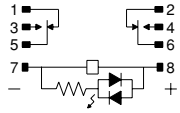
Standard type



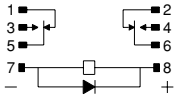
LED AC type



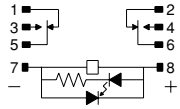
LED DC type



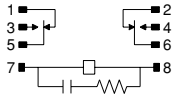
Diode DC type



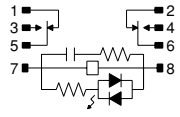
Diode/LED DC type



CR AC type



CR/LED AC type



SAFETY STANDARDS

	File No.	Certification authority: UL/C-UL	File No.	Certification authority: TÜV
1 Form C	E43028*	10A 250V AC, ½HP 125V AC, 10A 30V DC	B 04 01 13461 027	15A 125V AC (cosϕ=1.0), 15A 30V DC (0ms)
2 Form C	E43028*	10A 250V AC, ½HP 125V AC, 10A 30V DC	B 04 01 13461 027	10A 125V AC (cosϕ=1.0), 10A 30V DC (0ms)

* CSA standard: Certified by C-UL

NOTES

1. Coil applied voltage

1) DC coil

To ensure proper operation, the voltage applied to both terminals of the coil should be ±5% (at 20°C 68°F) the nominal voltage of the coil. Also, be aware that the pick-up and dropout voltages will fluctuate depending on the ambient temperature and operating conditions.

2) AC Coil

To enable stable operation of the relay, apply the nominal voltage. Ensure that the fluctuation range of the power source voltage remains, in principle, within +10% to –15% of the value of the nominal current. Moreover, the ideal waveform for the voltage applied to the coil is a sine curve. If commercially provided power surce is used, the waveform should be checked. If a stabilized AC power source is used, the conditioning equipment may distort the waveform, and abnormal heating may result. With AC coils, hum can be normally stopped by the use of a shading coil. If the waveform is distorted, however, the shading coil may be ineffective.

2. LED indications

The light of the light emitting diode is what displays operation. If voltage remains after relay might illuminate briefly.

3. Switching lifetime

The switching lifetime is defined under the standard test condition specified in the JIS C 5442(*2) standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75% R.H.). 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.

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

2) 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 HNO_3 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

4. Conditions for operation, transport and storage

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

(1) Temperature:

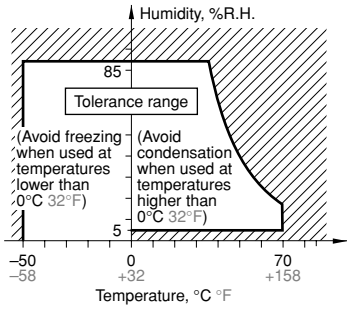
–50 to +70°C –58 to +158°F
(without LED)

–50 to +60°C –58 to +140°F
(with LED)

(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.

Temperature and humidity range for usage, transport, and storage



(3) Atmospheric pressure: 86 to 106kPa

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, 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. Diode characteristics

1) Reverse breakdown voltage: 1,000 V

2) Forward current: 1 A

6. Diode and CR built-in type

Since the diode and CR inside the relay coil are designed to absorb the counter emf, the element may be damaged if a large surge, etc., is applied to the diode and CR.

If there is the possibility of a large surge voltage from the outside, please implement measures to absorb it.

7. 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.

For Cautions for Use, see Page 21.

TYPES

1. Sockets

Type	No. of poles	Item	Part No.
Plug-in socket	1-pole	HL-1 socket	HL1-SS-K
	2-pole	HL-2 socket	HL2-SS-K
PC board socket	1-pole	HL1 PC board socket	HL1-PS-K
	2-pole	HL2 PC board socket	HL2-PS-K

Standard packing: Carton: 20 pcs.; Case: 200 pcs.
Notes: 1. Use the hold-down clip that is shipped with the socket.
2. Certified by UL and CSA (TÜV is unacquired.)

2. Terminal sockets

Type	No. of poles	Item	Part No.
DIN rail terminal socket	1/2-poles (common)	HK screw terminal socket	AHKA21
		HK screw terminal socket (Finger protect type)	AHKA21P

Standard packing: Carton: 10 pcs.; Case: 100 pcs.
Notes: 1. Use the hold-down clip that is shipped with the terminal socket.
2. Certified by UL/C-UL and TÜV
3. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.784 to 0.98 N·m.
4. When attaching directly to a chassis, please use an M4 × 12 metric coarse screw thread.
5. Not compatible with HJ relays. Please use the HJ relay dedicated terminal socket.

DIMENSIONS (mm inch)

The CAD data of the products with a CAD Data mark can be downloaded from: http://panasonic-electric-works.net/ac

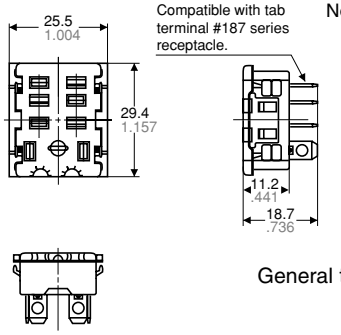
1. Plug-in type sockets

CAD Data

HL1 Socket (HL1-SS-K)

HL2 Socket (HL2-SS-K)

HL1-socket External dimensions



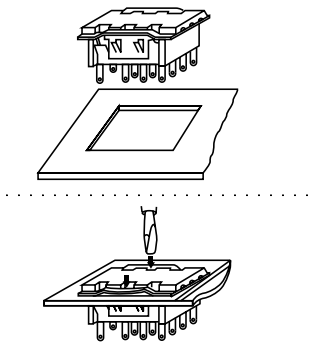
Note: The external and mounting dimensions are the same for HL2-socket (HL2-SS-K). Only the number of terminals varies.

General tolerance: ±0.3 ±.012

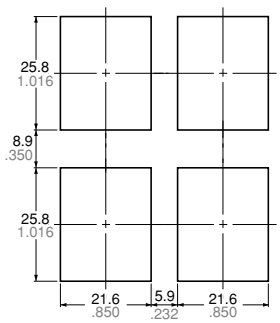
Hold-down clip

Hold-down clip is packaged with the socket.

Mounting hole diagram



Side-by-side installation



Tolerance: ±0.1 ±.004

Notes: 1. Applicable chassis board thickness is 1.0 to 2.0 mm.
2. Installation is easy by inserting the socket from the top into the holes and by depressing the two down arrows on the retention fitting from the front.

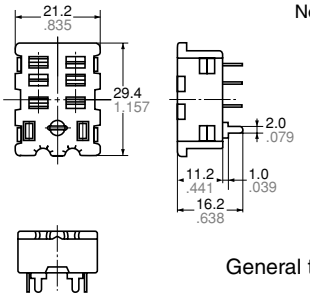
2. PC board type sockets

CAD Data

HL1 PC board type socket
(HL1-PS-K)

HL2 PC board type socket
(HL2-PS-K)

HL2 PC board type socket
External dimensions



Note: The external and mounting dimensions are the same for HL1 PC board type socket (HL1-PS-K). Only the number of terminals varies.

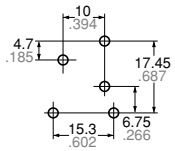
General tolerance: ±0.3 ±.012

Hold-down clip

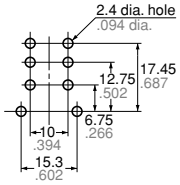
Hold-down clip is packaged with the socket.

PC board pattern (Bottom view)

1 Form C

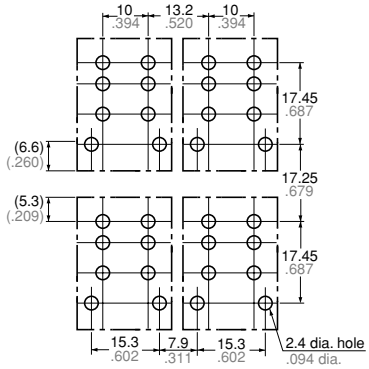


2 Form C



Tolerance: ±0.1 ±.004

Side-by-side installation (For 2 Form C)



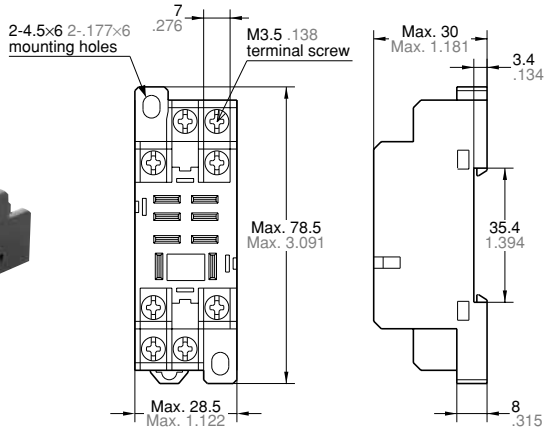
Tolerance: ±0.1 ±.004

3. DIN rail screw terminal socket

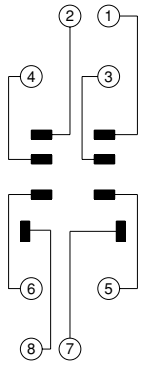
HK screw terminal socket
(AHKA21)

CAD Data

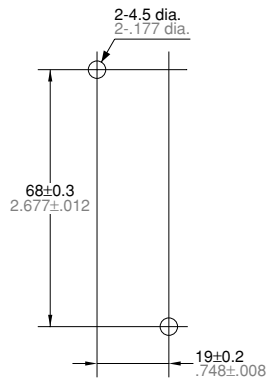
External dimensions



Schematic



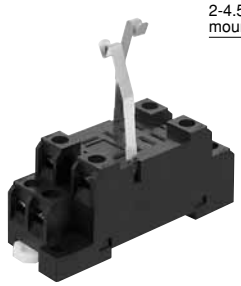
Mounting hole dimensions



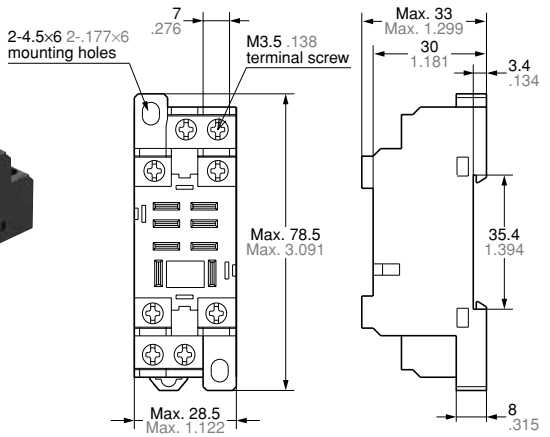
General tolerance: ±0.5 ±.020

HK screw terminal socket (Finger protect type)
(AHKA21P)

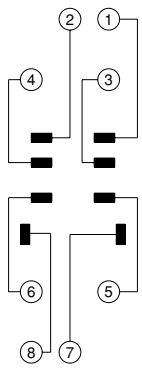
CAD Data



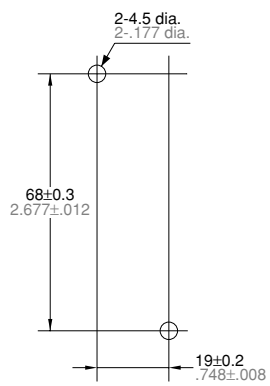
External dimensions



Schematic



Mounting hole dimensions



General tolerance:
±0.5 ±.020

Note: Round type terminal is unable to attach.

Panasonic
ideas for life

Relay for control panel of 1c 15A, and 2c 10A

HL RELAYS

Compliance with RoHS Directive

FEATURES

1. Compact high-capacity control relay
In the same external dimensions as an HC relay, this compact power relay enables high-capacity control:
15 A for 1 Form C, 10 A for 2 Form C.

2. Designed for high reliability
High operational reliability is achieved by solder-less construction, in which all connections between lead wires and the contact springs and terminal plate are welded.

3. Various types provided in rich lineup. LED indicator type also available.

4. The terminals are compatible with #187 series tab terminals.

5. Sockets and terminal sockets are available.

TYPICAL APPLICATIONS

1. Factory automation equipment and automotive devices

2. Control panels, power supply equipment, molding equipment, machine tools, welding equipment, agricultural equipment, etc.

3. Office equipment, automatic vending machines, telecommunications equipment, disaster prevention equipment, copiers, measuring devices, medical equipment, amusement devices, etc.

4. All types of household appliance

ORDERING INFORMATION

HL ☐ - ☐ - ☐ - **F**

Contact arrangement
1: 1 Form C
2: 2 Form C

Terminal arrangement
H: Plug-in type
L: Plug-in with LED indication
HP: PC board type
PL: PC board with LED indication
HTM: TM type

Nominal coil voltage
AC 6, 12, 24, 48, 100 (100/110), 120 (110/120), 200 (200/220), 240 (220/240) V
DC 6, 12, 24, 48, 100 (100/110) V

Contact material
F: $AgSnO_2$ type

Notes: Certified by UL and CSA
Please inquire about TV approved products.

TYPES

1. Plug-in type

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V AC	HL1-H-AC6V-F	HL2-H-AC6V-F
12V AC	HL1-H-AC12V-F	HL2-H-AC12V-F
24V AC	HL1-H-AC24V-F	HL2-H-AC24V-F
48V AC	HL1-H-AC48V-F	HL2-H-AC48V-F
100/110V AC	HL1-H-AC100V-F	HL2-H-AC100V-F
110/120V AC	HL1-H-AC120V-F	HL2-H-AC120V-F
200/220V AC	HL1-H-AC200V-F	HL2-H-AC200V-F
220/240V AC	HL1-H-AC240V-F	HL2-H-AC240V-F
6V DC	HL1-H-DC6V-F	HL2-H-DC6V-F
12V DC	HL1-H-DC12V-F	HL2-H-DC12V-F
24V DC	HL1-H-DC24V-F	HL2-H-DC24V-F
48V DC	HL1-H-DC48V-F	HL2-H-DC48V-F
100/110V DC	HL1-H-DC100V-F	HL2-H-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

2. Plug-in type (with LED indication)

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V AC	HL1-L-AC6V-F	HL2-L-AC6V-F
12V AC	HL1-L-AC12V-F	HL2-L-AC12V-F
24V AC	HL1-L-AC24V-F	HL2-L-AC24V-F
48V AC	HL1-L-AC48V-F	HL2-L-AC48V-F
100/110V AC	HL1-L-AC100V-F	HL2-L-AC100V-F
110/120V AC	HL1-L-AC120V-F	HL2-L-AC120V-F
200/220V AC	HL1-L-AC200V-F	HL2-L-AC200V-F
220/240V AC	HL1-L-AC240V-F	HL2-L-AC240V-F
6V DC	HL1-L-DC6V-F	HL2-L-DC6V-F
12V DC	HL1-L-DC12V-F	HL2-L-DC12V-F
24V DC	HL1-L-DC24V-F	HL2-L-DC24V-F
48V DC	HL1-L-DC48V-F	HL2-L-DC48V-F
100/110V DC	HL1-L-DC100V-F	HL2-L-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

3. PC board type

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V AC	HL1-HP-AC6V-F	HL2-HP-AC6V-F
12V AC	HL1-HP-AC12V-F	HL2-HP-AC12V-F
24V AC	HL1-HP-AC24V-F	HL2-HP-AC24V-F
48V AC	HL1-HP-AC48V-F	HL2-HP-AC48V-F
100/110V AC	HL1-HP-AC100V-F	HL2-HP-AC100V-F
110/120V AC	HL1-HP-AC120V-F	HL2-HP-AC120V-F
200/220V AC	HL1-HP-AC200V-F	HL2-HP-AC200V-F
220/240V AC	HL1-HP-AC240V-F	HL2-HP-AC240V-F
6V DC	HL1-HP-DC6V-F	HL2-HP-DC6V-F
12V DC	HL1-HP-DC12V-F	HL2-HP-DC12V-F
24V DC	HL1-HP-DC24V-F	HL2-HP-DC24V-F
48V DC	HL1-HP-DC48V-F	HL2-HP-DC48V-F
100/110V DC	HL1-HP-DC100V-F	HL2-HP-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

4. PC board type (with LED indication)

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V AC	HL1-PL-AC6V-F	HL2-PL-AC6V-F
12V AC	HL1-PL-AC12V-F	HL2-PL-AC12V-F
24V AC	HL1-PL-AC24V-F	HL2-PL-AC24V-F
48V AC	HL1-PL-AC48V-F	HL2-PL-AC48V-F
100/110V AC	HL1-PL-AC100V-F	HL2-PL-AC100V-F
110/120V AC	HL1-PL-AC120V-F	HL2-PL-AC120V-F
200/220V AC	HL1-PL-AC200V-F	HL2-PL-AC200V-F
220/240V AC	HL1-PL-AC240V-F	HL2-PL-AC240V-F
6V DC	HL1-PL-DC6V-F	HL2-PL-DC6V-F
12V DC	HL1-PL-DC12V-F	HL2-PL-DC12V-F
24V DC	HL1-PL-DC24V-F	HL2-PL-DC24V-F
48V DC	HL1-PL-DC48V-F	HL2-PL-DC48V-F
100/110V DC	HL1-PL-DC100V-F	HL2-PL-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

5. TM type

Nominal coil voltage	1 Form C	2 Form C
	Part No.	Part No.
6V AC	HL1-HTM-AC6V-F	HL2-HTM-AC6V-F
12V AC	HL1-HTM-AC12V-F	HL2-HTM-AC12V-F
24V AC	HL1-HTM-AC24V-F	HL2-HTM-AC24V-F
48V AC	HL1-HTM-AC48V-F	HL2-HTM-AC48V-F
100/110V AC	HL1-HTM-AC100V-F	HL2-HTM-AC100V-F
110/120V AC	HL1-HTM-AC120V-F	HL2-HTM-AC120V-F
200/220V AC	HL1-HTM-AC200V-F	HL2-HTM-AC200V-F
220/240V AC	HL1-HTM-AC240V-F	HL2-HTM-AC240V-F
6V DC	HL1-HTM-DC6V-F	HL2-HTM-DC6V-F
12V DC	HL1-HTM-DC12V-F	HL2-HTM-DC12V-F
24V DC	HL1-HTM-DC24V-F	HL2-HTM-DC24V-F
48V DC	HL1-HTM-DC48V-F	HL2-HTM-DC48V-F
100/110V DC	HL1-HTM-DC100V-F	HL2-HTM-DC100V-F

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

* For sockets and terminal sockets, see page 108.

RATING

1. Coil data

1) AC coils

Nominal coil voltage	Nominal coil current (mA)		Nominal operating power (VA)		Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Inductance (H)		Max. applied voltage
	50Hz	60Hz	50Hz	60Hz			When drop-out	When operating	
6V AC	224	200	1.3	1.2	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	0.078	0.074	110%V of nominal voltage
12V AC	111	100					0.312	0.295	
24V AC	56	50					1.243	1.181	
48V AC	28	25					4.974	4.145	
100/110V AC	13.4/14.7	12/13.2					23.75	20.63	
110/120V AC	12.2/13.5	10.9/11.9					27.19	25.57	
200/220V AC	6.7/7.4	6/6.6					85.98	81.76	

Notes: 1. The relay operates in a range of 80% to 110% V of the nominal voltage, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the rated voltage.
In particular, for AC operation, if the applied voltage drops to 80% V or more below the nominal voltage, humming will occur and a large current will flow leading possibly to coil burnout.
2. The maximum applied voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.)

2) DC coils (at 20°C 68°F)

Nominal coil voltage	Nominal coil current (mA)	Nominal operating power (W)	Coil resistance (Ω)	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Max. applied voltage (at 70°C 158°F)
6V DC	150	0.9	40	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	110%V of nominal voltage
12V DC	75		160			
24V DC	37		650			
48V DC	18.5		2,600			
100/110V DC	10	1.0	10,000			

Notes: 1. The nominal operating current is ±10% (20°C 68°F).
2. The coil resistance for DC operation is the value measured when the coil temperature is 20°C 68°F. Compensate ±0.4% for every ±1°C change in temperature.
3. The relay operates in a range of 80% to 110% V of the nominal voltage, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the nominal voltage.
4. For use with 200 V DC, connect a 10 KΩ (5W) resistor, in series, to the 100 V DC relay.
5. The maximum applied voltage is the maximum voltage fluctuation value for the coil power supply. This value is not a permissible value for continuous operation. (This value differs depending on the ambient temperature. Please contact us for details.)

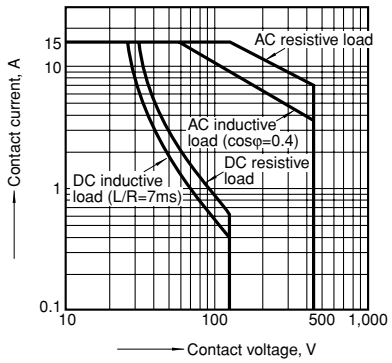
2. Specifications

Characteristics	Item		Specifications
Contact	Contact resistance (Initial)		Max. 50 mΩ (By voltage drop 6 V DC 1A)
	Contact material		$AgSnO_2$ type
Rating	Nominal switching capacity		1 Form C: 15A 125V AC, 10A 250V AC (resistive load) 2 Form C: 10A 125V AC (resistive load)
	Min. switching capacity (Reference value)*1		100mA 5V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as "Breakdown voltage" section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (Detection current: 10mA)
		Between contact sets	1,500 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	2,000 Vrms for 1min. (Detection current: 10mA)
	Temperature rise (coil)		Max. 80°C 176°F (By resistive method, nominal voltage)
	Operate time (at 20°C 68°F)*2		DC type/AC type: Max. 25ms (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time (at 20°C 68°F)*2		DC type/AC type: Max. 25ms (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 196 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10μs.)
		Destructive	Min. 980 m/s^2 (Half-wave pulse of sine wave: 6 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 2 mm
Expected life	Mechanical		AC type: 5×10^7 (at 180 times/min.), DC type: 10^8 (at 180 times/min.)
	Electrical	AC load	1 Form C: 15A 125V AC, 10A 250V AC resistive load (cosφ=1) Life switching cycle: Min. 5×10^5 2 Form C: 10A 250V AC resistive load (cosφ=1) Life switching cycle: Min. 3×10^5
		DC load	1 Form C: 3A 30V DC resistive load (cosφ=1) Life switching cycle: Min. 5×10^5 2 Form C: 3A 30V DC resistive load (cosφ=1) Life switching cycle: Min. 5×10^5
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –50°C to +70°C –58°F to +158°F (Without LED indication); –50°C to +60°C –58°F to +140°F (With LED indication) 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. 35g 1.23 oz

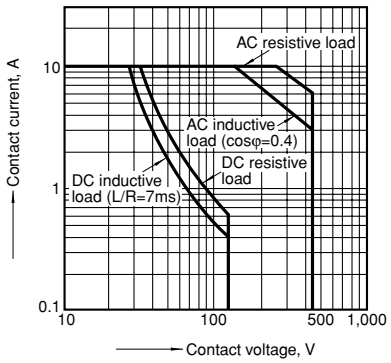
Notes: If integrating into electrical appliances that will be subject to compliance to the Electrical Appliance and Material Safety Law, please use in an ambient temperature between –50°C to +40°C –58°F to +104°F (AC type).
*1. This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2. For the AC coil types, the operate/release time will differ depending on the phase.
*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.

REFERENCE DATA

Switching capacity range (1 Form C)



Switching capacity range (2 Form C)



DIMENSIONS (mm inch)

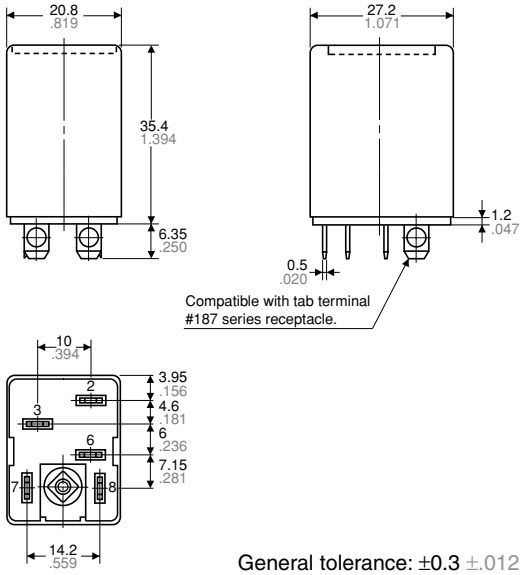
The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

1. Plug-in type

1 Form C

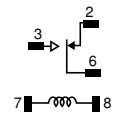
CAD Data

External dimensions

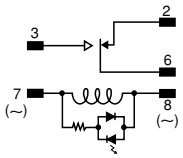


Schematic (Bottom view)

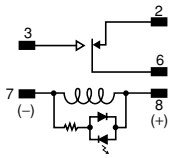
Standard type



LED AC type



LED DC type

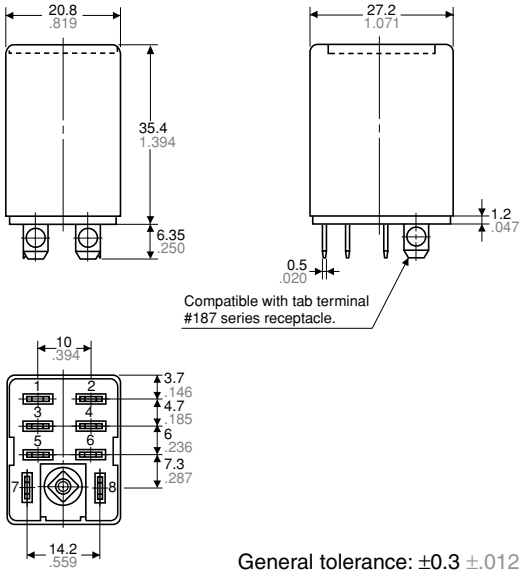


General tolerance: ±0.3 ±.012

2 Form C

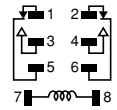
CAD Data

External dimensions

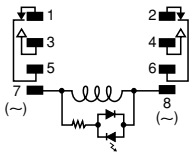


Schematic (Bottom view)

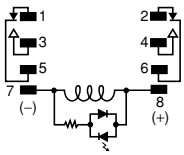
Standard type



LED AC type



LED DC type



General tolerance: ±0.3 ±.012

2. PC board type

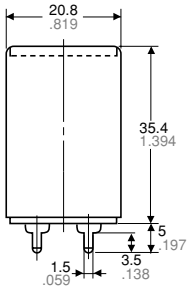
1 Form C

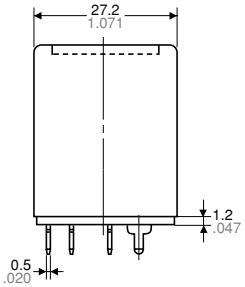
External dimensions

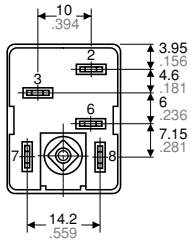
Schematic (Bottom view)

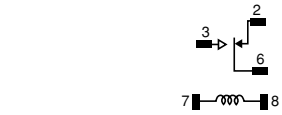
Standard type

CAD Data

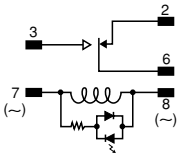




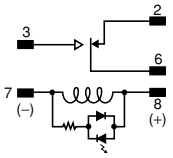




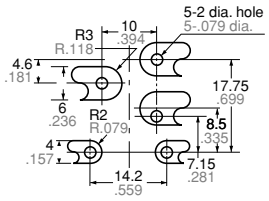
LED AC type



LED DC type



PC board pattern (Bottom view)



General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

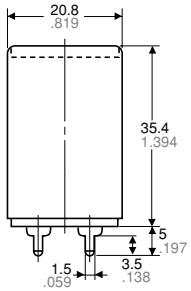
2 Form C

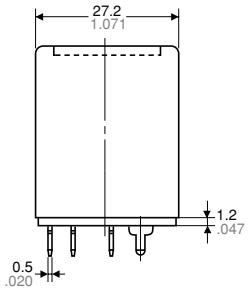
External dimensions

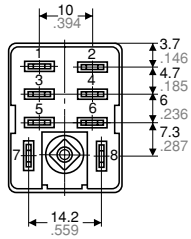
Schematic (Bottom view)

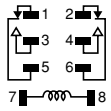
Standard type

CAD Data

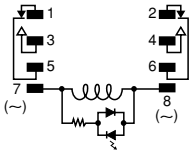




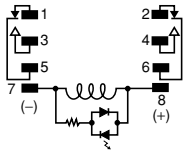




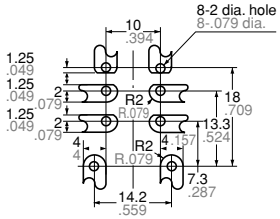
LED AC type



LED DC type



PC board pattern (Bottom view)



General tolerance: ±0.3 ±.012

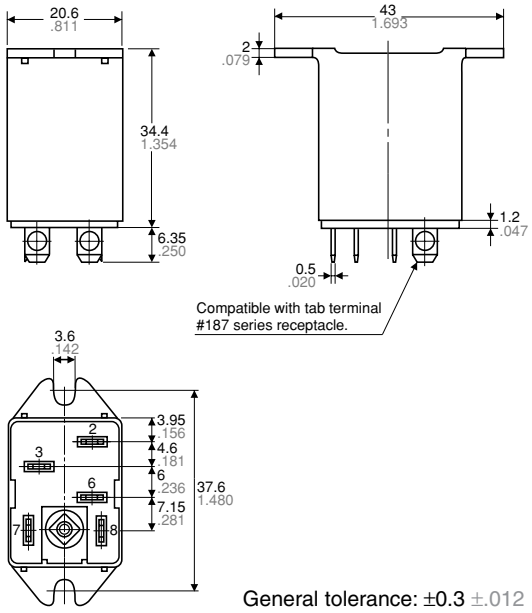
Tolerance: ±0.1 ±.004

3. TM type

1 Form C

CAD Data

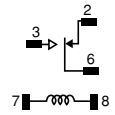
External dimensions



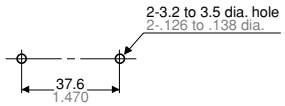
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

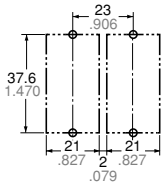
Standard type



Chassis (Panel) cutout



Chassis (Panel) cutout in tandem mounting



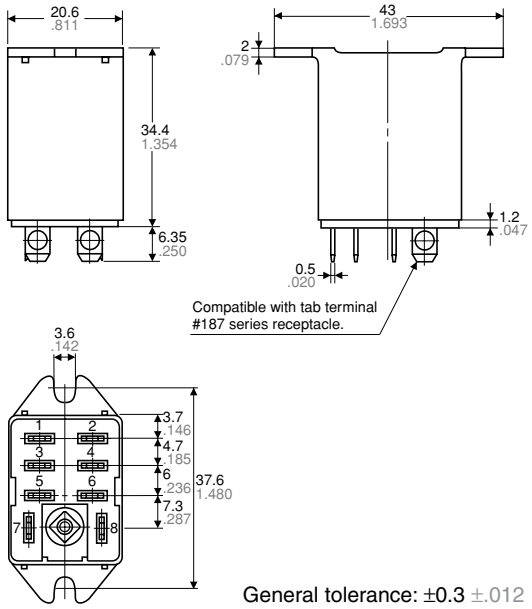
Tolerance: ±0.1 ±.004

Notes: 1. If connecting to #187 series tab terminals, use AMP Faston #187 series or #187 tab terminals conforming to UL or CSA inch-standard dimensions.
2. In mounting, use M3 screws and M3 washers.
3. When mounting TM types, use washers to prevent damage or distortion to the polycarbonate cover.
4. When tightening fixing screws, the optimum torque range should be 0.294 to 0.49 N·m, (3 to 5 kgf·cm). Moreover, use washers to prevent loosening.

2 Form C

CAD Data

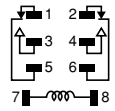
External dimensions



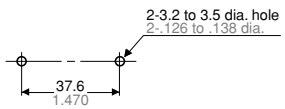
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

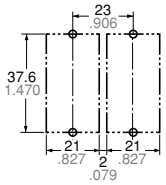
Standard type



Chassis (Panel) cutout



Chassis (Panel) cutout in tandem mounting



Tolerance: ±0.1 ±.004

Notes: 1. If connecting to #187 series tab terminals, use AMP Faston #187 series or #187 tab terminals conforming to UL or CSA inch-standard dimensions.
2. In mounting, use M3 screws and M3 washers.
3. When mounting TM types, use washers to prevent damage or distortion to the polycarbonate cover.
4. When tightening fixing screws, the optimum torque range should be 0.294 to 0.49 N·m, (3 to 5 kgf·cm). Moreover, use washers to prevent loosening.

SAFETY STANDARDS

Contact arrangement	UL/C-UL (Recognized)		CSA (Certified)		TV rating (UL/CSA)	
	File No.	Contact rating	File No.	Contact rating	File No.	Rating
1 Form C	E43028	15A 250V AC 1/3HP 125, 250V AC 10A 30V DC	LR26550 etc.	10A 125, 250V AC 1/3HP 125, 250V AC 10A 30V DC	UL: E43149 CSA: LR26550 etc.	NO→TV-5 NC→TV-2
2 Form C	E43028	10A 250V AC 1/3HP 125, 250V AC 10A 30V DC	LR26550 etc.	10A 125, 250V AC 1/3HP 125, 250V AC 10A 30V DC	UL: E43149 CSA: LR26550 etc.	NO→TV-4 NC→TV-2

For Cautions for Use, see Page 21.

FEATURES

1. HL relay connection accessories include plug-in sockets, PC board sockets, and terminal socket for DIN rails.
2. Certified by UL and CSA

3. A hold-down clip is included in the package.

The fixing method is the same as for HL sockets, HC sockets and ordinary HC terminal sockets.

HC/HL-LEAF-SPRING-MK

The fixing method is the same as for the HL DIN rail terminal sockets and the HC DIN terminal sockets.

HC/HL-LEAF-SPRING-K

TYPES

Type	No. of poles	Item	Part No.
Plug-in socket	1-pole	HL1 socket	HL1-SS-K
	2-pole	HL2 socket	HL2-SS-K
PC board socket	1-pole	HL1 PC board socket	HL1-PS-K
	2-pole	HL2 PC board socket	HL2-PS-K
DIN rail terminal socket	1/2-pole (common)	HL2-DIN terminal socket	HL2-SFD-K

Standard packing: Socket: Carton: 20 pcs.; Case: 200 pcs.
Terminal socket: Carton: 10 pcs.; Case: 100 pcs.
* DIN rail terminal socket: Not compatible with HK relays. Please use the HK relay dedicated terminal socket.

DIMENSIONS (mm inch)

The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

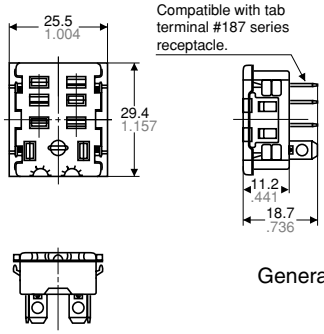
1. Plug-in type sockets

CAD Data

HL1 Socket (HL1-SS-K)

HL2 Socket (HL2-SS-K)

HL1 socket External dimensions



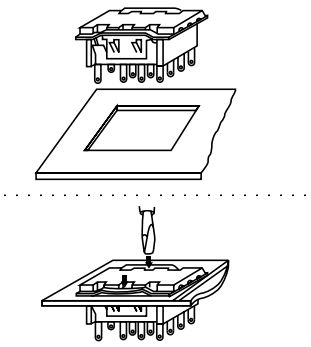
Note: The external and mounting dimensions of HL2 socket are the same for HL1 socket types. Only the number of terminals varies.

General tolerance: ±0.3 ±.012

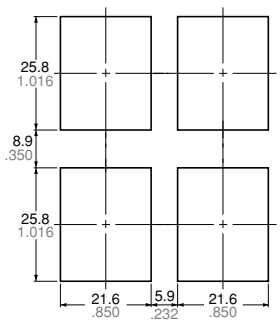
Hold-down clip

Hold-down clip is packaged with the socket.
(Applied to HC sockets and ordinary HC terminal sockets)

Mounting hole diagram



Side-by-side installation



Tolerance: ±0.1 ±.004

Notes: 1. Applicable chassis board thickness is 1.0 to 2.0 mm.
2. Installation is easy by inserting the socket from the top into the holes and by depressing the two down arrows on the retention fitting from the front.

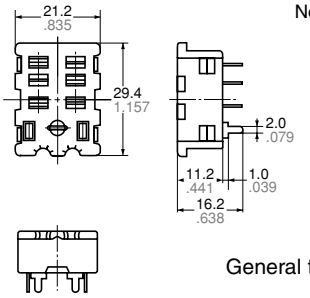
2. PC board type sockets

CAD Data

HL1 PC board type socket
(HL1-PS-K)

HL2 PC board type socket
(HL2-PS-K)

HL2 PC board type socket
External dimensions



Note: The external and mounting dimensions of HL2 PC board type socket are the same for HL1 PC board type socket. Only the number of terminals varies.

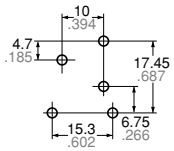
General tolerance: ±0.3 ±.012

Hold-down clip

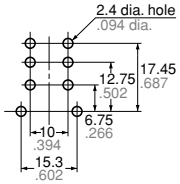
Hold-down clip is packaged with the socket.
(Applied to HC sockets and ordinary HC terminal sockets)

PC board pattern (Bottom view)

1 Form C

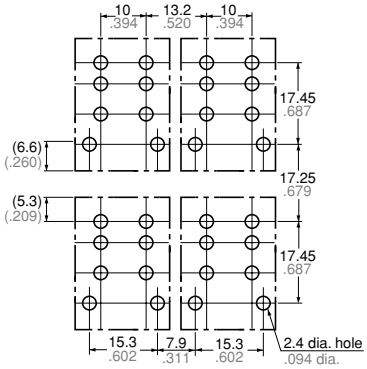


2 Form C



Tolerance: ±0.1 ±.004

Side-by-side installation (For 2 Form C)



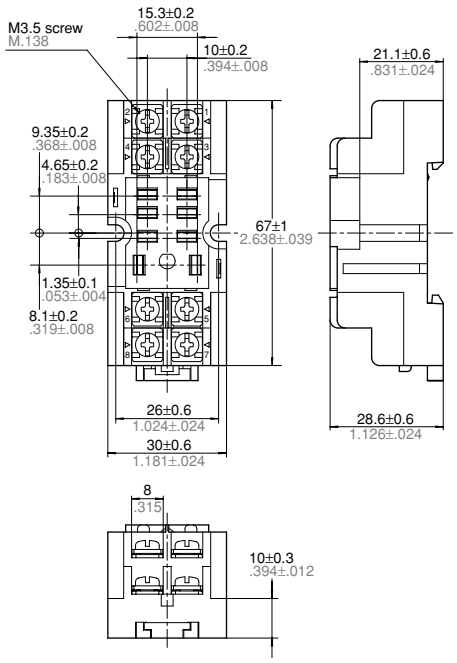
Tolerance: ±0.1 ±.004

3. DIN rail terminal sockets

(HL2-SFD-K)

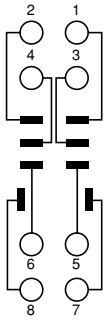
CAD Data

HL2-DIN rail terminal socket
External dimensions



General tolerance: ±0.5 ±.020

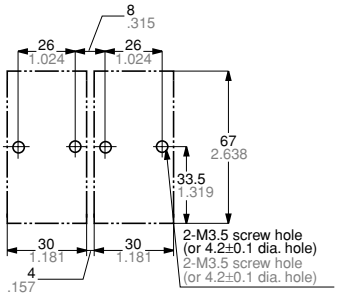
Schematic



With a relay mounted

Hold-down clip is packaged with the terminal socket. (Applied to HC DIN rail terminal sockets)

Mounting hole diagram



Tolerance: ±0.1 ±.004

Chassis (Panel) cutout in tandem (side-by-side) mounting

*To prevent damage or distortion, when tightening fixing screws, the optimum torque range should be 0.784 to 0.98 N·m, (8 to 10 kgf·cm).

Panasonic
ideas for life

Relay for control panel of 10A (2c/3c/4c)

HP RELAYS

Compliance with RoHS Directive

FEATURES

1. High-capacity and long life
Mechanical life is more than 10 million operations and, with electrical life of more than 200,000 operations (resistive load 10 A; inductive load 7.5 A), the relay has excellent inductive load durability.
2. Easy mounting and wiring
The terminal arrangement is apparent at a glance and wiring is easy. Moreover, quick tab terminal is also possible.
3. Operation indicator option
Optional operation indicators are available for easy visual confirmation that relays are operating. They simplify maintenance.
4. Wide range of sockets and terminal sockets
To enable use with DIN rails, DIN terminal sockets are also available.

TYPICAL APPLICATIONS

HP relays enjoy wide use in various applications, particularly in automation controls and remote controls.
Applications include:
1. Industrial machinery
For controlling positioning, pressure, and temperature in molding equipment, boilers, pumps, charging pressure equipment, measuring and evaluation equipment, textile machines, etc.
2. Machine tools
Control of positioning and directional change in turning machines, lathes, borers, etc.
3. Food processing packing machines
Automatic control of packing equipment for milk and seafood, bottling, canning, and packaging
4. Office equipment
Control of copiers, time recorders, etc.
5. Coin operate machines
Control of food, cigarette, and other vending machines
6. Measuring devices and equipment
For repeating installation of control signals and in power amplifiers
7. Generators, transformers and power receiving equipment.
Functional parts in protective equipment, functional assistance in automatic adjustment equipment, telemeters and other remote monitoring equipment
8. Control of conveyance equipment
Control panels for elevators, escalators, and other conveyance equipment, control of all kinds industrial transport equipment such as conveyors.
9. Amusement equipment
Control of equipment in amusement parks, etc., control of bowling alley equipment, control of fountains in public parks

ORDERING INFORMATION

HP □ - □ □ - □ - □

Contact arrangement
2: 2 Form C
3: 3 Form C
4: 4 Form C

Terminal arrangement
Nil: Plug-in terminal
TM: TM type (2 Form C only)
M: Direct mounting (3 Form C only)

Operation indication
Nil: Without indication
L: With indication

Nominal coil voltage
AC 24, 48, 100, 115, 200, 220, 240 V
DC 12, 24, 48, 100, 110 V

Contact material
F: 4 Form C, Silver alloy (cadmium-free)
Nil: 2 Form C, 3 Form C (Silver)

With LED indicator type
Nominal coil voltage: 24 V AC
12, 24, 48 V DC
With neon lamp type
Nominal coil voltage: 100, 115, 200, 220, 240 V AC
100, 110 V DC

TYPES

1. Plug-in type

Nominal coil voltage	2 Form C	3 Form C	4 Form C
	Part No.	Part No.	Part No.
24V AC	HP2-AC24V	HP3-AC24V	HP4-AC24V-F
48V AC	HP2-AC48V	HP3-AC48V	HP4-AC48V-F
100V AC	HP2-AC100V	HP3-AC100V	HP4-AC100V-F
115V AC	HP2-AC115V	HP3-AC115V	HP4-AC115V-F
200V AC	HP2-AC200V	HP3-AC200V	HP4-AC200V-F
220V AC	HP2-AC220V	HP3-AC220V	HP4-AC220V-F
240V AC	HP2-AC240V	HP3-AC240V	HP4-AC240V-F
12V DC	HP2-DC12V	HP3-DC12V	HP4-DC12V-F
24V DC	HP2-DC24V	HP3-DC24V	HP4-DC24V-F
48V DC	HP2-DC48V	HP3-DC48V	HP4-DC48V-F
100V DC	HP2-DC100V	HP3-DC100V	HP4-DC100V-F
110V DC	HP2-DC110V	HP3-DC110V	HP4-DC110V-F

Standard packing (2 Form C): Carton: 20 pcs.; Case: 100 pcs.
Standard packing (3 Form C, 4 Form C): Carton: 10 pcs.; Case: 50 pcs.

2. Plug-in type (with operation indication)

	Nominal coil voltage	2 Form C	3 Form C	4 Form C
		Part No.	Part No.	Part No.
With LED indication	24V AC	HP2-L-AC24V	HP3-L-AC24V	HP4-L-AC24V-F
With neon lamp	100V AC	HP2-L-AC100V	HP3-L-AC100V	HP4-L-AC100V-F
	115V AC	HP2-L-AC115V	HP3-L-AC115V	HP4-L-AC115V-F
	200V AC	HP2-L-AC200V	HP3-L-AC200V	HP4-L-AC200V-F
	220V AC	HP2-L-AC220V	HP3-L-AC220V	HP4-L-AC220V-F
	240V AC	HP2-L-AC240V	HP3-L-AC240V	HP4-L-AC240V-F
With LED indication	12V DC	HP2-L-DC12V	HP3-L-DC12V	HP4-L-DC12V-F
	24V DC	HP2-L-DC24V	HP3-L-DC24V	HP4-L-DC24V-F
	48V DC	HP2-L-DC48V	HP3-L-DC48V	HP4-L-DC48V-F
With neon lamp	100V DC	HP2-L-DC100V	HP3-L-DC100V	HP4-L-DC100V-F
	110V DC	HP2-L-DC110V	HP3-L-DC110V	HP4-L-DC110V-F

Standard packing (2 Form C): Carton: 20 pcs.; Case: 100 pcs.
Standard packing (3 Form C, 4 Form C): Carton: 10 pcs.; Case: 50 pcs.

3. TM type and Direct mount type

Nominal coil voltage	2 Form C (TM type)	3 Form C (direct mount type)
	Part No.	Part No.
24V AC	HP2-TM-AC24V	HP3-M-AC24V
48V AC	HP2-TM-AC48V	HP3-M-AC48V
100V AC	HP2-TM-AC100V	HP3-M-AC100V
115V AC	HP2-TM-AC115V	HP3-M-AC115V
200V AC	HP2-TM-AC200V	HP3-M-AC200V
220V AC	HP2-TM-AC220V	HP3-M-AC220V
240V AC	HP2-TM-AC240V	HP3-M-AC240V
12V DC	HP2-TM-DC12V	HP3-M-DC12V
24V DC	HP2-TM-DC24V	HP3-M-DC24V
48V DC	HP2-TM-DC48V	HP3-M-DC48V
100V DC	HP2-TM-DC100V	HP3-M-DC100V
110V DC	HP2-TM-DC110V	HP3-M-DC110V

Standard packing: Carton: 10 pcs.; Case: 50 pcs.

4. Direct mount type (with LED indication)

	Nominal coil voltage	3 Form C
		Part No.
With neon lamp	100V AC	HP3-ML-AC100V
	115V AC	HP3-ML-AC115V
	200V AC	HP3-ML-AC200V
	220V AC	HP3-ML-AC220V
	240V AC	HP3-ML-AC240V
	100V DC	HP3-ML-DC100V
	110V DC	HP3-ML-DC110V

Standard packing: Carton: 10 pcs.; Case: 50 pcs.
Notes: 1. Standard packaging is handled in units of inner cartons. Please specify if you require inner cartons to be boxed.
2. Sockets, terminal sockets and installation brackets are not included. Please order these separately.
3. For products compliant with international standards, please refer to the standards chart.

* For sockets and terminal sockets, see page 117.

RATING

1. Coil data

1) AC coils

Contact arrangement	Nominal coil voltage	Nominal operating current (mA)		Nominal operating power (VA)		Inductance (H)		Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Max. applied voltage (at 20°C 68°F)
		50Hz	60Hz	50Hz	60Hz	50Hz	60Hz			
2 Form C	24V AC	94mA	78mA	2.25VA	1.9VA	0.753	0.776	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	110%V of nominal voltage
	48V AC	46.5mA	39mA	2.23VA	1.9VA	3.055	3.106			
	100V AC	25.3mA	21mA	2.36VA	2.1VA	12.60	12.03			
	115V AC	23.1mA	18mA	2.31VA	2.1VA	16.70	15.83			
	200V AC	12.4mA	11mA	2.48VA	2.2VA	48.03	45.81			
	220V AC	10.6mA	9.5mA	2.34VA	2.1VA	61.28	57.90			
	240V AC	10.0mA	9.0mA	2.40VA	2.2VA	69.00	66.26			
3 Form C	24V AC	148.7mA	130mA	3.56VA	3.1VA	0.0494	0.475	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	110%V of nominal voltage
	48V AC	74.2mA	65mA	3.56VA	3.1VA	1.976	1.899			
	100V AC	36.4mA	32mA	3.64VA	3.2VA	8.500	8.038			
	115V AC	32.5mA	28.5mA	3.74VA	3.3VA	10.79	10.36			
	200V AC	18.2mA	16mA	3.65VA	3.2VA	33.53	32.10			
	220V AC	16.0mA	14.2mA	3.54VA	3.1VA	41.35	39.32			
	240V AC	15.8mA	13.9mA	3.79VA	3.3VA	45.94	44.05			
4 Form C	24V AC	229mA	200mA	5.49VA	4.8VA	0.320	0.309	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	110%V of nominal voltage
	48V AC	108mA	95mA	5.18VA	4.6VA	1.348	1.292			
	100V AC	57.3mA	50mA	5.73VA	5.0VA	5.348	5.156			
	115V AC	47.6mA	42mA	5.47VA	4.8VA	7.264	6.953			
	200V AC	28.5mA	25mA	5.69VA	5.0VA	21.27	20.45			
	220V AC	23.8mA	21mA	5.24VA	4.6VA	27.75	26.57			
	240V AC	23.3mA	20.5mA	5.58VA	4.9VA	30.98	29.75			

2) DC coils (20°C 68°F)

Contact arrangement	Nominal coil voltage	Nominal current (mA)	Nominal operating power (W)	Coil resistance (Ω)	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Max. applied voltage (at 20°C 68°F)
2 Form C	12V DC	109mA	1.3W	110Ω	80%V or less of nominal voltage (Initial)	15%V or more of nominal voltage (Initial)	110%V of nominal voltage
	24V DC	54.5mA	1.3W	440Ω			
	48V DC	26.7mA	1.3W	1,800Ω			
	100V DC	14.9mA	1.5W	6,700Ω			
	110V DC	15.0mA	1.7W	7,300Ω			
3 Form C	12V DC	120mA	1.4W	100Ω	80%V or less of nominal voltage (Initial)	15%V or more of nominal voltage (Initial)	110%V of nominal voltage
	24V DC	60mA	1.4W	400Ω			
	48V DC	31mA	1.5W	1,560Ω			
	100V DC	15.6mA	1.6W	6,400Ω			
	110V DC	14.9mA	1.6W	7,450Ω			
4 Form C	12V DC	127mA	1.5W	95Ω	80%V or less of nominal voltage (Initial)	15%V or more of nominal voltage (Initial)	110%V of nominal voltage
	24V DC	63mA	1.5W	380Ω			
	48V DC	32.0mA	1.5W	1,500Ω			
	100V DC	16.3mA	1.6W	5,950Ω			
	110V DC	15.7mA	1.7W	7,000Ω			

Notes: 1. The nominal current area is ±15% (60Hz) [AC coils],. ±10% (20°C) [DC coils]
2. The coil resistance for DC operation is the value measured when the coil temperature is 20°C 68°F. Compensate ±0.4% for every ±1°C change in temperature.
3. The relay operates in a range of 80% to 110% V of the nominal coil voltage, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the nominal coil voltage. In particular, for AC operation, if the impressed voltage drops to 80% V or more below the nominal coil voltage, humming will occur and a large current will flow leading possibly to coil burnout.
4. For use with 200 V DC, connect a 6.7kΩ (10W) resistor, in series, to the 100 V DC relay [3 Form C type is .6.4kΩ (5W); 4 Form C type is .6.2kΩ (10W)].
5. As a general rule, only a pure DC voltage should be used for the coil drive. However, a DC power supply that contains ripples has characteristics that differ from pure DC. Therefore, please verify characteristics (operate voltage, release voltage, humming) using the actual circuit that will be used.

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		2 Form C, 3 Form C, 4 Form C
	Contact resistance (Initial)		Max. 15 mΩ (By voltage drop 6 V DC 1A)
	Contact material	2 Form C, 3 Form C	Ag
		4 Form C	Ag alloy (cd free)
Rating	Nominal switching capacity		10A 250V AC (resistive load)
	Min. switching capacity (Reference value)*1		100mA 5V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as “Breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min (2 Form C, 4 Form C). 2,000 Vrms for 1min (3 Form C) (Detection current: 10mA.)
		Between contact sets	1,500 Vrms for 1min (2 Form C, 4 Form C). 2,000 Vrms for 1min (3 Form C) (Detection current: 10mA.)
		Between contact and coil	1,500 Vrms for 1min (2 Form C, 4 Form C). 2,000 Vrms for 1min (3 Form C) (Detection current: 10mA.)
	Temperature rise (coil)		Max. 65°C 149°F (By temperature method, at 40°C, nominal current)
	Operate time*2		Max. 25ms (2 Form C), Max.30ms (3 Form C, 4 Form C) (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time*2		Max. 25ms (2 Form C), Max.30ms (3 Form C, 4 Form C) (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.)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 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 2 mm
Expected life	Mechanical		Min. 10^7
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –50°C to +40°C –58°F to +104°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			2 Form C: approx. 60g 2.12oz, 3 Form C: approx. 100g 3.53oz, 4 Form C: approx. 125g 4.41oz

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. For the AC coil types, the operate/release time will differ depending on the phase.
*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.

3. Electrical life

1) AC load

Voltage	125V AC		250V AC		Expected life
Load	Resistive load (A) (cosφ=1)	Inductive load (A) (cosφ=0.4)	Resistive load (A) (cosφ=1)	Inductive load (A) (cosφ=0.4)	
Current	—	—	10	7.5	Min. 2×10^5
	10	7.5	7.5	5	Min. 5×10^5
	5	3	3	2	Min. 10^6
	1	0.7	0.6	0.4	Min. 2×10^6

Note: When the electromagnet or exciting coil (Solenoid, etc.) is the load, the value of motor or lamp load is applicable.

2) DC load

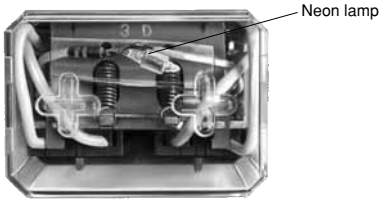
Voltage	24V DC		125V DC		Expected life
Load	Resistive load (A)	Inductive load (A)	Resistive load (A)	Inductive load (A)	
Current	—	7	—	—	Min. 2×10^5
	7.5	5	0.5	0.4	Min. 5×10^5
	5	3	0.3	0.2	Min. 10^6
	1	0.6	0.1	0.06	Min. 2×10^6

Notes: 1. For DC inductive loads, use an arc suppressing circuit.
2. Cautions at DC load use
When used under a DC load operating at high repetition rate with considerable arcing, corrosion of the contacts and/or the contact blades is likely to occur.

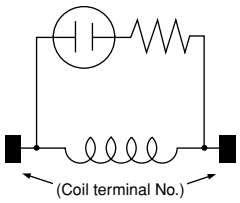
4. Life of LED and neon lamp (with operation indication)

	Continuous	Use rating (ON time) 50%
With neon lamp	25,000 hours (approx. 3 years)	Approx. 6 years
With LED indication	50,000 hours (approx. 5.5 years)	100,000 hours (approx. 11 years)

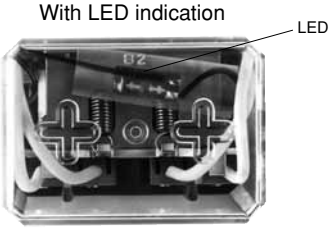
With neon lamp



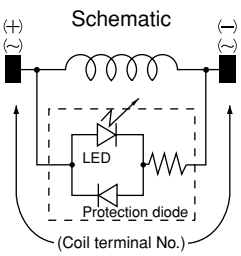
Schematic



With LED indication



Schematic

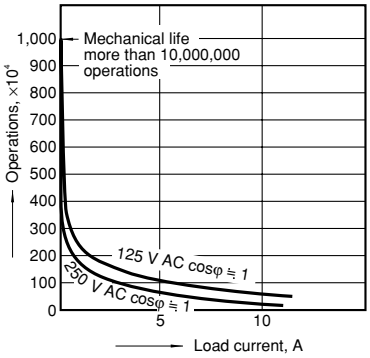


Coil terminal No. and polarity (DC type)

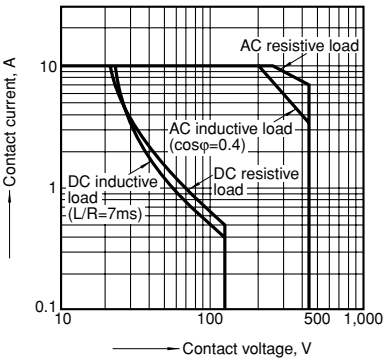
	Polarity	2 Form C	3 Form C	4 Form C
Terminal No.	(+)	7	10	10
	(–)	2	2	1

REFERENCE DATA

1. Life curve



2. Max. switching capacity



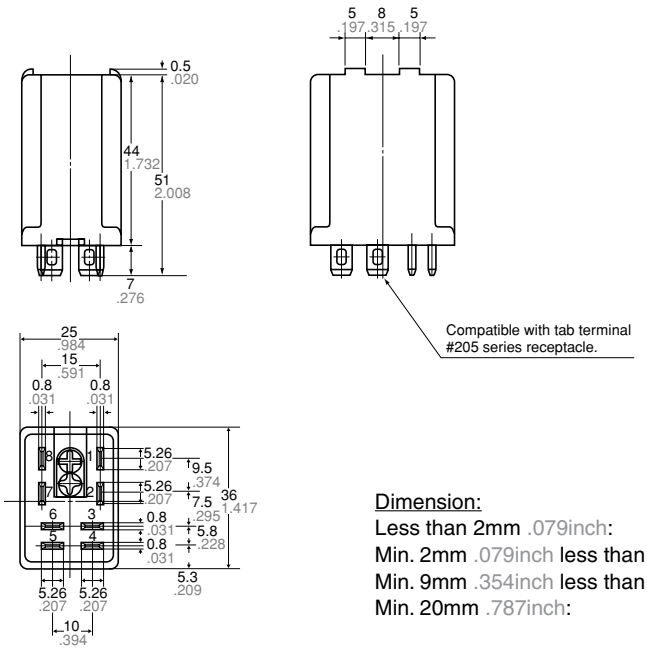
DIMENSIONS (mm inch)

The CAD data of the products with a CAD Data mark can be downloaded from: http://panasonic-electric-works.net/ac

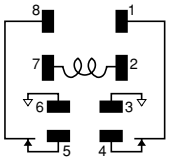
Plug-in type (2 Form C)

CAD Data

External dimensions



Schematic (Bottom view)

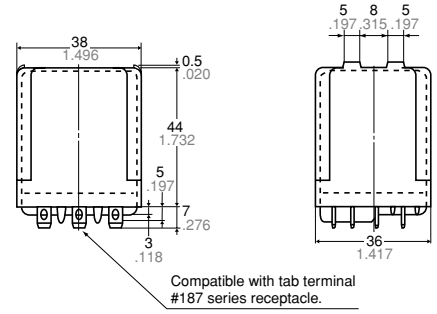


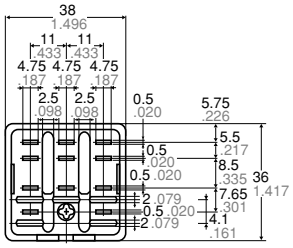
Dimension:	Tolerance
Less than 2mm .079inch:	±0.2 ±.008
Min. 2mm .079inch less than 9mm .354inch:	±0.5 ±.020
Min. 9mm .354inch less than 20mm .787inch:	±1 ±.039
Min. 20mm .787inch:	±1.5 ±.059

Plug-in type (3 Form C)

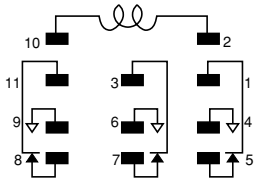
CAD Data

External dimensions





Schematic (Bottom view)

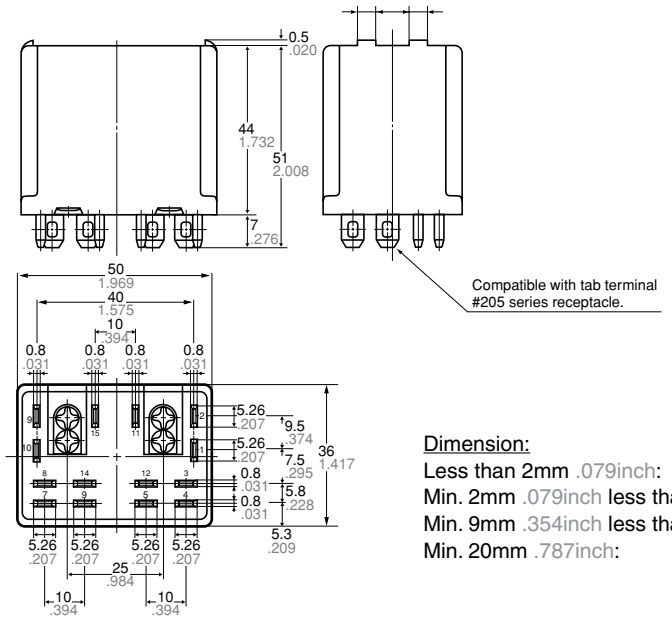


Dimension:	Tolerance
Less than 2mm .079inch:	±0.2 ±.008
Min. 2mm .079inch less than 9mm .354inch:	±0.5 ±.020
Min. 9mm .354inch less than 20mm .787inch:	±1 ±.039
Min. 20mm .787inch:	±1.5 ±.059

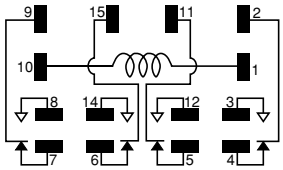
Plug-in type (4 Form C)

CAD Data

External dimensions



Schematic (Bottom view)



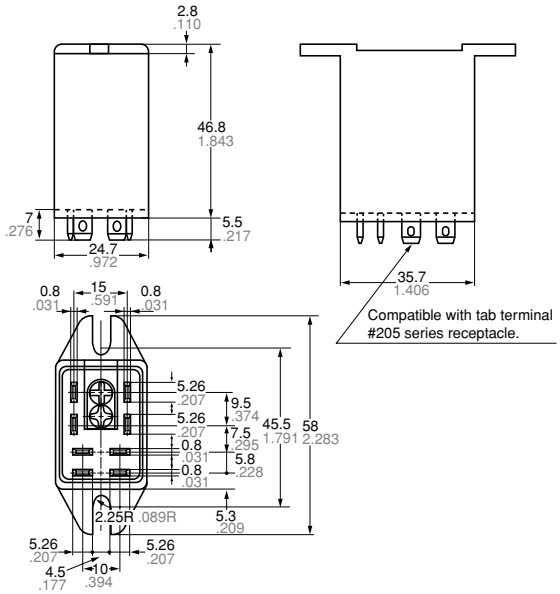
Dimension:	Tolerance
Less than 2mm .079inch:	±0.2 ±.008
Min. 2mm .079inch less than 9mm .354inch:	±0.5 ±.020
Min. 9mm .354inch less than 20mm .787inch:	±1 ±.039
Min. 20mm .787inch:	±1.5 ±.059

TM type
(2 Form C)

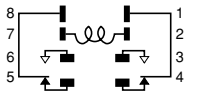
CAD Data

Dimension:	Tolerance
Less than 2mm .079inch:	±0.2 ±.008
Min. 2mm .079inch less than 9mm .354inch:	±0.5 ±.020
Min. 9mm .354inch less than 20mm .787inch:	±1 ±.039
Min. 20mm .787inch:	±1.5 ±.059

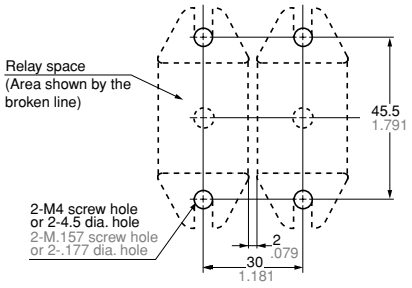
External dimensions



Schematic (Bottom view)

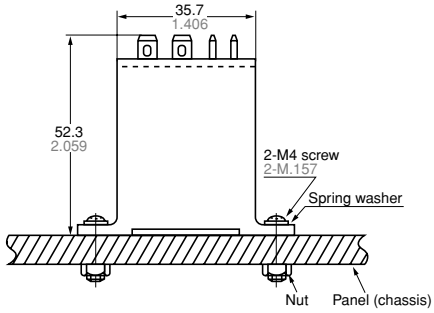


Mounting hole diagram



Tolerance: ±0.1 ±.004
(Pitch for side-by-side mounting)

Installed relay

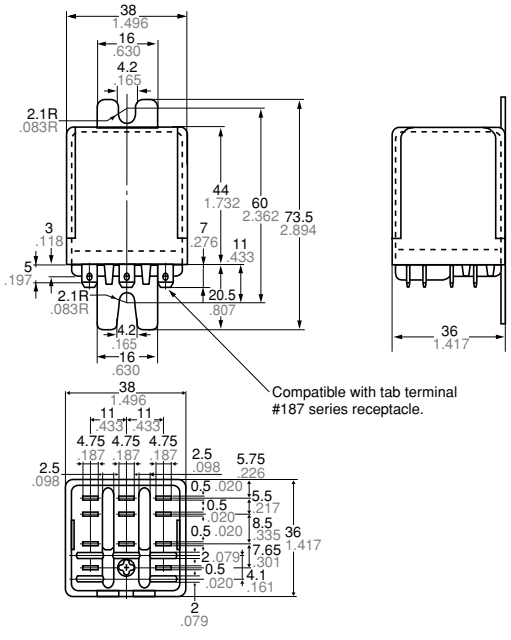


Direct mounting type
(3 Form C)

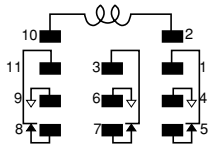
CAD Data

Dimension:	Tolerance
Less than 2mm .079inch:	±0.2 ±.008
Min. 2mm .079inch less than 9mm .354inch:	±0.5 ±.020
Min. 9mm .354inch less than 20mm .787inch:	±1 ±.039
Min. 20mm .787inch:	±1.5 ±.059

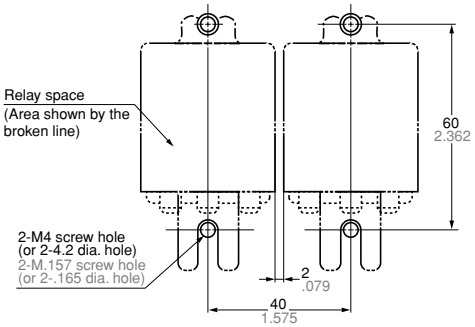
External dimensions



Schematic (Bottom view)

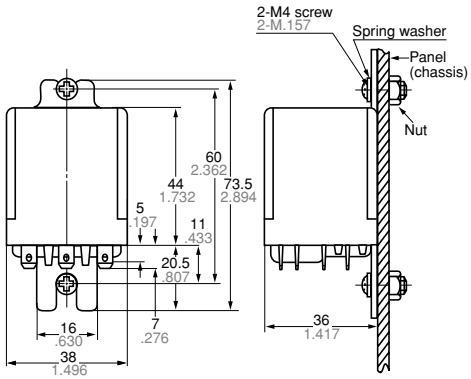


Mounting hole diagram



Tolerance: ±0.1 ±.004
(Pitch for side-by-side mounting)

Installed relay

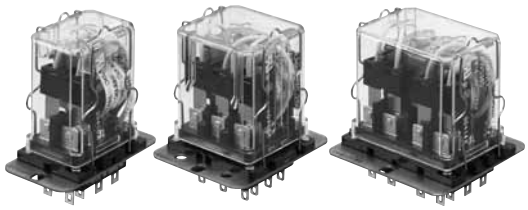


SAFETY STANDARDS

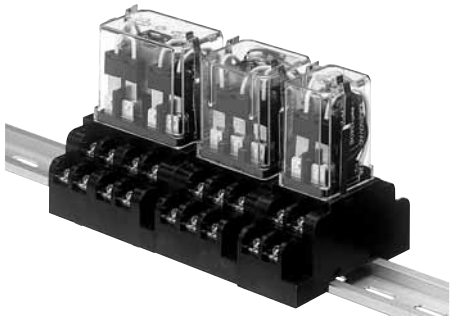
UL/C-UL (Recognized)		CSA (Certified)	
File No.	Contact rating	File No.	Contact rating
E43028	10A 250V AC, 1/3HP 125, 250V AC, 10A 30V DC	LR26550 etc.	10A 250V AC, 1/3HP 125, 250V AC, 10A 30V DC

For Cautions for Use, see Page 21.

HP RELAYS
(Square hole sockets and DIN rail terminal sockets)



Square hole sockets



DIN rail terminal sockets

TYPES

1. For DIN rail terminal sockets, hold-down clip included.
2. For square hole sockets, powerful hold-down clip included.

Type	No. of poles	Item	Part No.	Standard packing	
				Carton	Case
Square hole socket	2-pole	HP2-square hole socket	HP2-SRS	20 pcs.	100 pcs.
	3-pole	HP3-square hole socket	HP3-SRS	10 pcs.	50 pcs.
	4-pole	HP4-square hole socket	HP4-SRS	10 pcs.	50 pcs.
DIN rail terminal socket	2-pole	HP2-DIN rail terminal socket	HP2-SFD	10 pcs.	50 pcs.
	3-pole	HP3-DIN rail terminal socket	HP3-SFD	10 pcs.	50 pcs.
	4-pole	HP4-DIN rail terminal socket	HP4-SFD	5 pcs.	25 pcs.
Common part	2/3/4-pole (common)	HP-hold down clip for socket	AW5806	—	50 pcs.

Note: For square hole sockets and DIN rail terminal sockets, certified by UL/C-UL

DIMENSIONS (mm inch)

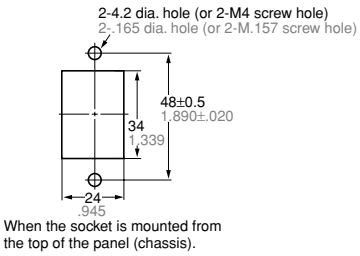
The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

1. Square hole socket (hold-down clip included)

HP2-Square hole socket (HP2-SRS)

CAD Data

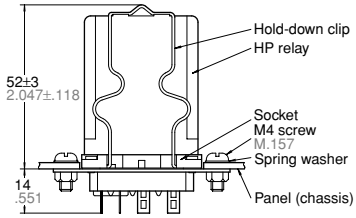
Front surface mounting

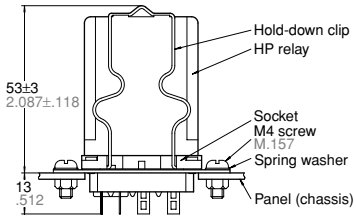


When the socket is mounted from the top of the panel (chassis).

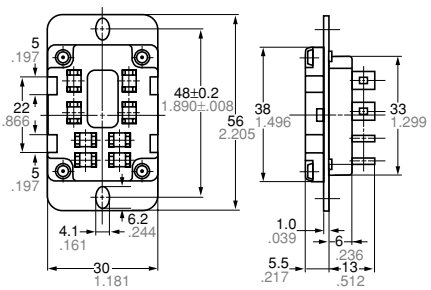
Tolerance: ±0.1 ±.004

Mounting dimensions



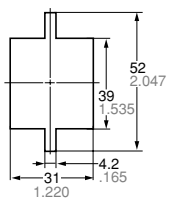


External dimensions



General tolerance: ±0.1 ±.004

Rear surface mounting



When the socket is mounted from below the panel (chassis).

Tolerance: ±0.1 ±.004

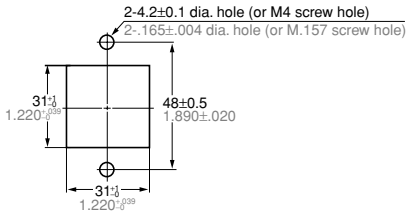
Notes: 1. Optimum space-saving panel cut-out.
2. Can be mounted from either the front or the rear of the panel.
3. Hold-down clip is included in package.

HP RELAY ACCESSORIES

HP3-Square hole socket (HP3-SRS)

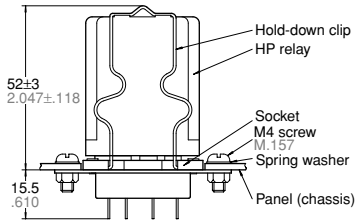
CAD Data

Front surface mounting

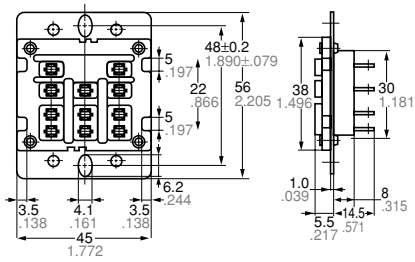


Tolerance: ±0.1 ±.004

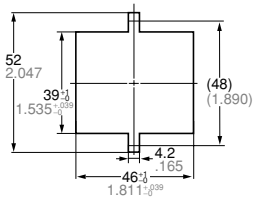
Mounting dimensions



External dimensions

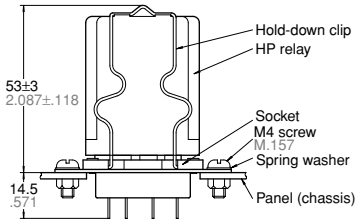


Rear surface mounting



Tolerance: ±0.1 ±.004

Mounting dimensions



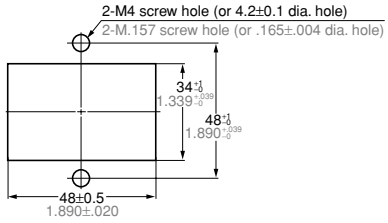
General tolerance: ±0.1 ±.004

Notes: 1. Optimum space-saving panel cut-out.
2. Can be mounted from either the front or the rear of the panel.
3. Hold-down clip is included in package.

HP4-Square hole socket (HP4-SRS)

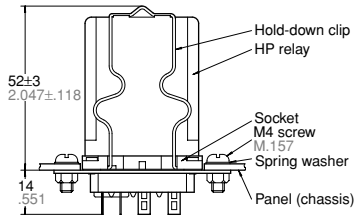
CAD Data

Front surface mounting

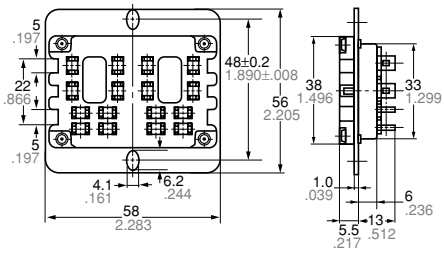


Tolerance: ±0.1 ±.004

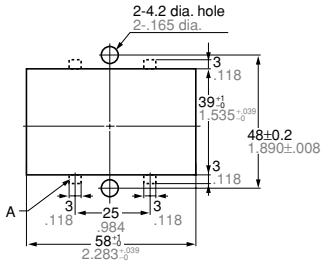
Mounting dimensions



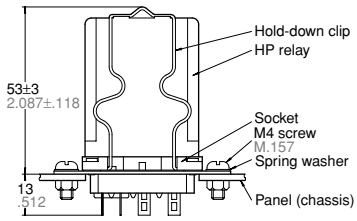
External dimensions



Rear surface mounting



Mounting dimensions



General tolerance: ±0.1 ±.004

Tolerance: ±0.1 ±.004

Notes: 1. Optimum space-saving panel cut-out.
2. Can be mounted from either the front or the rear of the panel.
3. Hold-down clip is included in package.

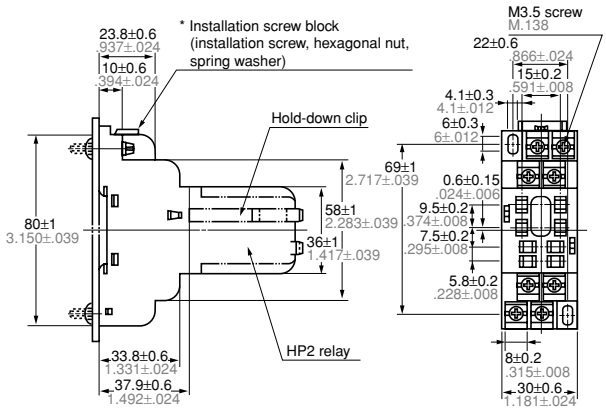
* When using the former hold-down clip, it is necessary to cut out the A section marked by the broken line (not necessary with the powerful hold-down clip).

2. DIN rail terminal socket (hold-down clip and installation screw included)

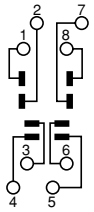
HP2-DIN rail terminal socket (HP2-SFD)

CAD Data

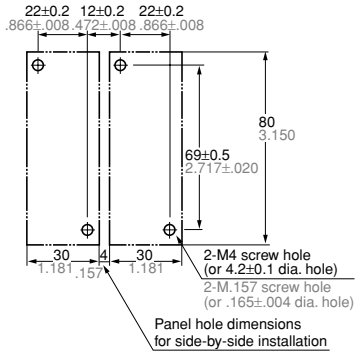
External dimensions



Schematic



Mounting hole diagram

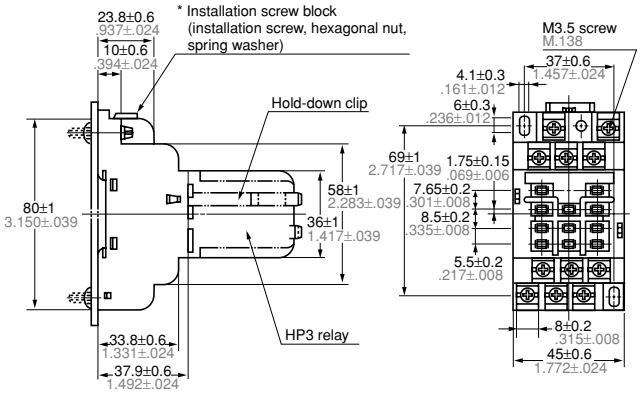


Notes: 1. For direct mounting, use the included installation screw block.
2. A hold-down clip is included with the terminal socket.

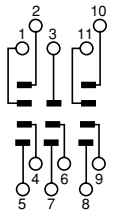
HP3-DIN rail terminal socket (HP3-SFD)

CAD Data

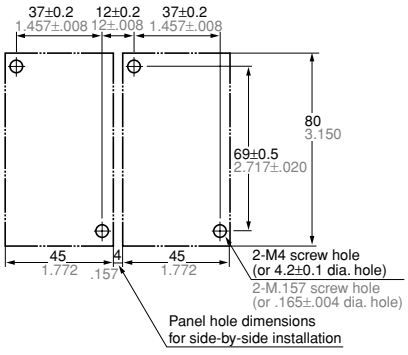
External dimensions



Schematic



Mounting hole diagram

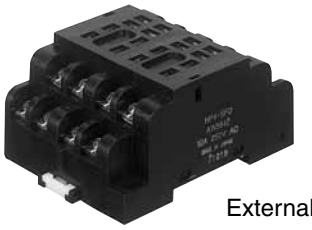


Notes: 1. For direct mounting, use the included installation screw block.
2. A hold-down clip is included with the terminal socket.

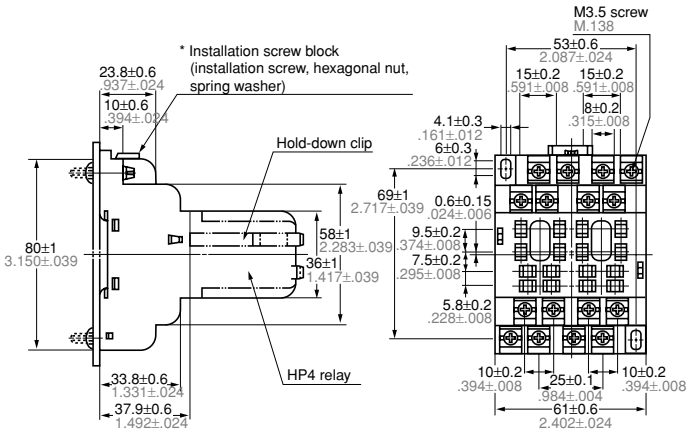
HP RELAY ACCESSORIES

HP4-DIN rail terminal socket (HP4-SFD)

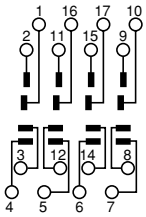
CAD Data



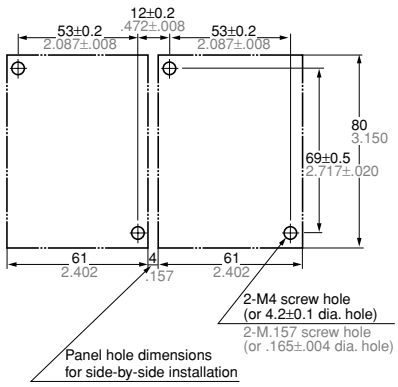
External dimensions



Schematic



Mounting hole diagram



Notes: 1. For direct mounting, use the included installation screw block.
2. A hold-down clip is included with the terminal socket.

NOTES

1. There are two types of HP relay: plug-in and direct mounting (HP2-TM and HP3-M only).
Avoid use of direct mounting types in sockets or DIN rail terminal sockets.
Note: Mounting measurements for direct mounting types (HP2-TM and HP3-M) are shown in the drawing on page 116.

2. The terminals are compatible with tab terminals. Consequently, for direct mounting types, in addition to soldering, AMP terminals can be used.

Part number	Compatible tab terminal
HP2	#205 series
HP3	#187 series
HP4	#205 series

3. When tightening the fixing screws of direct mounting types, use washers to prevent damage or distortion.
The optimum torque range is 0.49 to 0.69 N·m, (5 to 7 kgf·cm).
To prevent loosening of direct mounting types, terminal sockets and sockets, etc., when fixing the screws, use spring washers, etc. Moreover, wiring (soldering), should be done with care while ensuring strong connections.
4. When tightening DIN rail terminal socket fixing screws, to prevent damage, the optimum torque range should be 0.784 to 0.98 N·m, (8 to 10 kgf·cm).

5. Avoid use in adverse conditions, such as where the relay will be subjected to strong vibrations or shock, where there is exposure to harmful gas, or where ambient temperatures are high (more than 40°C 104°F).
6. Use in DC load
Abnormal wear of the contacts and contact springs will occur when the switching frequency is high and there are large arcs. In particular, if high-frequency operation in hot or humid conditions is intended, use arc-suppressing circuits.
7. There is no particular specification for HP relay mounting orientation.
8. Do not insert or remove relays into or out of live circuits.

Panasonic
ideas for life

Relay for control panel of 20A (2c/3c/4c)

HG RELAYS

Compliance with RoHS Directive

FEATURES

1. High-capacity and long life
The electrical life of this high capacity is 20A 100,000 operations (250 V AC). It can be used for 1.5kW (3-phase 200 V) motor control.

2. High breakdown voltage
Both between contacts, and between contacts and coil, high breakdown voltage is 2,000 V for 1 minute.

3. Easy mounting and wiring
The terminal arrangement is apparent at a glance and wiring is easy. Moreover, #250 series tab terminals can be used.

4. Socket and terminal sockets available
Lineup includes DIN terminal sockets that enable the use of DIN rails. The pole numbers of the terminal sockets are interchangeable and different terminal sockets can be used in combination.

TYPICAL APPLICATIONS

1. HP relays enjoy wide use in various applications, particularly in automation controls and remote controls.

2. Industrial machinery
For controlling positioning, pressure, and temperature in molding equipment, boilers, pumps, charging pressure equipment, measuring and evaluation equipment, textile machines, etc.

3. Machine tools
Control of positioning and directional change in turning machines, lathes, borers, etc.

4. Food processing packing machines
Automatic control of packing equipment for milk and seafood, bottling, canning, and packaging

5. Office equipment
Control of copiers, time recorders, etc.

6. Coin operate machines
Control of food, cigarette, and other vending machines

7. Measuring devices and equipment
For repeating installation of control signals and in power amplifiers

8. Generators, transformers and power receiving equipment.
Functional parts in protective equipment, functional assistance in automatic adjustment equipment, telemeters and other remote monitoring equipment

9. Control of conveyance equipment
Control panels for elevators, escalators, and other conveyance equipment, control of all kinds industrial transport equipment such as conveyors.

10. Amusement equipment
Control of equipment in amusement parks, etc., control of bowling alley equipment, control of fountains in public parks

ORDERING INFORMATION

HG □ - □ - F

Contact arrangement
2: 2 Form C
3: 3 Form C
4: 4 Form C

Nominal coil voltage
AC 24, 48, 100, 115, 200, 220, 240 V
DC 12, 24, 48, 100, 110, 200 V

Contact material
F: $AgSnO_2$ type

Note: Certified by UL and CSA

TYPES

Nominal coil voltage	2 Form C	3 Form C	4 Form C
	Part No.	Part No.	Part No.
24V AC	HG2-AC24V-F	HG3-AC24V-F	HG4-AC24V-F
48V AC	HG2-AC48V-F	HG3-AC48V-F	HG4-AC48V-F
100V AC	HG2-AC100V-F	HG3-AC100V-F	HG4-AC100V-F
115V AC	HG2-AC115V-F	HG3-AC115V-F	HG4-AC115V-F
200V AC	HG2-AC200V-F	HG3-AC200V-F	HG4-AC200V-F
220V AC	HG2-AC220V-F	HG3-AC220V-F	HG4-AC220V-F
240V AC	HG2-AC240V-F	HG3-AC240V-F	HG4-AC240V-F
12V DC	HG2-DC12V-F	HG3-DC12V-F	HG4-DC12V-F
24V DC	HG2-DC24V-F	HG3-DC24V-F	HG4-DC24V-F
48V DC	HG2-DC48V-F	HG3-DC48V-F	HG4-DC48V-F
100V DC	HG2-DC100V-F	HG3-DC100V-F	HG4-DC100V-F
110V DC	HG2-DC110V-F	HG3-DC110V-F	HG4-DC110V-F
200V DC	HG2-DC200V-F	HG3-DC200V-F	HG4-DC200V-F

Standard packing (2 Form C): Carton: 20 pcs.; Case: 100 pcs.
Standard packing (3 Form C, 4 Form C): Carton: 10 pcs.; Case: 50 pcs.
Note: Terminal sockets and sockets are not included. Please order these separately.

* For sockets and terminal sockets, see page 126.

RATING

1. Coil data

1) AC coils

Contact arrangement	Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Nominal operating current [±20%] (at 20°C 68°F)		Coil inductance		Nominal operating power		Max. applied voltage (at 40°C 104°F)
				50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	
2 Form C	24V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	167mA	150mA	0.441H	0.416H	4.2VA	3.6VA	110%V of nominal voltage
	48V AC			86mA	75mA	1.717H	1.660H			
	100V AC			42mA	36mA	7.457H	7.216H			
	115V AC			36mA	31.3mA	9.868H	9.531H			
	200V AC			21mA	18mA	30.39H	29.00H			
	220V AC			19mA	16.4mA	35.99H	34.82H			
	240V AC			18mA	15mA	42.06H	41.68H			
3 Form C	24V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	250mA	216mA	0.299H	0.290H	6.0VA	5.2VA	110%V of nominal voltage
	48V AC			125mA	108mA	1.195H	1.163H			
	100V AC			61mA	52mA	5.174H	5.039H			
	115V AC			52.4mA	45.2mA	6.844H	6.648H			
	200V AC			30mA	26mA	20.71H	20.14H			
	220V AC			27.3mA	23.6mA	25.00H	24.27H			
	240V AC			25mA	21.6mA	29.97H	29.06H			
4 Form C	24V AC	80%V or less of nominal voltage (Initial)	30%V or more of nominal voltage (Initial)	367mA	316mA	0.204H	0.199H	8.8VA	7.6VA	110%V of nominal voltage
	48V AC			184mA	158mA	0.817H	0.795H			
	100V AC			88mA	76mA	3.540H	3.444H			
	115V AC			76.8mA	66.1mA	4.685H	4.557H			
	200V AC			44mA	38mA	14.16H	13.79H			
	220V AC			39mA	34mA	17.48H	16.89H			
	240V AC			36.6mA	31.6mA	20.48H	19.87H			

2) DC coils

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	Max. applied voltage (at 40°C 104°F)
2 Form C	12V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	119.6mA	100Ω	1.4W	110%V of nominal voltage
	24V DC			57.6mA	416Ω	1.4W	
	48V DC			30.3mA	1,585Ω	1.5W	
	100V DC			14.4mA	6,950Ω	1.4W	
	110V DC			14.4mA	7,650Ω	1.6W	
	200V DC			7.2mA	27,800Ω	1.4W	
3 Form C	12V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	134mA	89.5Ω	1.6W	110%V of nominal voltage
	24V DC			66mA	364Ω	1.6W	
	48V DC			33.1mA	1,450Ω	1.6W	
	100V DC			16.5mA	6,060Ω	1.7W	
	110V DC			16.5mA	6,670Ω	1.8W	
	200V DC			8.4mA	23,800Ω	1.7W	
4 Form C	12V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	168mA	71.4Ω	2.0W	110%V of nominal voltage
	24V DC			81.2mA	296Ω	1.9W	
	48V DC			45.7mA	1,050Ω	2.2W	
	100V DC			20.3mA	4,930Ω	2.0W	
	110V DC			20.3mA	5,420Ω	2.2W	
	200V DC			12.9mA	15,500Ω	2.6W	

Notes: 1. The nominal current area is±15% (60Hz) [AC coils],. ±10% (20°C) [DC coils]
2. The coil resistance for DC operation is the value measured when the coil temperature is 20°C 68°F. Compensate ±0.4% for every ±1°C change in temperature.
3. The relay operates in a range of 80% to 110% V of the nominal voltage, but ideally, in consideration of temporary voltage fluctuations, it should be operated at the nominal voltage. In particular, for AC operation, if the impressed voltage drops to 80% V or more below the nominal voltage, humming will occur and a large current will flow leading possibly to coil burnout.
4. As a general rule, only a pure DC voltage should be used for the coil drive. However, a DC power supply that contains ripples has characteristics that differ from pure DC. Therefore, please verify characteristics (operate voltage, release voltage, humming) using the actual circuit that will be used.

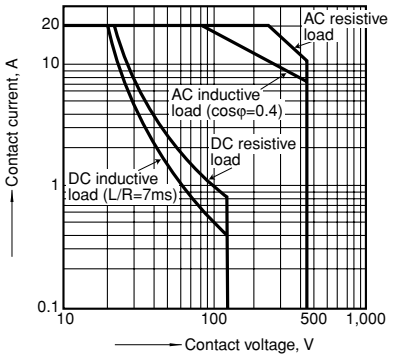
2. Specifications

Characteristics	Item		Specifications
Contact	Contact resistance (Initial)		Max. 15 mΩ (By voltage drop 6 V DC 1A)
	Contact material		$AgSnO_2$ type
Rating	Nominal switching capacity		20A 250V AC (resistive load)
	Min. switching capacity (Reference value)*1		100mA 5V DC
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500V DC) Measurement at same location as “Breakdown voltage” section.
	Breakdown voltage (Initial)	Between open contacts	2,000 Vrms for 1min (Detection current: 10mA)
		Between contact sets	2,000 Vrms for 1min (Detection current: 10mA)
		Between contact and coil	2,000 Vrms for 1min (Detection current: 10mA)
	Operate time*2		Max. 30ms (2 Form C), Max.40ms (3 Form C, 4 Form C) (Nominal coil voltage applied to the coil, excluding contact bounce time.)
	Release time*2		Max. 30ms (2 Form C), Max.40ms (3 Form C, 4 Form C) (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 98 m/s² (Except for contact operating direction) (Half-wave pulse of sine wave: 11 ms; detection time: 10μs)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 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 2 mm
Expected life	Mechanical	AC coil	Min. 10^7 (at 180 times/min.)
		DC coil	Min. 10^6 (at 180 times/min.)
	Electrical		20A 250V AC resistive load (cosφ=1), Min. 10^5
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –50°C to +40°C –58°F to +104°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			2 Form C: approx. 130g 4.59oz, 3 Form C: approx. 185g 6.53oz, 4 Form C: approx. 240g 8.47oz

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. For the AC coil types, the operate/release time will differ depending on the phase.
*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.

REFERENCE DATA

1. Switching capacity range



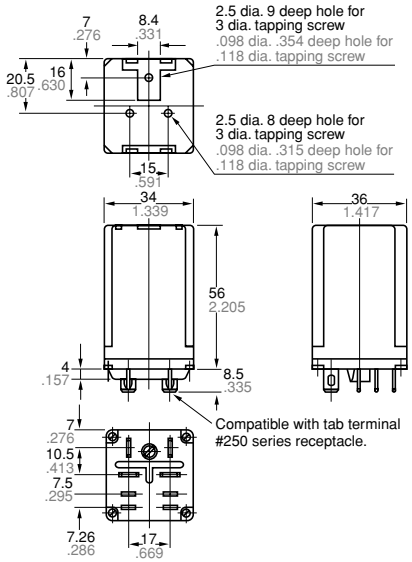
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

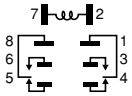
2 Form C

CAD Data

External dimensions



Schematic (Bottom view)

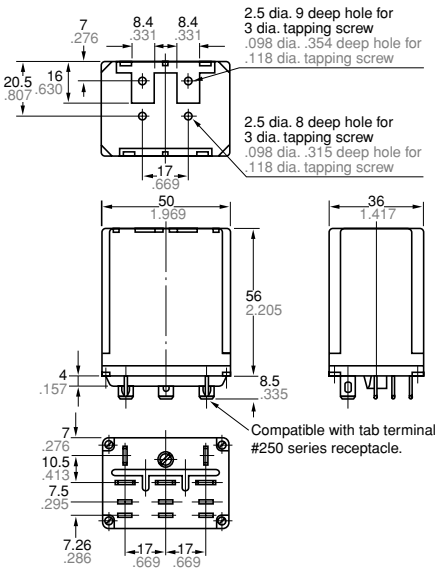


General tolerance: ±0.5 ±.020

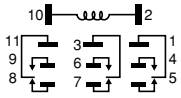
3 Form C

CAD Data

External dimensions



Schematic (Bottom view)

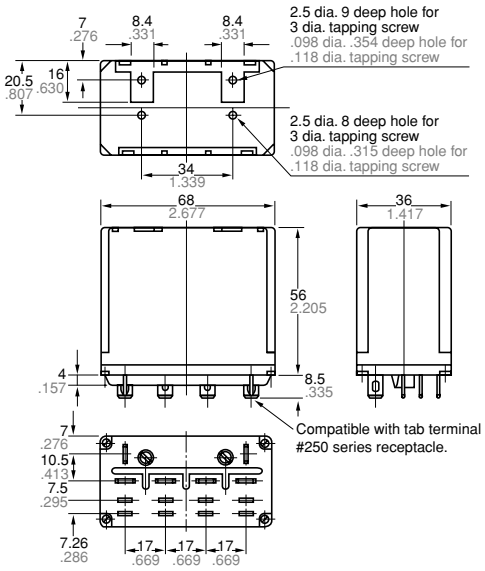


General tolerance: ±0.5 ±.020

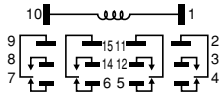
4 Form C

CAD Data

External dimensions



Schematic (Bottom view)

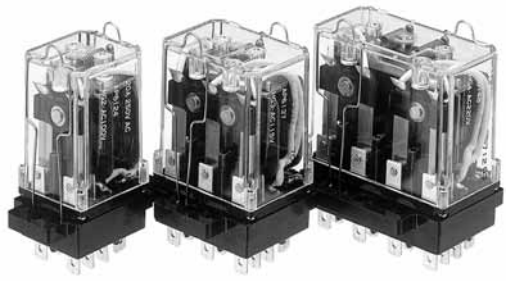


General tolerance: ±0.5 ±.020

SAFETY STANDARDS

	UL/C-UL (Recognized)		CSA (Certified)	
	File No.	Contact rating	File No.	Contact rating
Single phase	E43028	3/4HP 125V AC, 2HP 250V AC	LR26550 etc.	3/4HP 125V AC, 1HP 250V AC
Three phase	E43028	2HP 125V AC, 3HP 250V AC 20A 250V AC (cosϕ=0.75)	LR26550 etc.	2HP 125V AC, 1HP 250V AC 15A 125V AC (cosϕ=0.75), 10A 250V AC (cosϕ=0.75)

For Cautions for Use, see Page 21.



Plug-in socket

DIN rail terminal socket

TYPES

For plug-in sockets and DIN rail terminal sockets hold-down clip included.

Type	No. of poles	Item	Part No.	Standard packing	
				Carton	Case
Plug-in socket	2-pole	HG2-socket	HG2-SS	10 pcs.	50 pcs.
	3-pole	HG3-socket	HG3-SS	5 pcs.	25 pcs.
	4-pole	HG4-socket	HG4-SS	5 pcs.	25 pcs.
DIN rail terminal socket	2-pole	HG2-DIN rail terminal socket	HG2-SFD	10 pcs.	50 pcs.
	3-pole	HG3-DIN rail terminal socket	HG3-SFD	5 pcs.	25 pcs.

Notes: 1. Plug-in socket: Certified by UL and CSA, DIN rail terminal socket: Certified by UL/C-UL
2. For a 4-pole relay with DIN rail terminal socket, use two 2-pole types side by side.

DIMENSIONS (mm inch)

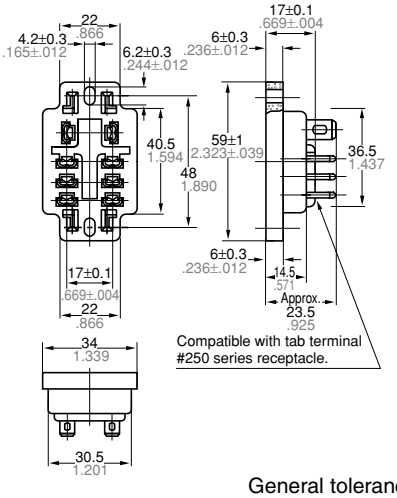
The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

1. Plug-in socket (with hold-down clip)

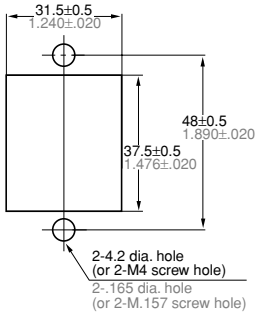
HG2-Socket (HG2-SS)

CAD Data

External dimensions



Mounting hole diagram



With a relay mounted

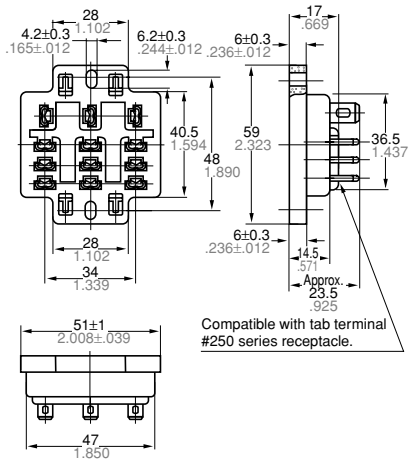
Note: Hold-down clip is packaged with the socket.

General tolerance: ±0.6 ±.024

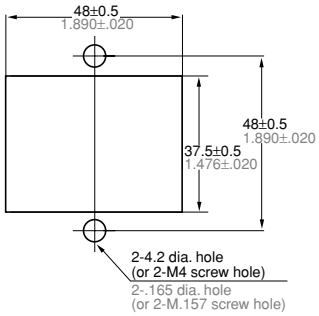
HG3-Socket (HG3-SS)

CAD Data

External dimensions



Mounting hole diagram



With a relay mounted

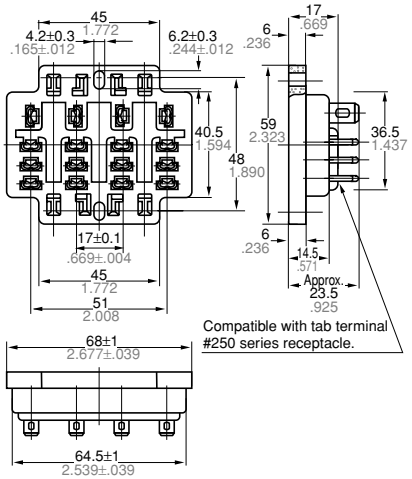
Note: Hold-down clip is packaged with the socket.

General tolerance: ±0.6 ±.024

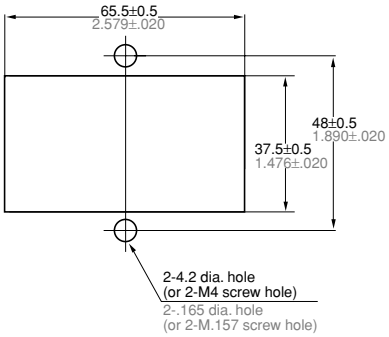
HG4-Socket (HG4-SS)

CAD Data

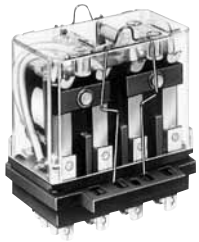
External dimensions



Mounting hole diagram



With a relay mounted



Note: Hold-down clip is packaged with the socket.

General tolerance: ±0.6 ±.024

2. DIN rail terminal socket (with hold-down clip and installation screw)

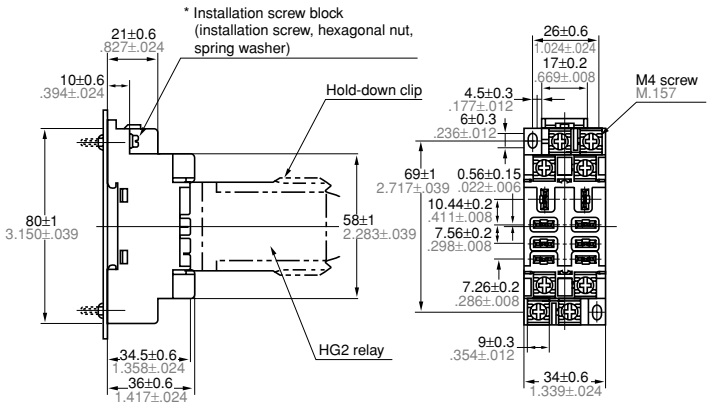
HG2-DIN rail terminal socket (HG2-SFD)

CAD Data

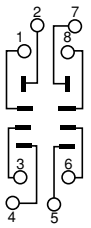
With a relay mounted

Note: Hold-down clip is packaged with the terminal socket.

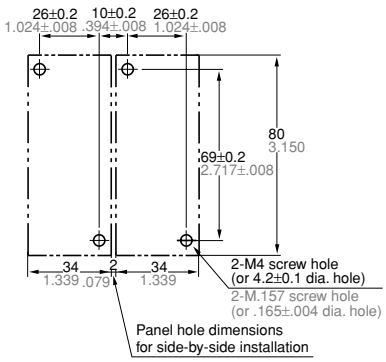
External dimensions



Schematic



Mounting hole diagram



Tolerance: ±0.1 ±.004

*For direct mounting, use the included installation screw block.

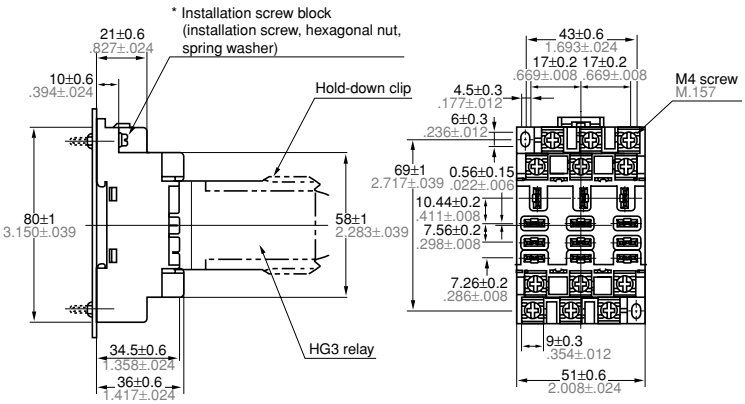
HG3-DIN rail terminal socket (HG3-SFD)

CAD Data

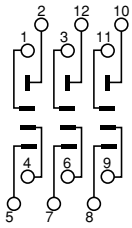
With a relay mounted

Note: Hold-down clip is packaged with the terminal socket.

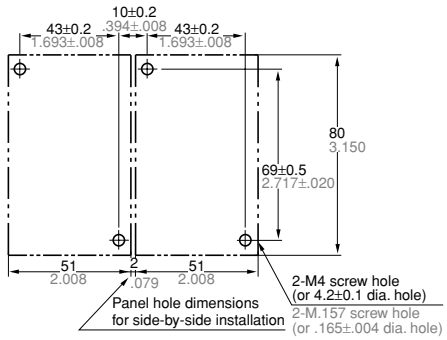
External dimensions



Schematic



Mounting hole diagram

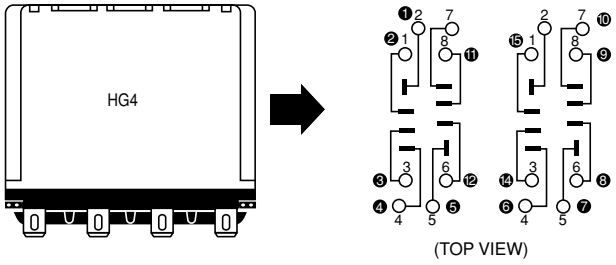


Tolerance: ±0.1 ±.004

*For direct mounting, use the included installation screw block.

With 4-pole HG relays, use two HG2-DIN rail terminal sockets side by side.

Schematic for terminal socket and relay



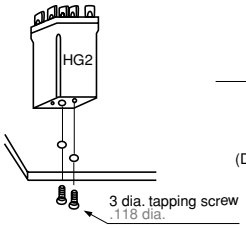
Note: The plain numbers denote the terminal socket terminal number. The white numbers in black circles denote the relay terminal number.

With a relay mounted

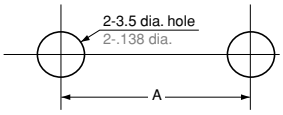
Note: Hold-down clip is packaged with the terminal socket.

OTHER WAYS TO MOUNT RELAYS

With direct mounting by cover tapping
(Tab terminal connection)
Compatible with #250 series



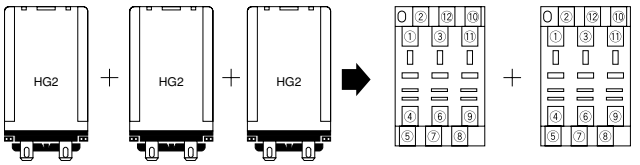
Mounting hole diagram



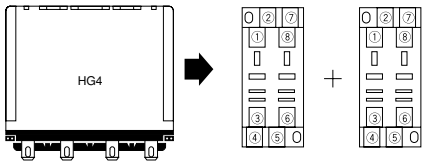
(Dimension A) HG2: 15mm .591inch
HG3: 17mm .669inch
HG4: 34mm 1.339inch

DIL RAIL TERMINAL SOCKET (SOCKET) COMBINATION

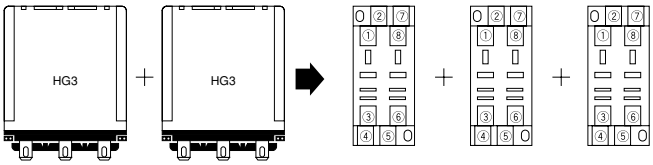
Because the pole numbers of the terminal sockets (sockets) are interchangeable, different terminal sockets (sockets) can be used in combination.



HG2 main unit + HG2 main unit + HG2 main unit → HG3 terminal socket + HG3 terminal socket



HG4 main unit → HG2 terminal socket + HG2 terminal socket



HG3 main unit + HG3 main unit → HG2 terminal socket + HG2 terminal socket + HG2 terminal socket

NOTES

1. Hold-down clip
Please use the hold-down clip whenever HG relays will be used in applications where strong vibrating or shock force occurs.

2. Mounting direction
There is no restriction on the mounting direction. However, if the mounted relay will be susceptible to strong vibrations or shocks, to avoid influence on switching operations, mount so that the direction of vibration and shock are not in line with the direction of contact switching. (In direction of contact switching operation, resistance to external shock is more than 98 m/s^2). Moreover, if the mounted relay is likely to be susceptible to strong vibrations or shocks, be sure to fit the hold-down clip.

3. Environment
Avoid use in adverse conditions, such as where there is exposure to harmful gas, or where ambient temperatures are high (more than 40°C 104°F).

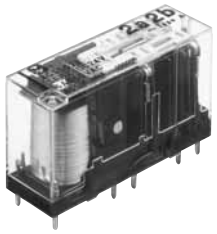
4. Do not insert or remove relays into or out of live circuits.

5. To prevent damage or distortion, when tightening fixing screws of terminal socket, the optimum torque range should be 1.176 to 1.37 N·m (12 to 14 kgf·cm).

Panasonic
ideas for life

Slim type safety relays

SF RELAYS
Slim type



Compliance with RoHS Directive

FEATURES

1. Forcibly guided contact structure
(EN50205 ClassA TÜV recognized)
2. Slim profile (mm inch)
Compact size with slim profile relay reduces substrate size.
[4-poles type] 40 (L)×13 (W)×24 (H)
1.575 (L)×.512 (W)×.945 (H)
[6-poles type] 50 (L)×13 (W)×24 (H)
1.969 (L)×.512 (W)×.945 (H)
3. Built-in LED indication type available
Built-in LED eliminates need for design and mounting of separate LED circuit. This cuts costs and saves labor.
4. Fast response time is achieved (8 ms or less).
Circuit is quickly opened to ensure safety.
5. Sockets and terminal sockets 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.

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
DC 12, 24, 48V

Note: Please consult us about other coil voltages.

TYPES

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.

* For sockets and terminal sockets, see page 135.

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

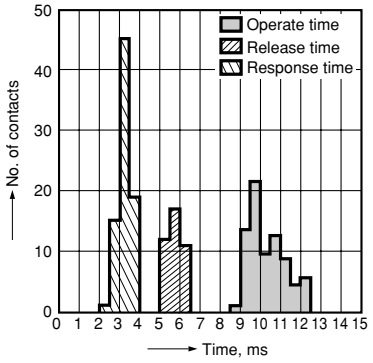
Characteristics	Item		Specifications				
			4-pole		6-pole		
Contact	Contact arrangement		2 Form A 2 Form B	3 Form A 1 Form B	4 Form A 2 Form B	5 Form A 1 Form B	3 Form A 3 Form B
	Contact resistance (Initial)		Max. 100 mΩ (By voltage drop 6 V DC 1A)				
	Contact material		Au flashed $AgSnO_2$ type				
Rating	Nominal switching capacity (resistive load)		6A 250V AC, 6A 125V 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		360mW		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) (without diode)				
	Release time (at 20°C 68°F)		Max. 20ms (Nominal coil voltage applied to the coil, excluding contact bounce time) (without diode)				
Mechanical characteristics	Shock resistance	Functional	Min. 200 m/s^2 (Half-wave pulse of sine wave: 11 ms; detection time: 10μs)				
		Destructive	Min. 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., $\cos\varphi = 0.3$)				
			[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.

REFERENCE DATA

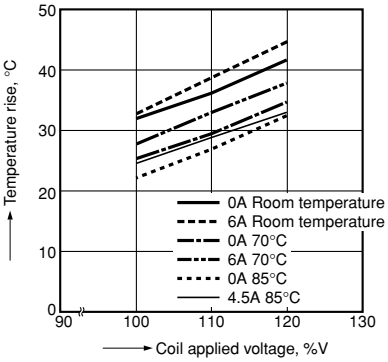
1. Operate/response/release time

Tested sample: SFS4-DC24V (4 Form A/2 Form B), 20pcs. (a contacts: 80, b contacts: 40)



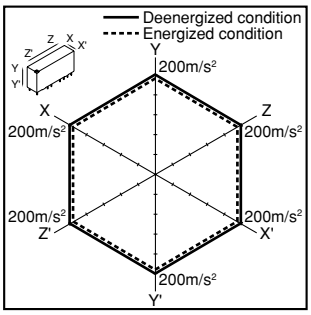
2. Coil temperature rise

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

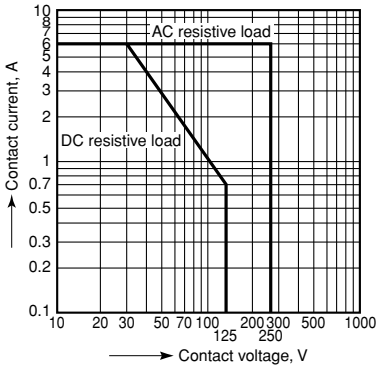


3. Malfunctional shock

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				

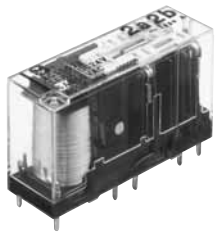
>0.5: contact gap is kept at min. 0.5 mm .020inch
Empty cells: either ON or OFF
Note: Contact gaps are shown at the initial state.
If the contact transfer is caused by load switching, it is necessary to check the actual loading.

DIMENSIONS (mm inch)

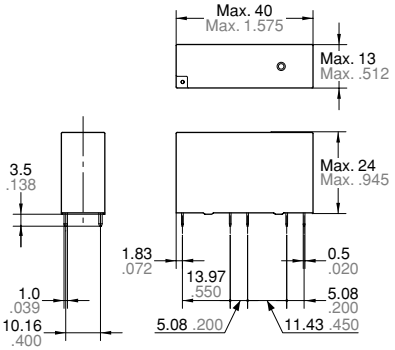
The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

1. 4-pole (2 Form A 2 Form B, 3 Form A 1 Form B)

CAD Data

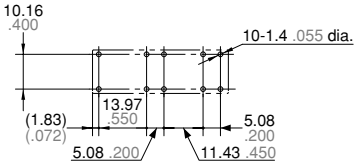


External dimensions



General tolerance: ±0.3 ±.012

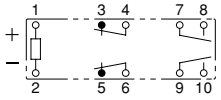
PC board pattern (Bottom view)



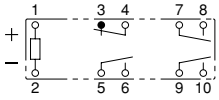
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Standard

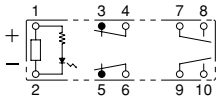


(2 Form A 2 Form B)

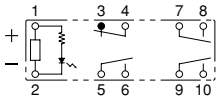


(3 Form A 1 Form B)

With LED indication



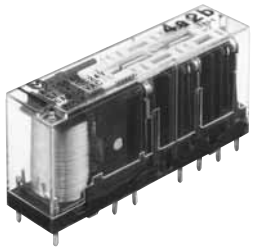
(2 Form A 2 Form B)



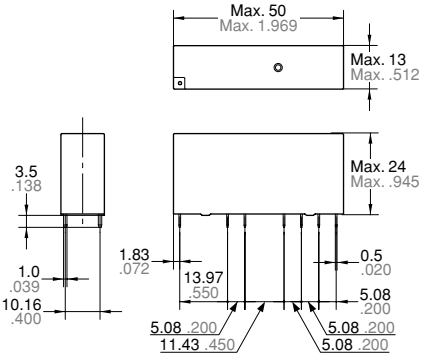
(3 Form A 1 Form B)

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

CAD Data

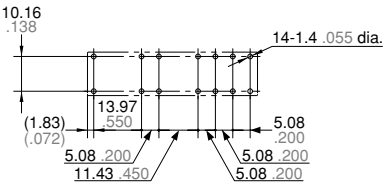


External dimensions



General tolerance: ±0.3 ±.012

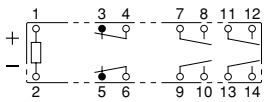
PC board pattern (Bottom view)



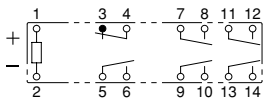
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

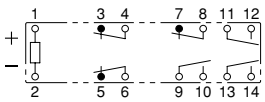
Standard



(4 Form A 2 Form B)

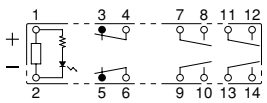


(5 Form A 1 Form B)

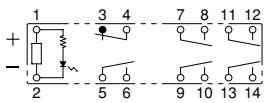


(3 Form A 3 Form B)

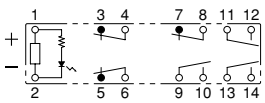
With LED indication



(4 Form A 2 Form B)



(5 Form A 1 Form B)



(3 Form A 3 Form B)

SAFETY STANDARDS

Certification authority	File No.	
UL/C-UL	E43149*	6A 277V AC, 6A 30V DC
TÜV	B 05 04 13461 054	6A 250V AC (cosϕ=1.0), 6A 250V DC (0ms), AC15: 2A 240V AC (cosϕ=1.0), DC13: 1A 24V DC (L/R 48ms)

* CSA standard: Certified by C-UL

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.

2. Coil connection

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

3. 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.

4. 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

5. Installation

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

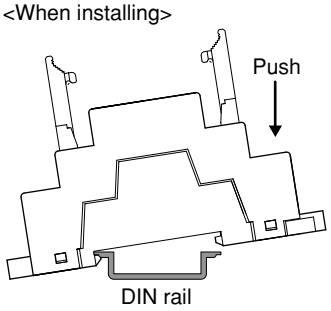
(1) When attaching directly to chassis

- Use a M3.5 screw, spring washer, and hex nut.
- For the mounting pitch, refer to the dimensions.

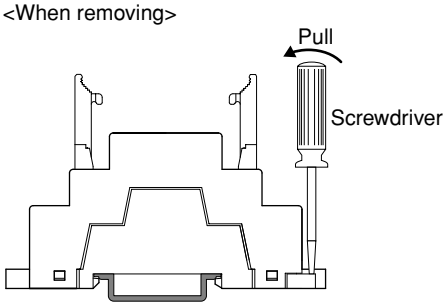
(2) When installing on a DIN rail

- Use a 35 mm 1.378 inch wide DIN rail (DIN46277).
- Install and remove as shown in the figures below.

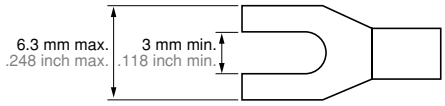
<When installing>



<When removing>



2) Refer to the figure below for applicable wire-pressed terminals.
(You cannot use round type wire-pressed terminals.)



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

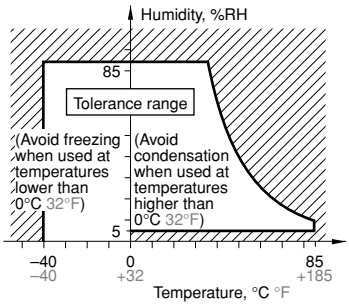
1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:

(1) Temperature:
–40 to +85°C –40 to +185°F
(When the temperature is 70 to 80°C, 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.

For Cautions for Use, see Page 21.

TYPES

Type	No. of poles	Part No.
PC board sockets	4-pole	SFS4-PS
	6-pole	SFS6-PS
DIN rail terminal socket (Finger protect type)	4-pole	SFS4-SFD
	6-pole	SFS6-SFD

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

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)

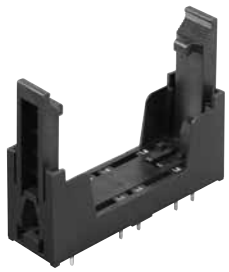
DIMENSIONS (mm inch)

The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

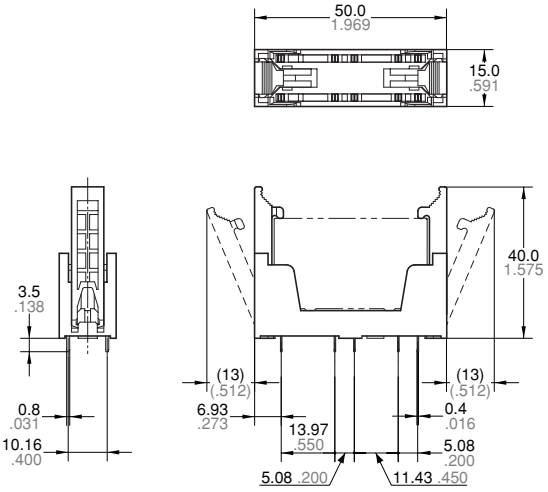
1. PC board sockets (4-pole)

(SFS4-PS)

CAD Data

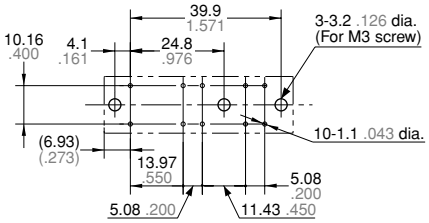


External dimensions



General tolerance: ±0.3 ±.012

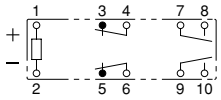
PC board pattern (Bottom view)



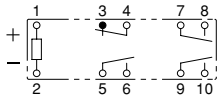
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Standard

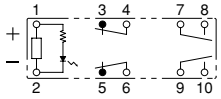


(When 2 Form A 2 Form B mounted)

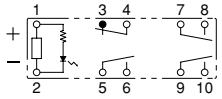


(When 3 Form A 1 Form B mounted)

With LED indication



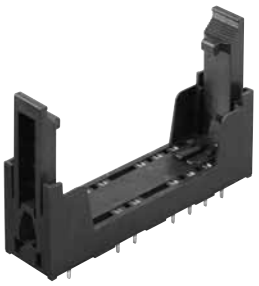
(When 2 Form A 2 Form B mounted)



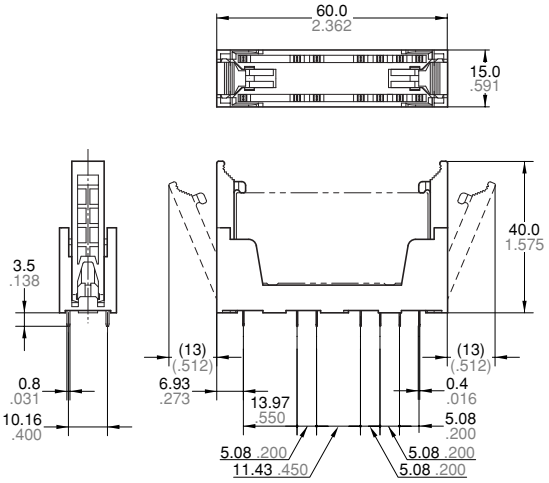
(When 3 Form A 1 Form B mounted)

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

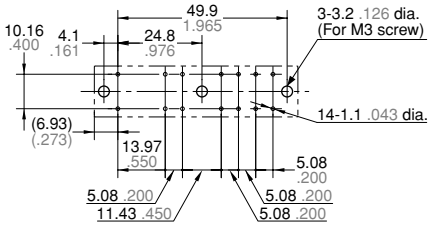
CAD Data



External dimensions



PC board pattern (Bottom view)

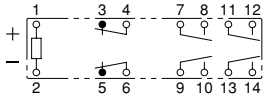


Tolerance: ±0.1 ±.004

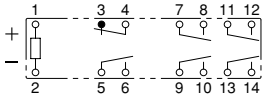
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

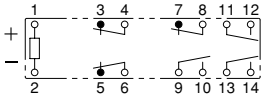
Standard



(When 4 Form A 2 Form B mounted)

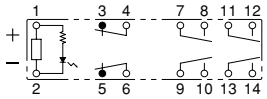


(When 5 Form A 1 Form B mounted)

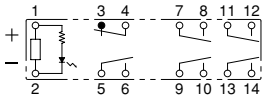


(When 3 Form A 3 Form B mounted)

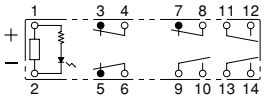
With LED indication



(When 4 Form A 2 Form B mounted)



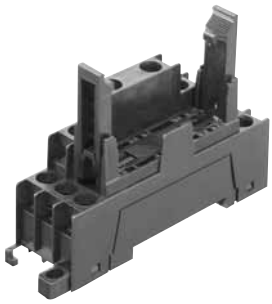
(When 5 Form A 1 Form B mounted)



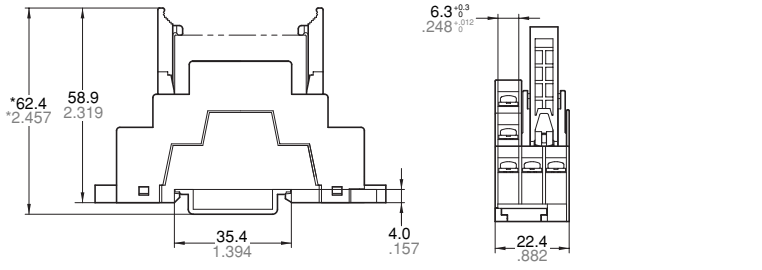
(When 3 Form A 3 Form B mounted)

3. DIN rail terminal socket (Finger protect type) (4-pole)
(SFS4-SFD)

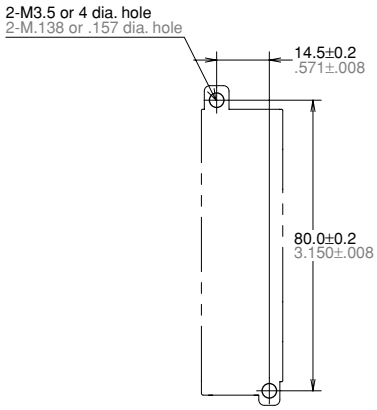
CAD Data



External dimensions

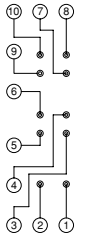


Mounting hole dimensions



Tolerance: ±0.1 ±.004

Schematic (Top view)



General tolerance: ±0.5 ±.020

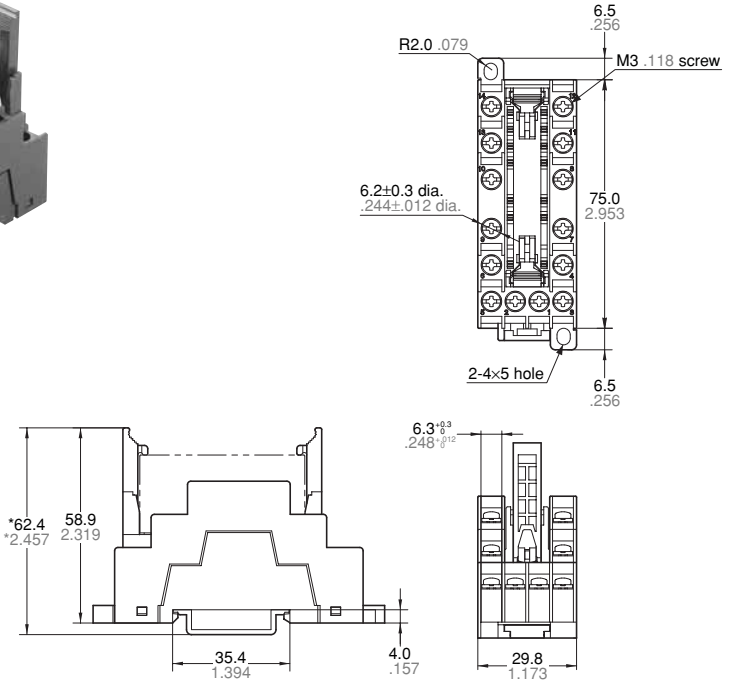
* Reference value (when using DIN rail ATA48011)

Note: Round terminals cannot be used with DIN terminal sockets.

4. DIN rail terminal socket (Finger protect type) (6-pole)
(SFS6-SFD)

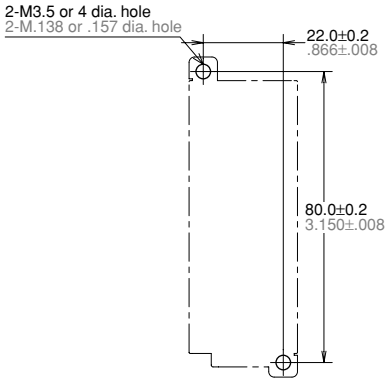
CAD Data

External dimensions



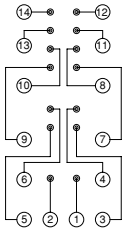
General tolerance: ±0.5 ±.020

Mounting hole dimensions



Tolerance: ±0.1 ±.004

Schematic (Top view)



* Reference value (when using DIN rail ATA48011)

Note: Round terminals cannot be used with DIN terminal sockets.

Panasonic
ideas for life

Flat type safety relays

SF RELAYS

Compliance with RoHS Directive

FEATURES

1. Forced operation contacts
N.O. and N.C. side contacts are connected through a card so that one interacts with the other in movement. In case of a contact welding, the other keeps a min. 0.5mm .020inch contact gap.

2. Separated chamber structure
N.O. and N.C. side contacts are put in each own space surrounded with a card and a body-separater. That prevents short circuit between contacts, which is caused by their springs welding or damaged.

3. Contact arrangement of 3 Form A 1 Form B
Enables various forms of control circuit.

4. High breakdown voltage
High breakdown voltage 2,500 Vrms (between contact sets/ between contact and coil)

5. High sensitivity
Realizes thin shape and high sensitivity (500mW nominal operating power) by utilizing high-efficiency polarized magnetic circuit with 4-gap balanced armature.

6. Complies with safety standards
Standard products are UL, CSA, TÜV and SEV certified. Conform to European standards. TÜV certified. Complies with SUVA European standard.

TYPICAL APPLICATIONS

1. Industrial equipment such as presses and machine tools
2. Elevators and other kinds of hoisting mechanisms, conveyor equipment.

ORDERING INFORMATION

SF 3 - ☐

Contact arrangement
3: 3 Form A 1 Form B

Nominal coil voltage
DC 5, 12, 24, 48, 60V

TYPES

Contact arrangement	Nominal coil voltage	Part No.
3 Form A 1 Form B	5V DC	SF3-DC5V
	12V DC	SF3-DC12V
	24V DC	SF3-DC24V
	48V DC	SF3-DC48V
	60V DC	SF3-DC60V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

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 coil 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)
3 Form A 1 Form B	5V DC	80%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	100mA	50Ω	500mW	120%V of nominal voltage
	12V DC			41.7mA	288Ω		
	24V DC			20.8mA	1,152Ω		
	48V DC			10.4mA	4,608Ω		
	60V DC			8.3mA	7,200Ω		

2. Specifications

Characteristics	Item		Specifications
Contact	Arrangement		3 Form A 1 Form B
	Contact resistance (Initial)		Max. 30 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, 30V DC
	Max. switching current		6A
	Nominal operating power		500mW
	Min. switching capacity (Reference value)*1		100mA 5V DC
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	2,500 Vrms for 1min. (Detection current: 10mA)
		Between contact sets	2,500 Vrms for 1min. (Detection current: 10mA)
		Between contact and coil	2,500 Vrms for 1min. (Detection current: 10mA)
	Temperature rise (coil)		Max. 45°C 113°F (By resistive method, nominal voltage applied to the coil; contact carrying current: 6A)
	Surge breakdown voltage (between contact and coil)		—
	Operate time		Max. 30ms (Nominal voltage applied to the coil, excluding contact bounce time.)
	Release time		Max. 15ms (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)
Mechanical characteristics	Shock resistance	Functional	Min. 294 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs)
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms)
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 2 mm (Detection time: 10μs)
		Destructive	10 to 55 Hz at double amplitude of 2 mm
Expected life	Mechanical		Min. 10^7: (at 180 times/min.)
	Electrical		Min. 3×10^4 (at 20 times/min.)*2
Conditions	Conditions for operation, transport and storage*3		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)
	Max. Operating speed		180 times/min.
Unit weight			38g 1.34oz

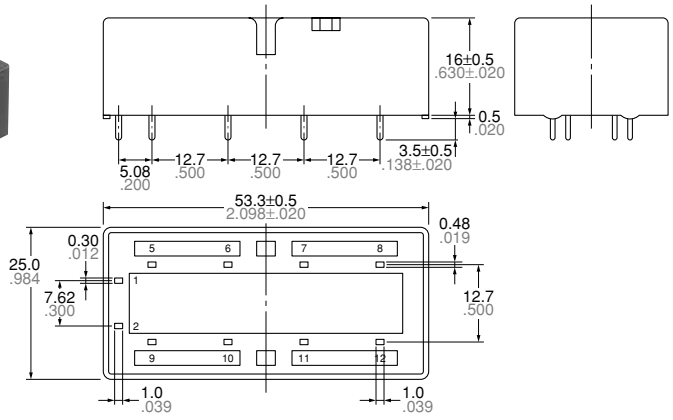
Notes: *1. This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*2. More than 10^5 operations when applying the nominal switching capacity to one side of contact pairs of each Form A contact and Form B contact
*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.

DIMENSIONS (mm inch)

The CAD data of the products with a **CAD Data** mark can be downloaded from: http://panasonic-electric-works.net/ac

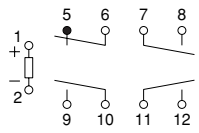
CAD Data

External dimensions

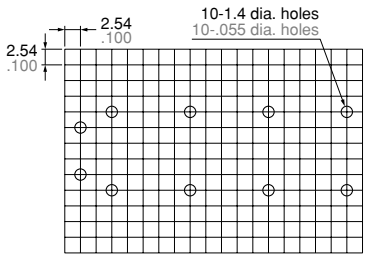


General tolerance: ±0.3 ±.012

Schematic (Bottom view)



PC board pattern (Bottom view)



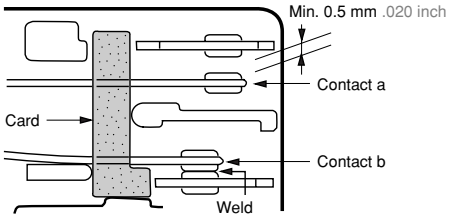
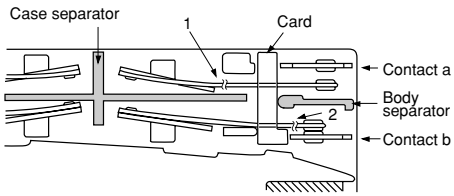
Tolerance: ±0.1 ±.004

SAFETY STANDARDS

UL/C-UL (Recognized)		CSA (Certified)		TÜV (Certified)		SEV	
File No.	Contact rating	File No.	Contact rating	File No.	Rating	File No.	Contact rating
E43149	6A 250V AC	LR26550 etc.	6A 250V AC	R9919003 (SF3)	6A 250V AC	97.1 10376 99.1 10197.01	6A 250V AC

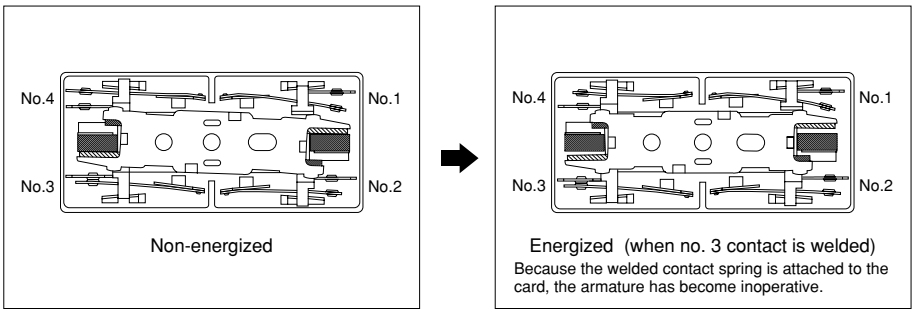
SAFETY STRUCTURE OF SF RELAYS

This SF relay design ensures that subsequent operations shut down and can automatically return to a safe state when the SF relay suffers overloading and other circuit abnormalities (unforeseen externally caused circuit or device breakdowns, end of life incidents, and noise, surge, and environmental influences) owing to contact welding, spring fusion or, in the worst-case scenario, relay breakdown (coil rupture, faulty operation, faulty return, and fatigue and breakage of the operating spring and return spring), and even in the event of end of life.

	Structure	Operation
1. Forced operation method (3 Form A 1 Form B types)	 The two contacts “a” and “b” are coupled with the same card. The operation of each contact is regulated by the movement of the other contact.	Even when one contact is welded closed, the other maintains a gap of greater than 0.5 mm .020 inch. In the diagram on the left, the lower contact “b” have welded but the upper contact “a” maintain at a gap of greater than 0.5 mm .020 inch. Subsequent contact movement is suspended and the weld can be detected
2. Separate chamber method (3 Form A 1 Form B types)	 In independent chambers, the contacts “a” and “b” are kept apart by a body/case separator or by the card itself.	Prevents shorting and fusing of springs and spring failure owing to short-circuit current. As shown on the diagram on the left, even if the operating springs numbered 1 and 2 there is no shorting between “a” and “b” contacts.
3. 3 Form A 1 Form B contact	Structure with independent COM contact of (3 Form A 1 Form B), contacts.	Independent COM enables differing pole circuit configurations. This makes it possible to design various kinds of control circuits and safety circuits.

Form “b” Contact Weld

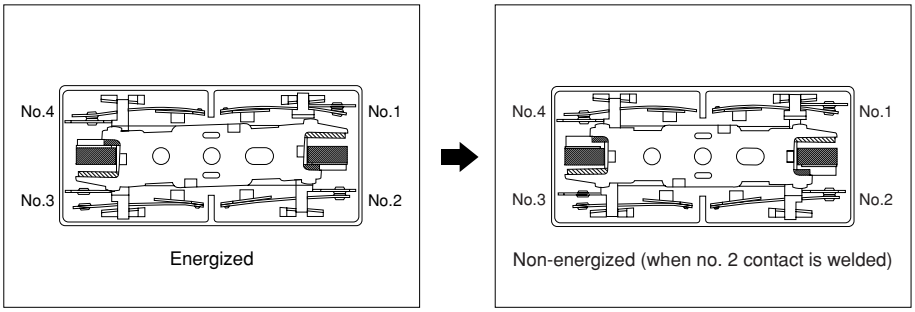
If the form “b” contact (No. 3) welds, the armature becomes non-operational, the contact gaps at the three form “a” contacts are maintained at greater than 0.5 mm .020 inch. Reliable isolation is thus ensured.



If the No. 3 contact welds.
Each of the three form “a” contacts (No. 1, 2, and 4) maintain a gap of greater than 0.5 mm .020 inch.

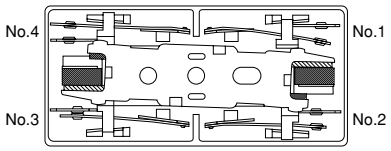
Form “a” Contact Weld

When the form “a” contacts (No. 1, 2, or 4) weld, the armature remains in a non-returned state and the contact gap at the single form “b” contact is maintained at greater than 0.5 mm .020 inch. Reliable isolation is thus ensured.



If the No. 2 contact welds.
The single form “b” contact (No. 3) maintains a gap of greater than 0.5 mm .020 inch.

Contact Operation Table



Contact No.	No.1	No.2	No.3	No.4
Terminal No.	11–12	7–8	5–6	9–10

The table below shows the state of the other contacts when the current through the welded form “a” contact is 0 V and the rated voltage is applied through the form “b” contact.

		State of other contacts			
		1	2	3	4
Welded terminal No.	1			>0.5	
	2			>0.5	
	3	>0.5	>0.5		>0.5
	4			>0.5	

* Contact gaps are shown at the initial state.
If the contacts change state owing to loading/breaking it is necessary to check the actual loading.

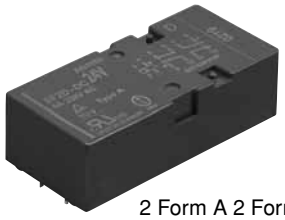
>0.5: contact gap is kept at min. 0.5 mm .020 inch
Empty cells: either closed or open

For Cautions for Use, see Page 21.

Panasonic
ideas for life

Flat type safety relays (double contact)

SF RELAYS
Double contact type



2 Form A 2 Form B

4 Form A 4 Form B

FEATURES

1. High contact reliability
High contact reliability is achieved through the use of a double contact.

2. Forced operation contacts
N.O. and N.C. side contacts are connected through a card so that one interacts with the other in movement. In case of a contact welding, the other keeps a min. 0.5mm .020inch contact gap.

3. Independent operation contacts (4 Form A 4 Form B)
There are 4 points of forced operation contacts.
Each pair of contacts is free from the main armature and is independent from each other. So if a N.O. pair of contacts are welded, the other 3 N.O. contacts are not effected (operate properly) That enables to plan a circuit to detect welding or go back to the beginning condition.

4. Separated chamber structure
N.O. and N.C. side contacts are put in each own space surrounded with a card and a body-separater. That prevents short circuit between contacts, which is caused by their springs welding or damaged.

5. High breakdown voltage
High breakdown voltage 2,500 Vrms between contacts and coil.

6. High sensitivity
Realizes thin shape and high sensitivity (500 mW nominal operating power) by utilizing high-efficiency polarized magnetic circuit with 4-gap balanced armature.

7. Complies with safety standards
Standard products are UL, CSA, TÜV and SEV certified. Conform to European standards. TÜV certified. Complies with SUVA European standard.

TYPICAL APPLICATIONS

1. Industrial equipment such as presses and machine tools
2. Elevators and other kinds of hoisting mechanisms, conveyor equipment.

Compliance with RoHS Directive

ORDERING INFORMATION

SF [ ] [D] - [ ]

Contact arrangement
2: 2 Form A 2 Form B
4: 4 Form A 4 Form B

Nominal coil voltage
DC 5, 12, 24, 48, 60V

Note: Certified by UL, CSA, TÜV and SEV

TYPES

Contact arrangement	Nominal coil voltage	Part No.
2 Form A 2 Form B	5V DC	SF2D-DC5V
	12V DC	SF2D-DC12V
	24V DC	SF2D-DC24V
	48V DC	SF2D-DC48V
	60V DC	SF2D-DC60V
4 Form A 4 Form B	5V DC	SF4D-DC5V
	12V DC	SF4D-DC12V
	24V DC	SF4D-DC24V
	48V DC	SF4D-DC48V
	60V DC	SF4D-DC60V

Standard packing: Carton: 20 pcs.; Case: 200 pcs.

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 coil 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)
2 Form A 2 Form B	5V DC	75%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	100mA	50Ω	500mW	120%V of nominal voltage
	12V DC			41.7mA	288Ω		
	24V DC			20.8mA	1,152Ω		
	48V DC			10.4mA	4,608Ω		
	60V DC			8.3mA	7,200Ω		
4 Form A 4 Form B	5V DC	75%V or less of nominal voltage (Initial)	15%V or more of nominal voltage (Initial)	100mA	50Ω	500mW	
	12V DC			41.7mA	288Ω		
	24V DC			20.8mA	1,152Ω		
	48V DC			10.4mA	4,608Ω		
	60V DC			8.3mA	7,200Ω		

2. Specifications

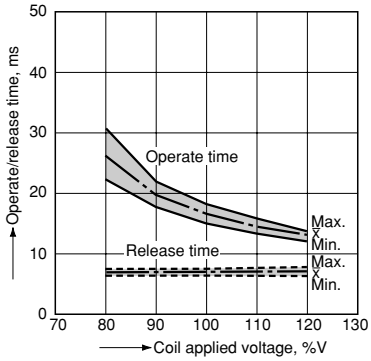
Characteristics	Item		Specifications	
Contact	Arrangement		2 Form A 2 Form B	4 Form A 4 Form B
	Contact resistance (Initial)		Max. 30 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		Au-flashed $AgSnO_2$ type	
Rating	Nominal switching capacity (resistive load)		6A 250V AC, 6A 30V DC	
	Max. switching power (resistive load)		1,500VA 180W	
	Max. switching voltage		440V AC, 30V DC	
	Max. switching current		6A	
	Nominal operating power		500mW	
	Min. switching capacity (Reference value)*1		100mA 5V DC	
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	1,300 Vrms for 1min. (Detection current: 10mA)	
		Between contact sets	2,500 Vrms for 1min. (Detection current: 10mA)	
		Between contact and coil	2,500 Vrms for 1min. (Detection current: 10mA)	
	Temperature rise (coil) (at 20° 68°F)		Max. 45°C 113°F (By resistive method, nominal voltage applied to the coil; contact carrying current: 6A)	
	Operate time		Max. 30ms (Nominal voltage applied to the coil, excluding contact bounce time.)	
	Release time		Max. 15ms (Nominal voltage applied to the coil, excluding contact bounce time.) (without diode)	
Mechanical characteristics	Shock resistance	Functional	Min. 294 m/s² (Half-wave pulse of sine wave: 11 ms; detection time: 10μs)	
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 2 mm (Detection time: 10μs)	
		Destructive	10 to 55 Hz at double amplitude of 2 mm	
Expected life	Mechanical		Min. 10^7 (at 180 times/min.)	
	Electrical		Min. 10^5 (at 20 times/min.)	
Conditions	Conditions for operation, transport and storage*2		Ambient temperature: –40°C to +70°C –40°F to +158°F Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)	
	Max. Operating speed		180 times/min.	
Unit weight			Approx. 38g 1.34oz	Approx. 47g 1.66oz

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.

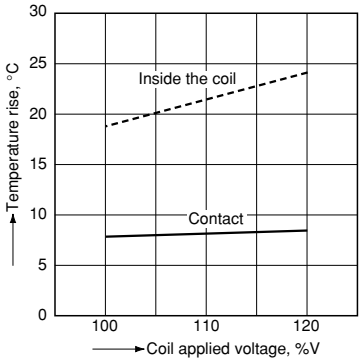
*2. The upper limit of the ambient temperature is the maximum temperature that can satisfy the coil temperature rise value. Refer to Usage, transport and storage conditions in NOTES.

REFERENCE DATA

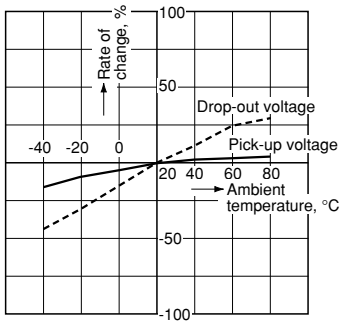
1. Operate/release time (without diode)
Tested sample: SF2D-DC24V (2 Form A 2 Form B)
Quantity: n = 20



2. Temperature rise
Tested sample: SF4D-DC24V (4 Form A 4 Form B)
Quantity: n = 6
Coil applied voltage: 100%V, 120%V
Contact carry current: 6A



3. Ambient temperature characteristics
Tested sample: SF4D-DC24V (4 Form A 4 Form B)
Quantity: n = 6



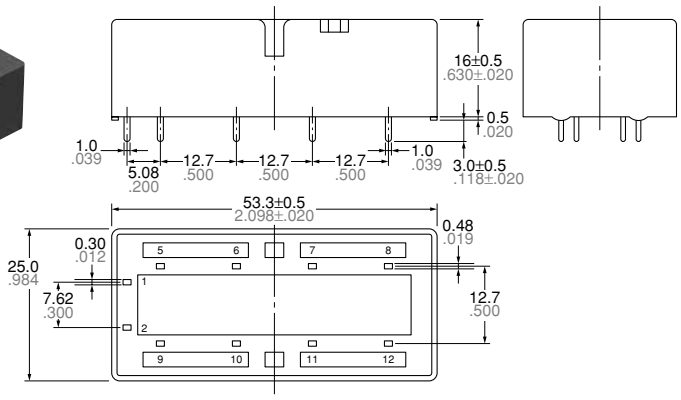
DIMENSIONS (mm inch)

The CAD data of the products with a CAD Data mark can be downloaded from: http://panasonic-electric-works.net/ac

1. 2 Form A 2 Form B

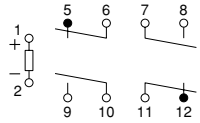
CAD Data

External dimensions

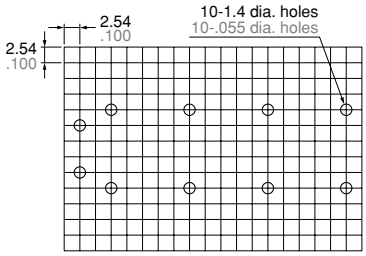


General tolerance: ±0.3 ±.012

Schematic (Bottom view)



PC board pattern (Bottom view)

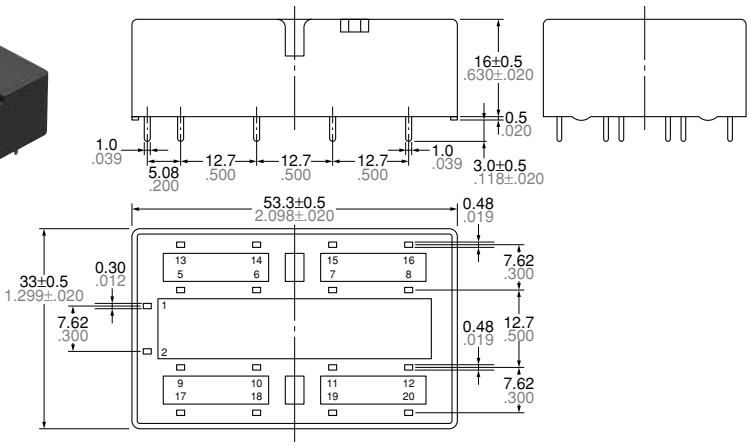


Tolerance: ±0.1 ±.004

2. 4 Form A 4 Form B

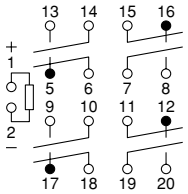
CAD Data

External dimensions

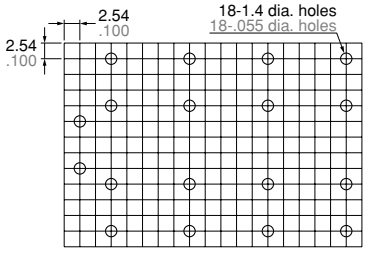


General tolerance: ±0.3 ±.012

Schematic (Bottom view)



PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

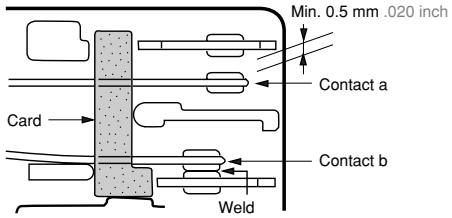
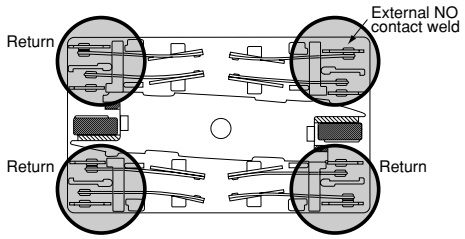
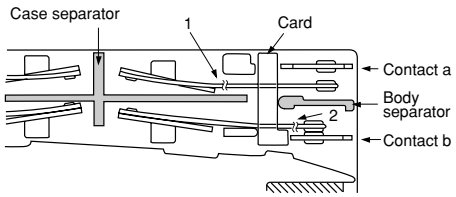
SAFETY STANDARDS

UL/C-UL (Recognized)		TÜV (Certified)		SEV	
File No.	Contact rating	File No.	Rating	File No.	Contact rating
E120782*	6A 250V AC 6A 24V DC	968 EZ 116.00 01 (SF2D) 968 EZ 113.00 01 (SF4D)	8A 24V DC 6A 230V AC	01, 1851	6A 230V AC 6A 24V DC

* CSA standard: Certified by C-UL

SAFETY STRUCTURE OF SF RELAYS

This SF relay design ensures that subsequent operations shut down and can automatically return to a safe state when the SF relay suffers overloading and other circuit abnormalities (unforeseen externally caused circuit or device breakdowns, end of life incidents, and noise, surge, and environmental influences) owing to contact welding, spring fusion or, in the worst-case scenario, relay breakdown (coil rupture, faulty operation, faulty return, and fatigue and breakage of the operating spring and return spring), and even in the event of end of life.

	Structure	Operation
1. Forced operation method (2 Form A 2 Form B, 4 Form A 4 Form B types)	 The two contacts “a” and “b” are coupled with the same card. The operation of each contact is regulated by the movement of the other contact.	Even when one contact is welded closed, the other maintains a gap of greater than 0.5 mm .020 inch. In the diagram on the left, the lower contact “b” have welded but the upper contact “a” maintain at a gap of greater than 0.5 mm .020 inch. Subsequent contact movement is suspended and the weld can be detected
2. Independent operation method (4 Form A 4 Form B type)	 None of four contacts are held in position by the armature. Even though one of the external N.O. contacts has welded, the other three contacts have returned owing to the de-energizing of the coil.	Enables design of safety circuits that allow weld detection and return at an early stage. As shown at the top right of the diagram on the left, if the external N.O. contact welds, a 0.5 mm .020 inch gap is maintained. Each of the other contacts returns to N.O. because the coil is no longer energized.
3. Separate chamber method (2 Form A 2 Form B, 4 Form A 4 Form B types)	 In independent chambers, the contacts “a” and “b” are kept apart by a body/case separator or by the card itself.	Prevents shorting and fusing of springs and spring failure owing to short-circuit current. As shown on the diagram on the left, even if the operating springs numbered 1 and 2 there is no shorting between “a” and “b” contacts.
4. 2 Form A 2 Form B contact 4 Form A 4 Form B contact	Structure with independent COM contact of 2 Form A 2 Form B and 4 Form A 4 Form B contacts.	Independent COM enables differing pole circuit configurations. This makes it possible to design various kinds of control circuits and safety circuits.

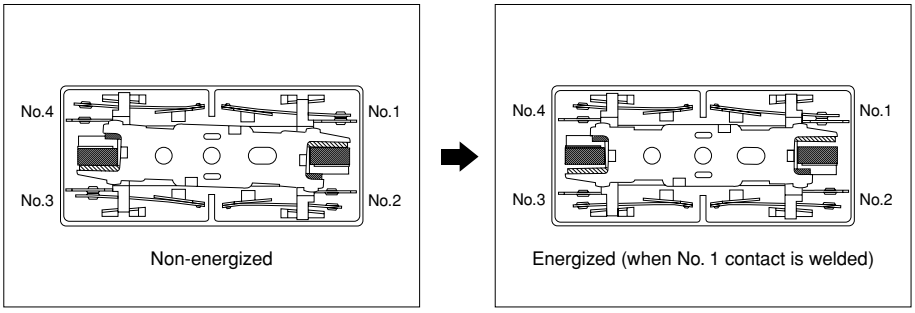
THE OPERATION OF SF RELAYS (when contacts are welded)

SF relays work to maintain a normal operating state even when the contact welding occur by overloading or short-circuit currents. It is easy to make weld detection circuits and safety circuits in the design to ensure safety even if contacts weld.

1) 2 Form A 2 Form B type

Form “b” Contact Weld

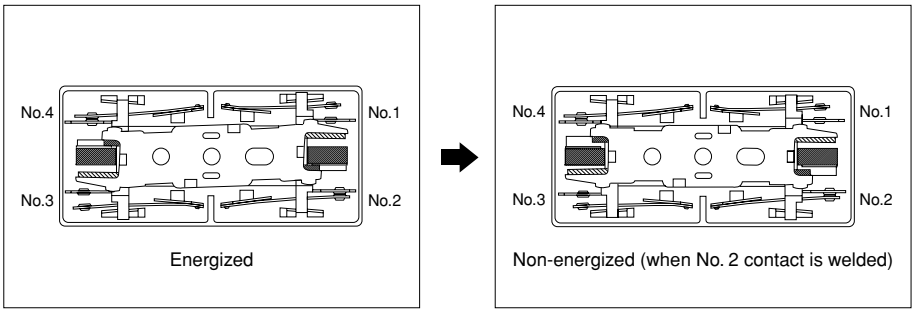
If the form “b” contact (No. 1 and 3) welds, the armature becomes non-operational, the contact gaps at the three form “a” contacts are maintained at greater than 0.5 mm .020 inch. Reliable isolation is thus ensured.



Example: If the No. 1 contact welds
Each of the three form “a” contacts (No. 2 and 4) maintain a gap of greater than 0.5 mm .020 inch.

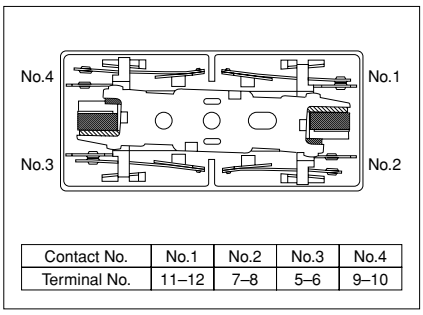
Form “a” Contact Weld

When the form “a” contacts (No. 2 or 4) weld, the armature remains in a non-returned state and the contact gap at the two form “b” contact is maintained at greater than 0.5 mm .020 inch. Reliable isolation is thus ensured.



Example: If the No. 2 contact welds.
The two form “b” contact (No. 1 or 3) maintains a gap of greater than 0.5 mm .020 inch.

Contact Operation Table



Contact No.	No.1	No.2	No.3	No.4
Terminal No.	11–12	7–8	5–6	9–10

The table below shows the state of the other contacts when the current through the welded form “a” contact is 0 V and the rated voltage is applied through the form “b” contact.

Welded terminal No.	State of other contacts: 1	2	3	4
1		>0.5		>0.5
2	>0.5		>0.5	
3		>0.5		>0.5
4	>0.5		>0.5	

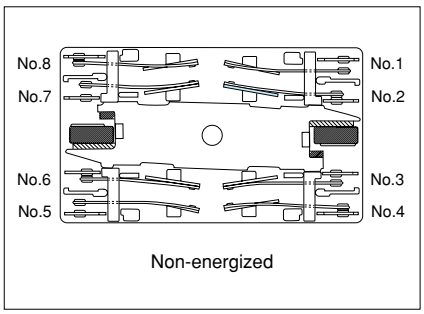
>0.5: contact gap is kept at min. 0.5 mm .020 inch
Empty cells: either closed or open

* Contact gaps are shown at the initial state.
If the contacts change state owing to loading/breaking it is necessary to check the actual loading.

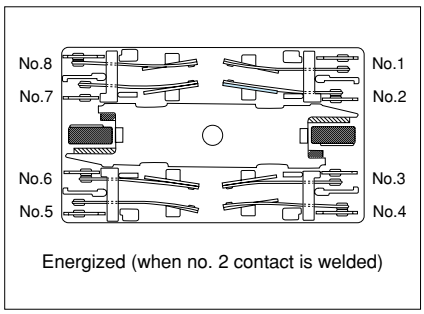
2) 4 Form A 4 Form B type

Internal Contacts Weld

When internal contacts (No. 2, No. 3, No. 6 or No. 7) are welded, the armature becomes non-operational and the four form “a” contact gaps are maintained at 0.5 mm .020inch or greater. Reliable cut-off is thus ensured.



Non-energized

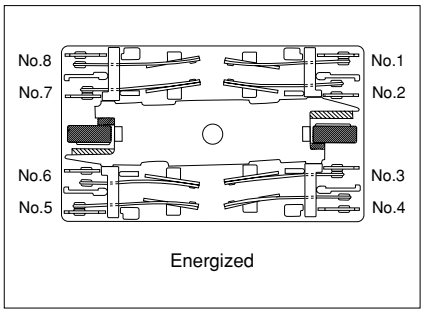


Energized (when no. 2 contact is welded)

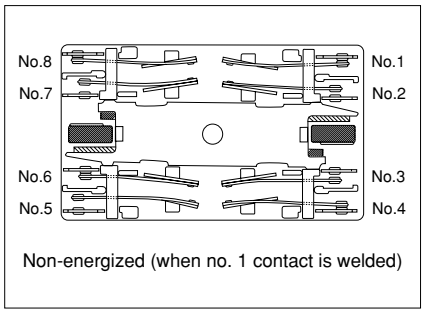
Example: If the No. 2 contact welds.
Each of the four form “a” contacts (No. 1, 3, 5, and 7) maintains a gap of greater than 0.5 mm .020 inch.

External Contacts Weld

When external contacts (No. 1, No. 4, No. 5 or No. 8) are welded, gaps of 0.5 mm .020inch and greater are maintained between adjacent contacts and other contacts operate normally by the coil being non-energized.



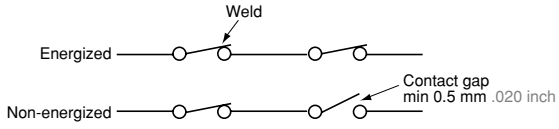
Energized



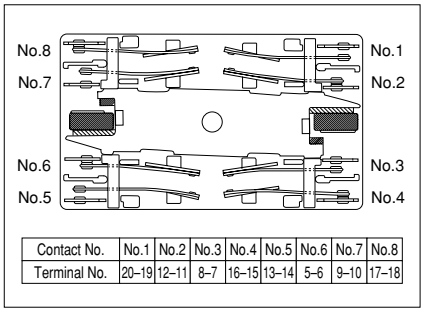
Non-energized (when no. 1 contact is welded)

Example 1: If the No. 1 contact welds.
The adjacent No. 2 contact maintains a gap of greater than 0.5 mm .020 inch. The other contacts, because the coil is not energized, return to their normal return state; each of form “a” contacts (No. 3, 5, and 7) maintains a contact gap of greater than 0.5 mm .020 inch; each of the form “b” contacts (No. 4, 6, and 8) return to a closed state.

Example 2:
If external connections are made in series.
Even if one of the contacts welds, the other contacts operate independently and the contact gaps are maintained at greater than 0.5 mm .020 inch.



Contact Operation Table



Contact No.	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8
Terminal No.	20–19	12–11	8–7	16–15	13–14	5–6	9–10	17–18

The table below shows the state of the other contacts when the current through the welded form “a” contact is 0 V and the rated voltage is applied through the form “b” contact.

Contact No. / Contact No.		State of other contacts							
		1	2	3	4	5	6	7	8
Welded terminal No.	1		>0.5	>0.5	≠	>0.5	≠	>0.5	≠
	2	>0.5		>0.5		>0.5		>0.5	
	3		>0.5		>0.5		>0.5		>0.5
	4	≠	>0.5	>0.5		≠	>0.5	≠	>0.5
	5	>0.5	≠	>0.5	≠		>0.5	>0.5	≠
	6	>0.5		>0.5		>0.5		>0.5	
	7		>0.5		>0.5		>0.5		>0.5
	8	>0.5	>0.5	≠	>0.5	≠	>0.5	>0.5	

>0.5: contact gap is kept at min. 0.5 mm .020 inch
≠: contact closed
Empty cells:
either closed or open

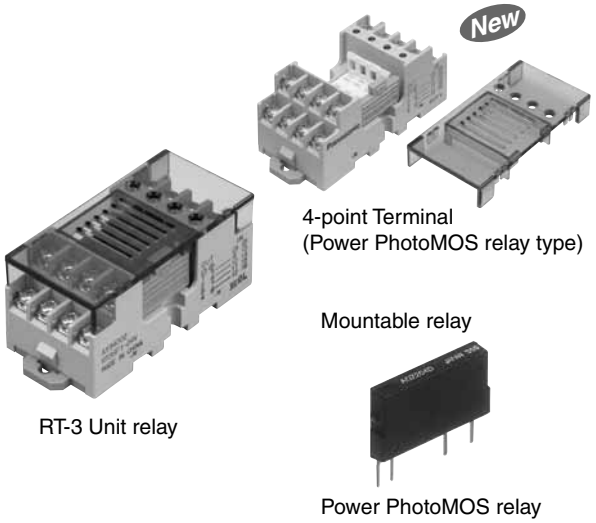
* Contact gaps are shown at the initial state.
If the contacts change state owing to loading/breaking it is necessary to check the actual loading.

For Cautions for Use, see Page 21.

Panasonic
ideas for life

Slim, Space-saving, 4-point Unit Relay

RT-3 UNIT RELAY 4-POINT TERMINAL
(Power PhotoMOS Relay type)



FEATURES

1. Space-saving type with four independent points on a base measuring 33 × 67 mm 1.299 × 2.638 inch. Contributes to a more compact control panel.

2. Power PhotoMOS relays, for high reliability and long life, are installed.

This type is equipped with Power PhotoMOS relays which have a reputation for high reliability and long life. Helps make devices maintenance-free.

3. Can be mounted on a DIN rail or mounted directly (by screws).

4. Equipped with an LED display to allow easy confirmation of operation.

5. Possible to select relay for use in the 4-point terminal in accordance with load.

Compliance with RoHS Directive

TYPES

1. RT-3 Unit relay

Contact arrangement	Type	Rated input voltage	Part No.
1 Form A × 4	DC only (Equipped with AQZ102)	12 V DC	RT3SP1-12V
		24 V DC	RT3SP1-24V
	AC/DC dual use (Equipped with AQZ204)	12 V DC	RT3SP2-12V
		24 V DC	RT3SP2-24V

Standard packing: Carton: 1 pc.; Case: 20 pcs.

Notes: 1. Only for use with Power PhotoMOS standard type relays. Cannot be equipped with PA relays.
2. Please inquire other contact arrangement.

2. 4-point Terminal

Type	Rated input voltage	Part No.
New Power PhotoMOS relay type	12 V DC	RT3BB12V
	24 V DC	RT3BB24V

Standard packing: Carton: 1 pc.; Case: 20 pcs.

3. Mountable relays for 4-point Terminal (per relay, at 25°C 77°F, initial)

Possible relays		Output			
Type	Part No.	Maximum load voltage	Recommended load voltage	Continuous load current	Peak load current
Power PhotoMOS Relay (DC only)	AQZ102	60V DC	0 to 30V DC	2.00A	9.0A
	AQZ105	100V DC	0 to 50V DC	1.50A	6.0A
	AQZ107	200V DC	0 to 100V DC	0.70A	3.0A
	AQZ104	400V DC	0 to 200V DC	0.40A	1.5A
Power PhotoMOS Relay (AC/DC dual use)	AQZ202	60V (peak)	0 to 12V AC/0 to 30V DC	1.80A	9.0A
	AQZ205	100V (peak)	0 to 24V AC/0 to 50V DC	1.20A	6.0A
	AQZ207	200V (peak)	0 to 48V AC/0 to 100V DC	0.60A	3.0A
	AQZ204	400V (peak)	0 to 125V AC/0 to 200V DC	0.30A	1.5A
	AQZ404 (1 Form B type)	400V (peak)	0 to 125V AC/0 to 200V DC	0.30A	1.5A

Notes: 1. Peak load current is limited to "100 ms, 1 shot".
2. The ratings per point in the table above also apply during 4-point simultaneous operation.
3. Please use a load current that is within the range of the data given below in "REFERENCE DATA 2. Load current vs. ambient temperature characteristics".
4. Be very careful regarding the polarity on the output side when equipped with AQZ10* (dedicated power PhotoMOS DC type).
5. Never equip a product with a relay other than those given above. Doing so can cause product malfunction, breakdown, and breakdown of connected devices.

RATING

1. Input ratings (per relay)

Part No.	Rated input voltage	Operate voltage (at 25°C 77°F)	Release voltage (at 25°C 77°F)	Input current (during application of rated input voltage) (at 25°C 77°F)	Allowable variation of rated input voltage (at –20°C to +55°C –4°F to +131°F)
RT3SP1-12V	12 V DC	Max. 9.5 V DC (5.1 V typ.)	Min. 3.0 V DC (5.0 V typ.)	6.2 mA typ.	90% to 110% of rated input voltage
RT3SP2-12V					
RT3SP1-24V	24 V DC	Max. 15.0 V DC (6.8 V typ.)	Min. 3.5 V DC (6.5 V typ.)	6.7 mA typ.	
RT3SP2-24V					

Note: This product has a built-in input current limiting resistor; therefore, it is not necessary to externally connect a resistor to the input. The input voltage can be applied directly.

2. Output ratings (per relay, at 25°C 77°F)

Part No.	Equipped relay	Maximum load voltage	Recommended voltage	Continuous load current	Peak load currant
RT3SP1-12V	AQZ102 (DC only)	60 V (DC)	0 to 30 V (DC)	2 A (DC)	9 A (100 ms 1 shot)
RT3SP1-24V					
RT3SP2-12V	AQZ204 (AC/DC dual use)	400 V (DC, AC peak value)	0 to 200 V (DC) 0 to 125 V (AC)	0.3 A (DC, AC peak value)	1.5 A (100 ms 1 shot)
RT3SP2-24V					

Notes: 1. During 4-point simultaneous operation, the rating per point is also as shown above.
2. The load current varies depending on ambient temperature. Refer to the "REFERENCE DATA 2. Load current vs. ambient temperature characteristics".

SPECIFICATIONS

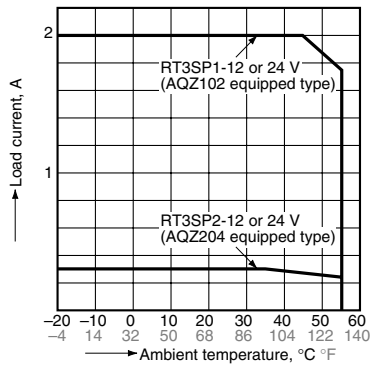
Item		Specifications
Breakdown voltage	Between input and output	2,000 Vrms for 1 min.
	Between different terminals (between relays, both ways)	1,500 Vrms for 1 min.
Insulation resistance		Min. 100 MΩ (Using 500 V DC megger, Measurement at same location as "Breakdown voltage" section.)
Vibration resistance		10 to 55 Hz at double amplitude 1 mm .039 inch
Shock resistance		Min. 196 m/s²
Ambient temperature		–20°C to +55°C –4°F to +131°F
Ambient humidity		35% to 85% R.H. (Not condensing)
Storage temperature		–30°C to +80°C –22°F to +176°F (Not freezing and condensing)
Terminal screw fasten torque		0.3 to 0.5 N·m {3 to 5 kgf·cm}
Cross connection protecting diode		1.5 A, inverse voltage 40 V
Unit weight		Approx. 100 g 3.53 oz

Notes: 1. The value of breakdown voltage and insulation resistance is the initial one.
2. Condensing occurs when the unit relay is exposed to sudden temperature change in a high temperature and high humidity atmosphere. This may cause some troubles like insulation failure of the socket or the print circuit board. Take care under this condition.
3. Below 0°C 32°F, condensing water can freeze and cause socket contact failures and other problems. Take care under this condition.

REFERENCE DATA

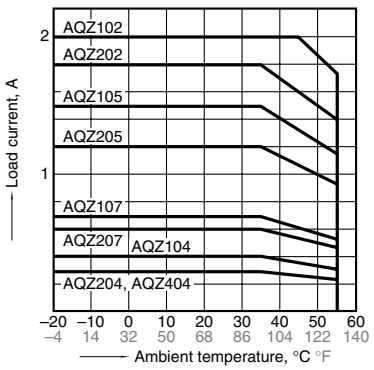
1. Load current vs. ambient temperature characteristics (1)

Allowable ambient temperature: –20°C to +55°C –4°F to +131°F



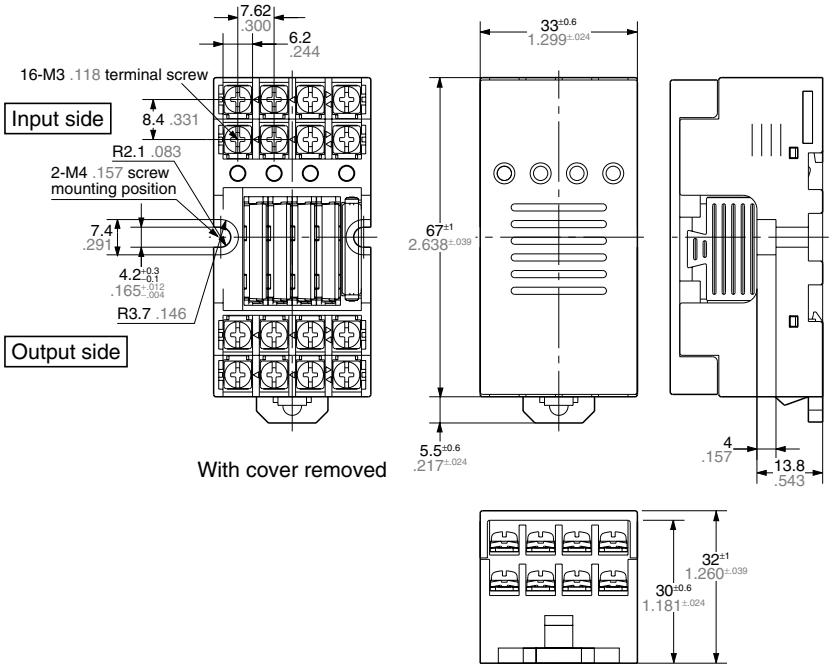
2. Load current vs. ambient temperature characteristics (2)

Allowable ambient temperature: –20°C to +55°C –4°F to +131°F



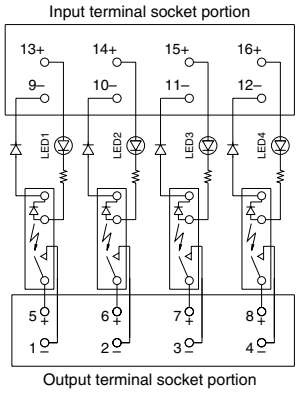
DIMENSIONS (mm inch)

1. External dimensions



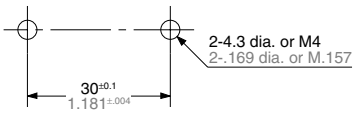
With cover removed

2. Schematic



Note: The polarities of the output terminal socket are for the DC only type (equipped with AQZ102)

3. Mounting hole pattern



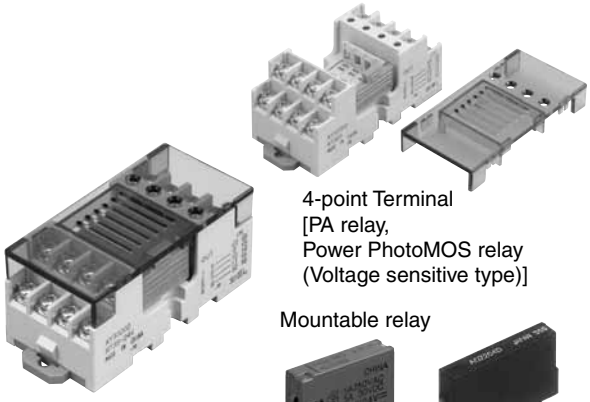
General tolerance: ±0.3 ±.012

Panasonic
ideas for life

Slim, Space-saving, 4-point Unit Relay

RT-3 UNIT RELAY 4-POINT TERMINAL

[PA Relay type, Power PhotoMOS Relay (Voltage sensitive type)]



FEATURES

1. Slim, space-saving type (33 mm 1.299 inch wide) with four independent points on a base measuring 33 × 67 mm 1.299 × 2.638 inch. This contributes to a more compact control panel.

2. PA relays, which have high sensitivity Au clad twin contacts, are installed.

PA relays, 5 mm .197 inch wide, are installed. The PA relays feature high sensitivity (12 V type: 120 mW, 24 V type: 180 mW) and twin contacts with Au-cladding, which combine to ensure high reliability even with minute loads.

3. Can be mounted on a DIN rail or mounted directly (by screw).

4. Equipped with an LED display to allow easy confirmation of operation.

5. Possible to select relay for use in the 4-point terminal in accordance with load.

Compliance with RoHS Directive

TYPES

1. RT-3 Unit relay

Contact arrangement	Rated input voltage	Part No.
1 Form A × 4	12 V DC	RT3S-12V
	24 V DC	RT3S-24V

Standard packing: Carton: 1 pc.; Case: 20 pcs.

Notes: 1. Cannot be equipped with Power PhotoMOS standard type relays. However, equipping with voltage-sensitive type of Power PhotoMOS relays is possible.
2. 5 V DC units are also available. Please inquire.
3. Please inquire about other contact arrangement.

2. 4-point Terminal

Type	Rated input voltage	Part No.
PA relay, Power PhotoMOS relay (Voltage sensitive type)	12, 24V DC	RT3BB

Standard packing: Carton: 1 pc.; Case: 20 pcs.

3. Mountable relays for 4-point Terminal (per relay, at 25°C 77°F, initial)

Product Name	Part No.
PA relay	PA1a-12V, PA1a-24V
Power PhotoMOS relay (Voltage sensitive type)	AQZ10∗D (DC only)
	AQZ20∗D (AC/DC dual use)

Note: Never install relays into this product other than those given above. Doing so will cause malfunction, breakdown, and breakdown of the connected product.

RATING

1. RT-3 Unit relay

1) Input ratings (per PA relay)

Part No.	Rated input voltage	Input current (at rated input voltage, 20°C 68°F)	Allowable variation of rated input voltage (–20 to +55°C –4 to +131°F)
RT3S-12V	12 V DC	Approx. 11.5 mA (Relay 10 mA + LED 1.5 mA)	12 V DC ± 10%
RT3S-24V	24 V DC	Approx. 10.5 mA (Relay 7.5 mA + LED 3 mA)	24 V DC ± 10%

2) PA relay coil specifications (reference value)

Relay part No.	Pick-up voltage (Initial) (at 20°C 68°F)	Drop-out voltage (Initial) (at 20°C 68°F)	Coil resistance (±10%) (at 20°C 68°F)	Nominal operating power
PA1a-12V	70%V or less of nominal voltage	5%V or more of nominal voltage	1,200 Ω	120 mW
PA1a-24V			3,200 Ω	180 mA

3) Output ratings (per PA relay)

Specification	Item	Specifications
Contact rating	Rated control capacity (resistive load)	3 A 250 V AC, 3 A 30 V DC
	Maximum allowable contact power (resistive load)	500 VA (AC), 60 W (DC)
	Maximum allowable contact voltage	250 V AC, 30 V DC
	Maximum allowable contact current	3 A
	Minimum load (reference value)	100 mV 100 μA
Expected life	Electrical (resistive load)	Min. 3×10^4: 3 A 250V AC Min. 3×10^4: 3 A 30V DC Min. 10^5: 2 A 250V AC Min. 10^5: 2 A 30V DC
	Mechanical	Min. 2×10^7 (at 180 times/min.)

Note: During 4-point simultaneous operation, the rating per point is also as shown above.

2. 4-point Terminal

1) Input ratings (per relay)

Rated input voltage	Allowable variation of rated input voltage	Allowable input voltage
12, 24V DC	12V DC±10%, 24V DC±10%	0.2A

Note: The input voltage value above is the allowable current when no relay is installed. Please note that input voltage is determined by the type of relay installed.

2) Input rating when PA relay installed (per relay, at 20°C 68°F)

Type	Rated voltage input	Operate voltage (Initial)	Release voltage (Initial)	Input current (during application of rated input voltage)
PA1a-12V	12V DC	Max. 9.5V DC (Relay max. 8.4V + include diode max. 1.1V)	Min. 1.0V DC (Relay min. 0.6V + include diode min. 0.4V)	Approx. 11.5mA (Relay 10mA + LED 1.5mA)
PA1a-24V	24V DC	Max. 17.9V DC (Relay max. 16.8V + include diode max. 1.1V)	Min. 1.6V DC (Relay min. 1.2V + include diode min. 0.4V)	Approx. 10.5mA (Relay 7.5mA + LED 3mA)

3) Input rating when Power PhotoMOS relay voltage sensitive type installed (per relay, at 25°C 77°F)

Type	Rated voltage input	Operate voltage (Initial)	Release voltage (Initial)	Input current (during application of rated input voltage)
AQZ∗0∗D	12, 24V DC	Max. 5.1V DC (Relay max. 4.0V + include diode max. 1.1V)	Min. 1.2V DC (Relay min. 0.8V + include diode min. 0.4V)	Approx. 10.0mA (Relay 7.0mA + LED 3mA)

4) Output rating (per relay)

Allowable load voltage	Allowable load current
600V (DC), 600V (AC peak value)	3A

Note: The value above is the allowable value when no relay is installed.
Please note that limitations apply to the load voltage and current depending on the type of relay installed.

5) Output rating when PA relay installed (per relay, at 20°C 68°F)

Specification	Item	Specifications
Contact rating	Rated control capacity (resistive load)	3 A 250 V AC, 3 A 30 V DC
	Maximum allowable contact power (resistive load)	750 VA (AC), 90 W (DC)
	Maximum allowable contact voltage	250 V AC, 30 V DC
	Maximum allowable contact current	3 A
	Minimum load (reference value)	100 mV 100 μA
Expected life	Electrical (resistive load)	Min. 3×10^4: 3 A 250V AC, 3 A 30V DC Min. 10^5: 2 A 250V AC, 2 A 30V DC
	Mechanical	Min. 2×10^7 (at 180 times/min.)

Note: During 4-point simultaneous operation, the rating per point is also as shown above.

6) Output rating when Power PhotoMOS relay voltage sensitive type installed (per relay, at 25°C 77°F)

Possible relays		Maximum load voltage (DC, AC peak value)	Continuous load current (DC, AC peak value)	Possible relays		Maximum load voltage (DC, AC peak value)	Continuous load current (DC, AC peak value)
Type	Part No.			Type	Part No.		
DC only	AQZ102D	60V	1.80A	AC, DC dual use	AQZ202D	60V	1.350A
	AQZ105D	100V	1.15A		AQZ205D	100V	0.900A
	AQZ107D	200V	0.55A		AQZ207D	200V	0.450A
	AQZ104D	400V	0.30A		AQZ204D	400V	0.225A

Notes: 1. During 4-point simultaneous operation, the rating per point is also as shown above.
2. Please use a load current that is within the range of the data given below in “REFERENCE DATA Load current vs. ambient temperature characteristics”.

SPECIFICATIONS

RT-3 Unit relay/4-point Terminal

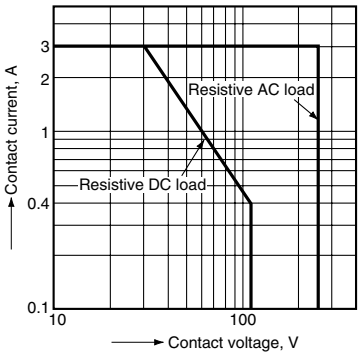
Item		Specifications
Breakdown voltage	Between input and output	2,000 Vrms for 1 min.
	Between different terminals (between relays, both ways)	1,500 Vrms for 1 min.
Insulation resistance		Min. 100 MΩ (Using 500 V DC megger)
Vibration resistance (destructive)		10 to 55 Hz at double amplitude 1 mm .039 inch
Vibration resistance (functional)		10 to 55 Hz at double amplitude 1 mm .039 inch
Shock resistance (destructive)		Min. 196 m/s²
Shock resistance (functional)		Min. 98 m/s²
Ambient temperature		–20°C to +55°C –4°F to +131°F
Ambient humidity		35% to 85% R.H. (Not condensing)
Storage temperature		–30°C to +80°C –22°F to +176°F (Not freezing and condensing)
Terminal screw fasten torque		0.3 to 0.5 N·m
Coil surge absorber		Diode (1A, 400V)
Cross connection protecting diode		1.5 A, inverse voltage 40 V
Unit weight		Approx. 100 g 3.53 oz

Notes: 1. The value of breakdown voltage and insulation resistance is the initial one.
2. Condensing occurs when the unit relay is exposed to sudden temperature change in a high temperature and high humidity atmosphere. This may cause some troubles like insulation failure of the socket or the print circuit board. Take care under this condition.
3. Below 0°C 32°F, condensing water can freeze and cause socket contact failures and other problems. Take care under this condition.

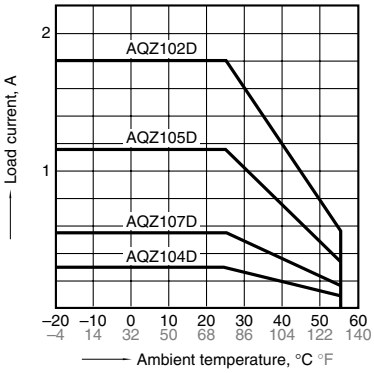
REFERENCE DATA

1. Maximum value for switching capacity (output)

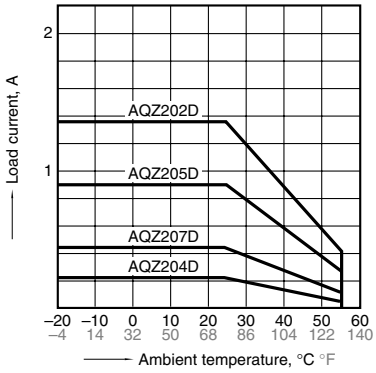
Per PA relay



2. Load current vs. ambient temperature characteristics (DC only)

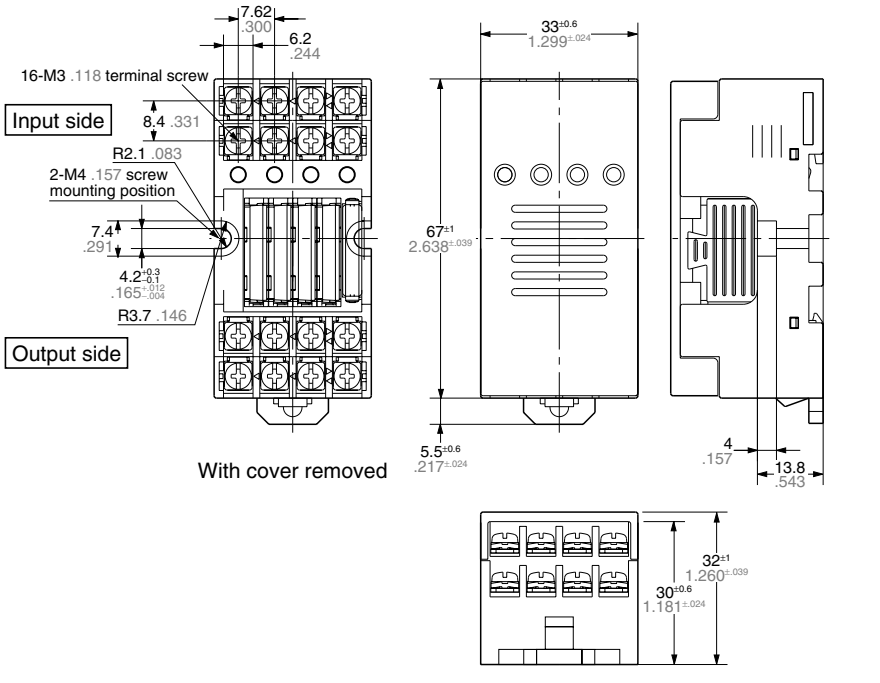


3. Load current vs. ambient temperature characteristics (AC/DC dual use)

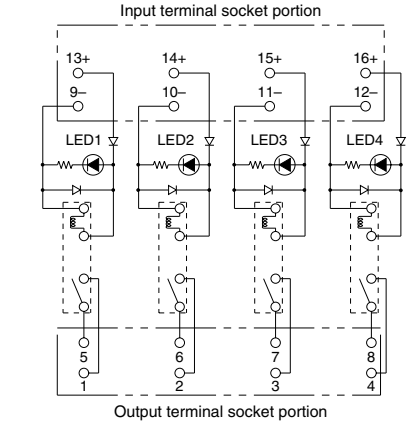


DIMENSIONS (mm inch)

1. External dimensions

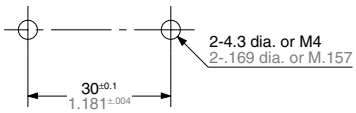


2. Schematic



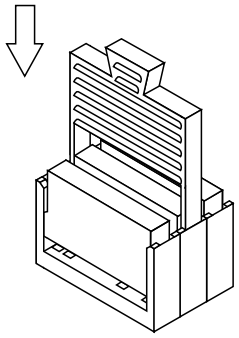
Note: Cannot be equipped with Power PhotoMOS standard type relays. However, equipping with voltage sensitive type of Power PhotoMOS relays is possible.

3. Mounting hole pattern

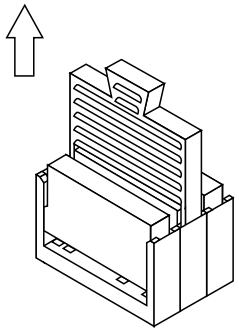


1. Never install modules (relays) into this product other than those designated. Doing so will cause malfunction, breakdown, and breakdown of the connected product.
2. If a unit is dropped be sure to check its external appearance and characteristics before using it.
3. The operation and return voltage values when equipped with PA relays are based on the relay terminals being face down. (RT-3 Unit relay (PA type), 4-point Terminal)
4. Switching lifetime (PA relay)
This characteristic depends on the relay and is effected 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.
1) When used for AC load-operating and the operating phase is synchronous, rocking and fusing can easily occur due to contact shifting.
2) 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 HNO_3 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
5. Operating environment
1) Keep the product as far way as possible from power cables, high tension equipment, power equipment, equipment with transmitting devices such as amateur radios, or equipment which generates a large switching surge.
2) The main unit is made of resin; therefore, do not use it in areas where it may come in contact with (or be exposed to) organic solvents such as gasoline, thinner, and alcohol, or strong alkaline substances such as ammonia and caustic soda.
3) Do not use the product in areas where it may be exposed to flammable gases, corrosive gases, excessive dust, or moisture, or areas where it may be subjected to strong vibration or shock.

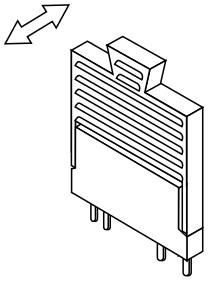
6. Installing and removing the module
1) Firmly insert the module into the socket with the terminals going in the direction of the blade receptacles.
2) The module can be easily removed using the removal key.
(1) Insert the removal key into the socket slots.



(2) Pull the removal key up to remove the module.



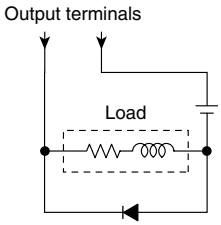
(3) Slide the removal key off of the module.



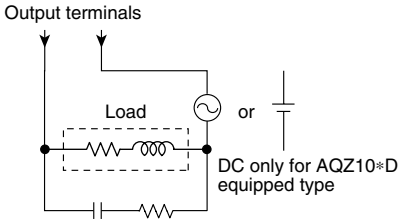
7. Wiring and circuit configuration
1) Perform wiring according to the internal schematic. Take care not to make any mistakes.
In particular, with the RT-3 Unit relay (PA relay type) and 4-point terminal, be careful of the polarity on the output side when equipped with AQZ10∗D (DC type). Also, with the RT-3 Unit relay (Power PhotoMOS relay type), be careful of the polarity on the output side of the DC type (RT3SP1-∗∗V for type equipped with AQZ102).
2) We recommend the use of wire-pressed terminals for connection to the terminal portion.
• Example of applicable wire-pressed terminal

Company Name	Part Name	Applicable wire-pressed terminal
J.S.T. Mfg Co., Ltd.	1.25 to C3A	0.25 to 1.65mm²

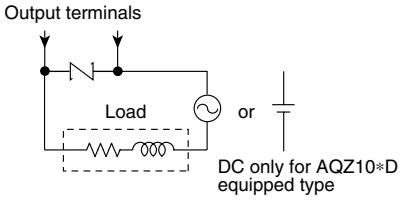
3) When the load is inductive, limit spike voltages generated from the load to less than the maximum load voltage.
Typical circuits are shown below.
(1) Add a clamp diode to the load.



(2) Add an R-C snubber to the load.



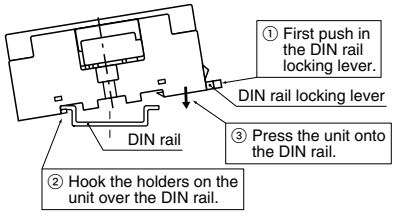
(3) Add a varistor between the output terminals.



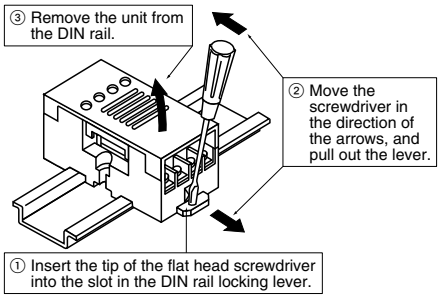
4) Even if spike voltages generated from the load are limited by a clamp diode or R-C snubber, inductances in long circuit wires will still create spike voltages. Keep wires as short as possible to minimize inductance.

8. Installation

1) Perform mounting hole cutout according to the panel cutout drawings.
2) When installing the unit on a DIN rail, use the DIN rail locking lever on the side of the unit. Installation is accomplished by simply fitting the unit onto the rail and pressing gently.



3) To remove the unit from the DIN rail, use a flat head screwdriver to pull out the DIN rail locking lever.



9. Transporting and storage

1) If the product is subjected to extreme vibration while being transported, the relays may become detached, the lead may become bent, and the unit may become damaged. Handle the carton and case with care.
2) If the product is stored in an extremely adverse environment, visible defects and deterioration of performance characteristics may result. We recommend the following storage conditions.

- Temperature: 5 to 30°C 41 to 86°F
- Humidity: Max. 60% R.H.
- Environment: No hazardous substances such as sulfurous acid gases and little dust.

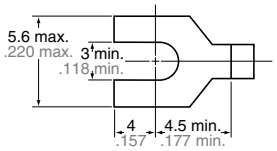
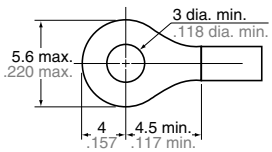
10. When equipped with Power PhotoMOS relay voltage drive type [RT-3 Unit relay (PA relay type), 4-point Terminal]

Since the Power PhotoMOS relay voltage sensitive type does not require the current-controlling resistance on the input side, it can be used together with PA relays on RT-3 unit relay (PA relay type) or RT-2 relay terminals.
When connecting Power PhotoMOS relay voltage sensitive types, since it will be a close connection, it will be necessary to be careful of load currents. Be sure to refer to the information given regarding "Load currents vs ambient temperature characteristics" in the precautions given for use of 4-point terminals.

TERMINAL BLOCK

We recommend using wire-pressed terminals for connection to the terminal portion.

- Applicable electrical wire: 0.25 to 1.65 mm² .01 to .065 inch
- Applicable wire-pressed terminals (mm inch)

		
Company Name	Part Name	Part Name
J.S.T. Mfg Co., Ltd.	1.25 to C3A	1.25 to 3
NICHIFU	1.25Y to 3N	1.25 to 3
Nippon Tanshi Co., Ltd.	VD1.25 to 3	R1.25 to 3

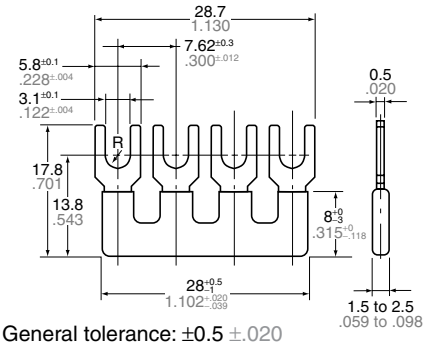
ACCESSORIES

Short circuit plate for RT-3 Unit relay
Use when you want to bridge terminals.

< With insulator >

AY3802

External dimensions (mm inch)

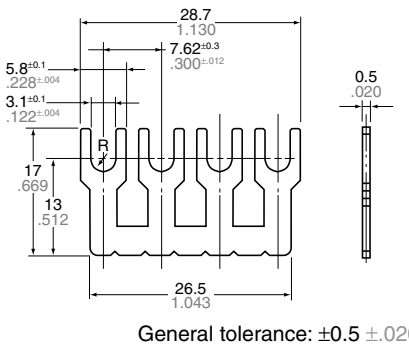


General tolerance: ±0.5 ±.020

< Without insulator >

AY3803

External dimensions (mm inch)

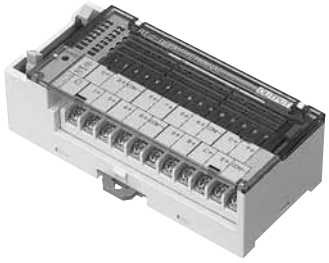


General tolerance: ±0.5 ±.020

Panasonic
ideas for life

Palm-sized, 16-channel Relay Terminals

RT-2 RELAY TERMINAL



Pressure connector connect type

Wire-direct connect type

FEATURES

1. Possible to select relay for use in the RT-2 relay terminal in accordance with load. [Mountable relay: PA relay and Power PhotoMOS relay (voltage sensitive type)]
2. Slim, space-saving design (52mm 2.047 inch wide)
3. Equipped with an LED display to allow easy confirmation of operation.
4. Contact output with four independent points

Compliance with RoHS Directive

ORDERING INFORMATION

RT 2S – □ □ – □ **16** – □

Installation type
Nil: DIN rail mounting type
M: Direct mounting type

Termination type
Nil: Pressure connector connect type
C: Wire-direct connect type

I/O type
ID: Input device (DC)
OD: Output device (DC)

No. of I/O channels
16: 16 channels

Nominal coil voltage
12 V: 12 V DC
24 V: 24 V DC

TYPES

1. DIN Rail Mounting Type

1) Pressure connector connect type

I/O type	Rated voltage	Part No.
Input device	12 V DC	RT2S-ID16-12V
	24 V DC	RT2S-ID16-24V
Output device	12 V DC	RT2S-OD16-12V
	24 V DC	RT2S-OD16-24V

Standard packing: Carton: 1 pc.; Case: 10 pcs.

2) Wire-direct connect type

I/O type	Rated voltage	Part No.
Input device	12 V DC	RT2S-C-ID16-12V
	24 V DC	RT2S-C-ID16-24V
Output device	12 V DC	RT2S-C-OD16-12V
	24 V DC	RT2S-C-OD16-24V

Standard packing: Carton: 1 pc.; Case: 10 pcs.

2. Direct Mounting Type

1) Pressure connector connect type

I/O type	Rated voltage	Part No.
Input device	12 V DC	RT2S-M-ID16-12V
	24 V DC	RT2S-M-ID16-24V
Output device	12 V DC	RT2S-M-OD16-12V
	24 V DC	RT2S-M-OD16-24V

Standard packing: Carton: 1 pc.; Case: 10 pcs.

2) Wire-direct connect type

I/O type	Rated voltage	Part No.
Input device	12 V DC	RT2S-MC-ID16-12V
	24 V DC	RT2S-MC-ID16-24V
Output device	12 V DC	RT2S-MC-OD16-12V
	24 V DC	RT2S-MC-OD16-24V

Standard packing: Carton: 1 pc.; Case: 10 pcs.

3. Interface Relay

Type	Rated voltage	Part No.
PA relay	12 V DC	PA1a-12V
	24 V DC	PA1a-24V

Standard packing: Carton: 25 pcs.; Case: 1,000 pcs.

RATING

1. Relay coil specifications (per PA relay)

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 55°C 131°F)
12 V DC	70%V or less of nominal voltage	5%V or more of nominal voltage	10 mA	1,200 Ω	120 mW	120%V of nominal voltage
24 V DC			7.5 mA	3,200 Ω	180 mW	

Note: The LED draws a drive current of approximately 3 mA per channel. When calculating the supply capacity required, include the total current consumed by the LEDs.

2. Contacts (per PA relay)

Characteristics	Item	Specifications
Contact rating	Nominal switching capacity (resistive load)	2 A 250 V AC, 2 A 30 V DC
	Max. switching power (resistive load)	500 VA (AC), 60 W (DC)
	Max. switching voltage	250 V AC, 30 V DC
	Max. switching current	2 A
	Min. switching capacity (reference value)	100 mV 100 μA
Expected life	Electrical (resistive load)	Min. 10^5 (2 A 250V AC) Min. 10^5 (2 A 30V DC) Min. 3×10^5 (1 A 250V AC) Min. 3×10^5 (1 A 30V DC)
	Mechanical	Min. 2×10^7 (at 180 times/min.)

SPECIFICATIONS

Item		Input	Output
Insulation resistance	Between connector terminals	Min. 100 MΩ (excluding power at 500 V DC megger)	Min. 100 MΩ (excluding power at 500 V DC megger)
	Between unlike poles on the terminals	Min. 100 MΩ (at 500 V DC megger)	Min. 100 MΩ (at 500 V DC megger)
	Between like poles on the terminals (for output)	—	Min. 100 MΩ (at 500 V DC megger)
Breakdown voltage	Between connector terminals	2,000 Vrms for 1 min. (excluding power)	2,000 Vrms for 1 min. (excluding power)
	Between unlike poles on the terminals	1,500 Vrms for 1 min.	1,500 Vrms for 1 min.
	Between like poles on the terminals (for output)	—	1,000 Vrms for 1 min.
Vibration resistance (Destructive)		10 to 55 Hz at double amplitude 1 mm .039 inch	10 to 55 Hz at double amplitude 1 mm .039 inch
Vibration resistance (Functional)		10 to 55 Hz at double amplitude 1 mm .039 inch	10 to 55 Hz at double amplitude 1 mm .039 inch
Shock resistance (Destructive)		Min. 196 m/s² (20 G)	Min. 196 m/s² (20 G)
Shock resistance (Functional)		Min. 98 m/s² (10 G)	Min. 98 m/s² (10 G)
Superimposed power noise		Min. 1,000 V*	Min. 1,000 V*
Superimposed I/O noise		Min. 1,000 V*	Min. 1,500 V*
Ambient temperature		0°C to +55°C +32°F to +131°F	0°C to +55°C +32°F to +131°F
Ambient humidity		35% to 85% R.H. (Not condensing)	35% to 85% R.H. (Not condensing)
Storage temperature		–30°C to +80°C –22°F to +176°F (Not freezing and condensing)	–30°C to +80°C –22°F to +176°F (Not freezing and condensing)
Terminal screw fasten torque		0.3 to 0.5 N·m (3 to 5 kgf·cm) for pressure connector connect type; 0.2 to 0.4 N·m (2 to 4 kgf·cm) for wire-direct connect type	
Coil surge absorber		Diode (1 A, 400 V)	Diode (1 A, 400 V)
Cross connection protecting diode		1A, inverse voltage 40 V	1.5 A, inverse voltage 40 V
Unit weight		Approx. 200 g 7.1 oz	Approx. 200 g 7.1 oz

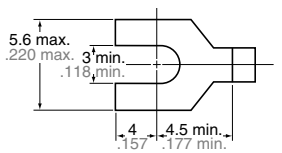
* According to in-house measurement.

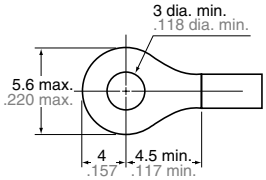
Notes: 1. The value of breakdown voltage and insulation resistance is the initial one.
2. Condensing occurs when the unit relay is exposed to sudden temperature change in a high temperature and high humidity atmosphere. This may cause some troubles like insulation failure of the socket or the PC board. Take care under this condition
3. Below 0°C 32°F, condensing water can freeze and cause socket contact failures and other problems. Take care under this condition.

TERMINAL BLOCK

1. Pressure connector connect type

- Applicable electrical wire
  0.25 to 1.65 mm² .01 to .065 inch
- Applicable wire-pressed terminals (mm inch)





Company name	Fork type	Round type
J.S.T. Mfg Co., Ltd.	1.25 – C3A	1.25 – 3
NICHIFU Co., Ltd.	1.25Y – 3N	1.25 – 3
Nippon Tanshi Co., Ltd.	VD1.25 – 3	R1.25 – 3

2. Wire-direct connect type

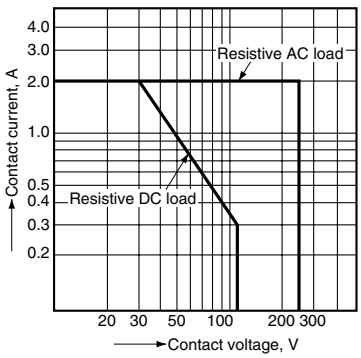
Strip the wire ends as follows

Stripping length	Recommended wire
8 to 10 mm .315 to .394 inch	0.128 to 1.318 mm .005 to 0.52 inch 0.4 to 1.3 mm dia. .016 to .051 inch

REFERENCE DATA

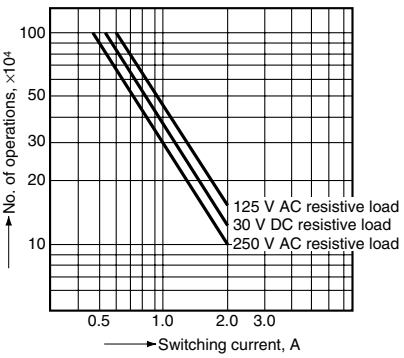
1. Maximum value for switching capacity (output)

Per PA relay



2. Life curve (output)

Per PA relay

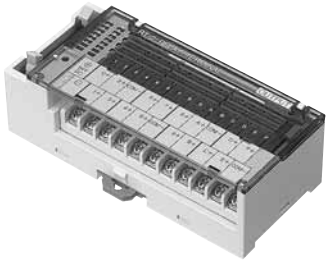


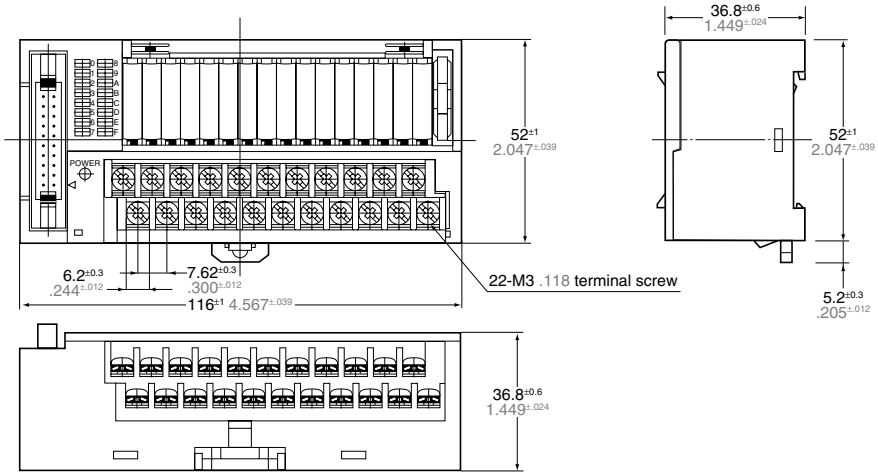
DIMENSIONS (mm inch)

Dimensions are common to both input and output module.

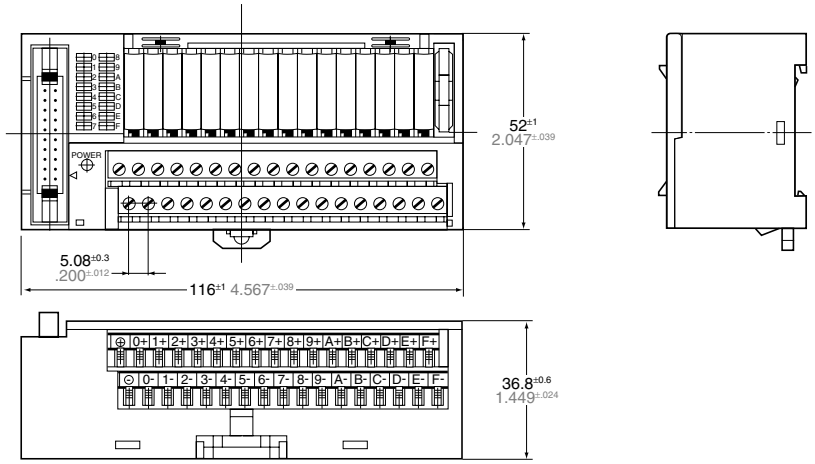
1. DIN rail mounting

Pressure connector connect type



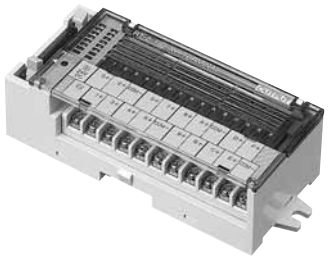


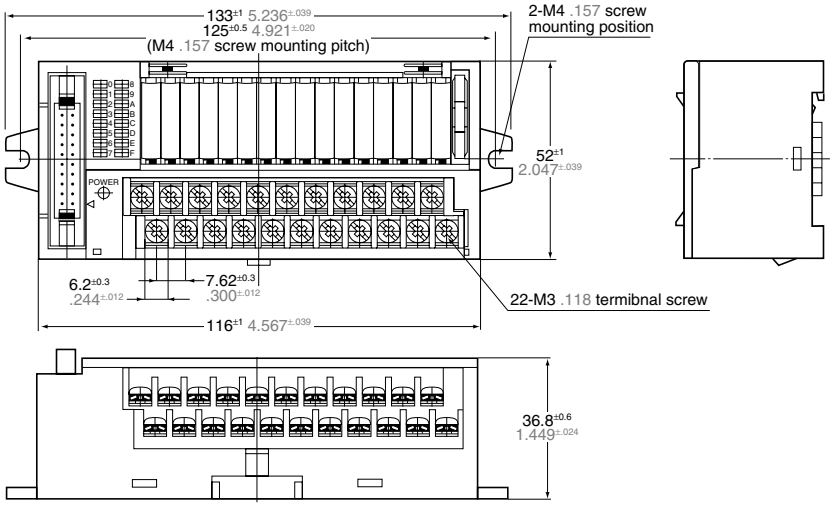
Wire-direct connect type



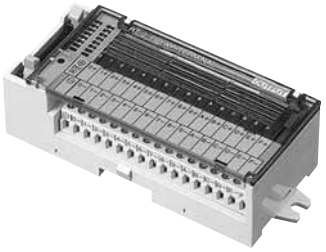
2. Direct mounting

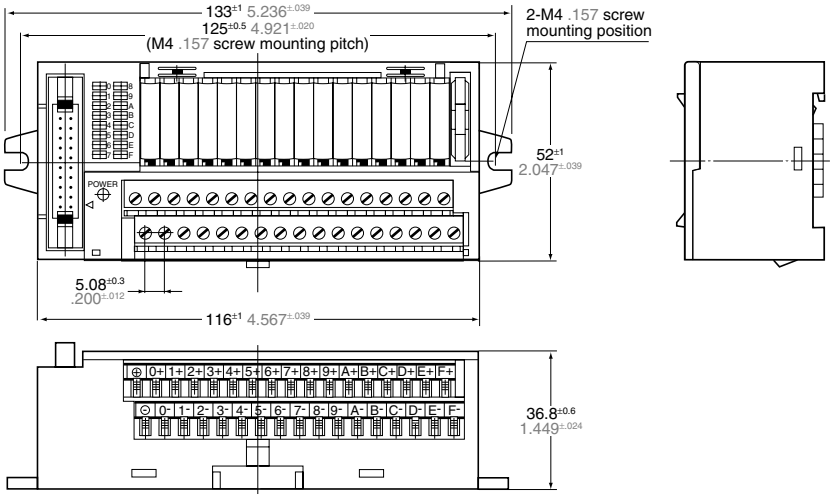
Pressure connector connect type





Wire-direct connect type

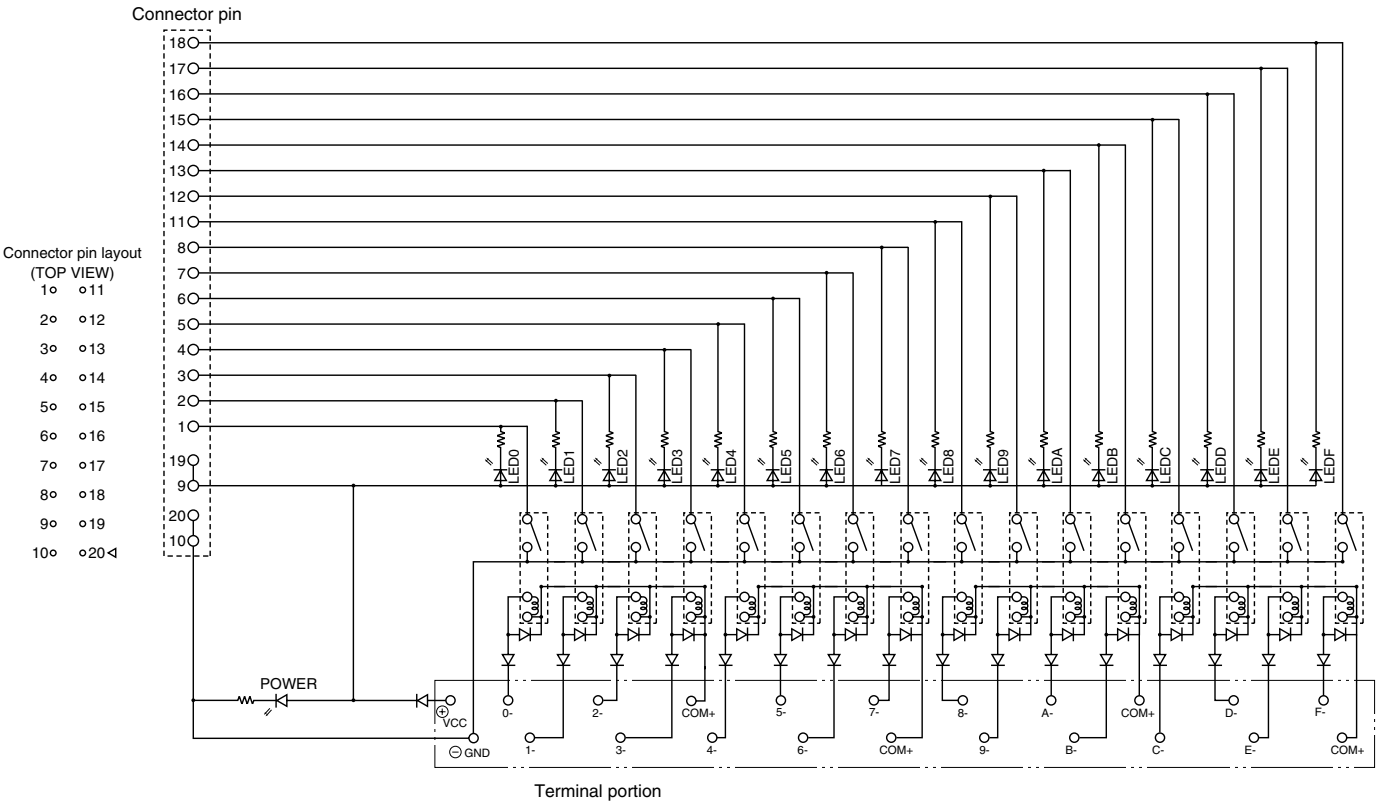




SCHEMATIC (common to both DIN rail mounting and direct mounting)

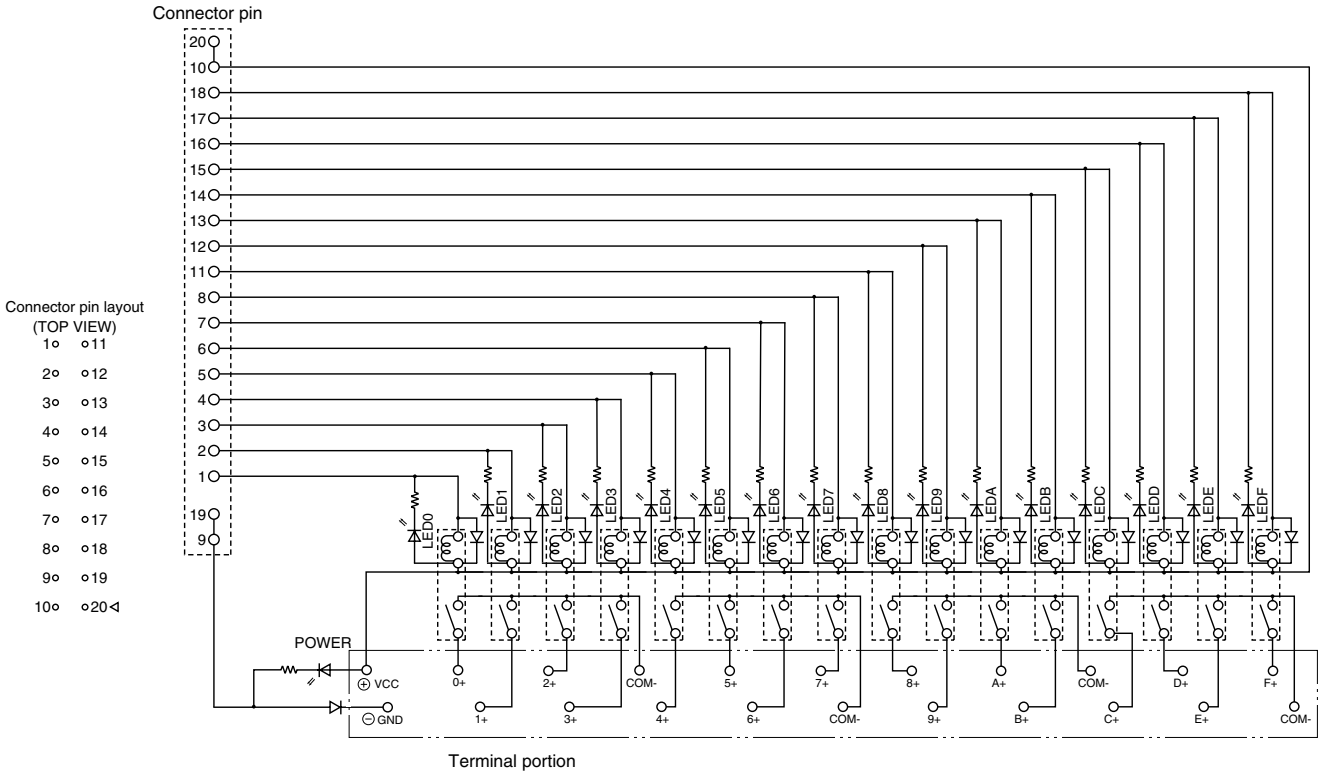
1. Pressure connector connect type (4 commons)

Input module



Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.

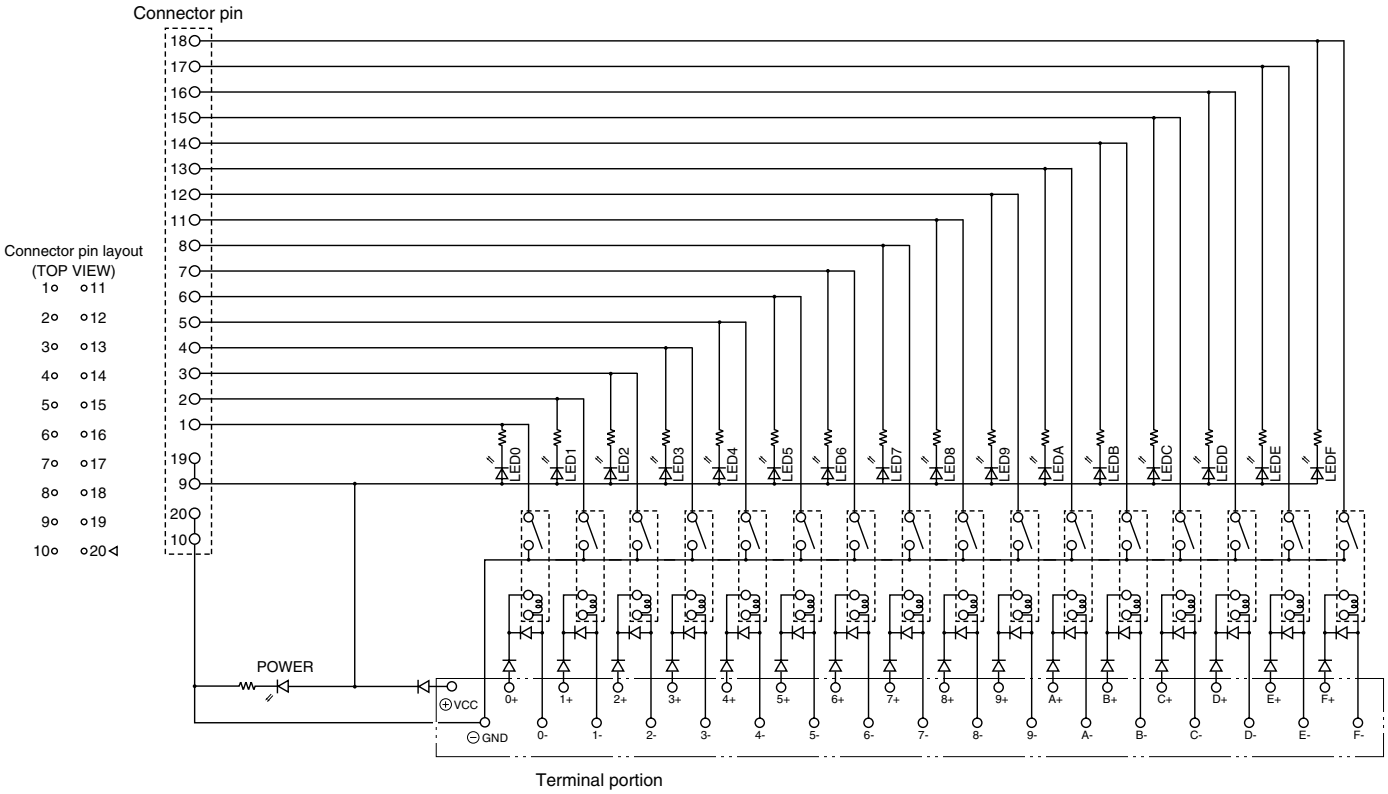
Output module



Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.

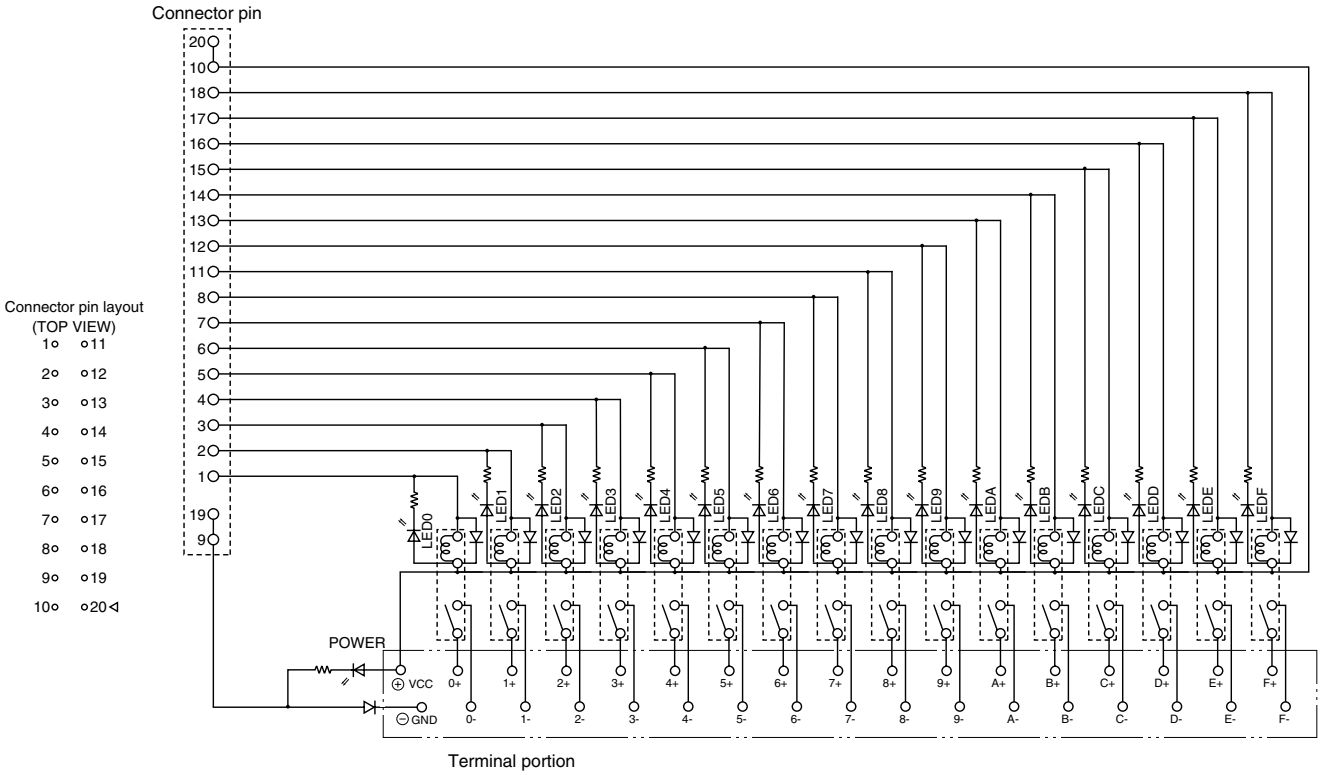
2. Wire-direct connect type (Individual common)

Input module



Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.

Output module



Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.

NOTES

1. When equipped with Power PhotoMOS relay voltage sensitive type

Since the Power PhotoMOS relay voltage sensitive type does not require the current-controlling resistance on the input side, it can be used together with PA relays on RT-3 Unit relays (PA relay types) or RT-2 relay terminals (output module).

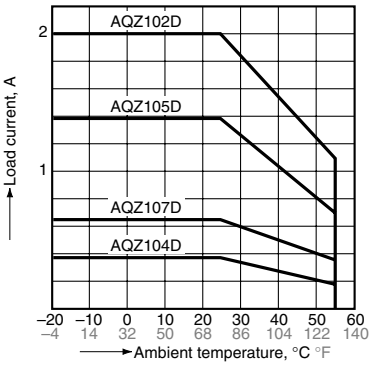
When connecting Power PhotoMOS relay voltage sensitive types to RT-3 Unit relays (PA relay types) or RT-2 relay terminals, it will be necessary to be careful of load currents (since it will be a close connection). Be sure to use within the range given in the "Load currents vs ambient temperature characteristics" graphs given below.

• Power PhotoMOS relay (voltage sensitive type)

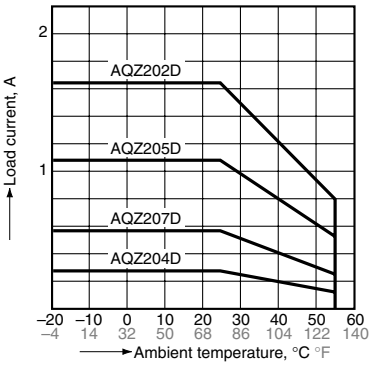
Load currents vs ambient temperature characteristics

When equipped on RT-3 Unit relay (PA relay type) or RT-2 relay terminal (output module).

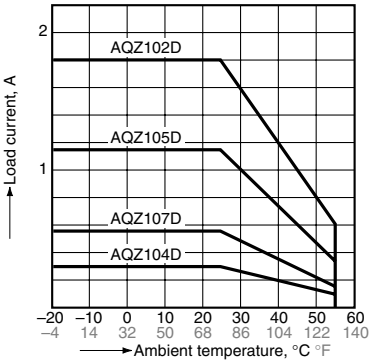
1) DC type, 12 V input



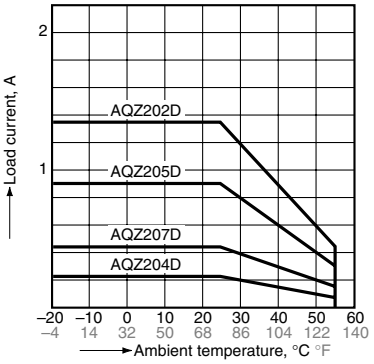
3) AC/DC type, 12 V input



2) DC type, 24 V input



4) AC/DC type, 24 V input



2. Operating environment

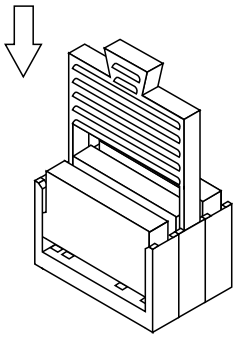
1) Use the product at ambient operating temperature between 0°C and 55°C 32°F and 131°F. (When installing in the control panel, take heat release into due consideration. Installing of the product at 90 degrees to the control panel is recommended. When installing the product horizontally or placing it on a heating unit, use a cooling fan.)
2) Keep the supply voltage within the range of 90% V to 110% V of the nominal voltage.
3) Keep the product as far as possible from power cables, high tension equipment, power equipment, equipment with transmitting devices such as amateur radios, or equipment which generates a large switching surge.
4) The main unit is made of resin; therefore, do not use it in areas where it may come in contact with (or be exposed to) organic solvents such as benzine, thinner, and alcohol or strong alkaline substances such as ammonia and caustic soda.
5) Do not use the product in areas where it may be exposed to flammable gases, corrosive gases, excessive dust, or moisture, or areas where it may be subjected to strong vibration or shock.

3. Dropping

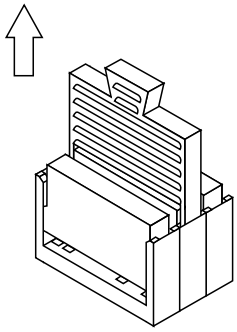
If a unit is dropped be sure to check its external appearance and characteristics before using it.

4. Installing and removing the module

1) Firmly insert the module into the socket with the terminals going in the direction of the blade receptacles.
2) The module can be easily removed using the removal key.
(1) Insert the removal key into the socket slots.



(2) Pull the removal key up to remove the module.

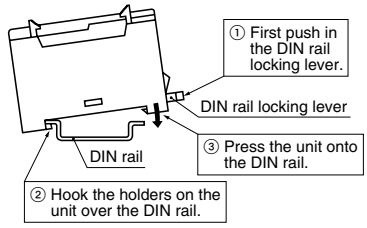


5. Wiring and circuit configuration

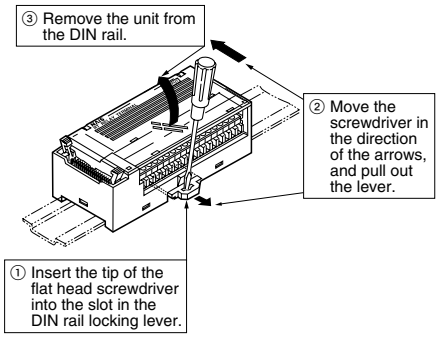
1) Make all connections according to the schematic. Polarity should be observed when wiring DC type.
2) Use of wire-pressed terminal is recommended for connections to pressure connector connect type. For the wire-direct connect type, strip wire ends to the specified length.
3) When wiring power lines or power cables, twisted pair treatment (standed wire treatment) should be done in order to improve noise resistance.
4) When the load output device is an inductive load type, installing a diode and surge absorber to both ends of the load is recommended.
5) In order to improve noise resistance, class 3 grounding of the control panel is recommended.
6) Do not pass the wiring over the surface of the case. (When unavoidable, keep the wire at least 3 cm 1.181 inch away from the surface of the case.)
7) Turn off the power before connecting/ disconnecting connector and cables.
8) With some types of control devices, leakage current may cause the relay to fail to turn off after the control input is turned off. Make sure that the relay turns off after the control input is turned off.

6. Installation

1) Perform mounting hole cutout according to the panel cutout drawings.
2) When installing the unit on a DIN rail, use the DIN rail locking lever on the side of the unit. Installation is accomplished by simply fitting the unit onto the rail and pressing gently.



3) To remove the unit from the DIN rail, use a flat head screwdriver to pull out the DIN rail locking lever.



7. Transporting and storage

1) If the product is subjected to extreme vibration while being transported, the relays may become detached, the lead may become bent, and the unit may become damaged. Handle the carton and case with care.
2) If the product is stored in an extremely adverse environment, visible defects and deterioration of performance characteristics may result. We recommend the following storage conditions.

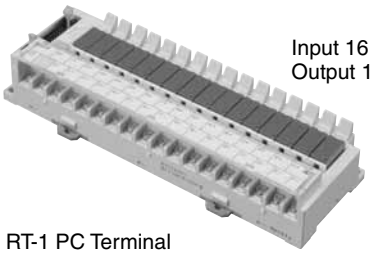
- Temperature: 5 to 30°C 41 to 86°F
- Humidity: Max. 60% R.H.
- Environment: No hazardous substances such as sulfurous acid gases and little dust.

Panasonic
ideas for life

Wide variation relay terminal

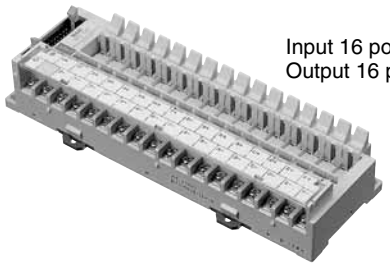
RT-1 PC RELAY TERMINAL
RT-1 PC TERMINAL

RT-1 PC Relay Terminal (PQ relays mounted)



Input 16 points
Output 16 points

RT-1 PC Terminal



Input 16 points
Output 16 points

Compliance with RoHS Directive

FEATURES

1. Easy connecting and simplified wiring

Connection to the various programmable controllers is performed with the one-touch connector. Wiring efficiency is improved and wiring within panels is greatly simplified.

2. Space saving

By integrating the interface relay and terminal, a 16-point type is still compact. (W)205 × (D)67 × (H)38.5 mm (W)8.071× (D)2.638× (H)1.516 inch. Helps reduce the size of control panels.

3. Wide range of I/O points for easy expansion

Complete lineup includes 16, 8, and 4-point input types and 16, 8, 4, and 2-point output types. A single cable allows for expansion up to a maximum of 16 points.

4. High sensitive and reliable PQ relays are mounted

The RT-1 PC relay terminal is a RT-1 PC terminal (terminal block) that is equipped with a highly reliable, 15.6 mm .614 inch height, slim PQ relay for use as an interface relay. Also, single-action removal and installation of the relay are performed with the provided lever. This greatly simplifies relay maintenance and replacement of the SSR.

ORDERING INFORMATION

RT □ – □ □ □ – □ – □

1: RT-1 PC terminal
1SQ: RT-1 PC relay terminal (PQ relays mounted)

Input or Output
I: Input
O: Output

Voltage type
A: AC (RT-1 PC terminal only)
D: DC

No. of I/O points
16: 16 points
08: 8 points
04: 4 points (RT-1 PC terminal only)
02: 2 points (RT-1 PC terminal only)

Nominal coil voltage
12V: 12 V
24V: 24 V
100V: 100/110 V
200V: 200/220 V

Types of connector
S: S type (Standard pitch)
M: M type (Half pitch)

TYPES

1. RT-1 PC relay terminal

RT-1 PC relay terminal is the RT-1 PC terminal equipped with a PQ relay.

Item	Types of connector	Input or output	No. of I/O points	Normal operating voltage	Part No.
RT-1 PC relay terminal S type input 16 points 12V DC	S type	Input	16	12 V DC	RT1SQ-ID16-12V-S
RT-1 PC relay terminal S type input 16 points 24V DC				24 V DC	RT1SQ-ID16-24V-S
RT-1 PC relay terminal S type input 8 points 12V DC			8	12 V DC	RT1SQ-ID08-12V-S
RT-1 PC relay terminal S type input 8 points 24V DC				24 V DC	RT1SQ-ID08-24V-S
RT-1 PC relay terminal S type output 16 points 12V DC		Output	16	12 V DC	RT1SQ-OD16-12V-S
RT-1 PC relay terminal S type output 16 points 24V DC				24 V DC	RT1SQ-OD16-24V-S
RT-1 PC relay terminal S type output 8 points 12V DC			8	12 V DC	RT1SQ-OD08-12V-S
RT-1 PC relay terminal S type output 8 points 24V DC				24 V DC	RT1SQ-OD08-24V-S
RT-1 PC relay terminal M type input 8 points 12V DC	M type	Input	8	12 V DC	RT1SQ-ID08-12V-M
RT-1 PC relay terminal M type input 8 points 24V DC				24 V DC	RT1SQ-ID08-24V-M
RT-1 PC relay terminal M type output 16 points 12V DC		Output	16	12 V DC	RT1SQ-OD16-12V-M
RT-1 PC relay terminal M type output 16 points 24V DC				24 V DC	RT1SQ-OD16-24V-M

Standard packing: Carton: 1 pc.; Case: 10 pcs.

2. RT-1 PC Terminal

Not equipped with a relay. Install a separately-sold PQ relay or AQ-C solid state relay for interfacing.

Item	Types of connector	Input or output	No. of I/O points	Normal operating voltage	Part No.
RT-1 PC terminal S type input 16 points 100V AC	S type	Input	16	100/110 V AC	RT1-IA16-100V-S
RT-1 PC terminal S type input 16 points 200V AC				200/220 V AC	RT1-IA16-200V-S
RT-1 PC terminal S type input 16 points 12V DC				12 V DC	RT1-ID16-12V-S
RT-1 PC terminal S type input 16 points 24V DC				24 V DC	RT1-ID16-24V-S
RT-1 PC terminal S type input 8 points 100V AC			8	100/110 V AC	RT1-IA08-100V-S
RT-1 PC terminal S type input 8 points 200V AC				200/220 V AC	RT1-IA08-200V-S
RT-1 PC terminal S type input 8 points 12V AC				12 V DC	RT1-ID08-12V-S
RT-1 PC terminal S type input 8 points 24V AC				24 V DC	RT1-ID08-24V-S
RT-1 PC terminal S type input 4 points 100V AC			4	100/110 V AC	RT1-IA04-100V-S
RT-1 PC terminal S type input 4 points 200V AC				200/220 V AC	RT1-IA04-200V-S
RT-1 PC terminal S type input 4 points 12V DC				12 V DC	RT1-ID04-12V-S
RT-1 PC terminal S type input 4 points 24V DC				24 V DC	RT1-ID04-24V-S
RT-1 PC terminal S type output 16 points 12V DC		Output	16	12 V DC	RT1-OD16-12V-S
RT-1 PC terminal S type output 16 points 24V DC				24 V DC	RT1-OD16-24V-S
RT-1 PC terminal S type output 8 points 12V DC			8	12 V DC	RT1-OD08-12V-S
RT-1 PC terminal S type output 8 points 24V DC				24 V DC	RT1-OD08-24V-S
RT-1 PC terminal S type output 4 points 12V DC			4	12 V DC	RT1-OD04-12V-S
RT-1 PC terminal S type output 4 points 24V DC				24 V DC	RT1-OD04-24V-S
RT-1 PC terminal S type output 2 points 12V DC			2	12 V DC	RT1-OD02-12V-S
RT-1 PC terminal S type output 2 points 24V DC				24 V DC	RT1-OD02-24V-S
RT-1 PC terminal M type input 8 points 100V AC	M type	Input	8	100/110 V AC	RT1-IA08-100V-M
RT-1 PC terminal M type input 8 points 200V AC				200/220 V AC	RT1-IA08-200V-M
RT-1 PC terminal M type input 8 points 12V DC			8	12 V DC	RT1-ID08-12V-M
RT-1 PC terminal M type input 8 points 24V DC				24 V DC	RT1-ID08-24V-M
RT-1 PC terminal M type output 16 points 12V DC		Output	16	12 V DC	RT1-OD16-12V-M
RT-1 PC terminal M type output 16 points 24V DC				24 V DC	RT1-OD16-24V-M

Standard packing: Carton: 1 pc.; Case: 10pcs.

Notes: 1. S type uses a standard pitch connector. You can use the connection connect it to our or other companies Programmable Controllers.
For the connection cable, see page 187. The M type uses the half-pitch connector. You can connect it to our micro-controllers (discontinued product).
2. The cable works with both the RT-1 PC relay terminal and the RT-1 PC terminal. Please refer to page 187.

3. Combination with Relay for interface and SSR

RT-1 PC terminal					Types of relay			SSR
					PQ relay (1 Form A)	DS-P relay		
Item				Part No.		1 Form A 1 Form B	2 Form A	
S type	Input	16 points	AC	RT1-IA16-100V-S, RT1-IA16-200V-S				Available
			DC	RT1-ID16-12V-S, RT1-ID16-24V-S	Available			Available
		8 points	AC	RT1-IA08-100V-S, RT1-IA08-200V-S				Available
			DC	RT1-ID08-12V-S, RT1-ID08-24V-S	Available			Available
		4 points	AC	RT1-IA04-100V-S, RT1-IA04-200V-S				Available
			DC	RT1-ID04-12V-S, RT1-ID04-24V-S	Available			Available
	Output	16 points	DC	RT1-OD16-12V-S, RT1-OD16-24V-S	Available			Available
		8 points	DC	RT1-OD08-12V-S, RT1-OD08-24V-S	Available			Available
		4 points	DC	RT1-OD04-12V-S, RT1-OD04-24V-S	Available			Available
		2 points	DC	RT1-OD02-12V-S, RT1-OD02-24V-S		Available	Available	
M type	Input	8 points	AC	RT1-IA08-100V-M, RT1-IA08-200V-M				Available
			DC	RT1-ID08-12V-M, RT1-ID08-24V-M	Available			Available
	Output	16 points	DC	RT1-OD16-12V-M, RT1-OD16-24V-M	Available			Available

Note: For type and rating of interface relay and SSR, see page 178.

RATING (RT-1 PC Relay Terminal)

1. Relay coil specifications (per PQ relay)

Nominal coil voltage	Pick-up voltage (at 20°C 68°F)	Drop-out voltage (at 20°C 68°F)	Rated operating current [±10%] (at 20°C 68°F)	Coil resistance [±10%] (at 20°C 68°F)	Nominal operating power	Max. applied voltage
12 V DC	75%V or less of nominal voltage	5%V or more of nominal voltage	16.7 mA	720 Ω	200 mW	130%V of rated voltage (at 70°C 158°F)
24 V DC			8.3 mA	2,880 Ω	200 mW	

2. Contacts (per PQ relay)

Characteristics	Item	Specifications
Contact rating	Nominal switching capacity (resistive load)	5 A 250 V AC, 5 A 30 V DC
	Max. switching power (resistive load)	1,250 VA, 150 W
	Max. switching voltage	250 V AC, 1100 V DC (0.3 A)
	Max. switching current	5 A
	Min. switching capacity (reference value)	100 μA 100 mV DC
Expected life	Electrical (at 20 times/min.)	Min. 10^5 (5 A 250V AC), Min. 10^5 (5 A 30V DC)
	Mechanical	Min. 2×10^7 (at 180 times/min.)

Note: The contact ratings and expected life values given are for when the relay is used separately. Depending on the number of I/O points on the RT-1 PC relay terminal, use within the temperature derating characteristics (see data page). When using the SSR, see page 178.

SPECIFICATIONS

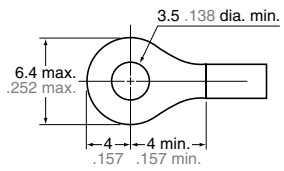
Item		Input	Output
Insulation resistance	Between connector terminals	Min. 100 MΩ (excluding power)	Min. 100 MΩ (excluding power)
	Between unlike poles on the terminals	Min. 100 MΩ (at 500 V DC megger)	Min. 100 MΩ (at 500 V DC megger)
	Between connector unlike poles (for input)	Min. 100 MΩ (excluding power, at 250 V DC megger)	—
	Between like poles on the terminals (for output)	—	Min. 100 MΩ (at 250 V DC megger)
Breakdown voltage	Between connector terminals	2,000 Vrms (excluding power)	2,000 Vrms (excluding power)
	Between unlike poles on the terminals	1,500 Vrms for 1 min.	1,500 Vrms for 1 min.
	Between connector unlike poles (for input)	250 Vrms for 1 min.	—
	Between like poles on the terminals (for output)	—	1,000 Vrms for 1 min.
Vibration resistance (Destructive)		10 to 55 Hz at double amplitude 1 mm .039 inch	10 to 55 Hz at double amplitude 1 mm .039 inch
Vibration resistance (Functional)		10 to 55 Hz at double amplitude 1 mm .039 inch	10 to 55 Hz at double amplitude 1 mm .039 inch
Shock resistance (Destructive)		Min. 196 m/s² (20 G)	Min. 196 m/s² (20 G)
Shock resistance (Functional)		Min. 98 m/s² (10 G)	Min. 98 m/s² (10 G)
Superimposed power noise		Min. 1,000 V*	Min. 1,000 V*
Superimposed I/O noise		Min. 500 V*	Min. 1,500 V*
Ambient temperature		0°C to +55°C +32°F to +131°F	0°C to +55°C +32°F to +131°F
Ambient humidity		35% to 85% R.H. (Not condensing)	35% to 85% R.H. (Not condensing)
Storage temperature		–30°C to +80°C –22°F to +176°F (Not freezing and condensing)	–30°C to +80°C –22°F to +176°F (Not freezing and condensing)
Terminal screw fasten torque		0.8 N·m {8 kgf·cm}	0.8 N·m {8 kgf·cm}
Coil surge absorber		Diode (1 A, 400 V)	Diode (1 A, 400 V)
Cross connection protecting diode		1 A, inverse breakdown voltage 40 V	1.5 A, inverse breakdown voltage 40 V

* According to in-house measurement.

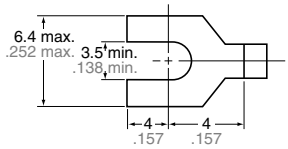
Notes: 1. The value of breakdown voltage and insulation resistance is initial.
2. Condensing occurs when the unit relay is exposed to sudden temperature change in a high temperature and high humidity atmosphere. This may cause some troubles like insulation failure of the socket or the print circuit board.
3. Below 0°C 32°F, condensing water can freeze and cause socket contact failures and other problems.

TERMINAL BLOCK

- Applicable electrical wire
  0.25 to 1.65 mm² .01 to .065 inch
- Applicable wire-pressed terminals (mm inch)



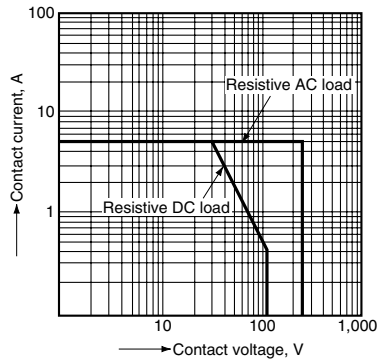
Company name	Round type
J.S.T. Mfg Co., Ltd.	1.25 – YS3A
NICHIFU Co., Ltd.	1.25 – 3L
Nippon Tanshi Co., Ltd.	VD1.25 – 3.5



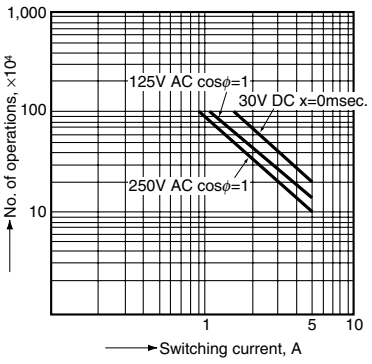
Company name	Fork type
J.S.T. Mfg Co., Ltd.	1.25 – 3.7
NICHIFU Co., Ltd.	1.25 – 3.5S
Nippon Tanshi Co., Ltd.	R1.25 – 3.5 · 2

REFERENCE DATA (with PQ relays mounted on)

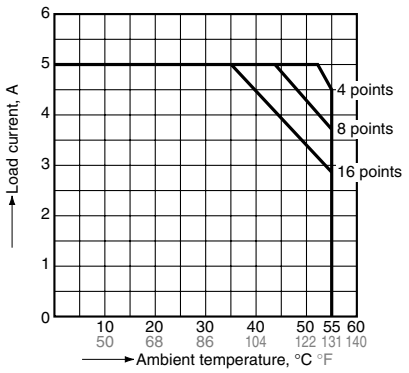
1. Maximum value for switching capacity (Output)



2. Life curve (Output)



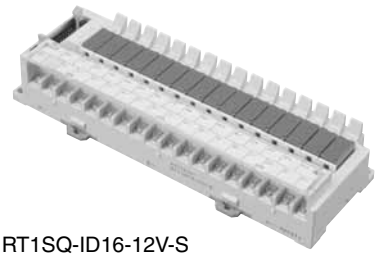
3. Load current vs. ambient temperature (Output)



DIMENSIONS (mm inch)

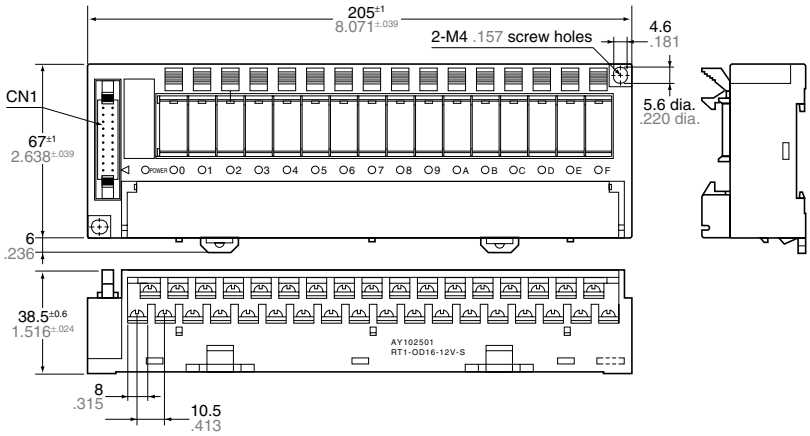
1. S type input 16 points

1) RT-1 PC relay terminal

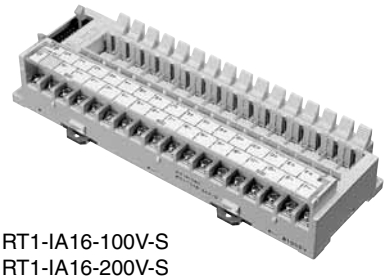


RT1SQ-ID16-12V-S
RT1SQ-ID16-24V-S

External dimensions

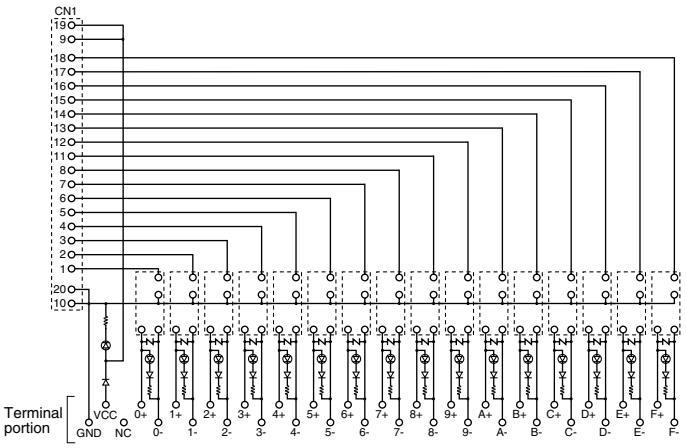


2) RT-1 PC terminal

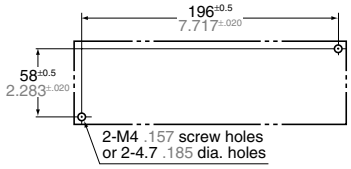


RT1-IA16-100V-S
RT1-IA16-200V-S
RT1-ID16-12V-S
RT1-ID16-24V-S

Terminal layout and schematic (for AC) (RT-1 PC terminal only)



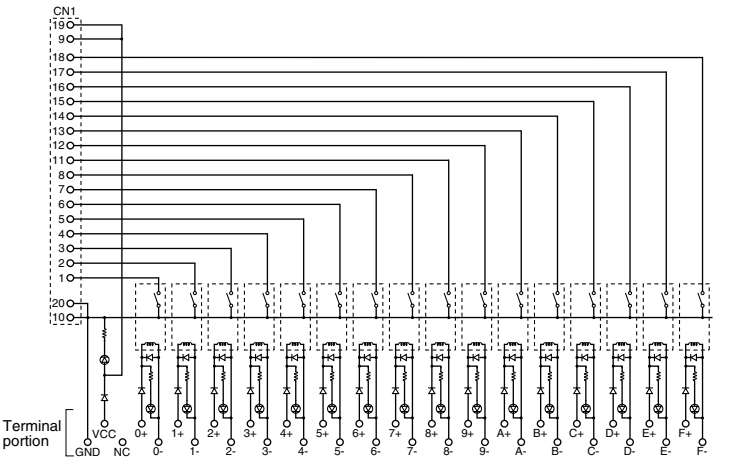
Mounting hole pattern



Connector pin layout

Terminal layout and schematic (for DC)

The figure below is of the RT-1 PC relay terminal. A relay is not equipped on the RT-1 PC terminal.

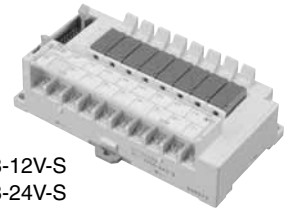


General tolerance: ±0.3 ±.012

Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.
The dimensions given in the diagram are the same for the RT-1 PC relay terminal and RT-1 PC terminal. However, a relay is not equipped on the RT-1 PC terminal.

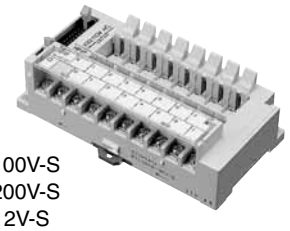
2. S type input 8 points

1) RT-1 PC relay terminal



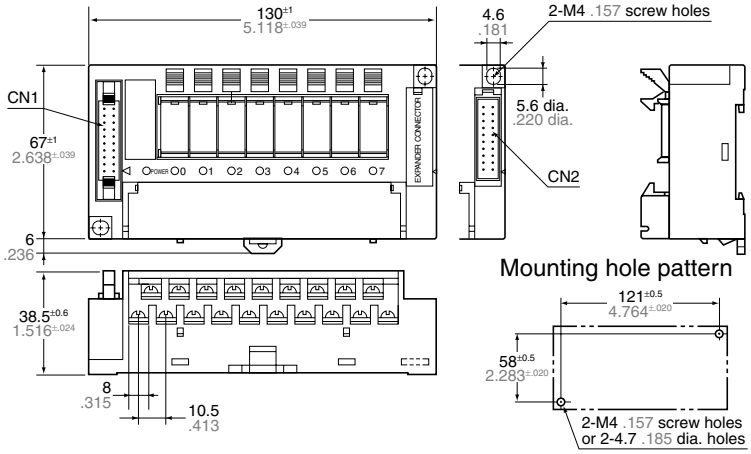
RT1SQ-ID8-12V-S
RT1SQ-ID8-24V-S

2) RT-1 PC terminal



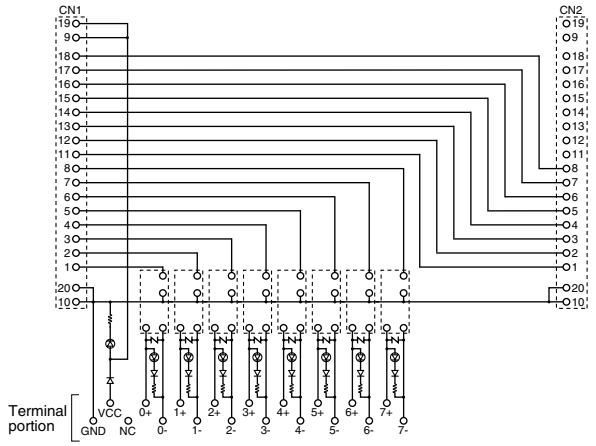
RT1-IA08-100V-S
RT1-IA08-200V-S
RT1-ID08-12V-S
RT1-ID08-24V-S

External dimensions



Connector pin layout

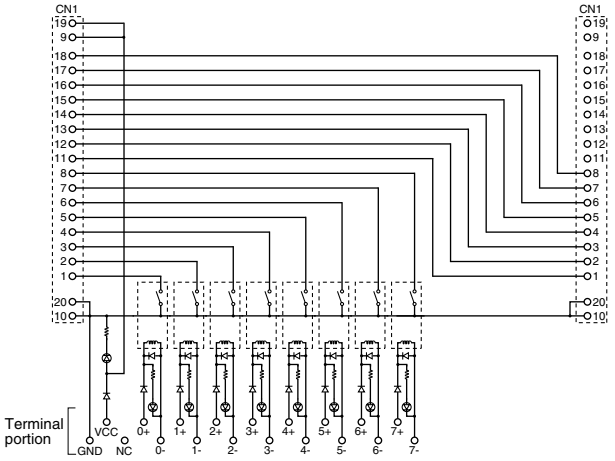
Terminal layout and schematic (for AC) (RT-1 PC terminal only)



Connector pin layout

Terminal layout and schematic (for DC)

The figure below is of the RT-1 PC relay terminal. A relay is not equipped on the RT-1 PC terminal.

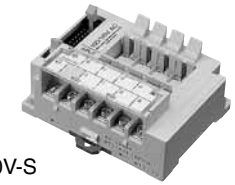


General tolerance: ±0.3 ±.012

Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.
The dimensions given in the diagram are the same for the RT-1 PC relay terminal and RT-1 PC terminal. However, a relay is not equipped on the RT-1 PC terminal.

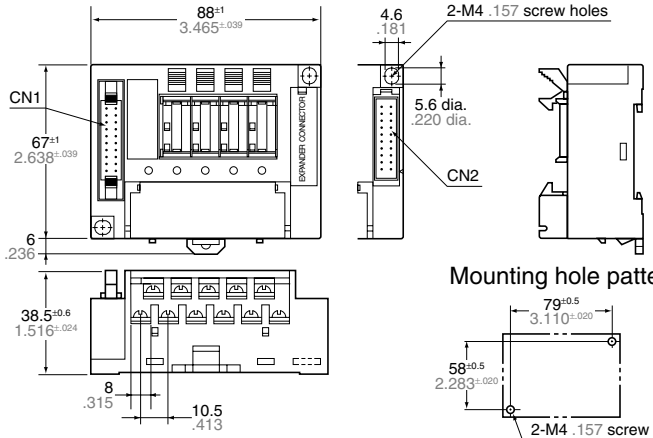
3. S type input 4 points

RT-1 PC terminal

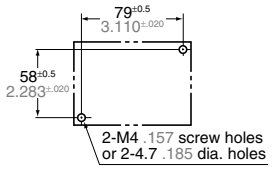


RT1-IA04-100V-S
RT1-IA04-200V-S
RT1-ID04-12V-S
RT1-ID04-24V-S

External dimensions

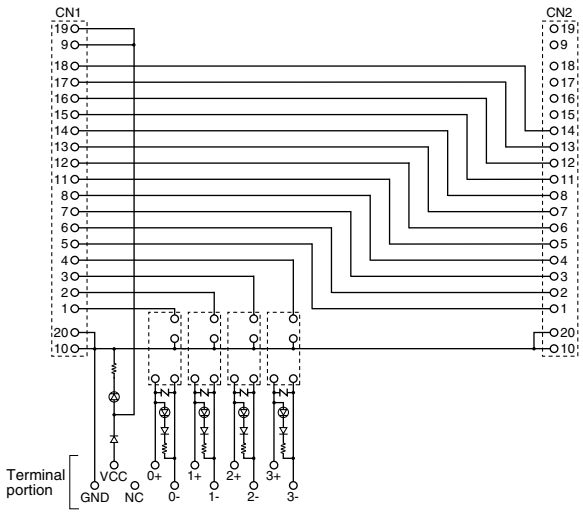


Mounting hole pattern

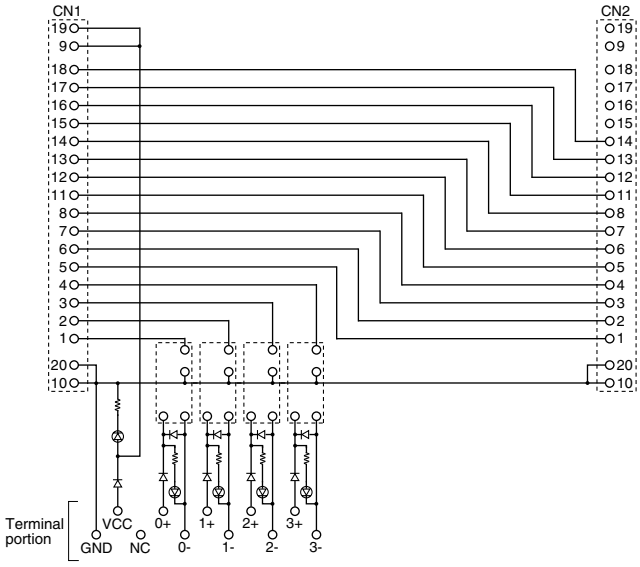


Connector pin layout

Terminal layout and schematic (for AC)



Terminal layout and schematic (for DC)

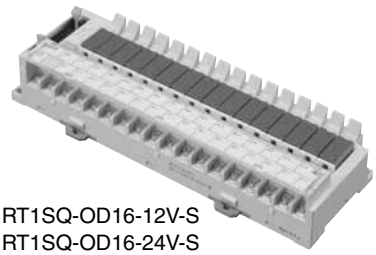


Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.

General tolerance: ±0.3 ±.012

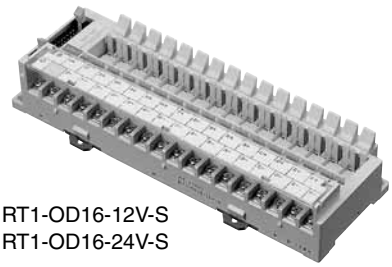
4. S type output 16 points

1) RT-1 PC relay terminal



RT1SQ-OD16-12V-S
RT1SQ-OD16-24V-S

2) RT-1 PC terminal

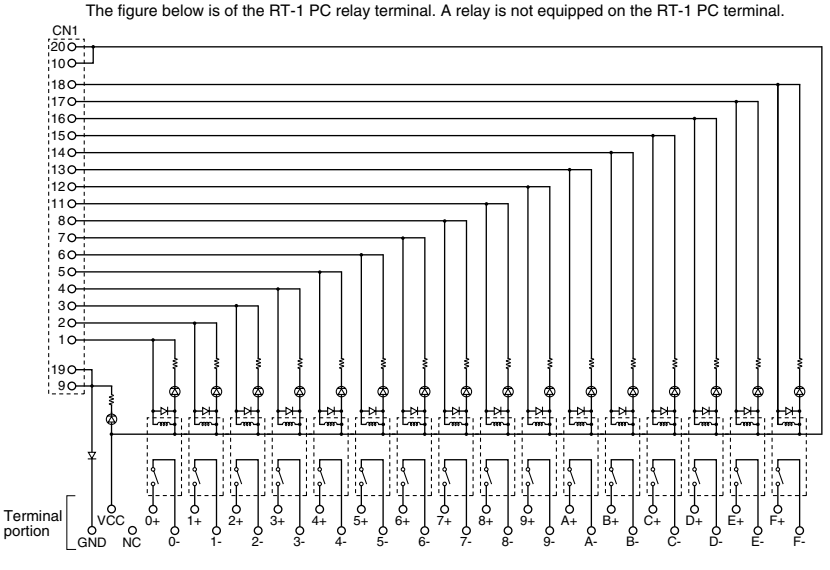


RT1-OD16-12V-S
RT1-OD16-24V-S

Connector pin layout

Terminal layout and schematic

The figure below is of the RT-1 PC relay terminal. A relay is not equipped on the RT-1 PC terminal.



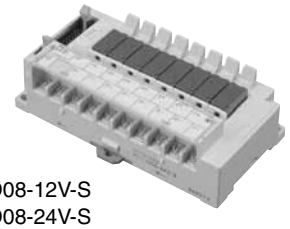
General tolerance: ±0.3 ±.012

Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.
The dimensions given in the diagram are the same for the RT-1 PC relay terminal and RT-1 PC terminal. However, a relay is not equipped on the RT-1 PC terminal.

Dimensions and Mounting hole pattern are the same as those of S type input 16 points type.

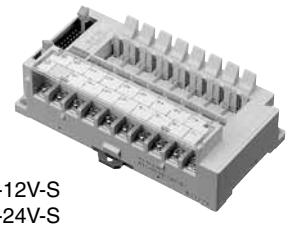
5. S type output 8 points

1) RT-1 PC relay terminal



RT1SQ-OD08-12V-S
RT1SQ-OD08-24V-S

2) RT-1 PC terminal

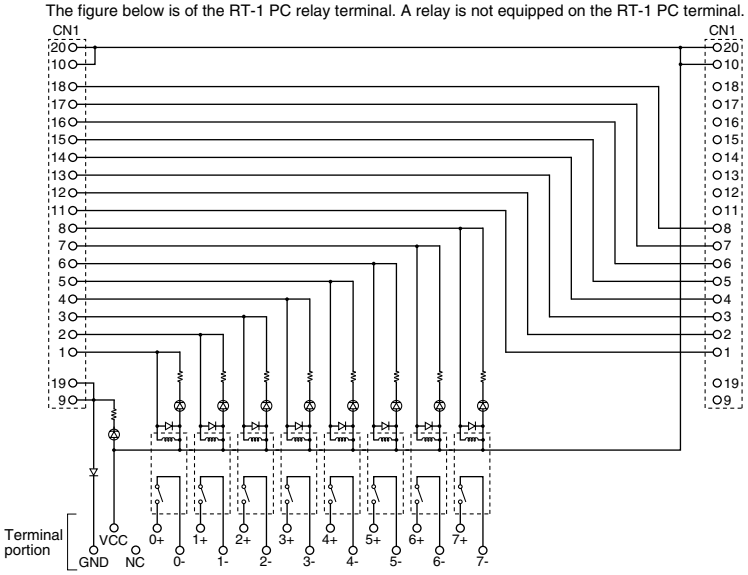


RT1-OD08-12V-S
RT1-OD08-24V-S

Connector pin layout

Terminal layout and schematic

The figure below is of the RT-1 PC relay terminal. A relay is not equipped on the RT-1 PC terminal.



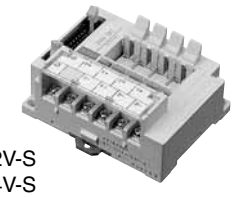
General tolerance: ±0.3 ±.012

Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.
The dimensions given in the diagram are the same for the RT-1 PC relay terminal and RT-1 PC terminal. However, a relay is not equipped on the RT-1 PC terminal.

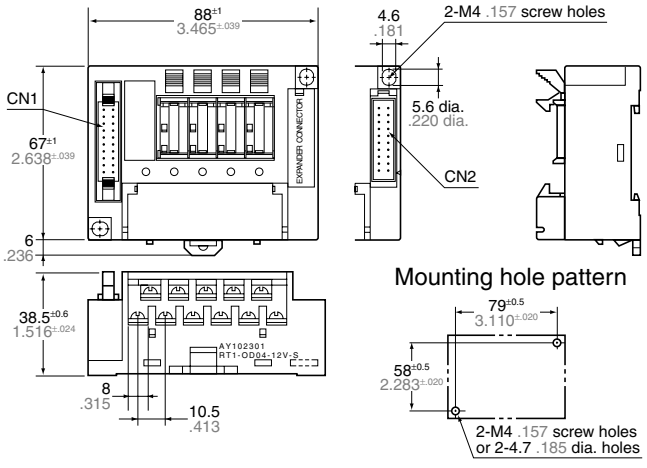
Dimensions and Mounting hole pattern are the same as those of S type input 8 points type.

6. S type output 4 points

RT-1 PC terminal



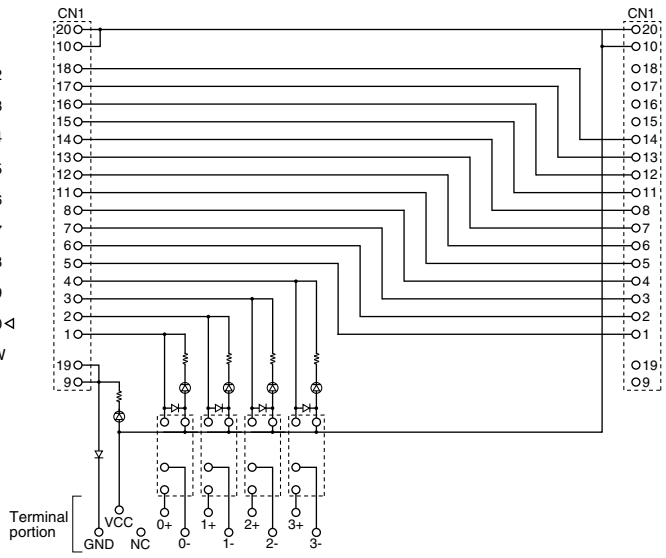
RT1-OD04-12V-S
RT1-OD04-24V-S



Mounting hole pattern

Connector pin layout

Terminal layout and schematic

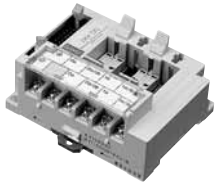


General tolerance: ±0.3 ±.012

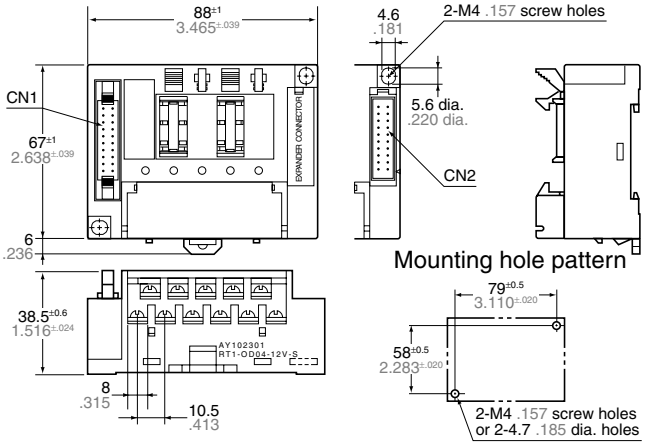
Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.

7. S type output 2 points

RT-1 PC terminal (1 Form A 1 Form B, 2 Form A)

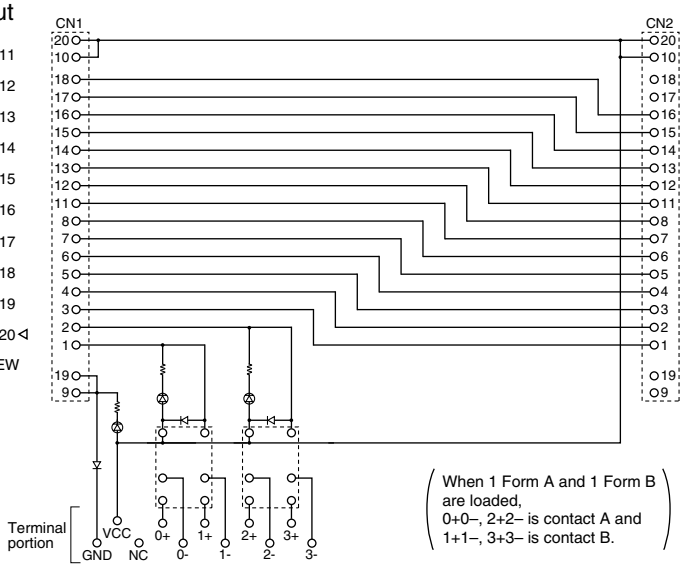


RT1-OD02-12V-S
RT1-OD02-24V-S



Connector pin layout

Terminal layout and schematic



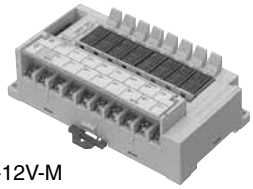
When 1 Form A and 1 Form B are loaded,
0+0–, 2+2– is contact A and
1+1–, 3+3– is contact B.

General tolerance: ±0.3 ±.012

Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.

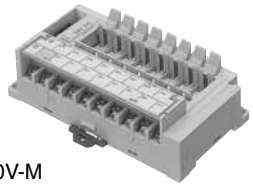
8. M type input 8 points

1) RT-1 PC relay terminal



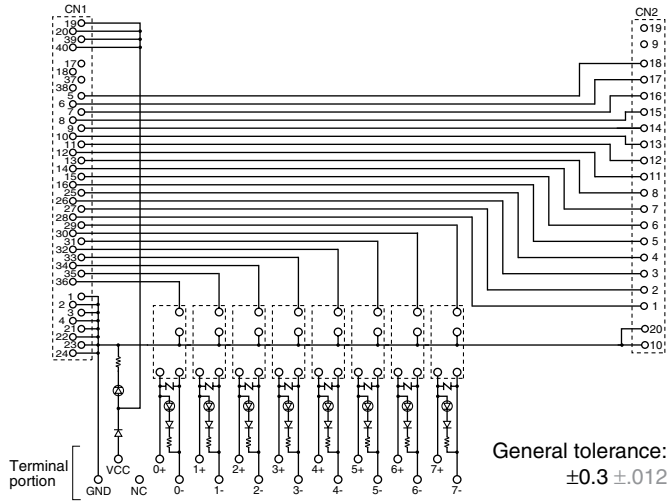
RT1SQ-ID08-12V-M
RT1SQ-ID08-24V-M

2) RT-1 PC terminal



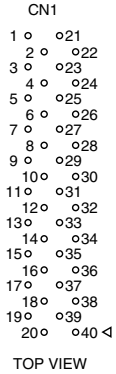
RT1-IA08-100V-M
RT1-IA08-200V-M
RT1-ID08-12V-M
RT1-ID08-24V-M

Terminal layout and schematic (for AC) (RT-1 PC terminal only)



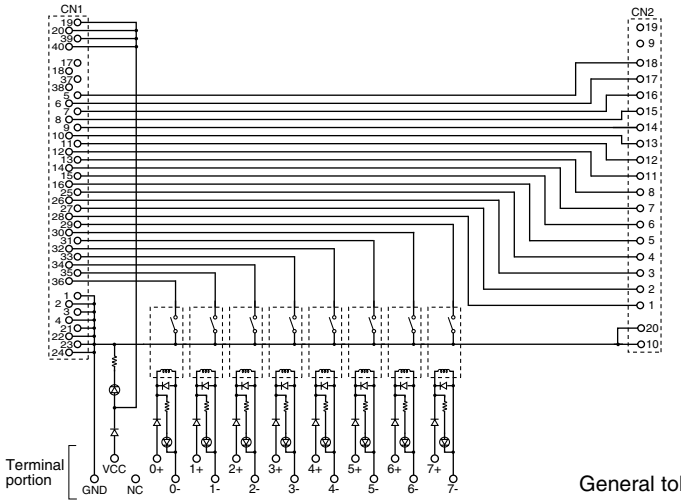
General tolerance: ±0.3 ±.012

Connector pin layout

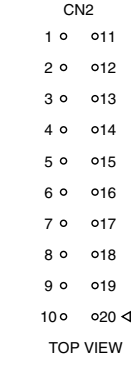


Terminal layout and schematic (for DC)

The figure below is of the RT-1 PC relay terminal. A relay is not equipped on the RT-1 PC terminal.



Connector pin layout



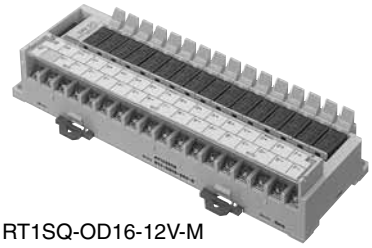
General tolerance: ±0.3 ±.012

Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.
The dimensions given in the diagram are the same for the RT-1 PC relay terminal and RT-1 PC terminal.
However, a relay is not equipped on the RT-1 PC terminal.

Dimensions and Mounting hole pattern are the same as those of RT-1 PC relay terminal S type input 8 points type. However, be aware that only the connector is different for the S and M types.

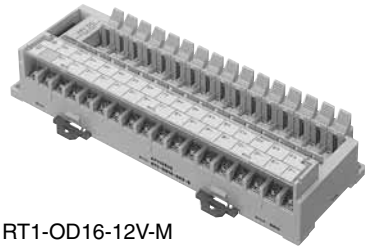
9. M type input 16 points

1) RT-1 PC relay terminal



RT1SQ-OD16-12V-M
RT1SQ-OD16-24V-M

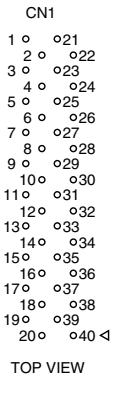
2) RT-1 PC terminal



RT1-OD16-12V-M
RT1-OD16-24V-M

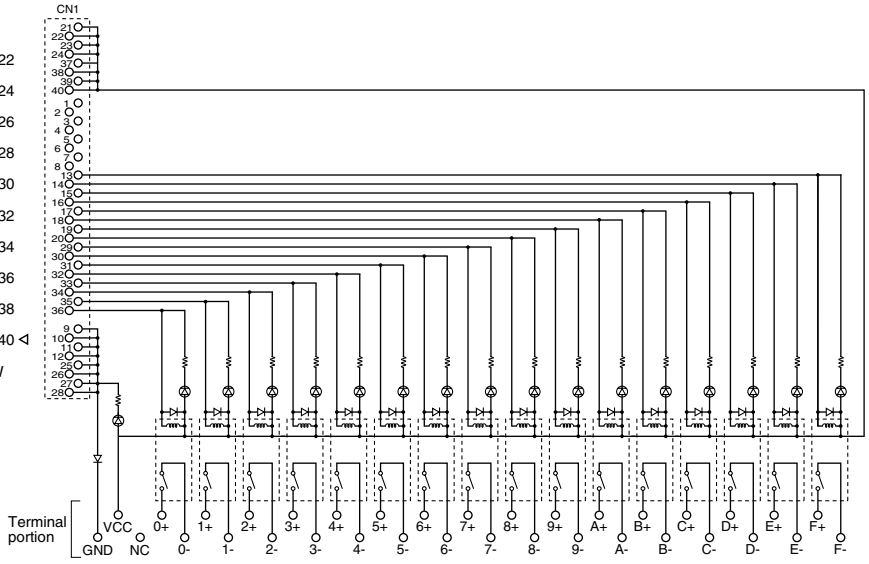
Note: Above terminal number is not marked on the terminal itself.
Wiring should be done according to the △ mark.
The dimensions given in the diagram are the same for the RT-1 PC relay terminal and RT-1 PC terminal. However, a relay is not equipped on the RT-1 PC terminal.

Connector pin layout



Terminal layout and schematic (for DC)

The figure below is of the RT-1 PC relay terminal. A relay is not equipped on the RT-1 PC terminal.



General tolerance: ±0.3 ±.012

Dimensions and Mounting hole pattern are the same as those of RT-1 PC relay terminal S type input 16 points type. However, be aware that only the connector is different for the S and M types.

NOTES

1. Part number

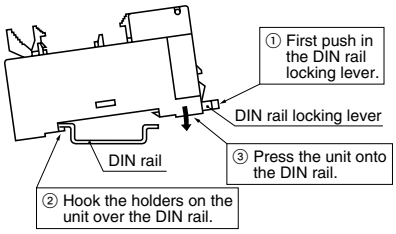
RT-1 PC relay terminal is a terminal device on which PQ relays are mounted.

Ex.) Part No. of RT-1 PC terminal
RT1-OD16-24V-S
Part No. of RT-1 PC relay terminal
RT1S-OD16-24V-S

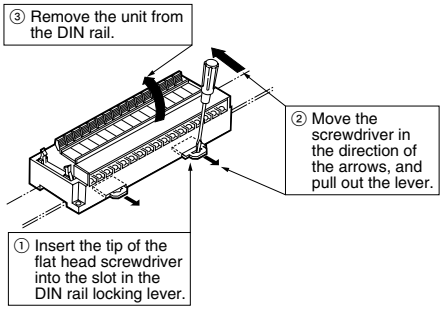
'S' is inserted to denote RT-1 PC relay terminal.

2. Installation

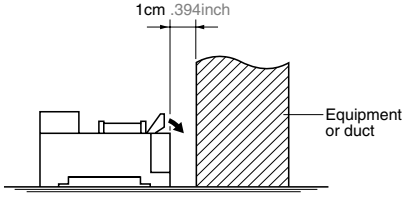
1) Perform mounting hole cutout according to the panel cutout drawings.
2) When installing the unit on a DIN rail, use the DIN rail locking lever on the side of the unit. Installation is accomplished by simply fitting the unit onto the rail and pressing.



To remove the unit from the DIN rail, use a flat head screwdriver to pull out the DIN rail locking lever.



3) When installing the RT-1 PC terminal to the control panel, leave at least a 1 cm .394 inch space between the terminal and neighboring equipment or ducts in order to ensure a space where the relay removal levers can operate.



4) Be careful not to drop or shock the unit. Excessive shock such as dropping may cause damage or malfunction.

3. Wiring and circuit configuration

1) Make all connections according to the schematic. DC specifications have polarity. The upper stage of the RT-1 PC terminal is positive, and the lower stage is negative.
2) The "NC" terminal indicated in the schematic has no electrical connections. It can be used as a relay terminal.
3) When wiring power lines or power cables, twisted pair treatment (standed wire treatment) should be done in order to improve noise resistance.
4) When the load output device is an inductive load type, installing a diode and surge absorber to both ends of the load is recommended.
5) In order to improve noise resistance, class 3 grounding of the control panel is recommended.
6) Do not pass the wiring over the surface of the case. (When unavoidable, keep the wire at least 3 cm 1.181 inch away from the surface of the case.)
7) Turn off the power before connecting/disconnecting connector cables.
When connecting cables, align the cable connector 'Black triangle' mark with the mark of the RT-1 PC terminal main unit and connect it. Incorrect insertion may cause malfunctions.

4. Installing and removing the interface relay and SSR

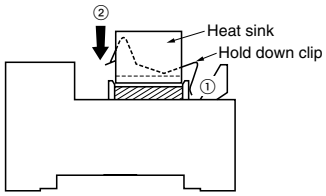
1) Turn the terminals of the interface relay and SSR in the same direction as the jack support and insert them securely.
2) The interface relay and SSR can be easily removed by lowering the removal levers to the outside. When the levers are forcibly put down, the interface relay and SSR may jump out. Put your hand on the relay or SSR lightly and operate the levers.

5. Continuous parallel operation of interface relay and SSR

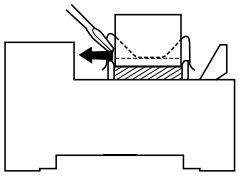
When performing a continuous parallel operation of the interface relay and SSR, use them according to the "load current vs. ambient temperature characteristic drawing" and "Input voltage vs. ambient temperature characteristic drawing".

6. Installing and removing the heat sink

1) Install the heat sink according to the following drawing (Fig.1). Remove it according to the following drawing (Fig.2).
2) Do not apply silicone grease to the heat sink. It may cause insufficient contact of the jack support.



Installation (Fig.1)
① Hold one side of the heat sink.
② Press it down and hold the other side of it.



Removal (Fig.2)
Insert a pair of tweezers of thin screwdriver and remove the spring in the direction of the arrow.

7. Operating environment

1) Use the product at ambient operating temperature between 0°C and 55°C 32°F and 131°F. (When installing in the control panel, take heat release into due consideration. Installing of the product at 90 degrees to the control panel is recommended. When installing the product horizontally or placing it on a heating unit, use a cooking fan.)
2) Keep the supply voltage within the range of 90% to 110%V of the rated voltage.
3) Keep the product as far away as possible from power cables, high tension equipment, power equipment, equipment with transmitting devices such as amateur radios, or equipment which generates a large switching surge.
4) The main unit is made of resin; therefore, do not use it in areas where it may come in contact with (or be exposed to) organic solvents such as benzine, thinner, and alcohol, or strong alkaline substances such as ammonia and caustic soda.
5) Do not use the product in areas where it may be exposed to flammable gases, corrosive gases, excessive dust, or moisture, or areas where it may be subjected to strong vibration or shock.

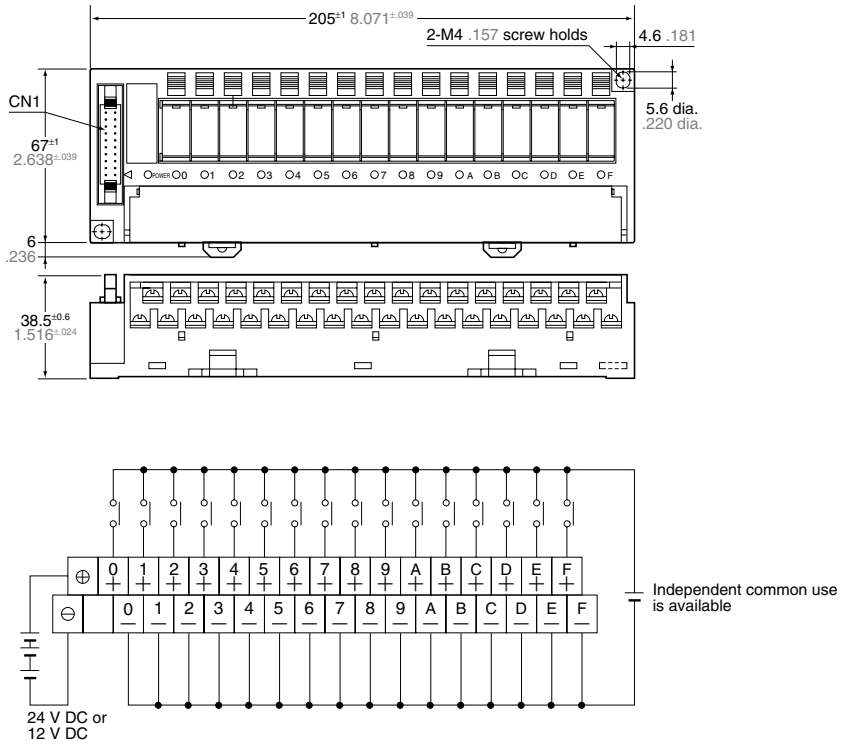
8. Transporting and storage

1) If the product is subjected to extreme vibration while being transported, the relays may become detached, the lead may become bent, and the unit may become damaged. Handle the carton and case with care.
2) If the product is stored in an extremely adverse environment, visible defects and deterioration of performance characteristics may result. We recommend the following storage conditions.

- Temperature: 5 to 30°C 41 to 86°F
- Humidity: Max. 60% R.H.
- Environment: No hazardous substances such as sulfurous acid gases and little dust.

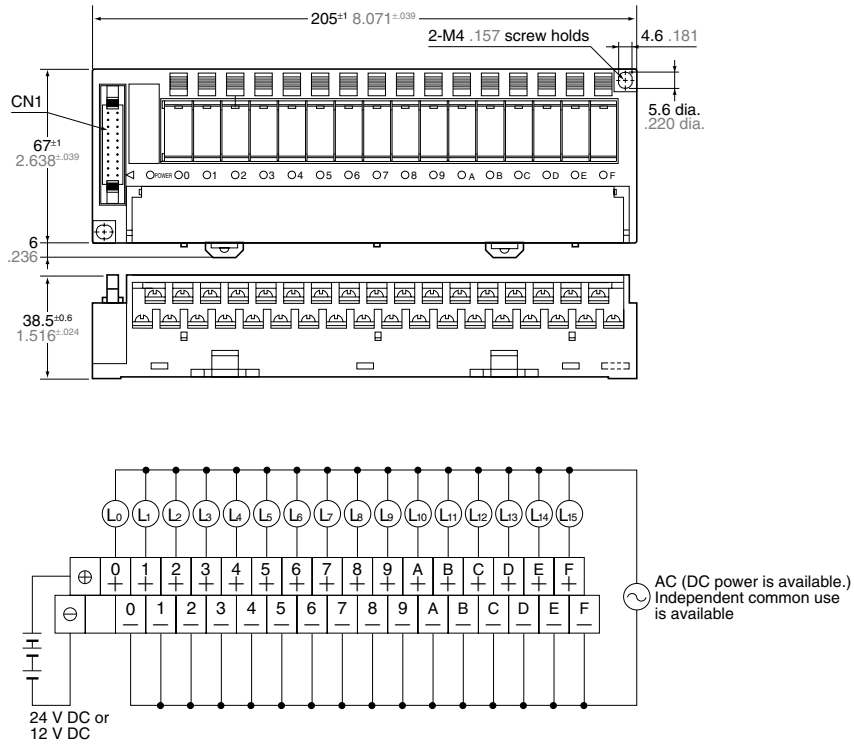
9. Precautions regarding wiring

1) For input



• The voltage specifications (relay and terminal) are provided. When using the RT-1 PC relay terminal, supply power to terminals (O+ to F+, O- to F-) according to the voltage specifications.
For DC specifications, pay attention to the polarity. A short-circuit plate is also available.
• Supply the nominal voltage (24 V DC or 12 V DC) of the input circuit on the controller (PC etc.) to the power input terminals ((+), (–)). Use a noiseless power supply.
• When a 1-to-2 cable connector is connected to the input terminal, use an input-only cable connector. If an output cable connector is used, it may cause damage or malfunction.

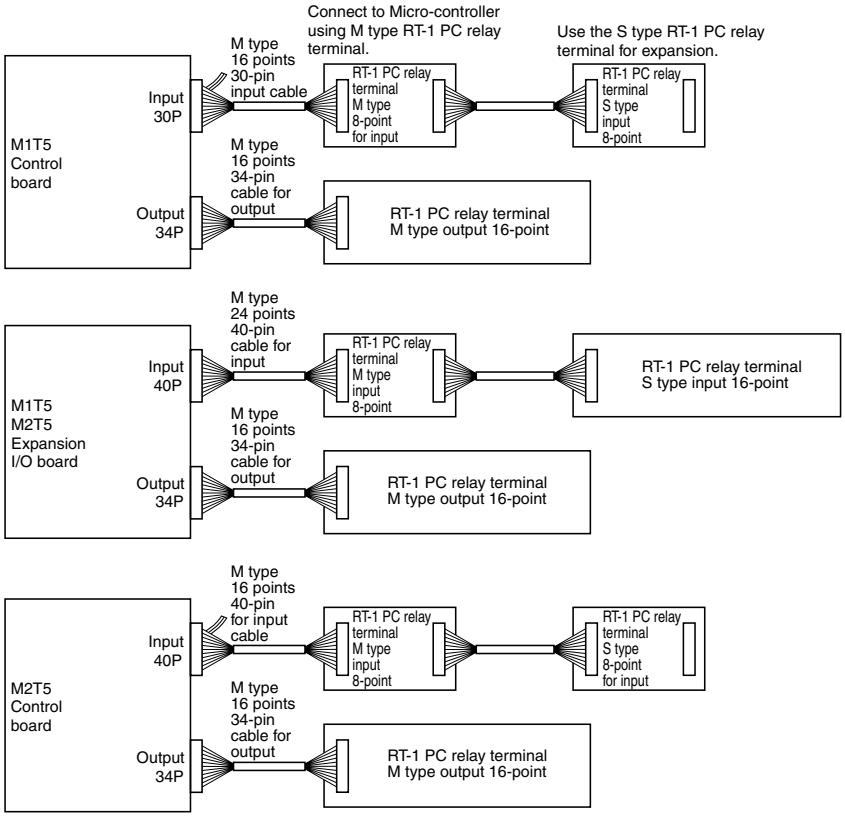
2) For output



• The voltage specifications (relay and terminal) are provided. Either 12 V DC or 24 V DC can be selected using the connecting controller.
Since terminals (O+ to F+, O- to F-) are output contacts, supply power according to the load. A 4-point short-circuit plate is also prepared.
• The power input terminals ((+), (–)) are used as a drive power supply for the relay and as an extra power supply for the output transistor of the controller. Match the voltage specifications of the controller to those of this unit. Use a noiseless power supply.
• When a 1-to-2 cable connector is connected to the output terminal, use an output-only cable connector. If an input cable connector is used, it may cause damage or malfunction.

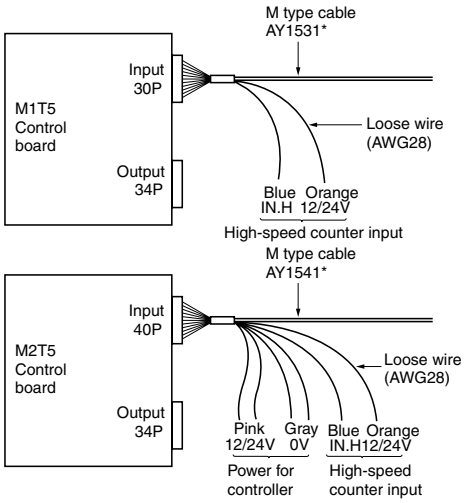
M TYPE RT-1 PC RELAY TERMINAL (for connection to Micro-controller)

1. Connect the M type Micro-controller to RT-1 PC terminals as shown in the diagram below.



2. For M type cable, see section on "CABLE".

3. Implement the high-speed counter input and controller power supply as shown in the diagram below. For more information see the M type Micro-controller catalog.



4. Power supply

1) Connecting RT-1 PC terminals to the M1T5

Provide power from the same power source as that used for M1T5 input and output.

2) Connecting the terminals to the M2T5

Because there is no power supply from the M2T5 to the terminals, provide power to the "+" and "-" screw terminals of the terminal.

For more information see the M type Micro-controller catalog.

CONNECTING POWER RELAYS

1. The main unit can be connected to power relays. (NC relay, HC relay, HL relay)

Connecting NC, HC and HL relays to the RT-1 PC terminals allows the load switching of high capacity, application to form C contact and application to multi-electrode contacts.

1) When the power relay is connected to the output 8-point or 4-point RT-1 PC terminal, it can be connected from the expansion connector. For connection from the expansion connector, our AZW bulk wire pressure welding socket is recommended. For the wiring, see the schematic of each terminal.

2) When the output terminal jumper relay is installed and the voltage output from a controller (PC etc.) is taken out to the terminal screw terminal, the terminal can be connected to the HC and HL terminal sockets (the effect is the same as Fig. 1).

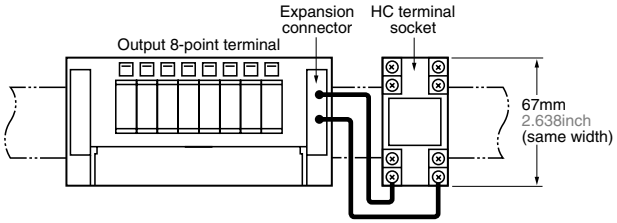


Fig. 1

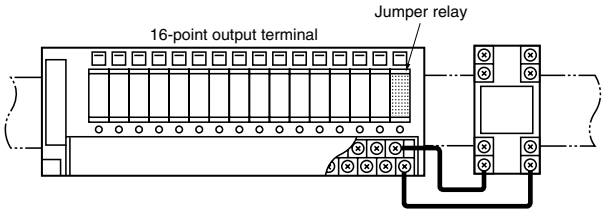


Fig. 2

Note: Set the current capacity per output of a controller (PC, etc.) to more than the nominal current of the HC or HL relay.

EXPANSION OF RT-1 PC TERMINAL

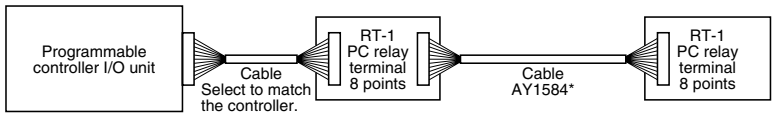
1. When expanding the RT-1 PC terminal, remove the expansion connector cover (EXPANDER CONNECTOR).

2. An expansion cable is available.

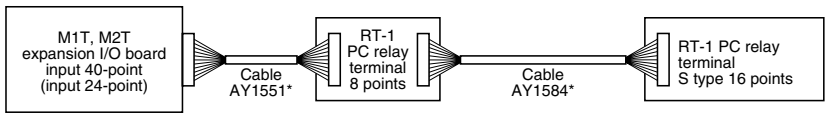
Refer to section on “CABLE”.

3. Example of expansion

1) The number of I/O points can be increased to 16 points.

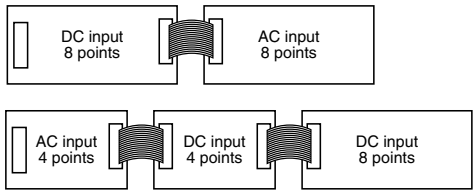


2) Expansion up to 24 points chained devices with M1T and M2T is only possible with 40-point expansion I/O board (input 24-point).



3) Since the AC input terminal can be expanded to the DC input terminal and vice versa, the number of DC and AC input points can be divided within the range of 16 points.

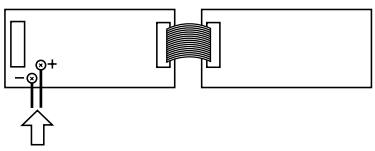
Example:



4. Power supply when expanding

When expanding the RT-1 PC terminal, be sure to supply power to the expansion RT-1 PC terminal block screw terminals (+) (–) (see the drawing).

Even when power is supplied to the expanded the terminal, it will not operate. The Power LED lights up only for the expansion the terminal and it does not light for the expanded the terminal.









1 Form A | 1 Form A 1 Form B | 2 Form A | DC output | AC output | DC input | AC input

PQ Relay | DS-P Relay | AQ-C Solid State Relay

Compliance with RoHS Directive

TYPES

Mountable relay	Type		Rated input voltage	Part No.
PQ relay	1 Form A		12 V DC	PQ1a-12V
			24 V DC	PQ1a-24V
DS-P relay	1 Form A 1 Form B		12 V DC	DSP1-DC12V
			24 V DC	DSP1-DC24V
	2 Form A		12 V DC	DSP2a-DC12V
			24 V DC	DSP2a-DC24V
AQ-C solid state relay	DC output		12 V DC	AQC1AD1-12V DC
			24 V DC	AQC1AD1-24V DC
	AC output Zero-cross	Load voltage 75 to 125 V AC	12 V DC	AQC1A1-ZT12V DC
			24 V DC	AQC1A1-ZT24V DC
		Load voltage 75 to 250 V AC	12 V DC	AQC1A2-ZT12V DC
			24 V DC	AQC1A2-ZT24V DC
	AC output Non Zero-cross	Load voltage 75 to 125 V AC	12 V DC	AQC1A1-T12V DC
			24 V DC	AQC1A1-T24V DC
		Load voltage 75 to 250 V AC	12 V DC	AQC1A2-T12V DC
			24 V DC	AQC1A2-T24V DC
	DC input		4/24 V DC	AQCD3-1M-4/24V DC
	AC input		100/240 V AC	AQCD3-1M-100/240V AC

Standard packing: Carton: 10 pcs.; Case: 100 pcs.
Note: Regarding terminals that can be used, please refer to the "3. Combination with Relay for interface and SSR" on page 166.

RATING

(Rating when used separately. Depending on the number of I/O points on the RT-1 PC terminal, use within the temperature derating characteristics).

1. Interface relay (PQ relay and DS-P relay)

1) Coil data (per relay)

Type	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
PQ relay	12 V DC	75%V or less of nominal voltage	5%V or more of nominal voltage	16.7 mA	720 Ω	200 mW	130% of nominal voltage (at 70°C 158°F)
	24 V DC			8.3 mA	2,880 Ω		
DS-P relay	12 V DC	80%V or less of nominal voltage	10%V or more of nominal voltage	25 mA	480 Ω	300 mW	130% of nominal voltage (at 60°C 140°F)
	24 V DC			12.5 mA	1,920 Ω		

2) Performance (per relay)

Chracteritics	Item		PQ relays	DS-P relays
Contact	Contact arrangement		1 Form A (twin contact)	1 Form A 1 Form B, 2 Form A
Rating	Nominal switching capacity (resistive load)		5A 250V AC, 5A 30V DC	5A 250V AC, 5A 30V DC
	Min. switching capacity (reference value)		100mW 100μA	—
	Max. switching current (resistive load)		5A	5A
	Nominal operating power		200mW	300mW
Electrical characteristics	Breakdown voltage	Between open contacts	1,000 Vrms for 1min.	1,000 Vrms for 1min.
		Between contacts sets	—	2,000 Vrms for 1min.
		Between contacts and coil	4,000 Vrms for 1min.	3,000 Vrms for 1min.
	Surge breakdown voltage (between contact and coil)*		Min. 8,000 V	Min. 5,000 V
	Operate time		Approx. 5.5 ms at 20°C 68°F	Approx. 5 ms
	Release time		Approx. 2.5 ms at 20°C 68°F	Approx. 4 ms
Expected life	Mechanical		Min. 2×10^7 (at 180 times/min.)	Min. 5×10^7 (at 180 times/min.)
	Electrical		Min. 10^5 (5A 250V AC), Min. 10^5 (5A 30V DC)	Min. 10^5 (at nominal control capacity, resistive load)

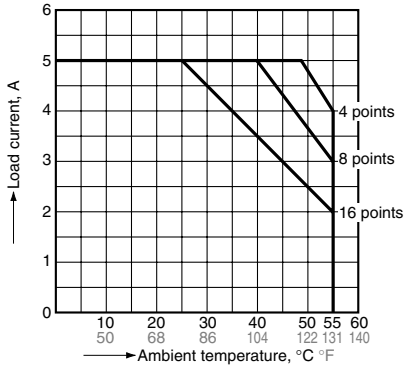
Notes: *1. Expressed using $\pm1.2 \times 50$ μs standard voltage waveform according to JEC-212-1981.
*2. The electrical life of PQ relays is not particularly good when used under frequent switching and low level load conditions. For such loads, we recommend the AQ-C SSR.

2. AQ-C Solid State Relay (per relay)

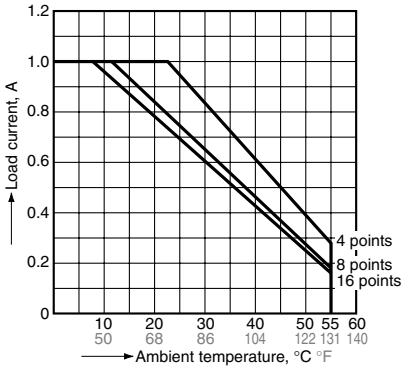
Item		Type	AC output (Zero-cross, Non zero-cross)		DC output		AC input	DC input
Input module	Input side	Normal voltage	—		—		100/240 V AC	4/24 V DC
		Input voltage	—		—		80 to 250 V AC	3 to 32 V DC
		Input current	—		—		Max. 5 mA	Max. 5 mA
	Output side	Logic supply voltage	—		—		4 to 32V DC	4 to 32V DC
Output module	Input side	Normal voltage	12V DC	24V DC	12V DC	24V DC	—	—
		Operating voltage	9.6 to 14.4 V DC	21.6 to 26.4 V DC	9.6 to 14.4 V DC	21.6 to 26.4 V DC	—	—
		Input impedance	Approx. 0.8 kΩ	Approx. 1.8 kΩ	Approx. 1.2 kΩ	Approx. 2.8 kΩ	—	—
	Output side	Load voltage	75 to 125 V AC, 75 to 250 V AC		3 to 60 V DC		—	—
		Load current	1A		1A		—	—
Characteristics		Operate time/Release time	Max. 1 ms (Non zero-cross), 1/2 cycle + Max. 1 ms (Zero-cross)/ 1/2 cycle + Max. 1 ms		Max. 0.5 ms/Max. 1 ms		Max. 20 ms	Max. 0.5 ms
		"Off-state" leakage current	0.6 mA (Load voltage 75 to 125 V type, when 100 V AC applied) 1.1 mA (Load voltage 75 to 250 V type, when 200 V AC applied)		Max. 0.1 mA		Max. 5μA	Max. 5μA
		Insulation resistance	Min. 1,000 MΩ		Min. 1,000 MΩ		Min. 1,000 MΩ	Min. 1,000 MΩ
		Breakdown voltage (Between input and output)	Min. 2,500 Vrms		Min. 2,500 Vrms		Min. 2,500 Vrms	Min. 2,500 Vrms

TEMPERATURE DERATING

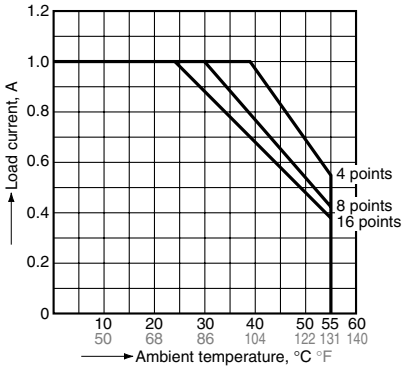
1. PQ relay mounted



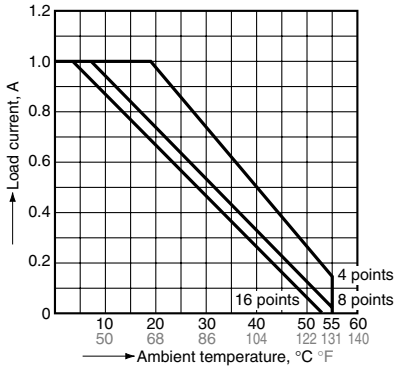
2.-(1)AQ-C Solid State Relay
DC output type mounted
(No heat sink)



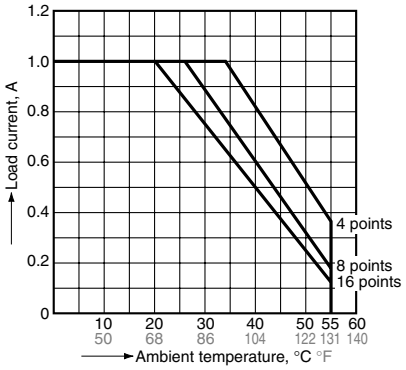
2.-(2)AQ-C Solid State Relay
DC output type mounted
(Heat sink attached)



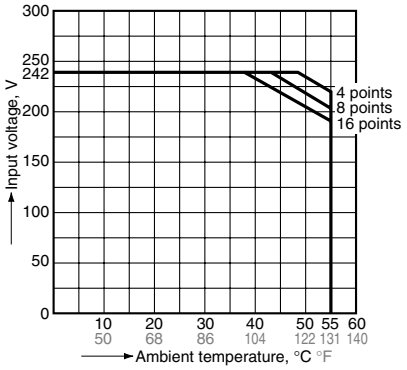
3.-(1)AQ-C Solid State Relay
AC output type mounted
(No heat sink)



3.-(2)AQ-C Solid State Relay
AC output type mounted
(Heat sink attached)



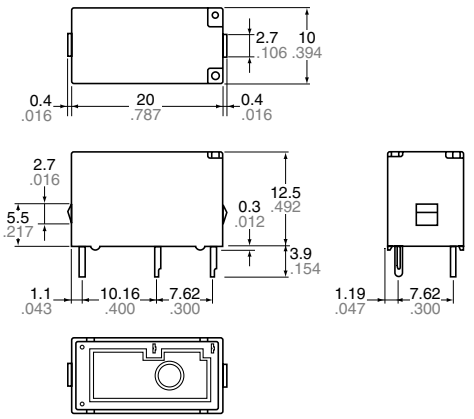
4. AQ-C Solid State Relay
AC input type mounted
(No heat sink)



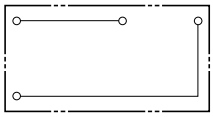
JUMPER RELAY A dummy relay used for output only

AY1801

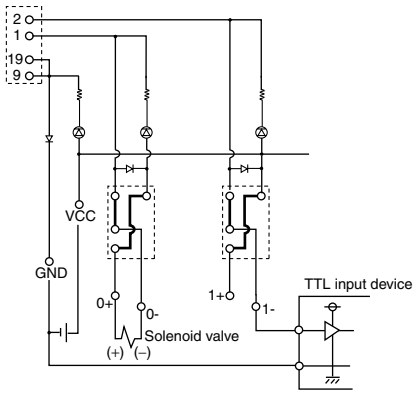
External dimensions (mm inch)



Schematic
(Bottom view)



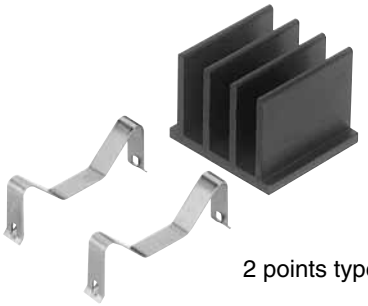
Example



Compliance with RoHS Directive

HEAT SINK

Heat sink (with 2 pieces of hold-down chip)

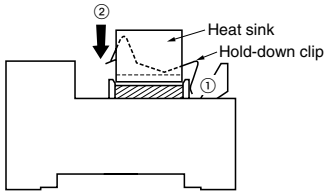


2 points type AY1811

Note: Do not apply silicone grease to the heat sink.
It may cause insufficient contact of the socket.

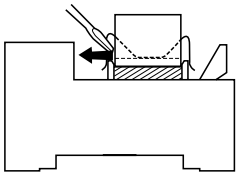
Installing and removing the heat sink

Installation



① Hold one side of the heat sink.
② Press it down and hold the other side of it.

Removal



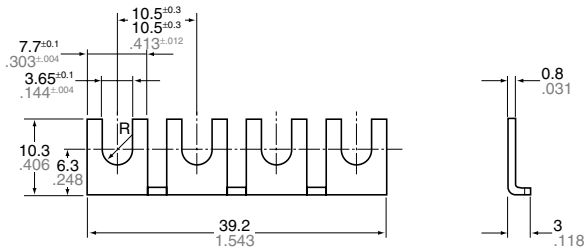
Insert a pair of tweezers or thin screwdriver and remove the heat sink in the direction of the arrow.

SHORT CIRCUIT PLATE

Use when you want to bridge terminals.

AY1803

External dimensions (mm inch)

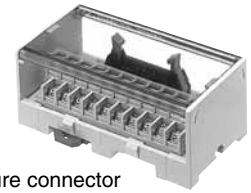


General tolerance:
±0.5 ±.020

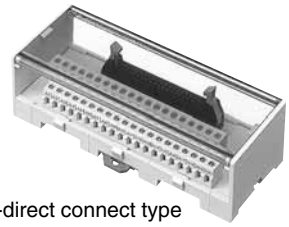
Panasonic
ideas for life

Connector terminal for PLCs, PCs and various controllers

CT-2 CONNECTOR TERMINAL



Pressure connector connect type



Wire-direct connect type

FEATURES

1. One-touch wiring with the various controller types greatly reduces the time required for wiring operations.
2. Integrated AXM connector (complying to MIL Standard)
3. Exclusive cables can be provided
4. DIN rail mounting type and direct mounting type are available

TYPICAL APPLICATIONS

I/O interface for PLCs, personal computers and various types of controllers.

Compliance with RoHS Directive

ORDERING INFORMATION

CT2 – □ □ – □ □

Installation type
Nil: DIN rail mounting type
M: Direct mounting type

Termination type
Nil: Pressure connector connect type
C: Wire-direct connect type

No. of poles
20: 20 poles
30: 30 poles
34: 34 poles
40: 40 poles

TYPES

1. DIN rail mounting type

Connection method	No. of poles	Part No.
Pressure connector connect type	20	CT2-20
	30	CT2-30
	34	CT2-34
	40	CT2-40
Wire-direct connect type	20	CT2-C-20
	30	CT2-C-30
	34	CT2-C-34
	40	CT2-C-40

Standard packing: Carton: 1 pc.; Case: 20 pcs.

2. Direct mounting type

Connection method	No. of poles	Part No.
Pressure connector connect type	20	CT2-M-20
	30	CT2-M-30
	34	CT2-M-34
	40	CT2-M-40
Wire-direct connect type	20	CT2-MC-20
	30	CT2-MC-30
	34	CT2-MC-34
	40	CT2-MC-40

Standard packing: Carton: 1 pc.; Case: 20 pcs.

SPECIFICATIONS

Item	Specifications
Rated voltage	125 V AC
Rated current	1 A
Breakdown voltage	250 Vrms for 1 min.
Insulation resistance	100 MΩ (at 500 V DC megger)
Fasten torque	Pressure connector connect type: 0.3 to 0.5 N·m {3 to 5 kgf·cm} Wire-direct connect type: 0.2 to 0.4 N·m {2 to 4 kgf·cm}
Ambient temperature	0°C to +55°C +32°F to +131°F

CONNECTOR

1. Applicable connector (socket)

Product name	No. of poles	Part No.
MIL type AXM Flat Cable Connector	20	AXM120415
	30	AXM130415
	34	AXM134415
	40	AXM140415

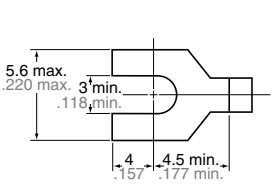
2. Applicable flat cable

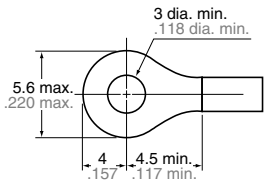
Standard wire: pitch (1.27 mm 0.050 inch)/conductor #28 (7 wire/0.127 dia.)

TERMINAL BLOCK

1. Pressure connector connect type

- Applicable electrical wire
  0.25 to 1.65 mm² .01 to .065 inch
- Applicable wire-pressed terminals (mm inch)





Company name	Fork type	Round type
J.S.T. Mfg Co., Ltd.	1.25 – C3A	1.25 – 3
NICHIFU Co., Ltd.	1.25Y – 3N	1.25 – 3
Nippon Tanshi Co., Ltd.	VD1.25 – 3	R1.25 – 3

2. Wire-direct connect type

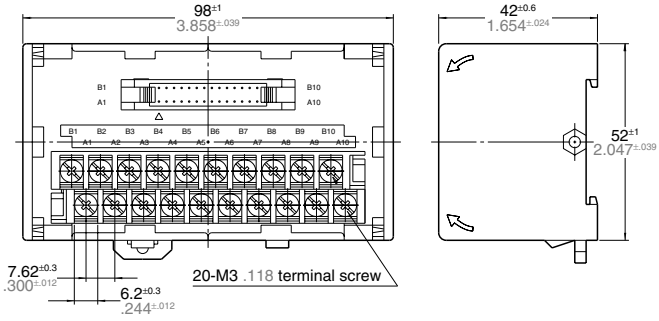
When wiring screw-clamped terminal blocks, strip the lead wires and connect them properly.

Stripping length	Applicable wire
8 to 10 mm .315 to .394 inch	• 0.128 to 1.318 mm .005 to 0.52 inch • 0.4 to 1.3 mm dia. .016 to .051 inch dia.

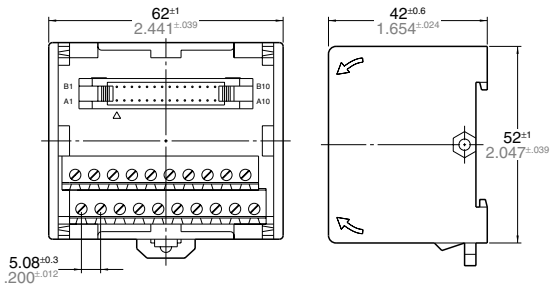
DIMENSIONS (mm inch)

1. DIN rail mounting type

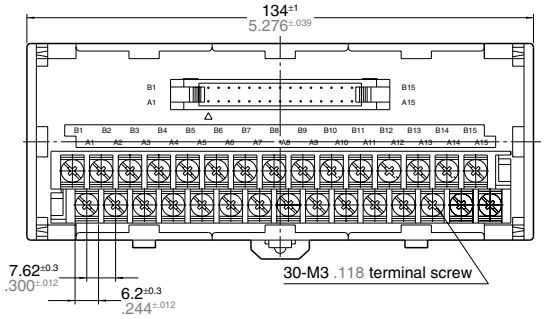
Pressure connector connect type (20 poles)
External dimensions



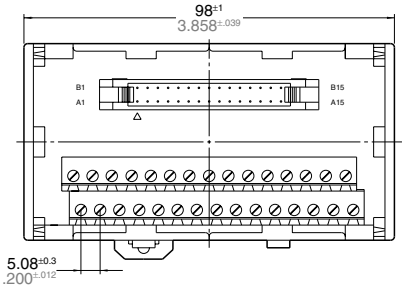
Wire-direct connect type (20 poles)
External dimensions



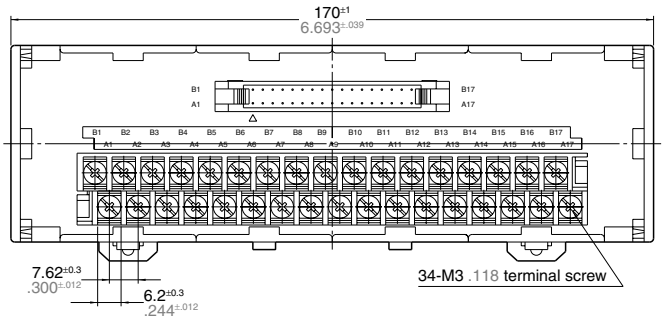
Pressure connector connect type (30 poles)
External dimensions



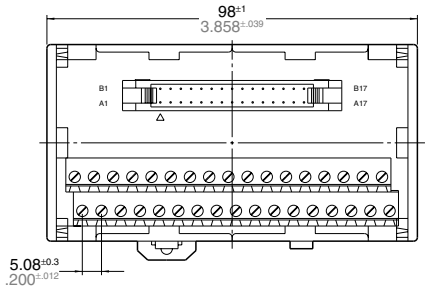
Wire-direct connect type (30 poles)
External dimensions



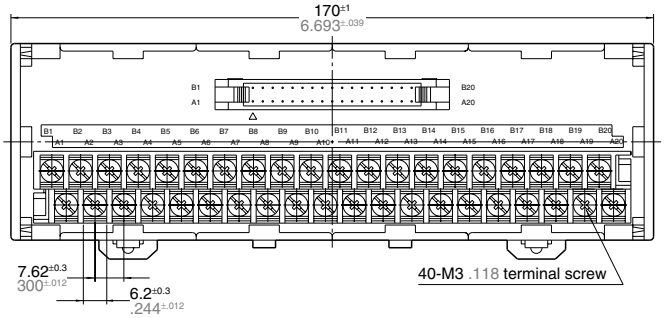
Pressure connector connect type (34 poles)
External dimensions



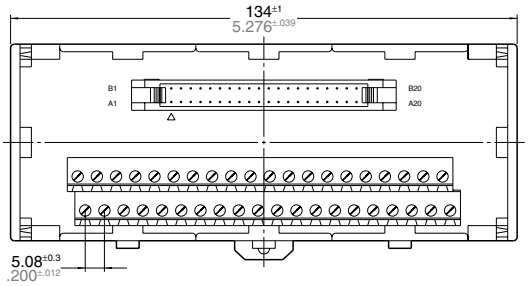
Wire-direct connect type (34 poles)
External dimensions



Pressure connector connect type (40 poles)
External dimensions

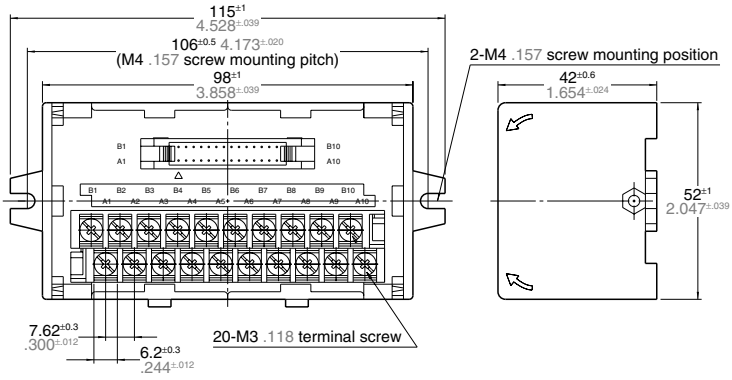


Wire-direct connect type (40 poles)
External dimensions

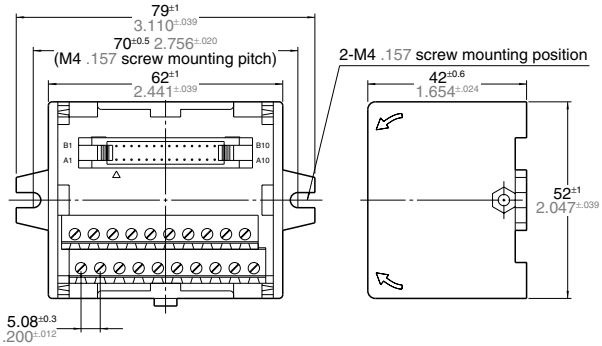


2. Direct mounting type

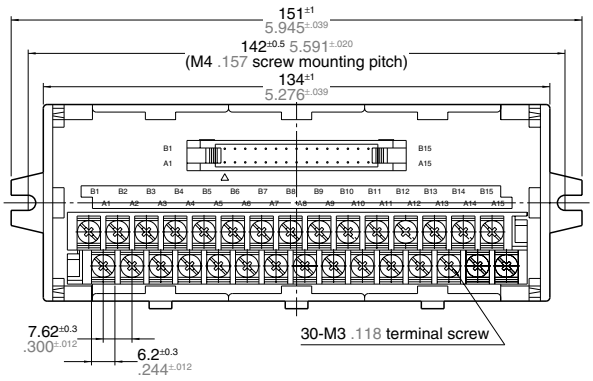
Pressure connector connect type (20 poles)
External dimensions



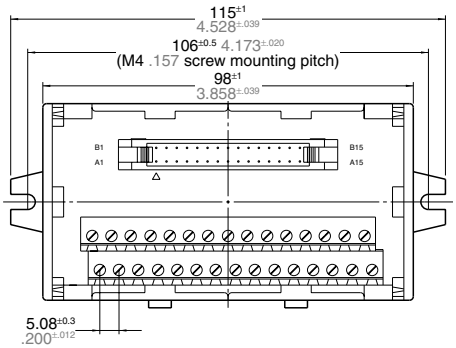
Wire-direct connect type (20 poles)
External dimensions



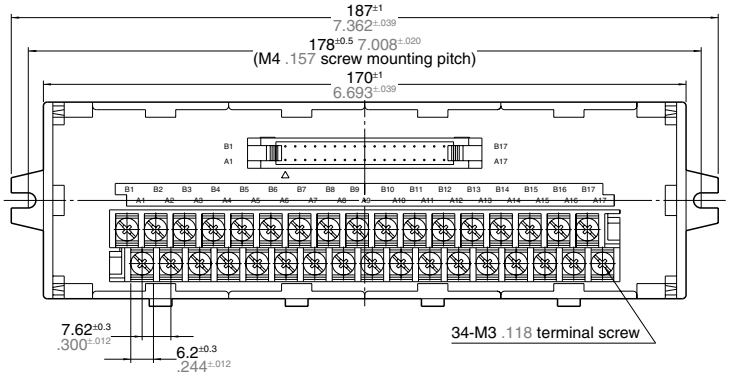
Pressure connector connect type (30 poles)
External dimensions



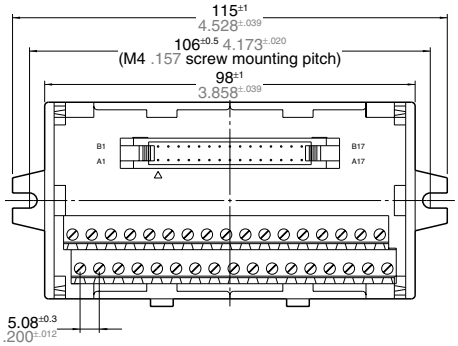
Wire-direct connect type (30 poles)
External dimensions



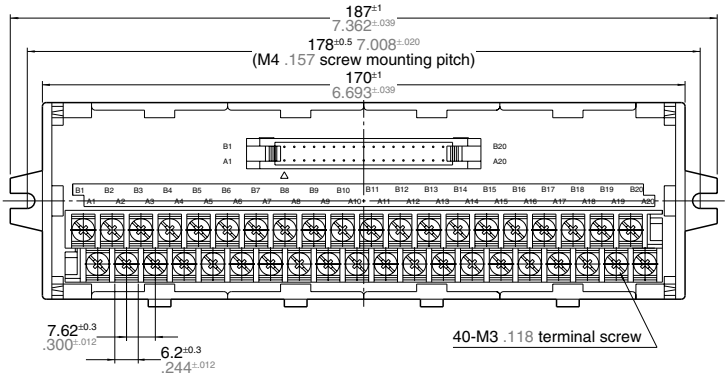
Pressure connector connect type (34 poles)
External dimensions



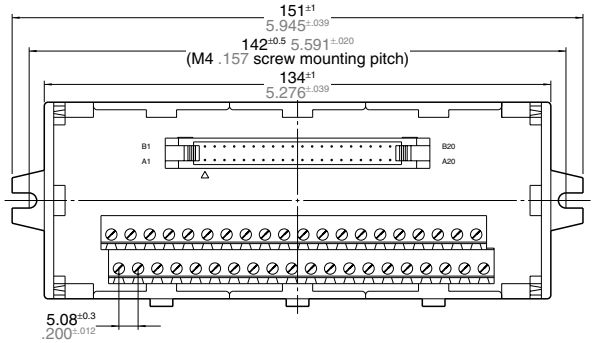
Wire-direct connect type (34 poles)
External dimensions



Pressure connector connect type (40 poles)
External dimensions

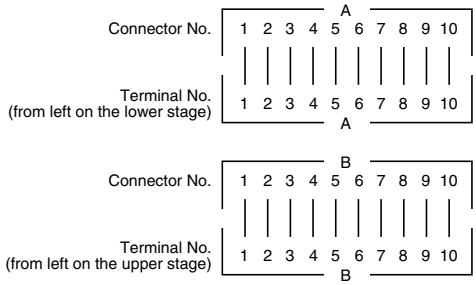


Wire-direct connect type (40 poles)
External dimensions

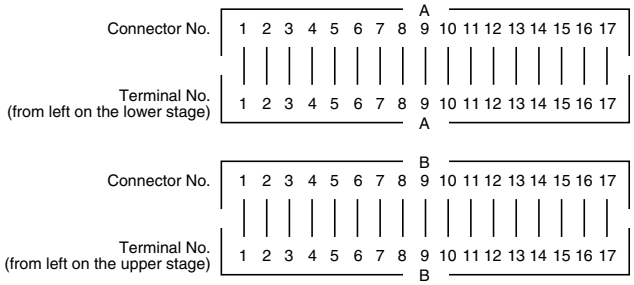


SCHEMATIC (Top View)

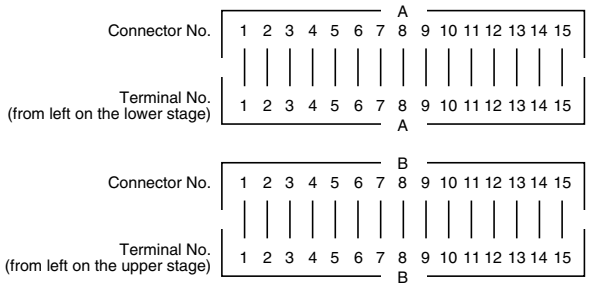
20 poles



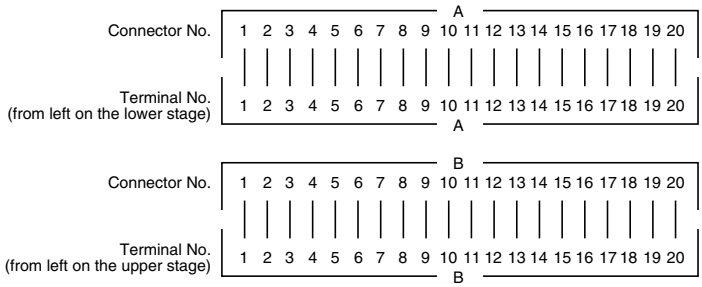
34 poles



30 poles



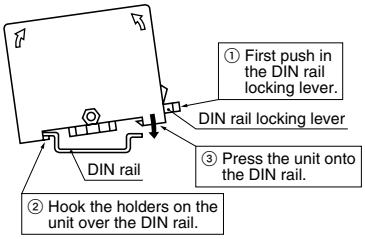
40 poles



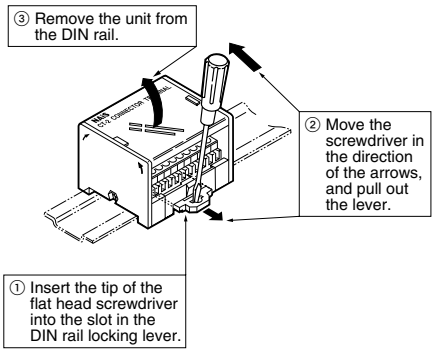
NOTES

1. Installation

1) Perform mounting hole cutout according to the mounting hole pattern.
2) When installing the unit on a DIN rail, use the DIN rail locking lever on the side of the unit. Installation is accomplished by simply fitting the unit onto the rail and pressing gently.



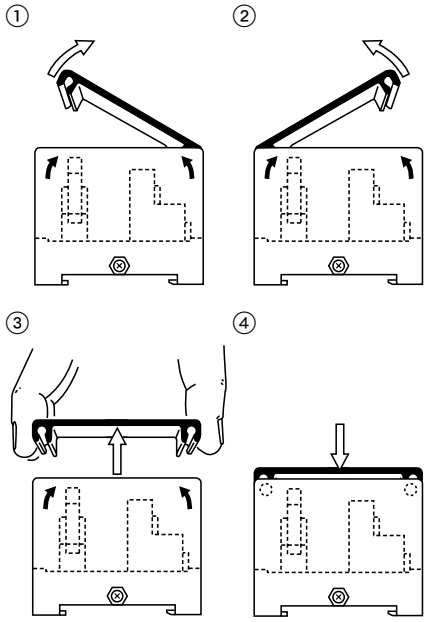
3) To remove the unit from the DIN rail, use a flat head screwdriver to pull out the DIN rail locking lever.



4) Be careful not to drop or shock the unit. Excessive shock such as dropping may cause damage or malfunction.

2. Removal of cover

1) Insertions and withdraws of connector can be done by lifting the cover like ①.
2) Wiring to the terminal can be done by lifting the cover like ②.
3) Removal of the cover can be done by lifting it like ③.
4) In case of resetting the cover, please push the cover like ④.



3. Wiring and circuit configuration

1) Make all connections according to the schematic.
2) When wiring power lines or power cables, twisted pair treatment (stranded wire treatment) should be done in order to improve noise resistance.
3) In order to improve noise resistance, class 3 grounding of the control panel is recommended.
4) Turn off the power before connecting/ disconnecting connector cables.

4. Operating environment

1) Use the product at ambient operating temperature between 0°C and 55°C 32°F and 131°F.
2) The main unit is made of resin; therefore, do not use it in areas where it may come in contact with (or be exposed to) organic solvents such as benzine, thinner, and alcohol or strong alkaline substances such as ammonia and caustic soda.
3) Do not use the product in areas where it may be exposed to flammable gases, corrosive gases, excessive dust, or moisture, or areas where it may be subjected to strong vibration or shock.

5. Transporting and storage

1) If the product is subjected to extreme vibration while being transported, the relays may become detached, the lead may become bent, and the unit may become damaged. Handle the carton and case with care.
2) If the product is stored in an extremely adverse environment, visible defects and deterioration of performance characteristics may result. We recommend the following storage conditions.

- Temperature: 5 to 30°C 41 to 86°F
- Humidity: Max. 60% R.H.
- Environment: No hazardous substances such as sulfurous acid gases and little dust.

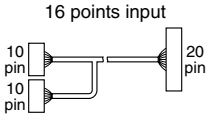
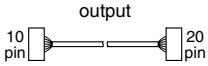
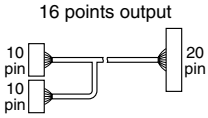
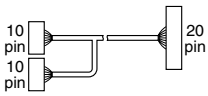
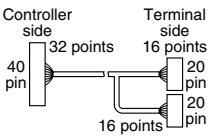
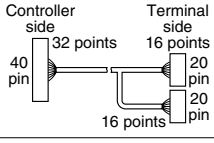
Expansion cable with wire-pressed terminal

Expansion cable

M type 16-point, 34-contact output cable

1. Connecting cable for FP series programmable controller to the interface terminal

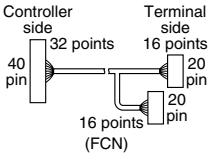
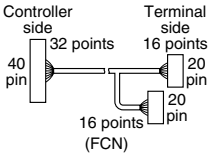
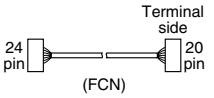
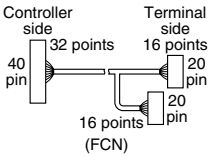
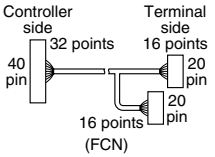
Cables for relay terminals have a ground wire; those for connector terminals or expansion cables do not.

Product name	Controller side unit	No. of connector contacts of controller side	Interface terminal	Cable							
				Product name and shape	Length (Part No.)						
					250 mm 9.842 inch	500 mm 19.685 inch	1,000 mm 39.37 inch	1,500 mm 59.055 inch	2,000 mm 78.74 inch	3,000 mm 118.11 inch	5,000 mm 196.85 inch
FP0, FP0R, FPΣ	8 points Input unit	Input side 10P	RT-2 relay terminal RT-1 PC relay terminal	for FP0, FP0R 8 points input 	—	—	AY15013	AY15014	AY15015	AY15016	AY15017
	16 points Input unit	Input side 10P × 2	RT-2 relay terminal RT-1 PC relay terminal	for FP0, FP0R, FPΣ 16 points input 	—	—	AY15913	AY15914	AY15915	AY15916	AY15917
	8 points Output unit	Output side 10P	RT-2 relay terminal RT-1 PC relay terminal	for FP0, FP0R 8 points output 	—	—	AY15023	AY15024	AY15025	AY15026	AY15027
	16 points Output unit	Output side 10P × 2	RT-2 relay terminal RT-1 PC relay terminal	for FP0, FP0R, FPΣ 16 points output 	—	—	AY15923	AY15924	AY15925	AY15926	AY15927
	16 point I/O unit	I/O side 20P	Connector terminal	20P 	—	AYT52202	AYT52203	AYT52204	AYT52205	AYT52206	AYT52207
	64 point I/O unit	I/O side 40P	RT-2 relay terminal RT-1 PC relay terminal/ S type	FPΣ 64 points I/O unit 	—	—	AY15633	AY15634	AY15635	AY15636	AY15637
FP2	32 points/ 64 points Input unit Output unit	32 points 40P × 1	RT-2 relay terminal RT-1 PC relay terminal/ S type	FP2 32/64 points I/O units 	—	—	AY15633	AY15634	AY15635	AY15636	AY15637
		64 points 40P × 2 (*Note)	Connector terminal	40P 	AYT51401	AYT51402	AYT51403	AYT51404	AYT51405	AYT51406	AYT51407

Standard packing: Carton: 1 pc.; Case: 10 pcs.

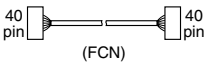
Note: Use the same cable even when using the 64 points type.

2. PC and relay terminal cables from other companies

Product name and shape		I/O type	Interface terminal	Length (Part No.)				
				1,000 mm 39.37 inch	1,500 mm 59.055 inch	2,000 mm 78.74 inch	3,000 mm 118.11 inch	5,000 mm 196.85 inch
Mitsubishi MELSEC·A, Q, QnA series		For 32-point input	RT-2 relay terminal RT-1 PC relay terminal/S type	AY16213	AY16214	AY16215	AY16216	AY16217
Mitsubishi MELSEC·A, Q, QnA series		For 32-point output	RT-2 relay terminal RT-1 PC relay terminal/S type	AY16223	AY16224	AY16225	AY16226	AY16227
Omron C200H C500		16-point Both input and output	RT-2 relay terminal RT-1 PC relay terminal/S type	AY17133	AY17134	AY17135	AY17136	AY17137
Omron C500		For 32-point input	RT-2 relay terminal RT-1 PC relay terminal/S type	AY17213	AY17214	AY17215	AY17216	AY17217
Omron C500		For 32-point output	RT-2 relay terminal RT-1 PC relay terminal/S type	AY17223	AY17224	AY17225	AY17226	AY17227

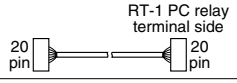
Standard packing: Carton: 1 pc.; Case: 10 pcs.

3. PC and connector terminal cables from other companies

Product name and shape	Shape	Length (Part No.)						
		250 mm 9.842 inch	500 mm 19.685 inch	1,000 mm 39.37 inch	1,500 mm 59.055 inch	2,000 mm 78.74 inch	3,000 mm 118.11 inch	5,000 mm 196.85 inch
Mitsubishi and Omron 40P		AYT57401	AYT57402	AYT57403	AYT57404	AYT57405	AYT57406	AYT57407

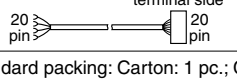
Standard packing: Carton: 1 pc.; Case: 10 pcs.

4. RT-1 PC relay terminal and RT-1 PC terminal expansion cables

Product name and shape	I/O type	Relay terminal	Length (Part No.)				
			70 mm 2.756 inch	250 mm 9.842 inch	500 mm 19.685 inch	1,000 mm 39.37 inch	2,000 mm 78.74 inch
Expansion cable 	16-point Both input and output	RT-1 PC relay terminal expansion	AY15840	AY15841	AY15842	AY15843	AY15845

Standard packing: Carton: 1 pc.; Case: 10 pcs.

5. Relay terminal cables with wire-pressed terminal

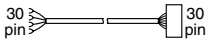
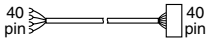
Product name and shape	I/O type	Relay terminal	Length (Part No.)				
			1,000 mm 39.37 inch	1,500 mm 59.055 inch	2,000 mm 78.74 inch	3,000 mm 118.11 inch	5,000 mm 196.85 inch
Cable with wire-pressure terminal 	16-point Both input and output	RT-2 relay terminal RT-1 PC relay terminal/ S type	AY15853	AY15854	AY15855	AY15856	AY15857

Standard packing: Carton: 1 pc.; Case: 10 pcs.

Note: Inquire regarding connecting cables for the various controllers.
Regarding the cables with wire-pressed terminals, the triangle mark does not correspond to wire No. 1, so be sure to inquire for details.

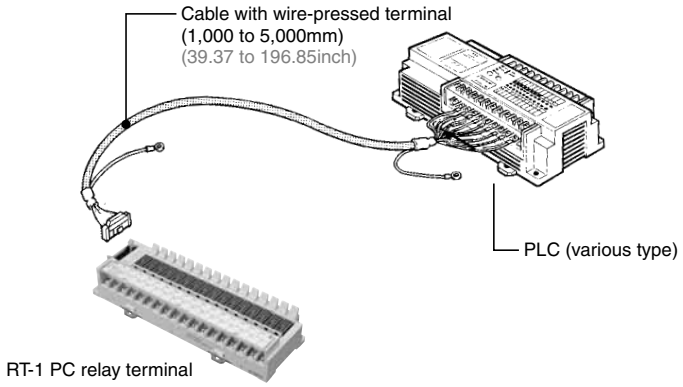
6. Connector terminal cables with wire-pressed terminals

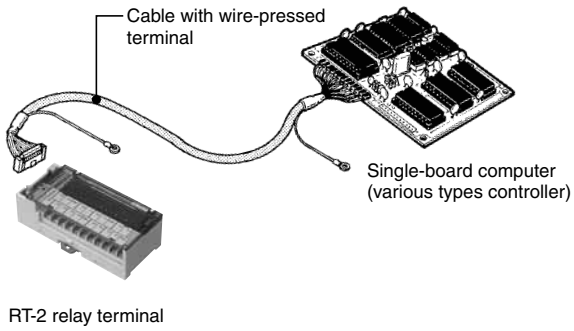
For both CT-2 connector terminals and connector terminals

Product name and shape	I/O type	Length (Part No.)					
		500 mm 19.685 inch	1,000 mm 39.37 inch	1,500 mm 59.055 inch	2,000 mm 78.74 inch	3,000 mm 118.11 inch	5,000 mm 196.85 inch
Expansion cable with wire-pressed terminal	20P 	AYT58202	AYT58203	AYT58204	AYT58205	AYT58206	AYT58207
	30P 	AYT58302	AYT58303	AYT58304	AYT58305	AYT58306	AYT58307
	34P 	AYT58342	AYT58343	AYT58344	AYT58345	AYT58346	AYT58347
	40P 	AYT58402	AYT58403	AYT58404	AYT58405	AYT58406	AYT58407

Standard packing: Carton: 1 pc.; Case: 10 pcs.

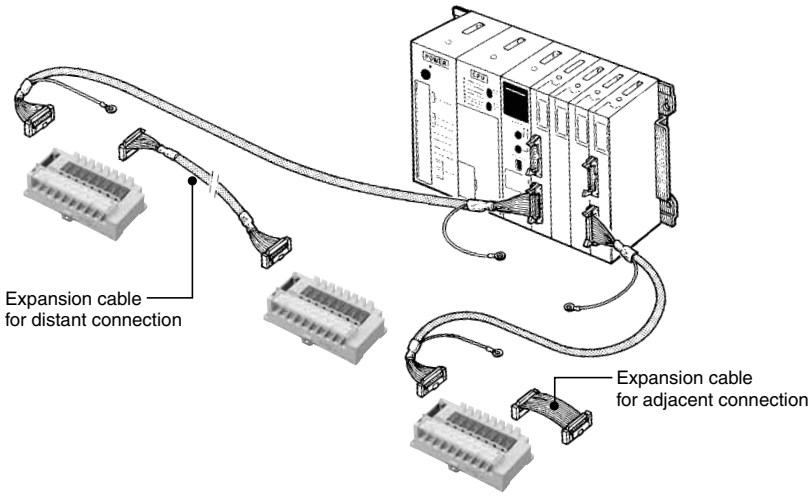
1. Connection Example for Various Types of Controller



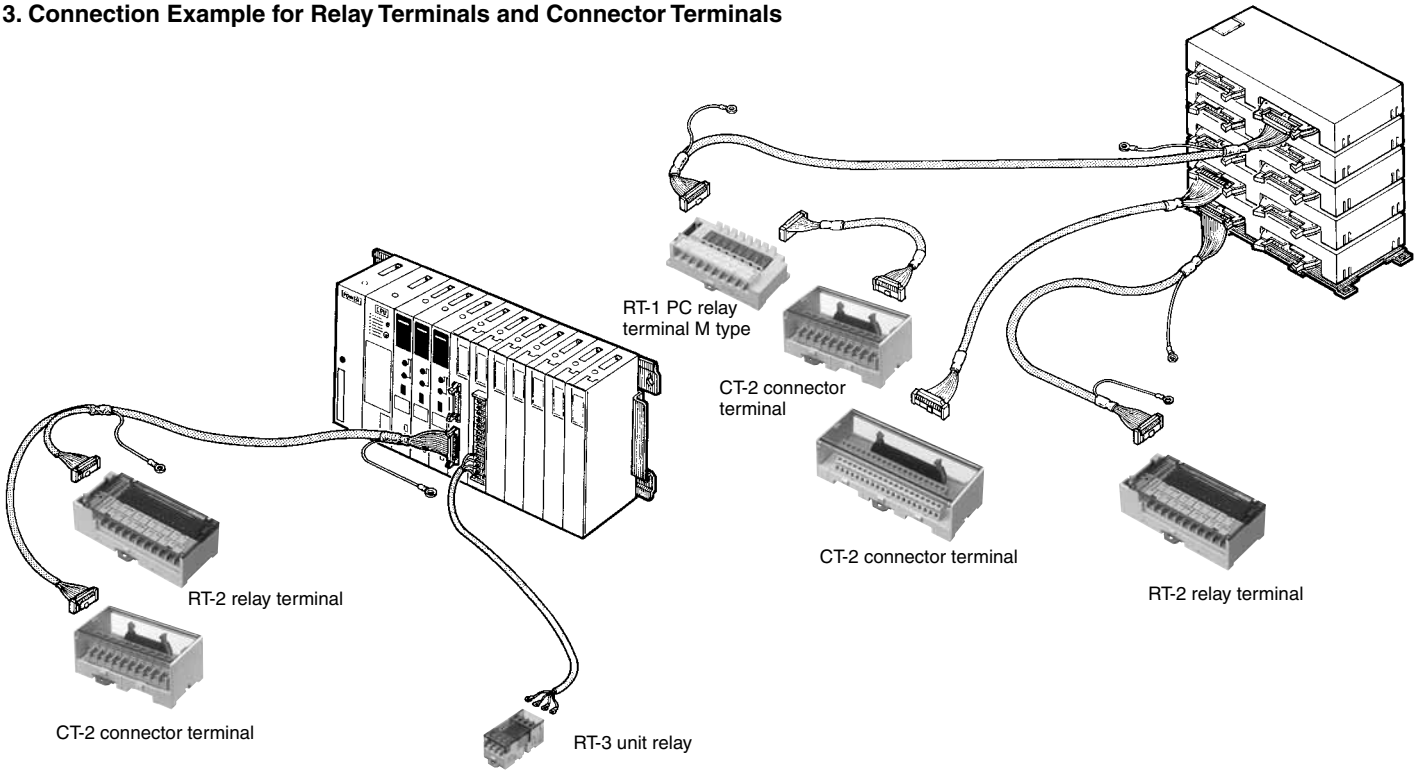


2. Expansion Example

RT-1 PC relay terminal can be expanded up to 16 points.



3. Connection Example for Relay Terminals and Connector Terminals



PRODUCTS CONFORMING TO EN/IEC STANDARDS

Relay

Product classification	Product name	CE marking	Applied directives	Applied standards	3rd party certifying body	File No.
Control panel relay	HN	—	—	EN61810-1	VDE	Nr.A882
	HJ	—	—	EN60255 EN61810-1	TÜV	Nr.R2024382 (standard) Nr.R50049126 (without standard)
	HC	—	—	EN61810-1	VDE	Nr.2735
	HK	—	—	EN61810-1	TÜV	Nr.B 0401 13461 027
Safety relay	SF/SF Double contact	—	—	EN61810 EN60255 EN50205	TÜV-Rheinland	No.R9919003 (SF3)/ No.968/EZ116.00/01 (SF2D) No.968/EZ113.00/01 (SF4D)
	SF Slim	—	—	EN61810-1 EN50205	TÜV	Nr.B 0606 13461 068

FOREIGN SPECIFICATIONS OVERVIEW

1. International Standards

IEC standard

International Electrotechnical Commission
By promoting international cooperation toward all problems and related issues regarding standardization in the electrical and electronic technology fields, the IEC, a non-governmental organization, was started in October, 1908, for the purpose of realizing mutual understanding on an international level. To this end, the IEC standard was enacted for the purpose of promoting international standardization.

2. North America

UL (Underwiters Laboratories Inc.)
This is a non-profit testing organization formed in 1894 by a coalition of U.S. fire insurance firms, which tests and approves industrial products (finished products). When electrical products are marketed in the U.S., UL approval is mandated in many states, by state law and city ordinances. In order to obtain UL approval, the principal parts contained in industrial products must also be UL-approved parts.
UL approval is divided into two general types. One is called "listing" (Fig. 1), and applies to industrial products (finished products). Under this type of approval, products must be approved unconditionally. The other type is called "recognition" (Fig. 2), and is a conditional approval which applies to parts and materials.

LISTING MARK

Fig. 1

RECOGNITION MARK

Fig. 2

CSA (Canadian Standards Association)
This was established in 1919 as a non-profit, non-governmental organization aimed at promoting standards. It sets standards for industrial products, parts, and materials, and has the authority to judge electrical products to determine whether they conform to those standards. The CSA is the ultimate authority in the eyes of both the government and the people in terms of credibility and respect. Almost all states and provinces in Canada require CSA approval by law, in order to sell electrical products. As a result, electrical products exported from Japan to Canada are not approved under Canadian laws unless they have received CSA approval and display the CSA mark. Approval is called "certification", and products and parts which have been approved are called "certified equipment", and display the mark shown in Fig. 3. The mark shown in Fig. 4 is called the "Component Acceptance" mark, and indicates conditional approval which is applicable to parts. The C-UL mark shown in Fig. 5 (finished products) and Fig. 6 (parts) indicates that the product has been tested and approved in UL laboratories, based on UL and CSA standards, through mutual approval activities.

Certification

Fig. 3

Component Acceptance

Fig. 4

Fig. 5

Fig. 6

3. Europe

EN standard

European Standards/Norme Europeennee (France)/Europaishe Norm (Germany)
Abbreviation for European Standards. A unified standard enacted by CEN/CENELEC (European Standards Committee/European Electrical Standards Committee). EU and EFTA member nations employ the content of the EN standards into their own national standards and are obligated to abolish those national standards that do not agree with the EN standards.

ENEC mark

The ENEC mark, approved by certifying authorities in Europe, is for electronic products. It can be displayed when a product is compliant with the European safety standard (EN standard). Device switches that display the ENEC mark can be freely distributed in the European Economic Area.

(1) Germany

VDE (Verband Deutscher Elektrotechniker)
The VDE laboratory was established mainly by the German Electric Technology Alliance, which was formed in 1893. It carries out safety experiments and passes approval for electrical devices and parts. Although VDE certification is not enforced under German law, punishment is severe should electrical shock or fire occur; therefore, it is, in fact, like an enforcement.

TÜV (Technischer Überwachungs-Verein)
TÜV is a civilian, non-profit, independent organization that has its roots in the German Boiler Surveillance Association, which was started in 1875 for the purpose of preventing boiler accidents. A major characteristic of TÜV is that it exists as a combination of 14 independent organizations (TÜV Rheinland, TÜV Bayern, etc.) throughout Germany. TÜV carries out inspection on a wide variety of industrial devices and equipment, and has been entrusted to handle electrical products, as well, by the government. TÜV inspection and certification is based mainly on the VDE standard.
TÜV certification can be obtained from any of the 14 TÜVs throughout Germany and has the same effectiveness as obtaining VDE certification.

(2) England

BSI (British Standards Institution)
BSI was inaugurated in 1931 as in institution for issuing standards of measure, inspection and certifying industrial products. In England the inspection of electrical goods is arbitrary and certified goods can carry the BSI designated certification label.

BEAB (British Electrotechnical Approvals Board for Household Equipment)
BEAB is a non-profit organization established in 1960. Intended for electrical household goods that use regular power supplies and for some control components, BEAB is an acknowledged standard that is based on testing using the BS standard.

(3) Denmark

DEMKO (Danmarks elektriske materielkontrol)
DEMKO was established for the safety of certain electrical goods and is based on the 1962 “Heavy Current Regulations” (Part B Appendix 601) that stipulates enforced testing and approval.

(4) Norway

NEMKO (Norges Elektriske Materiellkontroll)
By law in 1991, NEMKO was empowered to test and inspect electrical equipment for use in Norway. Products approved by NEMKO can display the mark shown on the left.

(5) Finland

EI (Finnish Electrical Inspectorate) – commonly known as FIMKO (Finnish Electrotechnical Standards)
Since its foundation in 1928, FIMKO has been concerned with electrical safety testing. As a government-recognized organization, it operates a qualification system based on the stipulations of EI-81 and issues certification. Some household electrical products and electrical and electronic office equipment require EI certification.

(6) Sweden

SEMKO (Svenska Elektriska Materielkontrollanstalten AB)
SEMKO was jointly set up in 1925 by associations from the electrical power supply industry and fire insurance industry. It was officially approved by the Swedish government in 1935.
SEMKO’s mission is to test all electrical equipment used in households, offices, shops, schools, and other places for conformance with official safety requirements and to issue permits.

(7) Switzerland

SEV (Schweizerischen Elektrotechnischen Verein)
This private organization for testing electrical products was established in 1903. SEV was recognized by the Swiss government in 1954. Since then, to be sold in Switzerland, designated electrical products and parts must receive SEV accreditation.

(8) Austria

OVE (Österreichischen Verbandes für Elektrotechnik)
Founded in 1965, OVE certifies that electrical products and parts conform with legally stipulated safety standards. Approved products display the OVE mark.

(9) Netherlands

KEMA (N.V. tot Keuring van Elekrotechnische Materialen)
KEMA was established in 1927 to deal with Dutch electrical safety codes. The KEMA mark, shown on the left, is normally awarded to cables and cords with conforming PVC insulation materials and to qualified household electrical products.

Standards Chart

Control panel relay, Safety relay

Item		UL/C-UL (Recognized)		CSA (Certified)		VDE (Certified)		TV rating (UL/CSA)		TÜV (Certified)	
		File No.	Contact rating	File No.	Contact rating	File No.	Contact rating	File No.	Rating	File No.	Rating
HN	1 Form C	E43149*	10A 277V AC 10A 30V DC	—	CSA standard certified by C-UL	40012003	10A 250V AC (cosϕ=1.0) 10A 30V DC (0ms)	E43149*	TV-5	—	—
	2 Form C	E43149*	5A 277V AC 5A 30V DC	—	CSA standard certified by C-UL	40012003	5A 250V AC (cosϕ=1.0) 5A 30V DC (0ms)	E43149*	TV-3	—	—
HN-TM	1 Form A	E43149*	16A 277V AC 16A 30V DC	—	CSA standard certified by C-UL	—	—	E43149*	TV-5	—	—
HJ	2 Form C	E43149*	7A 250V AC 7A 30V DC	—	CSA standard certified by C-UL	—	—	—	—	R2024382 (Standard) R2-50006950, R50049126 (Except standard)	7A 250V AC (cosϕ=1.0) 7A 30V DC (0ms) Test button type: 10A 250V AC (cosϕ=1.0) 10A 30V DC (0ms)
	4 Form C	E43149*	5A 250V AC 5A 30V DC	—	CSA standard certified by C-UL	—	—	—	—	R2024382 (Standard) R50049126 (Except standard)	5A 250V AC (cosϕ=1.0) 5A 30V DC (0ms)
HC Standard	1 Form C	E43028	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	LR26550 etc.	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	40017406	10A 250V AC (cosϕ=1.0) 3A 250V AC (cosϕ=0.4) 3A 30V DC (0ms)	UL E43149 CSA LR26550	TV-3		
	2 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	40017406	7A 250V AC (cosϕ=1.0) 2A 250V AC (cosϕ=0.4) 3A 30V DC (0ms)	UL E43149 CSA LR26550	TV-3		
	3 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—		
	4 Form C	E43028	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	LR26550 etc.	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	40017406	5A 65V AC (cosϕ=1.0) 3A 65V AC (cosϕ=0.4) 3A 30V DC (0ms)	—	—		
	4 Form C twin	E43149	3A 250V AC 3A 30V DC	LR26550 etc.	3A 250V AC 3A 30V DC	—	—	—	—		
HC Amber	1 Form C	E43028	6A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	6A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—		
	2 Form C	E43028	4A 250V AC 1/10HP 125, 250V AC 3A 30V DC	LR26550 etc.	4A 250V AC 1/10HP 125, 250V AC 3A 30V DC	—	—	—	—		
	4 Form C	E43028	2A 250V AC 1/20HP 125, 250V AC 2A 30V DC	LR26550 etc.	2A 250V AC 1/20HP 125, 250V AC 2A 30V DC	—	—	—	—		
	4 Form C twin	E43149	1A 250V AC 1A 30V DC	LR26550 etc.	1A 250V AC 1A 30V DC	—	—	—	—		
HC keep		E43149	3A 250V AC 3A 30V DC	LR26550 etc.	3A 250V AC 3A 30V DC	—	—	—	—		
HC with diode type (For DC)	1 Form C	E43028	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	LR26550 etc.	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	—	—	—	—		
	2 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—		
	3 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—		
	4 Form C	E43028	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	LR26550 etc.	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	—	—	—	—		
	4 Form C twin	E43149	3A 250V AC 3A 30V DC	LR26550 etc.	3A 250V AC 3A 30V DC	—	—	—	—		

Notes: 1. Please inquire if you need the relay marked standards that are not marked normally.
2. "*" indicates the UL/C-UL recognition file number.

SEMKO (Certified)		FIMKO		SEV		BSI		Remarks	Standard marking
File No.	Contact rating	File No.	Contact rating	File No.	Contact rating	File No.	Rating		
—	—	—	—	—	—	—	—		UL/C-UL, TV-5, VDE
—	—	—	—	—	—	—	—		TV-3, VDE
—	—	—	—	—	—	—	—		UL/C-UL, TV-5
—	—	—	—	—	—	—	—		UL/C-UL, TÜV
—	—	—	—	—	—	—	—		UL/C-UL, TÜV
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—	Approved (DC type only)	
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA

Standards Chart

Item		UL/C-UL (Recognized)		CSA (Certified)		VDE (Certified)		TV rating (UL/CSA)		TÜV (Certified)	
		File No.	Contact rating	File No.	Contact rating	File No.	Contact rating	File No.	Rating	File No.	Rating
HC with CR circuit	1 Form C	E43028	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	LR26550 etc.	10A 250V AC 1/3HP 125, 250V AC 3A 30V DC	—	—	—	—	—	—
	2 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—	—	—
	3 Form C	E43028	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	LR26550 etc.	7A 250V AC 1/6HP 125, 250V AC 3A 30V DC	—	—	—	—	—	—
	4 Form C	E43028	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	LR26550 etc.	5A 250V AC 1/10HP 125, 250V AC 3A 30V DC	—	—	—	—	—	—
	4 Form C twin	E43149	3A 250V AC 3A 30V DC	LR26550 etc.	3A 250V AC 3A 30V DC	—	—	—	—	—	—
HK	1 Form C	E43028*	10A 250V AC 1/2HP 125V AC 10A 30V DC	—	CSA standard certified by C-UL	—	—	—	—	B 04 01 13461 027	15A 125V AC (cosϕ=1.0) 15A 30V DC (0ms)
	2 Form C	E43028*	10A 250V AC 1/2HP 125V AC 10A 30V DC	—	CSA standard certified by C-UL	—	—	—	—	B 04 01 13461 027	10A 125V AC (cosϕ=1.0) 10A 30V DC (0ms)
HL	1 Form C	E43028	15A 250V AC 1/3HP 125, 250V AC 10A 30V DC	LR26550 etc.	10A 125, 250V AC 1/3HP 125, 250V AC 10A 30V DC	—	—	UL: E43149 CSA: LR26550 etc.	NO→TV-5 NC→TV-2	—	—
	2 Form C	E43028	10A 250V AC 1/3HP 125, 250V AC 10A 30V DC	LR26550 etc.	10A 125, 250V AC 1/3HP 125, 250V AC 10A 30V DC	—	—	UL: E43149 CSA: LR26550 etc.	NO→TV-4 NC→TV-2	—	—
HP		E43028	10A 250V AC 1/3HP 125, 250V AC 10A 30V DC	LR26550 etc.	10A 250V AC 1/3HP 125, 250V AC 10A 30V DC	—	—	—	—	—	—
HG	Single phase	E43028	3/4HP 125V AC 2HP 250V AC	LR26550 etc.	3/4HP 125V AC 1HP 250V AC	—	—	—	—	—	—
	Three phase	E43028	2HP 125V AC 3HP 250V AC 20A 250V AC (cosϕ=0.75)	LR26550 etc.	2HP 125V AC 1HP 250V AC 15A 125V AC (cosϕ=0.75) 10A 250V AC (cosϕ=0.75)	—	—	—	—	—	—
SF Slim		E43149*	6A 277V AC 6A 30V DC	—	CSA standard certified by C-UL	—	—	—	—	B 05 04 13461 054	6A 250V AC (cosϕ=1.0) 6A 250V DC (0ms) AC15: 2A 240V AC (cosϕ=1.0) DC13: 1A 24V DC (L/R 48ms)
SF (3 Form A 1 Form B)		E43149	6A 250V AC	LR2655 etc.	6A 250V AC	—	—	—	—	R9919003 (SF3)	6A 250V AC
SF Double contact (4 Form A 4 Form B, 2 Form A 2 Form B)		E120782*	6A 250V AC 6A 24V DC	—	CSA standard certified by C-UL	—	—	—	—	968 EZ 116.00 01 (SF2D) 968 EZ 113.00 01 (SF4D)	8A 24V DC 6A 230V AC

Notes: 1. Please inquire if you need the relay marked standards that are not marked normally.
2. '*' indicates the UL/C-UL recognition file number.

SEMKO (Certified)		FIMKO		SEV		BSI		Remarks	Standard marking
File No.	Contact rating	File No.	Contact rating	File No.	Contact rating	File No.	Rating		
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/C-UL, TÜV
—	—	—	—	—	—	—	—		UL/C-UL, TÜV
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/CSA
—	—	—	—	—	—	—	—		UL/C-UL, TÜV
—	—	—	—	97.1 10376 99.1 10197.01	6A 250V AC	—	—		UL/CSA, TÜV, SEV
—	—	—	—	01, 1851	6A 230V AC 6A 24V DC	—	—		UL/C-UL, TÜV, SEV

ISO14001
Certificate of approval

Since the establishment of the “Matsushita Electric Works Global Environmental Charter” (previous company name) in 1992, we are set to unite in a concerted effort toward making Panasonic Electric Works a company capable of sustainable development by striking the right balance between our commitments to the environment, the economy, and society. Regarding environmental conservation, we are fully committed to reducing the transfer and waste of chemical substances. In energy-related efforts, we are developing technologies to create energy-saving products, and for natural resources, we are working to eliminate industrial waste and developing recycling technologies.
Our goal is peaceful co-existence with our global society.

Matsushita Electric Works Global Environmental Charter


Lloyd's Register Quality Assurance

CERTIFICATE OF APPROVAL

■ **Responsibilities of industry**
- To provide products and services useful to society
- To fulfill social responsibilities
- To pursue corporate logic

■ **Harmonization with the global environment**
- Conservation of the global environment
- Protection of resources

■ **Harmonization with society**
- Contributing to local communities
- Contributing to the global community

ISO/TS16949
Certificate of approval

Our Switching Device Division has been accredited for ISO/TS16949, covering our quality management system for an entire spectrum of automotive products ranging from mechanical to semiconductor relays. ISO/TS16949 is a standard based on ISO9001 that adds items necessary for the automobile industry.
It calls for a comprehensive quality management system that includes CS, cost performance, ongoing improvement, and many other aspects of quality management.

■ **Certification Status**
- Switching Device Division approved
- Panasonic Electric Works Obihiro Co., Ltd. approved
- Panasonic Electric Works, (Thailand) Ltd. approved
- Panasonic Electric Works, Mexicana S.A. de C.V. approved

ISO9001
Certificate of approval

Our Switching Device Division, which handles from development to production and marketing, has been approved for certification of the ISO9001 quality assurance standards established by the International Standards Organization (ISO).
On October, 1993, this achievement was officially registered by the certification organizations UKAS of the United Kingdom and RVA of the Netherlands.

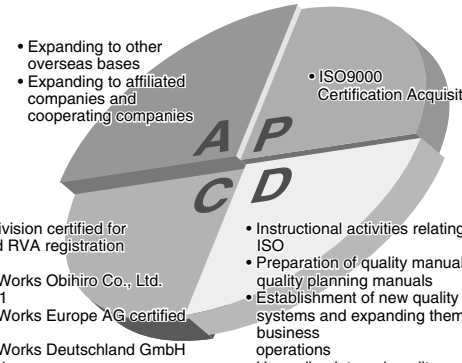

CERTIFICATE OF APPROVAL

Matsushita Electric Works Ltd.
Automation Components Division
Watarai-gun, Mie ken
Kadoma-shi, Osaka, Japan

ISO 9001 :1994
EN ISO 9001 :1994
BS EN ISO 9001 :1994
DIN EN ISO 9001: 1994
NF EN ISO 9001: 1994
NEN EN ISO 9001: 1994
JIS Z 9001 :1994

The design and manufacture of electro-magnetic and solid-state relays.

The Necessity and Pursuit of ISO Certification



- Switching Device Division certified for ISO9001 UKAS and RVA registration (October, 1993)
- Panasonic Electric Works Obihiro Co., Ltd. certified for ISO9001
- Panasonic Electric Works Europe AG certified for ISO9001
- Panasonic Electric Works Deutschland GmbH certified for ISO9001
- Panasonic Electric Works Automation Controls (Beijing) Co., Ltd. certified for ISO9001
- Panasonic Electric Works (Thailand), Ltd. certified for ISO9001
- Panasonic Electric Works, Mexicana S.A. de C.V. certified for ISO9001

- Instructional activities relating to ISO
- Preparation of quality manuals and quality planning manuals
- Establishment of new quality systems and expanding them to business operations
- Upgrading internal quality monitoring

▼

Advantages

- **Strengthening and upgrading quality assurance organizational structures applicable on an international basis**
- **Technology can be accumulated and disseminated through documentation and records**
- **Leads to improved reliability of the manufacturer’s quality and improved CS (customer satisfaction)**

INDEX

Please contact .....

Panasonic Electric Works Co., Ltd.

Automation Controls Business Unit

■ Head Office: 1048, Kadoma, Kadoma-shi, Osaka 571-8686, Japan

■ Telephone: +81-6-6908-1050 ■ Facsimile: +81-6-6908-5781

panasonic-electric-works.net/ac

Panasonic®

ASCT1B382E 201004-3YT

Printed in Japan.