

**Compact size 2 Form A and 2 Form B 35A power relays for energy management and industrial equipment**

## HE-S RELAYS

**New**



**RoHS compliant**

Protective construction: Flux-resistant type

### FEATURES

**1. High-capacity and long life 35A 277V AC  $5 \times 10^4$  (long life type)**

**2. Electrical life (resistive load)**

| Form A contact | Standard type   | Long life type  |
|----------------|-----------------|-----------------|
| 35A 277V AC    | $3 \times 10^4$ | $5 \times 10^4$ |
| 30A 220V AC    | —               | $1 \times 10^5$ |
| 20A 277V AC    | $1 \times 10^5$ | $2 \times 10^5$ |

**3. Compact size and low operating power**

W:  $30 \times$  L:  $36 \times$  H: 40 mm **W: 1.181 × L: 1.417 × H: 1.575 inch**  
Operating power: 1,880 mW (holding power: 170 mW)

**4. Reduced coil holding voltage contributes to saving energy of equipment**

The coil holding voltage can be reduced up to 30%V of the nominal coil voltage. This equals to operating power of approximately 170 mW, which contributes equipment energy savings.

\* Coil holding voltage is the coil voltage after 100 ms from the applied nominal coil voltage.

**5. Contact gap: 3.2 mm .126 inch (VDE0126 compliant)**

Compliant with European photovoltaic standard VDE0126  
Compliant with EN61810-1 2.5 kV surge breakdown voltage (between contacts)

**6. Insulation distance (initial)**

- Between Form A contact and coil: Min. 11.0 mm .433 inch (Clearance/Creepage)
- Between Form B contact and coil: Min. 3.2 mm .126 inch (Clearance/Creepage)
- Between Form A contact sets: Min. 8.2 mm .323 inch (Clearance/Creepage)
- Between Form A contact and Form B contact: Min. 12.8 mm .504 inch (Clearance/Creepage)

### TYPICAL APPLICATIONS

- Photovoltaic power generation systems (Solar inverter)
- Uninterruptible Power Supplies (UPS)
- Inverter
- Office air conditioner
- Industrial equipment

**7. Contact gap (initial)**

- Form A contact: Min. 3.2 mm .126 inch/each contact
- Form B contact: Min. 0.7 mm .028 inch  
Min. 0.5 mm .020 inch (When Form A contact welded)

**8. Mirror contact mechanisms (Compliant with EN60947-4-1 mirror contact)**

**Detection of main contact welding makes it possible to construct a safety circuit.**

- Designed so that Form A contact and Form B contact will not close at the same time.
- When Form A contact welded, Form B contact gap of at least 0.5 mm .020 inch is maintained.

\* Form B contact, when used to monitor the condition of Form A contact, can be used exclusively as an auxiliary contact.

| Condi-<br>tions                      | Normal operation |            | When Form A<br>contact welded |
|--------------------------------------|------------------|------------|-------------------------------|
|                                      | Non-excitation   | Excitation | Non-excitation                |
| Mirror<br>contact<br>mecha-<br>nisms |                  |            |                               |

ORDERING INFORMATION

AHES

9

Contact arrangement / Operating function

3: 2 Form A Single side stable type

4: 2 Form A 1 Form B Single side stable type

Contact specifications

1: Standard type

2: Long life type

Terminals form

9: PC board terminal type

Nominal coil voltage (DC)

Part No.

Nominal coil voltage (V)

|   |    |    |    |   |
|---|----|----|----|---|
| 0 | 1  | 2  | 3  | 5 |
| 6 | 12 | 24 | 48 | 9 |

Note: Certified by UL/C-UL and VDE

TYPES

| Contact arrangement | Nominal coil voltage | Part No.      |                |
|---------------------|----------------------|---------------|----------------|
|                     |                      | Standard type | Long life type |
| 2 Form A            | 6V DC                | AHES3190      | AHES3290       |
|                     | 9V DC                | AHES3195      | AHES3295       |
|                     | 12V DC               | AHES3191      | AHES3291       |
|                     | 24V DC               | AHES3192      | AHES3292       |
|                     | 48V DC               | AHES3193      | AHES3293       |
| 2 Form A 1 Form B   | 6V DC                | AHES4190      | AHES4290       |
|                     | 9V DC                | AHES4195      | AHES4295       |
|                     | 12V DC               | AHES4191      | AHES4291       |
|                     | 24V DC               | AHES4192      | AHES4292       |
|                     | 48V DC               | AHES4193      | AHES4293       |

Standard packing: Carton: 25 pcs.; Case: 100 pcs.

RATING

1. Coil data

| Nominal coil voltage | Pick-up voltage<br>(at 20°C 68°F)<br>(Initial) | Drop-out voltage<br>(at 20°C 68°F)<br>(Initial) | Nominal operating current<br>[±10%] (at 20°C 68°F) | Coil resistance<br>[±10%] (at 20°C 68°F) | Nominal operating power<br>(at 20°C 68°F) | Max. applied voltage<br>(at 55°C 131°F)                          |
|----------------------|------------------------------------------------|-------------------------------------------------|----------------------------------------------------|------------------------------------------|-------------------------------------------|------------------------------------------------------------------|
| 6V DC                | 75%V or less of nominal voltage                | 5%V or more of nominal voltage                  | 313mA                                              | 19.1Ω                                    | ON: 1,880mW<br>Holding: 170mW*1           | 110%V of nominal coil voltage<br>150%V of nominal coil voltage*2 |
| 9V DC                |                                                |                                                 | 209mA                                              | 43.1Ω                                    |                                           |                                                                  |
| 12V DC               |                                                |                                                 | 157mA                                              | 76.6Ω                                    |                                           |                                                                  |
| 24V DC               |                                                |                                                 | 78mA                                               | 306.4Ω                                   |                                           |                                                                  |
| 48V DC               |                                                |                                                 | 39mA                                               | 1,225.5Ω                                 |                                           |                                                                  |

Notes: \*1. With 30%V coil holding voltage  
\*2. With no more than 24 hours per time with non-consecutive voltage application time.

## 2. Specifications

| Characteristics                                      | Item                                              |                                                                                                           | Specifications                                                                                                                                                                                                                                                                              |                                                                                         |
|------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
|                                                      |                                                   |                                                                                                           | Standard type                                                                                                                                                                                                                                                                               | Long life type                                                                          |
| Contact                                              | Arrangement                                       |                                                                                                           | 2 Form A, 2 Form A 1 Form B                                                                                                                                                                                                                                                                 | 2 Form A, 2 Form A 1 Form B                                                             |
|                                                      | Form A contact                                    | Contact resistance (Initial)                                                                              | Max. 100mΩ (By voltage drop 6V DC 1A),<br>Max. 3mΩ (By voltage drop 6V DC 20A, Reference value)                                                                                                                                                                                             |                                                                                         |
|                                                      |                                                   | Contact material                                                                                          | AgSnO <sub>2</sub> type                                                                                                                                                                                                                                                                     |                                                                                         |
|                                                      | Form B contact*6                                  | Contact resistance (Initial)                                                                              | Max. 100mΩ (By voltage drop 6V DC 1A)                                                                                                                                                                                                                                                       |                                                                                         |
|                                                      |                                                   | Contact material                                                                                          | Au flashed AgNi type                                                                                                                                                                                                                                                                        |                                                                                         |
| Rating                                               | Form A contact                                    | Nominal switching capacity (Resistive load)                                                               | 35A 277V AC                                                                                                                                                                                                                                                                                 |                                                                                         |
|                                                      |                                                   | Max. switching voltage                                                                                    | 480V AC, 110V DC                                                                                                                                                                                                                                                                            |                                                                                         |
|                                                      |                                                   | Contact carrying power (Resistive load)                                                                   | 9,695VA                                                                                                                                                                                                                                                                                     |                                                                                         |
|                                                      |                                                   | Max. switching current                                                                                    | 35A                                                                                                                                                                                                                                                                                         |                                                                                         |
|                                                      |                                                   | Min. switching capacity (Reference value)*1                                                               | 100mA 5V DC                                                                                                                                                                                                                                                                                 |                                                                                         |
|                                                      | Form B contact*6                                  | Nominal switching capacity (Resistive load)                                                               | 1A 277V AC, 1A 30V DC                                                                                                                                                                                                                                                                       |                                                                                         |
|                                                      |                                                   | Max. switching voltage                                                                                    | 277V AC, 30V DC                                                                                                                                                                                                                                                                             |                                                                                         |
|                                                      |                                                   | Contact carrying power (Resistive load)                                                                   | 277VA                                                                                                                                                                                                                                                                                       |                                                                                         |
|                                                      |                                                   | Max. switching current                                                                                    | 1A                                                                                                                                                                                                                                                                                          |                                                                                         |
|                                                      |                                                   | Min. switching capacity (Reference value)*1                                                               | 10mA 5V DC                                                                                                                                                                                                                                                                                  |                                                                                         |
|                                                      | Nominal operating power                           |                                                                                                           | 1,880mW (after applying min.100ms coil nominal voltage)                                                                                                                                                                                                                                     |                                                                                         |
|                                                      |                                                   |                                                                                                           | 170mW (30%V of coil holding voltage)                                                                                                                                                                                                                                                        |                                                                                         |
|                                                      | Electrical characteristics                        | Insulation resistance (Initial)                                                                           |                                                                                                                                                                                                                                                                                             | Min. 1,000MΩ (at 500 V DC) Measurement at same location as “Breakdown voltage” section. |
| Short current (A contact, Initial)                   |                                                   | Max. 1,000A 1 ms, 3 times (Reference value)                                                               |                                                                                                                                                                                                                                                                                             |                                                                                         |
| Breakdown voltage (Initial)                          |                                                   | Between open Form A contacts                                                                              | 2,000 Vrms for 1 min. (Detection current: 10mA)                                                                                                                                                                                                                                             |                                                                                         |
|                                                      |                                                   | Between Form A contact and coil                                                                           | 5,000 Vrms for 1 min. (Detection current: 10mA)                                                                                                                                                                                                                                             |                                                                                         |
|                                                      |                                                   | Between Form A contact sets                                                                               | 5,000 Vrms for 1 min. (Detection current: 10mA)                                                                                                                                                                                                                                             |                                                                                         |
|                                                      |                                                   | Between open Form B contacts                                                                              | 1,000 Vrms for 1 min. (Detection current: 10mA)                                                                                                                                                                                                                                             |                                                                                         |
|                                                      |                                                   | Between Form B contact and coil                                                                           | 2,000 Vrms for 1 min. (Detection current: 10mA)                                                                                                                                                                                                                                             |                                                                                         |
|                                                      |                                                   | Between Form A contact and Form B contact                                                                 | 5,000 Vrms for 1 min. (Detection current: 10mA)                                                                                                                                                                                                                                             |                                                                                         |
| Surge breakdown voltage*2 (Between contact and coil) |                                                   | 10,000V (Between Form A contact and coil) (Initial)<br>2,500V (Between Form B contact and coil) (Initial) |                                                                                                                                                                                                                                                                                             |                                                                                         |
| Coil holding voltage*3                               |                                                   | 30 to 110%V (Form A contact carrying current: 35A, at -40 to +55°C <b>-40 to +131°F</b> )                 |                                                                                                                                                                                                                                                                                             |                                                                                         |
|                                                      |                                                   | 30 to 60%V (Form A contact carrying current: 35A, at -40 to +85°C <b>-40 to +185°F</b> )                  |                                                                                                                                                                                                                                                                                             |                                                                                         |
| Operate time (at 20°C <b>68°F</b> ) (Initial)        |                                                   | Max. 30 ms (at nominal coil voltage, excluding contact bounce time)                                       |                                                                                                                                                                                                                                                                                             |                                                                                         |
| Release time (at 20°C <b>68°F</b> )*4 (Initial)      |                                                   | Max. 10 ms (at nominal coil voltage, excluding contact bounce time, without diode)                        |                                                                                                                                                                                                                                                                                             |                                                                                         |
| Mechanical characteristics                           | Shock resistance                                  | Functional                                                                                                | 98 m/s <sup>2</sup> (Half-wave pulse of sine wave: 11 ms; detection time: 10 μs)                                                                                                                                                                                                            |                                                                                         |
|                                                      |                                                   | Destructive                                                                                               | 980 m/s <sup>2</sup> (Half-wave pulse of sine wave: 6 ms)                                                                                                                                                                                                                                   |                                                                                         |
|                                                      | Vibration resistance                              | Functional                                                                                                | 10 to 55 Hz at double amplitude of 1.0 mm <b>.039 inch</b> (Detection time: 10 μs)                                                                                                                                                                                                          |                                                                                         |
|                                                      |                                                   | Destructive                                                                                               | 10 to 55 Hz at double amplitude of 1.5 mm <b>.059 inch</b>                                                                                                                                                                                                                                  |                                                                                         |
| Expected life                                        | Mechanical                                        |                                                                                                           | Min. 5×10 <sup>6</sup> (at 180 times/min.)                                                                                                                                                                                                                                                  |                                                                                         |
|                                                      | Electrical (Form A contact)                       | Resistive load                                                                                            | Min. 3×10 <sup>4</sup> (35A 277V AC) (ON : OFF = 1s : 9s)                                                                                                                                                                                                                                   | Min. 5×10 <sup>4</sup> (35A 277V AC) (ON : OFF = 1s : 9s)                               |
|                                                      |                                                   |                                                                                                           | —                                                                                                                                                                                                                                                                                           | Min. 1×10 <sup>5</sup> (30A 220V AC) (ON : OFF = 1s : 9s)                               |
|                                                      |                                                   | Min. 1×10 <sup>5</sup> (20A 277V AC) (ON : OFF = 1s : 9s)                                                 | Min. 2×10 <sup>5</sup> (20A 277V AC) (ON : OFF = 1s : 9s)                                                                                                                                                                                                                                   |                                                                                         |
|                                                      | Electrical (Form B contact)*6                     | Resistive load                                                                                            | Min. 3×10 <sup>4</sup> (35A 250V AC) (cosφ = 0.8)<br>(ON : OFF = 0.1s : 10s)                                                                                                                                                                                                                | Min. 5×10 <sup>4</sup> (35A 250V AC) (cosφ = 0.8)<br>(ON : OFF = 0.1s : 10s)            |
|                                                      |                                                   |                                                                                                           | Min. 1×10 <sup>5</sup> (1A 277V AC) (ON : OFF = 1s : 9s)                                                                                                                                                                                                                                    |                                                                                         |
| Conditions                                           | Conditions for operation, transport and storage*5 |                                                                                                           | Temperature: -40 to +55°C <b>-40 to +131°F</b> (Coil holding voltage 30 to 110%V)<br>Temperature: -40 to +85°C <b>-40 to +185°F</b> (Coil holding voltage 30 to 60%V or storage)<br>Humidity: 5 to 85% R.H. (Not freezing and condensing at low temperature)<br>Air pressure: 86 to 106 kPa |                                                                                         |
|                                                      |                                                   |                                                                                                           | Unit weight                                                                                                                                                                                                                                                                                 |                                                                                         |

Notes: \*1. This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

\*2. Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981

\*3. Coil holding voltage is the coil voltage after 100 ms from the applied nominal coil voltage.

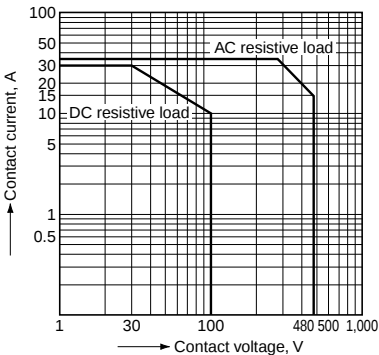
\*4. Release time will lengthen if a diode, etc., is connected in parallel to the coil. Be sure to verify operation under actual conditions.

\*5. The upper operation ambient temperature limit is the maximum temperature that can satisfy the coil temperature rise value. Refer to Usage, transport and storage conditions in NOTES.

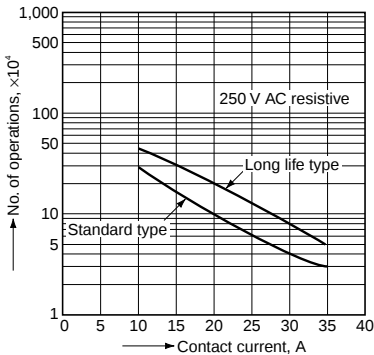
\*6. Regarding Form B contact, only the 2 Form A 1 Form B type applies.

REFERENCE DATA

1. Maximum switching power

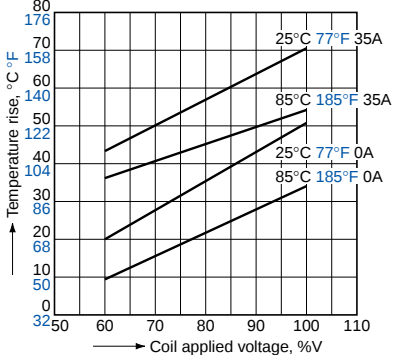


2. Life curve



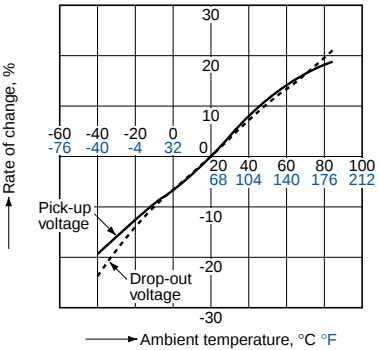
3. Coil temperature rise

Measured portion: Inside the coil  
Ambient temperature: 25°C 77°F, 85°C 185°F  
Contact current: 35 A/0 A



4. Ambient temperature characteristics

Tested sample: AHES3191, 6 pcs.

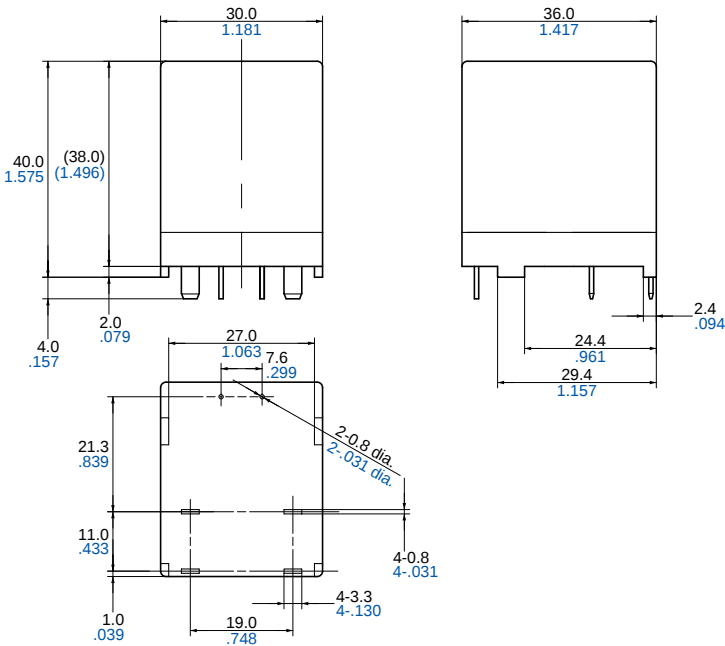


DIMENSIONS (mm inch)

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

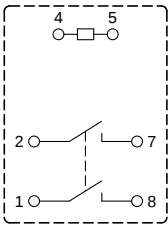
1. 2 Form A type

**CAD Data**

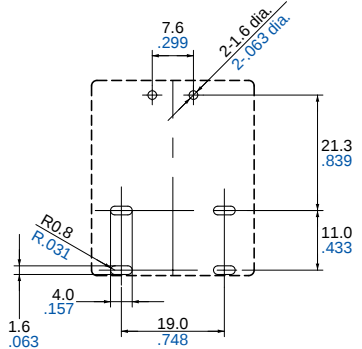


General tolerance:  $\pm 0.3 \pm .012$

Schematic (Bottom view)



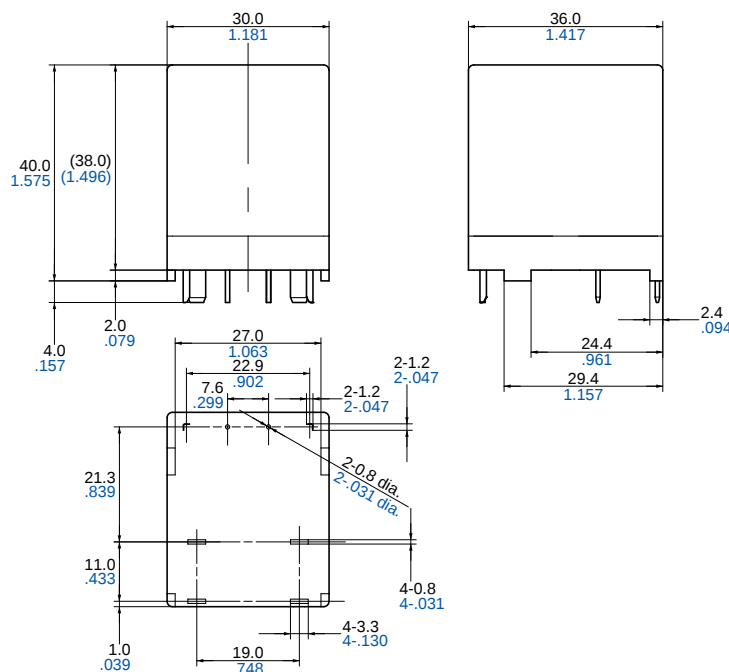
Recommended PC board pattern (Bottom view)



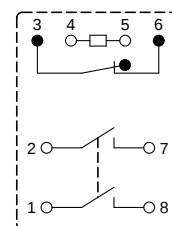
Tolerance:  $\pm 0.1 \pm .004$

## 2. 2 Form A 1 Form B type

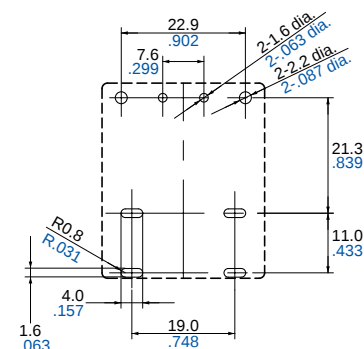
## CAD Data

General tolerance:  $\pm 0.3 \pm 0.12$ 

## Schematic (Bottom view)



## Recommended PC board pattern (Bottom view)

Tolerance:  $\pm 0.1 \pm 0.04$ 

## SAFETY STANDARDS

| Item                     | Certification        | File No. | N.O. contact (Form A contact)        |            |                    | N.C. contact (Form B contact) |            |                   |
|--------------------------|----------------------|----------|--------------------------------------|------------|--------------------|-------------------------------|------------|-------------------|
|                          |                      |          | Contact rating                       | Temp.      | Cycles             | Contact rating                | Temp.      | Cycles            |
| Standard type (AHES*19*) | UL/C-UL (Recognized) | E43149   | 35A, 277VAC, Resistive               | 85°C 185°F | 3×10 <sup>4</sup>  | —                             | —          | —                 |
|                          |                      |          | 20A, 277VAC, Resistive               | 85°C 185°F | 10 <sup>5</sup>    | —                             | —          | —                 |
|                          | VDE (Certified)      | 40042442 | 15A, 480VAC, Resistive               | 85°C 185°F | 10 <sup>5</sup>    | 1A, 30VDC, Resistive          | 85°C 185°F | 10 <sup>5</sup>   |
|                          |                      |          | TV-8                                 | 40°C 104°F | 25×10 <sup>3</sup> | 1A, 277VAC, Resistive         | 85°C 185°F | 10 <sup>5</sup>   |
| Standard type (AHES*19*) | UL/C-UL (Recognized) | E43149   | AC-7a: 35A, 250VAC, $\cos\phi = 0.8$ | 85°C 185°F | 3×10 <sup>4</sup>  | —                             | —          | —                 |
|                          |                      |          | AC-3: 12A, 230VAC, $\cos\phi = 0.45$ | 85°C 185°F | 3×10 <sup>4</sup>  | —                             | —          | —                 |
|                          | VDE (Certified)      | 40042442 | AC-3: 8A, 480VAC, $\cos\phi = 0.45$  | 85°C 185°F | 3×10 <sup>4</sup>  | DC-13: 1A, 24VDC, L/R = 48ms  | 85°C 185°F | 8×10 <sup>4</sup> |
|                          |                      |          | —                                    | —          | —                  | —                             | —          | —                 |

| Item                      | Certification        | File No. | N.O. contact (Form A contact)        |            |                    | N.C. contact (Form B contact) |            |                   |
|---------------------------|----------------------|----------|--------------------------------------|------------|--------------------|-------------------------------|------------|-------------------|
|                           |                      |          | Contact rating                       | Temp.      | Cycles             | Contact rating                | Temp.      | Cycles            |
| Long life type (AHES*29*) | UL/C-UL (Recognized) | E43149   | 35A, 277VAC, Resistive               | 85°C 185°F | 5×10 <sup>4</sup>  | —                             | —          | —                 |
|                           |                      |          | 20A, 277VAC, Resistive               | 85°C 185°F | 2×10 <sup>5</sup>  | —                             | —          | —                 |
|                           | VDE (Certified)      | 40042442 | 15A, 480VAC, Resistive               | 85°C 185°F | 10 <sup>5</sup>    | 1A, 30VDC, Resistive          | 85°C 185°F | 10 <sup>5</sup>   |
|                           |                      |          | TV-10                                | 40°C 104°F | 25×10 <sup>3</sup> | 1A, 277VAC, Resistive         | 85°C 185°F | 10 <sup>5</sup>   |
| Long life type (AHES*29*) | UL/C-UL (Recognized) | E43149   | AC-7a: 35A, 250VAC, $\cos\phi = 0.8$ | 85°C 185°F | 3×10 <sup>4</sup>  | —                             | —          | —                 |
|                           |                      |          | AC-3: 12A, 230VAC, $\cos\phi = 0.45$ | 85°C 185°F | 3×10 <sup>4</sup>  | —                             | —          | —                 |
|                           | VDE (Certified)      | 40042442 | AC-3: 8A, 480VAC, $\cos\phi = 0.45$  | 85°C 185°F | 3×10 <sup>4</sup>  | DC-13: 1A, 24VDC, L/R = 48ms  | 85°C 185°F | 8×10 <sup>4</sup> |
|                           |                      |          | —                                    | —          | —                  | —                             | —          | —                 |

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

| Item                                          | Characteristic (Form A contact)    |
|-----------------------------------------------|------------------------------------|
| Clearance/Creepage distance (IEC61810-1)      | Min. 5.5mm .217inch/8.0mm .315inch |
| Category of protection (IEC61810-1)           | RT II                              |
| Tracking resistance (IEC60112)                | PTI 175                            |
| Insulation material group                     | III a                              |
| Over voltage category                         | III                                |
| Rated voltage                                 | 250V                               |
| Pollution degree                              | 3                                  |
| Type of insulation (Between contact and coil) | Reinforced insulation              |
| Type of insulation (Between open contacts)    | Full disconnection                 |

## NOTES

1. For cautions for use, please refer to our web site.

([https://www3.panasonic.biz/ac/e/control/relay/cautions\\_use/index.jsp](https://www3.panasonic.biz/ac/e/control/relay/cautions_use/index.jsp))

2. When coil holding voltage controlled by PWM, check coil holding voltage and operation of relay under the actual condition.

### 3. Usage, transport and storage conditions

1) Temperature:

–40 to +55°C **–40 to +131°F** (When applied coil holding voltage is 30% to 110%V of nominal coil voltage)

–40 to +85°C **–40 to +185°F** (When applied coil holding voltage is 30% to 60%V of nominal coil voltage or storage)

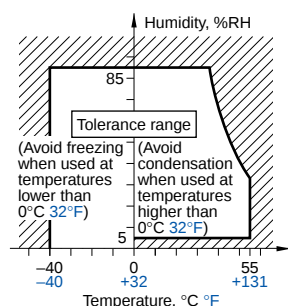
2) Humidity: 5 to 85% RH (Not freezing and condensing at low temperature)

In addition the humidity range depends on temperature. The allowable ranges are as follows;

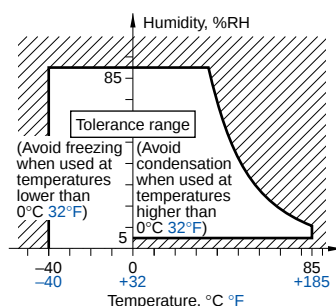
3) Air pressure: 86 to 106 kPa

Allowable range of temperature and humidity for operation, transport and storage.

[Coil holding voltage: 30% to 110%V]



[Coil holding voltage: 30% to 60%V]



### 4. Solder and cleaning conditions

1) Please obey the following conditions when soldering automatically.

(1) Pre-heating: within 120°C **248°F** (solder surface terminal portion) and within 120 seconds

(2) Soldering iron: 260°C±5°C **500°F±41°F** (solder temperature) and within 10 seconds (soldering time)

2) In case of manual soldering, following conditions should be observed.

- Max. 270°C **518°F** (solder temperature) within 10 seconds (soldering time)

- Max. 350°C **662°F** (solder temperature) within 5 seconds (soldering time)

\* Effects of soldering heat on the relays vary depending on the PC board. So please confirm actual soldering condition with the PC board used for assembling.

3) Do not clean this relay by immersion, since the relay is not sealed.

Also, be careful not to allow flux to overflow above the PC board or enter the inside of the relay.

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Please contact .....

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