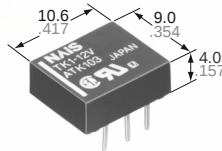


# NAIS

## ULTRA LOW PROFILE 2 AMP. POLARIZED RELAY

# TK-RELAYS



mm inch

## FEATURES

- Low profile 4 mm .157 inch height
- High contact capacity: 2 A
- Surge withstand voltage between contact and coil: 2,500 V (Bellcore rating)

## SPECIFICATIONS

### Contact

|                                                                  |                                                |                                                                |                 |
|------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------|-----------------|
| Arrangement                                                      | 1 Form C                                       |                                                                |                 |
| Initial contact resistance, max.<br>(By voltage drop 6 V DC 1 A) | 50 mΩ                                          |                                                                |                 |
| Contact material                                                 | Gold-clad silver alloy                         |                                                                |                 |
| Rating                                                           | Nominal switching capacity<br>(resistive load) | 2 A 30 V DC                                                    |                 |
|                                                                  | Max. Switching power<br>(resistive load)       | 60 W                                                           |                 |
|                                                                  | Max. switching voltage                         | 220 V DC                                                       |                 |
|                                                                  | Max. switching current                         | 2 A                                                            |                 |
|                                                                  | Min. switching capacity ※1                     | 10 μA 10 mV DC                                                 |                 |
| Nominal operating power                                          | Single side stable                             | 140 mW (1.5 to 12 V DC)<br>270 mW (24 V DC)                    |                 |
|                                                                  | 1 coil latching                                | 100 mW (1.5 to 12 V DC)<br>150 mW (24 V DC)                    |                 |
|                                                                  | 2 coil latching                                | 200 mW (1.5 to 9 V DC)<br>250 mW (12 V DC)<br>400 mW (24 V DC) |                 |
| Expected life (min. operations)                                  | Mechanical (at 180 cpm)                        | 10 <sup>8</sup> (Single side stable)                           |                 |
|                                                                  |                                                | 5 × 10 <sup>7</sup> (1 or 2 coil latching)                     |                 |
|                                                                  | Electrical (at 20 cpm)                         | 2 A 30 V DC resistive                                          | 10 <sup>5</sup> |

### Note:

※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.

### Remarks

\* Specifications will vary with foreign standards certification ratings.

\*1 Measurement at same location as "Initial breakdown voltage" section.

\*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 2 A.

\*3 Nominal voltage applied to the coil, excluding contact bounce time.

\*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.

\*5 Half-wave pulse of sine wave: 6 ms; detection time: 10 μs.

\*6 Half-wave pulse of sine wave: 6 ms.

\*7 Detection time: 10 μs.

\*8 Refer to 4. Conditions for operation, transport and storage mentioned in Cautions for use (Page 178).

\*9 The maximum ambient temperature allows for coil temperature rise at maximum allowable coil voltage.

As for the applicable range of continuous carrying current against temperature, please refer to "Maximum value of continuous carrying current" chart. (Page 175)

### Characteristics

|                                                                                                    |                          |                                                                       |
|----------------------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------|
| Initial insulation resistance*1                                                                    |                          | Min. 1,000 MΩ (at 500 V DC)                                           |
| Initial breakdown voltage                                                                          | Between open contacts    | 750 Vrms for 1 min.<br>(Detection current: 10 mA)                     |
|                                                                                                    | Between contact and coil | 1,500 Vrms for 1 min.<br>(Detection current: 10 mA)                   |
| FCC surge voltage between open contacts (10×160 μs)                                                |                          | 1,500 V                                                               |
| Surge voltage between contacts and coil (2×10 μs) [Bellcore]                                       |                          | 2,500 V                                                               |
| Temperature rise*2 (at 20°C)                                                                       |                          | Max. 50°C                                                             |
| Operate time [Set time]*3 (at 20°C)                                                                |                          | Max. 3 ms (Approx. 1.5 ms)<br>[Max. 3 ms (Approx. 1 ms)]              |
| Release time [Reset time]*4 (at 20°C)                                                              |                          | Max. 2 ms (Approx. 1 ms)<br>[Max. 3 ms (Approx. 1 ms)]                |
| Shock resistance                                                                                   | Functional*5             | Min. 750 m/s <sup>2</sup> {75 G}                                      |
|                                                                                                    | Destructive*6            | Min. 1,000 m/s <sup>2</sup> {100 G}                                   |
| Vibration resistance                                                                               | Functional*7             | 196 m/s <sup>2</sup> {20G}, 10 to 55 Hz at double amplitude of 3.3 mm |
|                                                                                                    | Destructive              | 294 m/s <sup>2</sup> {30G}, 10 to 55 Hz at double amplitude of 5 mm   |
| Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature) | Ambient temperature*9    | −40°C to +85°C<br>−40°F to +185°F                                     |
|                                                                                                    | Humidity                 | 5 to 85% R.H.                                                         |
| Unit weight                                                                                        |                          | Approx. 1 g .035 oz.                                                  |

## ORDERING INFORMATION

EX. TK 1 — L2 — H — 12V

| Contact arrangement | Operating function                                                   | Terminal shape                                                | Coil voltage (DC)             |
|---------------------|----------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| 1: 1 Form C         | Nil: Single side stable<br>L: 1 coil latching<br>L2: 2 coil latching | Nil: Standard PC board terminal<br>H: Self-clinching terminal | 1.5, 3, 4.5, 5, 6, 9, 12, 24V |

TYPES AND COIL DATA (at 20°C 68°F)

1. Single side stable

| Part No.                   |                         | Nominal voltage, V DC | Pick-up voltage, V DC (max.) | Drop-out voltage, V DC (min.) | Nominal operating current, mA (±10%) | Coil resistance, Ω (±10%) | Nominal operating power, mW | Max. allowable voltage, V DC |
|----------------------------|-------------------------|-----------------------|------------------------------|-------------------------------|--------------------------------------|---------------------------|-----------------------------|------------------------------|
| Standard PC board terminal | Self-clinching terminal |                       |                              |                               |                                      |                           |                             |                              |
| TK1-1.5 V                  | TK1-H-1.5 V             | 1.5                   | 1.125                        | 0.15                          | 93.8                                 | 16                        | 140                         | 2.25                         |
| TK1-3 V                    | TK1-H-3 V               | 3                     | 2.25                         | 0.3                           | 46.7                                 | 64.3                      | 140                         | 4.5                          |
| TK1-4.5 V                  | TK1-H-4.5 V             | 4.5                   | 3.38                         | 0.45                          | 31.1                                 | 145                       | 140                         | 6.7                          |
| TK1-5 V                    | TK1-H-5 V               | 5                     | 3.75                         | 0.5                           | 28.1                                 | 178                       | 140                         | 7.5                          |
| TK1-6 V                    | TK1-H-6 V               | 6                     | 4.5                          | 0.6                           | 23.3                                 | 257                       | 140                         | 9                            |
| TK1-9 V                    | TK1-H-9 V               | 9                     | 6.75                         | 0.9                           | 15.5                                 | 579                       | 140                         | 13.5                         |
| TK1-12 V                   | TK1-H-12 V              | 12                    | 9                            | 1.2                           | 11.7                                 | 1,028                     | 140                         | 18                           |
| TK1-24 V                   | TK1-H-24 V              | 24                    | 18                           | 2.4                           | 11.3                                 | 2,133                     | 270                         | 28.8                         |

2. 1 Coil latching

| Part No.                   |                         | Nominal voltage, V DC | Set voltage, V DC (max.) | Reset voltage, V DC (max.) | Nominal operating current, mA (±10%) | Coil resistance, Ω (±10%) | Nominal operating power, mW | Max. allowable voltage, V DC |
|----------------------------|-------------------------|-----------------------|--------------------------|----------------------------|--------------------------------------|---------------------------|-----------------------------|------------------------------|
| Standard PC board terminal | Self-clinching terminal |                       |                          |                            |                                      |                           |                             |                              |
| TK1-L-1.5 V                | TK1-L-H-1.5 V           | 1.5                   | 1.125                    | 1.125                      | 66.7                                 | 22.5                      | 100                         | 2.25                         |
| TK1-L-3 V                  | TK1-L-H-3 V             | 3                     | 2.25                     | 2.25                       | 33.3                                 | 90                        | 100                         | 4.5                          |
| TK1-L-4.5 V                | TK1-L-H-4.5 V           | 4.5                   | 3.38                     | 3.38                       | 22.2                                 | 202.5                     | 100                         | 6.7                          |
| TK1-L-5 V                  | TK1-L-H-5 V             | 5                     | 3.75                     | 3.75                       | 20                                   | 250                       | 100                         | 7.5                          |
| TK1-L-6 V                  | TK1-L-H-6 V             | 6                     | 4.5                      | 4.5                        | 16.7                                 | 360                       | 100                         | 9                            |
| TK1-L-9 V                  | TK1-L-H-9 V             | 9                     | 6.75                     | 6.75                       | 11.1                                 | 810                       | 100                         | 13.5                         |
| TK1-L-12 V                 | TK1-L-H-12 V            | 12                    | 9                        | 9                          | 8.3                                  | 1,440                     | 100                         | 18                           |
| TK1-L-24 V                 | TK1-L-H-24 V            | 24                    | 18                       | 18                         | 6.3                                  | 3,840                     | 150                         | 28.8                         |

3. 2 Coil latching

| Part No.                   |                         | Nominal voltage, V DC | Set voltage, V DC (max.) | Reset voltage, V DC (max.) | Nominal operating current, mA (±10%) | Coil resistance, Ω (±10%) | Nominal operating power, mW | Max. allowable voltage, V DC |
|----------------------------|-------------------------|-----------------------|--------------------------|----------------------------|--------------------------------------|---------------------------|-----------------------------|------------------------------|
| Standard PC board terminal | Self-clinching terminal |                       |                          |                            |                                      |                           |                             |                              |
| TK1-L2-1.5 V               | TK1-L2-H-1.5 V          | 1.5                   | 1.125                    | 1.125                      | 133.9                                | 11.2                      | 200                         | 2.25                         |
| TK1-L2-3 V                 | TK1-L2-H-3 V            | 3                     | 2.25                     | 2.25                       | 66.7                                 | 45                        | 200                         | 4.5                          |
| TK1-L2-4.5 V               | TK1-L2-H-4.5 V          | 4.5                   | 3.38                     | 3.38                       | 44.5                                 | 101.2                     | 200                         | 6.7                          |
| TK1-L2-5 V                 | TK1-L2-H-5 V            | 5                     | 3.75                     | 3.75                       | 40                                   | 125                       | 200                         | 7.5                          |
| TK1-L2-6 V                 | TK1-L2-H-6 V            | 6                     | 4.5                      | 4.5                        | 33.3                                 | 180                       | 200                         | 9                            |
| TK1-L2-9 V                 | TK1-L2-H-9 V            | 9                     | 6.75                     | 6.75                       | 22.2                                 | 405                       | 200                         | 13.5                         |
| TK1-L2-12 V                | TK1-L2-H-12 V           | 12                    | 9                        | 9                          | 20.8                                 | 576                       | 250                         | 14.4                         |
| TK1-L2-24 V                | TK1-L2-H-24 V           | 24                    | 18                       | 18                         | 16.7                                 | 1,440                     | 400                         | 26.4                         |

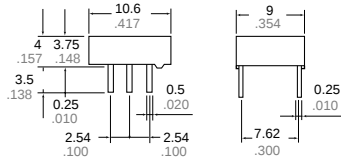
- Notes:
- Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
  - Standard packing: Tube: 50 pcs.; Case; 1,000 pcs.
  - In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

DIMENSIONS

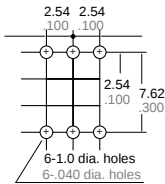
mm inch



Standard PC board terminal

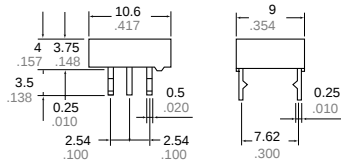


PC board pattern (Copper-side view)



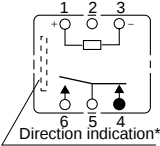
Tolerance: ±0.1 ±.004

Self-clinching terminal

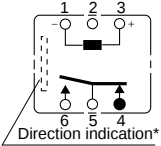


Schematic (Bottom view)

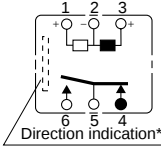
• Single side stable  
(Deenergized condition)



• 1-coil latching  
(Reset condition)



• 2-coil latching  
(Reset condition)



General tolerance: ±0.3 ±.012

\*Orientation stripe located on top of relay.

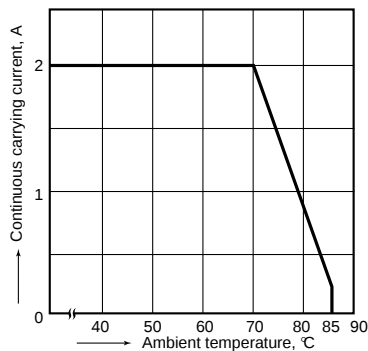
## REFERENCE DATA

### 1. Maximum value of continuous carrying current

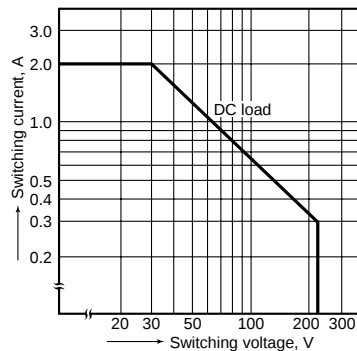
Test conditions:

Coil applied voltage: 110% of rated voltage

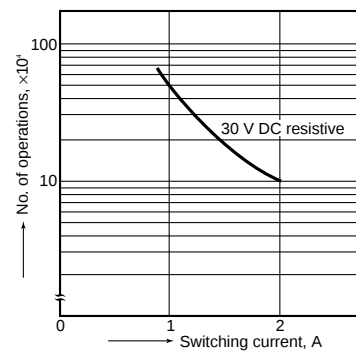
Continuous carrying current: 1,000 hours



### 2. Maximum switching capacity



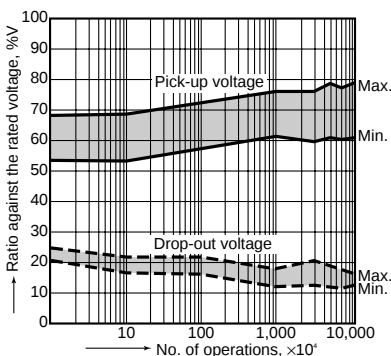
### 3. Life curve



### 4. Mechanical life

Tested sample: TK1-12V, 8 pcs.

Switching frequency: 30 Hz

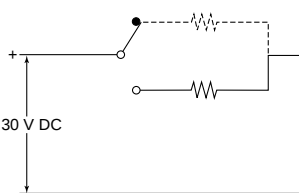


### 5. Electrical life (DC load)

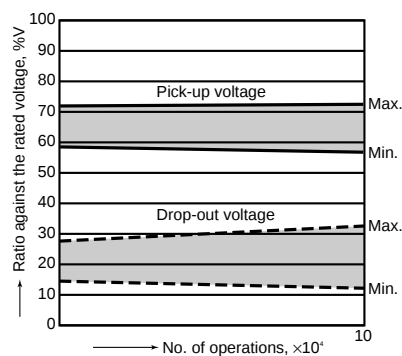
Tested sample: TK1-12V, 10 pcs.

Condition: 2 A 30 V DC resistive load, 20 cpm

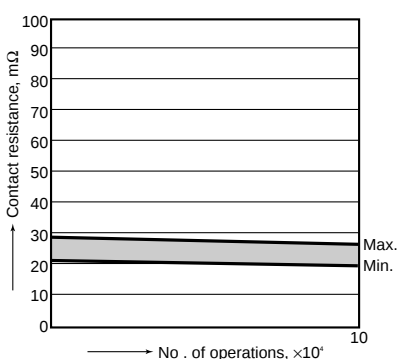
Circuit



### Change of pick-up and drop-out voltage



### Change of contact resistance



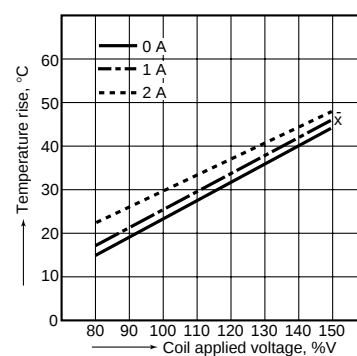
### 6. Coil temperature rise

Tested sample: TK1-12V, 6 pcs.

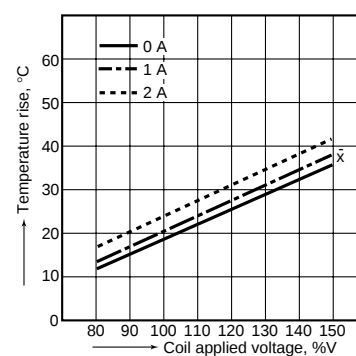
Measured portion: Inside the coil

Carrying current: 0 A, 1 A, 2 A

Ambient temperature: 25°C 77°F



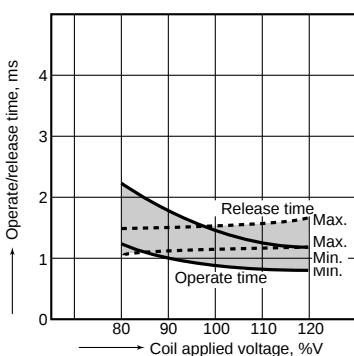
Ambient temperature: 70°C 158°F



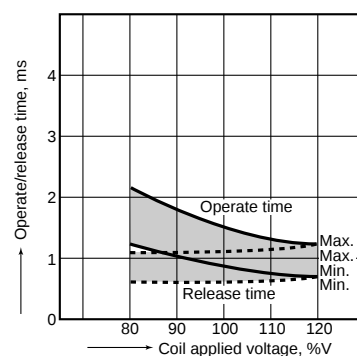
### 7. Operate/release time characteristics

Tested sample: TK1-5 V, 50 pcs.

<With diode>

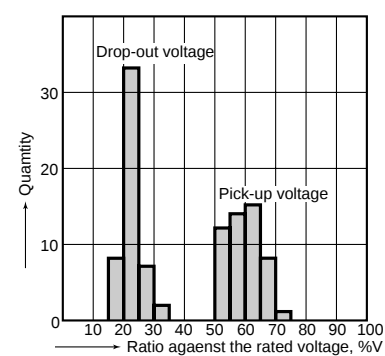


<Without diode>

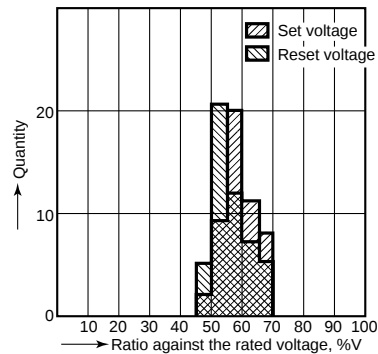


### 8. Distribution of pick-up and drop-out voltage

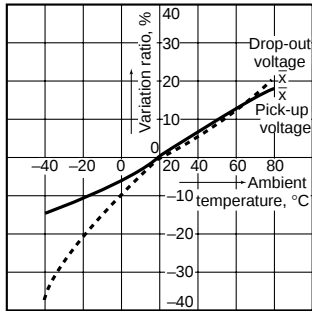
Tested sample: TK1-5V, 50 pcs.



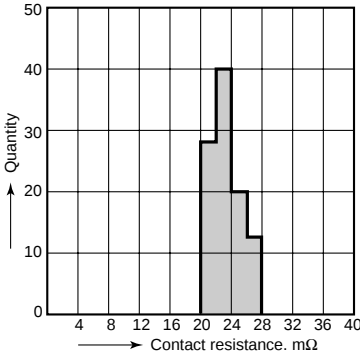
9. Distribution of set and reset voltage  
Tested sample: TK1-L2-12V, 50 pcs.



10. Ambient temperature characteristics  
Tested sample: TK1-12V, 5 pcs.

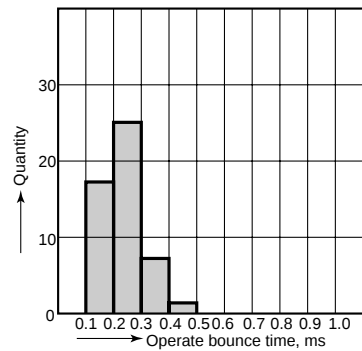


11. Distribution of contact resistance  
Tested sample TK1-5V, 50 pcs. (50×2 contacts)

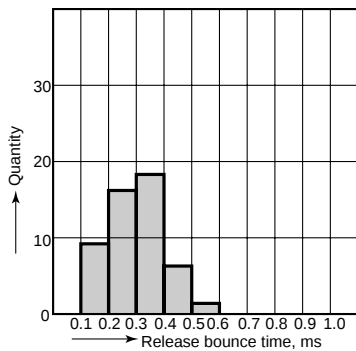


12. Distribution of operate/release bounce time  
Tested sample: TK1-5V, 50 pcs.

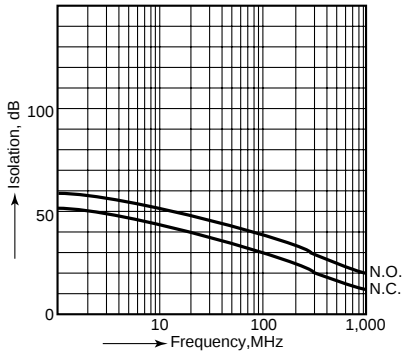
<Operate bounce time>



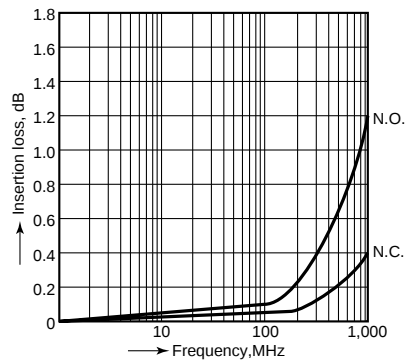
<Release bounce time>



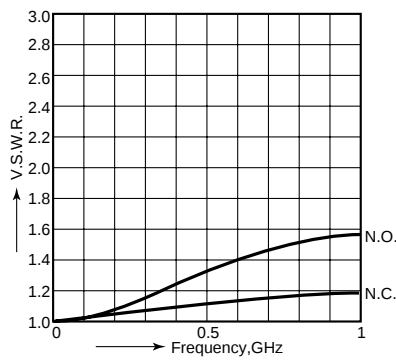
13.-(1) High-frequency characteristics  
Isolation characteristics



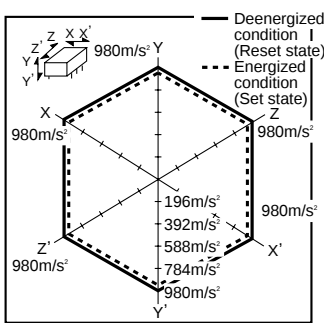
13.-(2) High-frequency characteristics  
Insertion loss characteristics



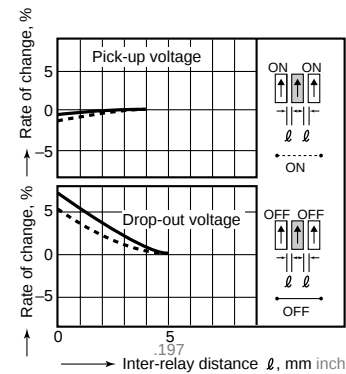
13.-(3) High-frequency characteristics  
V.S.W.R.



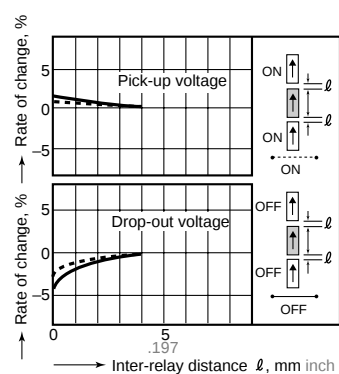
14. Malfunctional shock  
Tested sample: TK1-12V, 6 pcs. (single side stable);  
TK1-L2-12V, 6 pcs. (latching)



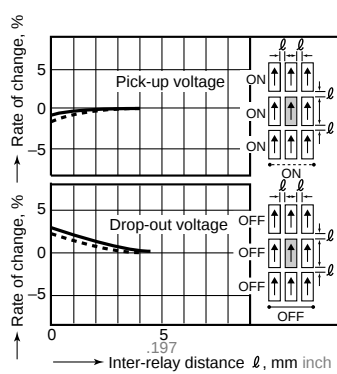
15.-(1) Influence of adjacent mounting



15.-(2) Influence of adjacent mounting

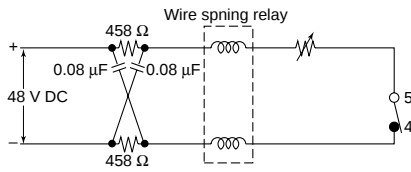


15.-(3) Influence of adjacent mounting

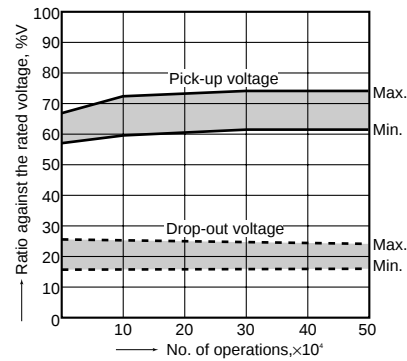


16. Actual load test (35 mA 48 V DC wire spring relay load)

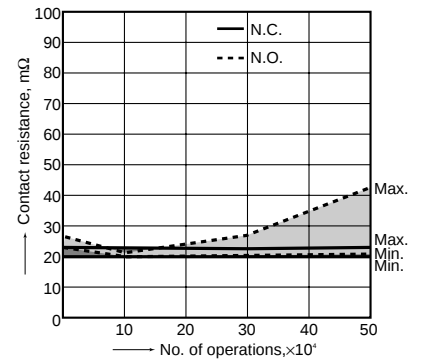
Circuit



Change of pick-up and drop-out voltage



Change of contact resistance



For Cautions for Use, see Page 178 and 179.