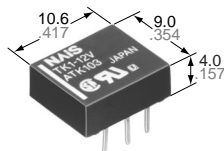


# NAIS

## 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. (By voltage drop 6 V DC 1 A)	50 mΩ	
Contact material	Gold-clad silver alloy	
Rating	Nominal switching capacity (resistive load)	2 A 30 V DC
	Max. switching power (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) 270 mW (24 V DC)
	1 coil latching	100 mW (1.5 to 12 V DC) 150 mW (24 V DC)
	2 coil latching	200 mW (1.5 to 9 V DC) 250 mW (12 V DC) 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. (Detection current: 10 mA)
	Between contact and coil	1,500 Vrms for 1 min. (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) [Max. 3 ms (Approx. 1 ms)]
Release time [Reset time]*4 (at 20°C)		Max. 2 ms (Approx. 1 ms) [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 -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 L: 1 coil latching L2: 2 coil latching	Nil: Standard PC board terminal 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

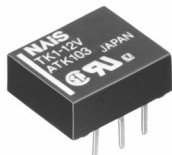
Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TK1-L2-1.5 V	TK1-L2-H-1.5 V	1.5	1.125	1.125	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:

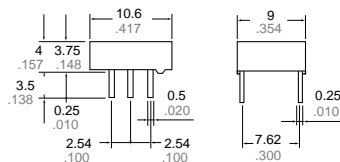
1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

## DIMENSIONS

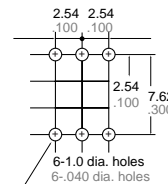
mm inch



Standard PC board terminal

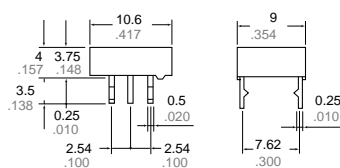


PC board pattern (Copper-side view)

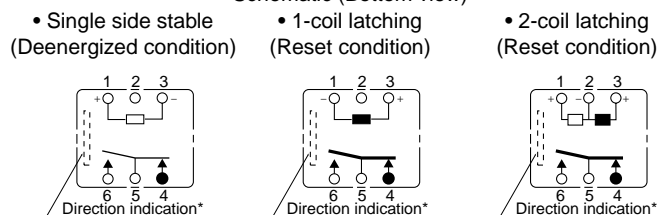


Tolerance: ±0.1 ±.004

Self-clinching terminal



Schematic (Bottom view)



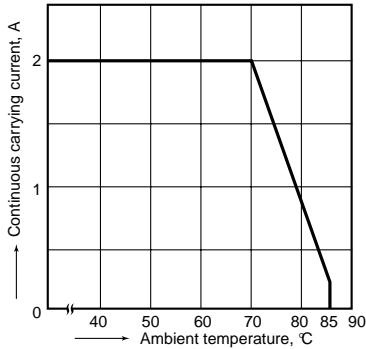
General tolerance: ±0.3 ±.012

\*Orientation stripe located on top of relay.

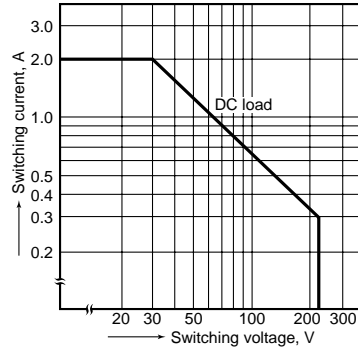
# REFERENCE DATA

## 1. Maximum value of continuous carrying current

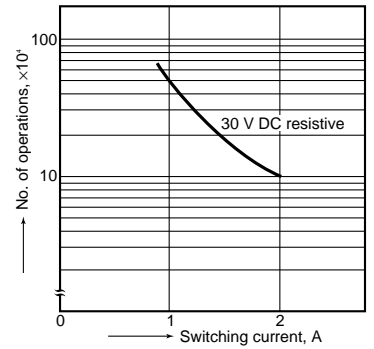
Test conditions:  
Coil applied voltage: 110% of rated voltage  
Continuous carrying current: 1,000 hours



## 2. Maximum switching capacity

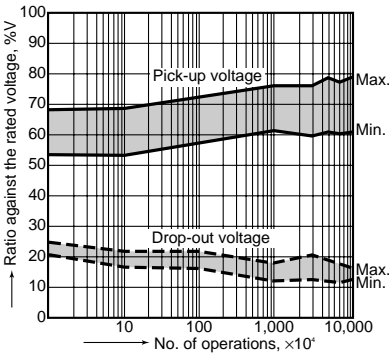


## 3. Life curve



## 4. Mechanical life

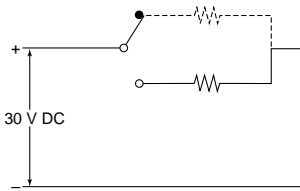
Tested sample: TK1-12V, 8 pcs.  
Switching frequency: 30 Hz



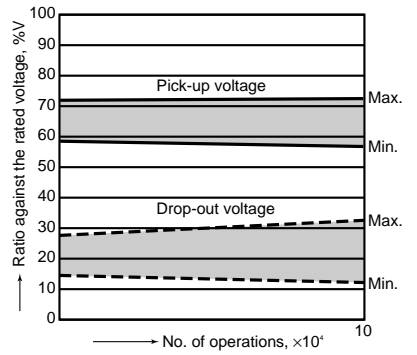
## 5. Electrical life (DC load)

Tested sample: TK1-12V, 10 pcs.  
Condition: 2 A 30 V DC resistive load, 20 cpm

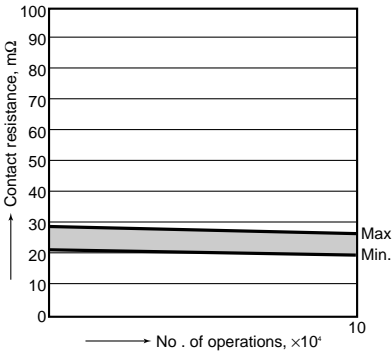
### Circuit



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

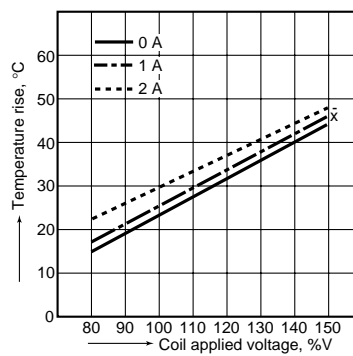


## Change of contact resistance

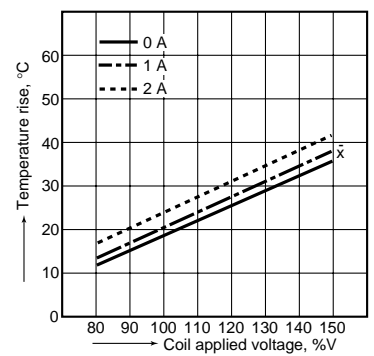


## 6. Coil temperature rise

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



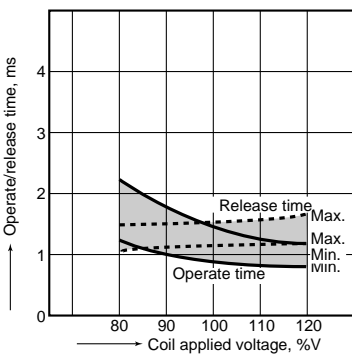
Ambient temperature: 70°C 158°F



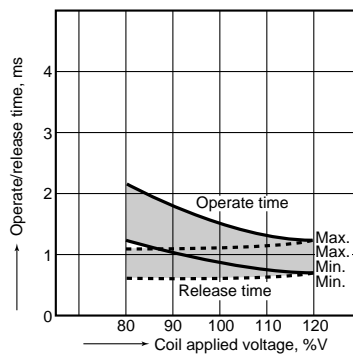
## 7. Operate/release time characteristics

Tested sample: TK1-5 V, 50 pcs.

### <With diode>

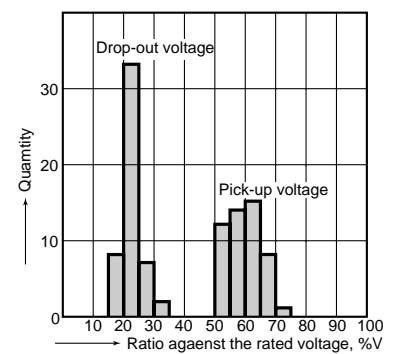


### <Without diode>

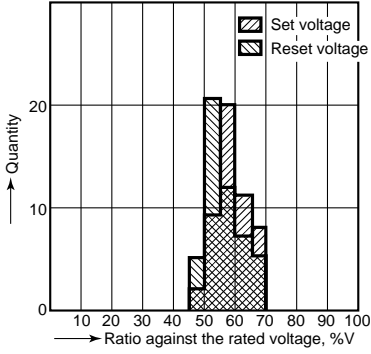


## 8. Distribution of pick-up and drop-out voltage

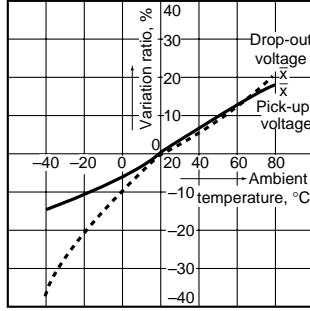
Tested sample: TK1-5V, 50 pcs.



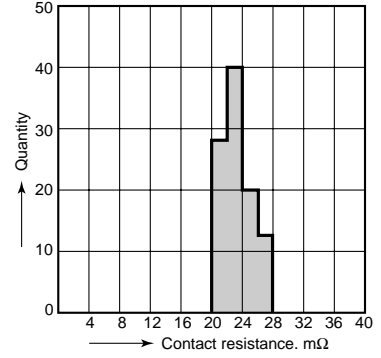
9. Distribution of set and reset voltage  
Tested sample: TK1-L2-12V, 50 pcs.



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

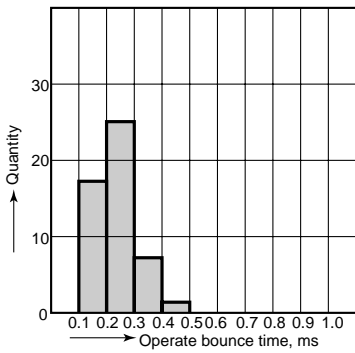


11. Distribution of contact resistance  
Tested sample TK1-5V, 50 pcs. (50x2 contacts)

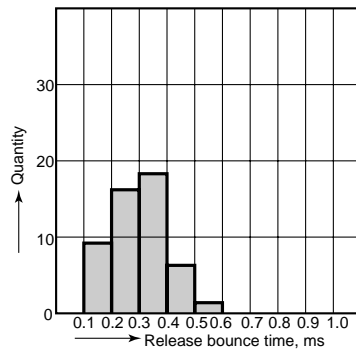


12. Distribution of operate/release bounce time  
Tested sample: TK1-5V, 50 pcs.

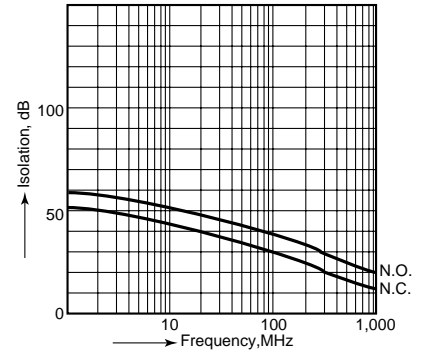
<Operate bounce time>



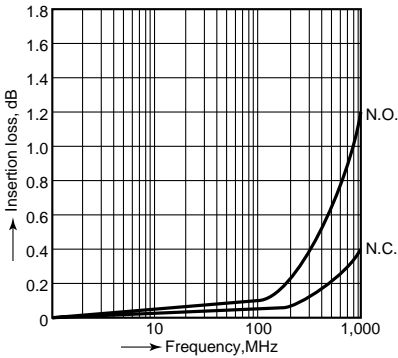
<Release bounce time>



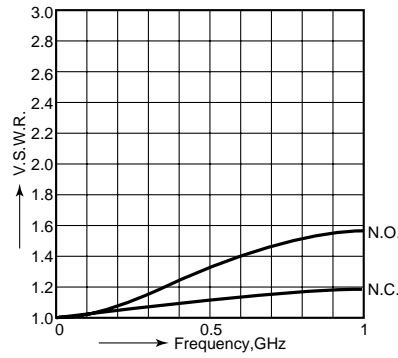
13.-(1) High-frequency characteristics  
Isolation characteristics



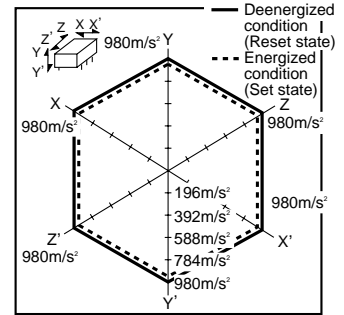
13.-(2) High-frequency characteristics  
Insertion loss characteristics



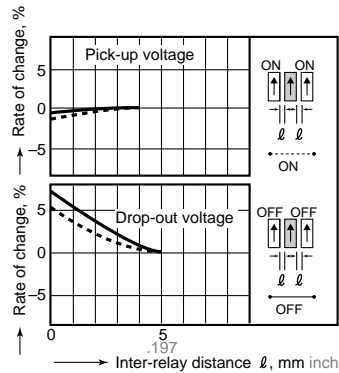
13.-(3) High-frequency characteristics  
V.S.W.R.



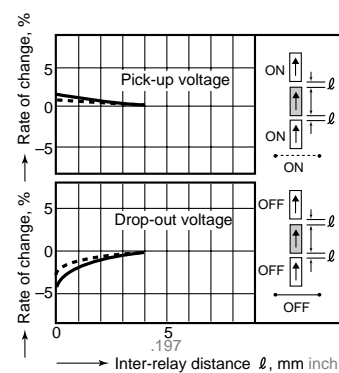
14. Malfunctional shock  
Tested sample: TK1-12V, 6 pcs. (single side stable);  
TK1-L2-12V, 6 pcs. (latching)



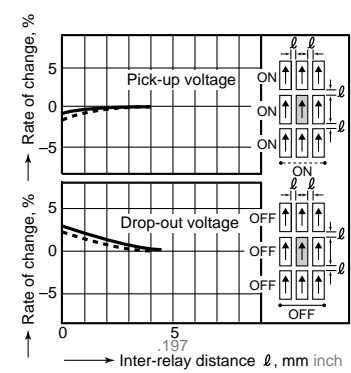
15.-(1) Influence of adjacent mounting



15.-(2) Influence of adjacent mounting

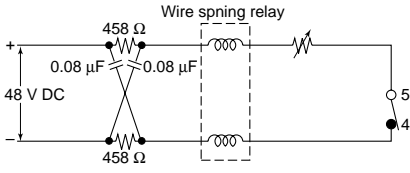


15.-(3) Influence of adjacent mounting

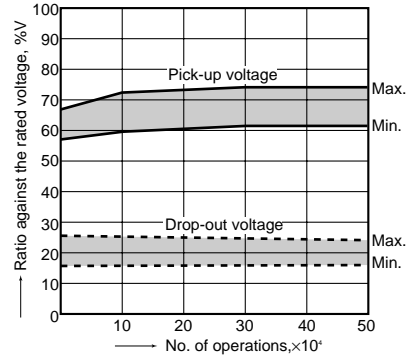


16. Actual load test (35 mA 48 V DC wire spring relay load)

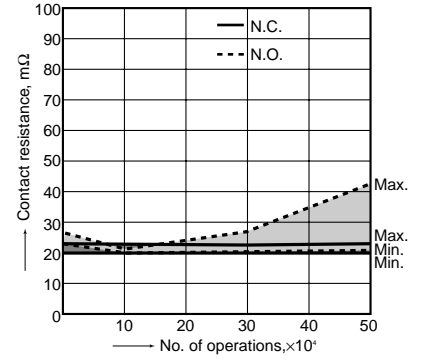
Circuit



Change of pick-up and drop-out voltage



Change of contact resistance



**For Cautions for Use, see Page 178 and 179.**