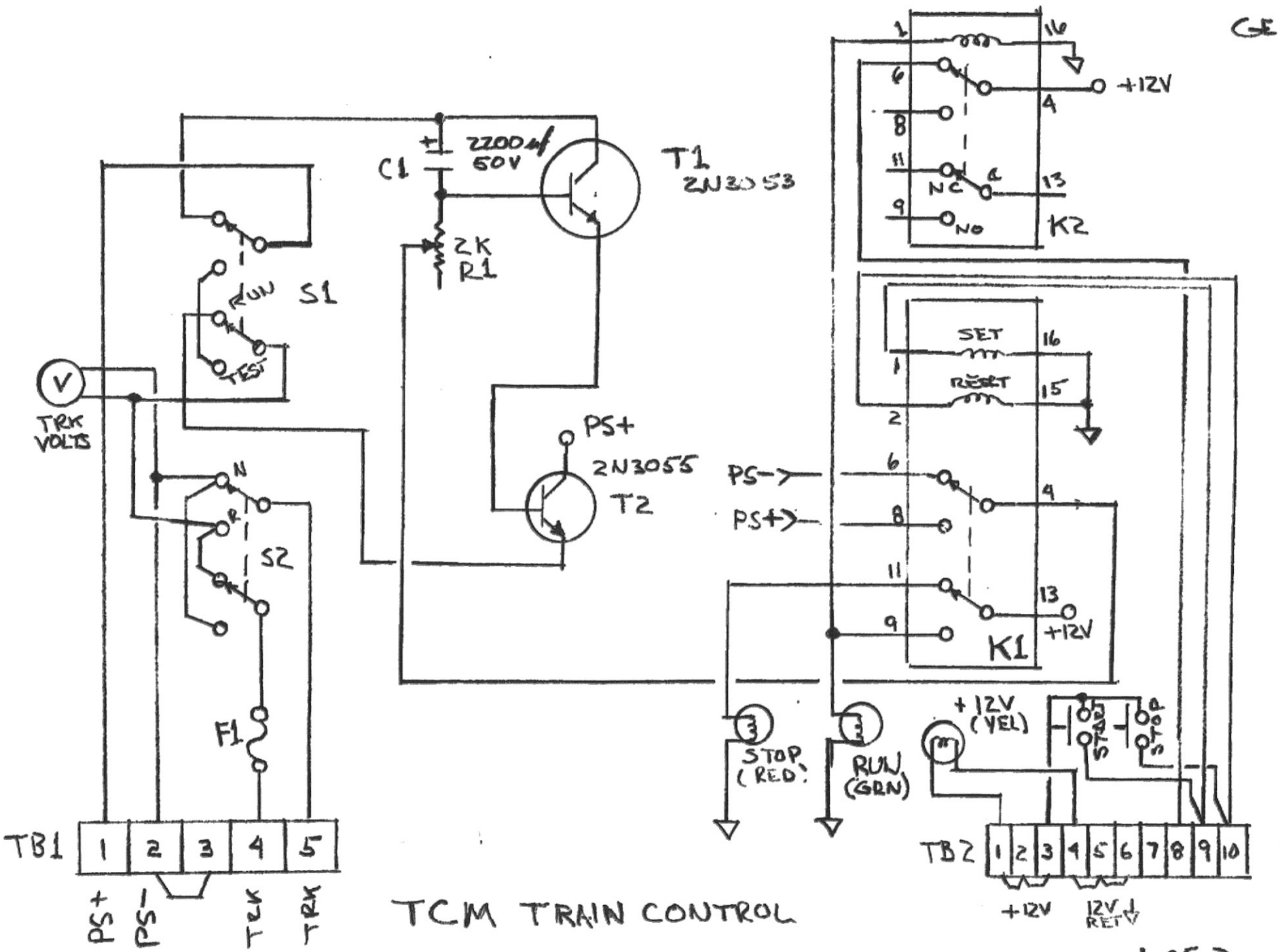
Tucson Garden Railway Society
Tucson Children's Museum
Train Control System

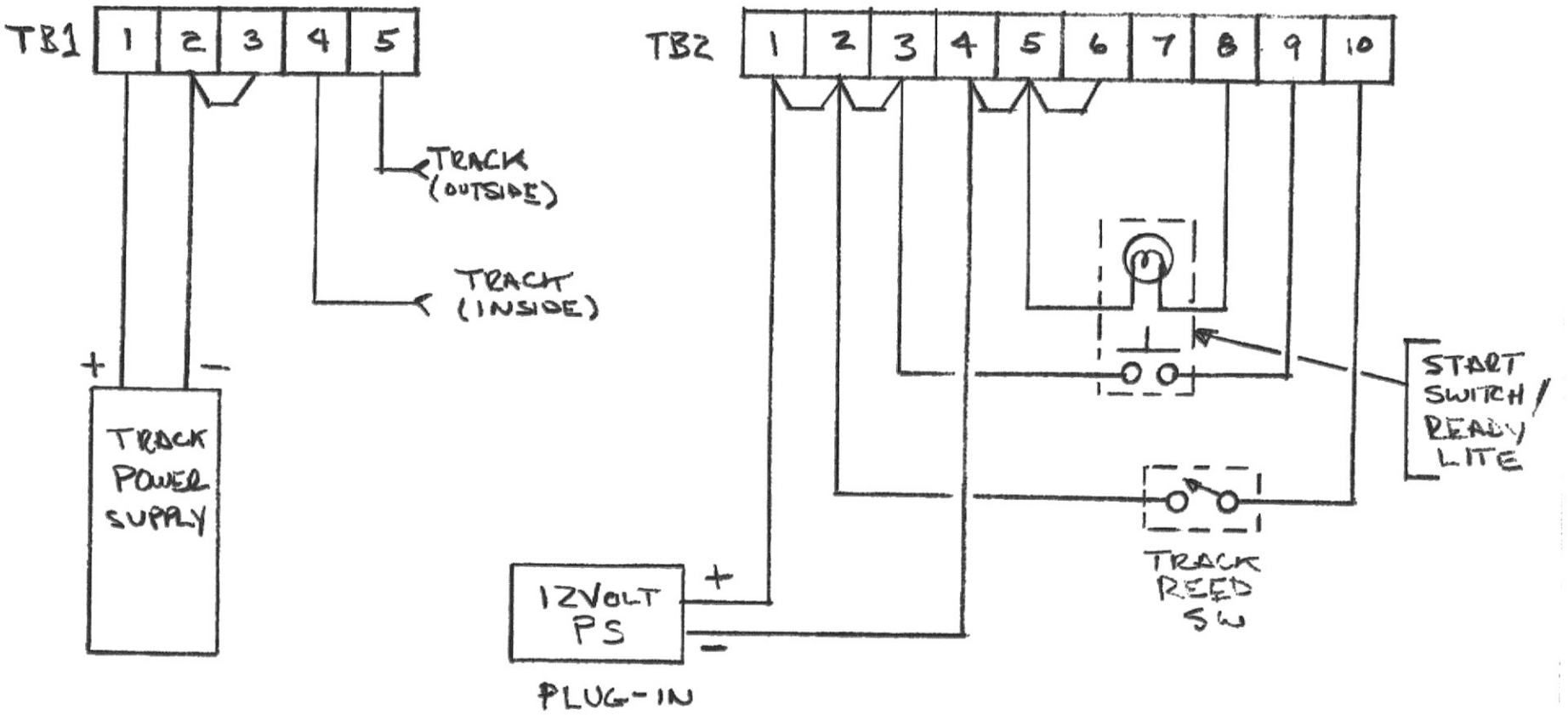
November, 2008

GEM 12/2019

GEM



TCM TRAIN CONTROL



TCM TRAIN CONTROL — TERMINAL BLOCK CONNECTIONS

REF	Description	Part # or Designation	Company	Notes
S1	switch, toggle, DPDT			
S2	switch, toggle, DPDT			
T1	transistor	2N2053		TO-39
T2	transistor, power	2N3055		TO-3
K1	Relay, dpdt, 12vdc coil	DS2Y-S-DC12V	Panasonic	DIP package
K2	Relay, set/reset, dpdt, 12vdc coil	DS2E-ML2-DC12V	Panasonic	DIP package
	LED Indicators, 12vdc	??		12vdc yel, RUN grn, STOP red
S3	Switch, pushbutton, spst, no	??		Run (test)
S4	Switch, pushbutton, spst, no	??		Stop (test)
C1	capacitor, electrolytic	2200 uf, 50v	Nichicon	
R1	potentiometer, 2K ohms			(sets momentum slew rate)
F1	fuse, approx 3 amp	Type 3AG	Littlefuse	

TYPES

Contact arrangement	Nominal coil voltage	High sensitivity type		Standard type	
		Single side stable type	2 coil latching type	Single side stable type	2 coil latching type
		Part No.	Part No.	Part No.	Part No.
1 Form C	1.5 V DC	DS1E-S-DC1.5V	DS1E-SL2-DC1.5V	DS1E-M-DC1.5V	DS1E-ML2-DC1.5V
	3 V DC	DS1E-S-DC3V	DS1E-SL2-DC3V	DS1E-M-DC3V	DS1E-ML2-DC3V
	5 V DC	DS1E-S-DC5V	DS1E-SL2-DC5V	DS1E-M-DC5V	DS1E-ML2-DC5V
	6 V DC	DS1E-S-DC6V	DS1E-SL2-DC6V	DS1E-M-DC6V	DS1E-ML2-DC6V
	9 V DC	DS1E-S-DC9V	DS1E-SL2-DC9V	DS1E-M-DC9V	DS1E-ML2-DC9V
	12 V DC	DS1E-S-DC12V	DS1E-SL2-DC12V	DS1E-M-DC12V	DS1E-ML2-DC12V
	24 V DC	DS1E-S-DC24V	DS1E-SL2-DC24V	DS1E-M-DC24V	DS1E-ML2-DC24V
	48 V DC	DS1E-S-DC48V	DS1E-SL2-DC48V	DS1E-M-DC48V	DS1E-ML2-DC48V
2 Form C	3 V DC	DS2E-S-DC3V	DS2E-SL2-DC3V	—	—
	5 V DC	DS2E-S-DC5V	DS2E-SL2-DC5V	—	—
	6 V DC	DS2E-S-DC6V	DS2E-SL2-DC6V	—	—
	9 V DC	DS2E-S-DC9V	DS2E-SL2-DC9V	—	—
	12 V DC	DS2E-S-DC12V	DS2E-SL2-DC12V	—	—
	24 V DC	DS2E-S-DC24V	DS2E-SL2-DC24V	—	—
	48 V DC	DS2E-S-DC48V	DS2E-SL2-DC48V	—	—

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

RATING

1.Coil data

- Operating characteristics such as 'Operate voltage' and 'Release voltage' are influenced by mounting conditions, ambient temperature, etc.
  Therefore, please use the relay within ± 5% of rated coil voltage.
- 'Initial' means the condition of products at the time of delivery.

1) Single side stable type

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 (at 50°C 122°F)
Standard (M) type	1.5 V DC	70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	266.7 mA	5.63 Ω	400 mW	1 Form C: 120%V of nominal voltage
	3 V DC			133.3 mA	22.5 Ω		
	5 V DC			80.0 mA	62.5 Ω		
	6 V DC			66.7 mA	90 Ω		
	9 V DC			44.4 mA	203 Ω		
	12 V DC			33.3 mA	360 Ω		
	24 V DC			16.7 mA	1,440 Ω		
	48 V DC			8.3 mA	5,760 Ω		
High sensitivity (S) type	1.5 V DC	1 Form C: 80%V or less of nominal voltage 2 Form C: 70%V or less of nominal voltage (Initial)	10%V or more of nominal voltage (Initial)	133.3 mA	11.3 Ω	200 mW	1 Form C: 160%V of nominal voltage 2 Form C: 220%V of nominal voltage
	3 V DC			66.7 mA	45 Ω		
	5 V DC			40.0 mA	125 Ω		
	6 V DC			33.3 mA	180 Ω		
	9 V DC			22.2 mA	405 Ω		
	12 V DC			16.7 mA	720 Ω		
	24 V DC			8.3 mA	2,880 Ω		
	48 V DC			4.2 mA	11,520 Ω		

2) 2 coil latching type

Type	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	
Standard (M) type	1.5 V DC	70%V or less of nominal voltage (Initial)	70%V or less of nominal voltage (Initial)	240 mA	240 mA	6.25 Ω	6.25 Ω	360 mW	360 mW	1 Form C: 120%V of nominal voltage
	3 V DC			120 mA	120 mA	25 Ω	25 Ω			
	5 V DC			72 mA	72 mA	69.4 Ω	69.4 Ω			
	6 V DC			60 mA	60 mA	100 Ω	100 Ω			
	9 V DC			40 mA	40 mA	225 Ω	225 Ω			
	12 V DC			30 mA	30 mA	400 Ω	400 Ω			
	24 V DC			15 mA	15 mA	1,600 Ω	1,600 Ω			
	48 V DC			7.5 mA	7.5 mA	6,400 Ω	6,400 Ω			
High sensitivity (S) type	1.5 V DC	1 Form C: 80%V or less of nominal voltage 2 Form C: 70%V or less of nominal voltage (Initial)	1 Form C: 80%V or less of nominal voltage 2 Form C: 70%V or less of nominal voltage (Initial)	120 mA	120 mA	12.5 Ω	12.5 Ω	180 mW	180 mW	1 Form C: 160%V of nominal voltage 2 Form C: 220%V of nominal voltage
	3 V DC			60 mA	60 mA	50 Ω	50 Ω			
	5 V DC			36 mA	36 mA	139 Ω	139 Ω			
	6 V DC			30 mA	30 mA	200 Ω	200 Ω			
	9 V DC			20 mA	20 mA	450 Ω	450 Ω			
	12 V DC			15 mA	15 mA	800 Ω	800 Ω			
	24 V DC			7.5 mA	7.5 mA	3,200 Ω	3,200 Ω			
	48 V DC			3.75 mA	3.75 mA	12,800 Ω	12,800 Ω			

2. Specifications

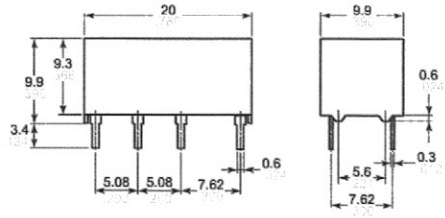
Characteristics	Item		Specifications	
Contact	Arrangement		1 Form C	2 Form C
	Initial contact resistance, max.		Max. 50 mΩ (By voltage drop 6 V DC 1A)	
	Contact material		Ag + Au clad	
Rating	Nominal switching capacity		2 A 30 V DC (resistive load)	
	Max. switching power		60 W, 125 VA (resistive load)	
	Max. switching voltage		220 V DC, 250 V AC	
	Max. carrying current		3 A	
	Min. switching capacity (Reference value)*1		10μA 10 mV DC	
	Nominal operating power		Single side stable (M type: 400 mW, S type: 200 mW); latching (M type: 360 mW, S type: 180 mW)	
Electrical characteristics	Insulation resistance (Initial)		Min. 100MΩ (at 500 V DC) Measurement at same location as "Initial breakdown voltage" section.	
	Breakdown voltage (Initial)	Between open contacts	1,000 Vrms for 1min. (500 Vrms for 1min: 1 Form C type) (Detection current: 10mA.)	
		Between contact and coil	1,500 Vrms for 1min. (1,000 Vrms for 1min: 1 Form C type) (Detection current: 10mA.)	
	Temperature rise		Max. 65°C (By resistive method, nominal coil voltage applied to the coil, contact carrying current: 2A.)	
	Operate time [Set time] (at 20°C 68°F)		Max. 10 ms [10 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.)	
	Release time [Reset time] (at 20°C 68°F)		Max. 5 ms [10 ms] (Nominal coil voltage applied to the coil, excluding contact bounce time.) (without diode)	
Mechanical characteristics	Shock resistance	Functional*2	Min. 490 m/s²	Min. 490 m/s²
		Destructive	Min. 980 m/s² (Half-wave pulse of sine wave: 6 ms.)	
	Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3.3 mm (Detection time: 10μs.)	
		Destructive	10 to 55 Hz at double amplitude of 5 mm	
Expected life	Mechanical		Min. 10^8 (10^7: 1 Form C latching type) (at 600 cpm)	
	Electrical		Min. 5×10^5 rated load (at 60 cpm)	
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 (at rated load)		60 cpm	
Unit weight			Approx. 3g .11 oz	Approx. 4g .14 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. TX/TX-S/TX-D relay AgPd contact type are available for low level load switching (10V DC, 10mA max. level).
*2 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*3 Refer to "AMBIENT ENVIRONMENT" in GENERAL APPLICATION GUIDELINES.

DS (2 Form C)
Single side stable

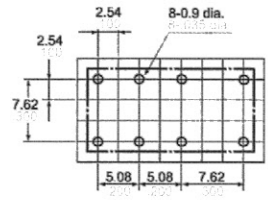
CAD Data

External dimensions

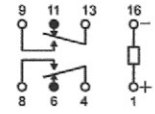


General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Schematic (Bottom view)



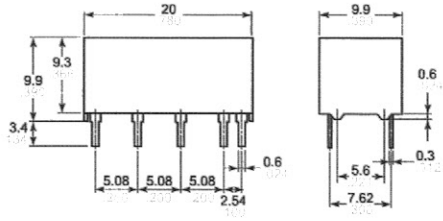
(Deenergized condition)

Tolerance: ±0.1 ±.004

DS (2 Form C)
2 coil latching

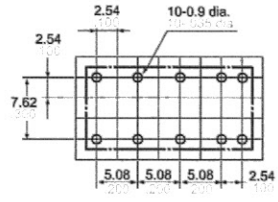
CAD Data

External dimensions

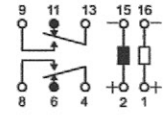


General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Schematic (Bottom view)



(Reset condition)

Tolerance: ±0.1 ±.004

NOTES

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