CKD

SM－185014－A

INSTRUCTION MANUAL

CYLINDER SWITCH

SW-T series(mono color)

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

The 4th edition

For Safety Use

To use this product safety, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (to the level pursuant to JIS B 8370 Pneumatic System Rules).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your applications, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, **read this operation manual carefully for proper operation.**

Observe the cautions on handling described in this manual, as well as the following instructions:

⚠ CAUTION :

- The cylinder may malfunction depending on the mounting position or wiring of the cylinder switch. Select a proper mounting position, and connect the wires correctly.
- Do not touch electric wiring connections (exposed lice parts): this will cause an electric shock. During wiring, keep the power off.
  Also, do not touch these live parts with wet hands.

[SM-185014-A]

INDEX

Cylinder switch
SW-T Series
Manual No. SM-185014-A

1. PRODUCTS

1.1 Applications

Model \ Item				Application・Purpose
Solid state	2-wire	1 color indicator type	T1H	for AC programmable controller, Relay, compact solenoid valve
			T1V	
			T2H	for DC Programmable controller, exclusive
			T2V	
	3-wire		T3H	for DC Programmable controller, Relay (Output method：NPN output)
			T3V	
			T3PH	for DC Programmable controller, Relay (Output method：PNP output)
			T3PV	
Reed	2-wire		T0H	for DC/AC Programmable controller, Relay
			T0V	
			T5H	for DC/AC Programmable controller, Relay, IC circuit (not including indicator light),Series connection
			T5V	
			T8H	for DC/AC Programmable controller, Relay
			T8V	

Note：T※H designates Axial lead wire, as well as T※V designates Radial lead wire.

1.2 Specifications

Kind・Model / Item	Reed switch			
	T0H/V		T5H/V	
Applications	For Programmable controller or Relay		For Programmable controller, Relay, IC circuit (not including indicator light), Series connection	
Power supply voltage	—			
Load voltage	DC12/24V	AC110V	DC5/12/24V	AC110V
Load current	5 to 50mA	7 to 20mA	50mA or less	20mA or less
Internal voltage drop	3V or less		0V	
Indicator light	LED (ON lighting)		Without indicator light	
Leakage current	0mA			
Lead wire length (Note 1)	1m (Oil proof vinyl cabtire cord 2-core, 0.2mm^2)			
Shock resistance	294m/s^2			
Insulation resistance	20MΩ or more at DC500V megger			
Withstand voltage	No abnormalities upon charging AC1000V for one minute			
Ambient temperature	−10 to +60℃			
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), Oil proof			

Kind・Model / Item	Reed switch		
	T8H/V		
Applications	Programmable controller or Relay		
Power supply voltage	—		
Load voltage	DC12/24V	AC110V	AC220V
Load current	5 to 50mA	7 to 20mA	7 to 10mA
Internal voltage drop	3V or less		
Indicator light	LED (ON lighting)		
Leakage current	0mA		
Lead wire length (Note 1)	1m (Oil proof vinyl cabtire cord 2-core, 0.3mm^2)		
Shock resistance	294m/s^2		
Insulation resistance	100MΩ or more at DC500V megger		
Withstand voltage	No abnormalities upon charging AC1500V for one minute		
Ambient temperature	−10 to +60℃		
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), Oil proof		

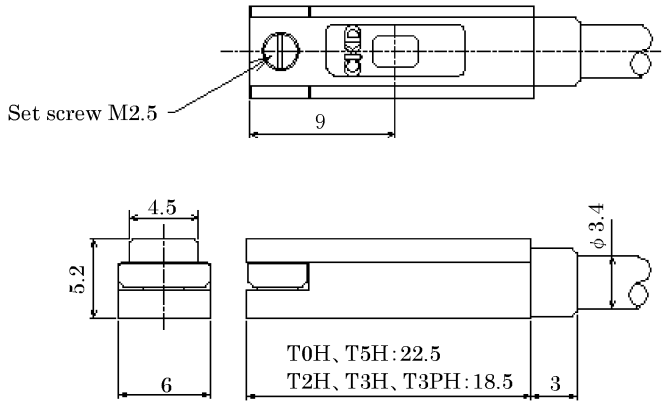
Kind・Model / Item	Solid state	
	T1H/V	T2H/V
Applications	For Programmable controller, Relay, compact solenoid valve	For Programmable controller, exclusive
Power supply voltage	—	
Load voltage	AC85 to 265V	DC10 to 30V
Load current	5 to 100mA	5 to 20mA (Note 2)
Current consumption	—	
Internal voltage drop	10% or less of load voltage	4V or less
Indicator light	LED (ON lighting)	
Leakage current	1mA or less at AC100V 2mA or less at AC200V	1mA or less
Lead wire length (Note 1)	1m (Oil proof vinyl cabtire cord 2-core, 0.3mm^2)	1m (Oil proof cabtire cord 2-core, 0.2mm^2)
Shock resistance	980m/s^2	
Insulation resistance	100MΩ or more at DC500V megger	20MΩ or more at DC500V megger
Withstand voltage	No abnormalities upon charging AC1500V for one minute	No abnormalities upon charging AC1000V for one minute
Ambient temperature	−10 to +60℃	
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), Oil proof	

Kind・Model / Item	Solid state	
	T3H/V	T3PH/V
Applications	For programmable controller or relay	
Output method	NPN output	PNP output
Power supply voltage	DC10 to 28V	
Load voltage	DC30V or less	
Load current	100mA or less	
Current consumption	10mA or less at DC24V	12mA or less at DC24V
Internal voltage drop	0.5V or less	
Indicator light	LED (ON lighting)	Yellow LED (ON lighting)
Leakage current	10μA or less	
Lead wire length (Note 1)	1m (Oil proof vinyl cabtire cord 3-core, 0.2mm^2)	
Shock resistance	980m/s^2	
Insulation resistance	20MΩ or more at DC500V megger	
Withstand voltage	No abnormalities upon charging AC1000V for one minute	
Ambient temperature	−10 to +60℃	
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), Oil proof	

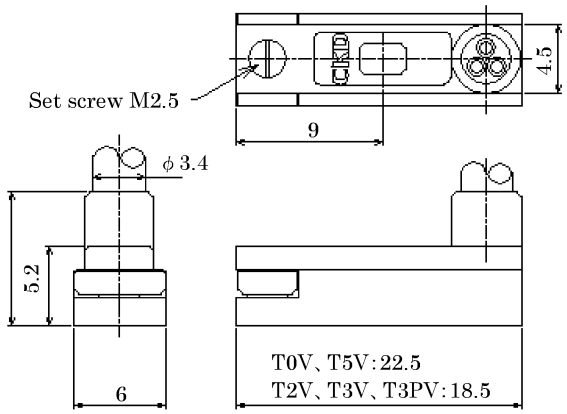
Note1：3m or 5m long lead wire is optionally available.
Note2：Max. value (20mA) of load current is that of 25℃. It drops lower than 20mA when the switch ambient temperature exceeds 25℃.（5 to 10mA at 60℃）

1.3 External Dimension

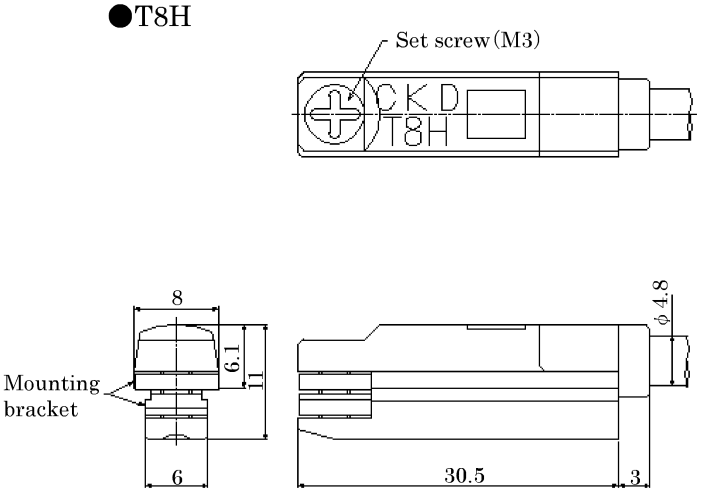
●T※H



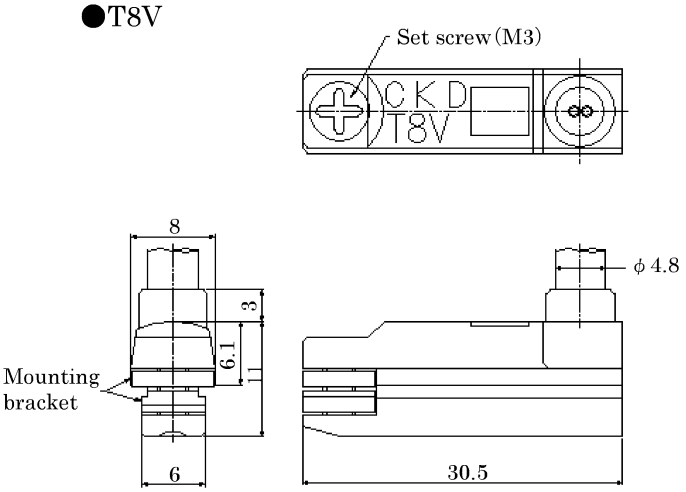
●T※V



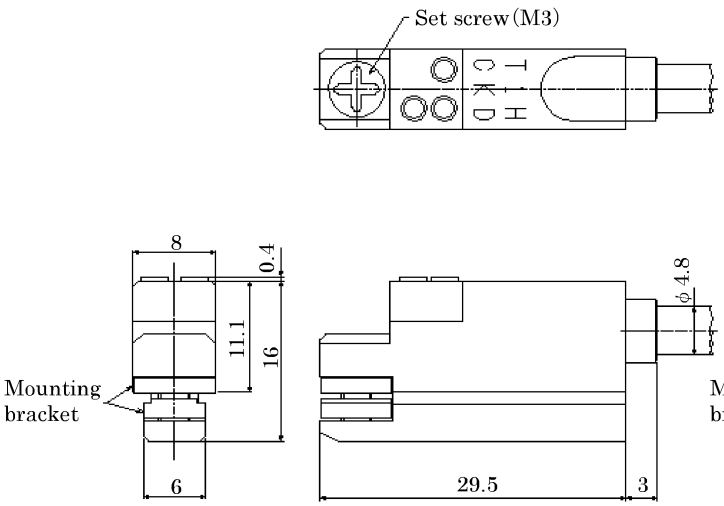
●T8H



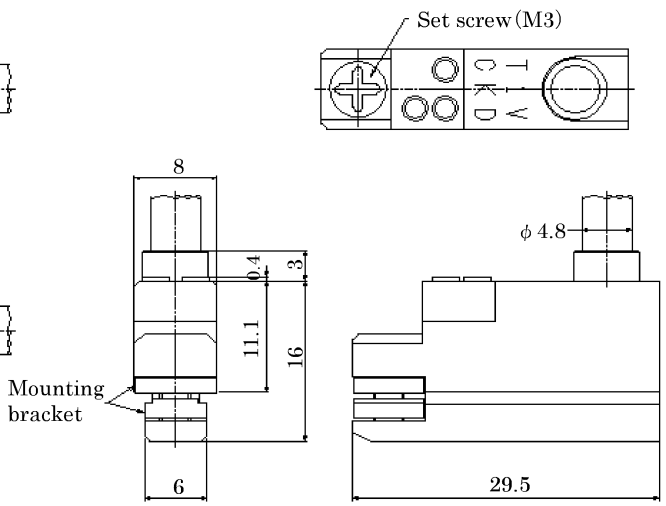
●T8V



●T1H

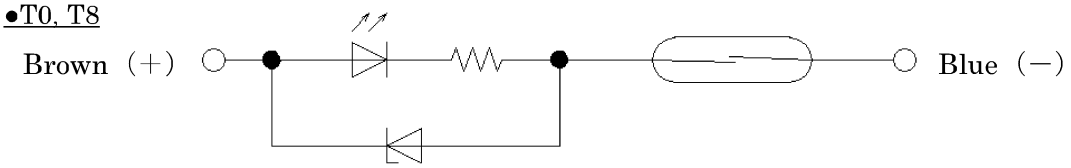


●T1V

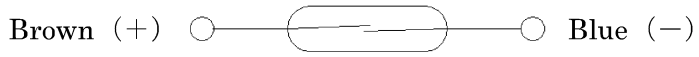


1.4 Internal circuit diagram

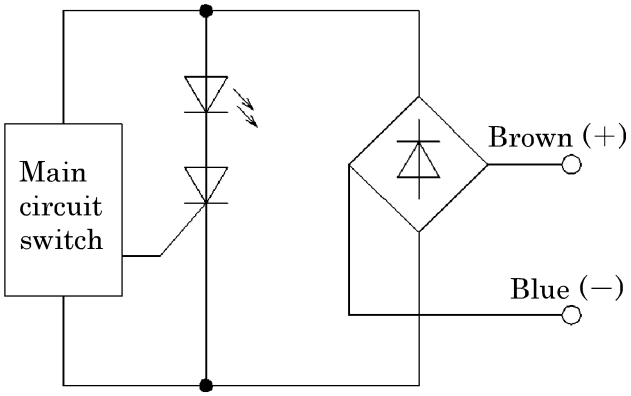
●T0, T8



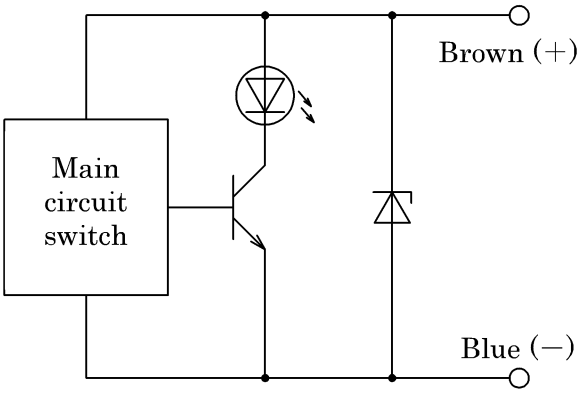
●T5



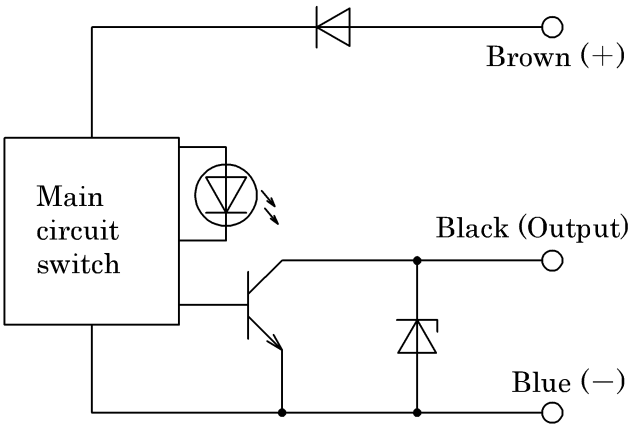
●T1



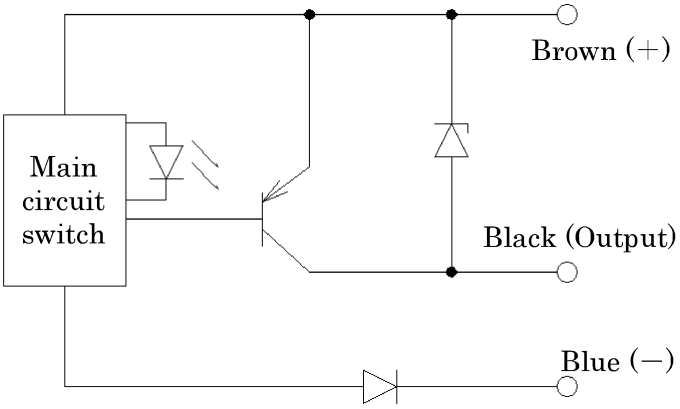
●T2

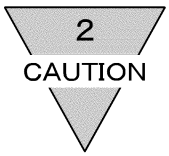


●T3



●T3P





2. CAUTION

2.1 Operational cautions, Common items

1) Magnetic environment

Avoid usage of these switches within the area where a strong magnetic field or large current exists (such as a large magnet or spot welding equipment). Position censoring errors will result when installing many cylinders with a switch which is parallel or a magnetized piece come across the cylinder due to intervention among them.

2) Protection of lead cord

Pay consideration to eliminate repeating bending stress or stretching of the lead cord while laying the cord. For the moving portion, use a cord of flexibility as for building a robot.

3) Operating temperature

Do not operate the product at a high temperature (60℃).

Always avoid operation of the product in a hot place due to temperature characteristics of magnetic and electronics parts.

4) Intermediate position detection

When activating the switch halfway of the stroke, the relay may not respond if the working piston speed is too fast.

(Example) Operate cylinder with the speed of less than 500mm/s in case the relay actuation time is 20ms.

5) Impact

Do not apply a large vibration or impact to the product when transporting the cylinder, or mounting or adjusting the switch.

2.2 Operational cautions, Solid state switch (T1, T2, T3, T3P)

1) Connection of lead wire

Comply with the color coding specified on the illustrations. Be sure to turn the power off before starting connecting work.

An erroneous wiring or short circuiting of load causes damage to not only switches, but also load side circuit. Wiring work without shutting electricity off may cause damage to the load side circuit.

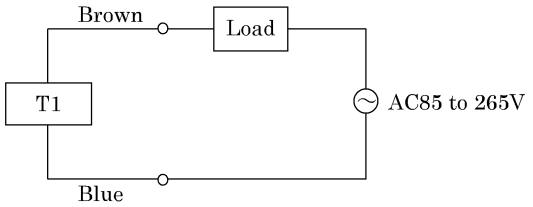


Fig. 1 : Basic Circuit Example of T1

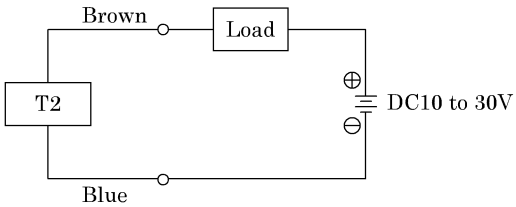


Fig. 2 : Basic Circuit Example of T2

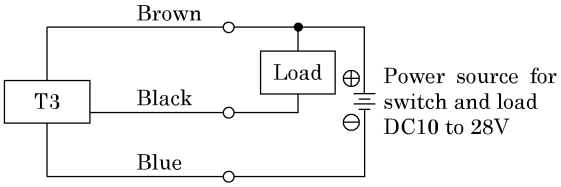


Fig. 3 : Basic Circuit Example of T3 (1)
(The same power source is used for switch and load)

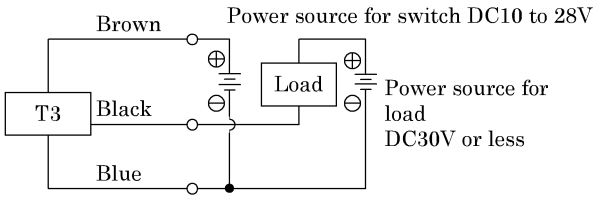


Fig. 4 : Basic Circuit Example of T3 (2)
(Different power sources are used for switch and load)

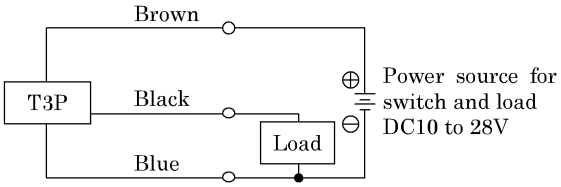


Fig. 5 : Basic Circuit Example of T3P (1)
(The same power source is used for switch and load)
(PNP output)

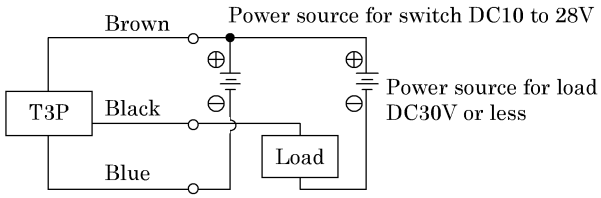


Fig. 6 : Basic Circuit Example of T3P (2)
(Different power sources are used for switch and load)
(PNP output)

2) Protection of output circuit

Install some protective circuit as illustrated in Fig. 7 or 8 when inducing type load (Relay) are to be used because these types apt to generate surge current switch off.

Install some protective circuit as illustrated in Fig. 9 when capacitor type load (capacitor) are to be used, because these types apt to generate a dash current when turning the switch ON.

Install some protective circuit as illustrated in Fig. 10 or 11 (in case of model T2) and Fig.12 (in case of model T3).

2
CAUTION

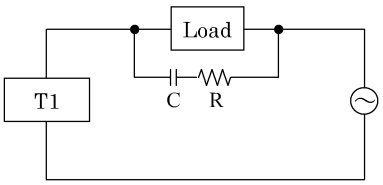


Fig. 7 : An example of protective circuit in CR circuit
Capacitor volume : 0.03 to 0.1 μF
Resister : 1 to 3kΩ

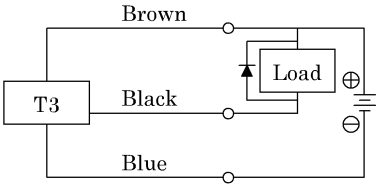


Fig. 8 : An example of using inducing load together with surge absorptive element (diode) (Hitachi Mfg. made diode V06C or equivalent is recommended)

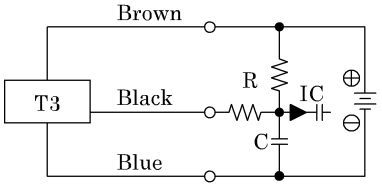


Fig. 9 : An example of using capacitor type load together with current regulating resister R. Comply with the following formula to figure out required R

$$\frac{V}{0.05} = R\,(\Omega)$$

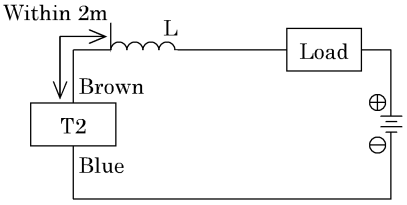


Fig.10 ・ Choke coil
L= a couple hundred μH to a couple mH surpassing high frequency characteristic
・ Install it near by a switch (within 2m)

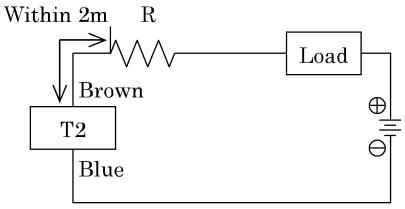


Fig.11 ・ Dash current restriction resister
R= as much large resister as the load circuit can afford
・ Install it near by a switch (within 2m)

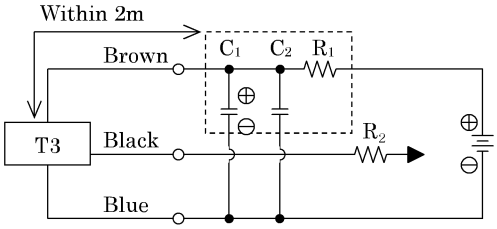


Fig. 12・Electric power noise absorptive circuit
C_1=20 to 50 μF electrolytic capacitor (Withstand voltage 50V or more)
C_2=0.01 to 0.1 μF ceramic capacitor
・Dash current restriction resister
R_1=20 to ss30Ω
R_2=As much large resister as the load circuit can afford
・Install it nearby the switch (Within 2m)

3) Connection to a programmable controller (Sequencer).
Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig. 13 to 17 respectively.

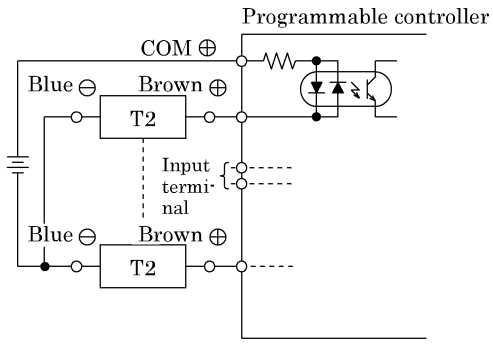


Fig.13 : An example of T2 connection to source input type (an external power source)

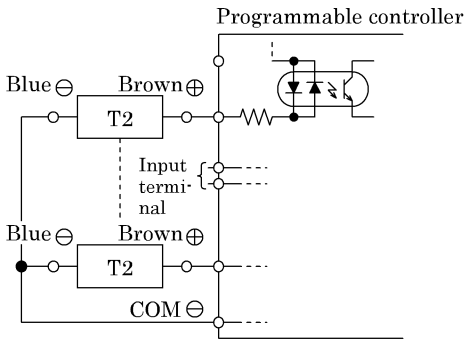


Fig.14 : An example of T2 connection to source input type (an internal power source)

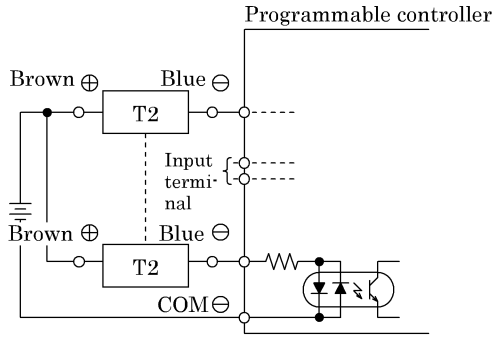


Fig.15 An example of T2 connection to sink input type (an external power source)

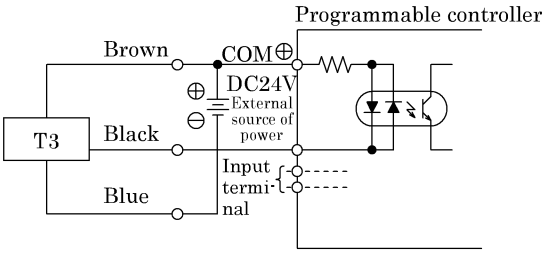


Fig.16 An example of T3 connection to source input type (an external power source)

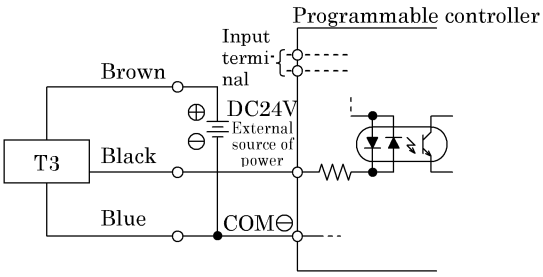


Fig.17 An example of T3 connection to source input type (an internal power source)

4) Parallel connection

The total voltage will decrease when the T2 switches connections have a leak. Therefore, confirm the input specifications for the programmable controllers, which are the connecting load. However, dimming or total failure of the indicator light may exist.

T3 and T3P switches hardly ever leak. When less than 10μA, then leakage may occur. Usually dimming and failure of the indicator light do not occur.

5) Series connection

When two or more T2 switches are connected in series, the voltage drop is equal to the sum of the voltage drops in all of the connected switches. The voltage applied to the load is the result of subtracting the total voltage drop from the power source voltage. It is necessary to determine the number of switches to be connected based on the specifications of the load.

When two or more T3 (T3P) switches are connected in series, the voltage drop is equal to the sum of the voltage drops in all the connected switches as in the case of the T2 switches. The current flowing through the switches is equivalent to the sum of the current consumption and the load current. It is necessary to determine the number of switches to be connected based on the specifications of the load so that the current will not exceed the maximum load current.

2
CAUTION

2.3 Operational cautions, Reed switch (T0, T5, T8)

1) Connection of lead wire
Instead of connecting the lead wires to the power source directly, always connect to the load in series. For DC connection, use such polarities of cords as brown + and blue −. The switch still functions right with reversed polarities but indicator light is not lit.

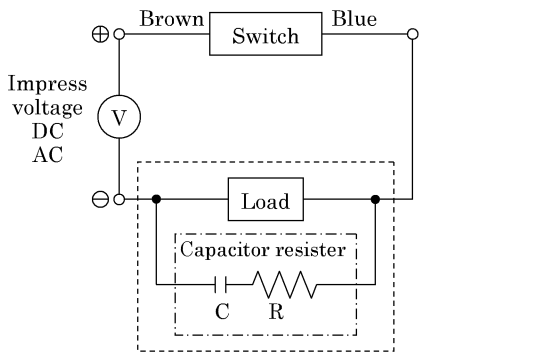
2) Capacity of contact points
Avoid using a load exceeding the max. capacity of contact points. On the other hand, switch indicator light may not be lit sometimes when current is lower than the rated current.

3) Protection of contact point
When an inductive load, such as relay is used or the wire length exceeds that stated in Table 1, always install a contact protective circuit.

Table 1

Electric power	Length of wire
DC	50m
AC	10m

(1) Protective circuit when connecting an inductive type load

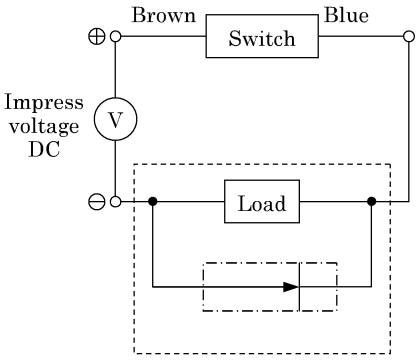


User circuit

Protect circuit (Spark absorbing circuit)

Recommended value
C (Capacitor) 0.033 to 0.1 μF
R (Resister)1 to 3kΩ
XEB1K1 Okaya Denki Mfg or equivalent

Fig.1 When capacitor and resister are used



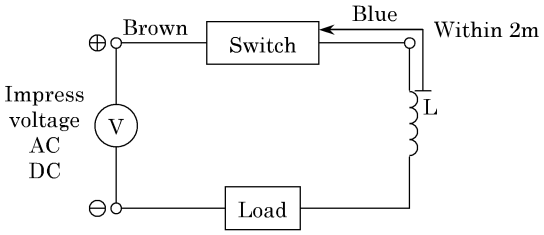
User circuit

Protect circuit

Rectifying diode, general use
Hitachi Mfg. product V06C or equivalent

Fig.2 When diode is used

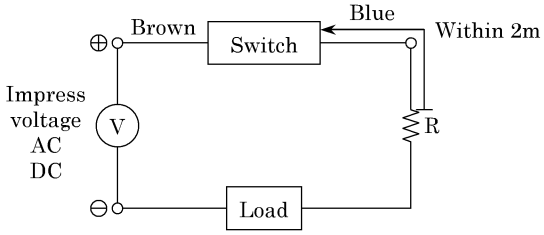
(2) Protective circuit when the wire length exceeds that stated Table 1



・ Choke coil
L=a couple hundred μH to a couple mH
surpassing high frequency characteristic

・ Install it near by a switch (within 2m)

Fig.3



・ Dash current restriction resister
R=As much large resister as the load
circuit can afford.

・ Install it near by a switch (within 2m)

Fig.4

4) Relay

Use such products as specified below or equivalent.

Omron Corporation ·····MY type
Fuji Electric Co., Ltd. ·····HH5 type
Panasonic, Ltd. ·····HC type

5) Parallel connection

There is no restriction in parallel connection number of switches of these types. Multi number connection of model T0 or T8 sometimes, cause a dimmed indicator light or complete indicator light failure.

6) Series connection

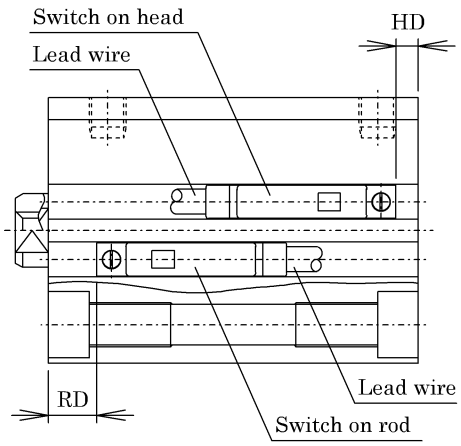
Total voltage loss, when connected T0 or T8 switches in series, equals to the sum of respective voltage loss of each switch.

Indicator light is lit only when all switches turn on.

3. INSTALLATION

3.1 Switch installation

1) Switch installation



(1) Stroke end mounting

Mount it to each position of RD (rod side) and HD (head side) respectively so as to have a switch actuate at the maximum sensitive position.

The dimensions HD and RD depend on the cylinder. For these dimensions, see the external dimension drawing of the cylinder used.

(2) Intermediate stroke mounting

Fix piston at the position where it is expected to stop. Slide switch back and forth along cylinder beyond fixed piston to locate positions where switch turns ON respectively. The center of those two points is the maximum sensitive position to have switch actuated. It is best suited where to have switch installed.

2) Actuation range

It is the distance from where switch turns ON, while the piston strokes one way to the point where it turns OFF, while the piston continues to stroke in the same direction.

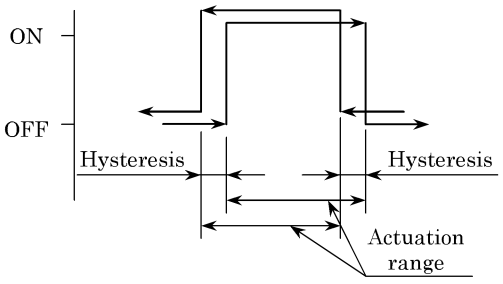
The center of actuation range is the maximum sensitive position for the actuate switch. At this point, due to being the least of external magnetic disturbance, switch actuates most stably.

3) Hysteresis

(1) Switch turns ON while piston moves one way. Switch turns OFF while piston reverses its way after stopping at the point where switch turned ON once.

The distance from ON point to OFF point is called hysteresis.

(2) When piston stops within the hysteresis, switch actuation becomes unstable as it easily is disturbed by an external magnetic field. Carefully avoid making it stop here.



4. MAINTENANCE

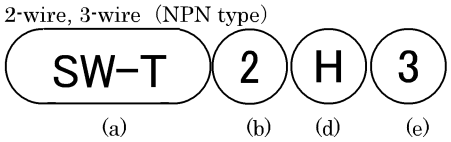
4.1 Troubleshooting

Troubles	Causes	Countermeasures
Indicator light is not lit	Deposited contact point	Replace the switch.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
	Damaged indicator light	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
Switch does not function right	Broken circuit	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
	Improper voltage	Correct voltage to specified.
	Incorrect location of switch	Correct its location.
	Aberrant position of switch	Set it back to original position and tighten the mounting device.
	Incorrect direction of switch mounting	Correct the direction of the switch mounting.
	The load (relay) cannot respond during detection in the middle of the stroke	Reduce the speed of piston. Replace the relay with a recommended one.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
Switch does not return	Piston is not moving	Make the piston move.
	Deposited contact point	Replace the switch.
	Excessive load (relay) than rated capacity	Replace the relay with a recommended one or replace the switch.
	The ambient temperature is out of the specification range	Adjust the ambient temperature within the range of -10 to 60℃.
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

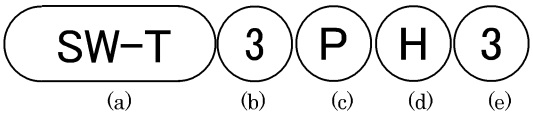
5. MODEL NO. CLASSIFICATION

5.1 Switch model No. classification

- 2-wire, 3-wire (NPN type)



- 3-wire (PNP type)



(a) Switch model	
SW-T	T-type cylinder switch

(b) Switch type・Lead wire		(c) Output method (Only 3-wire)		(d) Lead wire outlet direction		(e) Lead wire length	
0	Reed 2-wire	Blank	NPN output	H	Axial lead wire	No symbol	1m
1	Solid state 2-wire	P	PNP output	V	Radial lead wire	3	3m
2	Solid state 2-wire					5	5m
3	Solid state 3-wire						
5	Reed 2-wire						
8	Reed 2-wire						