Components for High Vacuum

To Use This Product Safely

Be sure to read this before use.
For General Precautions refer to Into 9.

Individual Precautions: Air Operated Valve for High Vacuum, AVB Series

Design / Selection

1. Confirmation of Specifications

Warning

- Incorrect equipment selection and handling can cause problems not only in this product, but also to your system. Please be sure to confirm the specifications of this product and its compatibility with your system before use.
- Check the compatibility between the gas contact part materials and working fluid before use.
- Use within the specified fluid temperature and pressure range.

2. Working fluids

Caution

- This product is designed for controlling vacuum or inert gas. If other fluids (active gas, liquids, solids, etc.) pass through, the product may fail to operate normally or may display decreased performance. Check the compatibility between the gas contact part materials and working fluid before use. If there is a risk of the applicable fluid solidifying, please confirm that there are no issues with its use before using.
- Avoid using fluids that build up crystallization in the piping.

3. Selection

Caution

- When managing valve responsiveness, pay attention to piping size and length and the flow characteristics of the operation solenoid valve.
- The cylinder and bellows interior are directly connected to atmosphere. Do not block the connecting hole between the bellows interior and the atmosphere (2 holes just under the operation port) in use.
- Fittings Select air piping and piping that match the working temperature.

4. Mounting

Caution

- Perform piping so no excessive force is applied to the flange. If heavy objects and mounted components vibrate, fix so that torque is not applied directly to the flange.

● High-Temperature Specification

- When insulating the valve, insulate only the body. Please note that insulating the cylinder may prevent the maintenance of normal operation.

5. Securing Space

Caution

- Secure sufficient space for maintenance and inspection.

6. Piping

Caution

- When piping, do not apply tension, compression, bending or other forces to the valve body from the piping.
- Durability may decrease due to exhaust flow, so we recommend use of the bellows side as the exhaust side except for models with limited vacuum pump connection ports.
  In addition, since durability varies depending on the operating conditions, please confirm sufficiently.

7. During Use

Caution

- Do not use valves as a footing or place any heavy objects on top of the valves.

Cylinder Switch

To Use This Product Safely

Read the precautions listed in the latest "Pneumatic cylinders" (No.RJ-002AA to 006AA) before use.

Design / Selection

Solid State Switch T2H, T2V, T3H, T3V

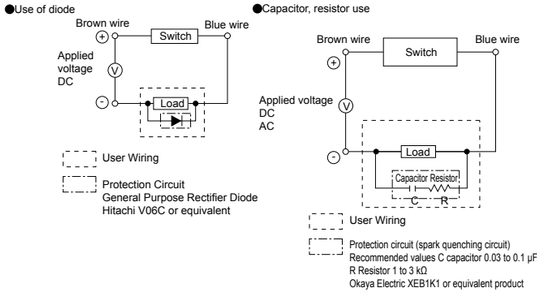
Reed Switch T0H, T5H, T0V, T5V

Warning

- Using outside the specified range of application, load current, voltage, temperature, impact, environment, etc. may cause damage or malfunction. Therefore, use correctly within the specified range.
- Never use in an explosive gas atmosphere. The switch does not have an explosive-proof structure. If used in an explosive gas atmosphere, it may cause an explosion disaster, so never use it.
- The lamps used are LEDs. If used continuously at high temperatures, visibility will gradually decrease. As the LED lamp circuit is separated from the switch output circuit, the switch output works normally even if the LED lamp goes out.
- Do not flow overcurrent.
  If overcurrent flows to the switch due to a load short-circuit, etc., the switch will be damaged with a risk of ignition. If necessary, please provide an overcurrent protection circuit such as a fuse on the output line and power supply line.

Caution

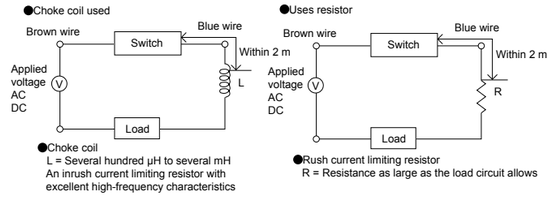
- Please be careful when using in an interlock circuit.
  When using the switch for an interlock signal requiring high reliability, provide a double interlock by installing a mechanical protection function or a sensor other than a switch as a safeguard against failure. In addition, please perform regular inspections and confirm that it operates normally.
- Please pay attention to the contact capacity.
  Do not use a load that exceeds the maximum contact capacity of the switch. It will cause failure. The lamp may not come on if the current is less than the rated current.
- Please pay attention to the contact protection circuit. (Reed switch)
  - When an inductive load (relay or solenoid valve) is connected, a surge voltage is generated when the switch is turned OFF. Provide a contact protection circuit.



- When connecting and using capacitive loads (capacitors), inrush current will occur when the switch is ON, so always install a contact protection circuit.
- If the wiring increases, the wiring capacity will be reached and a rush current will occur, damaging the switch or shortening the service life. Provide a contact protection circuit if the wiring length exceeds Table 1.

Switch	Voltage	Wiring length
T	DC	50 m
T	AC	10m

Table 1

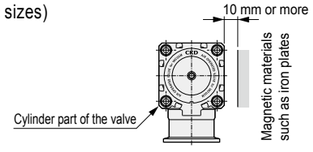


For specifications of contact protection circuits, refer to pneumatic cylinders (Catalog No. RJ-002AA to 006AA).

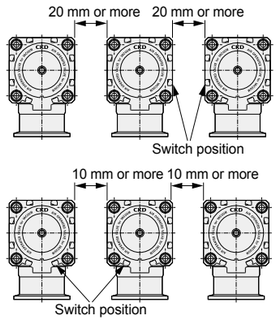
- Avoid using in environments where water is constantly splashing.
  - It may cause malfunction due to insulation failure, etc.
- Avoid using in oily or chemical environments.
  - The switch may be adversely affected (insulation failure, malfunction caused by swelling of the filled resin, hardening of lead wire sheath, etc.) if used in an environment containing oil, coolant, cleaning fluid, or chemicals. Consult with CKD.
- Do not use in environments with large impacts.
  For reed switch, if a strong impact (294 m/s² or more) is applied while in use, a signal may appear momentarily (1 ms or less) or malfunction. It may also be necessary to use a solid state switch depending on the operating environment, so please consult us.
- Do not use in locations where surge sources exist.
  If there are device components (solenoid lifters, high frequency induction furnace, motors, etc.) around the valve with proximity switch that generate a large surge, consider surge protection of the source as it may lead to deterioration or damage of the switch internal circuit element.
- Be careful about the accumulation of iron powder and close proximity to magnetic materials.
  If a large amount of iron chips such as cutting chips or welding spatter accumulate or if magnetic objects (material attracted to magnets) contact the valve with a valve switch, the valve will be demagnetized and valve switch operations may be inhibited.
  - Pay attention to the proximity of valves, etc. When installing more than one valve with switches in parallel, maintain sufficient distance according to the value shown.
  - The switches may malfunction due to mutual magnetic interference.

Caution

- The switch may malfunction if there is a magnetic substance such as a metal plate installed adjacently. Confirm that a distance of at least 10mm is allocated from the surface of the valves. (Common to all bore sizes)



■ The switch may malfunction if valves are installed adjacently. Check that the following distance is allocated from the surface. (Common to all bore sizes)



■ Pay attention to the magnetic environment.

● When installing valves with switch nearby in parallel, or if a magnetic object is very close to the valve with switch, mutual interference may occur and adversely affect detection accuracy.

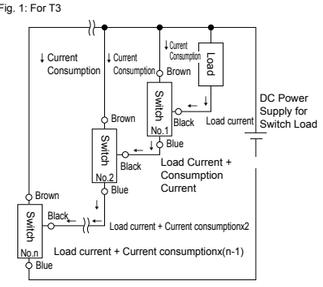
■ Be careful of the internal voltage drop caused by serial connection.

● When connecting multiple 2-wire switches in series, the voltage drop across the switches is the sum of the voltage drops of all connected switches. The voltage applied to the load side will be the power supply voltage minus the voltage drop across the switches. Check the load specifications before deciding on the number of units to connect.

● When connecting multiple 3-wire solid-state switches in series, the voltage drop across the switches is the sum of the voltage drops of all connected switches, similar to the 2-wire type. In addition, the current flowing to the switch is the sum of current consumption and load current of the switches connected as in the figure below. Check load specifications and determine the number of connections so as not to exceed the maximum load current of the switch.

● The lamp turns ON only when all switches are ON.

Fig. 1: For T3



■ Pay attention to the leakage current caused by the parallel connection.

● When connecting multiple 2-wire switches in parallel, the leakage current increases by the number of connected units. Therefore, confirm the load specifications and decide the number of connected units. The indicator lamp of the switch may become dim or not light up.

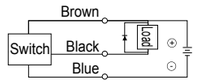
● For 2-wire solid state switches, from when one switch turns ON until it turns OFF, the voltage across the parallel-connected switches drops to the internal voltage drop value when the switch is ON, falling below the load voltage range, so other switches will no longer turn ON. Therefore, check the input specifications of the connected load, such as a programmable controller, before use.

● For 3-wire solid-state switches, the leakage current is very small (10μA or less), so there is no problem in normal use.

■ Output circuit protection

● When an inductive load (relay or solenoid valve) is connected, surge voltage is generated when the switch is turned OFF. Provide the following protection circuit.

T3

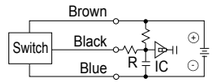


● Diode
D = Hitachi
V06C or equivalent product

Example of using a surge absorber with an inductive load.

● When connecting and using capacitive loads (capacitors), inrush current will occur when the switch is ON, so always install a protection circuit as shown in the figure below.

T3



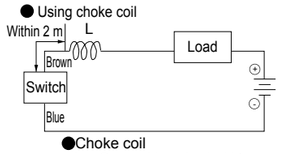
For the resistance R (Ω) at this time, use a value greater than or equal to the following formula.

$\frac{V}{0.05}$ =T3

● If the lead wire length exceeds 10 m, always install a protection circuit as shown in the figure below.

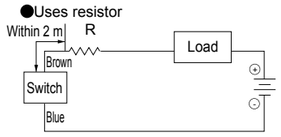
T2

● Using choke coil



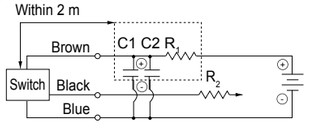
●Choke coil
L = Several hundred μH to several mH
Inrush current limiting resistor with
excellent high-frequency characteristics

●Uses resistor



Rush current limiting resistor
R = Resistance as large as the load circuit allows

●Uses resistor



Power Supply Noise Absorption Circuit
C_1=20 to 50μF
Electrolytic capacitor (withstand voltage 50 V or more)
C_2=0.01 to 0.1μF
Ceramic capacitor
Inrush Current Limiting Resistor
R_1 = 20 to 30 Ω
R_2 = Use a resistor as large as the load side circuit allows.

■ If special quality and reliability are required, such as when using with a customer-dedicated circuit board, a proximity switch is recommended. In addition, please be sure to thoroughly check the compatibility judgment by yourself.

Reed switch ET0H/ET0V

Warning

■ Using outside the specified range of application, load current, voltage, temperature, impact, environment, etc. may cause damage or malfunction. Therefore, use correctly within the specified range.

■ Never use in an explosive gas atmosphere. The switch does not have an explosive-proof structure. If used in an explosive gas atmosphere, it may cause an explosion disaster, so never use it.

■ The lamps used are LEDs. If used continuously at high temperatures, visibility will gradually decrease. As the LED lamp circuit is separated from the switch output circuit, the switch output works normally even if the LED lamp goes out.

■ Do not flow overcurrent.

If overcurrent flows to the switch due to a load short-circuit, etc., the switch will be damaged with a risk of ignition.
If necessary, please provide an overcurrent protection circuit such as a fuse on the output line and power supply line.

Caution

■ Please be careful when using in an interlock circuit.

When using the switch for an interlock signal requiring high reliability, provide a double interlock by installing a mechanical protection function or a sensor other than a switch as a safeguard against failure.
In addition, please perform regular inspections and confirm that it operates normally.

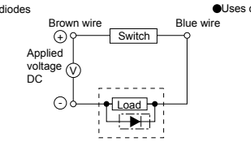
■ Please pay attention to the contact capacity.

Do not use a load that exceeds the maximum contact capacity of the switch. It will cause failure. The lamp may not come on if the current is less than the rated current.

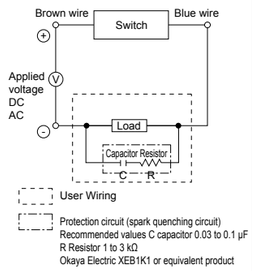
■ Please pay attention to the contact protection circuit.

● When an inductive load (relay or solenoid valve) is connected, a surge voltage is generated when the switch is turned OFF. Provide a contact protection circuit.

●Uses diodes



●Uses capacitors, resistors



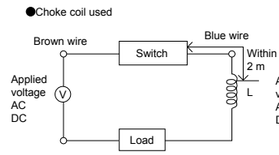
● When connecting and using capacitive loads (capacitors), inrush current will occur when the switch is ON, so always install a contact protection circuit.

● If the wiring increases, the wiring capacity will be reached and a rush current will occur, damaging the switch or shortening the service life. Provide a contact protection circuit if the wiring length exceeds Table 1.

Switch	Voltage	Wiring length
ET0	DC	50 m
ET0	AC	10m

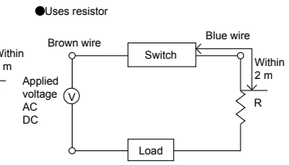
Table 1

●Choke coil used



●Choke coil
L = Several hundred μH to several mH
With excellent high-frequency characteristics

●Uses resistor



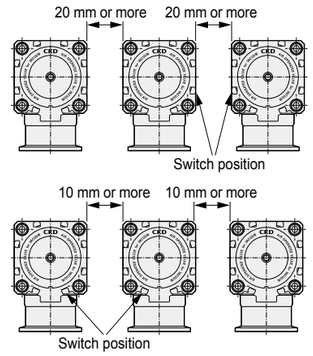
●Inrush Current Limiting Resistor
R = Resistance as large as the load circuit allows

For specifications of contact protection circuits, refer to pneumatic cylinders (Catalog No. RJ-002AA to 006AA).

■ Pay attention to the magnetic environment.

● When installing valves with switch nearby in parallel, or if a magnetic object is very close to the valve with switch, mutual interference may occur and adversely affect detection accuracy.

● If adjacent to a switch other than ET0, it may malfunction at the following distance. Therefore, check the operation before use. (Common to all bore sizes)



■ Be careful of the internal voltage drop caused by serial connection.

● When connecting multiple 2-wire switches in series, the voltage drop across the switches is the sum of the voltage drops of all connected switches. The voltage applied to the load side will be the power supply voltage minus the voltage drop across the switches. Check the load specifications before deciding on the number of units to connect.

■ Pay attention to the leakage current caused by the parallel connection.

● When connecting multiple 2-wire switches in parallel, the leakage current increases by the number of connected units. Therefore, confirm the load specifications and decide the number of connected units. The indicator lamp of the switch may become dim or not light up.

During Use

■ Do not use the same wiring as power lines or high-voltage lines.

Avoid parallel wiring or using the same conduit as power lines/high-voltage lines; use separate wiring. The control circuit containing the switch could malfunction due to noise.

■ Do not short-circuit the load.

If turned ON in a load short-circuited state, overcurrent will flow and the switch will be instantaneously damaged.

■ Be careful when connecting lead wires.

Turn off the power to the equipment on the connected electrical circuit side before performing wiring work. Working with the power on can cause electric shock or accidents due to unexpected operation.

● Reed Switch

Do not connect the switch lead wires directly to the power supply; always connect a load in series. Pay attention to the following (1), (2) for TO.

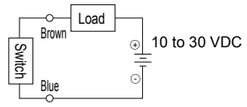
①When used for DC, connect the brown wire on the plus (+) side and the blue wire on the negative (-) side. The switch will function when connected in reverse, but the lamp will not turn ON.

②When connected to an AC relay or programmable controller input, conducting half wave rectification with that circuit may prevent the switch lamp from turning ON. The lamp will come ON when the switch lead's polarity is reversed.

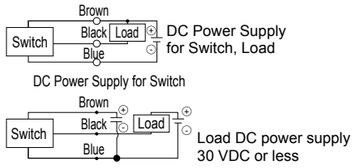
● Solid State Switch

Correctly connect the lead wires based on the color coding in the figure below. Incorrect wiring may cause damage. Please be careful.

●T2



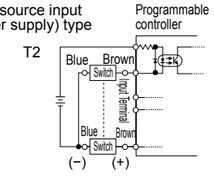
●T3



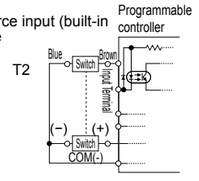
(Connection to Programmable Logic Controller (PLC))

● Connection method varies depending on the type of programmable controller. Connect according to the input specifications.

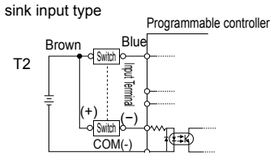
● Connection to source input (external power supply) type



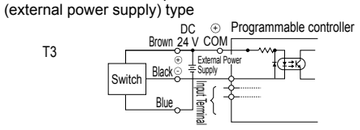
●Connection to source input (built-in power supply) type



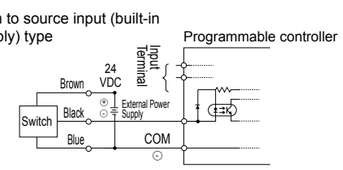
● Connection to sink input type



● Connection to source input (external power supply) type



●Connection to source input (built-in power supply) type



■ Lead wire protection

The lead wire's min. bending radius is 9 mm and over (when fixed). Pay attention to wiring so repeated bending and tensile strain are not applied to the lead wire.

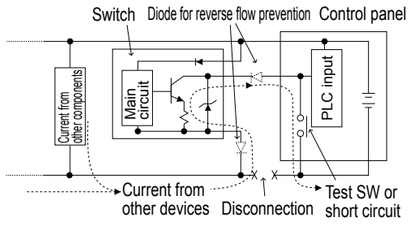
■ Relay

Use the following equivalent relays.

○ Omron・・・・・・・・・・・・・・・・・・・・・・MY type
○ Fuji Electric・・・・・・・・・・・・・・・・・・HH5 type
○ Panasonic・・・・・・・・・・・・・・・・・・・・HC type

■ Be careful about reverse current due to wire breakage or wiring resistance.

● When other components, including switches, are connected to the same power supply as the switch, and the output cable and power cable's minus side are short-circuited or the power supply's minus side is disconnected to check operation of the input unit from the control panel, reverse current could flow to the switch's output circuit and cause damage.



● To prevent damage due to reverse current, take the following measures.

①Avoid centralizing current at the power cable, especially a negative power cable, and use a wire as thick as possible.

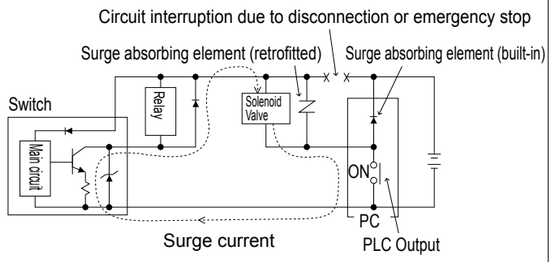
②Limit the number of components connected to the same power supply as the switch.

③Insert a diode in serial with the switch's output cable to prevent reversal of current.

④Insert a diode in serial with the switch's power cable minus side to prevent reversal of current.

■ Be careful about surge current bypass.

● When switch power is shared with an inductive load that generates surges, such as a solenoid valve or relay, if the circuit is cut off while the inductive load is functioning, surge current could enter the output circuit and cause damage depending on where the surge absorber is installed.

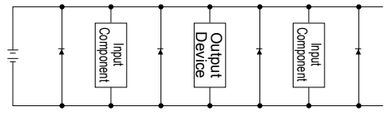


● To prevent damage due to surge current sneak paths, take the following measures.

① Separate the power supply for the output system comprising the inductive load, such as the solenoid valve and relay, and the input system, such as the switch.

② If a separate power supply cannot be used, directly install a surge absorption element for all inductive loads. Consider surge absorbing elements connected to PLCs, etc., as protecting only that equipment.

③ Connect a surge absorber to places on the power wiring shown in the figure below, as a measure against disconnections in unspecified areas.



Furthermore, if equipment is connected with connectors, disconnecting the connector while power is on may cause the output circuit to be damaged due to the above phenomenon. Always turn off the power before connecting or disconnecting connectors.

For cautions about mounting, installation, adjustment, use, and maintenance, refer to CKD components Product Site (https://www.ckd.co.jp/kiki/jp/) → "Model No." Instruction Manuals