CKD

SM-185321-A

INSTRUCTION MANUAL

SUPER COMPACT CYLINDER

LARGE BORE SIZE
SSD SERIES

- 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

For Safety Use

To use this product safely, 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 application, 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 instruction manual carefully for proper operation.

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

⚠ Precautions

- Before performing an overhaul inspection on the actuator, deactivate residual pressure completely.
- While the actuator is operating, do not step into or place hands in the driving mechanism.
- To prevent an electric shock, do not touch the electric wiring connections (exposed live parts) of the actuator equipped with a solenoid valve or switch.
  Perform an overhaul inspection with the power off. Also, do not touch these live parts with wet hands.

INDEX

Large Bore Size SSD Series
SUPER COMPACT CYLINDER
Manual No. SM-185321-A

NOTE : Letters & figures enclosed within Gothic style bracket (examples such as [C2-4PP07] · [V2-503-B] etc.) are editorial symbols being unrelated with contents of the book.

1. PRODUCT

1.1 Specification

Model code · Class / Item	SSD Double Acting	SSD-D Double Acting, Dual Rod
Tube bore mm	φ125, φ140, φ160	
Standard stroke mm	10, 20, 30, 40, 50, 60, 70, 80, 90, 100	
Media	Compressed Air	
Lubrication	Not required (Use Turbine oil Class 1, ISO VG32 when lubrication is preferred)	
Max. Working pressure (Note 1) MPa {kgf/cm²}	1 {10.2}	
Min. Working pressure (Note 1) MPa {kgf/cm²}	0.05 {0.5}	0.1 {1}
Withstanding pressure MPa {kgf/cm²}	1.6 {16.3}	
Ambient temperature range °C	−10~60 (Not to be frozen)	
Port size	Rc (PT) 3/8	
Working piston speed mm/s	50~300	
Option	Male thread at the Rod End (N)	

Note 1 : Pressure unit 1MPa≒10.2kgf/cm²

1.2 Specification of Switch

1) Kind and application of switch

Item / Model			Purpose · Application
Non contact type switch	2-core	T2H	DC, exclusively for Programmable Controller
		T2V	
	3-core	T3H	DC, for Programmable Controller or Relay
		T3V	
Contact type switch	2-core	T0H	AC/DC, for Programmable Controller or Relay
		T0V	
		T5H	AC/DC, for Programmable Controller, Relay IC circuit (no lamp), Series Wiring
		T5V	

(Note) T※H···Lead wire straight outlet type, T※V···Lead wire Elbow outlet type

2) Switch Specification

Class · Model code / Item	Contact type switch	
	T0H · T0V	T5H · T5V
Application	for Relay and Programmable Controller	for Programmable Controller, Relay, IC circuit (No Lamp) : Series connection
Power Voltage	——	
Load Voltage · Current	DC24V, 5~50mA AC100V, 7~20mA	DC24V, 50mA or lower AC100V, 20mA or lower
Power consumption	——	
Internal Voltage Drop	2.4V or lower	0V
Lamp	LED is lit when Power is ON.	——
Leak Current	0	
Length of Lead wire (Note 1)	Standard 1m (Oil resistance Vinyl cabtyre cord, 2-core 0.2mm^2)	
Max.Shock	30m/s^2{G}	
Insulation Resistance	More than 20MΩ with DC 500V megger tester	
Withstand voltage	Should be no abnormality for 1 minute charging AC1000V	
Ambience Temperature	−10~+60°C	
Protection structure	IEC Standard IP67, JIS C0920 (water tight type), Oil resistance	

Class · Model code / Item	Proximity switch	
	T2H · T2V	T3H · T3V
Application	Exclusively for Programmable Controller	for Programmable Controller and Relay
Power Voltage	——	DC10~28V
Load Voltage · Current	DC10~30V 5~25mA (Note 2)	DC30V or lower 100mA or lower
Power consumption	——	10mA or lower at DC24V (Power ON)
Internal Voltage Drop	4V or lower	0.5V or lower at 100mA
Lamp	LED is lit when Power is ON	
Leak Current	1 mA or lower	10μA or lower
Length of Lead wire (Note 1)	Standard 1m (Oil resistance Vinyl cabtyre cord, 2-core 0.2mm^2)	Standard 1m (Oil resistance Vinyl cabtyre cord, 3-core 0.2mm^2)
Max.Shock	100m/s^2{G}	
Insulation Resistance	More than 20MΩ with DC 500V megger tester	
Withstand voltage	Should be no abnormality for 1 minute charging AC1000V	
Ambience Temperature	−10~+60°C	
Protection structure	IEC Standard IP67, JISC0920 (water tight type), Oil resistance	

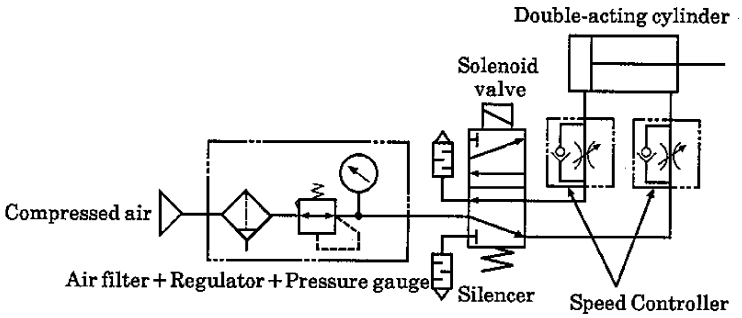
Note 1 : 3m, 5m optional lead wires are available beside standard length.

Note 2 : Max. Load Current (25mA) is at 25°C. It may drop lower than 25mA when ambient temperature rises higher than 25°C. for example : it may be 5~10mA at 60°C)

1.3 Fundamental Circuit Diagram

Fundamental Circuit Diagram of Double-acting Cylinder (Pre-lubricated type)

The following is the fundamental circuit diagram

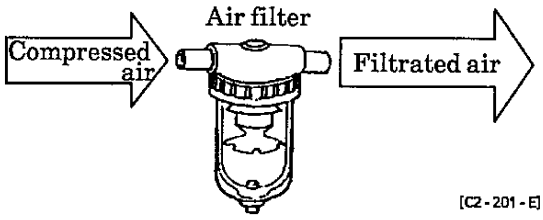


[C2-102-A]

2. CAUTION

2.1 Fluid

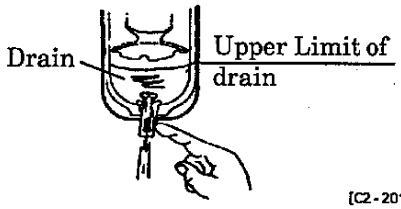
1) Use the compressed air, filtrated and dehumidified. Carefully select a filter of an adequate filtration rating (5μm or lower preferred), flow rate and its mounting position (as closest to directional control valve as possible).



[C2-201-E]

2) Be sure to drain out the accumulation in filter periodically.

3) Note that the intrusion of carbide of compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of solenoid valve and cylinder.



[C2-201-F]

Be sure to carry out thorough inspection and maintenance of compressor.

4) This cylinder does not require lubrication. It is recommended, however to use Turbine oil Grade 1, ISO VG32 as lubricant for the cylinders with the speed of 500 mm/sec and higher.

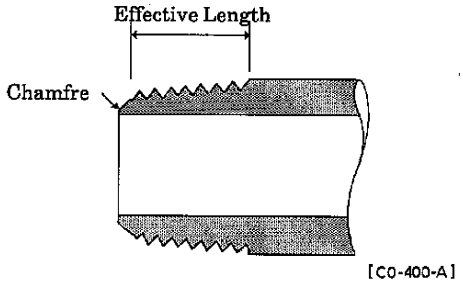
3. OPERATION

1) See to it that the air supply pressure to the cylinder is as shown in the "Specification". Operate the cylinder within this pressure range.
2) Install an external stopper when the dynamic energy is large, as it does not absorb the kinetic energy since it has no cushion.
3) Install a speed controller as shown in "Fundamental Circuit Diagram" on page 4 to control the piston speed.

4. INSTALLATION

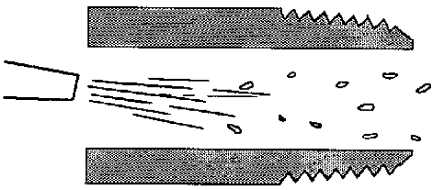
4.1 Piping

1) For piping beyond the filter, use pipes that hardly get corroded such as galvanized pipes, nylon tubes, rubber tubes, etc. (Refer to Selection Guide Table for Related Equipment.)
2) See to it that the pipe connecting cylinder and solenoid valve has effective sectional area needed for the cylinder to drive at specified speed. (Refer to Selection Guide Table for Related Equipment.)
3) Install filter preferably adjacent upper-stream to solenoid valve for eliminating rust, foreign substance and drain in the pipe.
4) Strictly observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.

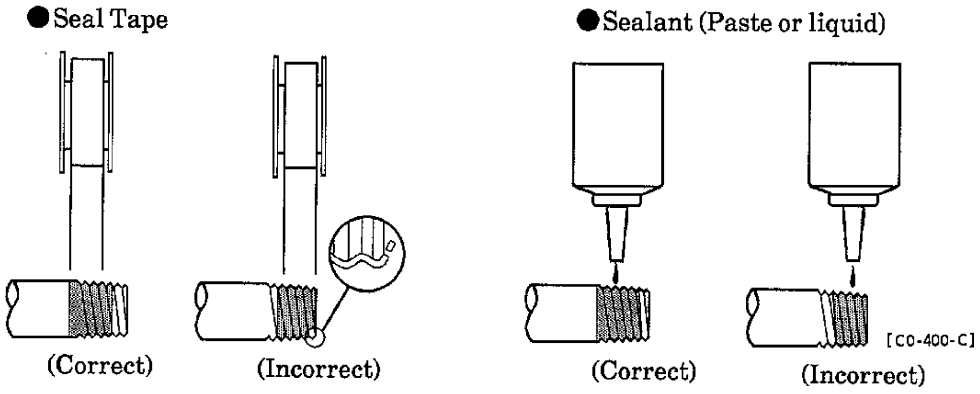


[C0-400-A]

5) Flush air into the pipe to blow out foreign substances and chips before piping.


[C0-400-B]

6) Refrain applying sealant or sealing tape approx. Two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.



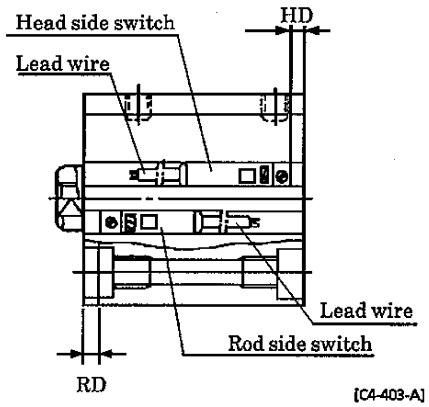
[C0-400-C]

4.2 Installation

1) The ambient temperature range for this cylinder is −10°C~+60°C (Standard model). Be sure that the cylinder should be used within range.
2) Mount the cylinder body directly using a hex. soc. hd. cap screw.
3) As for the rod end screw thread, there are external thread type and internal thread type.
   Choose which one adapts your application and use it.
4) Attach a guide so that no lateral load is exerted onto the piston rod.
   (Example) Apply no lateral load at all for the purpose of a stopper.

4.3 Position of Mounting Switch

1) Position of mounting switch



(1) At the stroke end

Refer the left illustration. Mount switches within the rod side dimension RD as well as the head side dimension HD for the purpose of having switches function at the points of the highest sensitivity.

Mount the switches to have lead wires come out inward as pre illustrated.

(2) Intermediate of stroke

Move the piston where it is anticipated to stop and fix it tentatively Slide a switch carefully along the side of cylinder over the piston to find out the spot where switch turns on. This type spot should be located on both side of piston. The intermediate spot between those points is of the highest sensitivity and where the switch is supposed to be installed.

- Relocation of switch

  Slide switch body along cylinder tube after loosening clamp screws and tighten screws when located the most sensitive position.

- Replacing switch

  Take out switch out of groove after loosening clamp screws. Slide new replacing switch into groove and tighten screws upon placing the switch at the most sensitive position. (Apply tightening torque of 0.1~0.2N · m {0.01~0.02kgf · m})

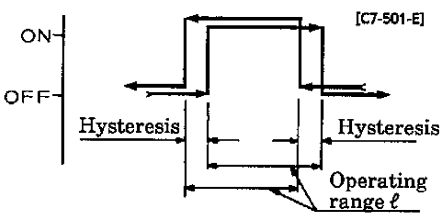
2) Operating range

(1) The range where switch turns ON first and turns OFF as the piston moves along its stroke is called Operating range.

(2) The center of the range is the mostly sensitive position. Setting switch at this point eliminates majority of external disturbance and provides the most stable actuation of switch.

3) Hysteresis

(1) The distance is called hysteresis between the positions where switch turns ON as piston slides long and where switch turns OFF due to reversing stroke of piston.



(2) Switch is apt to be disturbed its accuracy by external effect when piston stops within this range. Carefully avoid designing stopping location of piston.

Table of the maximum sensitive position (HD · RD), Operating range and Hysteresis

(mm)

Item	Proximity switch (T2H/V、T3H/V)				Read switch (T0H/V、T5H/V)			
Tube bore (mm)	Maximum sensitive position		Operating range	Hysteresis	Maximum sensitive position		Operating range	Hysteresis
	HD	RD			HD	RD		
ϕ125	24.5	29.5	4~10	1.5 or less	24.5	29.5	9~15	3 or less
ϕ140	31	33			31	33		
ϕ160	34	39			34	39		

5. OPERATIONAL CAUTIONS OF SWITCHES

5.1 General Cautions

1) Magnetic environment

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

2) Protection of lead cord

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

3) Service temperature

It is unsuitable to operate it in high temperature (above 60°C) due to thermal characteristics of magnetic parts and electronic parts. Eliminate operation in such high temperature.

4) Intermediate position sensing

Beware of unstable respondence of relay when piston speed is excessive in the event of intending actuation of switch in the way of piston stroke.

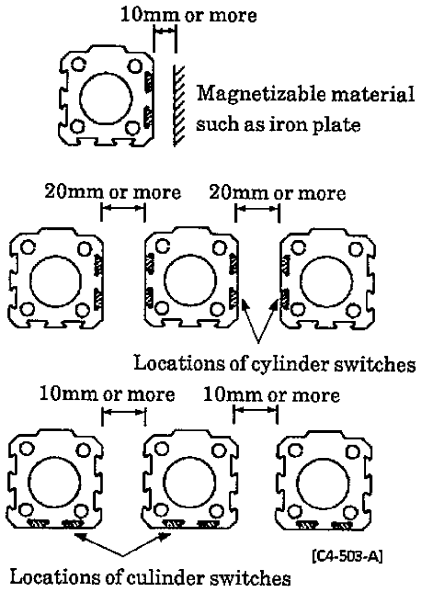
(Example) Operate cylinder with the speed of less than 500mm/s in case the relay actuation time is 20ms.

5) Shock

Carefully avoid big shock or vibration during transportation of cylinder or mounting and adjusting switch.

6) Magnetizable material such as iron plate near by cylinder switch is apt to cause malfunction of cylinder switches. Keep it from cylinder surface at least 10mm away (This is applicable for all bore sizes of tube).

7) It usually causes malfunction of cylinder switches when plural cylinders are laid adjoining. Keep a space between each other as illustrated to right (This is applicable for all bore sizes of tube).



5.2 Operational Cautions, Proximity Switch

1) Connection of lead cord

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 load side circuit. Wiring work without shutting electricity may, also, cause damage to load side circuit.

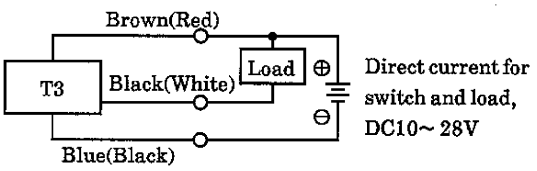


Fig.1 An example of the power for switch and load is the same.

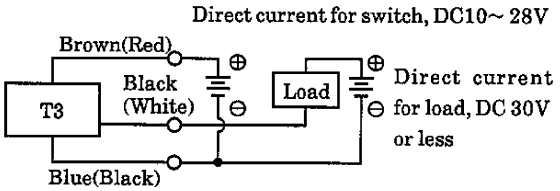


Fig.2 An example when the power for switch and load is independent.

2) Protection of output circuit

Install some protective circuit as per illustrated in Fig.3 when capacitor type load (relay or solenoid valve) are to be used because those types apt to generate surge current at turning switch off.

Install some protective circuit as per illustrated in Fig.4 when capacitor type lord (capacitor type) are to be used because those types apt to generate dash current at turning switch on.

Install some protective circuit as per illustrated in Fig.5 or 6 (in case of model T2) and Fig.7 (in case of model T3).

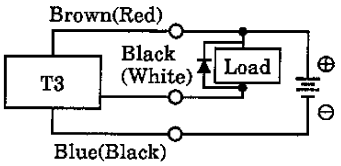


Fig.3 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.

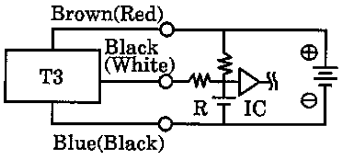


Fig. 4 An example of using capacitor type load together with current regulating resister R. Comply with the following formula to figure out required R. $\frac{V}{0.10} = R\,(\Omega)$

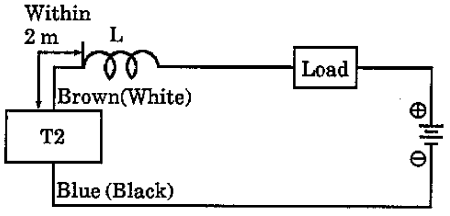


Fig. 5 • Choke coil L
L= a couple hundred μH ~ a couple mH surpassing high frequency characteristic
• Install it nearby the switch (within 2 m).

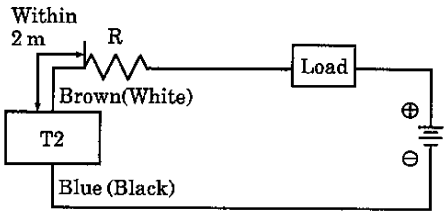


Fig. 6 • Dash current restriction resister R
R= As much large resister as the load circuit can afford.
• Install it nearby the switch (within 2 m).

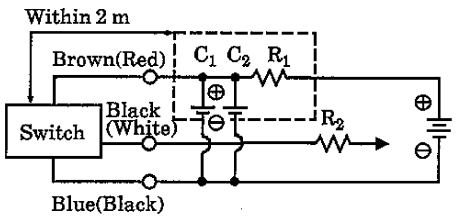


Fig. 7

- Electric power noise absorptive circuit C1
  C_1 = 20~50μF electrolytic capacitor (withstanding 50V or more)
  C_2 = 0.01~0.1μF ceramic capacitor
  R_1 = 20~30Ω
- Dash current restriction resister R2
  R_2 = As much large resister as the load circuit can afford.
- Install it nearby the switch (within 2 m).

3) Connection to a programmable controller (sequencer)

Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig. 8~12 respectively.

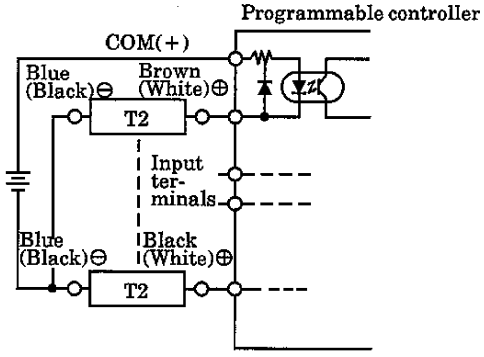


Fig. 8 An example of T2 connection to source input type (an external power source)

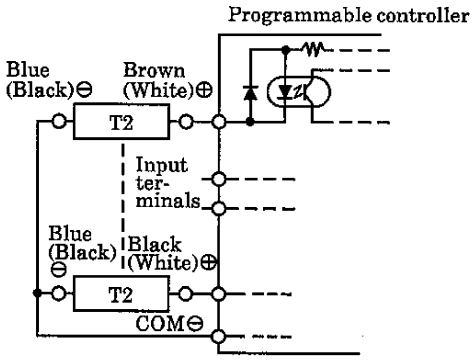


Fig. 9 An example of T2 connection to source input type (an internal power source)

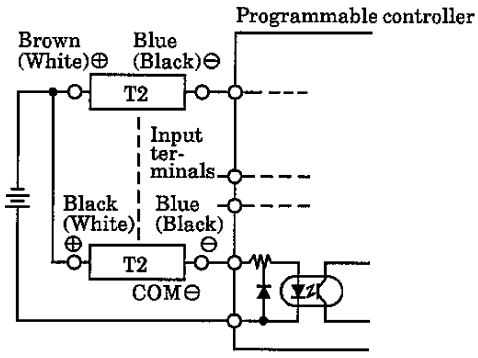


Fig. 10 An example of T2 connection to sink input type (an internal power source)

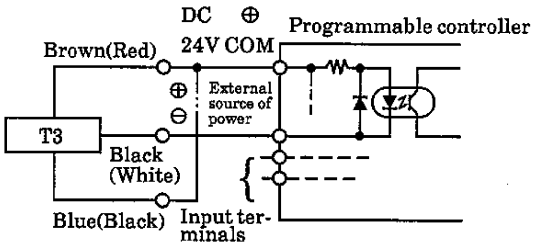


Fig. 11 An example of T3 connection to source input type (an external power source)

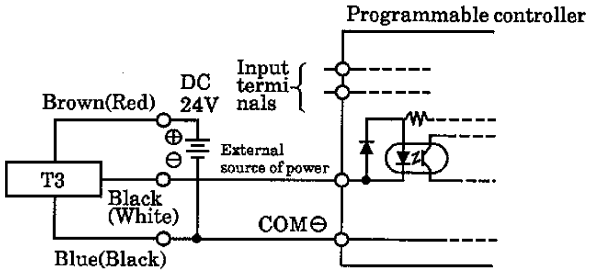


Fig. 12 An example of T3 connection to source input type (an internal power source)

4) Series connection

The total voltage loss when series connected T2 switches according to the number of switches connected. Therefore confirm the input specifications of programmable controllers which are connecting load. However, it may dim lamp or sometimes no lamp may be lit.

T3 switches, on the contrary, leak current is usually very minor (10μA or lower) to the extent of negligible, although leakage increases according total number of switches connected. Therefore, there is no incident of dim lamp or no lit lamp

5) Magnetic environment

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

6) Protection of lead cord

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

5.3 Operational cautions, Contact point switch, Model T0 & T5

1) Connection of lead cord

Instead of connecting the cord to the power source directly, always connect to the load in series. In case of model T0 connection, pay the following precautions.

Ⓐ For DC connection, use such polarities of cords as brown ⊕ and blue ⊖. The switch still functions right with reversed polarities but lamp is not lit.

Ⓑ For AC connection to either relay or input terminal to programmable controller, Switch lamp sometimes is not lit in case when half-wave rectification is being carried out. Lamp is lit, in this occasion, when polarities of cords for switch is reversed.

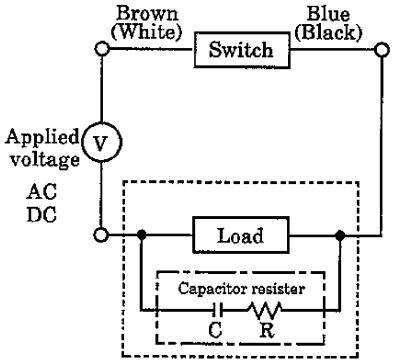
2) Capacity of contact points

Avoid using a load exceeding the max. capacity of contact points. On the other hand, in case of T0 model, switch lamp may not be lit sometimes when current is lower than the rated current.

3) Protection of contact point

Install such a contact protection circuit as illustrated in either Fig 1 or 2, as follows, when inducing a type load such as a relay is to be used.

Besides, install such a contact protection circuit as illustrated in either Fig.3 or 4 when the wiring road is over 10m.

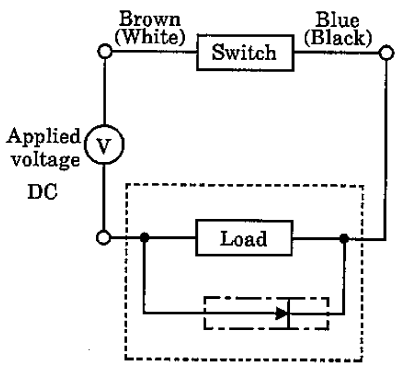


User circuit

Protective circuit (Spark absorbing circuit)

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

Fig. 1 When capacitor resister is used.

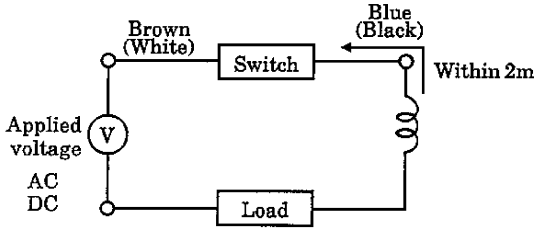


User circuit

Protective circuit

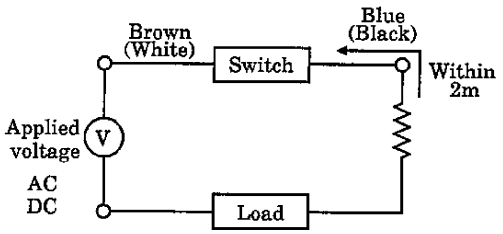
Rectifying diode, general use
Hitachi Mfg. product V06C or equivalent

Fig.2 When diode is used.



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

Fig. 3



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

Fig. 4

4) Relay

Use such products as specified below or equivalent.

OMRON Corporation	Model MY
FUJI ELECTRIC CORP	Model HH5
Matsushita Electric Works Ltd.	Model HC

5) Series connection

Total voltage loss, when connected T0 switches in series, equals to the sum of respective voltage loss of each switch. The total voltage loss becomes equivalent to one T0 (approx. 2.4V) when connecting the combination of one T0 for actuation confirming and rest of switches T5s. Lamp is lit only when all switches turn on.

6) Parallel connection

There is no restriction in parallel connection number of switches of these types. Multi number connection of model T0s, sometimes, cause a dimmed lamp or complete lamp failure.

7) Magnetic environment

Avoid usage of these switches within the area where strong magnetic fields or large currents exist. (such as a large magnet or spot welding equipment) Position censoring errors will result when installing many cylinders with switch in parallel or magnetized piece come across the cylinder due to intervention among each other.

8) Protection of lead cord

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

6. MAINTENANCE

6.1 Periodic Inspection

1) In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.

2) Inspection items

ⓐ Check the bolts and nuts fitting the piston rod end fittings and supporting fittings for slackening.

ⓑ Check to see that the cylinder operates smoothly.

ⓒ Check any change of the piston speed and cycle time.

ⓓ Check for internal and / or external leakage.

ⓔ Check the piston rod for flaw (scratch) and deformation.

ⓕ Check the stroke for abnormality.

See "Trouble shooting" 6.2, should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

6.2 Trouble shooting

1) Cylinder

Trouble	Cause	Countermeasure
Does not operate	No pressure or inadequate pressure	Provide an adequate pressure source.
	Signal is not transmitted to direction control valve	Correct the control circuit.
	Improper or misalignment of installation	Correct the installation state and / or change the supporting system.
	Broken packing	Replace the packing.
Does not function smoothly	Lowest speed than rated	Reduce the load. Consider the use of hydraulic cylinder.
	Improper or misalin\gnment of installation	Correct the installation state and / or change the supporting system.
	Exertion of transverse (lateral) load	Install a guide. Revise the installation state and / or change the supporting system.
	Excessive load	Increase the pressure itself and / or the inner diameter of the tube.
	Speed control valve is built in the way of "Meter in" circuit	Change the installation direction of the speed control valve.
Breakage and / or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load. Install cushion device with more efficiency. (External cushion)
	Exertion of transverse load	Install a guide. Revise the installation state and / or change the supporting system.

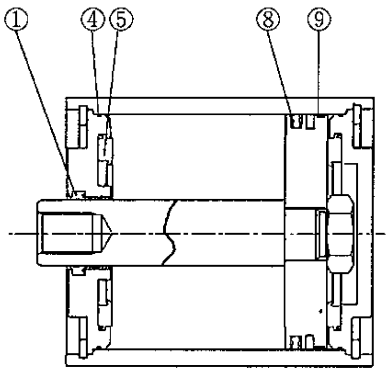
2) Switch

Trouble	Possible cause	Countermeasure
Lamp 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
	Damage to the lamp	Replace the lamp
	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
	Incorrect direction of switch mounting	Correct the direction of the switch
	Relay is unable to respond properly within the piston stroke	Adjust speed slow Replace the relay
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch
Switch does not return	Piston is not moving	Correct to have 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
	Improper ambient temperature	Adjust the ambient temperature within the range of −10~60°C
	Existence of a foreign magnetic field	Shield the magnetic field
	Inadequate incoming signal	Review the external signal circuit and remove the causes

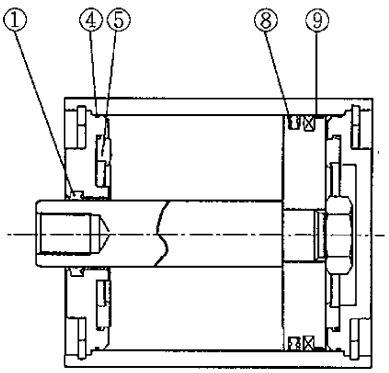
6.3 Disassembly

1) This cylinder is able to be disassembled.
Replace component parts by disassembling cylinder referring to internal structure drawing when air leakage is ever occurred.
2) Remove piston rod and rod metal after removing C shape snap ring for the purpose of disassembly.
3) Internal structure drawing and expendable parts list.

- SSD-ϕ125~ϕ160
(Double acting, single rod)



- SSD-L-ϕ125~ϕ160
(Double acting, single rod, with switch)

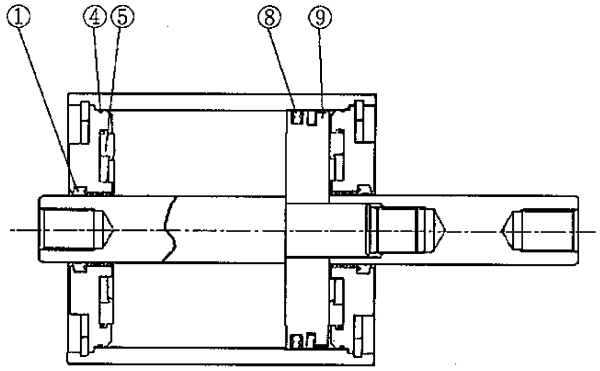


Expendable parts list (Specify the kit No. when ordering)

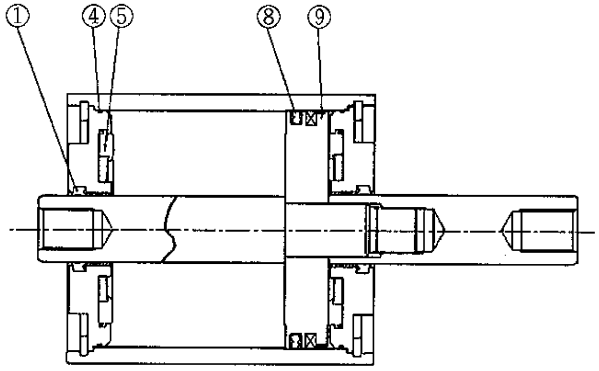
Tube bore (mm) / Parts name / Kit No. / Parts No.	①	④	⑤
	Rod packing	Metal gasket	Cushion rubber
ϕ125	SSD-125K	DRP-35	AS568-048	F3-236842
ϕ140	SSD-140K	DRP-35	AS568-160	F3-236843
ϕ160	SSD-160K	DRP-40	AS568-163	F3-236844

Tube bore (mm) / Parts name / Kit No. / Parts No.	⑧	⑨
	Piston packing	Wear ring
ϕ125	SSD-125K	PSD-125	F4-666997
ϕ140	SSD-140K	PSD-140	F4-666998
ϕ160	SSD-160K	PSD-160	F4-666999

- SSD-D-ϕ125~ϕ160
  (Double acting, double rod)



- SSD-DL-ϕ125~ϕ160
  (Double acting, double rod, with switch)



Expendable parts list (Specify the kit No. when ordering)

Tube bore (mm) / Parts name / Kit No. / Parts No.	①	④	⑤
	Rod packing	Metal gasket	Cushion rubber
ϕ125	SSD-D-125K	DRP-35	AS568-048	F3-236842
ϕ140	SSD-D-140K	DRP-35	AS568-160	F3-236843
ϕ160	SSD-D-160K	DRP-40	AS568-163	F3-236844

Tube bore (mm) / Parts name / Kit No. / Parts No.	⑧	⑨
	Piston packing	Wear ring
ϕ125	SSD-D-125K	PSD-125	F4-666997
ϕ140	SSD-D-140K	PSD-140	F4-666998
ϕ160	SSD-D-160K	PSD-160	F4-666999

7. MODEL CODING

7.1 Model coding of product

• Without switch

SSD — 125 — 10 ——————————— N

• With switch

SSD-L — 125 — 10 — T0H — R — N

ⓐ Model ⓑ ⓒ ⓓ ⓔ ⓕ

ⓐ Model		ⓑ Tube bore (mm)		ⓒ Standard stroke (mm)
SSD	Double acting, Single rod	125	φ125	10
SSD-L	Double acting, Single rod, with switch	140	φ140	20
SSD-D	Double acting, Double rod	160	φ160	30
SSD-DL	Double acting, Double rod, with switch			40
				50
				60
				70
				80
				90
				100

ⓓ Switch model code				ⓔ Qty of switch		ⓕ Option	
Lead outlet straight type	Lead outlet L type			R	1 ea., Rod side	N	Rod tip, Male thread
T0H※	T0V※	Contact point	2-core	H	1 ea., HEAd side	NN	Piston rod end length thread change.
T5H※	T5V※			D	2 ea.,		
T2H※	T2V※	Proximity	3-core				
T3H※	T3V※						

※ Lead cord length	
No cord	1m (Standard)
3	3m (Optional)
5	5m (Optional)

7.2 Model coding of Parts

1) Switch

Switch model code

T0H※

ⓓ

ⓓ Switch model code			
Lead outlet straight type	Lead outlet L type		
T0H※	T0V※	Contact point	2-core
T5H※	T5V※		
T2H※	T2V※	Proximity	3-core
T3H※	T3V※		

※ Lead cord length	
No cord	1m (Standard)
3	3m (Optional)
5	5m (Optional)

2) Expendable parts
Specify the kit No. when ordering.

Model	Kit No
SSD-125	SSD-125K
SSD-140	SSD-140K
SSD-160	SSD-160K

Model	Kit No
SSD-L-125	SSD-L-125K
SSD-L-140	SSD-L-140K
SSD-L-160	SSD-L-160K

Model	Kit No
SSD-D-125	SSD-D-125K
SSD-D-140	SSD-D-140K
SSD-D-160	SSD-D-160K

Model	Kit No
SSD-DL-125	SSD-DL-125K
SSD-DL-140	SSD-DL-140K
SSD-DL-160	SSD-DL-160K

[SM-185321-A]