CKD

SM－477208-A

INSTRUCTION MANUAL

PENCIL CYLINDER

SCPS3, SCPH3
SCPD3, SCPD3-O

- 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 2nd 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:

⚠ **DANGER:** When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, or when there is a high degree of emergency to a warning.

⚠ **WARNING:** When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries.

⚠ **CAUTION:** When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

⚠ WARNING:	a) This product is designed and manufactured as a general industrial machine part. It must be handled by an operator having sufficient knowledge and experience in handling. b) Use this product in accordance of specifications. This product must be used within its stated specifications. It must not be modified or machined. This product is intended for use as a general-purpose industrial device or part. It is not intended for use outdoors or for use under the following conditions or environment. (Note that this product can be used when CKD is consulted prior to use and the customer consents to CKD product specifications. The customer must provide safety measures to avoid risks in the event of problems.) 1. Use for special applications including nuclear energy, railway, aircraft, marine vessel, vehicle, medicinal devices, devices or applications coming into contact with beverages or foodstuffs, amusement devices, emergency cutoff circuits, press machines, brake circuits, or safety devices or applications. 2. Use for applications where life or assets could be adversely affected, and special safety measures are required. c) Observe corporate standards and regulations, etc., related to the safety of device design and control, etc. ISO4414, JIS B 8370 (pneumatic system rules) JFPS2008 (principles for pneumatic cylinder selection and use) Including High Pressure Gas Maintenance Law, Occupational Safety and Sanitation Laws, other safety rules, body standards and regulations, etc. d) Do not handle, pipe, or remove devices before confirming safety. 1.Inspect and service the machine and devices after confirming 2.Note that there may be hot or charged sections even after operation 3.When inspecting or servicing the device, turn off the energy the facility. Discharge any compressed air from the system, leakage of electricity. 4.When starting or restarting a machine or device that incorporates safety, such as pop-out prevention measures, is secured.

⚠ CAUTION:	a) Before performing an overhaul inspection on the actuator, deactivate residual pressure completely. b) While the actuator is operating, do not step into or place hands in the driving mechanism. c) 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

SCPS3,SCPH3,SCPD3,SCPD3-O

Pencil cylinder

Manual No. SM-477208-A

1. UNPACKING

1) Make sure that the type No. on the nameplate of the delivered Pencil Cylinder matches the type No. you ordered

2) Check the appearance for any damage.

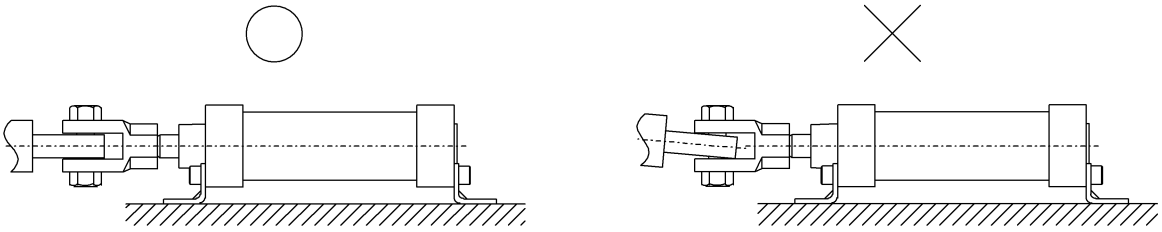
3) Stop up the piping port with a sealing plug to prevent the entry of foreign substances into the cylinder. Remove the sealing plug before piping.

2. INSTALLATION

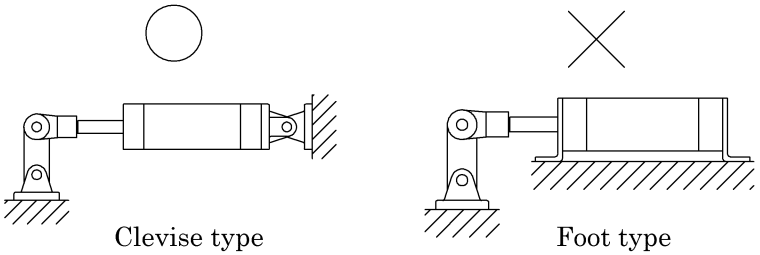
2.1 Installation

1) The ambient temperature for this type cylinder is −10 to 60℃ (No freezing). Always operate the cylinder within this temperature range.

2) When cylinder is fixed and rod end is connected with pin joint:
In case the load acting direction is not parallel with the rod axial center, the rod and tube may get entangled causing seizure, etc. Hence, make sure that the rod axial center and the load transfer direction are aligned to each other.



3) When the load acting direction changes with the cylinder operation:
Use an oscillating cylinder (clevis type) capable of making revolution to a certain angle. Furthermore, install the rod and connecting metal (knuckle) so that it moves in the same direction as the cylinder main body does.



Clevise type　　Foot type

4) Do not turn the cover. When install the cylinder or turn the piping joint into the port, it may be damaged from joint of cover for turning the cover.

5) When fix the work on the piston rod end, perform so that tightening torque does not apply the cylinder main body.

2.2 Piping

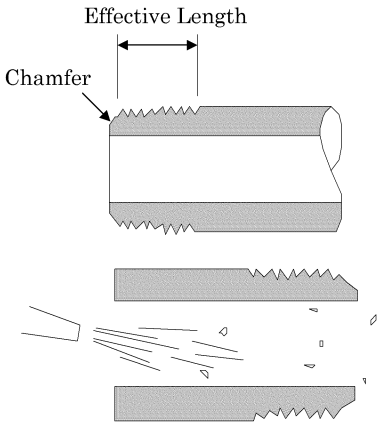
1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc.

2) See to it that the pipe connecting cylinder and solenoid valve has effective cross-sectional area which is needed for the cylinder to drive at the specified speed.

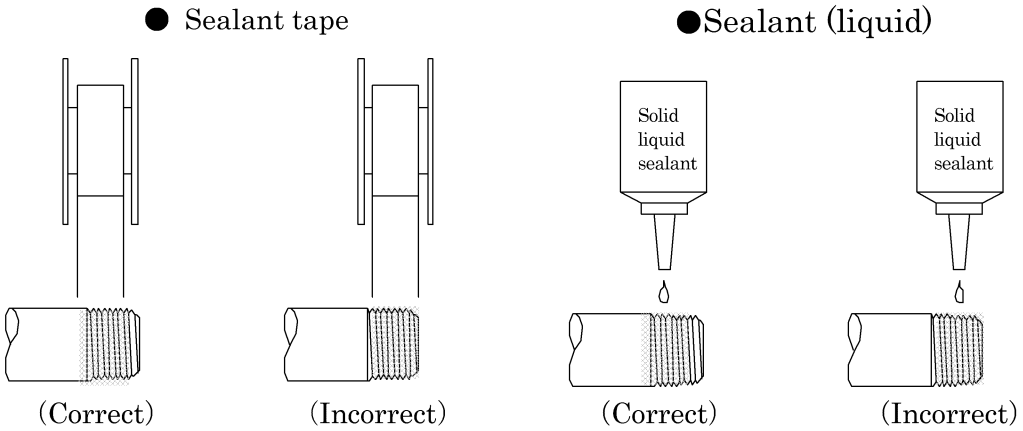
3) Install filter preferably adjacent to the upper-stream to the solenoid valve for eliminating rust, foreign substance in the drain of the pipe.

4) Be sure observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.

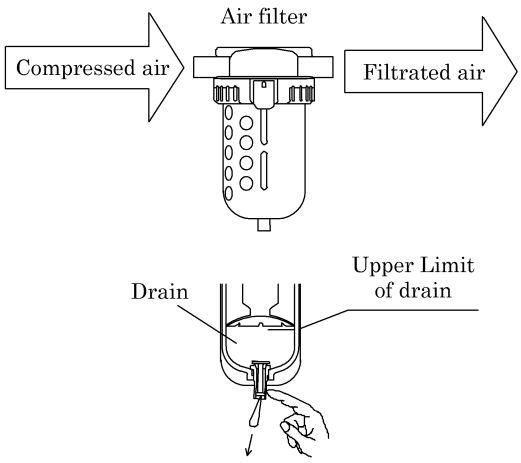
5) Flush air into the pipe to blow out foreign substances and chips before piping.



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



2.3 Fluid



1) It is necessary to use dehumidified air that has been filtered from compressed air. Carefully select an adequate filter that has an adequate filtration rate (preferably 5μm or less), flow rate and its mounting location (as nearest to the directional control valve as possible).

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

3) Note that the intrusion of carbide for the compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of the solenoid valve and the cylinder. Be sure to carry out thorough inspection and maintenance of the compressor.

4) This cylinder does not require lubrication. It is recommended, however, to use Turbine oil Grade 1, ISO VG32 as a lubricant, if and when lubrication is needed.

2.4 Location of Mounting Switches on a Cylinder

1) Location of mounting switches on a cylinder

(1) At the stroke end

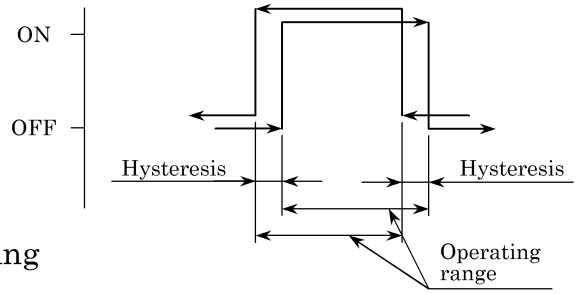
Mount switches within the rod side dimension RD as well as the head side dimension HD (refer to below table) for the purpose of having switches function at the points of the maximum sensitive position.

2) Operating range

The switch turns on first and turns off as the piston moves along its stroke. The center of the range is the maximum sensitive position. Setting switch at this point eliminates majority of external disturbance and provides the most stabile actuation of switch.

3) Hysteresis

Precise operating range deviate slightly depending upon the direction of piston movement as shown right.
Switch is apt to be disturbed its accuracy by external effect when piston stops within this range. Carefully avoid designing stopping location of piston.



Maximum sensitive position(HD、RD), operating range and hysteresis (mm)

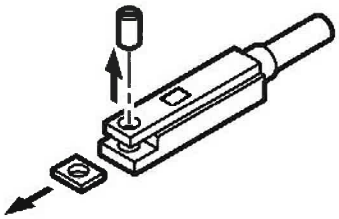
Bore size (mm)	Solid state switch							
	T2H/V,T3H/V,T2WH/V,T3WH/V							
	Maximum sensitive position				Operating range		Hysteresis	
	Head side HD(mm)		Rod side RD(mm)					
	1 color indicator type	2color indicator type	1 color indicator type	2color indicator type	1 color indicator type	2 color indicator type	1 color indicator type	2color indicator type
φ6	2	3.5	2	4	1.5～4	2.5～5	1.5 or less	1 or less
φ10	2.5	4	3.5	5.5	1.5～5.5	2.5～6		
φ16	3.5	5	2	3.5	2～6	2.5～6		

Bore size (mm)	Reed switch			
	T0H/V,T5H/V			
	Maximum sensitive position		Operating range	Hysteresis
	Head side HD(mm)	Rod side RD(mm)		
φ6	2	2	4～6	3 or less
φ10	2.5	3.5	3.5～7	
φ16	3.5	2	3.5～7.5	

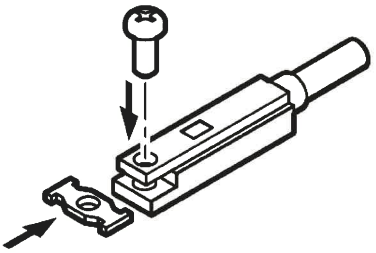
4) How to install the switch

(1) When use the standard T type switch(SW-T※)

1. Remove the nut and screw.

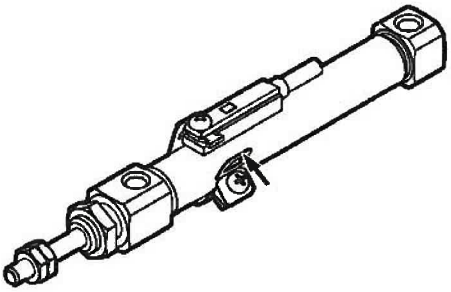


2. Assemble the mounting bracket and screw for SCPD3. (SCPD3-T)

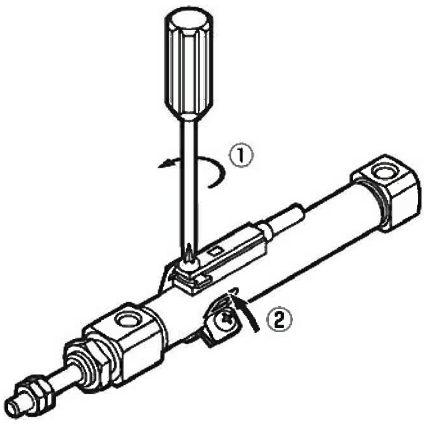


(2) When use the switches for SCPD3 (SCPD3-T※) or after assembling (1), assemble as below procedure.

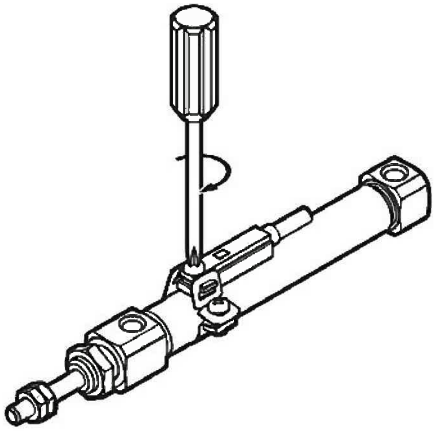
1. Put the angle hole of the band into the mounting bracket and fix to the cylinder.



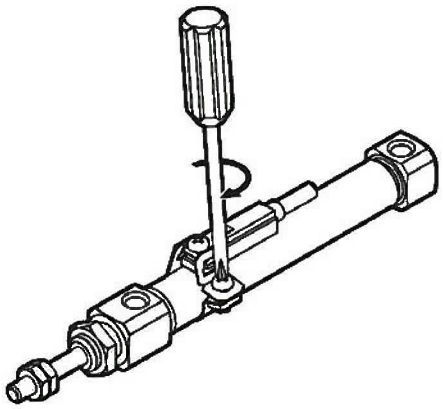
If difficult to fix, follow the below procedure.
①Tighten the screw of switch side.
②Put the angle hole of the band into the mounting bracket.



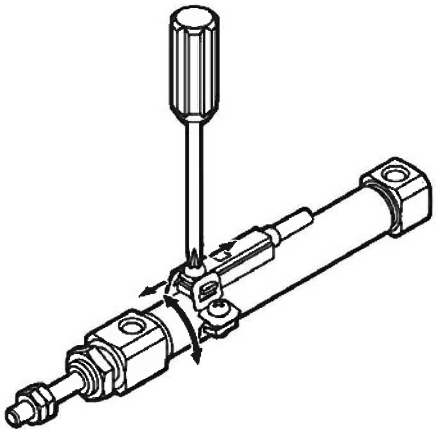
2. Tighten the screw of switch side.
Tightening torque : 0.1～0.15N・m



3. Tighten the screw of band side.
Tightening torque : 0.1～0.15N･m



4. When adjust the location of mounting switch on a cylinder :
Loosen a screw of the switch, and adjust the position, then tighten the screw of switch again on the best position.
Tightening torque : 0.1～0.15N･m



3. OPERATION

3.1 How to Use the Cylinder

1) The working pressure for this type of cylinder is specified in “7.1 Product Specifications”. Strictly avoid to operate the cylinder with higher range than specified.

2) Keep the range of load connected to the rod reasonable to prevent rod from being damaged due to the excessive energy of momentum inertia.
Refer to the “7.1 Product Specifications” for the allowable energy absorption.

3) Adjust the working piston speed with the speed controller mounted.

4) Mount a speed controller directly on or as near to the cylinder as possible.

5) Carefully prevent lateral load to the rod to avoid irregular wear and tear of rod cover or rod itself

6) Make sure to use a hose nipple (with fixed chalk) or speed controller when piping the pencil cylinder to the system.

3.2 How to Use the Switch

3.2.1 Common items

1) Magnetic environment
Do not use a switch other than the strong magnetic field proof switch in a place where strong magnetic field or large current (large magnet or spot welding machine, etc.) exists around the switch mounting position. If a cylinder with the switch is installed in parallel to this product or the magnetic substance moves near the cylinder, the mutual interference may occur and affect the detection accuracy.

2) Lead wire wiring
Carefully perform the wiring so that a bending stress or tensile strength does not apply to the lead wire repeatedly.
Additionally, connect wires for robot having the bending resistance to movable parts.

3) Operating temperature
Do not operate the product at a high temperature (Over than 60℃).

4) The cylinder switch could malfunction if cylinders with switch are installed parallel adjacently. Check that the following table 1 distance is maintained between cylinder switches.

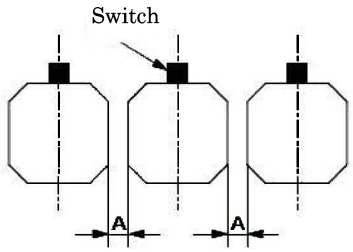


Table 1 : Dimensions of A (mm)

Switch	T0,T5	T2,T3	T2W,T3W
Bore size	Reed	Solid state	
ϕ 6	0 or more ※1	3 or more	3 or more
ϕ 10	0 or more	3 or more	3 or more
ϕ 16	0 or more	3 or more	3 or more

※1 SCPS3-6 port axis direction type must be 3mm or more distance is maintained.

5) The cylinder switch could malfunction if cylinders are installed adjacently with other type. Check that the following table 2 distance is maintained between cylinder switches.

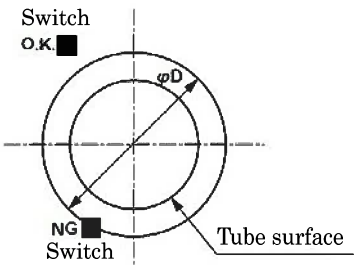


Table 2 : Dimensions of D (mm)

Switch	T0,T5	T2,T3	T2W,T3W
Bore size	Reed	Solid state	
ϕ 6	ϕ 16.5 or more	ϕ 22.5 or more	ϕ 22.5 or more
ϕ 10	ϕ 21 or more	ϕ 26.5 or more	ϕ 26.5 or more
ϕ 16	ϕ 34 or more	ϕ 35 or more	ϕ 35 or more

3.2.2 Operational Cautions, Solid State Switch (T1, T2, T3)

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

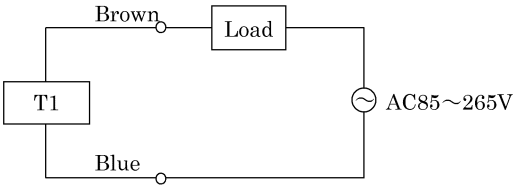


Fig.1 Fundamental circuit Example of T1

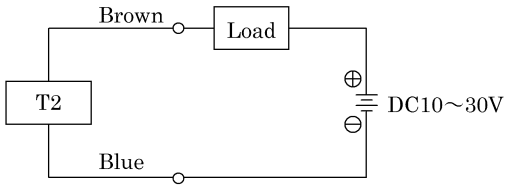


Fig.2 Fundamental circuit Example of T2

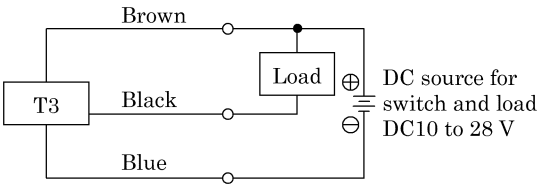


Fig.3 Fundamental circuit Example of T3 (1)
(In case the same source of power is used.)

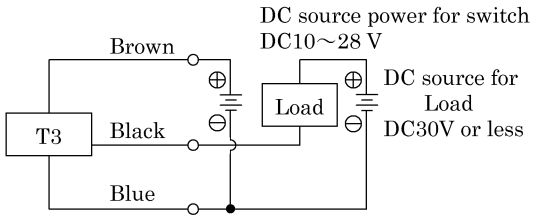


Fig.4 Fundamental circuit Example of T3 (2)
(In case individual sources of power are used.)

2) Output circuit protection

Install some protective circuit as illustrated in Fig. 5 or 6 when inducing type load (Relay or solenoid valve) are to be used because those types apt to generate surge current switch off.

Install some protective circuit as illustrated in Fig. 7 when capacitor type load (Capacitor type) 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. 8 or 9 (in case of model T2) and Fig 10 (in case of model T3).

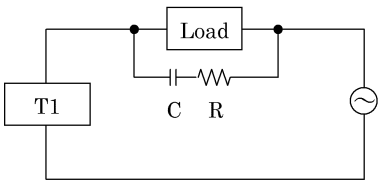


Fig.5 An example of protective circuit at CR circuit
Capacitor volume：0.03 to 0.1Mf
Resister：1 to 3kΩ

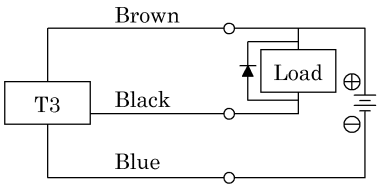
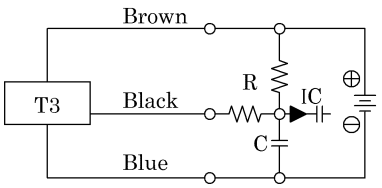


Fig.6 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)



Flg.7 An example of using capacitor type load together with current regulating resister R. Comply with the following formula to figure out required R.

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

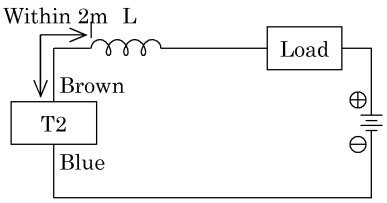


Fig.8 ・Choke coil
L = a couple hundred μH to a couple mH surpassing high frequency characteristic
・Install it near by a switch (within 2m).

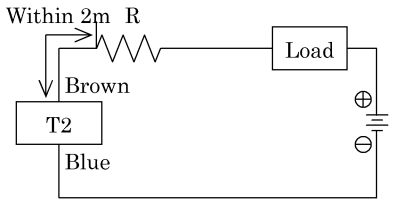


Fig.9 ・Dash current restriction resister.
R = As much large resister as the load circuit can afford.
・Install it near by a switch (within 2m).

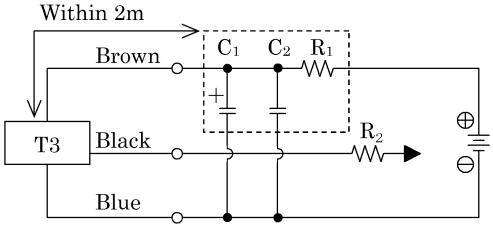


Fig10・Electric power noise absorptive circuit.
C_1=20～50 μF electrolytic capacitor
(Withstand voltage 50V or more)
C_2=0.01～0.1 μF ceramic capacitor
R_1=20～30 Ω

・Dash current restriction resister.
R_2=As much large resister as the load circuit can afford.
・Install it nearby the switch (Within 2m)

3) Connection to programmable controller (Sequencer).
Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig. 11 to 15 respectively.

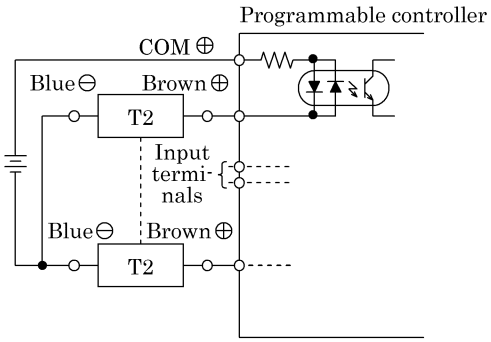


Fig.11 An example of T2 connection to source input type (an external power source)

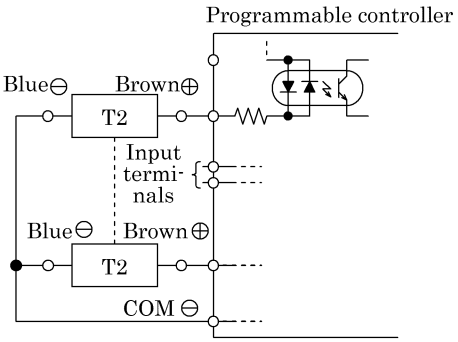


Fig.12 An example of T2 connection to source input type (an internal power source)

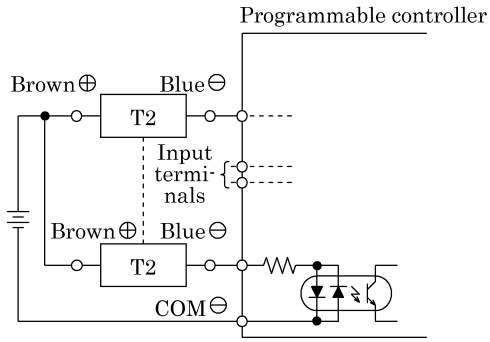


Fig.13 An example of T2 connection to source input type

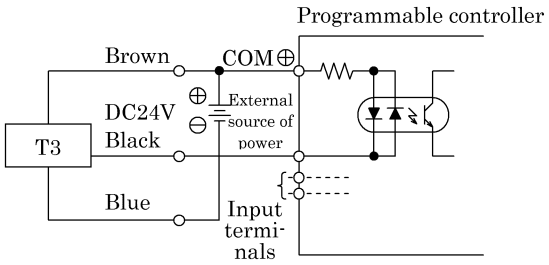


Fig.14 An example of T3 connection to source input type (an internal power source)

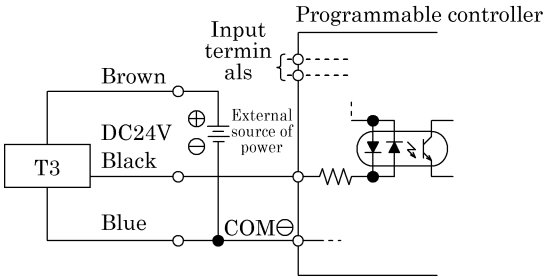


Fig.15 An example of T3 connection to source input type (an internal power source)

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

3.2.3 Operational Cautions, Reed Switch (T0, T5, T8)

1) Lead wire connections

Do not connect the lead wires of the switch to the power supply directly. Always connect the loads in series. For T0 switch, carefully check following items Ⓐ, Ⓑ.

Ⓐ When using the switch for DC power supply, connect the brown and blue lines to the positive and negative sides, respectively. If these lines are connected reversely, the switch is activated, but the indicator light is not lit.

Ⓑ When the switch is connected to an AC relay or a programmable controller input, the indicator light on the switch is not lit if the half-wave rectification is performed in the connected circuit. If this occurs, reverse the polarities of the switch lead wire connection. The indicator light may then be lit.

2) Contact capacity

Do not use a load exceeding the maximum contact capacity of the switch. Additionally, if the current is lower than the rated current value, the indicator light may not be lit.

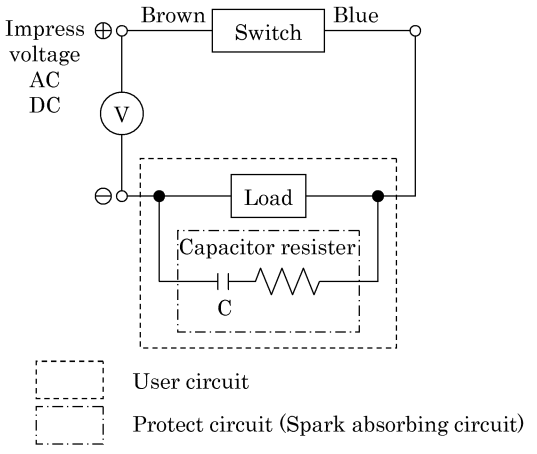
3) Contact protective measures

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

Table 3

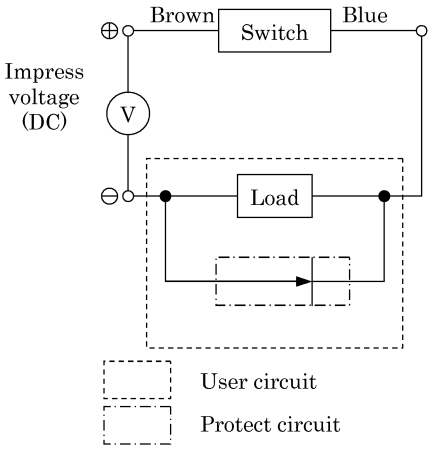
Electric power	Length of wire
DC	100m
AC	10m

(1) Protective circuit when connecting an inductive type load.



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

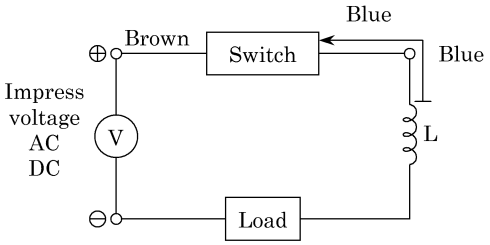
Fig.1 When capacitor resister
(In case the same source of power is used.)



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

Fig.2 When diode is used.

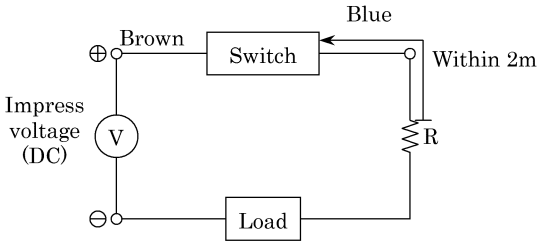
(2) Protective circuit when the wire length exceeds that stated Table 3.



・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
Always use the relays listed below.
Omron Corporation ····· MY type
Fuji Electric Co., Ltd. ····· HH5 type
Panasonic, Ltd. ····· HC type

5) Serial 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 T5 switches. Indicator light 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 T0 and T8, sometimes, cause a dimmed indicator light or complete indicator light failure.

4. MAINTENANCE

4.1 Periodical Inspection

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

2) Inspection items

(1) Check the bolts and nuts bracket the cylinder for slackening.

(2) Check the bolts and nuts fitting the piston rod end bracket and mounting bracket for slackening.

(3) Check to see that the cylinder operates smoothly.

(4) Check any change of the working piston speed and cycle time.

(5) Check for internal and/or external leakage.

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

(7) Check the stroke for abnormality.

See“5. TROUBLE SHOOTING” should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

Note : This type of cylinder is unable to be overhauled. Replace if duly trouble occurs to the cylinder itself.

5. TROUBLE SHOOTING

1) Cylinder Specifications

Trouble	Causes	Remedies
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 mounting style.
	Broken piston packing	Replace the cylinder.※
Does not function smoothly.	Speed is below the low speed limit	Limit the load variation.
	Improper or misalignment of installation.	Correct the installation state and/or change the mounting style.
	Exertion of transverse (lateral) load.	Install a guide. Revise the installation state and/or change the mounting style.
	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 meter-out circuit of the speed control valve.
Breakage and / or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load and/or install a mechanism with more secured cushion effect (e.g.external cushion mechanism).
	Exertion of transverse load.	Install a guide. Reverse the installation state and/or change the mounting style.

※Being a caulked type, this cylinder is unable to be overhauled.

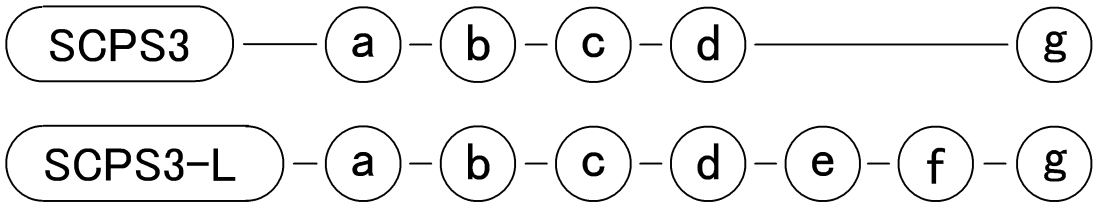
2) Switch Specifications

Troubles	Causes	Remedies
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.
	Relay is unable to respond properly	Turn the speed down. 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 -10～60℃.
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

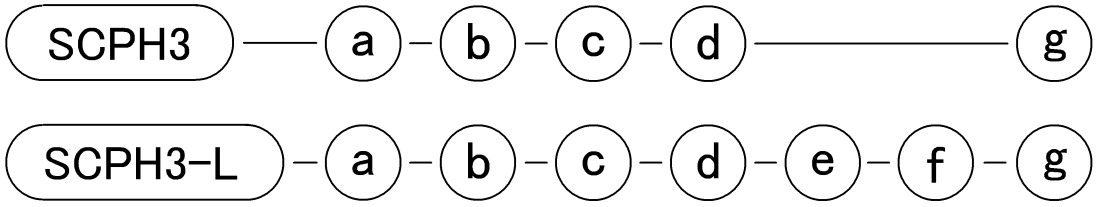
6. HOW TO ORDER

6.1 Product Number Coding

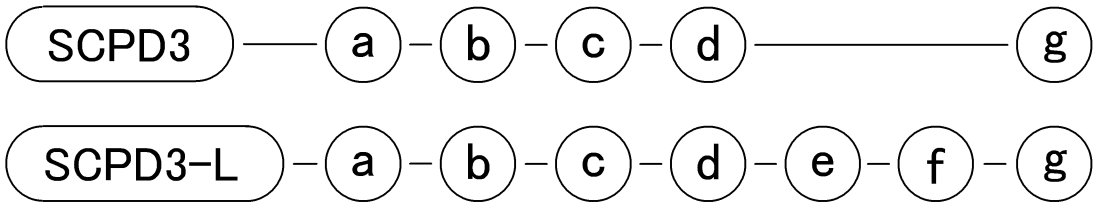
(1) Single-acting, Advance type



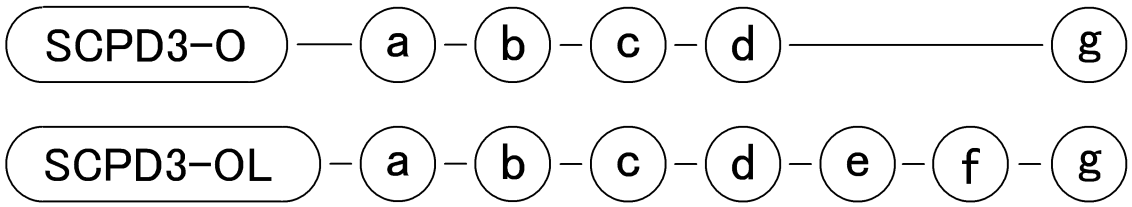
(2) Single-acting, Retracting type



(3) Double-acting



(4) Double-acting, Low speed type



(a) Mounting Style (Note1)		(b) Bore size (mm)		(c) Stroke		(d) Port Direction	
00	Basic type	6	ϕ 6	15	15	No code	Perpendicular to cylinder axis
LS	Single axial foot type (rod side)	10	ϕ 10	30	30		
FA	Rod side flange type	16	ϕ 16	45	45	0	Parallel to cylinder axis
CB	Double clevis type			60	60		

Note1:Mounting bracket is attached to the product at shipment.

(e) Switch model (Note 2)			(f) Qty. of switch		(g) Accessory (Note 3)	
	Switch type	Lead wire				
T2V※	Solid state	2-wire	R	Rod side, 1 ea.	I	Rod eye
T2WV※			H	Head side, 1 ea.	Y	Rod clevis
T3V※		3-wire	D	2 ea.	B1	Eye bracket
T3WV※			T	3 ea.	B2	Clevis bracket
T0V※	Reed	2-wire				
T5V※						

※ Lead wire Length	
No code	1m (Standard)
3	3m (Option)
5	5m (Option)

Note 2, Note3：Switch, accessory are attached to the product at shipment.

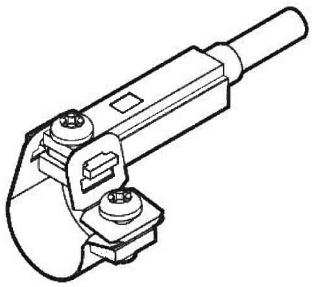
6.2 Compornent Parts Model Coding

(1) Switch Single Number coding

●Switch main body＋Mounting bracket

SCPD3 – T0H – 6

- T0H: Switch No. Previous page (e)
- 6: Bore size Previous page (b)

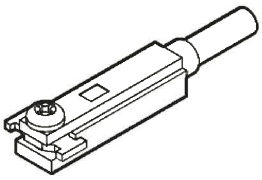


●Switch main body
(With fixing bracket)

SCPD3 – T0H

- T0H: Switch No. Previous page (e)

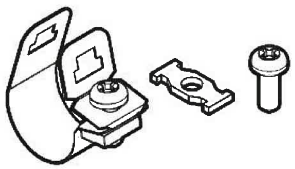
Note) T type standard switch, fixing bracket, pan head machine screw differ.



●Mounting bracket
+Switch fixing bracket

SCPD3 – TS – 6

- 6: Bore size Previous page (b)



When purchase 20 or more,
packed all together.

●Mounting bracket

SCPD3 – T – 6

- 6: Bore size Previous page (b)

When purchase 20 or more,
packed all together.

7. SPECIFICATION

7.1 Product Specifications

Model / Item		SCPS3 SCPS3-L			SCPH3 SCPH3-L			SCPD3 SCPD3-L			SCPD3-O SCPD3-OL		
Bore size	mm	φ6	φ10	φ16	φ6	φ10	φ16	φ6	φ10	φ16	φ6	φ10	φ16
Actuation		Single-acting, advancing type			Single-acting, retracting type			Double-acting			Double-acting, Low speed type		
Working fluid		Compressed air											
Max. working pressure	MPa	1.0											
Min. working pressure	MPa	0.3	0.15		0.39	0.2		0.15	0.1		0.15	0.1	
Proof pressure	MPa	1.6											
Ambient temperature	℃	−10～60 (Not frozen)											
Port size		M5											
Stroke tolerance	mm	+1.0 0											
Working piston speed	mm/s	50～750									10～200		
Cushion		Rubber cushion (Both ends)											
Lubrication		Not required (Use Grade 1 ISO VG 32 Turbine oil, if lubrication is preferred)									Must be oil free		
Allowable energy absorption	J	0.012	0.041	0.162	0.012	0.041	0.162	0.012	0.041	0.162	0.012	0.041	0.162

Note：Do not keep pressurizing the single-acting cylinder.
If it would keep pressurizing, a piston rod may not return by spring load when the pressure is extracted.

7.2 Switch specifications

1) Type of switch and applications

Type No. / Item			Purpose・Application
Solid state	2 wire	T2H	DC programmable controller
		T2V	
		T2WH	
		T2WV	
	3 wire	T3H	DC programmable controller, relay
		T3V	
		T3WH	
		T3WV	
Reed	2 wire	T0H	AC/DC programmable controller, relay
		T0V	
		T5H	AC / DC programmable controller, relay, IC circuit (without indicator light), serial connection
		T5V	

2) Switch Specifications

Item	Reed			
	T0H, T0V		T5H, T5V	
Applications	Programmable controller, relay		Programmable controller relay, IC circuit (without indicator light), serial connection	
Power supply voltage	—			
Load Voltage	DC12/24V	AC110V	DC5/12/24V	AC110V
Load Current	5～50mA (Note 1)	7～20mA (Note 1)	50mA or lower	20mA or lower
Current consumption	—			
Internal voltage drop	2.4V or lower		0V	
Indicator light	LED (ON lighting)		Without indicator light	
Leakage current	0mA			
Lead wire length	1m (Oil-proof vinyl cabtyre cord 2-wire 0.2mm^2)			
Shock resistance	294m/s^2			
Insulation resistance	20MΩ or more measuring with DC 500V megger tester			
Withstand voltage	No failure at 1000VAC applied for one minute.			
Ambient temperature	-10～60℃			
Degree of protection	IEC Standard IP67, JIS C0920 (water tight type), oil resistance			

Item	Solid state			
	T2H, T2V	T2WH, T2WV	T3H, T3V	T3WH, T3WV
Applications	DC Programmable controller		DC Programmable controller, relay	
Power supply voltage	—		DC10～28V	
Load Voltage	DC10～30V	DC24V±10%	DC30V or lower	DC30V or lower
Load Current	5～20mA (Note 1)		100mA or lower	50mA or lower
Current consumption	—		10mA or lower at DC 24V (ON)	
Internal voltage drop	4V or lower		0.5V or lower	
Indicator light	LED (ON lighting)	Red/Green LED (ON lighting)	LED (ON lighting)	Red/Green LED (ON lighting)
Leakage current	1mA or lower		10μA or lower	
Lead wire length	Standard 1m (Oil-proof vinyl cabtyre cord, 2-wire, 0.2mm^2)		Standard 1m (Oil-proof vinyl cabtyre cord, 3-wire, 0.2mm^2)	
Shock resistance	980m/s^2			
Insulation resistance	20MΩb or more measuring with DC 500V megger tester			
Withstand voltage	No failure at 1000VAC applied for one minute			
Ambient temperature	-10～60℃			
Degree of protection	IEC Standard IP67, JIS C0920 (water tight type), oil resistance			

Note 1: Max. load current above is value at 25 ℃. The current will be lower if the temperature around switch is higher than 25 ℃. (50% at 60℃).