CKD

SM－390108-A

INSTRUCTION MANUAL

SUPER TWIN-ROD CYLINDER

CLEAN SERIES

STR2-P7 Series
-P5 Series(Custom order)

- 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:

⚠ 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.
- The P7 series uses fluorine-based grease. Avoid exposure to open flame to prevent generation of possibly injurious toxic gases. Smoking with a hand with the grease may generate toxic gas, so this is harmful to the health.

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STR2
Super Twin-Rod Cylinder
Clean Series
Manual No. SM-390108-A

1. UNPACKING

1) Open the package in a clean room. The product is packaged in a clean room, and should be opened just before piping it in the clean room.

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

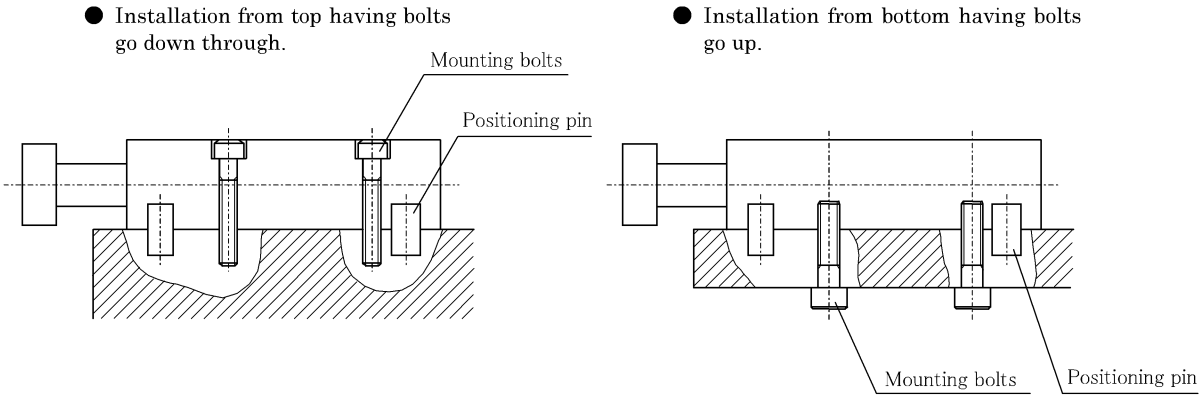
3) Check the appearance for any damage.

2. INSTALLATION

2.1 Installation

1) Serviceable range of ambient temperature for cylinder of this type is −10 to 60℃.
Use it within this range.

2) Directly mount cylinder making use of socket headed mounting bolts.



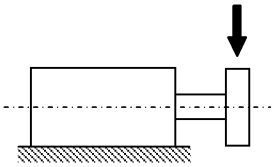
Use socket headed bolts to install cylinder from top through bottom.
Refer to the table below as for sizes of bolts.

Bore size (mm)	Size of socket headed bolts		Size of positioning pins	Qty
	Installation from top	Installation from bottom		
φ6	M3×15ℓ	M4	φ4×8ℓ	2
φ10	M4×20ℓ	M5	φ4×8ℓ	2
φ16	M4×25ℓ	M5	φ6×12ℓ	2
φ20	M5×32ℓ	M6	φ6×12ℓ	2
φ25	M6×40ℓ	M8	φ6×12ℓ	2
φ32	M6×45ℓ	M8	φ6×12ℓ	2

3) Refer to the graph “Tolerable weight of load” below, to find the limit of the load fixed to the end plate.

Allowable lateral load

Lateral load : F



Sliding bearing (N)

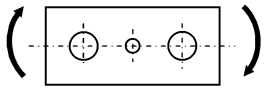
Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-M-6-※	2.4	1.9	1.5	1.3	1.1	-	-	-	-	-
STR2-M-10-※	5.8	4.8	4.1	3.5	3.1	-	-	-	-	-
STR2-M-16-※	15.9	13.3	11.5	10.1	8.9	8.1	7.3	6.7	6.2	5.8
STR2-M-20-※	20.3	17.3	15.1	13.4	12.1	10.9	10.0	9.2	8.5	7.9
STR2-M-25-※	22.1	18.9	16.5	14.7	13.1	11.9	10.9	10.1	9.3	8.7
STR2-M-32-※	34.9	30.2	26.7	23.9	21.6	19.7	18.1	16.8	15.7	14.7

Roller bearing (N)

Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-B-6-※	2.6	1.9	1.5	1.2	1.0	-	-	-	-	-
STR2-B-10-※	6.0	4.4	3.6	3.0	2.6	-	-	-	-	-
STR2-B-16-※	11.4	8.5	7.0	5.9	5.1	4.5	4.0	3.7	3.3	3.0
STR2-B-20-※	12.7	9.6	7.9	6.8	5.9	5.3	4.7	4.3	3.9	3.6
STR2-B-25-※	14.7	11.1	9.2	7.9	6.9	6.1	5.5	5.0	4.6	4.2
STR2-B-32-※	24.3	18.5	15.4	13.3	11.7	10.5	9.5	8.7	8.0	7.4

Allowable rotary torque

Torque : T (N・m)



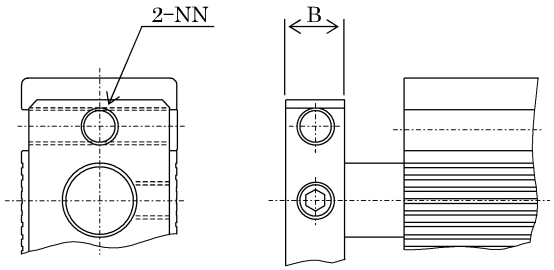
Sliding bearing (N・m)

Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-M-6-※	0.008	0.006	0.005	0.004	0.003	-	-	-	-	-
STR2-M-10-※	0.029	0.024	0.020	0.017	0.015	-	-	-	-	-
STR2-M-16-※	0.099	0.083	0.071	0.063	0.055	0.050	0.045	0.041	0.038	0.036
STR2-M-20-※	0.142	0.121	0.105	0.093	0.084	0.076	0.070	0.064	0.059	0.055
STR2-M-25-※	0.187	0.160	0.140	0.125	0.111	0.101	0.092	0.085	0.079	0.074
STR2-M-32-※	0.383	0.332	0.293	0.262	0.237	0.216	0.199	0.184	0.172	0.161

Roller bearing (N・m)

Model	Stroke (mm)									
	10	20	30	40	50	60	70	80	90	100
STR2-B-6-※	0.009	0.006	0.005	0.004	0.003	-	-	-	-	-
STR2-B-10-※	0.030	0.022	0.018	0.015	0.013	-	-	-	-	-
STR2-B-16-※	0.071	0.053	0.043	0.036	0.031	0.028	0.025	0.023	0.020	0.018
STR2-B-20-※	0.088	0.067	0.055	0.047	0.041	0.037	0.032	0.030	0.027	0.025
STR2-B-25-※	0.125	0.094	0.078	0.067	0.058	0.051	0.046	0.042	0.039	0.035
STR2-B-32-※	0.267	0.203	0.169	0.146	0.128	0.115	0.104	0.095	0.088	0.081

4) In case of utilizing bolt holes NN on the end plate, make sure to keep length of bolt within the dimension B. Otherwise, sticking bolt tip may cause damage of end plate.



Bore size (mm)	Dimension B
ϕ 6	6
ϕ 10	6
ϕ 16	8
ϕ 20	10
ϕ 25	12
ϕ 32	12

5) Keep flatness of matching surface to end plate within 0.05. Otherwise, it may cause malfunction of cylinder.

6) There is a stroke adjusting bolt for 0 to -5mm at the piston retracting end of Super Twin Rod Cylinder. After loosen the hexagonal lock nut and adjust required stroke, keep hexagonal lock nut tightened. Avoid operating cylinder while removing the stopper bolt.

2.2 Piping

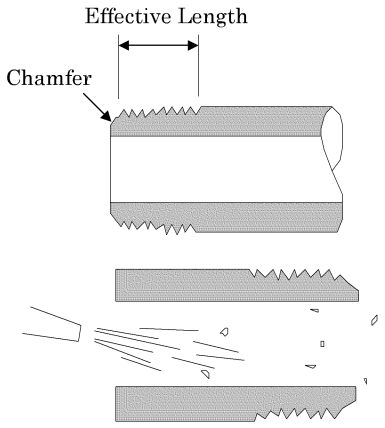
1) For piping beyond the air filter, use pipes that hardly get corroded such as galvanized pipes, nylon tubes, rubber tubes, etc.

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

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

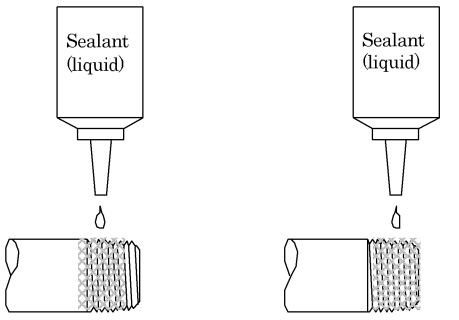
4) Strictly observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.

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



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

●Sealant (liquid)



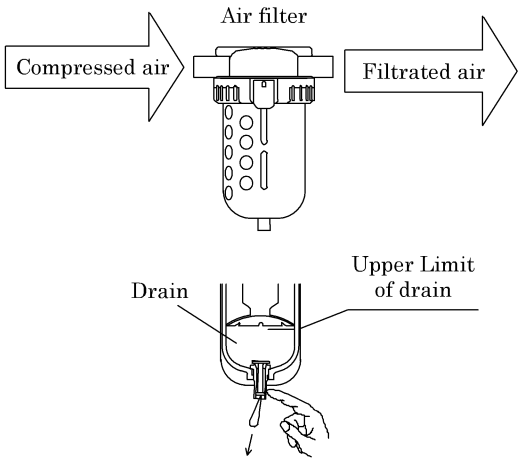
7) Super Twin Rod Cylinder has 2-ea connecting ports in each direction of stroke. Make use of appropriate ports to suit the purpose of operation and plugging other unrequired ports.
Confirm, after relocating plugs, no air leakage through plugged ports.

2.3 Fluid

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

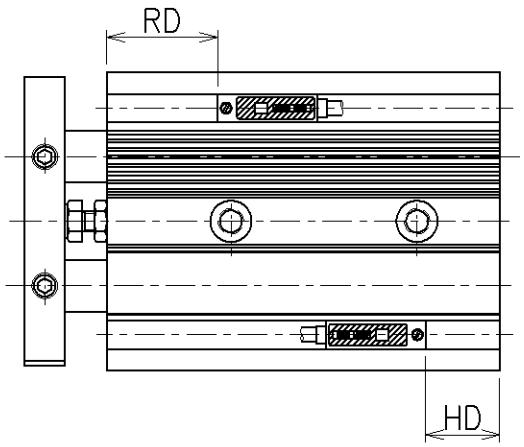
2) Be sure to drain out the accumulation in the filter periodically.

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



2.4 Switch Mounting

1) Switch mounting location



(1) Stroke end mounting
Install one switch at the distance of RD away from rod end and the other at the distance of HD away from cylinder head, so as to have each switch function at its most sensitive location.

(2) Mounting it an intermediate point of stroke
At first, fix the piston rod at the point where rod is made to stop. Slide a switch along the surface of cylinder longitudinally. Mark the first location where switch turns ON while keep sliding till near the stroke end.
Reverse direction of sliding and mark the second location where switch turns ON. The center point of those two points is the most sensitive point of the switch and it is the switch mounting location, accordingly.

2) Scope of function

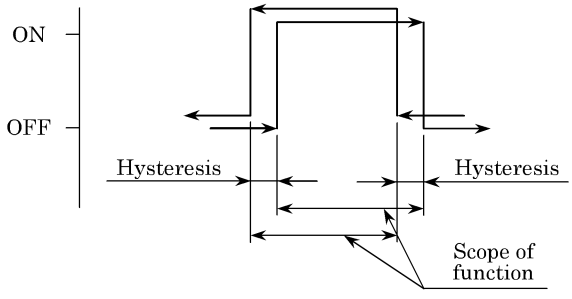
(1) It is the distance of two positions where switch turns ON, while piston continues its stroke in one direction, and where it turns OFF.

(2) The center point of scope of function is the most sensitive point of switch. Selection of this point for piston stopping makes the external magnetic disturbance the least and provides the most stabile function of switch.

3) Hysteresis

(1) It is the distance of two points where switch turns ON as piston travels in one direction and where switch turns OFF while piston travels reversely.

(2) Beware of that the function of switch becomes unstable when piston stops within this distance and easily affected by the disturbance.



- Relocation of switch

  Make switch slide along cylinder tube after loosening the switch mounting screw then tighten mounting screw upon selecting relocating position. (Note 1)

- Replacement of switch

  Take the switch body out of a groove upon loosening switch mounting screw. Insert a new replacement back to a grove and tighten the screw. (Note 1)

Note1: Apply screw tightening torque of 0.1 to 0.2 N.m using prescision driver or watch driver of handle dia. 5 to 6 mm, minus tip width 2.4mm of less, thickness 0.3mm or less.

Maximum sensitive position, operating range and hysteresis (Unit : mm)

Switch model No.	Solid state switch (K2H,K2V,K3H,K3V)				Bicolor solid state switch (K※Y※※)			
Item / Bore size (mm)	Maximum sensitive position		Operating range	Hysteresis	Maximum sensitive position		Operating range	Hysteresis
	HD	RD			HD	RD		
ϕ6	3.5	21	1 to 6	2 or less	2.5	20	4 to 7.5	1.5 or less
ϕ10	2.5	33	1 to 5.5		1	32		
ϕ16	7	39.5	1.5 to 7.5		5.5	38.5	4.5 to 9	
ϕ20	10.5	45	3 to 9		9.5	44	5.5 to 10	
ϕ25	11.5	43.5	3.5 to 10.5		10.5	42.5	6.5 to 10.5	
ϕ32	15.5	55.5			14.5	54.5	1.5 to 10.5	

Switch model No.	Reed switch (K0H,K0V,K5H,K5V)			
Item / Bore size (mm)	Maximum sensitive position		Operating range	Hysteresis
	HD	RD		
ϕ6	3.5	21	4 to 9	3 or less
ϕ10	2.5	33		
ϕ16	7	39.5	5 to 12.5	
ϕ20	10.5	45	6.5 to 14.5	
ϕ25	11.5	43.5	8 to 14.5	
ϕ32	15.5	55.5	5.5 to 14	

※ Switches are mounted at the most sensitive locations (HD,RD) ex-factory.

※ Reed switches (K0H, K0V, K5H, and K5V) are not available for the STR2-B-6,10.

3. OPERATION

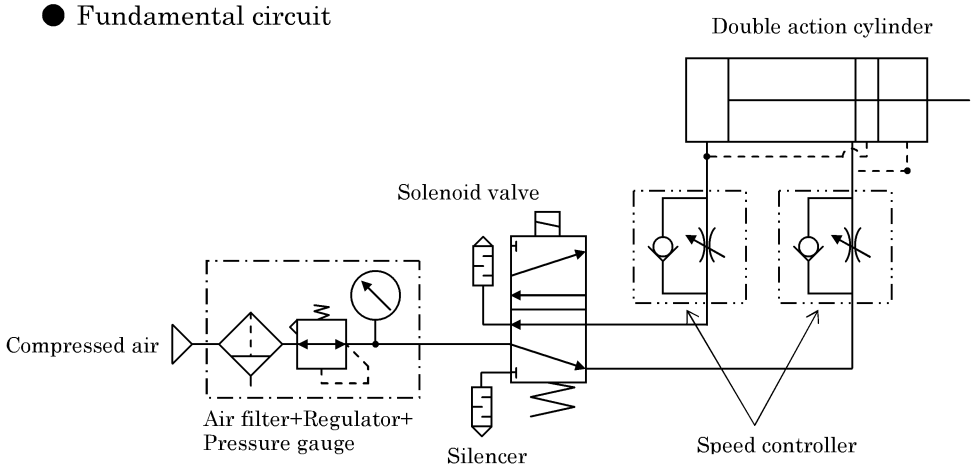
3.1 Operating the Cylinder

1) The working pressure for this type of cylinder is specified in "Product Specifications". Operate the system within this range.

2) Although a rubber cushion is installed to the cylinder, it is advisable to provide an external stopper device in case kinetic energy is large. Tolerable kinetic energy to cylinder with respective bore diameter is per table posted below.

3) Upon installation speed controllers as per Fundamental circuit drawing below figure, set it to the specified working piston speed by opening speed controllers gradually from closing state.

● Fundamental circuit



4) Prevent charging larger lateral load than tolerated to the end plate.
There may be, otherwise, remarkable wear or damage of metal or bearing as well as piston rod.

5) No excessive load should be attached to the end plate.
There may be possible damage of metal or bearing due to momentum inertia.

Remarks : Tolerable kinetic energy

Cylinder boar dia. (mm)	Rubber cushion Tolerable kinetic energy J	
	PUSH	PULL
φ6	0.008	0.059
φ10	0.061	0.083
φ16	0.181	0.083
φ20	0.303	0.127
φ25	0.68	0.237
φ32	1.3	0.311

$$\text{Kinetic energy(J)} = \frac{1}{2} \times \text{Mass (kg)} \times \{\text{Speed(m/s)}\}^2$$

Note : Mean speed of cylinder is calculated by the following formula.

$$v_a = \frac{L}{T}$$

v_a : Mean speed (m/s)
L : Cylinder stroke (m)
T : Response time (s)

Against this, working piston speed just about rushing into cushion is calculated by the following simplified formula.

$$v_m = \frac{L}{T} \times \left(1 + 1.5 \times \frac{\omega}{100}\right)$$

v_m : Working piston speed just about rushing into cushion (m/s)
ω : Cylinder load ratio (%)

To calculate kinetic energy, use the value of v_m in place of speed.

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
Pay consideration to eliminate repetitive bending stress or stretching of lead cord when installing the cord. To the moving portion, use such cord of flexibility as for building robots.

3) Operating temperature
Unserviceable in the ambient temperature over 60℃.
Avoid using this type of cylinder in such a high temperature due to characteristics of magnetic parts and electronic components.

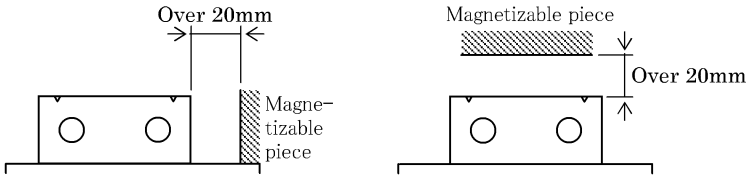
4) Intermediate position detection
Beware that an excessive speed of piston may make relay unable to respond in the system to make the switch actuate in the midway of stroke.

(Example)In case that relay response time is 20ms and switch actuating range is 6mm, set working piston speed less than 30mm/s.

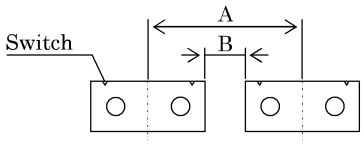
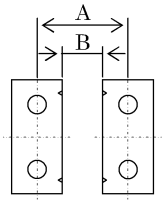
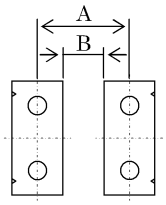
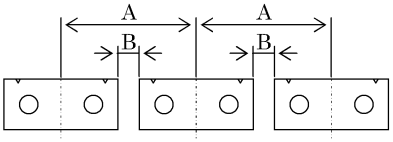
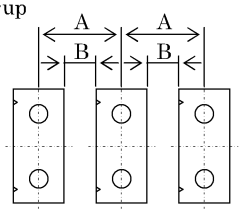
5) Impact
Prevent strong vibration or shock during transportation of cylinder or during installation and adjusting switch.

6) Reed switch is unserviceable with models STR2-B-6 and 10.
Also, avoid mounting STR2-B-6 with solid state switch on such a magnetizable material as iron plate. Detecting error of switch may be resulted.

7) Keep such a magnetizable material as iron away over 20mm from cylinder surface because it may cause malfunction of switch. (All ports same dia.)



8) When installing prural number of cylinders, keep such a magnetizable material as iron away posted in the table below from cylinder surface because it may cause malfunction of switch.

The adjacency condition			Type of switches	φ 6	φ 10	φ 16	φ 20	φ 25	φ 32
2 cylinders parallel	Flat line-up 	A	K2, K3	43	45	56	66	75	111
			K0, K5	40*	47*	62	81	85	111
		B	K2, K3	7	1	2	4	3	15
			K0, K5	4*	3*	8	19	12	15
	Vertical line-up, switches facing to adjacent cylinder 	A	K2, K3	28	27	36	47	47	58
			K0, K5	27*	26*	36	53	53	58
		B	K2, K3	15	12	15	20	14	20
			K0, K5	14*	11*	15	26	20	20
	Vertical line-up, switches on the side away from adjacent cylinder. 	A	K2, K3	19	16	22	28	34	39
			K0, K5	14*	16*	22	33	34	39
		B	K2, K3	6	1	1	1	1	1
			K0, K5	1*	1*	1	6	1	1
More than 3 cylinders parallel	Flat line-up 	A	K2, K3	44	45	57	67	77	111
			K0, K5	41*	47*	64	83	86	111
		B	K2, K3	8	1	3	5	5	15
			K0, K5	5*	3*	10	21	14	15
	Vertical line-up 	A	K2, K3	33	30	40	51	49	58
			K0, K5	30*	28*	42	60	97	58
		B	K2, K3	20	15	19	24	16	20
			K0, K5	17*	13*	21	33	25	20

＊:These are dimensions of model STR2-M series.
As for models STR2-B-6 and 10, reed switches are unserviceable.

3.2.3 Operational Cautions, Solid state switch (K2,K3)

1) Connection of lead wire

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

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

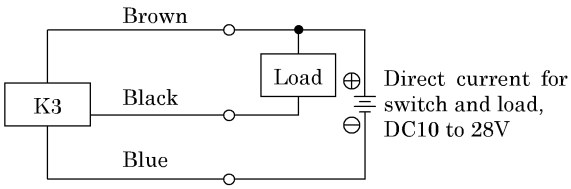


Fig.1 An example (1) of fundamental circuit of K3 (In case the power for switch and load is the same.)

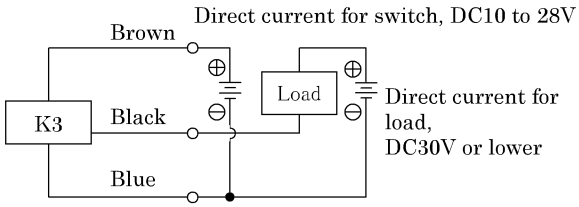


Fig.2 An example (2) of fundamental circuit of K3 (In case the power for switch and load is independent.)

2) Protection of output circuit

Install some protective circuit as per illustrated in Fig. 3 when inducing 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 illustrated in Fig. 4 when capacitor type load (Capacitor type) are to be used because those types apt to generate dash current at turning the switch ON.

Install some protective circuit as per illustrated in Fig. 5 or 6 (in case of model K2) and Fig 7 (in case of model K3) when length of lead wire is over than 10m.

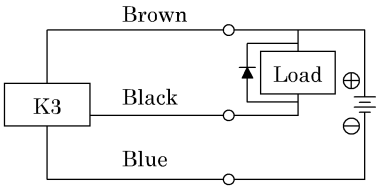


Fig.3 An example of using inducing load together with surge absorptive element (diode). Hitachi Mfg. made diode V06C or equivalent is recommended.)

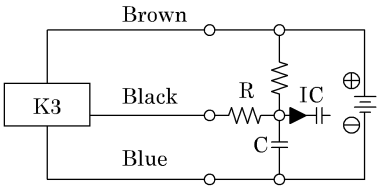


Fig.4 An example of using capacitor type load together with current regulating resister R. Comply with the following formula to figure out required R.

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

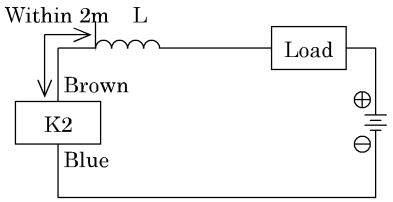


Fig.5・Choke coil L
L=A couple hundred μH to a couple mH surpassing high frequency characteristic
・Install it near by a switch (within 2m)

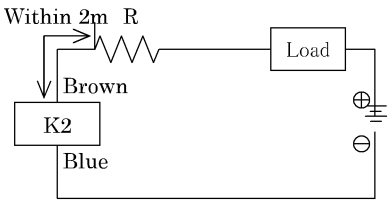


Fig 6 ・Dash current restriction resister R
R=As much large resister as the load circuit can afford
・Install it near by a switch (Within 2m)

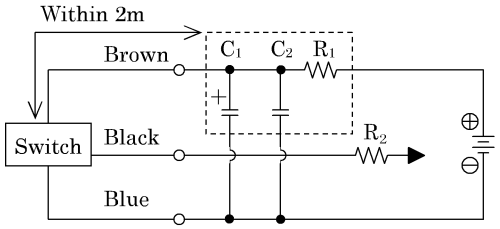


Fig.7 ·Electric power noise absorptive circuit
C_1=20 to 50 μF electrolytic capacitor
(Withstand voltage 50V or more)
C_2=0.01 to 0.1 μF ceramic capacitor
R_1=20 to 30Ω
·Dash current restriction resister R2
R_2=As much large resister as the load circuit can afford.
·Install it near by a switch (within 2m)

3) Connection to a programmable controller (Sequencer).
Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig. 8 to 12 respectively.

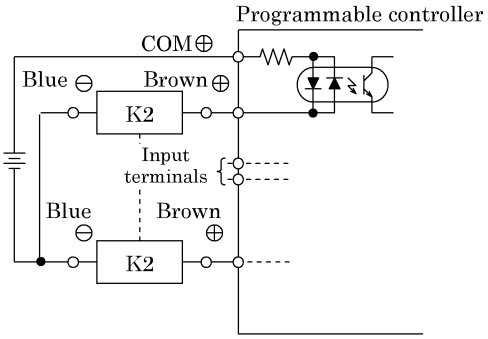


Fig.8 An example of K2 model connection to source load input type (an external power of source)

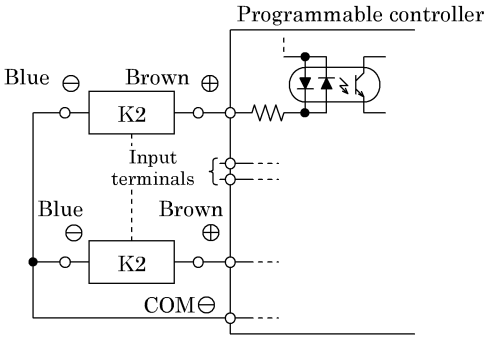


Fig.9 An example of K2 model connection to source load input type (an internal power of source)

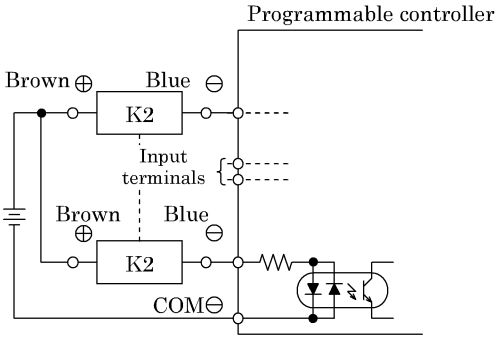


Fig.10 An example of K2 model connection to sink load input type (an external power of source)

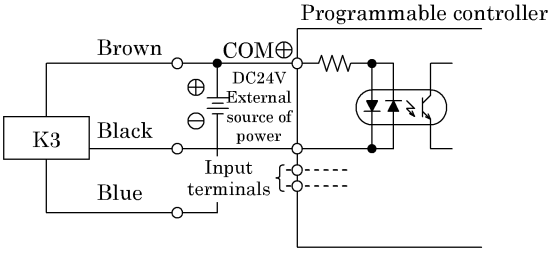


Fig 11 An example of K3 model connection to source load input type (an external power of source)

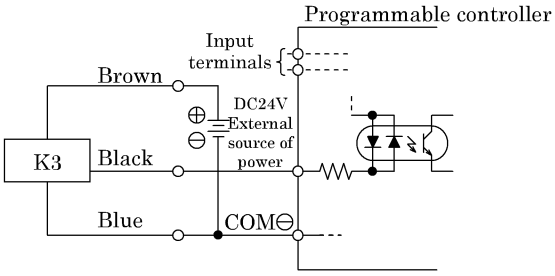


Fig.12 An example of K3 model connection to source load input type (an internal power of source)

4) Series connection

The total voltage loss when series connected K2 switches equals to the sum of respective voltage loss of each switch. Load side voltage is only the residual after total voltage loss. Therefore, confirm the required voltage to the programmable controller input before deciding the number of switches connected in series. It is recommended of consulting us prior to have plural number of K3 switches connedted.

5) Parallel connection

When connecting K2 switches in parallel, leakage current multiplies by the number of switches connected. Therefore, confirm the required current to the programmable controller input before deciding the number of switches connected. In some occasions, either the indicator lights dim or distinguish at all.

While one switch turns ON till turns OFF, the rest of switches do not turn ON due to internal voltage drop between both ends of switch coming lower than range of load voltage. It is, therefore, confirmation of input specification of programmable controller inlet is mandatory.

K3, on the contrary, connection of these switches creates vary rare problem of multiplied leakage due to almost negligible leakage (less than 10μA) of individual switch. There will be no visible difference of luminance of indicator lights.

3.2.3 Operational Cautions, Reed Switch (K0, K5)

1) Connection of lead wire

Instead of connecting a wire to the power source directly, always connect to the load in series. In case of K0 connection, pay the following precautions Ⓐ, Ⓑ.

Ⓐ For DC connection, use such polarities of wires as white ＋ and black －. The switch still functions right with reversed polarities but indicator light is not lit.

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

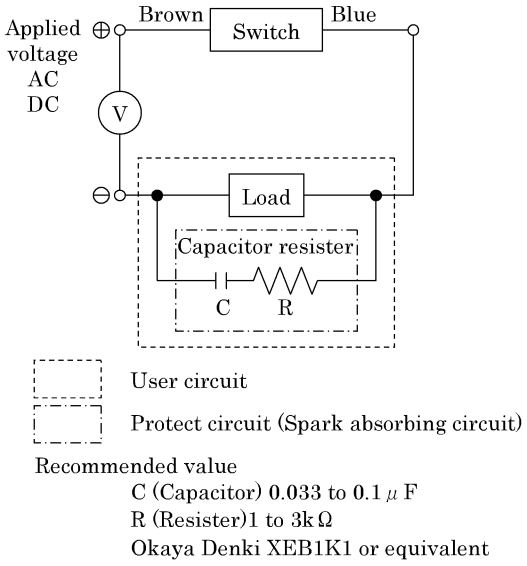
2) Protection of contact point

Install such protective circuit when inducing type load such as relay is to be used or the cord length exceeds the length per table 1, below.

Table 1

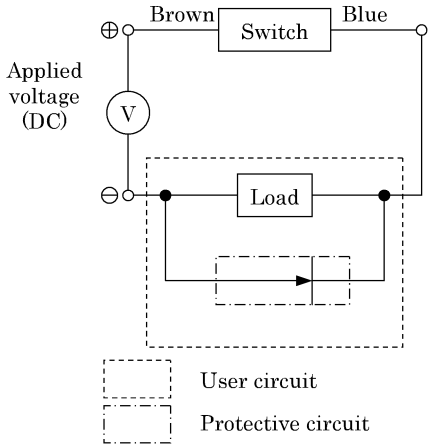
Power Supply	Length of wire
DC	100m
AC	10m

(1) Protective circuit when connecting an inductive type load



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

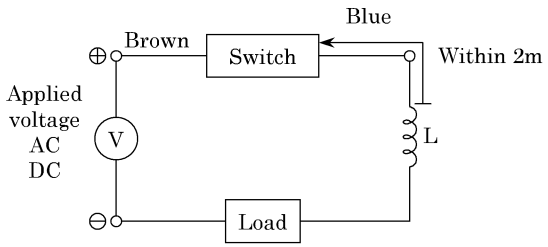
Fig.1 When capacitor resister is used



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

Fig.2 When diode is used

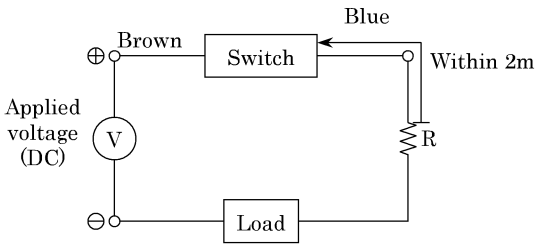
(2) Protective circuit when the wire length exceeds that stated Table 3.



・ Choke coil L
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
R=As much large resister as the load
circuit can afford.

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

Fig.4

3) Capacity of contact points
Avoid using a load exceeding the max. capacity of contact points. On the other hand, in case of K0 model, switch indicator light may not be lit sometimes when current is lower than rated current.

4) Relay
Use such products as specified below or equivalent.
Omron Corporation・・・・・・・・・・・・・・・・・Model MY
Fuji Electric Co., Ltd.・・・・・・・・・・・・・・・Model HH5
Panasonic, Ltd.・・・・・・・・・・・・・・・・・・・・Model HC

5) Series connection
Total voltage loss, when connected K0 switches in series, equals to the sum of respective voltage loss of each switch. The total voltage loss becomes equivalent to one K0 switch (approx. 2.4V) when connecting the combination of one K0 switch for actuation confirming and rest of switches K5. 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 K0, sometimes, cause dimmed indicator light or no indicator light lit.

4. MAINTENANCE

4.1 Periodic Inspection

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

2) Inspection items

(1) Check the bolts and nuts slackening for end plate and cylinder body.

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

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

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

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

(6) Check the stroke for abnormality.

See“4.2. Trouble Shooting”, should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

4.2. Trouble Shooting

1) Cylinder

Troubles	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.
	Broken piston packing	Replace the packing.
Does not function smoothly	Speed is below the low speed limit	Limit the load variation.
	Improper or misalignment of installation	Correct the installation state.
	Exertion of transverse (lateral) load	Install a guide. Revise the installation state.
	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 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.

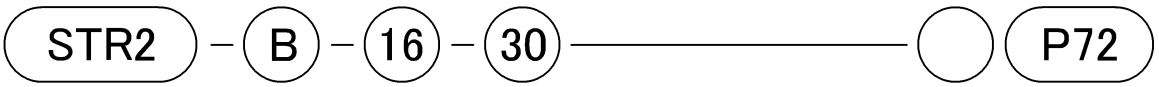
2) Switch

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 within the piston stroke	Adjust speed slower. Replace the relay with a recommended one.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
Switch does not return	Piston is not moving	Make the piston move.
	Deposited contact point	Replace the switch.
	Excessive load (relay) than rated capacity	Replace the relay with a recommended one or replace the switch.
	The ambient temperature is out of the specification range	Adjust the ambient temperature within the range of -10 to 60℃.
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

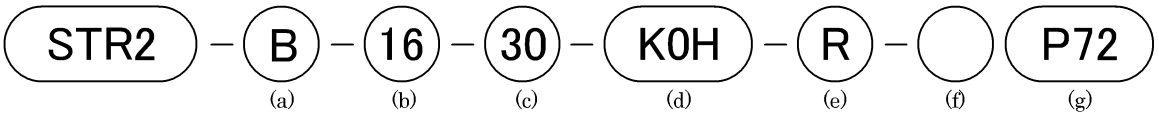
5. HOW TO ORDER

5.1 Product Number Coding

Without switch



With switch



(a) Type of bearing		(b) Bore size (mm)		(c) Stroke (mm)						
M	Sliding bearing	6	ϕ 6	Bore size	ϕ 6	ϕ 10	ϕ 16	ϕ 20	ϕ 25	ϕ 32
B	Roller bearing	10	ϕ 10	10	●	●	●	●	●	●
		16	ϕ 16	20	●	●	●	●	●	●
		20	ϕ 20	30	●	●	●	●	●	●
		25	ϕ 25	40	●	●	●	●	●	●
		32	ϕ 32	50	●	●	●	●	●	●
				60	–	–	●	●	●	●
				70	–	–	●	●	●	●
				80	–	–	●	●	●	●
				90	–	–	●	●	●	●
				100	–	–	●	●	●	●

(d) Switch model No.					(e) Qty. of switches		(f) Option	
Axial lead wire	Radial lead wire	Switch type	Indicator light	Lead wire	R	One on rod side	No code	No option
					H	One on head side	O	Piping port position change 180°
K0H※	K0V※	Reed	1 color indicator light	2 wire	D	2 installed		
K5H※	K5V※		Without indicator light					
K2H※	K2V※	Solid state	1 color indicator light	3 wire				
K3H※	K3V※							
K2YH※	K2YV※		2 color indicator light	2 wire				
K3YH※	K3YV※							

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

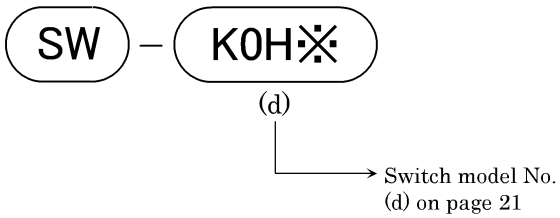
※ mark indicates length of lead wire.

(g) Clean room specifications (Note)		
	Structure	Material restriction
P72	Exhaust treatment	–
P73	Vacuum treatment	–
P52	Exhaust treatment	Copper, silicon, halogen-based (fluorine・chlorine・oxalic) unacceptable
P53	Vacuum treatment	Copper, silicon, halogen-based (fluorine・chlorine・oxalic) unacceptable

Note : "P52,P53" are custom orders.

5.2 Component Parts Model Coding

1) Switch only



6. SPECIFICATION

6.1 Product Specification

Items			STR2-M-P7・P5 STR2-B-P7・P5					
Bore size		mm	φ6	φ10	φ16	φ20	φ25	φ32
Actuation			Double-acting					
Working fluid			Compressed air					
Max. working pressure		MPa	0.7					
Min. working pressure		MPa	0.25	0.2	0.15			
Proof pressure		MPa	1.05					
Ambient temperature		℃	-10 to60 (No freezing)					
Port size			M5					Rc1/8
Port size (Relief port)			M5					Rc1/8
Stroke tolerance		mm	$^{+2.0}_{0}$					
Adjustable stroke range		mm	0 to-5					
Working piston speed		mm/s	50 to500					
Revolvable angle tolerance	M :Sliding bearing		±0.4°	±0.3°			±0.2°	
	B :Roller bearing		±0.2°	±0.1°			±0.3°	
Cushion			Rubber cushion					
Lubrication			Not required					
Allowable Energy absorption		PUSH	0.008	0.061	0.181	0.303	0.68	1.3
	J	PULL	0.059	0.083	0.083	0.127	0.237	0.311

6.2 Switch specification

1) Type of switch and application

Model code / Items			Purpose・Application
Solid state	2 wire	K2H	Exclusively for DC Programmable Controller
		K2V	
	3 wire	K3H	For DC Programmable Controller and Relay
		K3V	
Reed	2 wire	K0H	For AC/DC Relay and Programmable Controller
		K0V	
		K5H	For AC / DC Programmable Controller, Relay, IC circuit (No indicator light): Series connection
		K5V	
Bicolor solid state	2 wire	K2YH	Exclusively for DC Programmable Controller
		K2YV	
	3 wire	K3YH	For DC Programmable Controller and Relay
		K3YV	

Note 1. K※H indicate lead wire straight type, K※V indicate lead wire L type.

2) Switch Specification

Items	Reed 2 wire			
	K0H/V		K5H/V	
Applications	For Relay and Programmable Controller		For Programmable Controller, Relay, IC circuit (No indicator light): Series connection	
Power Supply Voltage	—			
Load Voltage	DC12/24V	AC110V	DC5/12/24V	AC110V
Load Current	5 to 50mA	7 to 20mA	50mA or lower	20mA or lower
Current consumption	—			
Internal Voltage Drop	2.4V or lower		0V	
Indicator light	LED (ON lighting)		—	
Leakage current	0mA			
Length of Lead wire (Note 1)	Standard 1m (Oil resistance Vinyl cabtyre cord, 2-core 0.2mm²)			
Shock resistance	294m/s²			
Insulation Resistance	20MΩ or more with DC 500V meggar tester			
Withstand voltage	Should be no abnormality for 1 minute charging AC1000V			
Ambient temperature	-10 to 60℃			
Degree of protection	IEC Standard IP67, JIS C0920 (Splash Proof), Oil resistance			

Items	Solid state 2 wire	
	K2H/V	K2YH/V
Applications	Exclusively for Programmable Controller	
Power Supply Voltage	—	
Load Voltage	DC10 to 30V	
Load Current	5 to 20mA (Note 2)	
Current consumption	—	
Internal Voltage Drop	4V or lower	
Indicator light	LED (ON lighting)	Red/Green LED (ON lighting)
Leakage current	1mA or lower	
Length of Lead wire (Note 1)	Standard 1m (Oil resistance Vinyl cabtyre cord, 2-core 0.2mm²)	Standard 1m (Oil resistance Vinyl cabtyre cord, 2-core 0.3mm²)
Shock resistance	980m/s²	
Insulation Resistance	20MΩ or more with DC 500V meggar tester	100MΩ or more with DC 500V meggar tester
Withstand voltage	Should be no abnormality for 1 minute charging AC1000V	
Ambient temperature	-10 to 60℃	
Degree of protection	IEC Standard IP67, JIS C0920 (Splash Proof), Oil resistance	

Items	Solid state 3 wire	
	K3H/V	K3YH/V
Applications	For Programmable controller and Relay	
Power Supply Voltage	DC10 to 28V	
Load Voltage	DC30V or lower	
Load Current	50mA or lower	
Current consumption	10mA or lower at DC24V	
Internal Voltage Drop	0.5V or lower	
Indicator light	LED (ON lighting)	Red/Green LED (ON lighting)
Leakage current	10μA or lower	
Length of Lead wire (Note 1)	Standard 1m (Oil resistance Vinyl cabtyre cord, 3-core 0.2mm²)	
Shock resistance	980m/s²	
Insulation Resistance	20 MΩ or more with DC 500V meggar tester	100 MΩ or more with DC 500V meggar tester
Withstand voltage	Should be no abnormality for 1 minute charging AC1000V	
Ambient temperature	-10 to 60℃	
Degree of protection	IEC Standard IP67, JIS C0920 (Splash Proof), Oil resistance	

Note 1 : 3m, 5m optional lead wire are available besides standard length.

Note 2 : Max. Load Current (20A) is at 25℃. It may drop lower than 20mA when ambient temperature rises higher than 25℃. (For example: it may be 5 to 10mA at 60℃.)