CKD

SM－461692-A

INSTRUCTION MANUAL

TIGHT CYLINDER

(Air Cushioned)

CMK2-C

- 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 3rd edition

For Safety Use

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

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

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

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

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

⚠ CAUTION :

- 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.

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TIGHT CYLINDER
(Air Cushioned)
Manual No. SM-461692-A

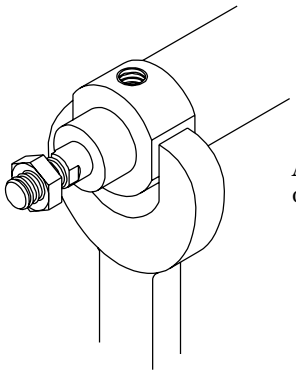
1. UNPACKING

1) Make sure that the type No. on the nameplate of the delivered Selex 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 cylinder is -10 to 60℃ (No freezing).
2) Use cylinder with bellows over its rod within the area with much dust.
3) Carefully avoid other object from hitting the tube. Otherwise, it may get the tube distorted and cause malfunction of the cylinder.
4) Assembly of mounting brackets:
   Apply an open ended spanner onto double sided machined surface of mounting end cover as shown below when to hold the tube while attaching the mounting bracket.

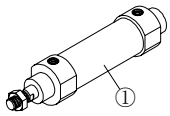


Apply an open ended spanner onto the double sided machined surface.

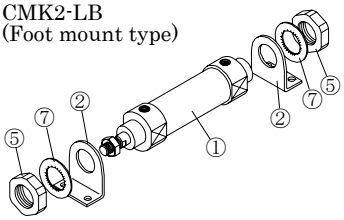
The mounting brackets are supplied with the cylinder at the time of delivery. Install them as shown in the upper figures on next page. Tightening torque is 23N・m.

Assembly of mounting bracket (Same as disassembling)

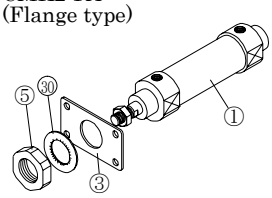
CMK2-00 (Basic type)



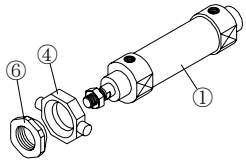
CMK2-LB (Foot mount type)



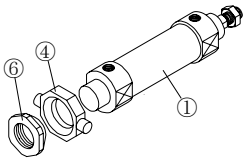
CMK2-FA (Flange type)



CMK2-TA (Rod side trunnion type)



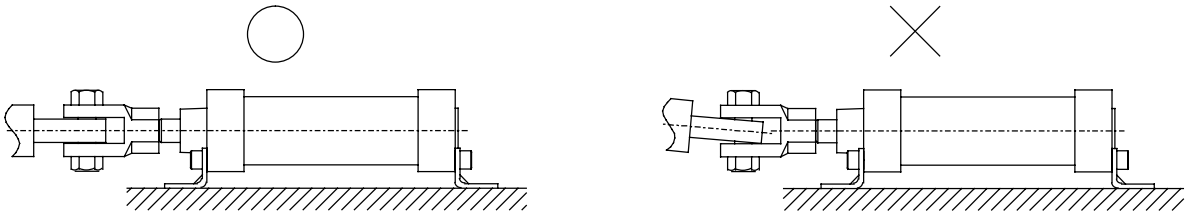
CMA2-TB (Head side trunnion type)



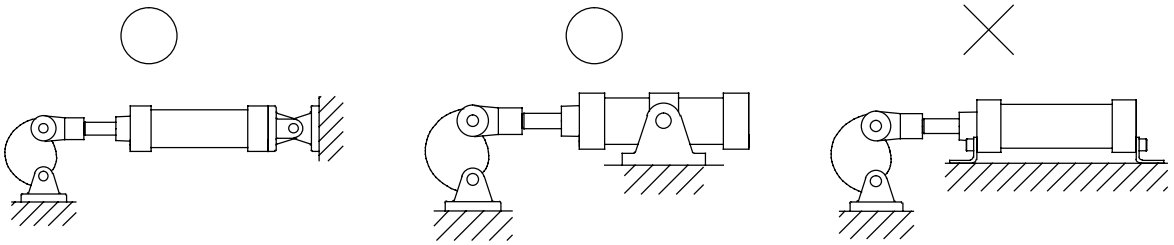
No.	Parts name	No.	Parts name
①	Cylinder body	⑥	Nut (for both TA type and TB type)
②	Foot bracket	⑦	Mounting Washer (for LB type and FA type)
③	Flange		
④	Trunnion (Axis type)		
⑤	Nut (for both LB type and FA type)		

5) When cylinder is fixed and rod end is guided:
In case the piston rod of cylinder and the load are misaligned, the bushes and packings of the cylinder are extremely worn out.

6) 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.6)



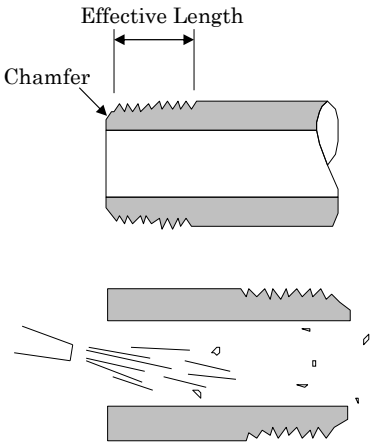
7) When the load acting direction changes with the cylinder operation:
Use an oscillating cylinder (clevis type or trunnion type) capable of making revolution to a certain angle.



Clevis type　　Trunnion type　　Foot type

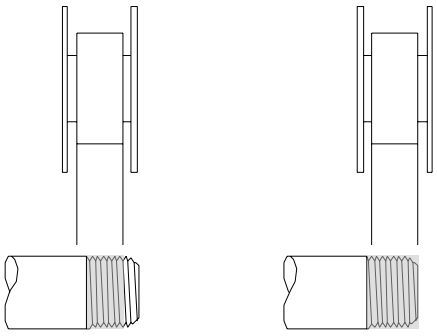
2.2 Piping

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.



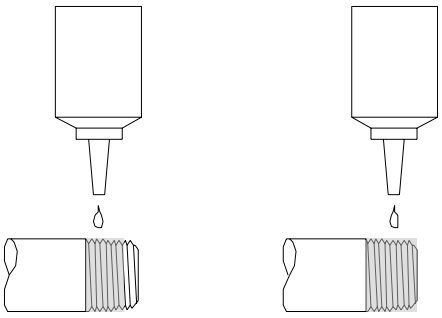
6) Refrain from applying sealant or sealing tape approx. two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.

● Seal Tape



(Correct) (Incorrect)

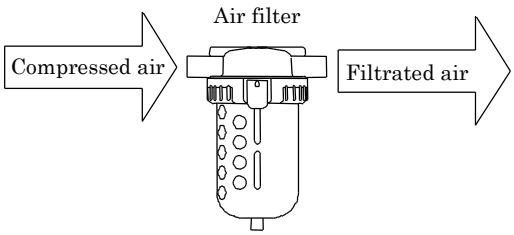
● Sealant (liquid)



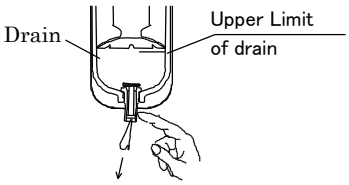
(Correct) (Incorrect)

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 5 μ m or less), flow rate and its mounting location (as nearest to the direc- tional control valve as possible).



2) Be sure to drain out the accumula- tion in the filter periodically.

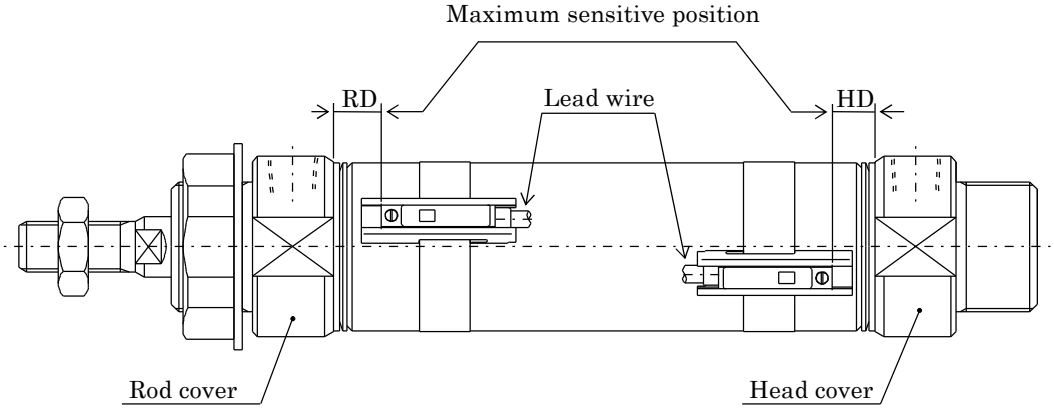


3) Note that the intrusion of carbide for the compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of the solenoid valve and the cylinder. Be sure to carry out thorough inspection and maintenance of the compressor.

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.

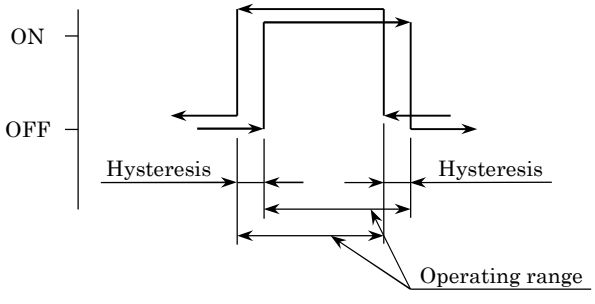


(1) At the stroke end
Refer the illustration above. Mount switches within the rod side dimension RD as well as the head side dimension HD for the purpose of having switches function at the points of the maximum sensitive position.

(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 posits is of the maximum sensitive position and where the switch is supposed to be installed.

(3) Location around the circumference of cylinder
There is no restriction. Install switch(es) wherever easy to utilize it.

2) Operating range
The switch turns on first and turns off as the piston moves along its stroke. Precise operating range deviate slightly depending upon the direction of piston movement as shown right.



3) Hysteresis
Precise operating range deviate slightly depending upon the direction of piston movement as shown right.

4) Relocation of switch and replacement

(1) Relocation of switch
Slide switch body along cylinder tube after loosening mounting screws and tighten screws when located the most sensitive position.

(2) Replacement of Switch
Take out switch out of groove after loosening mounting 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 to 0.2N ・m)

Maximum sensitive position (HD, RD), Operating Range, Hysteresis (unit:mm)

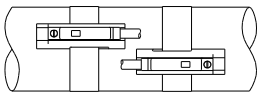
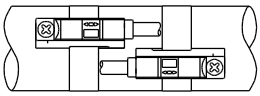
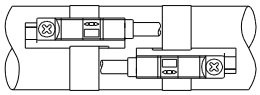
Proximity switch								
Bore size (mm)	T2□, T3□, T3P□, T2Y□, T3Y□, T2J□							
	Max. sensitive position				Operating range (reference value)		Hysteresis	
	Head side HD (mm)		Rod side RD (mm)					
	1-color display	2-color display	1-color display	2-color display	1-color display	2-color display	1-color display	2-color display
ϕ 20	7.0	6.0	8.0	7.0	2.5 to 5.5	3.5 to 7.5	1.5 or less	1.0 or less
ϕ 25	8.5	7.5	9.5	8.5	2.5 to 5.5	3.5 to 7.5		
ϕ 32	8.5	7.5	9.5	8.5	2.5 to 6.0	3.5 to 8.0		
ϕ 40	10.5	9.5	11.5	10.5	3.0 to 7.0	4.0 to 9.0		

Proximity switch								
Bore size (mm)	T2W□, T3W□				T1□			
	Max. sensitive position		Operating range (reference value)	Hysteresis	Max. sensitive position		Operating range (reference value)	Hysteresis
	Head side HD (mm)	Rod side RD (mm)			Head side HD (mm)	Rod side RD (mm)		
ϕ 20	9.0	10.0	3.5 to 7.5	1.0 or less	6.0	7.0	2.5 to 5.5	1.5 or less
ϕ 25	10.5	11.5	3.5 to 7.5		7.5	8.5	2.5 to 5.5	
ϕ 32	10.5	11.5	3.5 to 8.0		7.5	8.5	2.5 to 6.0	
ϕ 40	12.5	13.5	4.0 to 9.0		9.5	10.5	3.0 to 7.0	

Reed switch								
Bore size (mm)	T0□, T5□				T8□			
	Max. sensitive position		Operating range (reference value)	Hysteresis	Max. sensitive position		Operating range (reference value)	Hysteresis
	Head side HD (mm)	Rod side RD (mm)			Head side HD (mm)	Rod side RD (mm)		
ϕ 20	7.0	8.0	6.5 to 11.0	3 or less	1	2	6.5 to 11.0	3 or less
ϕ 25	8.5	9.5	7.5 to 12.0		2.5	3.5	7.5 to 12.0	
ϕ 32	8.5	9.5	6.5 to 11.5		2.5	3.5	6.5 to 11.5	
ϕ 40	10.5	11.5	7.5 to 13.5		4.5	3.5	7.5 to 13.5	

5) Location of switches mount at ex-factory
Switches are mounted at the maximum sensitive position on cylinder. And the location along circumference of cylinder differs in accordance with stroke. Refer the table below.

●Min. stroke length of types with switch

Switch type		T0□※･T5□※･T2□※･T3□※･T3P□※	T2W□※･T3W□※	T2Y□※･T3Y□※･T2J□※･T8□※･T1□※	
Stroke	One piece	10 mm		10mm	
	Two pieces	25 mm	30 mm	Over 25 mm and under 35 mm	35 mm
Sketch					

3. OPERATION

3.1 Operating the Cylinder

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

2) Though the cushion has been adjusted at no load when delivered, adjust the cushion needle when the change of cushion effect is required.
Tightening the needle (clockwise) makes cushion more effective. Tighten the needle lock nut all the way after adjustment.
If kinetic energy such as load is heavy or speed is too fast, exceeding the values given in Table 1, consider of providing a shock absorber.

Table1

Bore size (mm)	Effective air cushion length (mm)	Allowable energy absorption (J)
ϕ 20	12	0.34
ϕ 25		0.46
ϕ 32		0.88
ϕ 40		1.27

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

3.2 How to use the Switches

3.2.1 Common items

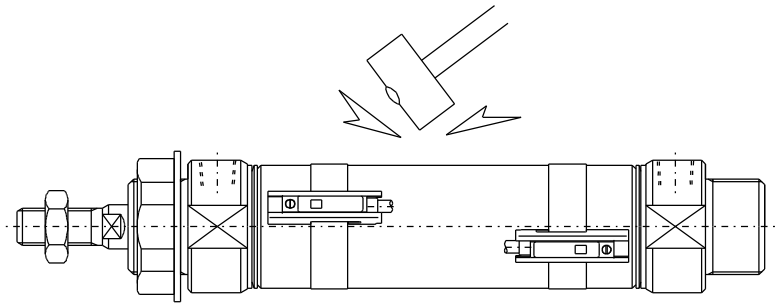
1) Magnetic environment
Avoid installation of switches within the area where strong magnetic field or large current (such as large magnet or spot welding equipment) exist. There may be a certain influence over sensing accuracy due to the interference of each magnetic field in case of parallel connection of cylinders with switch or when a magnetized article very much closely passes by the cylinder switch.

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 50℃).
Always avoid operation of the product in a hot place due to temperature characteristics of magnetic and electronics parts.

4) Intermediate position detection
When activating the switch halfway of the stroke, the relay may not respond if the working piston speed is too fast.
When the operation time of the relay is 20 ms, operate the product at a working piston speed of 500 mm/s or less.

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



3.2.2 Operational Cautions, Solid state switch (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.

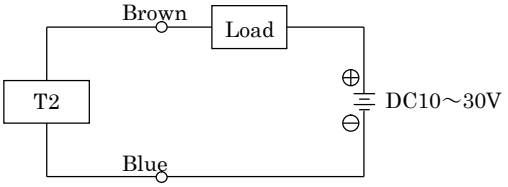


Fig.1 Fundamental circuit Example of T2

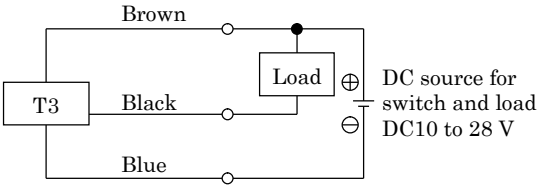


Fig.2 Fundamental circuit Example of T3 (1)
(In case the same source of power is used.)

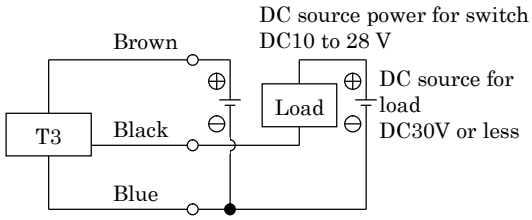


Fig.3 Fundamental circuit Example of T3 (2)
(In case individual sources of power are used.)

2) Protection of output circuit

Install some protective circuit as illustrated in Fig. 4 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. 5 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. 6or 7 (in case of model T2) and Fig 8 (in case of model T3).

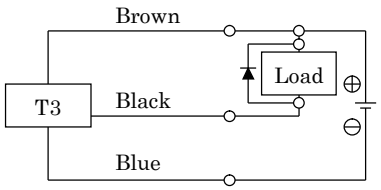
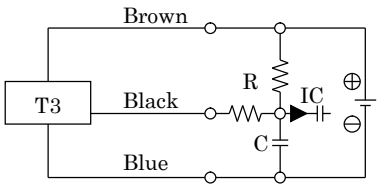


Fig.4 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)



Flg.5 An example of using capacitor type load together with current regulating resister R.
Comply with the following formula to figure out required R. $\frac{V}{0.05}=R(\Omega)$

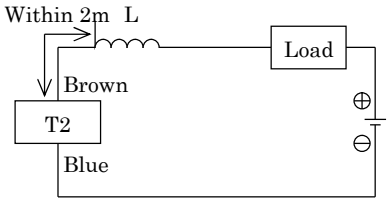


Fig.6 · Choke coil
L= a couple hundred μH to a couple mH surpassing high frequency characteristic
· Install it near by a switch (within 2m).

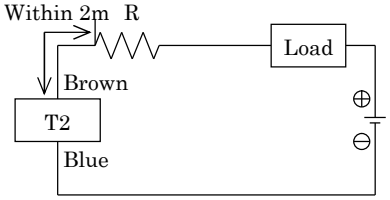


Fig.7 · Dash current restriction resister.
R= As much large resister as the load circuit can afford.
· Install it near by a switch (within 2m).

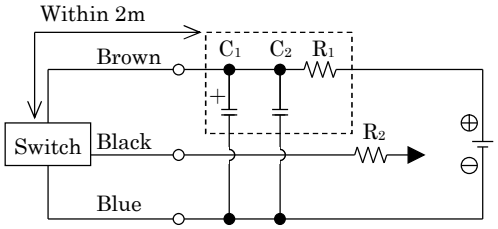


Fig8· Electric power noise absorptive circuit.
C_1=20 to 50 μF electrolytic capacitor
(Withstand voltage 50V or more)
C_2=0.01 to 0.1 μF ceramic capacitor
R_1=20 to 30Ω

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

3) Protection of output circuit

Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig. 9 to 13 respectively.

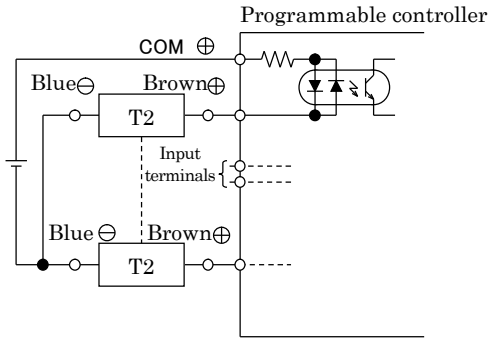


Fig.9 An example of T2 connection to source input type (an external power source)

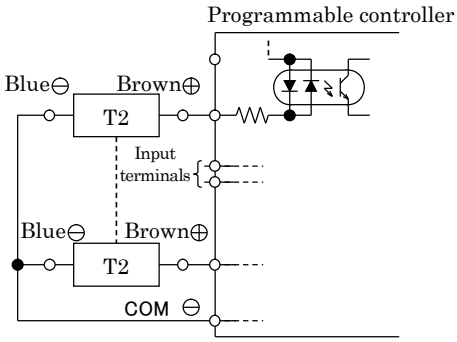


Fig.10 An example of T2 connection to source input type

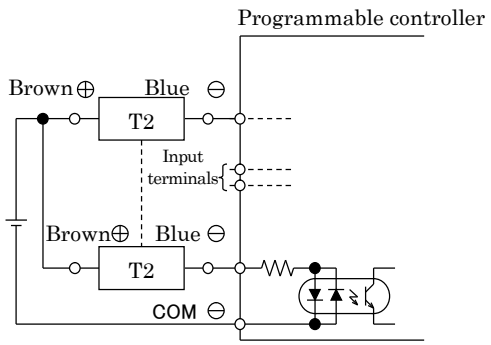


Fig.11 An example of T2 connection to source input type

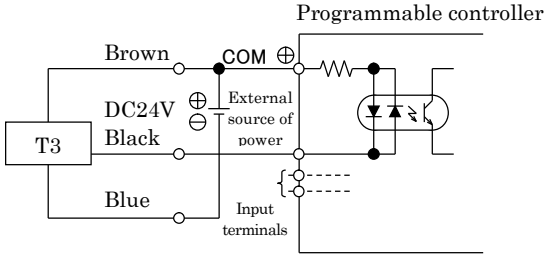


Fig.12 An example of T3 connection to source input type (an internal power source)

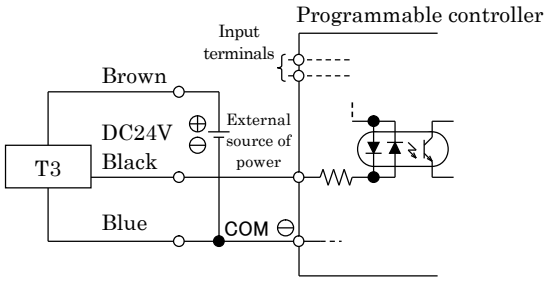


Fig.13 An example of T3 connection to source input type (an internal power source)

4) Series 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 10 μA, then leakage may occur. Usually dimming and failure of the indicator light do not occur.

3.2.3 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 and T8 switch, carefully check following items (1), (2).

(1) 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.

(2) 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.

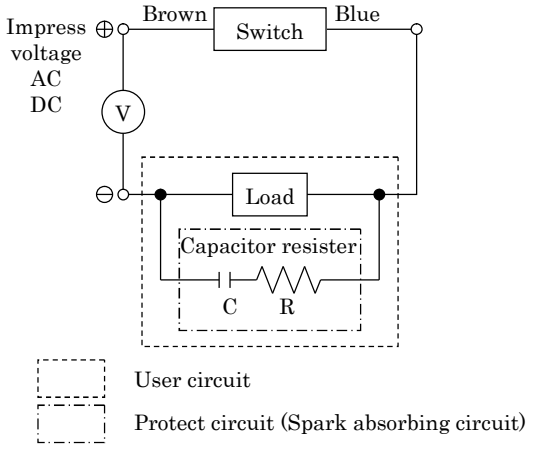
2) Contact protective measures

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

Table1

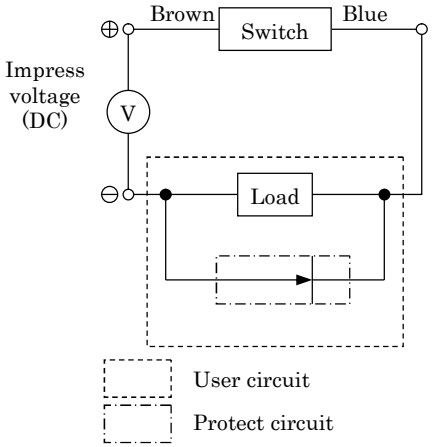
Electric power	Length of wire	
	T0, T5	T8
DC	50m	50m
AC	10m	30m

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



Recommended value
C (Capacitor) 0.033 to 0.1 μ F
R (Resister)1 to 3k Ω
XEB1K1 Okaya Denki Mfg or equivalent

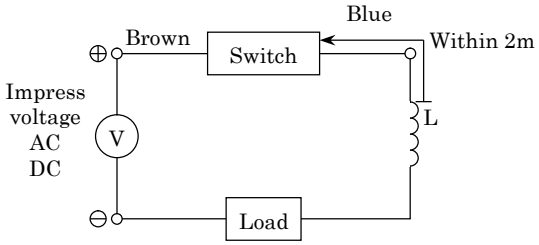
Fig.1 When capacitor resister is used.



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

Fig.2 When diode is used.

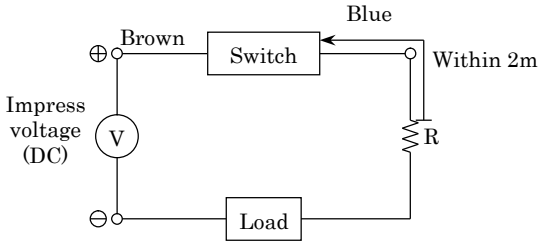
(2) Protective circuit when the wire length exceeds that stated Table 1



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

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

Fig.3



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

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

Fig.4

3) 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.

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, 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 fitting the piston rod end brackets and mounting brackets for slackening.
   (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 "Trouble shooting", 5 should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

5. TROUBLE SHOOTING

1) Cylinder

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 and consider the adoption of low pressure cylinder.
	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.

Note : The cylinder of this type is unable to be disassembled because of being caulked type assembly.
Replace cylinder in its entirety when some trouble is discovered.

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. Tightening torque is 0.5 to 0.7 N･m
	Incorrect direction of switch mounting	Correct the direction of the switch mounting.
	Relay is unable to respond properly	Replace the relay with a recommended one.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
	Excessive speed of piston if it is to sense an intermediate point of stroke	Reduce the speed of piston. Connect switches in parallel Use “R6” type
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.

Note1. Refer ”2.4 Location of mounting Switches on a Cylinder” as for replacing a switch and correcting its location.

6. HOW TO ORDER

6.1 Product Number Coding

● Without switch

CMK2-C - 00 - 20 NN - 100 ——— V I

● With switch

CMK2-C - 00 - 20 NN - 100 - T0H - R - V I

(a) (b) (c) (d) (e) (f) (g) (h)

(a) Mounting style		(b) Bore size (mm)		(c) Pipe thread type	
00	Basic type	20	ϕ 20	Blank	Rc
LB	Axial foot type (both sides)	25	ϕ 25	NN	NPT (custom order)
LS	Axial foot type (single)	32	ϕ 32	GN	G (custom order)
FA	Rod side flange type	40	ϕ 40		
FB	Head side flange type				
CA	Eye type				
CC	Fixed eye type				
CC1	Eye, bush press fitting type				
CB	Clevis type				
TA	Rod side trunnion type				
TB	Head side trunnion type				

(d) Stroke (mm) (Note1)		(e) Switch model No.					(f) Switch quantity	
25	25	Lead wire Straight type	Lead wire L type	Switch type	Indicator light	Lead wire	R	One on rod side
50	50						H	One on head side
75	75	T0H※	T0V※	Reed	1 color indicator	2 wire	D	Two
100	100	T5H※	T5V※		Without indicator light		T	Three
150	150	T8H※	T8V※		1 color indicator			
200	200	T1H※	T1V※	Solid state				
250	250	T2H※	T2V※					
300	300	T3H※	T3V※			3 wire		
		T3PH※	T3PV※					
		T2YH※	T2YV※		2 color indicator	2 wire		
		T3YH※	T3YV※			3 wire		
		T2WH※	T2WV※			2 wire		
		T3WH※	T3WV※			3 wire		
		T2JH※	T2JV※		Off delay type	2 wire		

※mark shows lead wire length.

Note1. For single foot type (LS type), maximum stroke length is 50mm.

※Lead wire length	
Blank	1 (standard)
3	3m (option)
5	5m(option)

(g) Option (Note2、Note3、Note4)				(h) Accessory	
		Max. ambient	Max. instantaneous	I	Rod eye
J	Bellows	100℃	200℃	Y	Rod clevis
L	Bellows	250℃	400℃	B2	(Pin and washer splitpin are attached)
F	Push-in joint (straight)				
FE	Push-in joint (elbow)				
M	Piston rod material (stainless steel)				
V	Boss cut off				

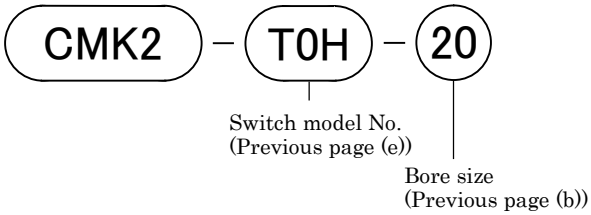
Note2. Applicable tube outer diameter of F : push-in joint (straight), FE : push-in joint (elbow) is 6mm.

Note3. For bellows "J" type, stroke length should be more than 25mm. When stroke length is shorter than 25mm, consult with CKD.

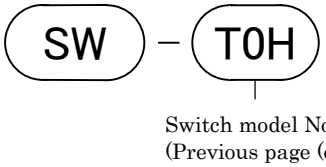
Note4. Instantaneous maximum temperature is the temperature when spark and spatter etc. instantaneously contact to bellows.

6.2 Component parts Model coding

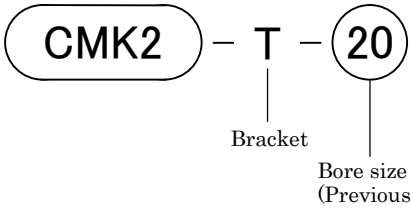
- Switch main body + Mounting bracket



- Switch only



- Mounting bracket



7. SPECIFICATION

7.1 Product Specifications

Model / Item		CMK2-C			
Bore size	mm	φ20	φ25	φ32	φ40
Actuation		Double-acting type			
Working fluid		Compressed Air			
Max. working pressure	MPa	1.0			
Min. working pressure	MPa	0.2			
Proof pressure	MPa	1.6			
Ambient temperature	℃	−10 to 60((No freezing)			
Port size		Rc1/8			
Stroke tolerance	mm	$^{+2.0}_{0}$ (to 200), $^{+2.4}_{0}$ (over 200)			
Working piston speed	mm/s	50 to 700 (Use within the allowable energy absorption)			
Cushion		Air cushion			
Lubrication		Not required (When lubricating, use turbine oil ISO VG32.)			
Allowable energy absorption	J	0.34	0.46	0.88	1.27

7.2 Switch Specifications

Type & Model / Item	Reed 2 wire						
	T0H/V		T5H/V		T8H/V		
Applications	For programmable controller, relay		For programmable controller, relay, IC circuit (without indicator light), series connection		For programmable controller, relay		
Power voltage	—						
Load Voltage	12/24 VDC	110 VAC	5/12/24 VDC	110 VAC	12/24 VDC	110 VAC	220 VAC
Load Current	5 to 50 mA	7 to 20 mA	50 mA or less	20 mA or less	5 to 50 mA	7 to 20 mA	7 to 10 mA
Current consumption	—						
Internal voltage drop	3 V or less		0.1 V or less		4 V or less		
Indicator lamp	Red LED (Lit when ON)		Without indicator lamp		Red LED (Lit when ON)		
Leakage current	0 mA						
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtyre cable 2-conductor 0.2 mm²)				Standard 1m (Oil resistant vinyl cabtyre cable 2-conductor 0.3 mm²)		
Max. shock resistance	294 m/s²						
Insulation resistance	20 MΩ and over with 500 VDC megger				100 MΩ and over with 500 VDC megger		
Withstand voltage	No failure after 1 minute of 1,000 VAC application				No failure after 1 minute of 1,500 VAC application		
Ambient temperature range	−10℃(14°F) to 60℃(140°F)						
Protection structure	IEC Standards IP67, JIS C0920 (water-tight type), oil resistance						

Type & Model / Item	Proximity 2-wire				
	T1H/V	T2H/V	T2YH/V	T2JH/V	T2WH/V
Applications	For programmable controller, relay, compact solenoid valve	Dedicated for programmable controller			
Power voltage	—				
Load Voltage	85 to 265 VAC	10 to 30 VDC			24 VDC±10%
Load Current	5 to 100 mA	5 to 20 mA (Note2)			
Current consumption	—				
Internal voltage drop	10% or less of load voltage	4 V or less			
Off-delay time	—			200±50 ms	—
Indicator lamp	Red LED (Lit when ON)		Red / green LED (Lit when ON)	Red LED (Lit when ON)	Red / green LED (Lit when ON)
Leakage current	1 mA or less with 100 VAC 2 mA or less with 200 VAC	1 mA or less			
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtyre cable 2-conductor 0.3 mm^2)	Standard 1m (Oil resistant vinyl cabtyre cable 2-conductor 0.2 mm^2)	Standard 1m (Oil resistant vinyl cabtyre cable 2-conductor 0.3 mm^2)		Standard 1m (Oil resistant vinyl cabtyre cable 2-conductor 0.2 mm^2)
Max. shock resistance	980 m/s^2				
Insulation resistance	100 MΩ and over with 500 VDC megger	20 MΩ and over with 500 VDC megger	100 MΩ and over with 500 VDC megger		20 MΩ and over with 500 VDC megger
Withstand voltage	No failure after 1 minute of 1,500 VAC application	No failure after 1 minute of 1,000 VAC application			
Ambient temperature range	−10℃(14°F) to 60℃(140°F)				
Protection structure	IEC Standards IP67, JIS C0920 (water-tight type), oil resistance				

Type & Model / Item	Proximity 3-wire			
	T3H/V	T3PH/V	T3YH/V	T3WH/V
Applications	For programmable controller, relay			
Power voltage	10 to 28 VDC			
Load Voltage	30 VDC or less			
Load Current	100 mA or less		50 mA or less	
Current consumption	10 mA or less with 24 VDC			
Internal voltage drop	0.5 V or less			
Indicator lamp	Red LED (Lit when ON)	Yellow LED (Lit when ON)	Red / green LED (Lit when ON)	
Leakage current	10 μA or less			
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtyre cable 3-conductor 0.2 mm^2)		Standard 1m (Oil resistant vinyl cabtyre cable 3-conductor 0.3 mm^2)	Standard 1m (Oil resistant vinyl cabtyre cable 3-conductor 0.2 mm^2)
Max. shock resistance	980 m/s^2			
Insulation resistance	20 MΩ and over with 500 VDC megger		100 MΩ and over with 500 VDC megger	20 MΩ and over with 500 VDC megger
Withstand voltage	No failure after 1 minute of 1,000 VAC application			
Ambient temperature range	−10℃(14°F) to 60℃(140°F)			
Protection structure	IEC Standards IP67, JIS C0920 (water-tight type), oil resistance			

Note1: 3 m or 5 m long lead wire is optionally available.