CKD

SM－371138－A

INSTRUCTION MANUAL

TIGHT CYLINDER

Low hydraulic type

CMK2-H

- 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:

⚠ 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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CMK2-H

Tight cylinder
Low hydraulic type

Manual No. SM-371138-A

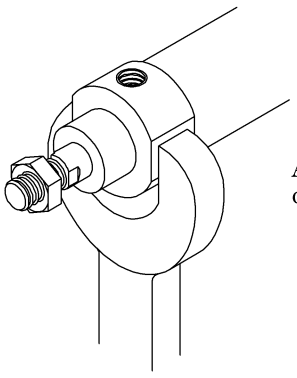
1. UNPACKING

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 5 to 50℃. Always operate the cylinder within this temperature range.
2) Use cylinder with bellows over its rod within the area with much dust.
3) Mount the converter unit or converter so that the lower limit of the oil level in the converter is higher than the upper limit of the oil level in the cylinder.
4) Carefully avoid other object from hitting the tube. Otherwise, it may get the tube distorted and cause malfunction of the cylinder.
5) Assembly of mounting bracket:
   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.

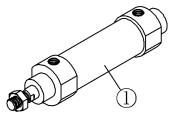


Apply an open ended spanner onto the double sided machined surface.

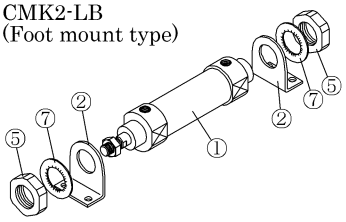
The mounting brackets are supplied with the cylinder at the time of delivery. Install them as shown in the upper figures on next page.
Tightening torque of mounting nut is 23 N・m.

Assembly of mounting bracket (same as disassembling)

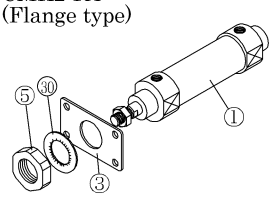
CMK2-00 (Basic type)



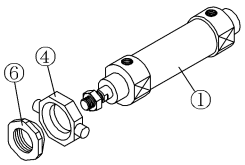
CMK2-LB (Foot mount type)



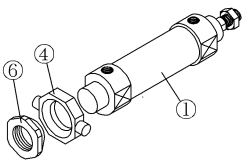
CMK2-FA (Flange type)



CMK2-TA (Rod side trunnion type)



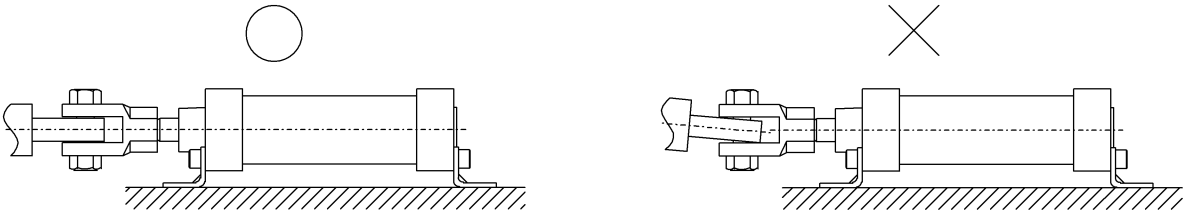
CMA2-TB (Head side trunnion type)



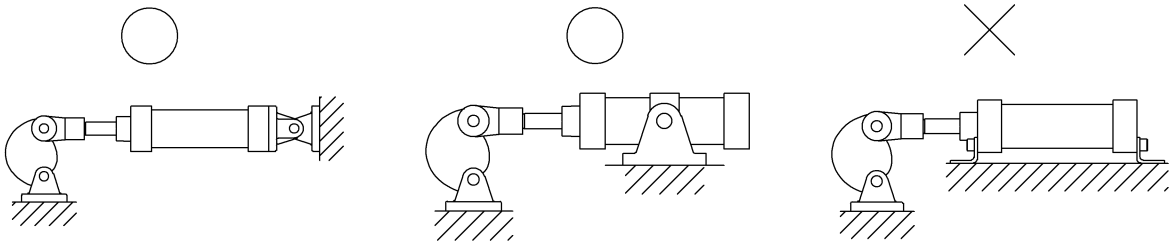
No.	Parts name	No.	Parts name
①	Cylinder body	⑥	Nut (for both TA type and TB type)
②	Foot bracket	⑦	Mounting Washer (for LB type and FA type)
③	Flange		
④	Trunnion (Axis type)		
⑤	Nut (for both LB type and FA type)		

6) 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.

7) 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.



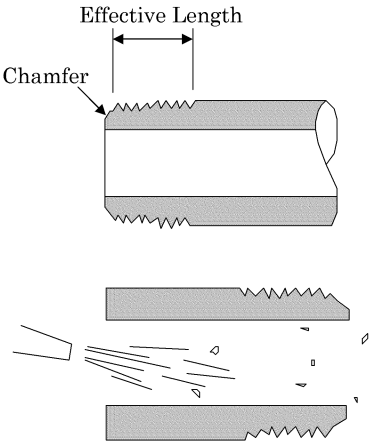
8) When the load acting direction changes with the cylinder operation:
Use an oscillating cylinder (clevis type or trunnion type) capable of making revolution to a certain angle.



Clevis type　　Trunnion type　　Foot type

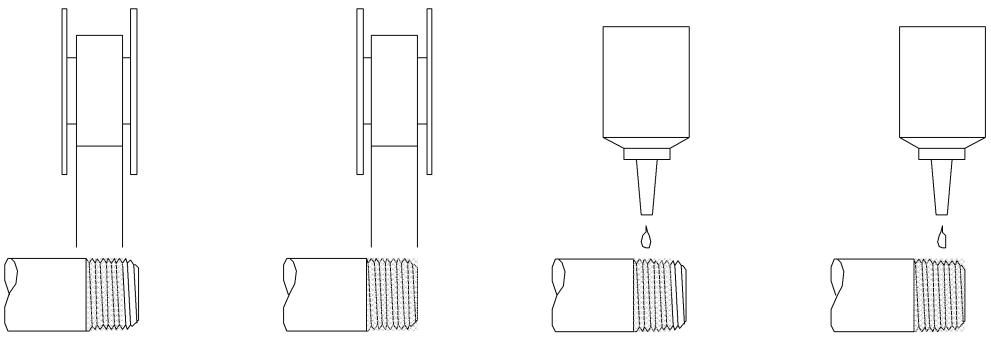
2.2 Piping

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　　● Sealant (liquid)



(Correct)　(Incorrect)　(Correct)　(Incorrect)

7) Carefully avoid placing an extreme ID difference within piping system whichcauses unstable flow speed.
8) Choking the ID at joint or 90˚ curvature will hinder expected flow speed.
9) Lay converter unit and /or control unit in the way of “Mater out” toward driving unit.
10) Inspect and confirm upon completion of piping that there is no leakage at each joint.

2.3 Working Fluid

1) Use petroleum family hydraulic fluid, viscosity 20 to 100mm2/s within the temperature range of 5 to 50 ℃.
Slow combustion hydraulic fluid, machine oil and spindle oil are unsuitable for use.

2) Recommended fluid
The hydraulic fluid which viscosity remains in 40mm2/s at operating temperature such as follow are recommended.

Fuji Kosan Co.	:	Fucoil hydroil × 22
Nisseki Co.	:	Highlandwide 22
Mitsubishi Petro Co.	:	Diamond powerfluid 18
Shell Oil Co.	:	Sheltellus C22
ESSO Co.	:	Univis J26
Mobil Oil Co.	:	Bellecity No.10
Maruzen Oil Co.	:	Swafluid 22

2.4 Cautions for Design and Selection

2.4.1 Warnings for design and selection

1) Do not use this product in a place close to a fire, and in equipment or machine at an ambient temperature exceeding 50 ℃.
- Doing so may cause a fire since the low hydraulic cylinder uses flammable working oil.

2) This product cannot be used in a clean room.

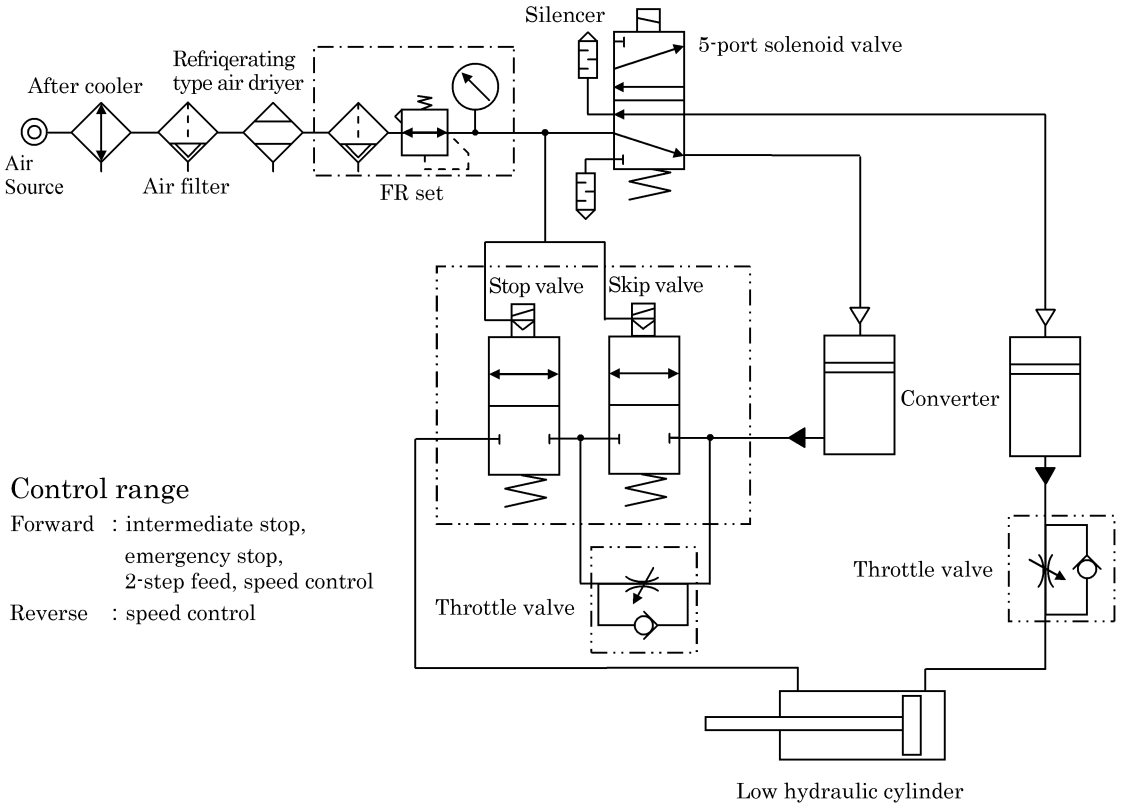
2.4.2 Cautions for design and selection

1) A small amount of the oil may ooze from the packing sliding part or gasket fixing part of the low hydraulic cylinder. Do not use this product in a vacuum container or a place where oozed oil needs to be eliminated.
2) Always attach an exhaust cleaner to the directional control valve for the lowhydraulic cylinder.
A small amount of the working oil may be discharged from the exhaust port of the directional control valve in the low hydraulic cylinder, causing the work place around the product to be contaminated.
3) Always install the low hydraulic cylinder in a place where the maintenance work can be carried out easily. Keep a sufficient maintenance space since the low hydraulic cylinder requires several kinds of the maintenance work, such as working oil supply or air removal.
4) Select an optimal combination of the low hydraulic cylinder and converter unit. Proper operation is obtained by combining the low hydraulic cylinder with an appropriate converter unit. Always select an appropriate converter unit.

5) The load to the low hydraulic cylinder is designed to be 50% or less of the theoretical output. To obtain the performance close to that of the hydraulic cylinder, such as constant speed operation and stop a accuracy, the load to the low hydraulic pressure cylinder needs to be 50% or less of the theoretical output.
6) Avoid the inching feed.
If the inching feed of the low hydraulic pressure cylinder is performed, the oil level exceeds the upper limit of the converter and the oil may overflow.
Do not perform the inching feed of the low hydraulic cylinder.

2.5 Fundamental Circuit Diagram and Selection of Related Equipment

2.5.1 Fundamental circuit diagram

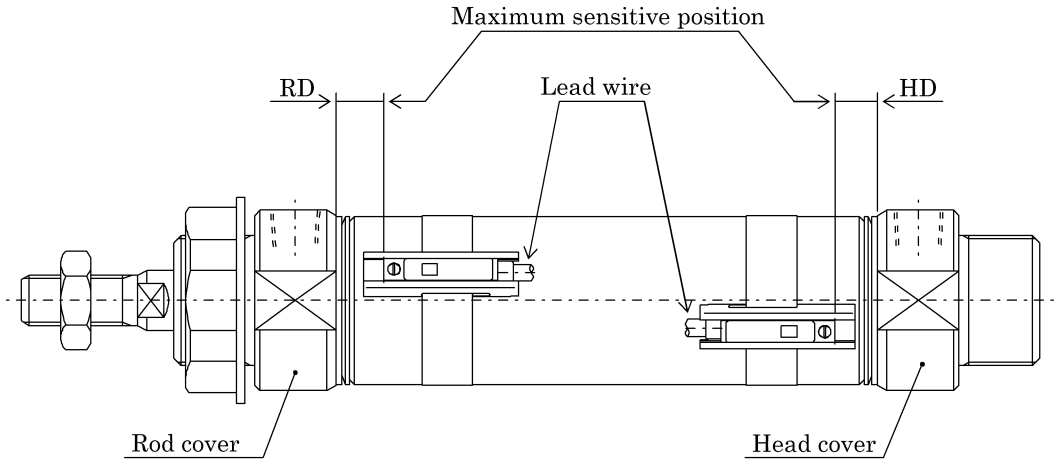


2.5.2 Related equipment

The low hydraulic cylinder combindly uses an air-hydro converter.

2.6 Location of Mounting Switches on a Cylinder

1) Location of mounting switches on a cylinder.

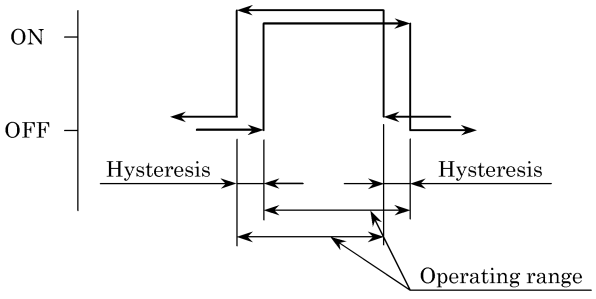


(1) At the stroke end
Refer the illustration above. Mount switches within the rod side dimension RD as well as the head side dimension HD for the purpose of having switches function at the points of the maximum sensitive position.

(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)

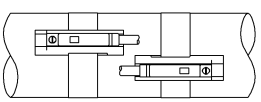
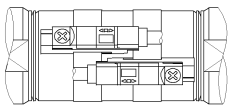
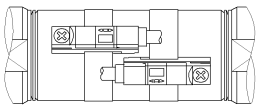
Maximum sensitive position (HD, RD), Operating Range, Hysteresis (unit:mm)

Bore size (mm)	Solid state switch (T2□, T3□, T3P□, T2J□, T2Y□, T3Y□, T2YF/M□, T3YF/M□)							
	Maximum sensitive position				Operating range (reference value)		Hysteresis	
	Head side HD (mm)		Rod side RD (mm)					
	One color indication type	Bi color indication type	One color indication type	Bi color indication type	One color indication type	Bi color indication type	One color indication type	Bi color indication type
φ20	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
φ25	8.5	7.5	9.5	8.5	2.5 to 5.5	3.5 to 7.5		
φ32	8.5	7.5	9.5	8.5	2.5 to 6	3.5 to 8		
φ40	10.5	9.5	11.0	10.5	3 to 7	4 to 9		

Bore size (mm)	Reed switch (T0□, T5□)			
	Maximum sensitive position		Operating range (reference value)	Hysteresis
	Head side HD (mm)	Rod side RD (mm)		
φ20	7.0	8.0	6.5 to 11	3 or less
φ25	8.5	9.5	7.5 to 12	
φ32	8.5	9.5	6.5 to 11.5	
φ40	10.5	11.0	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 lemgth of types with switch

Switch type		T0H/V※・T5H/V※ T2H/V※・T3H/V※	T2YH/V※・T3YH/V※	
Stroke	One piece	10mm	10mm	
	Two piece	25mm	under 35mm and over 25mm	35mm
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) The cushion of the cylinder of this type is unadjustable its cushion effect because of being made of rubber. Intend using additional cushion in the event that the kinetic energy is estimated exceeding the value shown in the table1 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)	Allowable energy absorption (J)
ϕ 20	0.166
ϕ 25	0.308
ϕ 32	0.424
ϕ 40	0.639

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

3.2 How to use the Switches

3.2.1 Common items

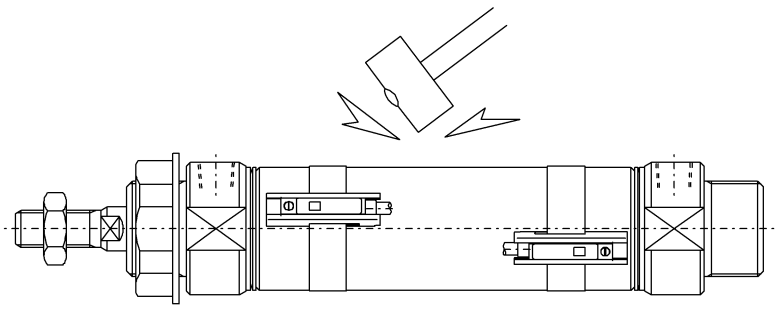
1) Magnetic environment
Avoid installation of switches within the area where strong magnetic field or large current (such as large magnet or spot welding equipment) exist. There may be a certain influence over sensing accuracy due to the interference of each magnetic field in case of parallel connection 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.

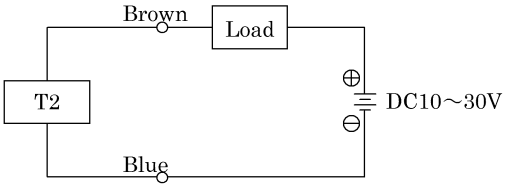


Fig.1 Fundamental circuit Example of T2

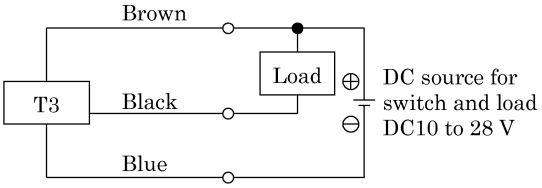


Fig.2 Fundamental circuit Example of T3 (1)
(In case the same source of power is used.)

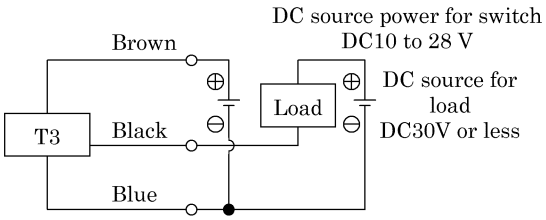


Fig.3 Fundamental circuit Example of T3 (2)
(In case individual sources of power are used.)

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).

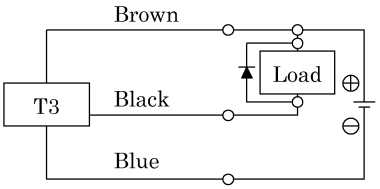
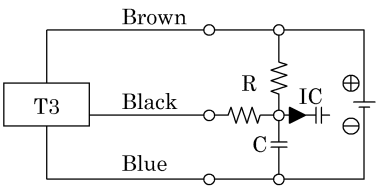


Fig.4 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)



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

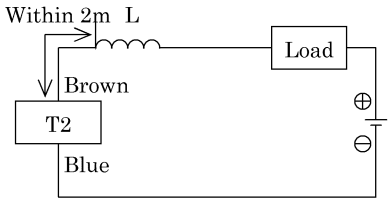


Fig.6 ・Choke coil
L= a couple hundred μH to a couple mH surpassing high frequency characteristic
・Install it near by a switch (within 2m).

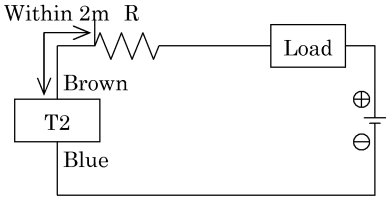


Fig.7 ・Dash current restriction resister.
R= As much large resister as the load circuit can afford.
・Install it near by a switch (within 2m).

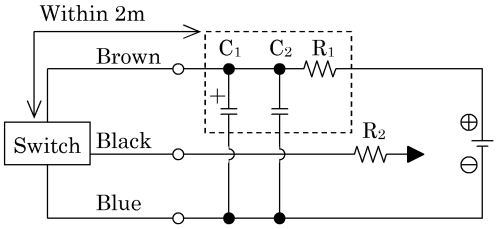


Fig8・ Electric power noise absorptive circuit.
C_1=20 to 50 μF electrolytic capacitor
(Withstand voltage 50V or more)
C_2=0.01 to 0.1 μF ceramic capacitor
R_1=20 to 30Ω

・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.

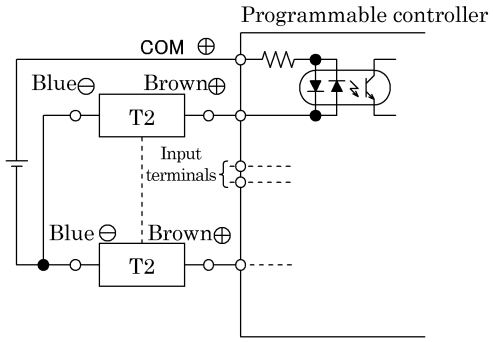


Fig.9 An example of T2 connection to source input type (an external power source)

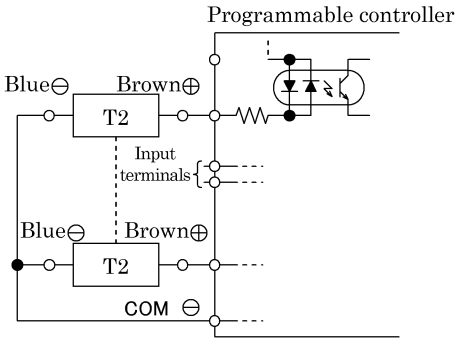


Fig.10 An example of T2 connection to source input type (an internal power source)

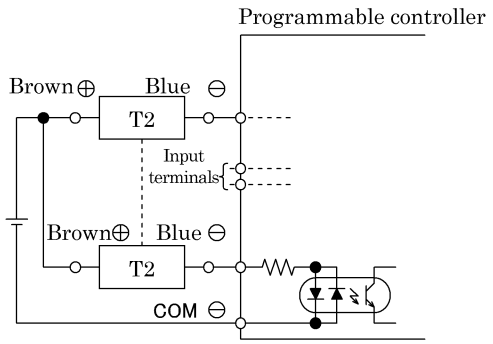


Fig.11 An example of T2 connection to source input type

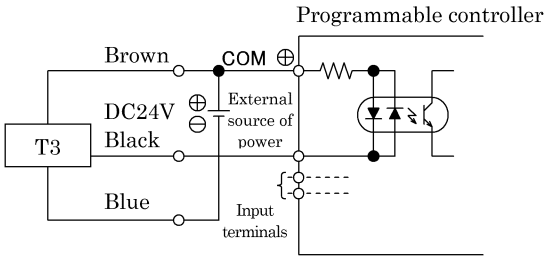


Fig.12 An example of T3 connection to source input type (an internal power source)

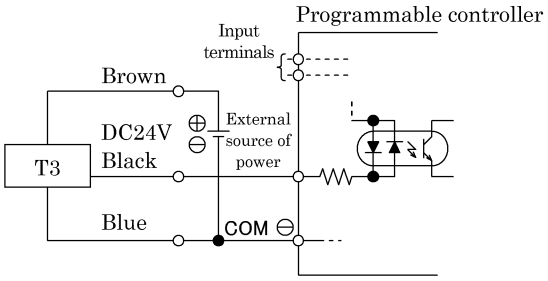


Fig.13 An example of T3 connection to source input type (an internal power source)

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 μ A, then leakage may occur. Usually dimming and failure of the indicator light do not occur.

3.2.3 Reed switch (T0, T5)

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 (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.

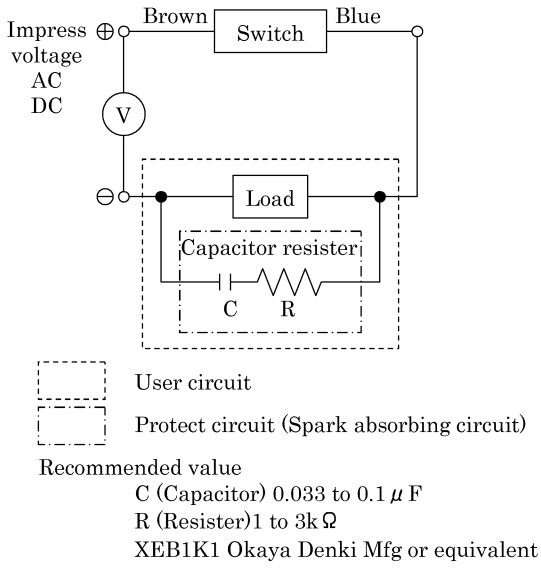
2) Contact protective measures

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

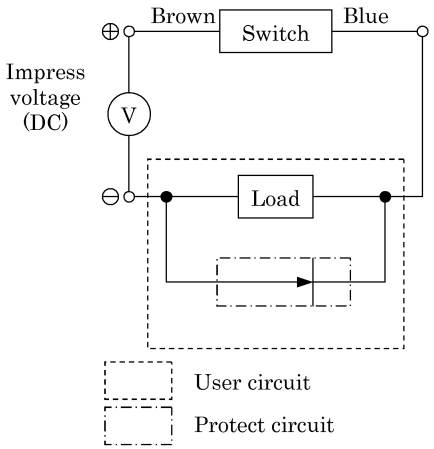
Electric power	Length of wire
DC	100m
AC	10m

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



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

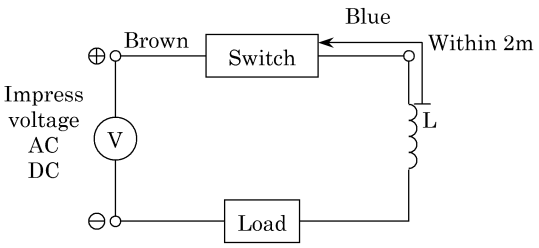
Fig.1 When capacitor resister is used.



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

Fig.2 When diode is used.

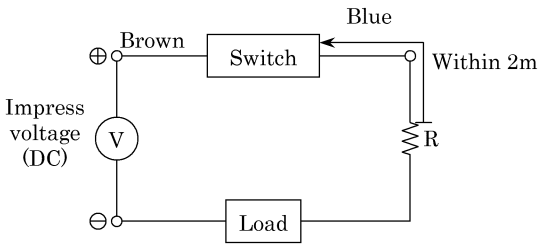
(2) Protective circuit when the wire length exceeds that stated Table 1



・ 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. Correct 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. Correct 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 specify.
	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	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.
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 ”2.6 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

● With out switch

CMK2-H – 00 – 20 NN – 100 ———— V Y

● With switch

CMK2-H – 00 – 20 NN – 100 – T0H – R – V Y

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

(a) Mounting style		(b) Bore size (mm)		(c) Pipe thread type		(d) Stroke (mm) note1	
00	Basic type	20	20 dia.	Blank	Rc	25	25
LB	Axial foot type (both sides)	25	25 dia.	NN	NPT (custom order)	50	50
LS	Axial foot type (single)	32	32 dia.	GN	G (custom order)	75	75
FA	Rod side flange type	40	40 dia.			100	100
FB	Head side flange type					150	150
CA	Eye type					200	200
CC	Fixed eye type					250	250
CC1	Eye, bush press fitting type					300	300
CB	Clevis type						
TA	Rod side trunnion type						
TB	Head side trunnion type						

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

(e) Switch model					(f) Switch Qty.	
Axial lead wire	Radial lead wire	Switch type	Indicator light	Lead wire	R	One on rod side
					H	One on head side
					D	Two
T0H※	T0V※	Reed	1 color indicator	2 wire	T	Three
T5H※	T5V※					
T2H※	T2V※	Solid state	1 color indicator	2 wire		
T3H※	T3V※			3 wire		
T2YH※	T2YV※		2 color indicator	2 wire		
T3YH※	T3YV※			3 wire		
T2YFH※	T2YFV※		With preventive maintenance output	3 wire		
T3YFH※	T3YFV※			4 wire		
T2YMH※	T2YMV※			3 wire		
T3YMH※	T3YMV※			4 wire		
T2JH※	T2JV※		Off delay type	2 wire		

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

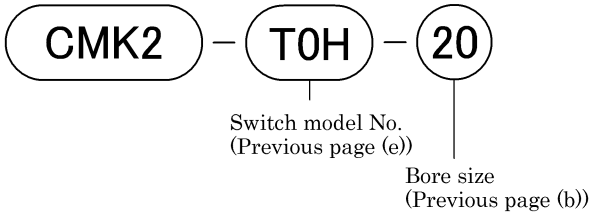
(g) Option note2, note3				(h) Accessory	
		Max. ambient	Instant max.	I	Rod eye
J	bellows	100℃	200℃	Y	Rod clevis (pin, washer and split pin attached.)
L	bellows	250℃	400℃	B2	Clevis bracket (pin and snap ring attached.)
M	Piston rod material change (stainless steel)				
V	Boss cut off				
P6	Copper and PTFE free				

Note2.For bellows "J" type, stroke length should be more than 25mm. When stroke length is shorter than 25mm, consult with CKD.

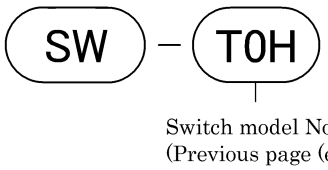
Note3.Instantaneous maximum temperature is the temperature when spark and spatter etc. instantaneously contact to bellows.

6.2 Component parts Model coding

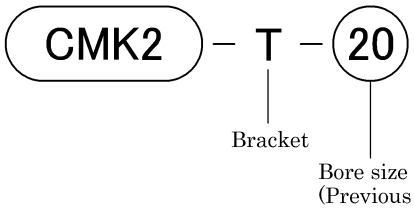
- Switch main body + Mounting bracket



- Switch only



- Mounting bracket



7. SPECIFICATION

7.1 Product Specifications

Model / Item		CMK2-H			
Bore size	mm	φ20	φ25	φ32	φ40
Actuation		Double-acting/Low hydraulic type			
Working fluid		Hydraulics actuation oil			
Max. working pressure	MPa	1.0			
Min. working pressure	MPa	0.15			
Proof pressure	MPa	1.6			
Ambient temperature	℃	5 to 50			
Port size		Rc1/8			
Stroke tolerance	mm	$^{+2.0}_{0}$ (to 200), $^{+2.4}_{0}$ (200 to)			
Working piston speed	mm/s	5 to 300			
Cushion		Rubber cushion			
Lubrication		Not required			
Allowable energy absorption	J	0.166	0.308	0.424	0.639

7.2 Switches Specifications

Descriptions	Reed 2 wire			
	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 to 50mA (Note2)	7 to 20mA (Note2)	50mA or less	20mA or less
Current consumption	—			
Internal voltage drop	2.4V or less		0V	
Indicator light	LED (ON lighting)		Without indicator light	
Leakage current	0mA			
Lead wire length (Note1)	1m(oil resistant vinyl cabtire code 2 conductor 0.2mm^2)			
Shock resistance	294m/s^2			
Insulation resistance	20MΩ over at DC500V megger			
Withstand voltage	No failure at AC1000V impressed for one minute			
Ambient temperature	−10 to 60℃			
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), oil resistance			

Descriptions	Solid state 2 wire		
	T2H, T2V	T2JH, T2JV	T2YH, T2YV
Applications	Programmable controller		
Power supply voltage	—		
Load Voltage	DC10 to 30V		
Load Current	5 to 20mA (Note 2)		
Current consumption	—		
Internal voltage drop	4V or less		
Off delay time	—	200±50ms	—
Indicator light	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)
Leakage current	1 mA or less		
Lead wire length (Note1)	(oil resistant vinyl cabtire code 2 conductor 0.2mm^2)	1m (oil resistant cabtire code 2 conductor 0.3mm^2)	1m (oil resistant vinyl cabtire code 2 conductor 0.3mm^2)
Shock resistance	980m/s^2		
Insulation resistance	20MΩ over at DC500V megger	100MΩ over at DC500V megger	
Withstand voltage	No failure at AC1000V impressed for one minute		
Ambient temperature	-10 to 60℃		
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), oil resistance		

Descriptions	Solid state 3 wire	
	T3H, T3V	T3YH, T3YV
Applications	Programmable controller, relay	
Power supply voltage	DC10 to 28V	
Load Voltage	DC30V or less	
Load Current	100 mA or less	50mA or less
Current consumption	10mA or less at DC24V	
Internal voltage drop	0.5V or less	
Indicator light	LED (ON lighting)	Red/green LED (ON lighting)
Leakage current	10μA or less	
Lead wire length (Note1)	1m (oil resistant vinyl cabtire code 3 conductor 0.2mm^2)	
Shock resistance	980m/s^2	
Insulation resistance	20MΩover at DC500V megger	100MΩ over at DC500V megger
Withstand voltage	No failure at AC1000V impressed for one minute	
Ambient temperature	-10 to 60℃	
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), oil resistance	

Descriptions		Solid state 3 wire	Solid state 4 wire
		T2YFH, T2YFV	T3YFH, T3YFV
Applications		Programmable controller	Programmable controller, relay
Indicator light	Mounting orientation adjustment	Red/green LED (ON lighting)	
	Preventive maintenance output	—	
Output	Power supply voltage	—	DC10 to 28V
	Load voltage	DC10 to 30V	DC30V
	Load current	5 to 20mA (Note2)	50mA or less
	Internal voltage drop	4V or less	0.5V or less
	Current consumption	—	10mA or less
	Leakage current	1mA or less	10 μA or less
Preventive maintenance output	Load voltage	DC30V or less	
	Load current	20mA or less	50mA or less
	Internal voltage drop	0.5V or less	
	Current consumption	10 μA or less	
	Signal holding (Ton)	—	
	Signal holding (Toff)	—	
Lead wire length (Note1)		1m(oil resistant vinyl cabtire code 3 conductor 0.2mm²)	1m(oil resistant vinyl cabtire code 4 cores 0.2mm²)
Shock resistance		980m/s²	
Insulation resistance		100MΩ over at DC500V megger	
Withstand voltage		No failure at AC1000V impressed for one minute	
Ambient temperature		−10 to 60℃	
Degree of protection		IEC Standards IP67, JIS C0920 (water tight type), oil resistance	

Descriptions		Solid state 3 wire	Solid state 4 wire
		T2YMH, T2YMV	T3YMH, T3YMV
Applications		Programmable controller	Programmable controller, relay
Indicator light	Mounting orientation adjustment	Red/green LED (ON lighting)	
	Preventive maintenance output	Yellow LED (ON lighting)	
Output	Power supply voltage	—	DC10 to 28V
	Load voltage	DC10 to 30V	DC30V or less
	Load current	5 to 20mA (Note2)	50mA or less
	Internal voltage drop	4V or less	0.5V or less
	Current consumption	—	10mA or less
	Leakage current	1.2mA or less	10 μA or less
Preventive maintenance output	Load voltage	DC30V or less	
	Load current	5 to 20mA (Note2)	50mA or less
	Internal voltage drop	4V or less	2.4V or less
	Current consumption	10 μA or less	
	Signal holding (Ton)	0.4±0.2sec after mounting orientation adjustment part red LED turned on.	
	Signal holding (Toff)	0.7±0.2sec after mounting orientation adjustment part green LED turned on.	
Lead wire length (Note1)		1m(oil resistant vinyl cabtire code 3 conductor 0.2mm²)	1m(oil resistant vinyl cabtire code 4 cores 0.2mm²)
Shock resistance		980m/s²	
Insulation resistance		100MΩ over at DC500V megger	
Withstand voltage		No failure at AC1000V impressed for one minute	
Ambient temperature		−10 to 60℃	
Degree of protection		IEC Standards IP67, JIS C0920 (water tight type), oil resistance	

Note 1： 3m or 5m long lead wire is optionally available.
Note 2： 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℃).