CKD

Small Bore Size Cylinder

CMK2-HP1 Series

INSTRUCTION MANUAL

SM-A09328-A/4

- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

PREFACE

Thank you for purchasing CKD's **"CMK2-HP1Series" Small Bore Size Cylinder.**
This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product is intended for users who have basic knowledge about materials, piping, electricity, and mechanisms of pneumatic components. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur due to fluid, piping, or other conditions. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device, the fluid control circuit, and the electric system that controls such mechanism is ensured.

To ensure the safety of device design and control, observe organization standards, relevant laws and regulations, which include the following:

ISO 4414, JIS B 8370, JFPS 2008 (the latest edition of each standard), the High Pressure Gas Safety Act, the Industrial Safety and Health Act, other safety rules, organization standards, relevant laws and regulations

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

⚠ **DANGER**	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ **WARNING**	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
⚠ **CAUTION**	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠ WARNING

The product must be handled by a qualified person who has extensive knowledge and experience.

The product is designed and manufactured as a device or part for general industrial machinery.

Use the product within the specifications.

The product must not be used beyond its specifications. Also, the product must not be modified and additional work on the product must not be performed.

The product is intended for use in devices or parts for general industrial machinery. It is not intended for use outdoors or in the conditions or environment listed below.

- In applications for nuclear power, railroad system, aviation, ship, vehicle, medical equipment, and equipment that directly touches beverage or food.
- For special applications that require safety including amusement equipment, emergency shut-off circuit, press machine, brake circuit, and safety measures.
- For applications where life or properties may be adversely affected and special safety measures are required.

(Exception is made if the customer consults with CKD prior to use and understands the specifications of the product. However, even in that case, safety measures must be taken to avoid danger in case of a possible failure.)

Do not handle the product or remove pipes and devices until confirming safety.

- Inspect and service the machine and devices after confirming the safety of the entire system. Also, turn off the energy source (air supply or water supply) and power to the relevant facility. Release compressed air from the system and use extreme care to avoid water or electric leakage.
- Since there may be hot or live parts even after operation has stopped, use extreme care when handling the product or removing pipes and devices.
- When starting or restarting a machine or device that incorporates pneumatic components, make sure that a safety measure (such as a pop-out prevention mechanism) is in place and system safety is secured.

Precautions on Product Disposal

⚠ CAUTION

When disposing of the product, comply with laws pertaining to disposal and cleaning of wastes and have an industrial waste disposal company dispose of the product.

CONTENTS

1. PRODUCT OVERVIEW

1.1 Model Number Indication

1.1.1 Product model number

■ **Example of model number indication：CMK2-HP1 series**

Without switch (built-in magnet for switch)

CMK2 - 00 - 20 ○ - 30 —— Y - HP1

With switch (built-in magnet for switch)

CMK2 - 00 - 20 ○ - 30 - T0H - R - M Y - HP1

Ⓐ Mounting *1

Ⓑ Bore size

Ⓒ Port thread

Ⓓ Stroke length

Ⓔ Switch model No.

Ⓕ Switch quantity *4

Ⓖ Option *5

Ⓗ Accessory *3

Code	Description		
Ⓐ Mounting			
00	Basic		
LB	Axial foot (both sides)		
LS	Axial foot (one side)		
FA	Rod side flange		
FB	Head side flange		
CA	Eye bracket		
CC	Eye bracket integrated		
CC1	Eye bracket, bush pressfit		
CB	Clevis bracket (pin and split washer pin included)		
TA	Rod side trunnion		
TB	Head side trunnion		
Ⓑ Bore size (mm)			
20	ø20	32	ø32
25	ø25	40	ø40
Ⓒ Port thread			
Blank	Rc thread		
NN	NPT thread (made to order)		
GN	G thread (made to order)		

Ⓓ Stroke length (mm)

Bore size	Stroke length *2	Custom stroke length
ø20	5 to 150	In 1 mm increments
ø25		
ø32		
ø40		

Ⓔ Switch model No.

Lead wire straight type	Lead wire L-shaped	Contact	Voltage AC	Voltage DC	Display	Lead Line
T0H*	T0V*	Reed	●	●	1-color display	2-wire
T5H*	T5V*	Reed	●	●	Without indicator lamp	2-wire
T8H*	T8V*	Reed	●	●	1-color display	2-wire
T1H*	T1V*	Proximity	●		1-color display	2-wire
T2H*	T2V*	Proximity		●	1-color display	2-wire
T3H*	T3V*	Proximity		●	1-color display	3-wire
T2HR3	T2VR3	Proximity		●	1-color display bend resistant lead wire	2-wire
T3PH*	T3PV*	Proximity		●	1-color display (made to order)	3-wire
T2WH*	T2WV*	Proximity		●	2-color display	2-wire
T2YH*	T2YV*	Proximity		●	2-color display	2-wire
T3WH*	T3WV*	Proximity		●	2-color display	3-wire
T3YH*	T3YV*	Proximity		●	2-color display	3-wire
T2JH*	T2JV*	Proximity		●	1-color display off-delay	2-wire

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

Ⓕ Switch quantity	
R	1 on rod side
H	1 on head side
D	2
T	3

Ⓖ Option	
M	Piston rod material (stainless steel)

Ⓗ Accessory	
I	Rod eye
Y	Rod clevis (pin and split washer pin included)
B2	Clevis bracket (pin and snap ring included)

Note 1: One side foot (LS) has the max. stroke length of 50mm.

Note 2: For the min.stroke length with switch, refer to 3 page.

Note 3: “I”and”Y”cannot be selected together.

Note 4: Up to three switches can be installed. If four or more switches are required, switch mounting brackets for the extra switches must be prepared separately.

Note 5: For 20 or 25 bore size, the rod is stainless steel asstandard and the rod nut is zinc chromate. If a stainless steel rod nut is necessary, select the “M” option code.

■ Example of model number indication：CMK2-P4※-HP1 series

Without switch (built-in magnet for switch)

CMK2 - 00 - 20 - 100 ——— P4 / P40 Y - HP1

With switch (built-in magnet for switch)

CMK2 - 00 - 20 - 100 - SW11 - R - M - P4 / P40 Y - HP1

Ⓐ Mounting *1

Ⓑ Bore size

Ⓒ Stroke

Ⓓ Switch model No.

Ⓔ Switch quantity *4

Ⓕ Option

Ⓖ Accessory *2

Code	Description
Ⓐ Mounting	
00	Basic
LB	Axial foot (both sides)
LS	Axial foot (one side)
FA	Rod side flange
FB	Head side flange
CA	Eye bracket
CC	Eye bracket integrated
CB	Clevis Bracket (pin and split washer pin included)
TA	Rod side trunnion
TB	Head side trunnion

Ⓑ Bore size (mm)		
20	ø20	*5
25	ø25	*5
32	ø32	
40	ø40	

Ⓒ Stroke (mm)

Bore size	Stroke	Custom Stroke
ø20	5 to 150	In 1 mm increments
ø25	5 to 150	
ø32	5 to 150	
ø40	5 to 150	

Ⓓ Switch model No.

For switch model number, refer to "Equipment related to rechargeable batteries P4* Series"(No.CC-1226A) .

Ⓔ Switch quantity	
R	1 on rod side
H	1 on head side
D	2
T	3

Ⓕ Option		
M	Piston rod, rod nut material (stainless steel)	*5

Ⓖ Accessory	
I	Rod eye
Y	Rod clevis (pin and split washer pin attached)
B2	Clevis bracket (pin and snap ring included)

Note 1:One side foot (LS) has the max. stroke length of 50mm.

Note 2:“I”and”Y”cannot be selected together.

Note 3:Refer to "Pneumatic Cylinders I (Catalog No.CB-029SA)" for custom specifications of rod end form.

Note 4:Up to three switches can be installed. If four or more switches are required, switch mounting brackets for the extra switches must be prepared separately.

Note 5:For 20 or 25 bore size, the rod is stainless steel asstandard and the rod nut is zinc chromate. If a stainless steel rod nut is necessary, select the “M” option code.

■ Stroke length

Bore size(mm)	Standard stroke length(mm)	Min. stroke length (mm)
φ20	25,50,75,100,150	5
φ25		
φ32		
φ40		

※ The custom stroke length is available in 1 mm increments.
※ Single foot (LS) has the max. stroke length of 50 mm.

■ Min. stroke length with switch

Switches / Bore size (mm)	1 switches					2 switches					3 switches				
	Proximity			Reed		Proximity			Reed		Proximity			Reed	
	T2 T3	T2W T3W	T1 T2Y T3Y T2J	T0 T5	T8	T2 T3	T2W T3W	T1 T2Y T3Y T2J	T0 T5	T8	T2 T3	T2W T3W	T1 T※Y※	T0 T5	T8
φ20	10					25	30	35	25	35	50	55	55	50	55
φ25	10					25	30	35	25	35	50	55	55	50	55
φ32	10					25	30	35	25	35	50	55	55	50	55
φ40	10					25	30	35	25	35	50	55	55	50	55

※Up to 3 switches can be mounted. (Unit:mm)

1.1.2 How to order mounting brackets

How to order mounting bracket

Bore size (mm) / Mounting brackets	ϕ20	ϕ25	ϕ32	ϕ40
Basic(00) Note 3	M1-00-20	M1-00-30	M1-00-30	M1-00-30
Axial foot (LB/LS) Note 2	M1-LB-20	M1-LB-30	M1-LB-30	M1-LB-30
Flange (FA/FB)	M1-FA-20	M1-FA-30	M1-FA-30	M1-FA-30
Trunnion (TA/TB)	M1-TA-20	M1-TA-30	M1-TA-30	M1-TA-40
Eye bracket (CA)	M1-CA-20	M1-CA-30	M1-CA-30	M1-CA-30
Clevis bracket (CB)	M1-CB-20	M1-CB-30	M1-CB-30	M1-CB-30

Note1 : Regarding mounting brackets, mounting nuts and toothed washers are attached with the axial foot type and flange type. Trunnions are supplied with mounting nuts.
Note2 : For axial foot types (two-sided), 2 sets of "M1-LB0** or [Bore size]" in the table above are required. For axial foot types (two-sided), 2 sets of "M1-LB0** or [Bore size]" in the table above are required.
Note3 : Mounting nut, toothed washer only. Although 1 set is included with the basic product (00),use this when needed.

How to order mounting bracket P4

Bore size (mm) / Mounting brackets	ϕ20	ϕ25	ϕ32	ϕ40
Axial foot (LB/LS)	M1-LB-20	M1-LB-30	M1-LB-30	M1-LB-30
Flange (FA/FB)	M1-FA-20	M1-FA-30	M1-FA-30	M1-FA-30
Trunnion (TA/TB)	M1-TA-20	M1-TA-30	M1-TA-30	M1-TA-40
Eye bracket (CA)	M1-CA-20	M1-CA-30	M1-CA-30	M1-CA-30
Clevis bracket (CB)	M1-CB-20	M1-CB-30	M1-CB-30	M1-CB-30

Note1 : Regarding mounting brackets, mounting nuts and toothed washers are attached with the axial foot type and flange type. Trunnions are supplied with mounting nuts.
Note2 : For axial foot types (two-sided), 2 sets of "M1-LB0** or [Bore size]" in the table above are required. For axial foot types (two-sided), 2 sets of "M1-LB0** or [Bore size]" in the table above are required.

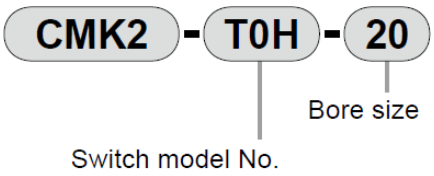
How to order mounting bracket P40

Bore size (mm) / Mounting brackets	ϕ20	ϕ25	ϕ32	ϕ40
Axial foot (LB/LS)	M1-LB-20-P40	M1-LB-25-P40	M1-LB-30-P40	M1-LB-30-P40
Flange (FA/FB)	M1-FA-20-P40	M1-FA-25-P40	M1-FA-30-P40	M1-FA-30-P40
Trunnion (TA/TB)	M1-TA-20-P40	M1-TA-25-P40	M1-TA-30-P40	M1-TA-40-P40
Eye bracket (CA)	M1-CA-20-P40	M1-CA-25-P40	M1-CA-30-P40	M1-CA-30-P40
Clevis bracket (CB)	M1-CB-20-P40	M1-CB-25-P40	M1-CB-30-P40	M1-CB-30-P40

Note1 : Regarding mounting brackets, mounting nuts and toothed washers are attached with the axial foot type and flange type. Trunnions are supplied with mounting nuts.
Note2 : For axial foot types (two-sided), 2 sets of "M1-LB0** or [Bore size]" in the table above are required. For axial foot types (two-sided), 2 sets of "M1-LB0** or [Bore size]" in the table above are required.

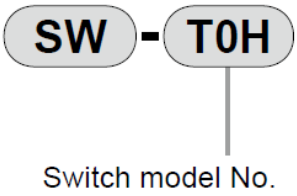
1.1.3 How to order switch

<Switch body+Mounting bracket set>

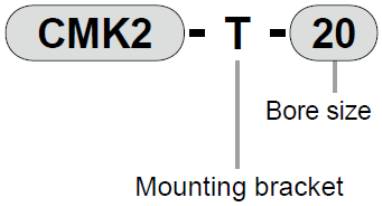


Please contact CKD for P40.

<Switch body only>



<Mounting bracket set>



<How to order switch mounting bracket>

P4	CMK2-T-[Bore size]
P40	CMK2-T-[Bore size]-P40

Switches for P4 * series have different order model numbers from the standard ones.
Please refer to "Equipment related to rechargeable batteries P4* Series"(No.CC-1226A).

1.2 Specifications

1.2.1 Product specifications

Model / Descriptions		CMK2-HP1 CMK2-P4※-HP1			
Bore size	mm	φ20	φ25	φ32	φ40
Actuation		Double acting			
Working fluid		Compressed air			
Max. working pressure	MPa	1.0			
Min. working pressure	MPa	0.1			
Proof pressure	MPa	1.6			
Ambient temperature	°C	-10 to 60 (no freezing)			
Port size		Rc1/8			
Stroke tolerance	mm	$^{+2.0}_{0}$(to 150)			
Working piston speed	mm/s	50 to 500			
Cushion		With rubber cushion			
Lubrication		Not required			
Allowable energy absorption	J	0.166	0.308	0.424	0.639

1.2.2 Switch specifications

Descriptions	Reed 2-wire type						
	T0H/V		T5H/V		T8H/V		
Applications	For programmable controller, relay		For programmable controller, relay, IC circuit(without indicator), serial connection		For programmable controller, relay		
Load voltage	12/24 VDC	110 VAC	5/12/24 VDC	110 VAC	12/24 VDC	110 VAC	220 VAC
Load current	5 mA to 50 mA	7 mA to 20 mA	50 mA or less	20 mA or less	5 mA to 50 mA	7 mA to 20 mA	7 mA to 10 mA
Current consumption	—						
Internal voltage drop	3 V or less (For DC, when the load current is 30mA)		0.1 V or less (Internal resistance 0.5 Ω or less.)		4V or less		
Indicator	Red LED (Lights up when turned on)		—		Red LED (Lights up when turned on)		
Leakage current	—						
Lead wire Note 1	Standard is 1 m (Oil-resistant vinyl cabtyre 2 core cord, 0.2 mm^2)				Standard is 1 m (Oil-resistant vinyl cabtyre 2 core cord, 0.3 mm^2)		
Shock resistance	294m/s^2						
Insulation resistance	20 MΩ or more with 500 VDC megger				100 MΩ or more with 500 VDC megger		
Withstand voltage	No abnormality after applying 1000 VAC for one minute				No abnormality after applying 1500 VAC for one minute		
Ambient temperature	−10°C to 60°C						
Degree of protection	IP 67 (IEC standard), JIS C 0920 (watertight), oil-resistant						

Descriptions	Proximity 2-wire type		
	T2H/V	T2HR3,T2VR3	T2YH/V
Applications	Only for programmable controller		
Power supply voltage	—		
Load voltage	10 VDC to 30 VDC		
Load current	5 mA to 20 mA Note 2		
Current consumption	—		
Internal voltage drop	4 V or less		
Output delay time	—		
Indicator	Red LED (Lights up when turned on)		Red/green LED (Lights up when turned on)
Leakage current	1 mA or less		
Lead wire Note 1	Standard is 1 m (Oil-resistant vinyl cabtyre 2 core cord, 0.2 mm^2)	Standard is 3 m (Elasticity,Oil-resistant vinyl cabtyre 2 core cord, 0.2 mm^2)	Standard is 1 m (Oil-resistant vinyl cabtyre 2 core cord, 0.3 mm^2)
Shock resistance	980 m/s^2 or less		
Insulation resistance	20 MΩ or more with 500 VDC megger		100 MΩ or more with 500 VDC megger
Withstand voltage	No abnormality after applying 1000 VAC for one minute		
Ambient temperature	−10°C to 60°C		
Degree of protection	IP 67 (IEC standard), JIS C 0920 (watertight), oil-resistant		

Descriptions	Proximity 2-wire type	
	T2JH/V	T1H/V
Applications	Only for programmable controller	For programmable controller, relay, small solenoid valve
Power supply voltage	—	—
Load voltage	10 VDC to 30 VDC	85 VAC to 265 VAC
Load current	5 mA to 20 mA Note 2	5 mA to 100 mA
Current consumption	—	—
Internal voltage drop	4 V or less	10% or less of load voltage
Output delay time	200±50ms	—
Indicator	Red LED (Lights up when turned on)	
Leakage current	1 mA or less	1 mA or less at 100 VAC 2 mA or less at 200 VAC
Lead wire Note 1	Standard is 1 m (Oil-resistant vinyl cabtyre 2 core cord, 0.3 mm^2)	
Shock resistance	980 m/s^2 or less	
Insulation resistance	100 MΩ or more with 500 VDC megger	
Withstand voltage	No abnormality after applying 1000 VAC for one minute	No abnormality after applying 1500 VAC for one minute
Ambient temperature	−10°C to 60°C	
Degree of protection	IP 67 (IEC standard), JIS C 0920 (watertight), oil-resistant	

Descriptions	Proximity 2,3-wire type	
	T2WH/V	T3WH/V
Applications	Only for programmable controller	For programmable controller, relay
Output method	—	NPN
Power supply voltage	—	10 VDC to 28 VDC
Load voltage	24 VDC ± 10%	30 VDC or less
Load current	5 mA to 20 mA Note 2	50 mA or less
Current consumption	—	10 mA or less at 24 VDC
Internal voltage drop	4 V or less	0.5 V or less
Output delay time	—	—
Indicator	Red/green LED(Lights up when turned on)	
Leakage current	1 mA or less	10 μA or less
Lead wire Note 1	Standard is 1 m (Oil-resistant vinyl cabtyre 2 core cord, 0.2 mm^2)	Standard is 1 m (Oil-resistant vinyl cabtyre 3 core cord, 0.2 mm^2)
Shock resistance	980 m/s^2 or less	
Insulation resistance	20 MΩ or more with 500 VDC megger	
Withstand voltage	No abnormality after applying 1000 VAC for one minute	
Ambient temperature	−10°C to 60°C	
Degree of protection	IP 67 (IEC standard), JIS C 0920 (watertight), oil-resistant	

Descriptions	Proximity 3-wire type		
	1-color display	1-color display (PNPoutput)(made to order)	2-color display
	T3H/V	T3PH/V	T3YH/V
Applications	For programmable controller, relay		
Output method	NPN	PNP	NPN
Power supply voltage	10 VDC 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 at 24 VDC	10 mA or less at 24 VDC	10 mA or less at 24 VDC
Internal voltage drop	0.5 V or less		
Indicator	Red LED (Lights up when turned on)	Yellow LED (Lights up when turned on)	Red/green LED (Lights up when turned on)
Leakage current	10 μA or less		
Lead wire Note 1	Standard is 1 m(Oil-resistant vinyl cabtyre 3 core cord, 0.2 mm^2)		Standard is 1 m(Oil-resistant vinyl cabtyre 3 core cord, 0.3 mm^2)
Shock resistance	980 m/s^2 or less		
Insulation resistance	20 MΩ or more with 500 VDC megger		100 MΩ or more with 500 VDC megger
Withstand voltage	No abnormality after applying 1000 VAC for one minute		
Ambient temperature	−10°C to 60°C		
Degree of protection	IP 67 (IEC standard), JIS C 0920 (watertight), oil-resistant		

Note 1:3 m and 5 m lead wires are available as options.
Note 2:The maximum load current of 20 mA is the value when the ambient temperature is 25°C.
The current will be lower than 20 mA when the ambient temperature of the switch is higher than 25°C (5 mA to 10 mA at 60°C).
Note3 : Switches for P4 * series have different order model numbers from the standard ones.
Please refer to "Equipment related to rechargeable batteries P4* Series"(No.CC-1226A).

2. INSTALLATION

2.1 Environment

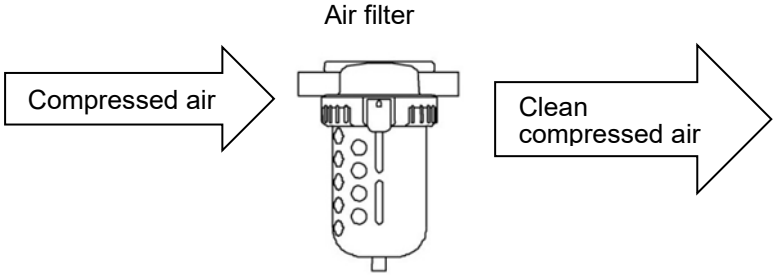
⚠ CAUTION

When using the product in a cutting, casting, or welding plant, install a cover to prevent foreign matters such as cutting fluid, chips, powder, and dust from entering.

Do not use the equipment in the following environments.

- Where cutting oil can splash onto the product (abrasives and polishing powder in the oil can abrade the sliding section)
- Where organic solvents, chemicals, acids, alkalis, and kerosene are present
- Where water can splash onto the product

- Use the product within the following ambient temperature range.
  −10°C to 60°C (no freezing)
- For compressed air, use clean and dry air that has been passed through an air filter.
  Use an air filter in the circuit and be careful with the filtration rate (a filter that removes particles exceeding 5 μm is desirable), flow rate, and mounting position (install the filter near the directional control valve).



- Since oil-impregnated bearings are used, oil may be discharged to the outside of the cylinder.
  Be careful when using it in a place where you do not want to drain oil.

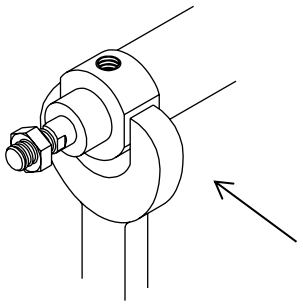
2.2 Unpacking

- Check that the model number ordered and the model number indicated on the product are the same.
- Check the exterior of the product for any damage.
- When storing the product, attach a sealing plug to the piping port to prevent foreign matters from entering the cylinder. Remove the sealing plug before piping.

2.3 Mounting

2.3.1 Attaching the mounting bracket

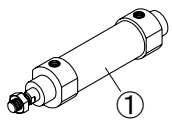
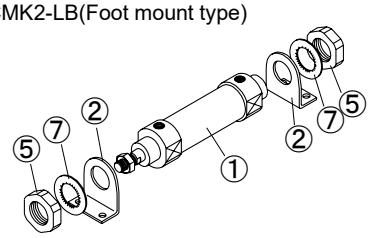
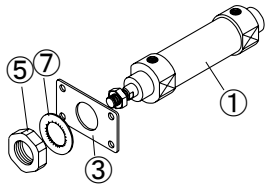
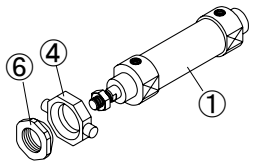
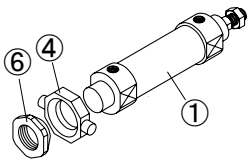
Apply an open ended spanner onto double sided machined surface of mounting end cover as shown below when to hold the tube while attaching the mounting bracket.



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 below figures shown.
Tightening torque is 23N・m.

Assembly of mounting bracket (Same as disassembling)

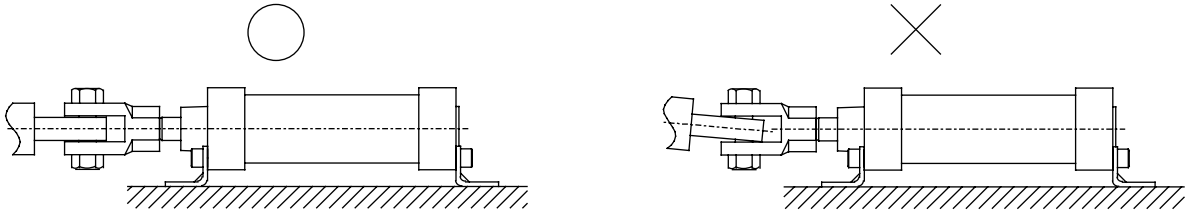
CMK2-00(Basic type) 	CMK2-LB(Foot mount type) 	CMK2-FA(Flange type) 
CMK2-TA(Rod side trunnion type) 	CMK2-TB(Head side trunnion type) 	

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

2.3.2 Mounting the Body

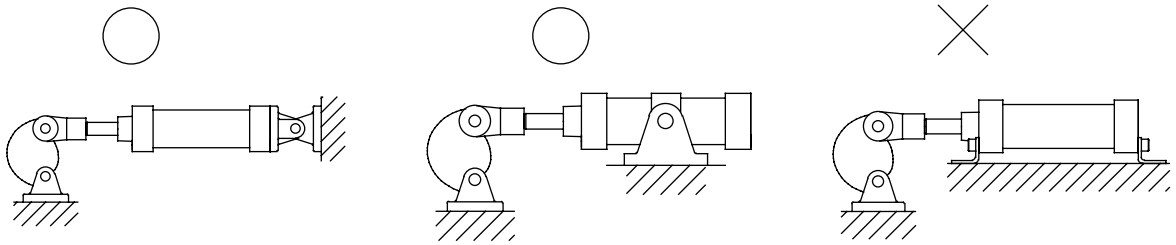
<When cylinder is fixed and rod end is guided>
In case the piston rod of cylinder and the load are misaligned, the bushes and packings of the cylinder are extremely worn out.

< When cylinder is fixed and rod end is connected with pin joint >
In case the load acting direction is not parallel with therod axial center, the rod and tube may get entangled causing seizure,etc. Heace, make sure that the rod axial center and the load transfer direction are aligned to eacher.



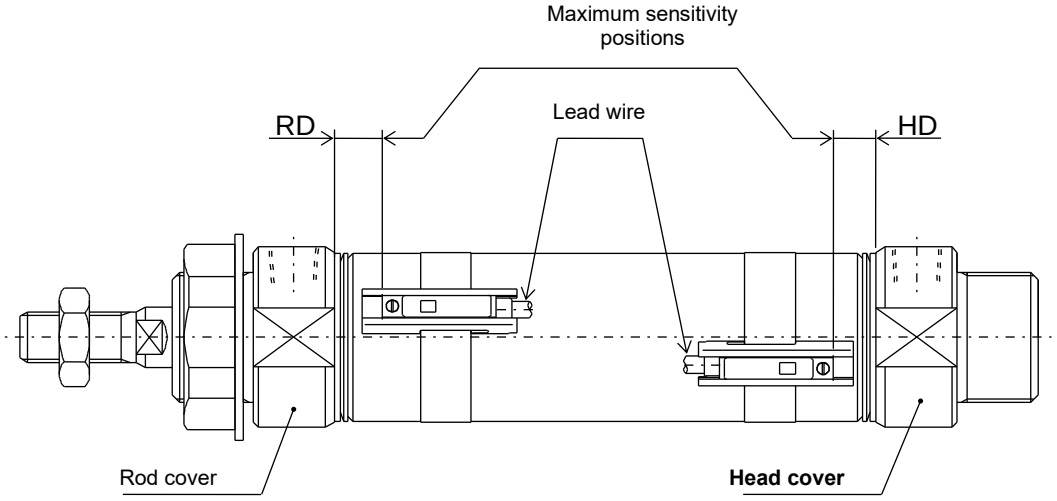
<When the load acting direction changes with the cylinder operation>
Use an oscillating cylinder (clevis type or trunnion type) capable of making revolution to a certain angle.

Clevis type Trunnion type Foot type



2.3.3 Mounting the switch

■ Mounting position



<Mounting the switch at the end of the stroke>
For the switch to function at maximum sensitivity, mount the switch at the RD dimension on the open-side end position and/or at the HD dimension on the closed-side end position (refer to the catalog). mount the switch in the direction as shown in the figure above so that the lead wire is inside.

<Mounting the switch at the intermediate position of the stroke>
For the switch to function at an intermediate position of the stroke, secure the piston at the position where the switch needs to function and then slide the switch on the piston back and forth to find the positions where the switch turns on when slid forward and when slid backward. The intermediate point between these two positions is where the switch functions at maximum sensitivity for that piston position and where the switch is to be mounted.

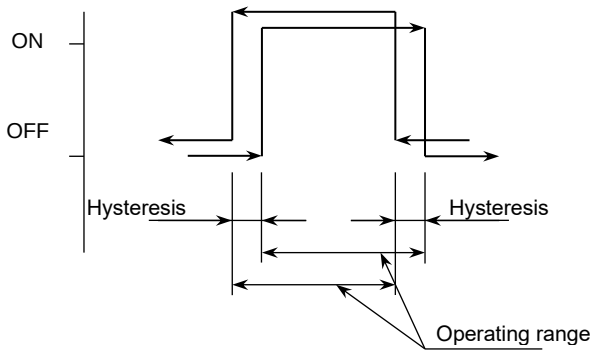
< Location around the circumference of cylinder >
There is no restriction. Install switch(es) wherever easy to utilize it.

■ Operating range

This is the range from where the switch is turned on when the piston moves and to where the switch is turned off when the piston moves farther in the same direction.

■ Hysteresis

This is the distance from where the switch is turned on when the piston moves and to where the switch is turned off when the piston moves in the opposite direction



■ The maximum sensitivity position (HD,RD),Operating range,Hysteresis (unit：mm)

Proximity switch (T2H/V,T3H/V,T2H/VR3,T2JH/V,T2YH/V,T3YH/V,T3PH/V)								
Bore size (mm)	The maximum sensitivity position				Operating range		Hysteresis	
	HD(mm)		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
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 6.0	3.5 to 8.0		
φ40	10.5	9.5	11.5	10.5	3.0 to 7.0	4.0 to 9.0		

Proximity switch (T1H/V)				
Bore size (mm)	The maximum sensitivity position		Operating range	Hysteresis
	HD(mm)	RD(mm)		
φ20	6.0	7.0	2.5 to 5.5	1.5 or less
φ25	7.5	8.5	2.5 to 5.5	
φ32	7.5	8.5	2.5 to 6.0	
φ40	9.5	10.5	3.0 to 7.0	

Proximity switch (T2WH/V,T3WH/V)				
Bore size (mm)	The maximum sensitivity position		Operating range	Hysteresis
	HD(mm)	RD(mm)		
φ20	9.0	10.0	3.5 to 7.5	1.0 or less
φ25	10.5	11.5		
φ32	10.5	11.5	3.5 to 8	
φ40	12.5	13.5	4 to 9	

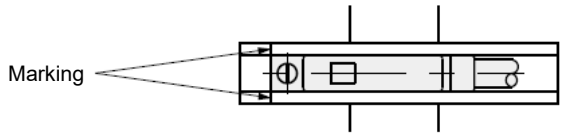
Reed switch						
Bore size (mm)	The maximum sensitivity position				Operating range	Hysteresis
	HD(mm)		RD(mm)			
	T0H/V T5H/V	T8H/V	T0H/V T5H/V	T8H/V		
φ20	7.0	1.0	8.0	2.0	6.5 to 11.0	3.0 or less
φ25	8.5	2.5	9.5	3.5	7.5 to 12.0	
φ32	8.5	2.5	9.5	3.5	6.5 to 11.5	
φ40	10.5	4.5	11.5	5.5	7.0 to 13.5	

Note1:Switches for P4 * series have different order model numbers from the standard ones.
Please refer to "Equipment related to rechargeable batteries P4* Series"(No.CC-1226A).

2.3.4 Changing the position of the switch

< When moving the switch position to the stroke lengthdirection>
The 1-color display switch can be fine-tuned by ±3 mm from the default. If the adjusting range exceeds ±3 mm, or when fine-tuning the 2-color display switch, move the band position.

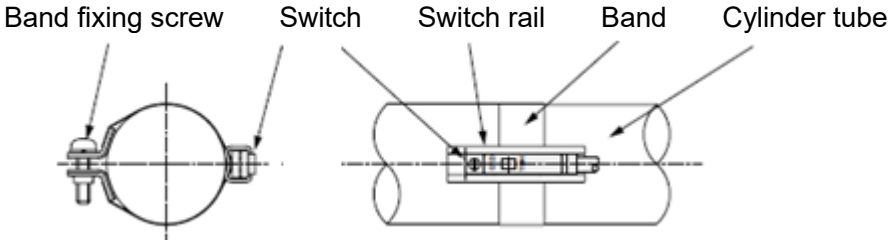
The switch bracket rail has a marking 4 mm from the rail end. Use as a guide to the mounting position when replacing the switch.



Switch rail markings are set to the default switch max. sensitivity position.The max. sensitivity position will change when the switch is changed or when the band is moved. Adjust the position accordingly in this case.

<When moving the switch position to the circumferential direction>
Loosen the band fixing screw, shift the switch rail in the circumferential direction, then tighten at the specified position. Tightening torque is 0.6 to 0.8N·m.

<Shifting the band position>
Loosen the band fixing screw, shift the switch rail and band along the cylinder tube, and tighten at the specified position. Tightening torque is 0.6 to 0.8N·m.



2.3.5 Replacing the switch

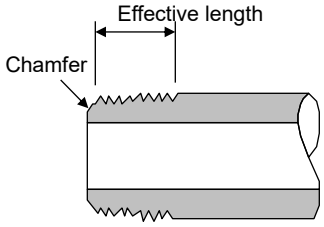
1. Loosen the fastening screw (set screw) and remove the switch body from the groove.
2. Put the replacement switch into the groove.
3. Determine where to position the switch and tighten the screw.
   (Tightening torque is 0.1 to 0.2 N·m for T0, T5, T2, T3, T2W, T3W, T3P, T2HR, T2VR, 0.5 to 0.7 N·m for T8, T1, T2Y, T3Y, T2J.)

2.4 Piping

⚠ WARNING

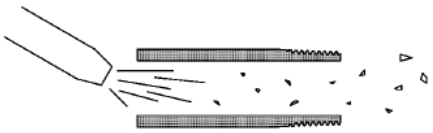
Insert the tube into the fitting until it firmly rests on the tube end and make sure that the tube does not come off before use.

- Use pipes that are made of corrosion-resistant materials after the filter such as zinc-plated pipes, nylon tubes, and rubber tubes.
- Use pipes with an effective cross-sectional area that allows the cylinder to achieve the predetermined piston speed.
- Install the filter for removing rust, foreign matters, and drainage from the piping as close as possible to the solenoid valve.
- Observe the effective thread length for the gas pipes.
- In addition, chamfer the threaded end of the pipes by about a 1/2 pitch.



■ Pipe cleaning

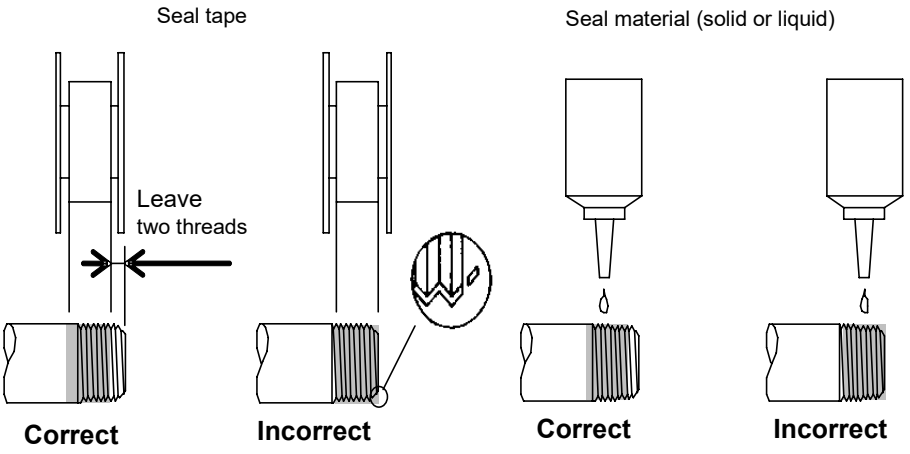
Before piping, blow air into the pipes to clean the interior and to remove cutting chips and foreign matters.



■ Seal material

Use a seal tape or a seal material to stop leakage from piping.
Apply a seal tape or seal material to the screw threads leaving two or more threads at the pipe end uncovered or uncoated. If the pipe end is fully covered or coated, a shred of seal tape or residue of seal material may enter inside of the pipes or device and cause a failure.

When using a seal tape, wind it around the screw threads in the direction opposite from the screw threads and press it down with your fingers to attach it firmly.
When using a liquid seal material, be careful not to apply it to resin parts. The resin parts can become damaged and this may lead to a failure or malfunction.
Also, do not apply seal material to the internal threads.

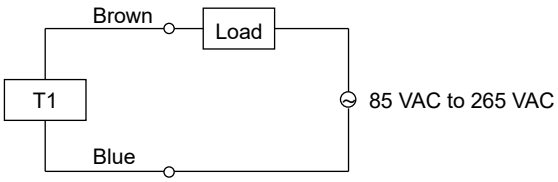


2.5 Wiring

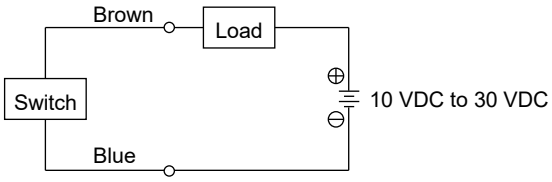
2.5.1 Proximity switch

■ Connection of lead wires

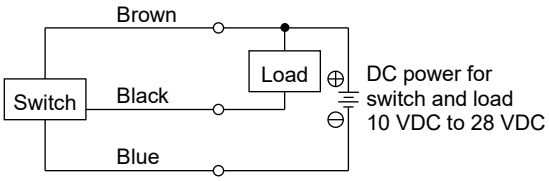
Turn off the power to the device in the electric circuit to which the switch is to be connected and connect the lead wires according to their color. Not turning off the power may cause damage to the electric circuit of the switch load.
If the switch is not wired correctly or the load is short-circuited, it may cause damage not only to the switch but also to the electric circuit on the load side.



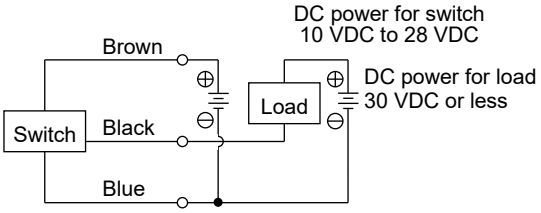
Example of T1 basic circuit



Example of 2-wire basic circuit



Example of 3-wire basic circuit (1)
(When same power is used for switch and load)

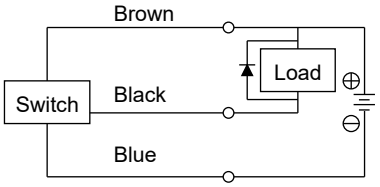


Example of 3-wire basic circuit (2)
(When separate power is used for switch and load)

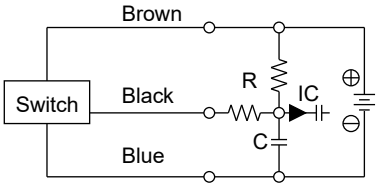
■ Protection of the output circuit

For the following cases, refer to the figures below and install a protection circuit:

- When an inductive load (relay or solenoid valve) is connected and used: See Ex. 1
  Use a surge absorption element since a surge voltage is generated when the switch is turned off.
- When a capacious load (capacitor) is connected and used: See Ex. 2
  Use a current regulating resistor since a starting current is generated when the switch is turned on.
- When the lead wire length exceeds 10 m: See Ex. 3 and 4 (2-wire type), Ex. 5 (3-wire type)

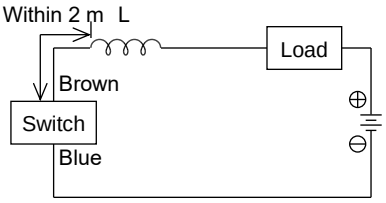


Ex. 1 Using inductive load with surge absorption element (diode). (For diode, use V06C manufactured by Hitachi or equivalent.)



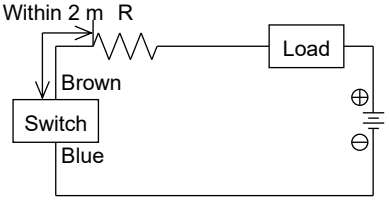
Ex. 2 Using capacious load with current regulating resistor R.
Use the following formula to figure out resistance R (Ω).

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



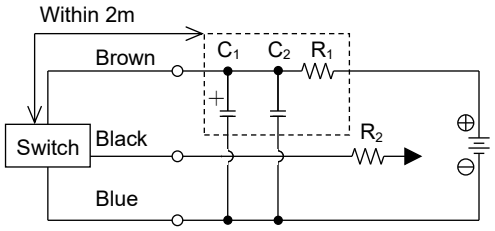
Ex. 3 - Choke coil
L = Several hundred μH to several mH
Excellent high frequency characteristic

- Wire near the switch (within 2 m).



Ex. 4 - Starting current restriction resistor
R = Highest possible resistance for the load circuit.

- Wire near the switch (within 2 m).



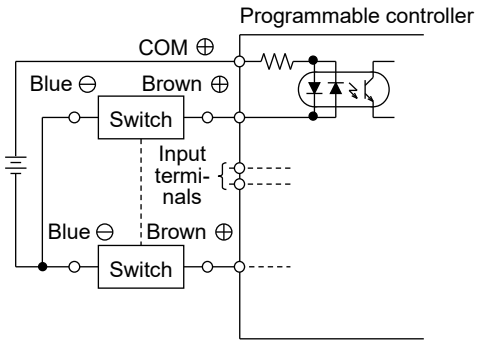
Ex. 5 - Power supply noise absorption circuit
C_1=20 μF to 50 μF electrolytic capacitor
(withstand voltage 50V or more)
C_2=0.01 μF to 0.1 μF ceramic capacitor
R_1=20 Ω to 30 Ω

- Starting current restriction resistor
R_2= Highest possible resistance for the load circuit.

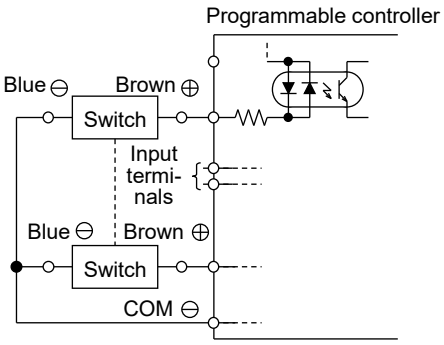
- Wire near the switch (within 2 m)

■ Connection to the programmable controller

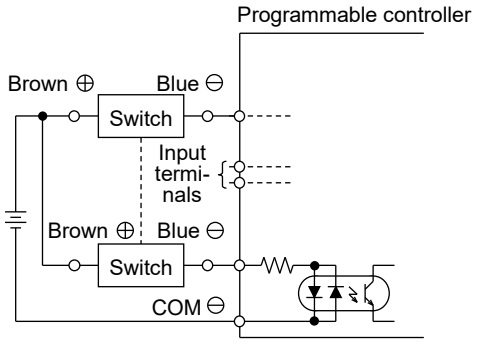
The connection method depends on the type of the programmable controller. Connect as shown below.



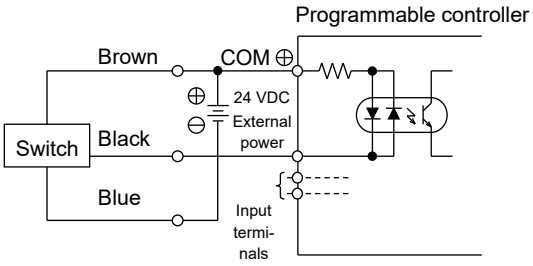
2-wire connection to source input (external power)



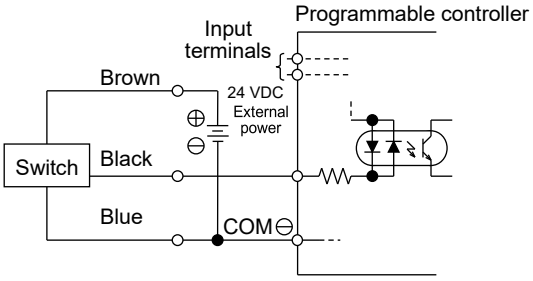
2-wire connection to source input (internal power)



2-wire connection to sink input (external power)



3-wire connection to source input (external power)



3-wire connection to source input (internal power)

■ Parallel connection

Since the leakage current of a 2-wire type switch increases according to the number of connected units, check the input specifications of the programmable controller, which is a connected load, to determine the number of switches to connect. For the 2-wire type switch, the indicator may become dim or not light up.

Although the leakage current of a 3-wire type switch increases according to the number of connected units, the leakage current is very small (10 μA or less) and can generally be ignored. For the 3-wire type switch, the indicator will light up without dimming.

2.5.2 Reed switch

■ Connection of lead wires

Do not connect the lead wire of the switch to the power directly. Make sure that the lead wire and the load are connected in serial.
For T0 and T8 switches, observe the following instructions as well:

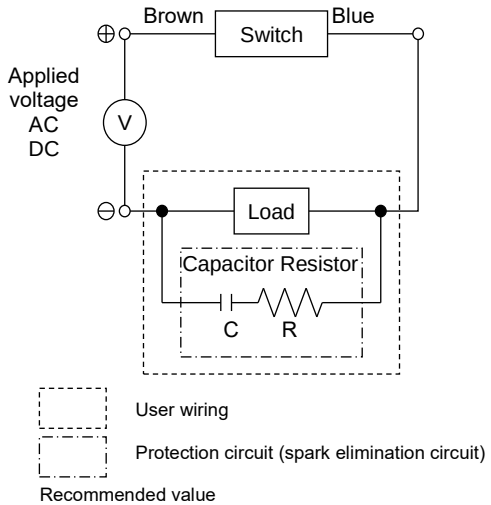
- When the switch is used with DC power, connect the brown wire to the positive side and the blue wire to the negative side. If the polarity of the connection of wires is reversed, the switch will turn on but the indicator will not light up.
- When the switch is connected to the input of a relay or a programmable controller for AC power and the half-wave rectification is performed in those circuits, the indicator on the switch may not light up. In that case, reversing the polarity of the connection of the lead wires of the switch will light up the indicator.

■ Contact protection measures

When the switch is used with an inductive load such as a relay or when the wiring length exceeds the value shown in the table to the right, install a contact protection circuit.

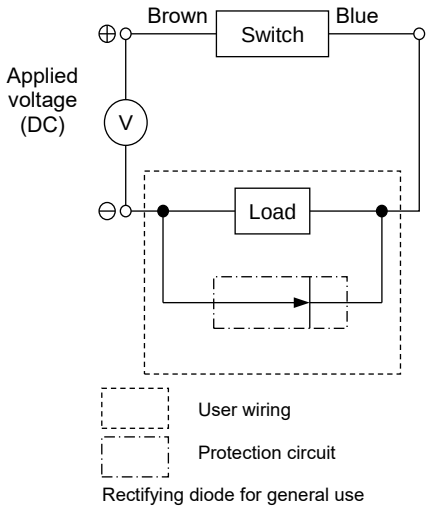
Power	Wiring length
DC	50 m
AC	10 m

< Protection when connecting an inductive load >



Recommended value
C (Capacitor) 0.033 μF to 0.1 μF
R (Resistor)1 kΩ to 3 kΩ
XEB1K1 manufactured by Okaya Electric Industries or equivalent

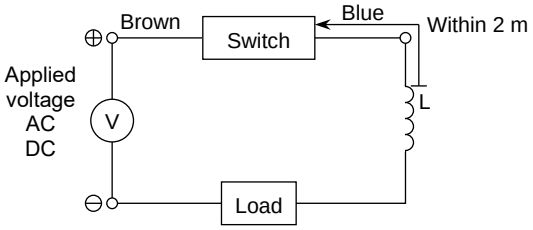
When capacitor and resistor are used



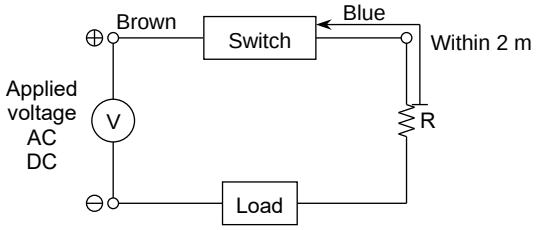
Rectifying diode for general use
V06C manufactured by Hitachi or equivalent

When diode is used

< Protection when the wiring length exceeds the value shown in the table above >



- Choke coil
  L = Several hundred μH to several mH
  Excellent high frequency characteristic
- Wire near the switch (within 2 m).



- Starting current restriction resistor
  R = Highest possible resistance for the load circuit
- Wire near the switch (within 2 m).

■ Contact capacity

Do not use a load that exceeds the maximum contact capacity of the switch. If the current falls below the rated current value, the indicator may not light up.

■ Relay

Use one of the following or equivalent relays:
- Omron Corporation ·····MY type
- Fuji Electric Co., Ltd. ·····HH5 type
- Panasonic Corporation ·····HC type

■ Serial connection

The voltage drop of multiple T0 and T8 switches connected in serial is the sum of the voltage drop of all switches.
The indicator will light up only when all the switches turn on.

■ Parallel connection

There is no limitation on the number of units that can be connected in parallel. However, the indicator may become dim or not light up for T0 and T8 switches.

3. USAGE

3.1 Using the Cylinder

■ Working pressure range

Use the cylinder within the following pressure range:

Model	Pressure range
CMK2-HP1	0.1 to 1.0

■ How to adjust the cushion

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 graphs below.

Bore size (mm)	Allowable energy absorption (J)
φ20	0.166
φ25	0.308
φ32	0.424
φ40	0.639

■ Adjustment of the piston speed

Mount a speed controller to adjust the piston speed.

3.2 Using the Switch

■ Magnetic environment

Do not use the switch in a place where there is a strong magnetic field or large current (such as a large magnet or welding machine). If switch mounted cylinders are installed close to each other and in parallel or if magnetic substances are moving close to the cylinder, the magnetic forces may interfere with each other and affect the detection accuracy.

■ Wiring of lead wires

When wiring, be careful not to apply bending stress and tension repeatedly to lead wires.
For movable sections, use wiring material with the same level of bending resistance as the robot wire.

■ Ambient temperature

Do not use the switch in a high temperature environment (60°C or more).
Using the switch in a high temperature environment may affect its performance due to the temperature characteristics of magnetic parts and electronic parts.

■ Intermediate position detection

When the switch is operated at an intermediate position in the length of the stroke, the relay will not respond if the piston speed is too high.
If the operation time of the relay is 20 ms, keep the piston speed at 500 mm/s or less.

■ Shock

Do not subject the product to strong vibrations and shocks when transporting the cylinder and mounting and adjusting the switch.

4. MAINTENANCE AND INSPECTION

⚠ WARNING

Do not disassemble the product.

Do not touch electrical wiring connections (bare live parts) of actuators equipped with solenoid valves, actuators equipped with switches, and other such actuators.

Do not touch live parts with bare hands.
An electric shock may occur.

⚠ CAUTION

Plan and perform daily and periodic inspections so that maintenance can be managed properly.
If maintenance is not properly managed, the product's functions may deteriorate significantly and this may lead to faults (such as short service life, damage, and malfunction) or accidents.

4.1 Periodic Inspection

In order to use the product under optimum conditions, perform a periodic inspection once or twice a year.

4.1.1 Inspection item

- Actuation state
- Change in the piston speed and cycle time
- External and internal leakages
- Damage and deformation of the piston rod
- Abnormality in the stroke

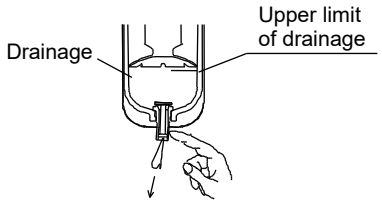
Check the items above and refer to "5. TROUBLESHOOTING" to correct any abnormality found. If there are loose threaded connections, tighten them.

4.1.2 Maintenance of the product

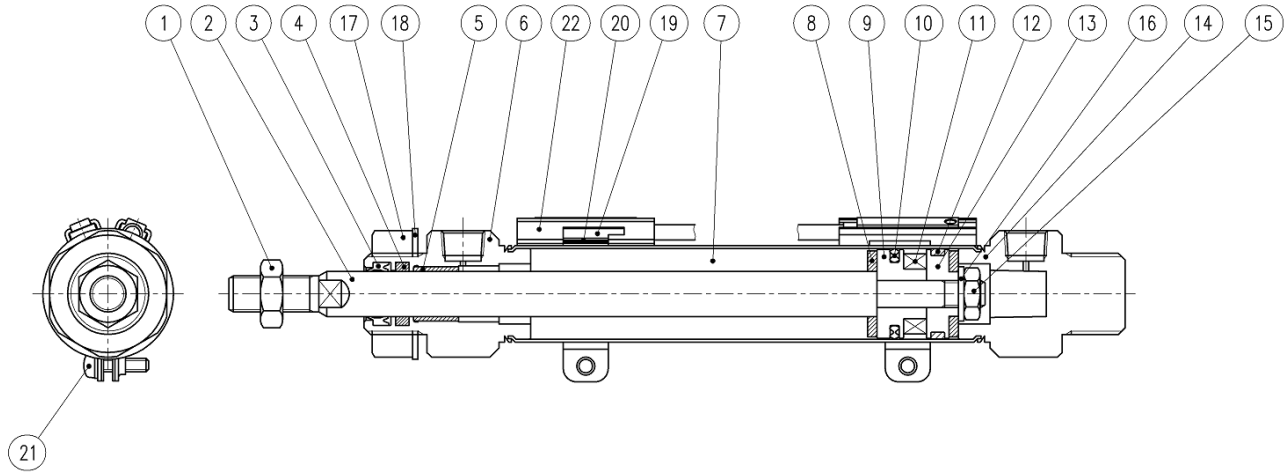
This cylinder does not require lubrication.

4.1.3 Maintenance of the circuit

- Discharge the drainage accumulated in the air filter periodically before it exceeds the specified line.
- Since foreign matters such as carbide (carbon or tar substance) from the compressor oil may contaminate the circuit and cause an operation fault of the solenoid valve or the cylinder, be careful when performing maintenance or inspection of the compressor.



4.1.4 Internal structural diagram



Parts list

No.	Part name	Material	Remarks
1	Rod nut	Steel Note 1	Zinc chromate
2	Piston rod	φ20,25：Stainless steel φ32,40：Carbon steel Note 1	Industrial chrome plating
3	Rod packing	NBR	
4	Lub Keeper	Special rubber	
5	Bush	φ20：Dry bearing φ25,32,40：Copper-based	
6	Rod cover	Aluminum alloy	
7	Cylinder tube	Stainless steel	
8	Cushion rubber	Urethane rubber	
9	Piston A	Aluminum alloy	
10	Piston packing	NBR	
11	Magnet	Plastic	
12	Wear ring	Polyacetal resin	
13	Piston B	Aluminum alloy	
14	Head cover	Aluminum alloy	
15	Hexagon nut	Steel	Zinc chromate
16	Spacer	Steel	Zinc chromate
17	Nut	Steel	Zinc chromate
18	Toothed washer	Steel	Zinc chromate
19	switch body		With switch
20	Band	Stainless steel	With switch
21	Pan head machine screw	Stainless steel	With switch
22	Switch rail	Stainless steel	With switch

Note1：Stainless steel when option “M” is selected.

Note 2:The above is the parts list of HP1 series.
For P4 series, the use of copper, zinc, nickel-based materials and electrolytic nickel plating is limited in the construction of the flow path parts and sliding parts.
For 40 series, the use of copper, zinc, nickel-based materials, zinc plating and electrolytic nickel plating is limited in the construction of all parts.

5. TROUBLESHOOTING

5.1 Problems, Causes, and Solutions

If the product does not operate properly, check the table below for a possible solution.

5.1.1 Cylinder

Problem	Cause	Solution
Does not operate.	No pressure or insufficient pressure is applied.	Secure sufficient pressure.
	No signal is input to directional control valve.	Repair the control circuit.
	Centers were not aligned when mounted.	Correct the way the cylinder is mounted. Change the mounting style.
	Piston packing is damaged.	Replace the cylinder.
Does not operate smoothly.	Speed is lower than minimum working piston speed.	Mitigate load fluctuation.
	Centers were not aligned when mounted.	Correct the way the cylinder is mounted. Change the mounting style.
	Lateral load is applied.	Install a guide. Correct the way the cylinder is mounted. Change the mounting style.
	Load is too large.	Increase the pressure. Enlarge the bore size.
	Speed control valve has meter-in circuit.	Change the mounting direction of the speed control valve.
Cylinder is damaged or deformed.	Force of shock due to high-speed actuation is excessive.	Decrease the speed. Lighten the load. Install a more effective cushion mechanism. (external cushion mechanism)
	Lateral load is applied.	Install a guide. Correct the way the cylinder is mounted. Change the mounting style.

5.1.2 Switch

Problem	Cause	Solution
Switch turns on but indicator does not blink.	Contact is welded.	Replace the switch.
	Rating of load is exceeded.	Replace the relay with one recommended by CKD or replace the switch.
	Indicator is damaged.	Replace the switch.
	External signal is faulty.	Check the external circuit.
Switch does not turn on.	Cables are disconnected.	Replace the switch.
	External signal is faulty.	Check the external circuit.
	Voltage is wrong.	Use specified voltage.
	Switch is not mounted in right place.	Mount the switch in right place.
	Switch is not positioned correctly.	Position and tighten the switch correctly
	Switch is facing opposite direction.	Mount the switch so that it faces the correct direction.
	Load (relay) cannot respond for intermediate position detection.	Lower the speed. Replace the relay with one recommended by CKD.
	Rating of load is exceeded.	Replace the relay with one recommended by CKD or replace the switch.
Switch does not turn off.	Piston is not moving.	Move the piston.
	Contact is welded.	Replace the switch.
	Rating of relay is exceeded.	Replace the relay with one recommended by CKD or replace the switch.
	Ambient temperature is too high or too low.	Use the switch at an ambient temperature of −10°C to 60°C.
	Magnetic field is nearby.	Install a magnetic shield.
	External signal is faulty.	Check the external circuit.

If you have any other questions or concerns, contact your nearest CKD sales office or distributor.

6. WARRANTY PROVISIONS

6.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.
However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure caused by incorrect use such as careless handling or improper management.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure that could have been avoided if the customer's machinery or device, into which the product is incorporated, had functions and structures generally provided in the industry.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

6.2 Warranty Period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer.