CKD

Small Compact Cylinder
Small Guided Compact Cylinder
MSD-HP1 Series
MSDG-L-HP1 Series

INSTRUCTION MANUAL

SM-A42794-A/2

- 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 **"MSD-HP1 Series, MSDG-L-HP1 Series" Small Compact Cylinder, Small Guided Compact 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 : MSD-HP1 series**

● Without switch (without magnet for switch)

MSD - 6 - 5 ——— R - HP1

● With switch (built-in magnet for switch)

MSD-L - 6 - 5 - F0H - R - R - HP1

Ⓐ Model No.

Code	Description	
Ⓐ Model No.		
MSD	Double acting/single rod	Without switch
MSD-L		With switch

Ⓑ Bore size

Ⓑ Bore size (mm)	
6	ø6
8	ø8

Ⓒ Stroke length

Ⓒ Stroke length (mm)	
5	5
10	10
15	15
20	20
25	25
30	30

Ⓓ Switch model No. *1

Lead wire Straight	Lead wire Radial	Contact	Voltage AC	Voltage DC	Display lamp	Lead wire
F0H*	F0V*	Reed		●	1-color display	2-wire
-	F2S*	Proximity		●		
F2H*	F2V*			●		
-	F3S*			●		3-wire
F3H*	F3V*			●		
F3PH*	F3PV*			●	1-color display (PNP output) (Made to order)	
F2YH*	F2YV*			●	2-color display	2-wire
F3YH*	F3YV*			●		3-wire

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

Ⓔ Switch quantity

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

Ⓕ Option *2

Ⓕ Option	
Blank	Front piping
R	Rear piping

Note1: For ø6 or ø8 with switch, use a non-magnetic (stainless steel, etc.) mounting bolt.

Note2: For rear piping, body side mounting is possible. Note that 2 bolts are used for rod side mounting and head side mounting.

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

● Without switch (without magnet for switch)

MSD - 6 - 5 ——— R P4/P40 - HP1

● With switch (built-in magnet for switch)

MSD-L - 6 - 5 - SW81 - R - R P4/P40 - HP1

Ⓐ Model No.

Ⓑ Bore size

Ⓒ Stroke

Ⓓ Switch model No. *1

Ⓔ Switch quantity

Ⓕ Piping port position *2

Code	Description	
Ⓐ Model No.		
MSD	Double acting/Single rod	Without switch
MSD-L		With switch

Ⓑ Bore size(mm)	
6	ø6
8	ø8

Ⓒ Stroke(mm)	
5	5
10	10
15	15
20	20
25	25
30	30

Ⓓ 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

Ⓕ Piping port position	
Blank	Front piping
R	Rear piping

Note1: For ø6 or ø8 with switch, use a non-magnetic (stainless steel, etc.) mounting bolt.

Note2: For rear piping, body side mounting is possible. Note that 2 bolts are used for rod side mounting and head side mounting.

■ Example of model number indication : MSDG-L-HP1 series

● With switch (built-in magnet for switch)

MSDG-L - 6 - 30 - F0H - D - R - HP1

Model No.

Ⓐ Bore size

Ⓑ Stroke length

Ⓒ Switch model No. *1 *2

Ⓓ Switch quantity

Ⓔ Option *3

Code	Description
Ⓐ Bore size (mm)	
6	ø6
8	ø8
12	ø12
16	ø16
Ⓑ Stroke length (mm)	
5	5
10	10
15	15
20	20
25	25
30	30

Ⓒ Switch model No.

Lead wire Straight	Lead wire Radial	Contact Point	Voltage AC	Voltage DC	Display lamp	Lead wire
F0H*	F0V*	Reed		●	1-color display	2-wire
-	F2S*	Proximity		●		
F2H*	F2V*			●		
-	F3S*			●		3-wire
F3H*	F3V*			●		
F3PH*	F3PV*			●	1-color display (PNP output) (Made to order)	
F2YH*	F2YV*			●	2-color display	2-wire
F3YH*	F3YV*			●		3-wire

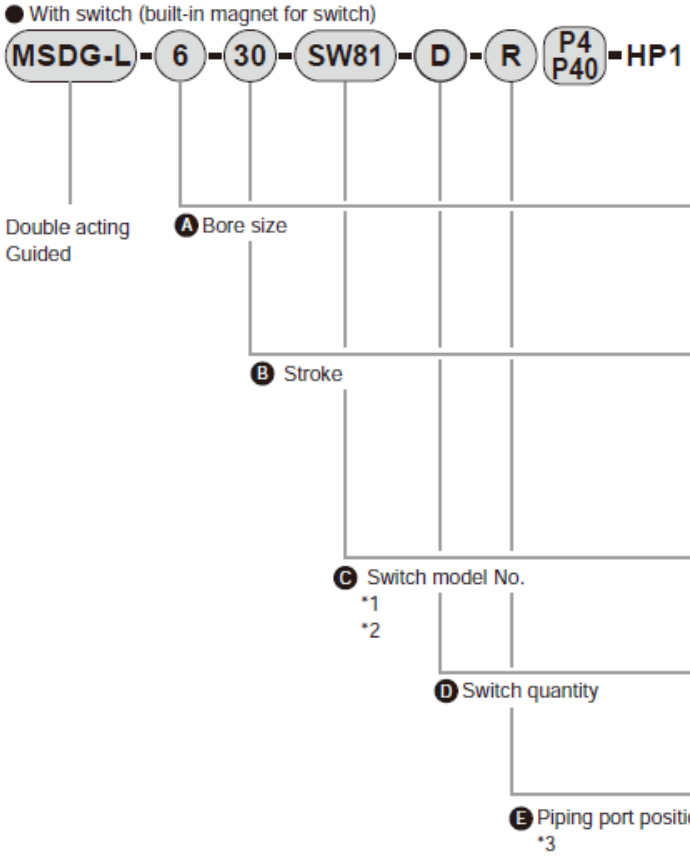
*** Lead wire length**	
Blank	1 m (standard)
3	3 m (option)

Ⓓ Switch quantity	
R	1 on rod side
H	1 on head side
D	2

Ⓔ Option	
Blank	Front piping
R	Rear piping

Note1: For ø6 or ø8 with switch, use a non-magnetic (stainless steel, etc.) mounting bolt.
Note2: When using a proximity switch with ø12 or ø16, use a non-magnetic (stainless steel, etc.) through bolt.
Note3: For rear piping, body side mounting is possible.

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



Code	Description
Ⓐ Bore size(mm)	
6	ø6
8	ø8
12	ø12
16	ø16
Ⓑ Stroke(mm)	
5	5
10	10
15	15
20	20
25	25
30	30
Ⓒ 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
Ⓔ Piping port position	
Blank	Front piping
R	Rear piping

Note1: For ø6 or ø8 with switch, use a non-magnetic (stainless steel, etc.) mounting bolt.
Note2: When using a proximity switch with ø12 or ø16, use a non-magnetic (stainless steel, etc.) through bolt.
Note3: For rear piping, body side mounting is possible.

■ Stroke length

<MSD-HP1>

Bore size (mm)	Standard stroke length (mm)	Max. stroke length (mm	Min. stroke length with two switches (mm)		Min. stroke length with one switch (mm)	
			Reed switch	Proximity switch	Reed switch	Proximity switch
φ6	5･10･15･20･25･30	30	10	5 (10)	5	5
φ8	5･10･15･20･25･30	30	10	5 (10)	5	5

※ Products with stroke length other than standard stroke length are not available.
※ For F2Y, F3Y or F3P, the min. stroke length will be the dimensions in ( ).

<MSDG-L-HP1>

Bore size (mm)	Standard stroke length (mm)	Max. stroke length (mm)	Min. stroke length with two switches (mm)		Min. stroke length with one switch (mm)	
			Reed switch	Proximity switch	Reed switch	Proximity switch
φ6	5･10･15･20･25･30	30	10	5	5	5
φ8	5･10･15･20･25･30	30	10	5	5	5
φ12	5･10･15･20･25･30	30	10	5	5	5
φ16	5･10･15･20･25･30	30	10	5	5	5

※ Products with stroke length other than standard stroke length are not available.

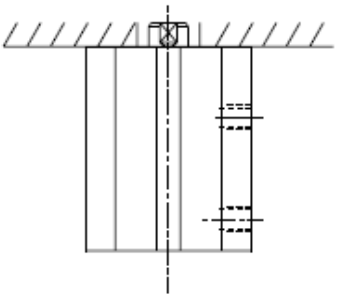
1.1.2 Switch selection table

Switches may not be installable depending on relations between cylinder installation and stroke length.
Refer to the table below to select a switch.
Switches cannot be used for side mounting in the following combinations.

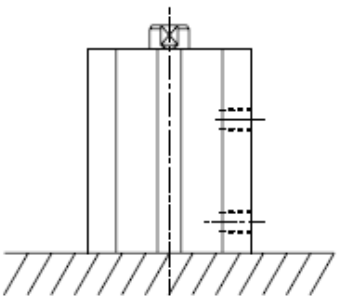
- Combinations in which F2YH/V, F3YH/V or F3PH/V is mounted at the switch mounting position H with stroke length 5 mm
- Combinations in which F2YH, F3YH or F3PH is mounted at the switch mounting position H with stroke length 10 mm

(Refer to page 5 for the min. stroke length with switch)

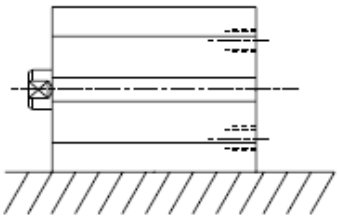
■ MSD-HP1 Series



(R) For rod side installation



(H) For head side installation



For side installation

●MSD-HP1 For rod side installation

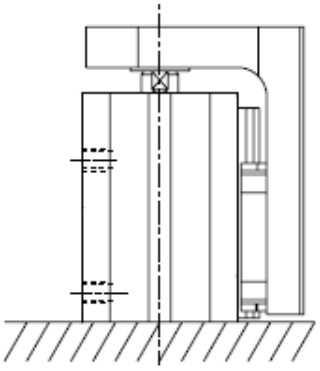
○: Available ×: Not available

Bore size (mm)	Stroke length (mm)	Switch position													
		Reed switch				Proximity switch									
		F0H		F0V		F2S/F3S		F2H/F3H		F2V/F3V		F2YH/F3YH/F3PH		F2YV/F3YV/F3PV	
		R	H	R	H	R	H	R	H	R	H	R	H	R	H
φ6	5	○	○	○	○	○	○	○	×	○	○	○	×	○	×
	10	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	15 up	○	○	○	○	○	○	○	○	○	○	○	○	○	○
φ8	5	○	○	○	○	○	○	○	×	○	○	○	×	○	×
	10	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	15 up	○	○	○	○	○	○	○	○	○	○	○	○	○	○

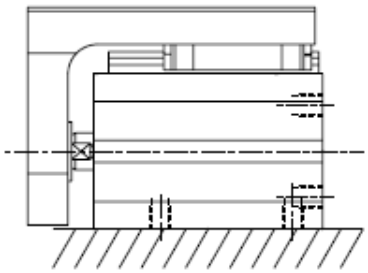
●MSD-HP1 For head side installation

Bore size (mm)	Stroke length (mm)	Switch position													
		Reed switch				Proximity switch									
		F0H		F0V		F2S/F3S		F2H/F3H		F2V/F3V		F2YH/F3YH/F3PH		F2YV/F3YV/F3PV	
		R	H	R	H	R	H	R	H	R	H	R	H	R	H
φ6	5	×	×	○	○	○	○	×	○	○	○	×	×	○	×
	10	○	×	○	○	○	○	×	○	○	○	×	○	○	○
	15	○	×	○	○	○	○	○	○	○	○	×	○	○	○
	20 up	○	×	○	○	○	○	○	○	○	○	○	○	○	○
φ8	5	×	×	○	○	○	○	×	○	○	○	×	×	○	×
	10	○	×	○	○	○	○	×	○	○	○	×	○	○	○
	15	○	×	○	○	○	○	○	○	○	○	×	○	○	○
	20 up	○	×	○	○	○	○	○	○	○	○	○	○	○	○

■ MSDG-L-HP1 Series



(H) For head side installation



For side installation

●MSDG-L-HP1 For head side installation ○:Available ×:Not available

Bore size (mm)	Stroke length (mm)	Switch position													
		Reed switch				Proximity switch									
		F0H		F0V		F2S/F3S		F2H/F3H		F2V/F3V		F2YH/F3YH/ F3PH		F2YV/F3YV/ F3PV	
		R	H	R	H	R	H	R	H	R	H	R	H	R	H
φ6	5	×	○	○	○	○	○	×	○	○	○	×	×	○	○
	10	○	○	○	○	○	○	×	○	○	○	×	○	○	○
	15 up	○	○	○	○	○	○	○	○	○	○	○	○	○	○
φ8	5	×	○	○	○	○	○	×	○	○	○	×	×	○	○
	10	○	○	○	○	○	○	×	○	○	○	×	○	○	○
	15 up	○	○	○	○	○	○	○	○	○	○	○	○	○	○
φ12	5	×	○	○	○	○	○	×	○	○	○	×	○	○	○
	10	○	○	○	○	○	○	×	○	○	○	×	×	○	○
	15 up	○	○	○	○	○	○	○	○	○	○	○	○	○	○
φ16	5	×	○	○	○	○	○	×	○	○	○	×	○	○	○
	10	○	○	○	○	○	○	×	○	○	○	×	○	○	○
	15 up	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note 1: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

Descriptions \ Model		MSD-HP1,MSD-L-HP1(With switch) MSD-P4※-HP1、MSD-L-P4※-HP1(With switch)
Bore size	mm	φ6,φ8
Actuation		Double acting
Working fluid		Compressed air
Max. working pressure	MPa	1.0
Min. working pressure	MPa	0.15
Proof pressure	MPa	1.6
Ambient temperature	°C	-10 to 60 (no freezing)
Port size		M3
Stroke tolerance	mm	$^{+0.5}_{0}$
Working piston speed	mm/s	50 to 500
Cushion		None
Lubrication		Not required
Allowable absorbed energy	J	This product cannot absorb the energy generated by an external load mounted on the cylinder. When using the product with no load, separately provide a shock absorber on the outside.

Descriptions \ Model		MSDG-L-HP1(With switch) MSDG-L-P4※-HP1(With switch)			
Bore size	mm	φ6	φ8	φ12	φ16
Actuation		Double acting			
Working fluid		Compressed air			
Max. working pressure	MPa	1.0			
Min. working pressure	MPa	0.2	0.15	0.1	
Proof pressure	MPa	1.6			
Ambient temperature	°C	5 to 60			
Port size	Front piping	M3		M5	
	Rear piping	M3		M3	
Stroke tolerance	mm	$^{+2.0}_{0}$			
Working piston speed	mm/s	50 to 500			
Cushion		With rubber cushion			
Lubrication		Not required			
Allowable absorbed energy	J	0.004	0.014	0.044	0.110

1.2.2 Switch specifications

Descriptions	Proximity			
	2-wire type		3-wire type	
	F2S/H/V	F2YH/V	F3S/H/V	F3YH/V
Applications	Only for programmable controller		For programmable controller, relay	
Power supply voltage	—		10 to 28VDC	
Load voltage	10 to 30VDC	24VDC±10%	30 VDC or less	
Load current	5 to 20mA Note 2		50 mA or less	
Current consumption	—		10 mA or less at 24 VDC	
Internal voltage drop	4V or less		0.5V or less	
Indicator	Yellow LED Note 3 (Lights up when turned on)	Red/green LED (Lights up when turned on)	Yellow LED Note 3 (Lights up when turned on)	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 (Elasticity,Oil-resistant vinyl cabtyre 2 core cord, 0.15 mm^2)		Standard is 1 m (Elasticity,Oil-resistant vinyl cabtyre 3 core cord, 0.15 mm^2)	
Shock resistance	980m/s^2			
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	Reed 2-wire type
	F3PH/V	F0H/V
Applications	For programmable controller, relay	Only for programmable controller
Power supply voltage	4.5 to 28VDC	—
Load voltage	30 VDC or less	24VDC±10%
Load current	50mA or less	5 to 20mA Note 2
Current consumption	10 mA or less at 24 VDC	—
Internal voltage drop	0.5 V or less at 30 mA	4V or less
Indicator	Yellow LED (Lights up when turned on)	Yellow LED Note 3 (Lights up when turned on)
Leakage current	10μA or less	1mA or less
Lead wire Note 1	Standard is 1 m (Elasticity,Oil-resistant vinyl cabtyre 3 core cord, 0.15 mm^2)	Standard is 1 m (Elasticity,Oil-resistant vinyl cabtyre 2 core cord, 0.15 mm^2)
Shock resistance	980m/s^2	294m/s^2
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	

Note 1: 3 m and 5 m lead wires are available as options. (Except 5m of F type switch)
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).
Note 3: The indicator is red LED for F2S and F3S.
Note 4: 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).
※ "F□H" show Lead wire straight type, as well as "F□V" show Lead wire angled type.

2. INSTALLATION

2.1 Environment

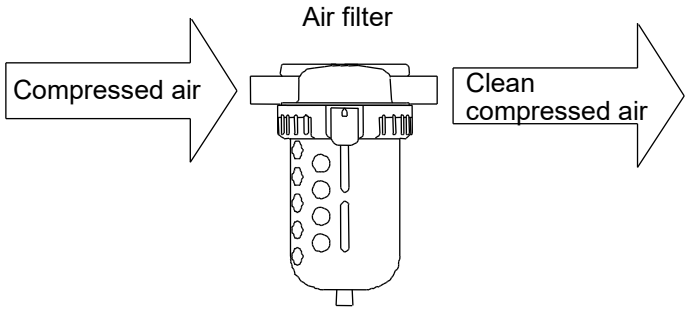
⚠CAUTION

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.
  MSD-HP1 −10°C to 60°C (no freezing)
  MSDG-L-HP1 5 to 60°C
- 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, take proper measures to prevent foreign matters from entering the cylinder.

2.3 Mounting

2.3.1 Mounting the Body

⚠CAUTION

Do not damage the surface flatness by denting or scratching the body (tube) mounting surface or the table surface. Make sure that the flatness of the mating surface for table mounting is 0.05 mm or less.

Provide a guide so that a lateral load is not applied to the piston rod.
(Example) Do not apply an excessive lateral load as a stopper.

2.3.2 Mounting the switch

■ Mounting position

< Mounting the switch at the stroke end >
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.

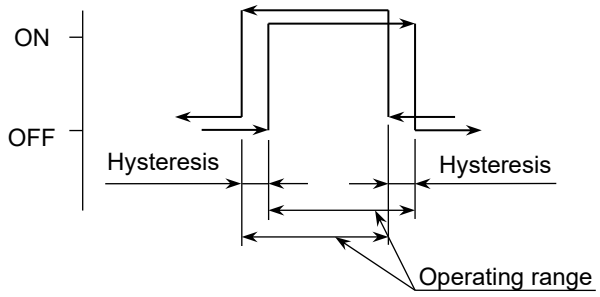
< Mounting the switch at the intermediate position of the stroke >
For the switch to function at an intermediate position of the stroke, secure the piston at the position where the switch needs to function and then slide the switch on the piston back and forth to find the positions where the switch turns 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.

■ 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

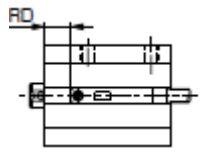
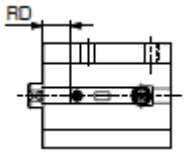
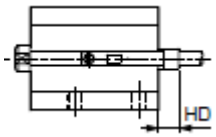
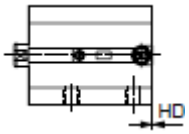
This is the distance from where the switch is turned on when the piston moves and to where the switch is turned off when the piston moves in the opposite direction.



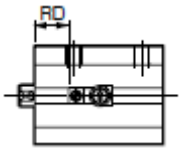
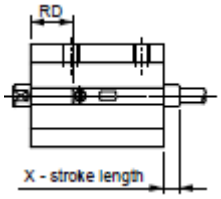
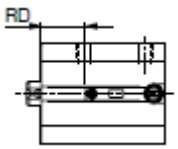
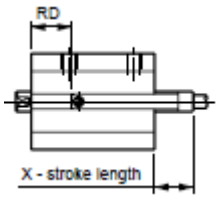
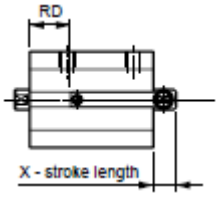
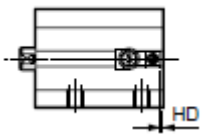
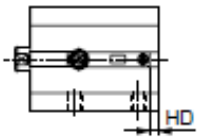
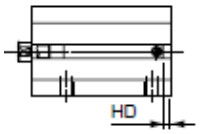
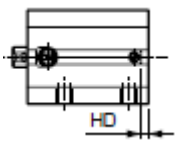
■ The maximum sensitivity position (HD,RD)

<MSD-HP1 Series>

●Reed switch

		F0H	F0V
φ6 φ8	RD		
	HD		

●Proximity switch

		F2S/F3S	F2H/F3H	F2V/F3V	F2YH/F3YH/F3PH	F2YV/F3YV/F3PV
φ6 φ8	RD					
	HD					

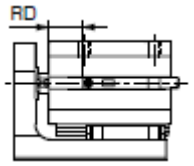
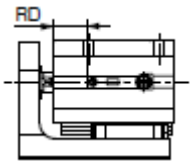
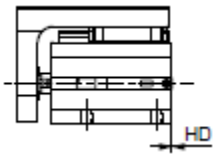
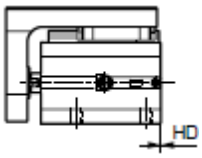
Switch mounting position dimensions (Unit: mm)

Model	Bore size (mm)	Reed switch				Proximity switch													
		F0H		F0V		F2S/F3S		F2H/F3H			F2V/F3V		F2YH/F3YH/F3PH			F2YV/F3YV/F3PV			
		RD	HD	RD	HD	RD	HD	RD	HD	X Note1	RD	HD	RD	HD	X Note1	RD	HD	X Note1	
MSD-L-HP1	φ6	3.5	3.5	3.5	0	6.5	0.5	7.5	1.5	7.7	7.5	1.5	7.5	1.5	12.2	7.5	1.5	9.2	
	φ8	5.5	4.0	5.5	0	8.5	0	9.5	1.0	8.2	9.5	1.0	9.5	1.0	12.7	9.5	1.0	9.7	

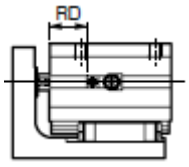
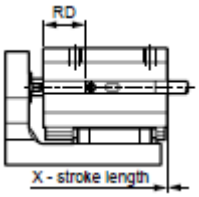
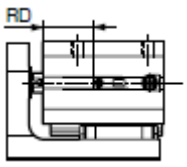
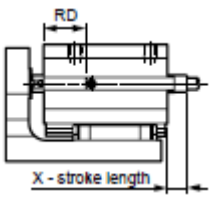
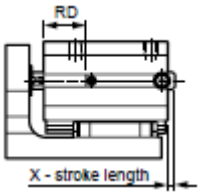
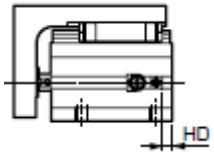
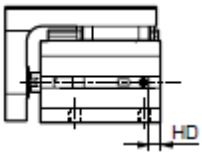
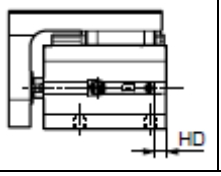
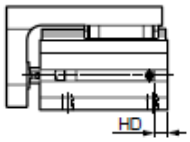
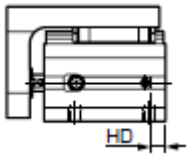
Note1： X dimensions indicate the switch protrusion from the body end surface. When the X-stroke length is negative, there is no protrusion from the body end surface.

<MSDG-L-HP1 Series φ6,φ8>

●Reed switch

		F0H	F0V
φ6 φ8	RD		
	HD		

●Proximity switch

		F2S/F3S	F2H/F3H	F2V/F3V	F2YH/F3YH/F3PH	F2YV/F3YV/F3PV
φ6 φ8	RD					
	HD					

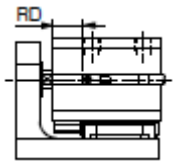
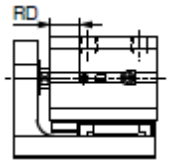
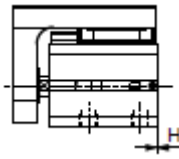
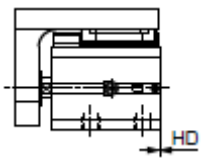
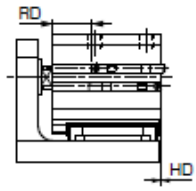
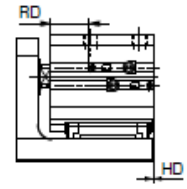
Switch mounting position dimensions (Unit: mm)

Model	Bore size (mm)	Reed switch				Proximity switch												
		F0H		F0V		F2S/F3S		F2H/F3H			F2V/F3V		F2YH/F3YH/ F3PH			F2YV/F3YV/ F3PV		
		RD	HD	RD	HD	RD	HD	RD	HD	X Note1	RD	HD	RD	HD	X Note1	RD	HD	X Note1
MSDG-L-HP1	φ6	6.0	0	6.0	0	9	2.5	10	3.5	5.2	10	3.5	10	3.5	9.7	10	3.5	6.7
	φ8	8.5	0	8.5	0	11.5	1.5	12.5	2.5	6.2	12.5	2.5	12.5	2.5	10.7	12.5	2.5	7.7

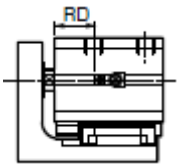
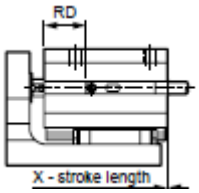
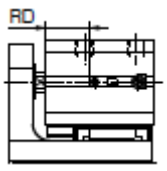
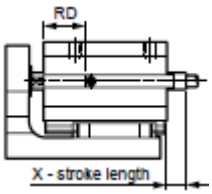
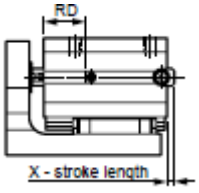
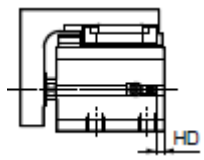
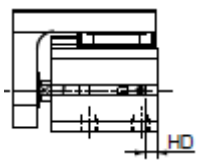
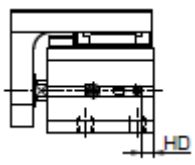
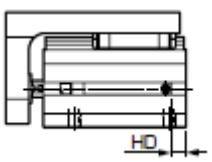
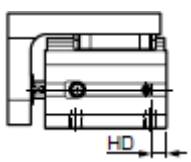
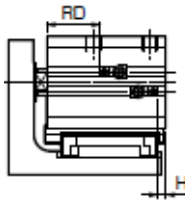
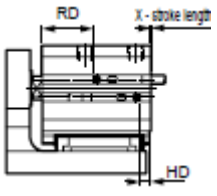
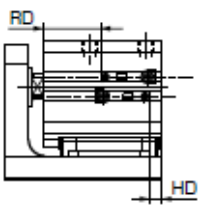
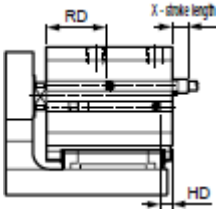
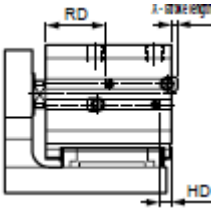
Note1： X dimensions indicate the switch protrusion from the body end surface. When the X-stroke length is negative, there is no protrusion from the body end surface.

<MSDG-L-HP1 Series φ12,φ16>

●Reed switch

		F0H	F0V
ϕ12	RD		
	HD		
ϕ16	RD		
	HD		

●Proximity switch

		F2S/F3S	F2H/F3H	F2V/F3V	F2YH/F3YH/F3PH	F2YV/F3YV/F3PV
ϕ12	RD					
	HD					
ϕ16	RD					
	HD					

Switch mounting position dimensions (Unit: mm)

Model	Bore size (mm)	Reed switch				Proximity switch											
		F0H		F0V		F2S/F3S		F2H/F3H			F2V/F3V		F2YH/F3YH/F3PH			F2YV/F3YV/F3PV		
		RD	HD	RD	HD	RD	HD	RD	HD	X Note1	RD	HD	RD	HD	X Note1	RD	HD	X Note1
MSDG-L-HP1	φ12	9.0	0	9.0	0	12	2.5	13	3.5	5.7	13	3.5	13	3.5	10.2	13	3.5	7.2
	φ16	14.0	0	14.0	0	16.5	2.5	17.5	3.5	5.2	17.5	3.5	17.5	3.5	9.7	17.5	3.5	6.7

Note1 : X dimensions indicate the switch protrusion from the body end surface. When the X-stroke length is negative, there is no protrusion from the body end surface.

■ Operating range, Hysteresis (unit：mm)

<MSD-HP1,MSDG-L-HP1>

Proximity switch (F2S/H/V,F3S/H/V,F2YH/V,F3YH/V,F3PH/V)					Reed switch (F0H/V)	
Bore size (mm)	Operating range		Hysteresis		Operating range	Hysteresis
	1-color display	2-color display	1-color display	2-color display		
φ6	1.5 to 3.0	-	1.0 or less	-	5 to 6	1.0 or less
φ8	1.5 to 3.5	-			5.5 to 6.5	
φ12	1.5 to 3.5	-			5.5 to 7.5	
φ16	1.5 to 3.5	-			4.5 to 7	

Note 1: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).
※For φ6 or φ8 with switch, use a non-magnetic (stainless steel, etc.) mounting bolt.
※If with proximity switches φ12 and φ16 and only when using through bolt, use the non-magnetic (stainless steel, etc.) mounting bolt.

2.3.3 Changing the position of the switch

1. Loosen the fastening screw (set screw).
2. Move the switch body along the groove on the side of the body and then tighten the screw at the predetermined position.

2.3.4 Replacing the switch

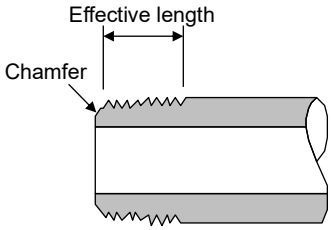
1. Loosen the fastening screw (set screw) and remove the switch body from the groove.
2. Put the replacement switch into the groove.
3. Determine where to position the switch and tighten the screw.
(Tightening torque is 0.03 to 0.08N・m for F2,F3,F0,F3P,F2Y,F3Y.)

2.4 Piping

⚠ WARNING

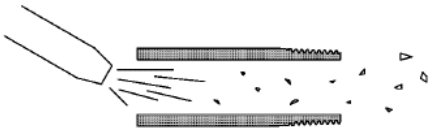
Insert the tube into the fitting until it firmly rests on the tube end and make sure that the tube does not come off before use.

- 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

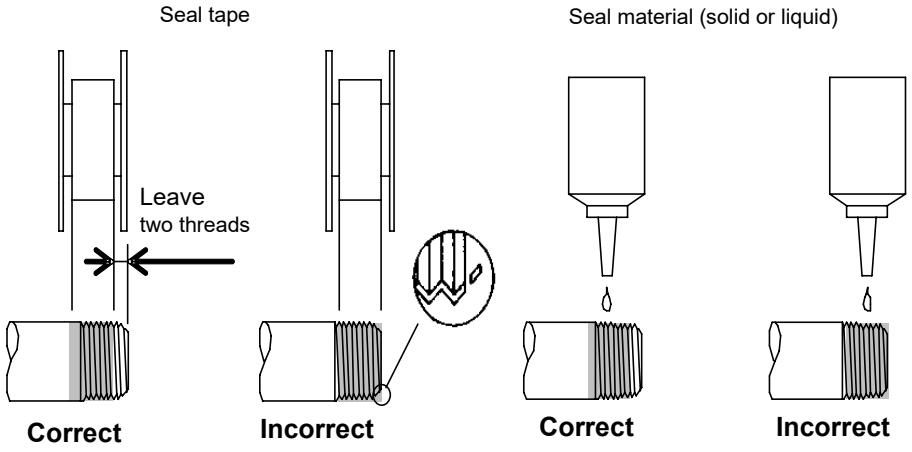
Before piping, blow air into the pipes to clean the interior and to remove cutting chips and foreign matters.



■ Seal material

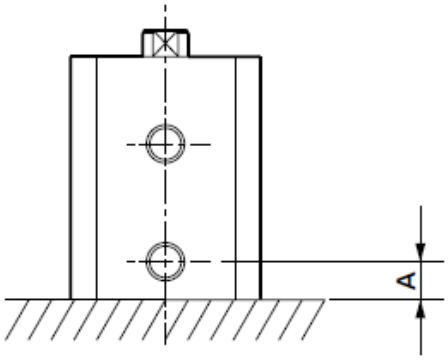
Use a seal tape or a seal material to stop leakage from piping.
Apply a seal tape or seal material to the screw threads leaving two or more threads at the pipe end uncovered or uncoated. If the pipe end is fully covered or coated, a shred of seal tape or residue of seal material may enter inside of the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



2.4.1 Piping port

Cautions for piping speed controller/fitting As compatible fittings are limited, refer to the table below to select a fitting.



<MSD-HP1,MSDG-L-HP1>

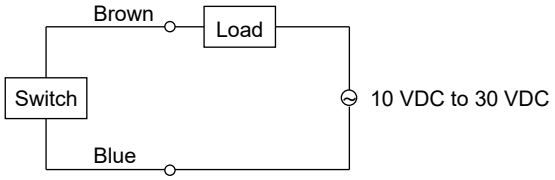
Code / Bore size (mm)	Port size	Port position dimension A	Available speed controller/fitting	Fitting O.D.
φ6 φ8	M3	4	SC3W-M3-3 SC3W-M3-4 SC3U-M3-3 SC3U-M3-4 GWS3-M3-S GWS4-M4-S FTS4-M3	φ8 or less
φ12 φ16	M5	5	SC3W-M5-3 SC3W-M5-4 SC3W-M5-6 SC3U-M5-3 SC3U-M5-4 SC3U-M5-6 GWS4-M5-S GWS6-M5-S FTS4-M5 FTS6-M5	φ10 or less

2.5 Wiring

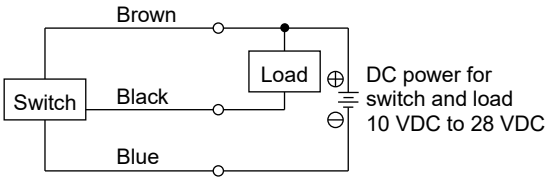
2.5.1 Proximity switch

■ Connection of lead wires

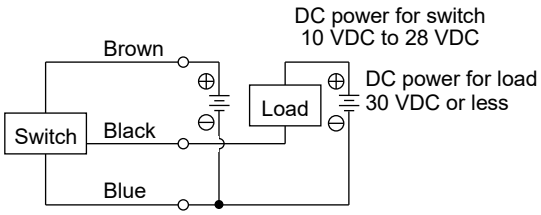
Turn off the power to the device in the electric circuit to which the switch is to be connected and connect the lead wires according to their color. Not turning off the power may cause damage to the electric circuit of the switch load.
If the switch is not wired correctly or the load is short-circuited,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



Example of 2-wire basic circuit



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

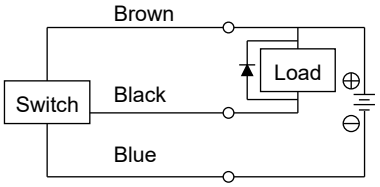


Example of 3-wire basic circuit (2)
(When separate power is used for switch and load)

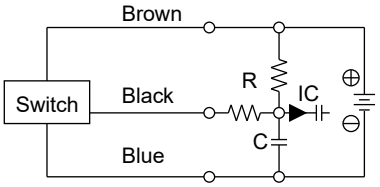
■ Protection of the output circuit

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)

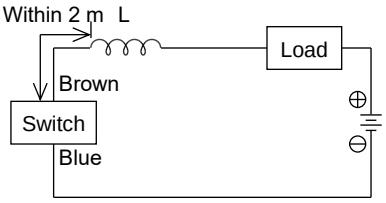


Ex. 1 Using inductive load with surge absorption element (diode). (For diode, use V06C manufactured by Hitachi or equivalent.)



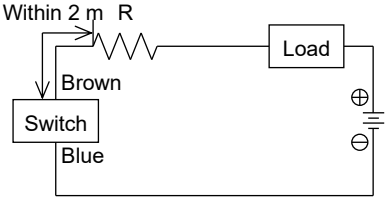
Ex. 2 Using capacious load with current regulating resistor R.
Use the following formula to figure out resistance R (Ω).

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



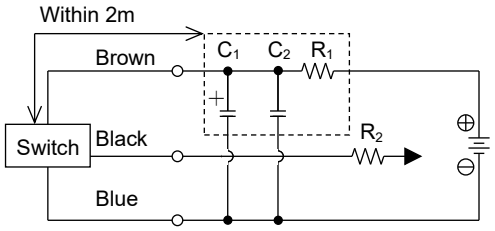
Ex. 3 - Choke coil
L = Several hundred μH to several mH
Excellent high frequency characteristic

- 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).



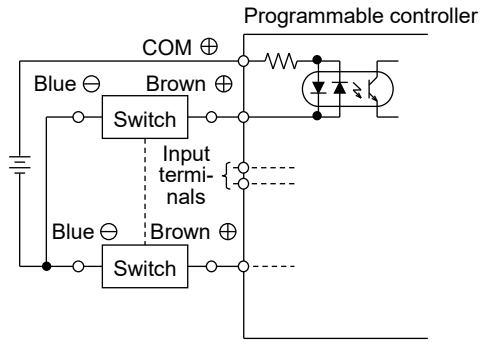
Ex. 5 - Power supply noise absorption circuit
C_1=20 μF to 50 μF electrolytic capacitor
(withstand voltage 50V or more)
C_2=0.01 μF to 0.1 μF ceramic capacitor
R_1=20 Ω to 30 Ω

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

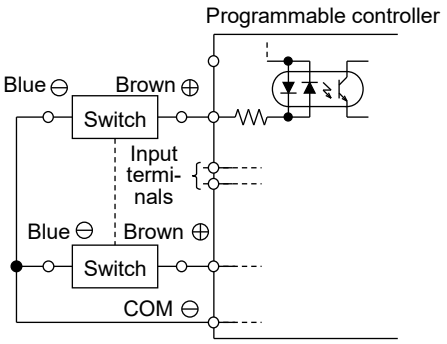
- Wire near the switch (within 2 m)

■ Connection to the programmable controller

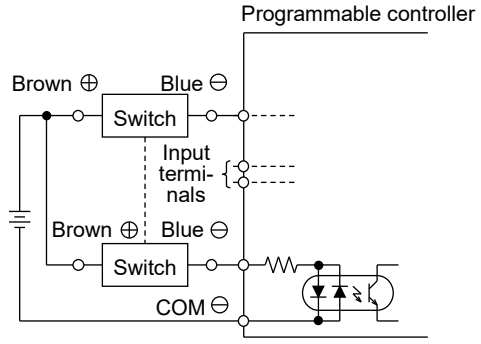
The connection method depends on the type of the programmable controller. Connect as shown below.



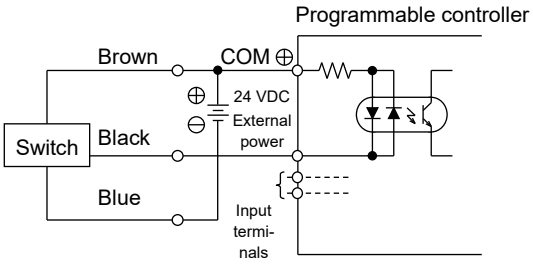
2-wire connection to source input
(external power)



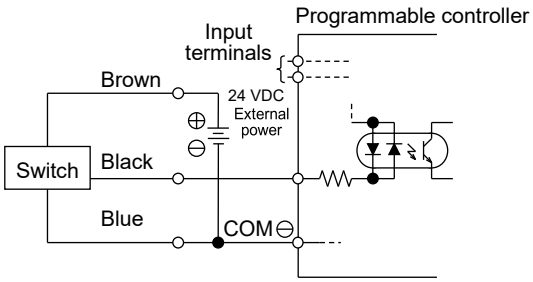
2-wire connection to source input
(internal power)



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 F0 switches, observe the following instructions as well:

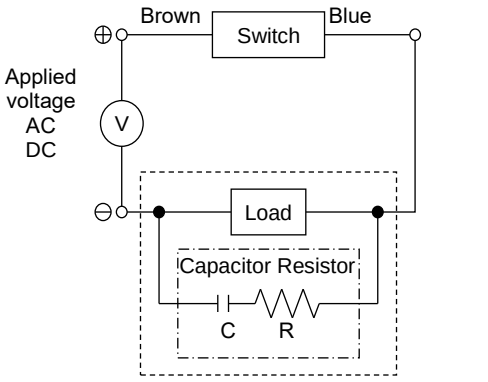
- When the switch is used with DC power, connect the brown wire to the positive side and the blue wire to the negative side. If the polarity of the connection of wires is reversed, the switch will turn on but the indicator will not light up.
- When the switch is connected to the input of a relay or a 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.

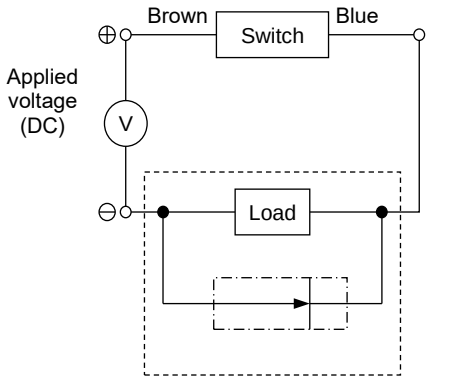
Power	Wiring length
DC	50 m
AC	10 m

<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

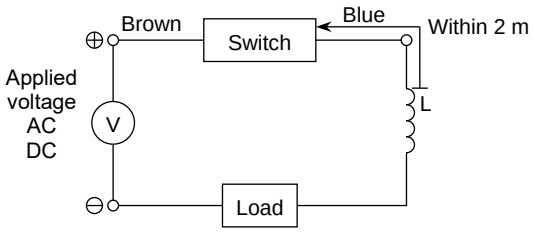
When capacitor and resistor are used



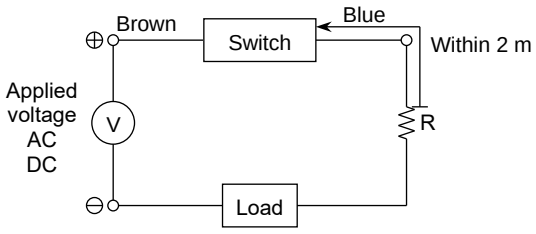
Rectifying diode for general use
V06C manufactured by Hitachi or equivalent

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 F0 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 F0 switches.

3. USAGE

3.1 Using the Cylinder

■ Working pressure range

Use the cylinder within the following pressure range:

Model	Bore size(mm)	Pressure range (MPa)
MSD-HP1	φ6,8	0.15 to 1.0
MSDG-L-HP1	φ6	0.2 to 1.0
	φ8	0.15 to 1.0
	φ12,16	0.1 to 1.0

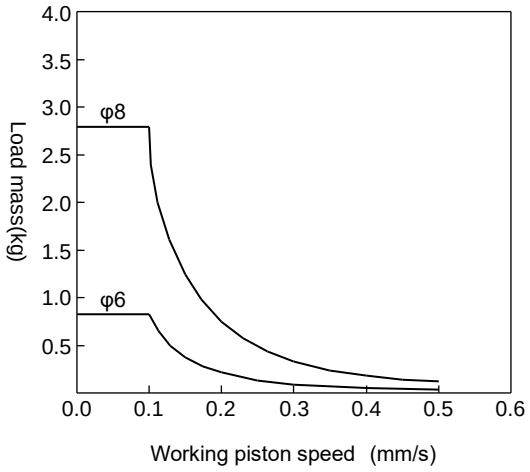
■ How to adjust the cushion

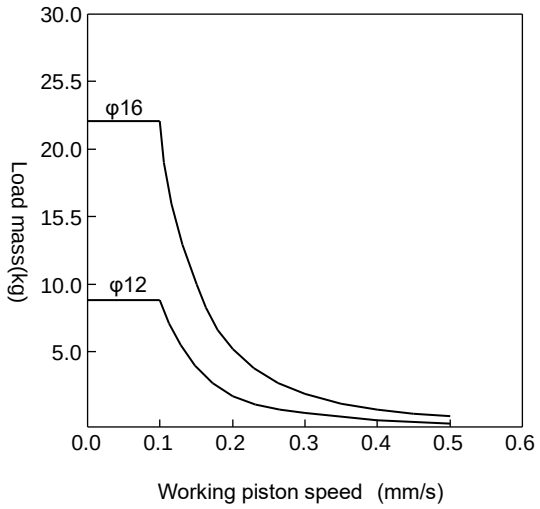
For MSD-HP1 cannot absorb the energy generated by an external load mounted on the cylinder. Although a rubber cushion is internally provided for MSDG-L-HP1, it is advisable to install an additional external stopper when the kinetic energy is excessive. Tolerable kinetic energy is as the graphs below indicate.

Model	Bore size(mm)	φ6	φ8	φ12	φ16
MSDG-L-HP1	Allowable energy absorption (J)	0.004	0.014	0.044	0.110

■ 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 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
- Stroke abnormality

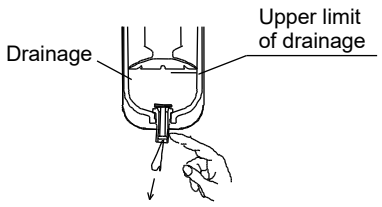
Check the items above and refer to "5. TROUBLESHOOTING" to correct any abnormality found. If there are loose threaded connections, tighten them.

4.1.2 Maintenance of the product

This cylinder does not require lubrication.

4.1.3 Maintenance of the circuit

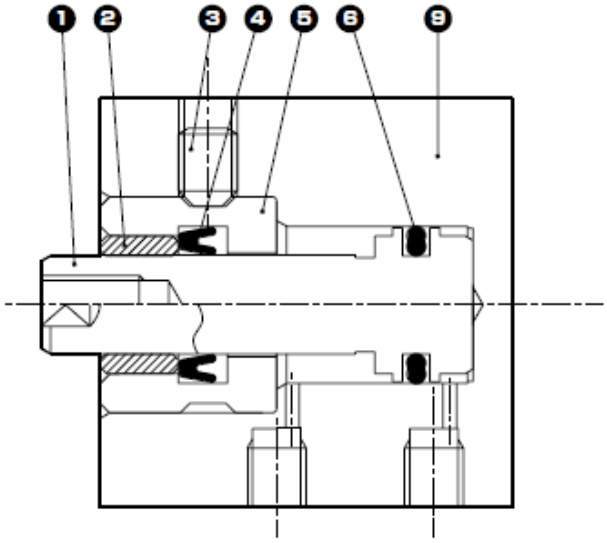
- Discharge the drainage accumulated in the air filter periodically before it exceeds the specified line.
- Since foreign matters such as carbide (carbon or tar substance) from the compressor oil may contaminate the circuit and cause an operation fault of the solenoid valve or the cylinder, be careful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



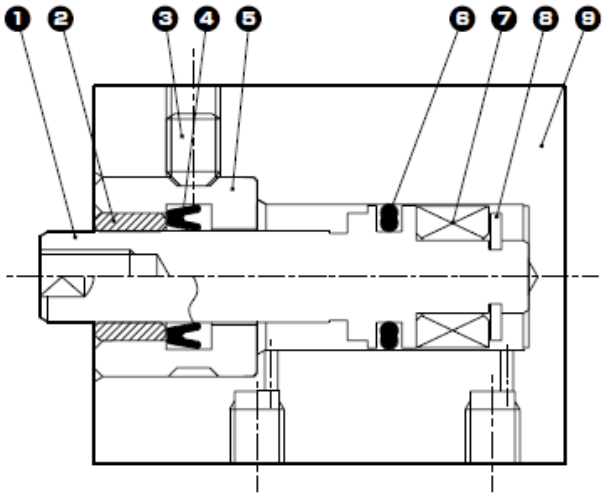
4.1.4 Internal structural diagram

<MSD-HP1 Series>

●MSD-6･8



●MSD-L-6･8



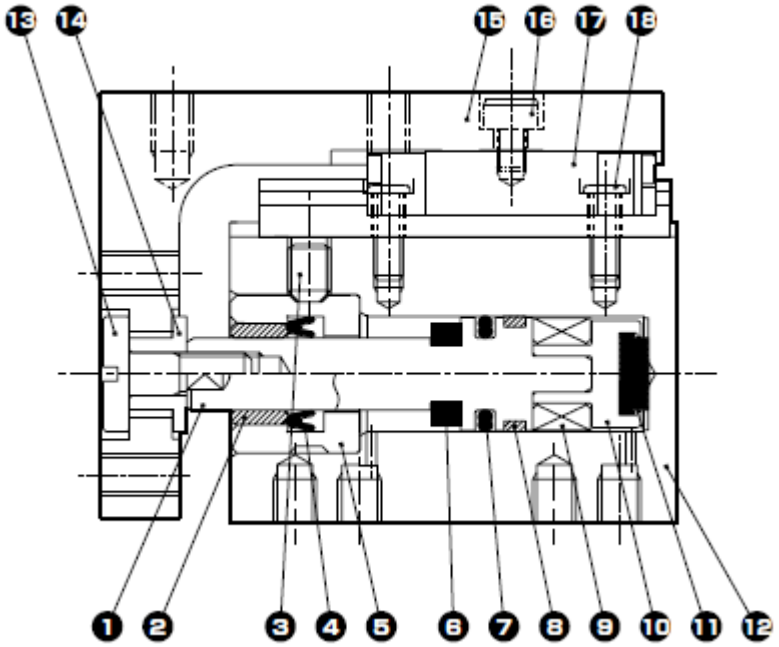
MSD-HP1 Series Parts list

No.	Part name	Material	Remarks
1	Piston	Stainless steel	
2	Bush	Oil-impregnated copper alloy	
3	Hexagon socket set screw	Stainless steel	
4	Rod packing	NBR	
5	Rod metal	Stainless steel	
6	Piston packing	NBR	
7	Magnet	Plastic	
8	E type snap ring	Stainless steel	
9	Body	Aluminum alloy	Hard alumite

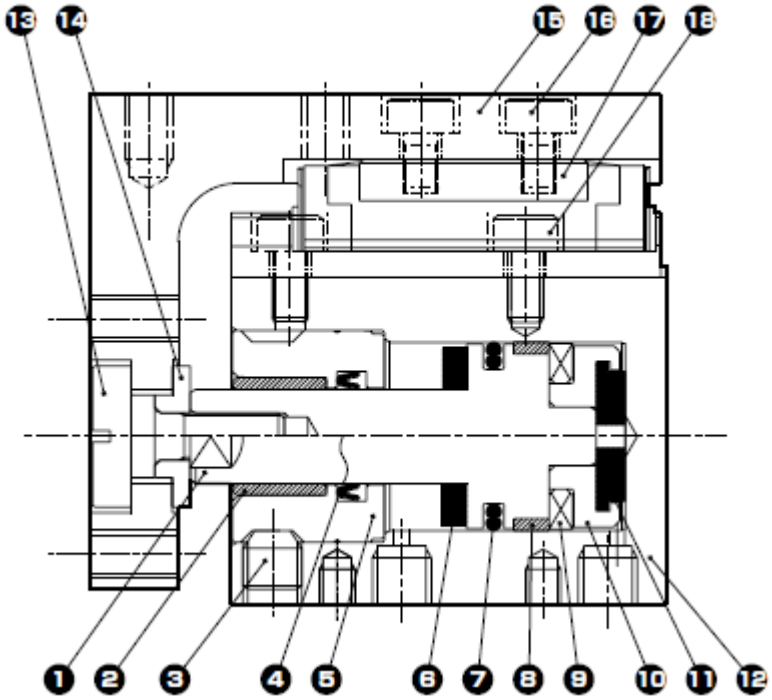
Note 1:The above is the parts list of HP1 series.
For P4 series, the use of copper, zinc, nickel-based materials and electrolytic nickel plating is limited in the construction of the flow path parts and sliding parts.
For 40 series, the use of copper, zinc, nickel-based materials, zinc plating and electrolytic nickel plating is limited in the construction of all parts.

<MSDG-L-HP1 Series>

●MSDG-L-6･8･12



●MSDG-L-16



MSDG-L-HP1 Series Parts list

No.	Part name	Material	Remarks
1	Piston	Stainless steel	
2	Bush	Oil-impregnated copper alloy	
3	Hexagon socket set screw	Stainless steel	
4	Rod packing	NBR	
5	Rod metal	Stainless steel	
6	Cushion rubber R	Urethane rubber	
7	Piston packing	NBR	
8	Wear ring	Acetal resin	
9	Magnet	Plastic	
10	Adaptor	Aluminum alloy	
11	Cushion rubber H	Urethane rubber	
12	Body	Aluminum alloy	Hard alumite
13	Floating bolt	Steel	Nickeling
14	Floating bush	Stainless steel	
15	Table	Aluminum alloy	Alumite
16	Hexagon socket head cap screw	Stainless steel	
17	High precision guide	Stainless steel	
18	Bolt	Stainless steel	

Note 1: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.	For MSD-HP1 use the switch at an ambient temperature of −10°C to 60°C. For MSDG-L-HP1 use the switch at an ambient temperature of 5°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.