CKD

SM－415541－A

INSTRUCTION MANUAL

SUPER RODLESS CYLINDER WITH BRAKE

SRT3

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

Ver.1

For Safety Use

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

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

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

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

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

⚠ **DANGER:** When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, or when there is a high degree of emergency to a warning.

⚠ **WARNING:** When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries.

⚠ **CAUTION:** When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

⚠ WARNING :	a) This product is designed and manufactured as a general industrial machine part. It must be handled by an operator having sufficient knowledge and experience in handling. b) Use this product in accordance of specifications. This product must be used within its stated specifications. It must not be modified or machined. This product is intended for use as a general-purpose industrial device or part. It is not intended for use outdoors or for use under the following conditions or environment. (Note that this product can be used when CKD is consulted prior to use and the customer consents to CKD product specifications. The customer must provide safety measures to avoid risks in the event of problems.) 1. Use for special applications including nuclear energy, railway, aircraft, marine vessel, vehicle, medicinal devices, devices or applications coming into contact with beverages or foodstuffs, amusement devices, emergency cutoff circuits, press machines, brake circuits, or safety devices or applications. 2. Use for applications where life or assets could be adversely affected, and special safety measures are required. c) Observe corporate standards and regulations, etc., related to the safety of device design and control, etc. ISO4414, JIS B 8370 (pneumatic system rules) JFPS2008 (principles for pneumatic cylinder selection and use) Including High Pressure Gas Maintenance Law, Occupational Safety and Sanitation Laws, other safety rules, body standards and regulations, etc. d) Do not handle, pipe, or remove devices before confirming safety. 1. Inspect and service the machine and devices after confirming 2. Note that there may be hot or charged sections even after operation 3. When inspecting or servicing the device, turn off the energy the facility. Discharge any compressed air from the system, leakage of electricity. 4. When starting or restarting a machine or device that incorporates safety, such as pop-out prevention measures, is secured.

⚠ CAUTION:	a) Before performing an overhaul inspection on the actuator, deactivate residual pressure completely. b) While the actuator is operating, do not step into or place hands in the driving mechanism. c) To prevent an electric shock, do not touch the electric wiring connections (exposed live parts) of the actuator equipped with a solenoid valve or switch. Perform an overhaul inspection with the power off. Also, do not touch these live parts with wet hands.

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SRT3
(Super Rodless Cylinder With Brake)
Manual No. SM-415541-A

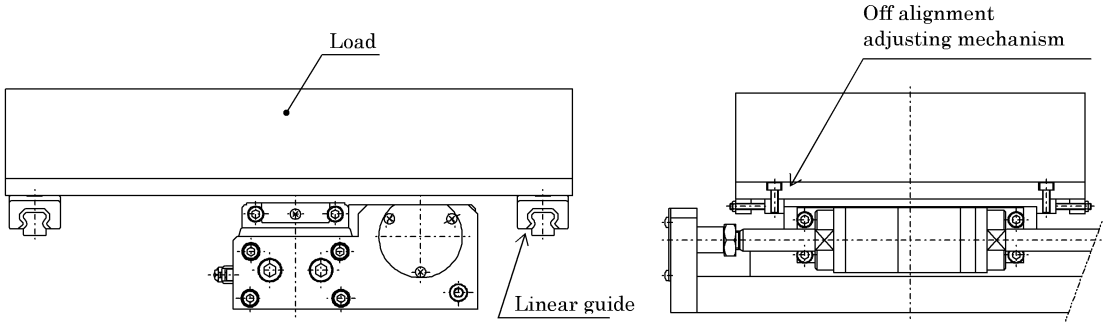
1. UNPACKING

1) Make sure that the type No. on the nameplate of the delivered Cylinder matches the type No. you ordered.
2) Check the appearance for any damage.
3) Stop up the piping port with a sealing plug to prevent the entry of foreign substances into the cylinder. Remove the sealing plug before piping.

2. INSTALLATION

2.1 Installation

1) The ambient temperature range for this cylinder is -10 to 60□ (to be unfrozen). Always operate the cylinder within this temperature range.
2) Be careful not to bump the cylinder tube against an object. The tube, when distorted, causes malfunction.
3) Air leaks in a small amount. Because of this, the pressure will not be retained even if the cylinder port is closed with air inside the cylinder.
4) Do not perform electric welding after the rodless cylinder is installed.
   The current runs through the cylinder to produce sparks between the dustproof belt and the cylinder tube, damaging the belt as a result.
5) Be sure to be below the max load which is described on the catalog.
6) Mounting the load
   Use SRT3 principally with an external linear guide such as LM guide. As for mounting, adopt such off alignment adjusting mechanism with external guide for easy adjusting and smooth operation. (Refer to the following schematics.)



7) Confirm that Brake operates when no compressed air is supplied to Brake releasing before operation. And then , mounting this cylinder.

2.2 Fundamental Circuit

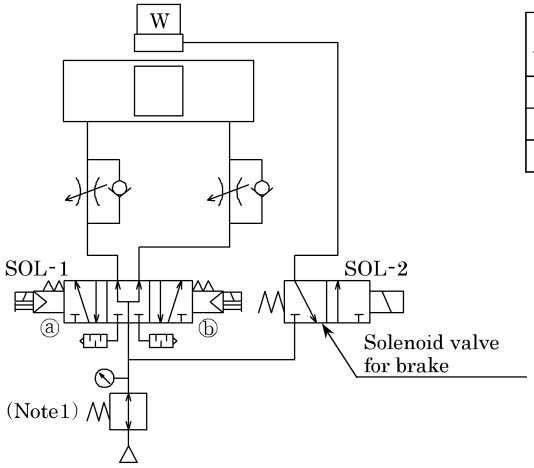
1) To retain an accurate operation, comply the following fundamentals and design such circuit as illustrated below.
   ① Supply the pressure to both side of piston when piston is stopped. (This is to eliminate the piston from popping out on succeeding start.)
   ② To make thrust balanced (including the load), install a regulator with a check valve within the circuit which provides larger thrust.
   ③ Install the solenoid valve for brake as close to the brake port as possible.

2) For air circuit, make it with 3-position PAB port connection valve as posted below.

In case of horizontal load

Use the circuit per Fig.1. In this case, no pressure regulator is required because rodless cylinder has the same sectional area at both ends of the piston.

Fig. 1

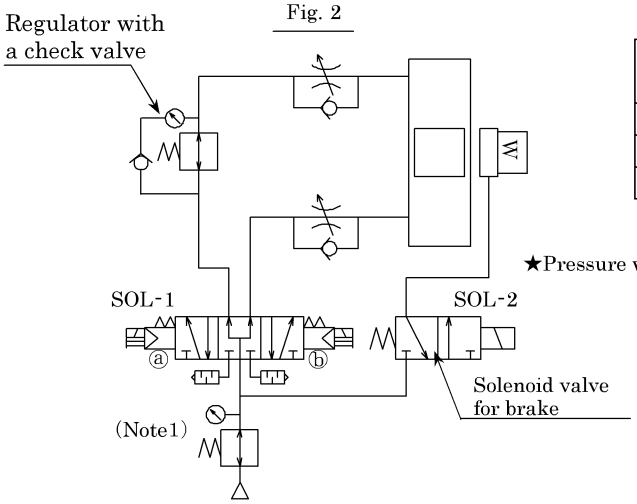


Actuating	SOL-1		SOL-2
	ⓐ	ⓑ	
Halt	OFF	OFF	OFF
Retreat	ON	OFF	ON
Advance	OFF	ON	ON

In case of vertical load

Should it be the case of such vertical moving load as illustrated in Fig.2, keep balance with the load by installing pressure regulator with check valve to eliminate table sliding down when brake is released.

Fig. 2



Actuating	SOL-1		SOL-2
	ⓐ	ⓑ	
Halt	OFF	OFF	OFF
Descent	ON	OFF	ON
Upturn	OFF	ON	ON

★Pressure within the regulator = $\frac{\pi D^2 P - 4W}{\pi D^2}$

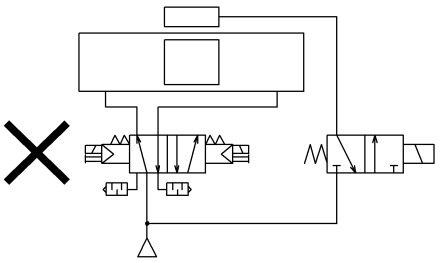
D : Cylinder bore [mm]
P : Working pressure [MPa]
W : Lord [N]

(Note 1) Install a regulator independently for exclusive use to stabilize the motion when pressure fluctuation is foreseen by some other pneumatic equipment.

3) Keeping a balance of propulsion
Keep a balance of propulsion by regulator with check valve as per fundamental

Adjust pressure in the duration of raising it instead of reducing it. Guide line value is calculated out of Fundamental Circuit" (□ marked on page 4).

4) Caution
Comply with either Fig.1 or Fig.2 posted on previous page, eve for the purpose of drop prevention or emergency stop.
2-position valve is not suitable for this purpose because the pressure for rodless cylinder itself, even while propulsion to it is suspended, also charges to brake line.



5) Brake may be released when back pressure is supplied to the cylinder under the licked condition.
So, select a single valve or the individual exhaust type for manifold valves.

6) The cylinder piston pushes out fast when Brake is released under the supplied pressure to one side of the cylinder. It is very dangerous. Be sure to observe the following items when Brake is released under adjustment operations and so on.

(1) Confirm that no person is in the movement area of the cylinder load at the time of the releasing Brake, and no problem occurs

(2) Observe the following items to prevent the cylinder load from dropping down at the time of the releasing Brake.

- Place the cylinder load at the bottom end.
- Keep the supplied air to the both side of the cylinder.
- Place a support for the load.

(3) Confirm that only one side of the cylinder is not compressed by air at the time of the releasing Brake.

7) Do not wipe off the grease applied to the brake shaft. Periodical greasing is recommended. Even when grease is applied thereto, it dose not have any influence upon holding power and stop position performance.

8) Fix the dog for Brake signal tight. Because of a loose dog has influence on the accuracy of the stop position.

9) It has influence on the accuracy of the stop position to have along tube which supplies compressed air to Brake. Consider the length to be as shorter as possible.

2.3 Electric control schematics

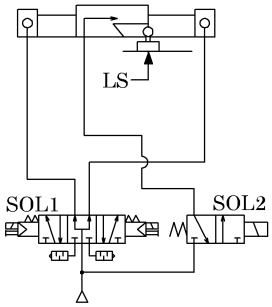
1) When sequencer (PC) is in use

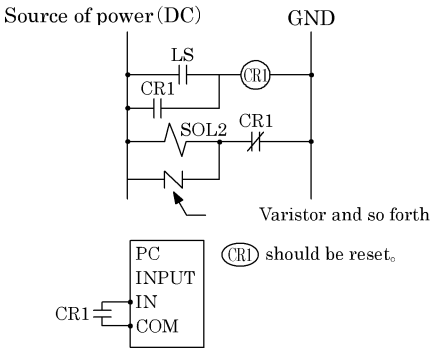
Positioning accuracy is deteriorated due to scanning time to use sequencer (PC) within control schematics for brake control solenoid.

(Example) Scanning time 10 msec
Cylinder speed 300 mm/s
In this case

→ Positioning error becomes within ± 1.5mm due to only scanning time.

For an intermediate stopping, to have the positioning accuracy stabilization, provide such a direct control system to solenoid valve for brake, as with a relay.

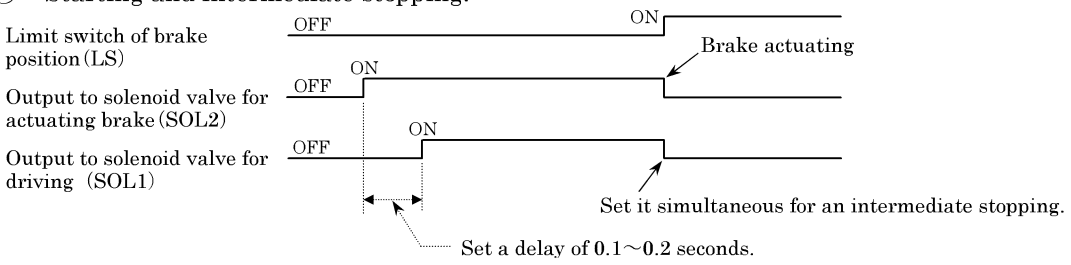




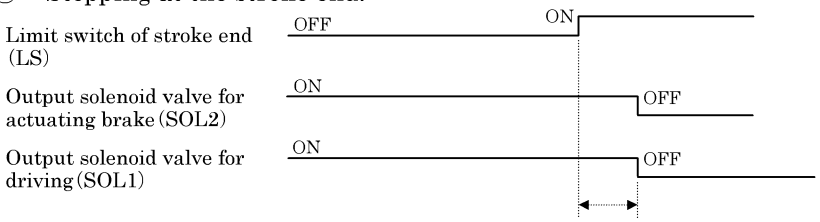
2) Output timing to solenoid valve for brake.

Refer to the following timing chart regarding output timing to both solenoid valve for brake and solenoid valve for driving.

① Starting and intermediate stopping.



② Stopping at the stroke end.



Set appropriate delay time considering the effect of bouncing due to cushion.

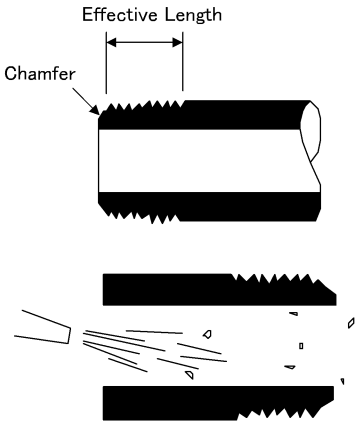
7) The length of the dog for Brake signal decides the signal time with the relation to the cylinder speed be longer than the reply time of sequencer (PC). And use detect circuit by a self-keeping circuit if necessary.

2.4 Piping

1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc.

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

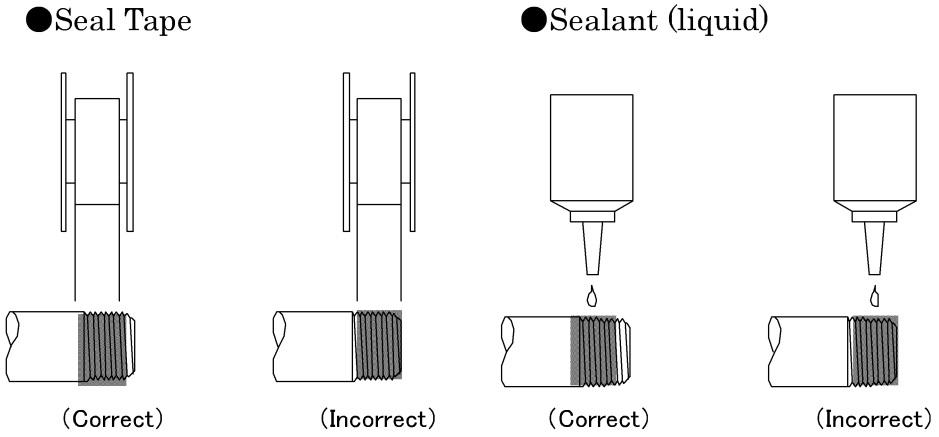
3) Install filter preferably adjacent to the upper-stream to the solenoid valve for eliminating rust, foreign substance in the drain of the pipe.



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

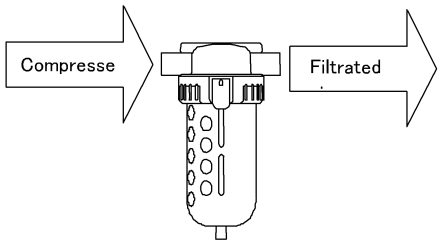
5) Flush air into the pipe to blow out foreign substances and chips before piping.

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

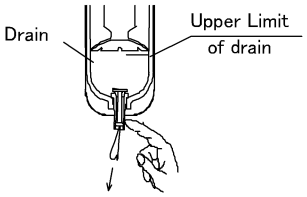


2.5 Operation Fluid

1) To obtain clean and dry air, make the compressed air go through an air filter first. In installing the filter within the circuit, take the following into consideration: filtering ability (5 microns or smaller desirable), fluid volume, and installation position (near the direction-control valve).



2) Drain the fluid regularly that has collected in the filter before the fluid level exceeds the limit line.



3) Make sure that the adequate maintenance and inspection of the compressor are carried out to ensure that the circuit is free from compressor oil carbide (carbon or tar-like material). The presence of carbide causes the solenoid valve and cylinder to malfunction.

4) As there is slight leak outside, it is not operable under the low oil pressure.

2.6 Location of Mounting Switches on a Cylinder

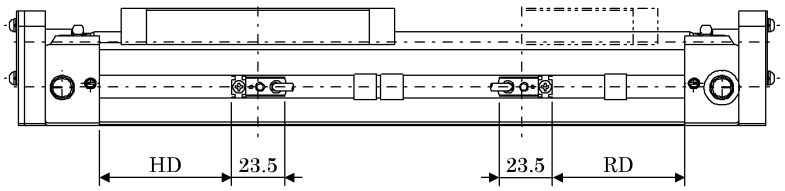
1) Location of mounting switches on a cylinder

(1) At the stroke end

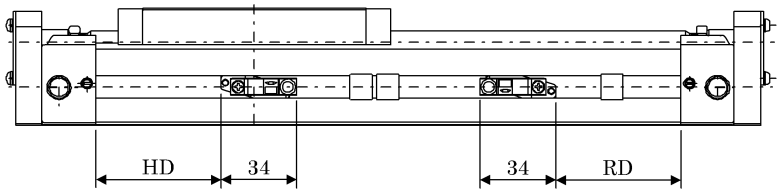
Refer the illustration above. Mount switches within the rod side dimension RD as well as the head side dimension HD (Refer to 10 page) for the purpose of having switches function at the points of the highest sensitivity.

● With cylinder switch, (lead wire L)

M※V※

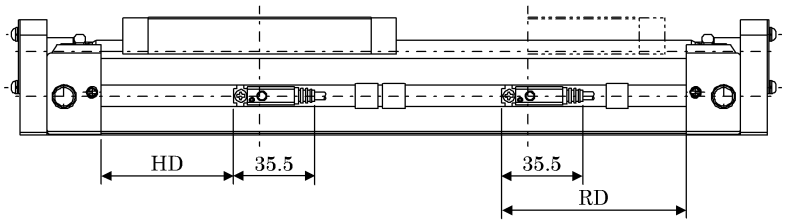


T※Y※V※

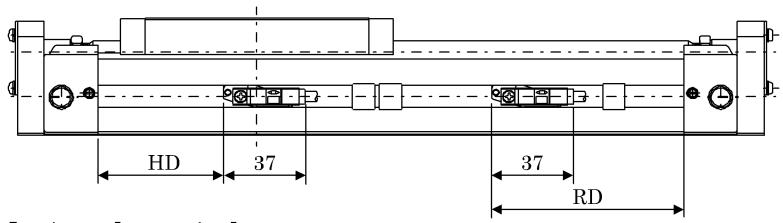


●With cylinder switch, (lead wire straight)

M※H※



T※Y※H※



(2) Moving the switch

Loosen the tightening screw (pan head small screw), and move the switch along the cylinder tube. Tighten at the required position.

(3) Exchange the switch

Loosen its mounting screws then slide the switch all the way out of the groove on the cylinder side. Slide new one back to the groove. Locate its setting point and tighten mounting screws. (Apply screw setting torque to 0.1 to 0.2 N・m)

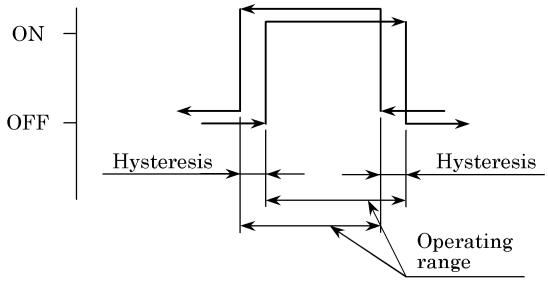
2) Operating range

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

3) Hysteresis

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

(2) Switch is apt to be disturbed its accuracy by external effect when piston stops within this range. Carefully avoid designing stopping location of piston.



Max. sensitive position (HD, RD)、Operating range、Hysteresis (mm)

Item / Bore size (mm)	Solid state switch (M2V/H, M2WV, M3V/H, M3WH, M3PV/H, M3WV)							
	Max sensitivity position				Operating range (Reference level)		Hysteresis	
	HD		RD					
	LED	Red / Green LED	LED	Red / Green LED	LED	Red / Green LED	LED	Red / Green LED
φ12	40.5		60.5		4～13	4～12	1.5 or less	1.0 or less
φ16	47		67		4～13	4～12		
φ20	52.5		72.5		4～13	4～12		
φ25	60		82		9.5～15.5	9～14	2.0 or less	1.5 or less
φ32	74		96		7.5～15	8～14		
φ40	80		102		11.5～17.5	10～16.5		
φ50	79		101		16.5～24	14～21	2.5 or less	
φ63	98		120		16～24	14～21		

Item / Bore size (mm)	Reed switch (M0V/H, M5V/H)			
	Max sensitive position		Operating range (Reference level)	Hysteresis
	HD	RD		
φ12	40.5	60.5	3～11	3.0 or less
φ16	47	67	3～11	
φ20	52.5	72.5	3～11	
φ25	60	82	8.5～13.5	3.5 or less
φ32	74	96	7～13.5	
φ40	80	102	10～16	
φ50	79	101	14.5～21.5	3.0 or less
φ63	98	120	14～21.5	

Item / Bore size (mm)	Solid state switch (T2YF/M□, T3YF/M□)			
	Max sensitive position		Operating range (Reference level)	Hysteresis
	HD	RD		
φ12	36	65	2～7	1.0 or less
φ16	42	72	2～7	
φ20	48	77	3～8	1.5 or less
φ25	56	86	3～10	
φ32	70	100	3～10	
φ40	76	106	4～11	
φ50	75	105	7～14	
φ63	94	124	7～14	

※ The cylinder switches were set at the max sensitive position (HD,RD) at the time of their shipment.

4) Middle-stroke detection

(1) To set the switch at the middle of the stroke, proceed as follows.

M0、M2、M3、M5

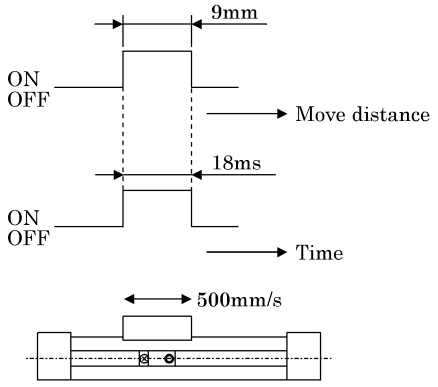
The piston is fixed to the stopping position, the switch is moved back and forth at the position of the piston, and position A in which the switch is turned on first is discovered. Move the switch further, find the position B where it is turned off, return it back from that position, and find the position C where it is turned on again. The middle of two positions of A and C is the highest sensitivity position at the piston position, and it becomes the best installation position.

2-color display solid state switch M2WV、M3WV、T2Y※※、T3Y※※

Move the switch and fasten it where the green light comes on (Max. sensitivity point).

・The 2-color display proximity switch indicates the operation range by turning on a red light and the Max. sensitivity range (SW set position for max. sensitivity) by a green light. This makes SW setting very easy.

Electricity is on even while the red light in on, posing no problem to the operation of the switch.



Mid-stroke detection is required often when the cylinder speed is relatively fast, and problems normally associated with stroke end detection may occur. The following cautions should be taken.

Exact responses from control circuits (relay circuit, programmable controller, program)?

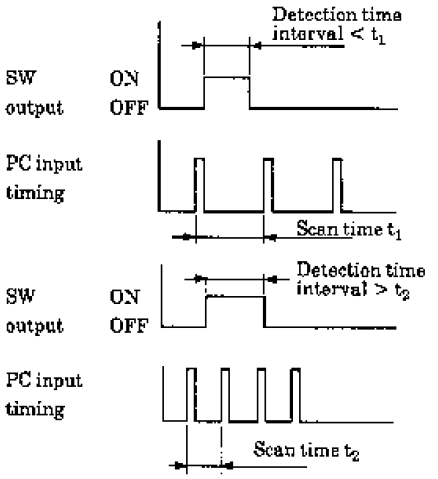
The cylinder switch has the response speed of faster than 1 ms, but the detection time interval can be made greater than one obtained by the following formula.

$$\text{Detection time interval (s)} = \frac{\text{Operation range (mm)}}{\text{Cylinder speed (mm/s)}}$$

Ex. When the operation range is 9 mm and the cylinder speed 500 mm/s, then the detection time interval is only 18 ms (see the drawing above)

It is necessary, therefore, to take in the signal without fail within this short time interval. Use a self-hold circuit or other means suitable to the situation.

With PC inputting, in particular, it is necessary that not only the response time of the input / output circuit, but the program scanning time are shorter than this detection time interval (see the drawig)



3. OPERATION

3.1 OPERATION

1) Range of working pressure

Operate the system within following range of air pressure.

Item / Tube bore	Pressure range for brake (MPa)	Pressure range for cylinder (MPa)
Equiv. to φ12～φ20	0.3～0.7	0.2～0.7
Equiv. to φ25～φ40		0.15～0.7
Equiv. to φ50、φ63		0.1～0.7

2) At the time of delivery, the tightness of the cushion has been adjusted with no load. Use the cushion needle to adjust its tightness to suit the load.
There will be cushioning by tightening (turning clockwise) the needle.
An impact absorber may be needed if the kinetic energy is greater than that in the table below, such as when the load is heavy and the object moves fast.

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

Cushion characteristics

Tube bore (mm)	Effective cushion length (mm)	Allowable energy absorption (J)	
		Cushioned	No cushion
Equiv. to φ12	14.5	0.03	0.003
Equiv. to φ16	19.2	0.22	0.007
Equiv. to φ20	22.2	0.59	0.010
Equiv. to φ25	20.9	1.40	0.015
Equiv. to φ32	23.5	2.57	0.030
Equiv. to φ40	23.9	4.27	0.050
Equiv. to φ50	24.9	9.13	0.072
Equiv. to φ63	29.6	17.4	0.138

3) For piston speed adjustment, install a speed controller as illustrated in the basic circuit on page 4.

3.2 Manual release of brake

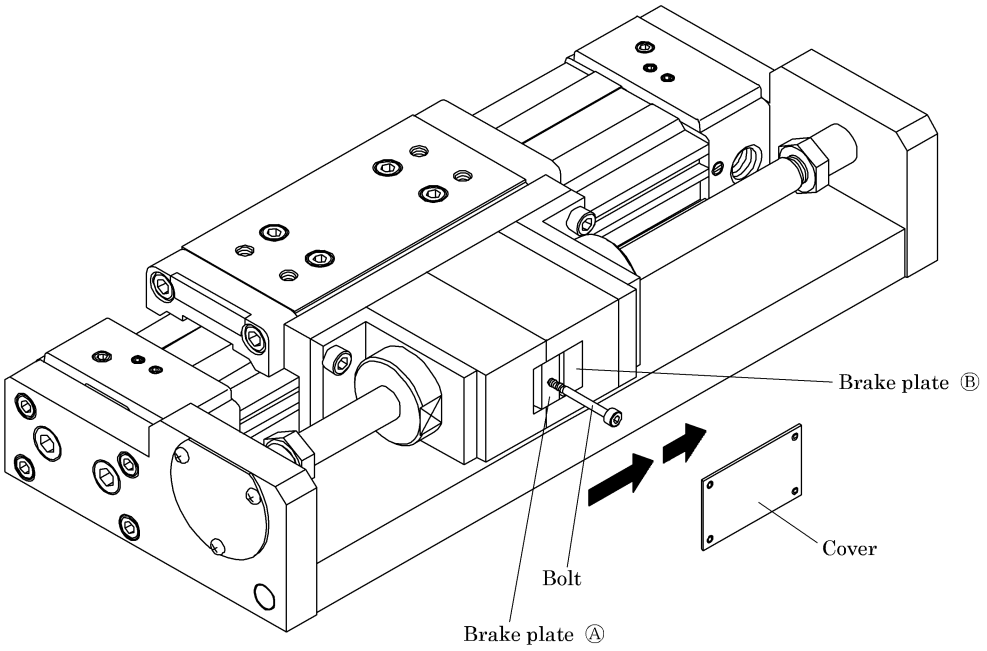
1) Screw Bolt in Brake plate Ⓐ and pull down in the arrow direction or set the slants of Brake plate Ⓐ and Ⓑ to the original position with a screw driver.

2) Caution

① In vertical mounting, beware of table sliding down upon releasing manual operation due to weight of load as the braking power no longer exists.
Should it be the case, give such preventive caution before releasing the manual operation as follows.

- Let the load move to the lowest end of stroke.
- Apply a stopper to load.
- Charge air pressure to rodless cylinder to keep a balance with the load.

② Be sure to remove Bolt for the manual release of brake and mount cover before operation.



Note 1) Be
enough.

Note 2) Select Bolt size among the following table.

Tube bore	Bolt size
Equiv. to ϕ 12～ ϕ 25	M3
Equiv. to ϕ 32～φ63	M4

3.3 How to Use the Switches

3.3.1 Common Items

1) Magnetic environment

Do not use a switch other than the strong magnetic field proof switch in a place where strong magnetic field or large current (large magnet or spot welding machine, etc.) exists around the switch mounting position. If a cylinder with the switch is installed in parallel to this product or the magnetic substance moves near the cylinder, the mutual interference may occur and affect the detection accuracy.

2) Lead wire wiring

Carefully perform the wiring so that a bending stress or tensile strength does not apply to the lead wire repeatedly.
Additionally, connect wires for robot having the bending resistance to movable parts.

3) Ambient temperature

Do not operate the product at a high temperature (Over than 60℃).
Always avoid operation of the product in a hot place due to temperature characteristics of magnetic and electronics parts.

4) Intermediate position detection

When setting the cylinder switch at mid-stroke and driving a load when the piston changes, if the speed is too fast, the cylinder switch will function but operation time will be too short and the load may not respond correctly.

(Example) Set cylinder speed 500mm/s or less, In case operating time of relay is 20ms.

5) Impact

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

6) The cylinder switch could malfunction if there is a magnetic substance, such as a steel plate, near the cylinder switch. Move the magnetic substance to at least 10 mm from the cylinder. (Same for all bore size)

3.3.2 Operational Cautions, Solid state switch (M2※、M2WV、M3※、M3WV、T2Y※※、T3Y※※)

1) Connection of lead cord

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

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

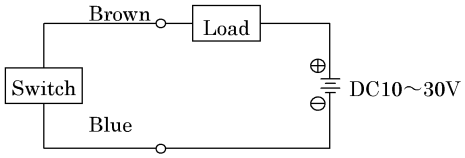


Fig.1 T2※Fundamental circuit Example

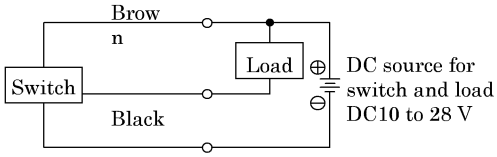


Fig.2 M3※(M3WV),T3Y※ Fundamental circuit Example (1)
(In case the same source of power is used.)

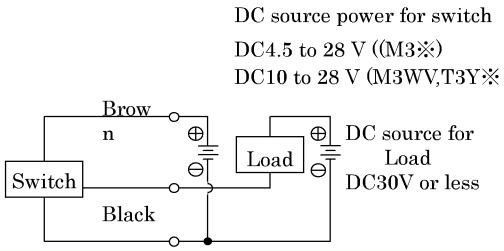


Fig.3 M3※(M3WV),T3Y※ Fundamental circuit Example (2)
(In case individual sources of power are used.)

2) Output circuit protection

Install some protective circuit as illustrated in Fig. 4 when inducing type load (Relay or solenoid valve) are to be used because those types apt to generate surge current switch off.

Install some protective circuit as illustrated in Fig. 5 when capacitor type load (Capacitor type) are to be used, because these types apt to generate a dash current when turning the switch ON.

Install some protective circuit as illustrated in Fig. 6 or 7 (in case of model M2※・M2WV、T2※) and Fig 8 (in case of model M3※・M3WV、T3※) if the lead wire length exceeds 10 m.

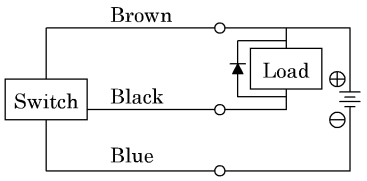
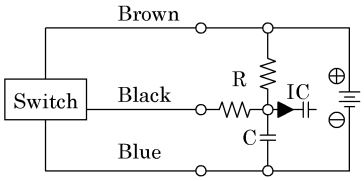


Fig.4 M3※(M3WV)、T3Y※
An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)



Flg.5 M3※(M3WV)、T3Y※
An example of using capacitor type load together with current regulating resister R.
Comply with the following formula to figure out required R.

$$\frac{V}{0.1} = R(\Omega)$$

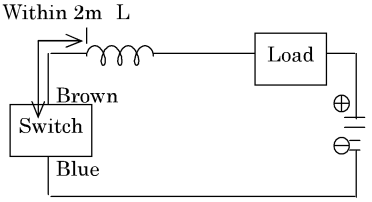


Fig.6 ・M2※(M2WV)、T2Y※
Choke coil
L = a couple hundred μH to a couple mH surpassing high frequency characteristic
・Install it near by a switch (within 2m).

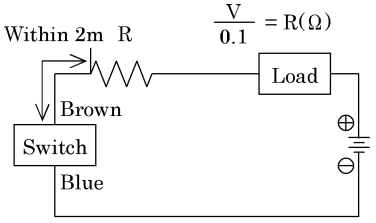


Fig.7 M2※(M2WV)、T2Y※
・Dash current restriction resister.
R = As much large resister as the load circuit can afford.
・Install it near by a switch (within 2m).

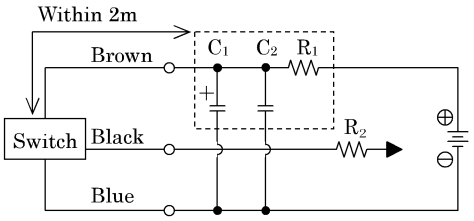


Fig.8 M3※ (M3WV)、T3Y※
・Electric power noise absorptive circuit.
C_1=20 to 50 μF electrolytic capacitor
(withstanding 50V or more)
C_2=0.01 to 0.1 μF ceramic capacitor
R_1=20 to 30 Ω
・Dash current restriction resister.
R_2=As much large resister as the load circuit can afford.
・Install it nearby the switch (Within 2m)

3） Connection differs with the type of programmable controller used. Connect based on input specifications.

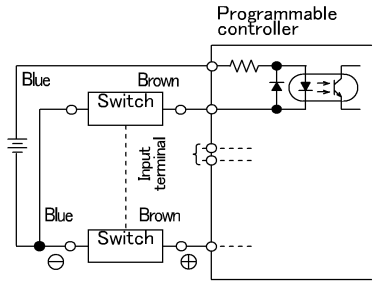


Fig.9 M2※,M2WV,T2Y※,T2W connection to source load input (external electric power) type

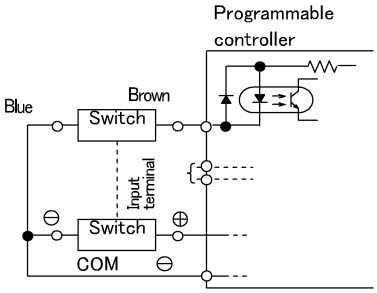


Fig.10 M2※,M2WV,T2Y※,T2W connection to source load input (internal electric power) type

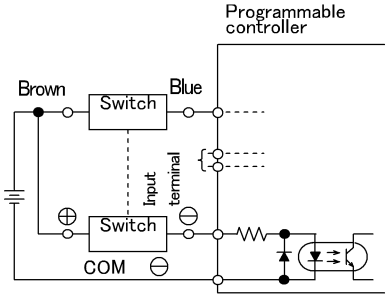


Fig.11 M2※,M2WV,T2Y※,T2W connection to sink input type

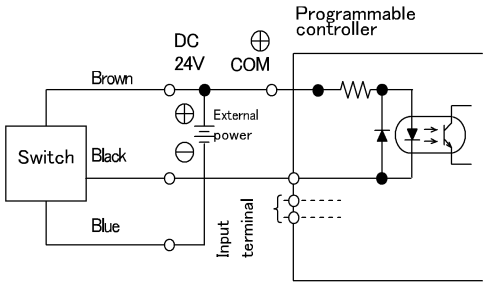


Fig.12 M3※,M3WV,T3Y※,T3W connection to source load input (external electric power) type

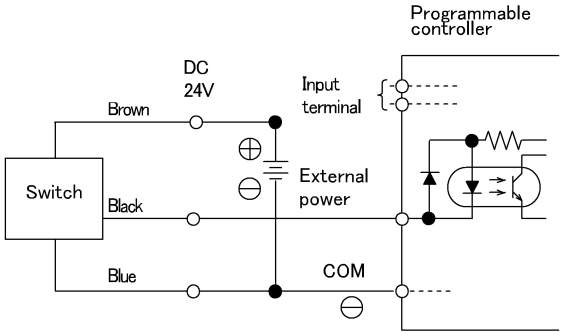


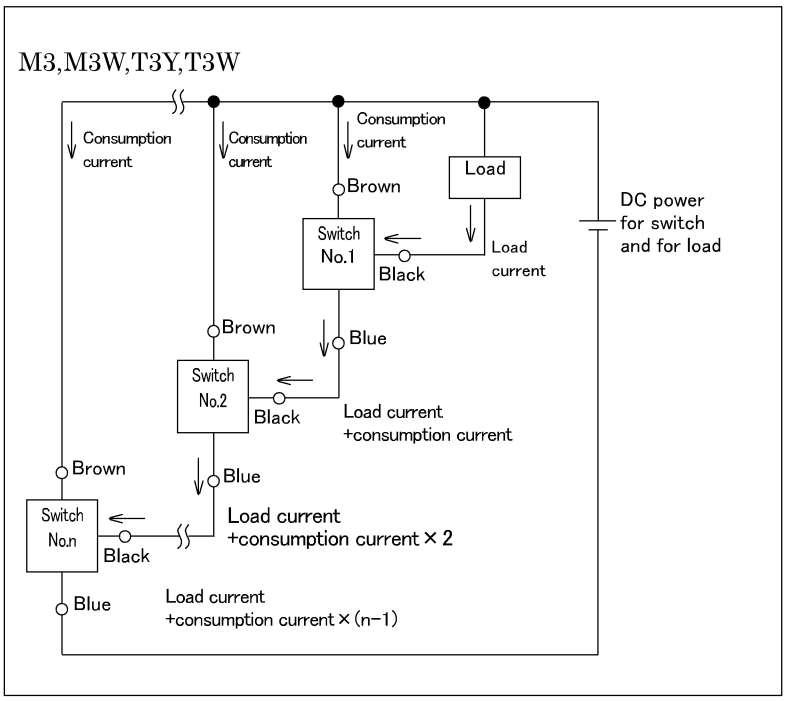
Fig.13 M3※,M3WV,T3Y※,T3W connection to source load input (internal electric power) type
The M3※,M3WV,T3Y※,T3W switch can not be connected to the sync. Input.

4) Serial connections

(1) When connecting several M2※, M2WV, T2Y※, T2W switches in serial, the switch voltage drop is the total voltage drop of all connected switches. The voltage applied to the load is the voltage obtained by subtracting the voltage drop at switches from the power voltage. Check input specifications of the programmable controller and determine the number of switches to be connected.

(2) When connecting several 3-wire serial proximity switches, the switch's voltage drop is the total voltage drop of all connected switches, as with the 2-wire switch. The current that flows to the switch is the total of the connected switch's current consumption and load current, as shown at upper right. Check load specifications and determine the number of switches to be connected so that the maximum switch load current is not exceeded.

(3) The light turns ON only when all switches are ON.



5) Parallel connections

When connecting M2※, M2WV, T2Y※, T2W switches in parallel, note that leakage current increases in proportion to the number of connected units. When 1 switch is changing from ON to OFF status, voltage at both ends of the switch connected in parallel drops to the internal voltage drop value at switch ON and is less than the load voltage range and other switches will not turn ON. Check input specifications of the programmable controller, which is the connection load, before starting use.

This is not a problem with the M3※, M3WV, T3Y※, T3W Their leak current increases by the number of switches connected, as in the case of the A and B, but the amount of the leak current is so small (less than 10 micro amperes) that is does not affect the operation in any way. There is no problem of the lamp becoming dim or unable to be turned on

3.3.3 Operational Cautions, Reed Switch (M0※、M5※)

1) Lead wire connections

Do not connect the lead wires of the switch to the power supply directly. Always connect the loads in series. For M0※ switch, carefully check following items Ⓐ, Ⓑ.

Ⓐ When using the switch for DC power supply, connect the brown and blue lines to the positive and negative sides, respectively. If these lines are connected reversely, the switch is activated, but the lamp is not lit.

Ⓑ When the switch is connected to an AC relay or a programmable controller input, the lamp on the switch is not lit if the half-wave rectification is performed in the connected circuit. If this occurs, reverse the polarities of the switch lead wire connection. The lamp may then be lit.

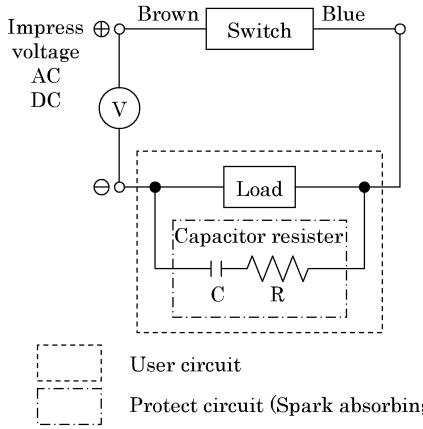
2) Contact protective measures

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

Table1

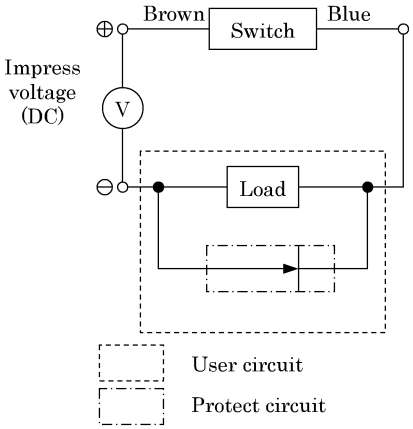
Electric power	Length of wire
DC	50m
AC	10m

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



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

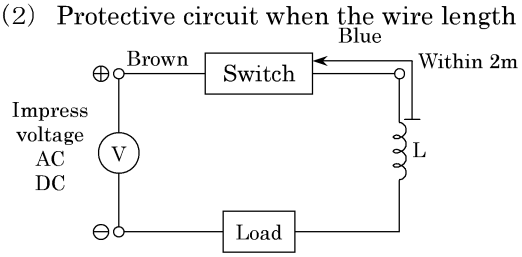
Fig.1 When capacitor resister
(In case the same source of power is used.)



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

Fig.2 When diode is used.

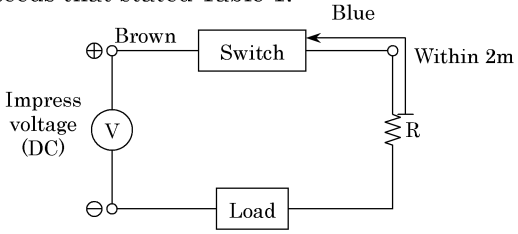
(2) Protective circuit when the wire length exceeds that stated Table 1.



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

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

Fig.3



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

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

Fig.4

3) Contact capacity

Do not use a load exceeding the maximum contact capacity of the switch. Additionally, if the current is lower than the rated current value, the lamp may not be lit.

4) Relay

Always use the relays listed below.

Omron Corporation	MY type
Fuji Electric Co. Ltd.	HH5 type
Matsushita Electric Works, Ltd	HC type

5) Serial connection

Total voltage loss, when connected M0 switches in series, equals to the sum of respective voltage loss of each switch.

The total voltage loss becomes equivalent to one M0※ (approx. 2.4V) when connecting the combination of one M0※ for actuation confirming and rest of M5※ switches. Lamp is lit only when all switches turn on.

6) Parallel connection

There is no restriction in parallel connection number of switches of these types. Multi number connection of model M0※, sometimes, cause a dimmed lamp or complete lamp failure.

4. MAINTENANCE

4.1 Periodical Inspection

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

2) Inspection items

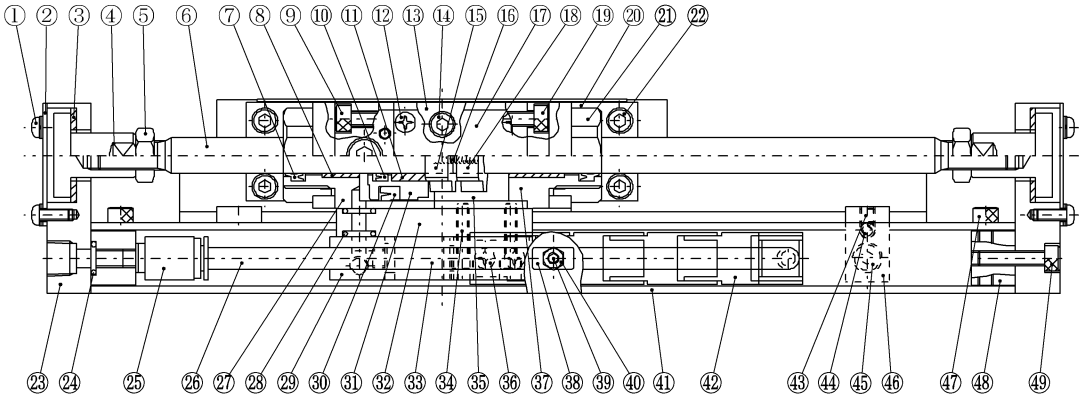
① Loose load mount screw, loose unit mount screw
② Check to see that the cylinder operates smoothly.
③ Check any change of the piston speed and cycle time.
④ Check for internal and/or external leakage.
⑤ Chang in table play
⑥ Stroke
⑦ Loose round head screw for the switch, or its position change
⑧ Cracks in the connecting part of the switch lead wire and the switch
⑨ Presence of magnetic material, such as cut chips, sticking to the switch mount position.
⑩ Check the mounting bolts and nuts of brake mechanism.
⑪ Check of release and holding operation of brake.

If any problems are detected, refer to
and implement proper measures. Fasten any loose sections if there are any.

3) The brake section is very important and a strong spring is assembled. The brake section should not be disassembled. When inspecting the inside of brake, it takes over and inspects by our company. Consult with CKD.

4.2 Disassembly・Assembly

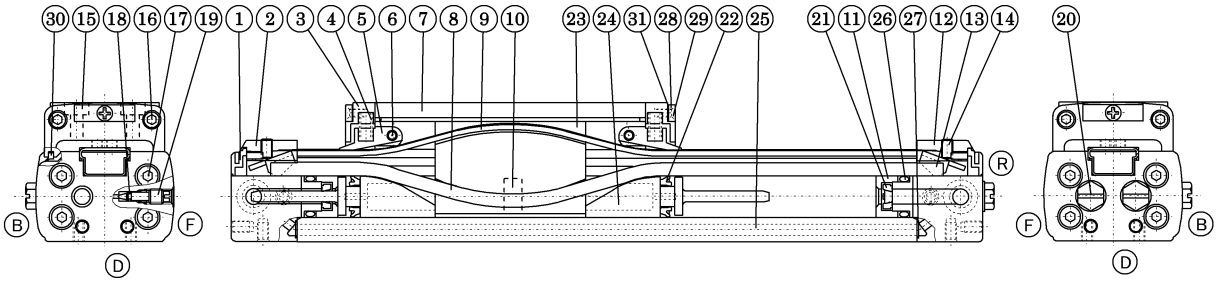
1） Internal structure of brake drawing and parts list



No.	Parts name	Material	Remarks	No	Parts name	Material	Remarks
1	Pan head machine screw	Carbon steel	Galvanizing	27	Body A	Aluminum alloy	Alumite
2	Joint section guard	Aluminum alloy	Alumite	28	Gasket	Nitrile rubber	
3	Slide plate	Dry bearing		29	Adaptor	Aluminum alloy	Alumite
4	Floating joint	Steel	Phosphonic acid mangan treatment	30	Piston packing seal	Nitrile rubber	
5	Square nut: 3 type	Carbon steel	Galvanizing	31	Release piston	Aluminum alloy	Alumite
6	Brake shaft	Steel	Rigid plating	32	Spacer	Aluminum alloy	Alumite
7	Rod packing seal	Nitrile rubber		33	Push-in joint		
8	Bush bearing	Dry bearing		34	Hex. Socket head cap bolt	Steel	Blackening
9	Hex. Socket head cap bolt	Steel	Galvanizing	35	Body B	Aluminum alloy	Alumite
10	Rod packing	Nitrile rubber		36	Pan head machine screw	Carbon steel	Galvanizing
11	Bush bearing	BDD bearing		37	Brake end guard	Aluminum alloy	Alumite
12	Cross-recessed head screw	Carbon steel	Galvanizing	38	Square nut	Carbon steel	Galvanizing
13	Brake mounting base	Aluminum alloy	Alumite	39	Pan head machine screw	Carbon steel	Galvanizing
14	Hex. Socket head cap bolt	Steel	Blackening	40	Square nut:3 type	Carbon steel	Galvanizing
15	Brake plate A	Cast iron	Galvanizing	41	Cable holder	Aluminum alloy	Alumite
16	Spring	Steel	Blackening	42	Cable bear	Special resin	
17	Cover	Aluminum alloy	Alumite	43	φ12～φ40:Hex. Socket head set screw φ50, φ63: ——	Steel —	Galvanizing —
18	Brake plate B	Cast iron	Galvanizing				
19	Hex. Socket head cap bolt	Steel	Galvanizing	44	φ 12 ～ φ 40 : Hex. Socket head set screw φ50, φ63:Hex. Socket head button bolt	Steel	Galvanizing
20	Brake axial foot	Steel	Galvanizing				
21	Fixing nut	Steel	Galvanizing	45	Hex. Socket head button bolt	Steel	Galvanizing
22	Hex. Socket head cap bolt	Steel	Galvanizing	46	Cable holder mounting plate	Steel	Galvanizing
23	End flange	Aluminum alloy	Alumite	47	Hex. Socket head cap bolt	Steel	Galvanizing
24	Gasket	Nitrile rubber		48	Cable holder stopper	Aluminum alloy	Alumite
25	Push-in joint			49	Hex. Socket head cap bolt	Steel	Galvanizing
26	Tube	Urethane					

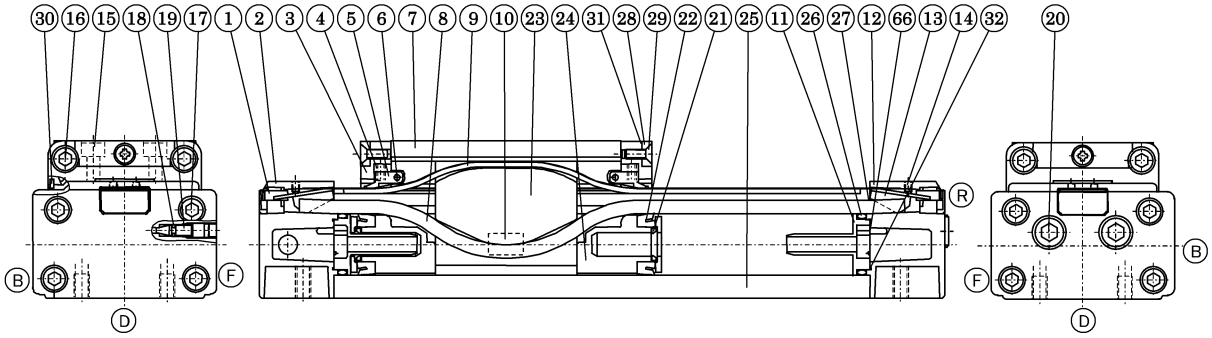
Note : φ 12、φ 16、φ　　㉞ Hex. Socket head bolt.

2) Internal structure of cylinder drawing and parts list. (Equiv. to φ12～φ40)



Parts No.	Name	Material
1	Belt cover	Polyamide
2	Cover (L)	Aluminum alloy
3	Table cover	Acetal resin
4	Spring	Carbon steel
5	Belt tension	Acetal resin
6	Parallel pin	Steel
7	Table	Aluminum alloy
8	Seal belt	Urethane rubber
9	Dust-proof belt	Stainless steel ＋ Nitrile rubber
10	Magnet	Special alloy
11	Cushion adapter	Acetal resin
12	Cover (R)	Aluminum alloy
13	Belt spacer	Steel
14	Hex. cap set screw	Alloy steel
15	Hex. head bolt	Alloy steel
16	Hex. head bolt	Alloy steel
17	Hex. head bolt	Alloy steel
18	Needle gasket	Nitrile rubber
19	Cushion needle	Steel
20	Plug	Steel
21	Cushion packing	Urethane rubber
22	Piston packing	Nitrile rubber
23	Yoke	Aluminum alloy
24	Piston	Acetal resin
25	Cylinder tube	Aluminum alloy
26	Cylinder gasket	Nitrile rubber
27	O-ring	Nitrile rubber
28	Plate	Stainless steel (ϕ 12 to ϕ 20), Alloy steel (ϕ 25 to ϕ 40)
29	Cross-recessed tapping screw	Stainless steel
30	Dust wiper	Acetal resin
31	2-side adhesive tape	－

3) Internal structure of cylinder drawing and parts list. (Equiv. toφ50、φ63)



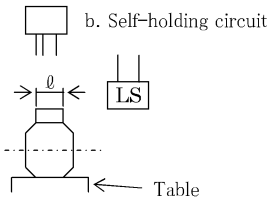
Parts No.	Name	Material
1	Belt cover	Polyamide
2	Cover (L)	Aluminum alloy
3	Table cover	Acetal resin
4	Spring	Carbon steel
5	Belt tension	Acetal resin
6	Parallel pin	Steel
7	Table	Aluminum alloy
8	Seal belt	Urethane rubber
9	Dust-proof belt	Stainless steel ＋ Nitrile rubber
10	Magnet	Special alloy
11	Cushion ring	Acetal resin
12	Cover (R)	Aluminum alloy
13	Belt spacer	Steel
14	Hex. cap set screw	Alloy steel
15	Hex. head bolt	Alloy steel
16	Hex. head bolt	Alloy steel
17	Hex. head bolt	Alloy steel
18	Needle gasket	Nitrile rubber
19	Cushion needle	Steel
20	Plug	Steel
21	Cushion packing	Urethane rubber
22	Piston packing	Nitrile rubber
23	Yoke	Aluminum alloy
24	Piston	Acetal resin
25	Cylinder tube	Aluminum alloy
26	Cylinder gasket	Nitrile rubber
27	O-ring	Nitrile rubber
28	Plate	Alloy steel
29	Cross-recessed tapping screw	Stainless steel
30	Dust wiper	Acetal resin
31	2-side adhesive tape	－
32	Cushion ring gasket (1)	Nitrile rubber
66	Cushion ring gasket (2)	Nitrile rubber (apply to φ63 only)

4) Repair kits list (Repair kit is common with SRL3.)

Tube bore (mm)	Repair kits No	Parts No.
Equiv. to ϕ 12	SRL3-12K-※	⑧ ⑨ ⑱ ㉑ ㉒ ㉖ ㉗ ㉚
Equiv. to ϕ 16	SRL3-16K-※	
Equiv. to ϕ 20	SRL3-20K-※	
Equiv. to ϕ 25	SRL3-25K-※	
Equiv. to ϕ 32	SRL3-32K-※	
Equiv. to ϕ 40	SRL3-40K-※	
Equiv. to ϕ 50	SRL3-50K-※	⑧ ⑨ ⑱ ㉑ ㉒ ㉖ ㉗ ㉚ ㉜
Equiv. to ϕ 63	SRL3-63K-※	⑧ ⑨ ⑱ ㉑ ㉒ ㉖ ㉗ ㉚ ㉜ ㊻

5. Trouble shooting

1) Cylinder

Trouble	Cause	Correction
Brake does not release.	Insufficient pressure to the brake mechanism.	Secure ample pressure.
	No signal to brake solenoid valve. (In case NO type-Electric signal is there.)	Reaffirm the circuit to receive a signal. (Reaffirm the circuit to shut off a signal.)
	Solenoid valve for brake does not function.	Check the circuit and repair the matter as is required. Repair or replace solenoid valve as is required.
	Damage to packing for brake piston.	Replace the brake unit.
Table does not stop	No signal to brake solenoid valve. (In case NO type-Electric signal is there.)	Reaffirm the circuit to receive a signal. (Reaffirm the circuit to shut off a signal.)
	Solenoid valve for brake does not function.	Check the circuit and repair the matter as is required. Repair or replace solenoid valve as is required.
	Damage to packing for brake piston.	Replace the brake unit.
	Left manual release of brake.	Release the manually open status.
	Skips off the dog for brake signal a. Excessive cylinder speed b. Circuit is not self-holding circuit  	a. Either slow down the speed or increase the dog length. b. Revise the circuit to that of self-holding.
	Cylinder switch does not function.	Correct or remove the cause of malfunction.
Inaccurate positioning	Effective sectional area of solenoid valve for brake is not large enough.	Replace the solenoid valve with the one of large effective sectional area.
	Either too fine or too long tubing of connecting solenoid valve for brake and brake port.	Either replace tubing with the one of large diameter or shorten it if possible. As an alternative, connect the solenoid valve directly.
	Too low response of solenoid valve for brake.	Replace the solenoid valve with the one of high response.
	Too low response of signal sensor switch to solenoid valve for brake.	Replace the sensor switch with the one of high response.
	Relays within signal circuit of brake control are actuated sequentially.	Revise the signal circuit. (Carefully review the response time, particularly when using programmable controller.
	There is a slackening of mounting a dog for brake signal.	Correct and remove the play.
	Remarkable wear and tear on the shape of the dog. a. Slant angle is to be maintained less than 30° when using roller plunger type limit switch. b. More length of dog than over run length is required when making an interlocking by means of dog.	a. The larger angle cause load variation and results inaccurate positioning. (The slant angle can be up to 60° when using roller lever.) b. When relay is used for self-holding circuit, dog length is required to provide an appropriate time length of relay actuating.

Trouble	Cause	Correction
Inaccurate positioning .	Fluctuation of cylinder speed. a. Misalignment of the center lines between table and load guide. b. The momentum inertia of load is excessive in comparison with thrust to cylinder. (Particularly when the positioning pitch is too small) c. See if the stopping position is within the cushion chamber or just after piston comes out of cushion chamber.	a. Eliminate misalignment by using free joint or equivalent parts. b. Either use larger bore cylinder or revise to hydraulic oil cylinder of low pressure range. c. Install a check valve to cushion in the event that stopping piston just when getting out of cushion chamber.
	Table is apt to pop out. a. Incorrect setting of pressure balancing regulator. b. Delayed timing of stop release.	a. Reset the pressure regulator. b. Shorten the timing of stop release. (See if supply line is chalked, also.)
	Fluctuation of load a. Feeding load change along curvature variation of copying profile. (Steady change) b. Remarkable change of load due to perpendicular load (Step change)	a. Revise the specification to adopt hydraulic cylinder of low pressure range. b. Revise the circuit by building plural number of regulators for pressure balancing in the event that the range of load variation is relatively small or load changes stepping trend.
	Inadequate positioning signal	Review the positioning signal circuit and remove the causes.
Table does not move.	Insufficient pressure to the cylinder.	Secure ample pressure.
	No signal to direction control solenoid valve.	Correct the control circuit.
	Misalignment of center lines at mounting cylinder.	Correct the installation state and/or change the supporting system.
	Damage to piston packing.	Replace piston packing.
	Damage to Seal belt.	Replace Seal belt.
Unsteady motion of table	Misalignment of center lines at mounting.	Correct the installation state and/or change the supporting system.
	Excessive moment	Install guide, correct the installation state.
	Excessive load.	Raise the pressure. Use the cylinder of larger bore.
		Revise the installation direction of speed control valve.
Damage or distortion	Shock due to high speed operation	Raise the cushion effect. Lower the speed. Reduce the load. Improve cushion mechanism. (Such as adopting external cushion mechanism.)
	Excessive moment	Install guide, correct the installation state.

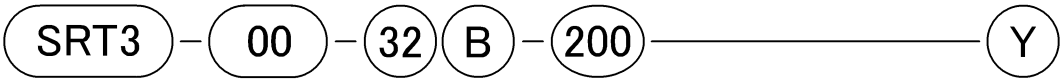
2) Switch

Troubles	Causes	Remedies
Indicator light is not lit.	Deposited contact point	Replace the switch.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
	Damaged Indicator light	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
Switch does not function right.	Broken circuit	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
	Improper voltage	Correct voltage to specified.
	Incorrect location of switch	Correct its location.
	Aberrant position of switch	Set it back to original position and tighten the mounting device. Tightening torque is 1.5 to 1.9 N·m.
	Incorrect direction of switch mounting	Correct the direction of the switch mounting.
	Excessive speed of piston if it is to sense an intermediate point of stroke	Reduce the speed of piston.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
Switch does not return.	Piston is not moving	Make the piston move.
	Deposited contact point	Replace the switch
	Excessive load (relay) than rated capacity	Replace the relay with a recommended one or replace the switch.
	The ambient temperature is out of the specification range	Adjust the ambient temperature within the range of -10 to 60℃.
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

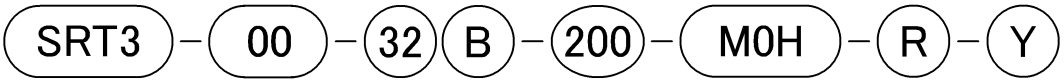
6. HOW TO ORDER

6.1 How to order product

- Without switch



- With switch



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

(a) Mounting style		(b) tube bore (mm)		(c) Cushion		(d) Stroke (mm)
00	Basic type	12	Equiv. to ϕ 12	B	Both side cushion	200
LB	Axial foot type	16	Equiv. to ϕ 16	R	R side cushion	300
		20	Equiv. to ϕ 20	L	L side cushion	400
		25	Equiv. to ϕ 25	N	No cushion	500
		32	Equiv. to ϕ 32			600
		40	Equiv. to ϕ 40			700
		50	Equiv. to ϕ 50			800
		63	Equiv. to ϕ 63			900
						1000

(e) Switch model No (note 1)					(f) Switch quantity	
Axial lead wire	Radial lead wire	contact	Indicator light	Lead wire	R	One on R side
					L	One on H side
M0H※	M0V※	reed	1 color indicator type	2-wire	D	Two
M5H※	M5V※		Without indicator light		T	Three
M2H※	M2V※	Solid state	1 color indicator type		4	Four
—	M2WV※		2 color indicator type			
M3H※	M3V※		1 color indicator type	3-wire		If more than 4 switches, indicate switch quantity.
—	M3WV※		2 color indicator type			
T2WH※	T2WV※		2 color indicator type	2-wire		
T2YH※	T2YV※					
T3WH※	T3WV※			3-wire		
T3YH※	T3YV※					
T2YD※	—		Strong magnetic field proof switch	2-wire		
T2YDT※	—					

※mark denotes the Lead wire length.

※ Lead wire length	
Blank	1m (Standard)
3	3m (Optional)
5	5m (Optional)

(e) Option (Note 2)	
Y	Floating joint
C	C mount bracket

Note 1 : Do not use in an environment containing spatter
itch (Radial lead wire type) or T-type switch.

6.1 How to order parts

1) Switch model unit display

(1) Switch body + Mounting bracket (Note 1)

SRL3 – M0H

Switch model No.
Page 30 (e)

(2) Only switch body

SW – M0H

Switch model No.
Page 30 (e)

(3) Mounting bracket (Note 2)

・M type switch

SRL3 – M

・T type switch

SRL3 – T

Lead wire holder (Note 3)

SRL3 – MH

(Note 1) Switch main body + mounting bracket set does not include any lead wire holder. When a lead wire holder is necessary, place an order separately.
(Note 2) M type switch bracket different from T type switch.
(Note 3) Lead wire holder is 10 pieces / 1 set.

1) C-mount unit display

SRL3 – 40 – M

Tube bore
Page 30 (b)

(C-mount, 4 mounting bolt 4 pcs.)

2) Floating joint set display

SRL3 – 40 – Y

Tube bore
Page 30 (b)

(Mount, mount base, pin, pain washer, pan head machine screw 4 mounting bolts with spring washer)

3) Repair parts model No. display

SRL3 – 40 K – 200

Tube bore
Page 30 (b)

stroke
Page 30 (d)

4) Mounting bracket model No. display

SRT3 – Mounting style (LB) – 40

(Braket 2 piece and mounting bolt 4 piece)

Tube bore
Page 30 (b)

Note: Switch bracket, C mount bracket, floating joint is common with SRL3.

仕　様

7. Specifications

7.1 Cylinder specifications

Item			SRT3							
Tube bore	mm		φ12	φ16	φ20	φ25	φ32	φ40	φ50	φ63
Actuation	mm		Double acting							
Working fluid			Compressed air							
Max. working pressure	MPa		0.7							
Min. working pressure	MPa	Cylinder section	0.2			0.15			0.1	
		Brake section	0.3 (Note)							
Proof pressure	MPa		1.05							
Ambient temperature	℃		5～60							
Port size		Cylinder section	M5		Rc1/8		Rc1/4		Rc3/8	
		Brake section	M5		Rc1/8					
Stroke tolerance	mm		$^{+2.0}_{0}$ (～1000), $^{+2.5}_{0}$ (～2000)							
Working piston speed	mm/s		50～1000							
Cushion			air cushion							
Lubrication			Not required (Use Grade 1 ISO VG 32 Turbine oil, if lubrication is preferred)							
Stop accuracy	mm		±1.5 (300mm/s at no load))							
Holding force	N		66	118	184	288	483	754	1178	1870

Note: Minimum working pressure of brake section is measured using a well balanced load.

7.2 Switch specifications

Item	Solid state switch	
	M2V・M2H	M2WV（2 color indicator type）
Applications	Programmable controller	
Power voltage	—	
Load voltage	DC10～30V	
Load current	5～30mA	
Current consumption	—	
Internal voltage drop	4V or less	
Indicator light	LED (ON lighting)	Red / green LED (ON lighting)
Leakage current	1Ma or less	
Lead wire length (note 1)	1m (oil resistant vinyl cabtire code, 2 conductor 0.2mm^2)	
Shock resistance	980m/s^2	
Insulation resistance	100MΩover at DC500V megger	
Withstand voltage	No failure at AC1000V impressed for one minute	
Ambient temperature	−10～＋60℃	
Protection structure	IEC standards IP67, JIS C0920 (water tight type), oil resistance	

Item	Solid state switch	
	M3V・M3H（NPN output）	M3WV（2 color indicator type）
Applications	Programmable controller, relay, compact solenoid valve	
Power voltage	DC4.5～28V	DC10～28V
Load voltage	DC30V or less	
Load current	200mA or less	150mA or less
Current consumption	10mA or less at DC24V	15mA or less at DC24V
Internal voltage drop	0.5V or less	
Indicator light	LED （ON lighting）	Red/green LED (ON lighting)
Leakage current	10μA or less	
Lead wire length (note 1)	1m (oil resistant vinyl cabtire code 3 conductor, 0.15mm^2)	
Shock resistance	980m/s^2	
Insulation resistance	100MΩover at DC500V megger	
Withstand voltage	No failure at AC1000V impressed for one minute	
Ambient temperature	−10～＋60℃	
Protection structure	IEC standards IP67, JIS C0920 (water tight type), oil resistance	

Item	Read switch			
	M0V・M0H		M5V・M5H	
Applications	Programmable controller, relay		Programmable controller, relay, IC circuit (without indicator light), serial connection	
Power voltage	—			
Load voltage	DC12/24V	AC110V	DC5/12/24V	AC110V
Load current	5～50mA	7～20mA	50mA or less	20mA or less
Current consumption	—			
Internal voltage drop	2.4V or less		0V	
Indicator light	LED （ON lighting）		Red/green LED (ON lighting)	
Leakage current	10μA or less			
Lead wire length (note 1)	1m (oil resistant vinyl cabtire code, 2 conductor 0.2mm^2)			
Shock resistance	980m/s^2			
Insulation resistance	100MΩover at DC500V megger			
Withstand voltage	No failure at AC1000V impressed for one minute			
Ambient temperature	−10～＋60℃			
Protection structure	IEC standards IP67, JIS C0920 (water tight type), oil resistance			

仕　様

Item	Solid state switch	
	T2YH, T2YV	T3YH, T3YV
Applications	Programmable controller	Programmable controller, relay
Power voltage	—	DC10～28V
Load voltage	DC10～30V	DC30V　or less
Load current	5～20mA（Note2）	50mA or less
Current consumption	—	10mA or less at DC24V
Internal voltage drop	4V or less	0.5V or less
Indicator light	Red/green LED (ON lighting)	
Leakage current	1mA or less	10μA or less
Lead wire length (note 1)	1m (oil resistant vinyl cabtire code, 2 conductor 0.3mm^2)	1m (oil resistant vinyl cabtire code, 3 conductor 0.2mm^2)
Shock resistance	980m/s^2	
Insulation resistance	100MΩover at DC500V megger	
Withstand voltage	No failure at AC1000V impressed for one minute	
Ambient temperature	−10～＋60℃	
Protection structure	IEC standards IP67, JIS C0920 (water tight type), oil resistance	

Item	Solid state switch	
	T2WH, T2WV	T3WH, T3WV
Applications	Programmable controller	Programmable controller, relay
Power voltage	—	DC10～28V
Load voltage	DC24V±10%	DC30V or less
Load current	5～20mA（Note 2）	50mA　or less
Current consumption	—	10mA or less at DC24V
Internal voltage drop	4V or less	0.5V or less
Indicator light	Red/green LED (ON lighting)	
Leakage current	1mA or less	10μA or less
Lead wire length (note 1)	1m (oil resistant vinyl cabtire code, 2 conductor 0.3mm^2)	1m (oil resistant vinyl cabtire code, 3 conductor 0.2mm^2)
Shock resistance	980m/s^2	
Insulation resistance	20MΩover at DC500V megger	
Withstand voltage	No failure at AC1000V impressed for one minute	
Ambient temperature	−10～60℃	
Protection structure	IEC standards IP67, JIS C0920 (water tight type), oil resistance	

Item	Solid state switch	
	T2YD	T2YDT
Applications	Programmable controller	
Indicator light	Red/green LED (ON lighting)	
Load voltage	DC24V±10%	
Load current	5～20mA	
Internal voltage drop	6V or less	
Current consumption	1.0mA or less	
Output delay time (Note 2) (ON delay, OFF delay)	30～60ms	
Lead wire length (note 1)	1m (oil resistant vinyl cabtire code, 2 conductor 0.5mm^2)	1m (oil resistant vinyl cabtire code, 2 conductor 0.5mm^2)　(option)
Shock resistance	980m/s^2	
Insulation resistance	100MΩover at DC500V megger	
Withstand voltage	No failure at AC1000V impressed for one minute	
Ambient temperature	−10～＋60℃	
Protection structure	IEC standards IP67, JIS C0920 (water tight type), oil resistance	

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

Note2: This shows a period of time between detection of the piston magnet by the magnetic sensor and sending of switch output.