Discontinue

CKD

SM-218864-A

INSTRUCTION MANUAL

SUPER RODLESS CYLINDER WITH BRAKE

SRT

- 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

Discontinue

For Safety Use

To use this product safely, 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:

⚠ Precautions

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

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SRT
Super Rodless Cylinder With Brake
Manual No. SM-218864-A

NOTE : Letters & figures enclosed within Gothic style bracket (examples such as [C2-4PP07] · [V2-503-B] etc.) are editorial symbols being unrelated with contents of the book.

Nov.28.1996
Revision : Feb.1.2000

1. PRODUCT

1.1 Specifications

Media		Compressed air
Max. service pressure	MPa	0.7
Min. service pressure	MPa	for cylinder Equiv. to ϕ32, ϕ40 0.15 Equiv. to ϕ50, ϕ63 0.1 for brake 0.3
Proof pressure	MPa	1.05
Range of ambienttemperature	°C	5 - 60
Lubrication		Not required (Use Turbine oil, class 1, ISO VG32 if required. Continue to pour the oil to fill when it starts.)
Range of piston speed	mm/s	50 - 1000
Positioning accuracy		±1.5mm (No load, at 300mm/s)
Brake holding power	N	Equiv. to ϕ32···483 Equiv. to ϕ40···754 Equiv. to ϕ50···1178 Equiv. to ϕ63···1870
Model Nos. of applicable switches		M2, M2W, M3, M3W, M0, M5

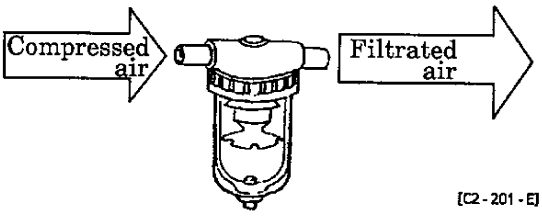
Note : Cylinder switches are available for cylinders of thes type.

[SM-218864]

2. CAUTION

2.1 Fluid

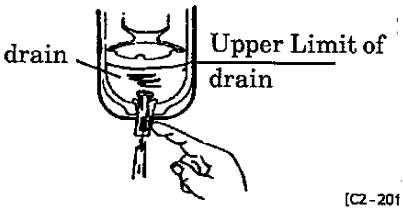
1) Use the compressed air, filtrated and dehumidified. Carefully select a filter of an adequate filtration rate (5μm or lower preferred), flow rate and its mounting location (as closest to directional control valve as possible).



[C2-201-E]

2) Be sure to drain out the accumulation in filter periodically.

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



[C2-201-F]

4) The cylinder of this type does not require lubrication. It is recommended, however, to use Turbine oil Grade 1, ISO VG32 as lubricant, if lubrication is preferred.

5) The cylinder of this type is inoperable with low pressure range due to the external fluid leakage.

3. OPERATION

3.1 Operation

1) Range of working pressure
Operate the system within following range of air pressure.

Model	Pressure range for brake MPa	Pressure range for cylinder MPa
Equiv. to ϕ32 & 40	0.3~0.7	0.15~0.7
Equiv. to ϕ50 & ϕ63		0.1~0.7

2) Cushion factor is adjusted at factory prior to shipment.
Adjust it, however, with cushion needle in case of re-adjusting it in compliance with load at site.
Tightening the needle increases cushion effect. In the event that the kinetic energy is exceeding the value in the following table due to heavier load, faster speed, etc, consider installation of a certain additional relieving system.

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

CUSHION CHARACTERISTICS

Tube bore (mm)	Effective cushion length (mm)	Absorbable energy (J)	
		With cushion	Without cushion
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) Install a set of piston speed controller as per illustrated fundamental circuit on page 5.

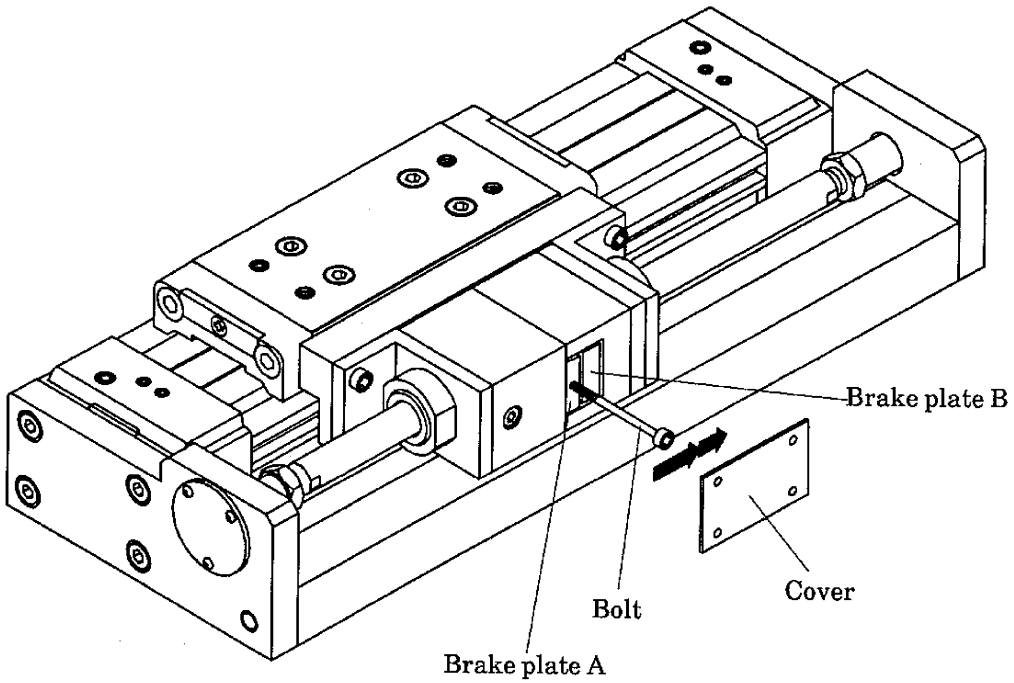
3.2 How to release manual operation of brake

1) Monual release of brake is the following procedure.
2) Cautions

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

③ Be sure to remove Bolt for the manual release of brake and mount cover before operation.



Note) Be carefull that it causes only one side release it Bolt doesn't pull down Brake plate A and B enough.

4. INSTALLATION

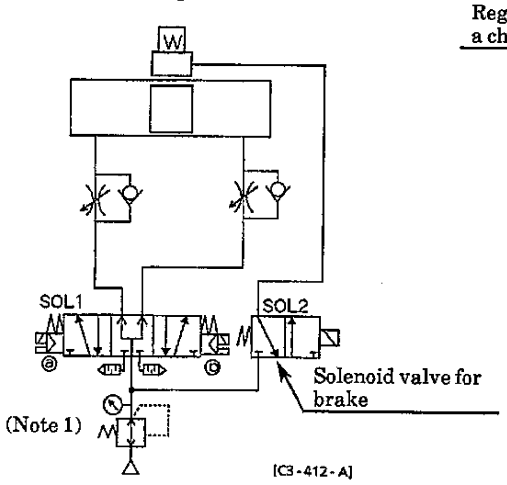
4.1 Fundamental Circuit

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.
   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.

For holizontal moving 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

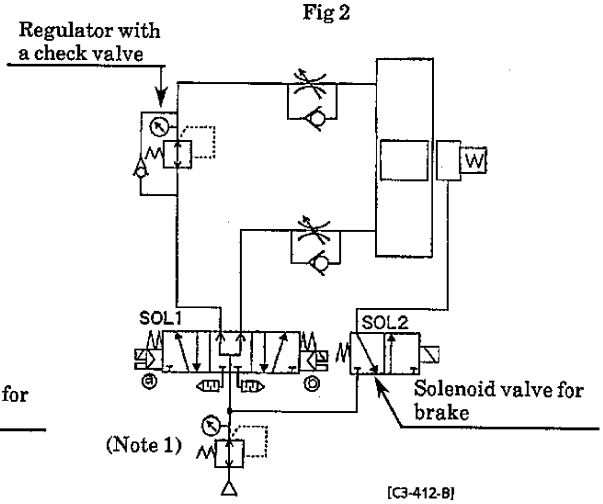


a	SOL-1	b	SOL-2	Actuating
OFF		OFF	OFF	Halt
ON		OFF	ON	Retreat
OFF		ON	ON	Advance

For vertical moving 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 isreleased.

Fig 2



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

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

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

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

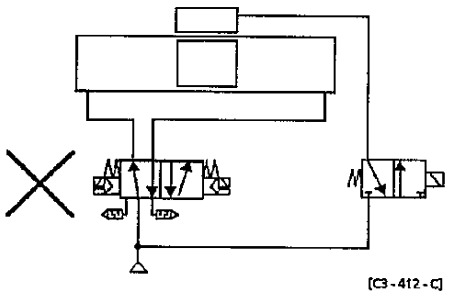
3) How to keep propulsion balance

Make use of regulator with a check valve as illustrated in "Paragraph 4-1. Basic circuit diagram". Adjust the pressure to remove sticking motion while visually inspecting it. It is, of course, able to calculate it by formulae.

4) Caution

Comply with either Fig. 1 or Fig. 2 posted on previous page, even 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 locked condition.

So, select a single valve or the individual exhaust type for manifold valves.

6) The cylinder rod pushes out fast when Brake is released under the supplied pressure to one side of the cylinder. It is very dangerous.

Be sure to excute the following items when Brake is released under adjustment operations and so on.

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

b) Excute 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 sides of the cylinder.
- Place a support for the load.

c) Confirm that only one side of the cylinder is not compressed by air.

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

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

9) It has influence on the accuracy of the stop possition to have a long tube which supplies compressued air to Brake. Consider the length to be as shorter as possible.

4.2 Electric control schematics

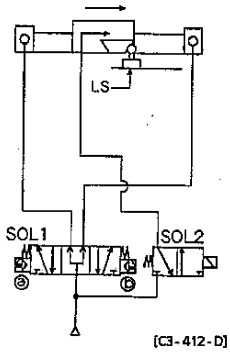
1) When sequencer (PC) is in use

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

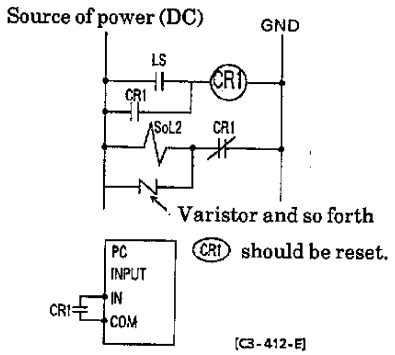
[Example]:

Scanning time	10msec	positioning error becomes within ±1.5mm due to only scanning time.
Cylinder speed	300mm/s	
In this case,		

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.



[C3-412-D]

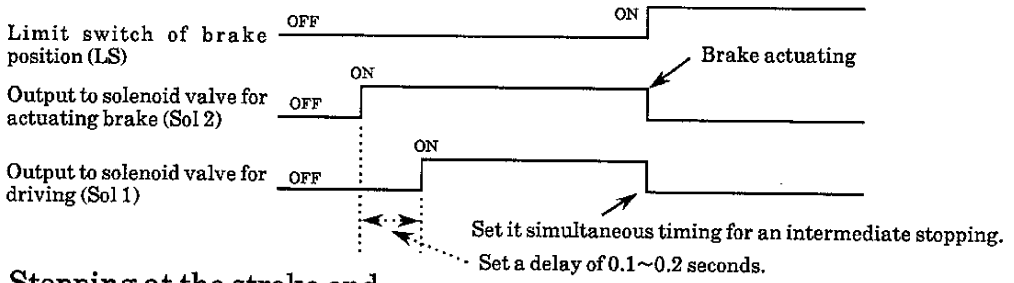


[C3-412-E]

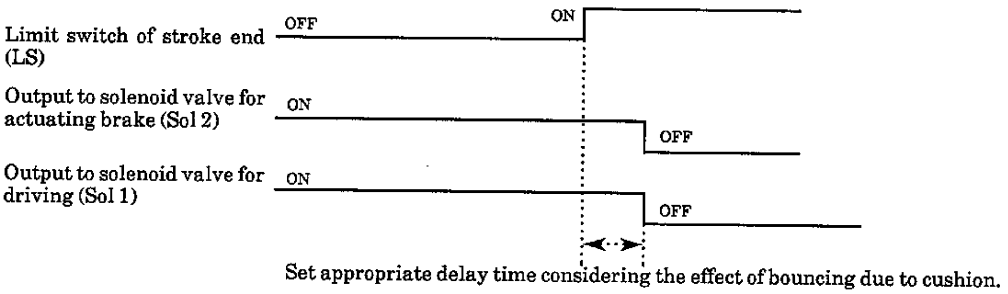
2) Output timing to solenoid valve for brake.

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



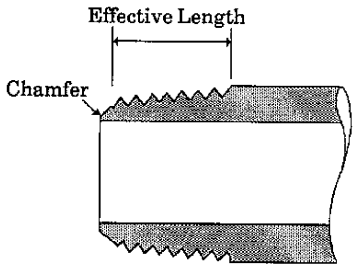
② Stopping at the stroke end



3) 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 a detect circuit by a self-keeping circuit if necessary.

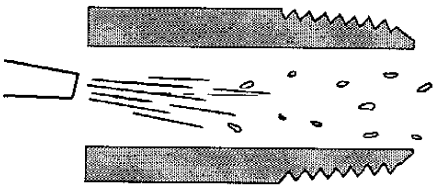
4.3 Piping

1) For piping beyond the filter, use pipes that hardly get corroded 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 needed for the cylinder to drive at specified speed.
3) Install filter preferably adjacent upper-stream to solenoid valve for eliminating rust, foreign substance and drain in the pipe.
4) Strictly observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.



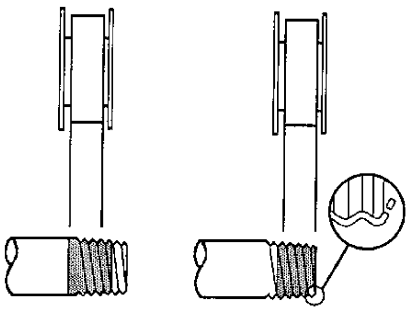
[CO-400-A]

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

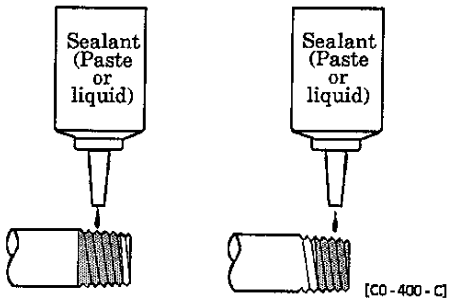

[CO-400-B]

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

● Seal Tape


Correct Incorrect

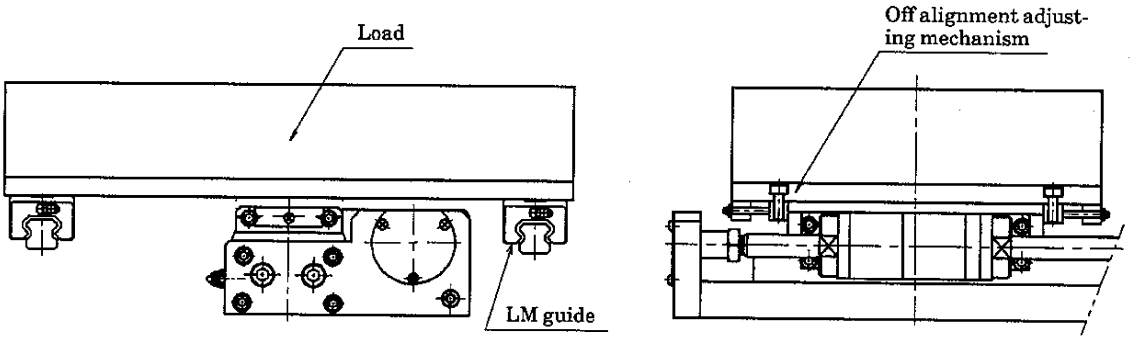
● Sealant (Paste or liquid)



[CO-400-C]
Correct Incorrect

4.4 Installation

1) The range of servicable ambient temperature is 5~60°C.
2) Carefully avoid anything from bouncing the cylinder as it may distort the tube resulting its malfunction.
3) Carefully beware that the given pressure will not be held by cylinder even when cylinder port is closed during the cycle of air supply. due to some unavoidable air leakage
4) Carefully avoid electric arc welding to rodless cylinder after completion of mounting it. Dust preventive belt may be damaged due to the spark generated between dust preventive belt and cylinder tube because of current running through cylinder.
5) Be sure to be below the mass of the max load which is described on the catalog (CC-N-362).
6) Mounting the load
   Use SRT 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 port before operation.
   And then, mounting this cylinder.

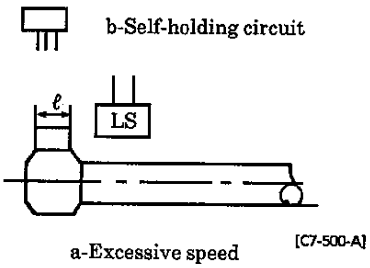
5. MAINTENANCE

5.1 Periodic Inspection

1) In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.
2) Inspection items
   ⓐ Check the loosen bolts and nuts for mounting the load and body.
   ⓑ Check if the cylinder operates smoothly.
   ⓒ Check any change of the piston speed and cycle time.
   ⓓ Check for external leakage.
   ⓔ Check for remarkable change of table play.
   ⓕ Check for the stroke abnormality.
   ⓖ Loosen screws for mounting switch or position discrepancy.
   ⓗ Check for any crack or flaw at joint of switch and switch lead cord.
   ⓘ Check for any magnetizable foreign particle at the location of switch mounting.
   ⓙ Check for the loosen bolts of mounting brake mechanism.
   ⓚ Varification of brake actuation and release motion

See "Trouble shooting", 5.2, should there be any trouble found, also additionally tighten bolts, nuts, etc. if there are any slackened ones.

5.2 Trouble Shooting

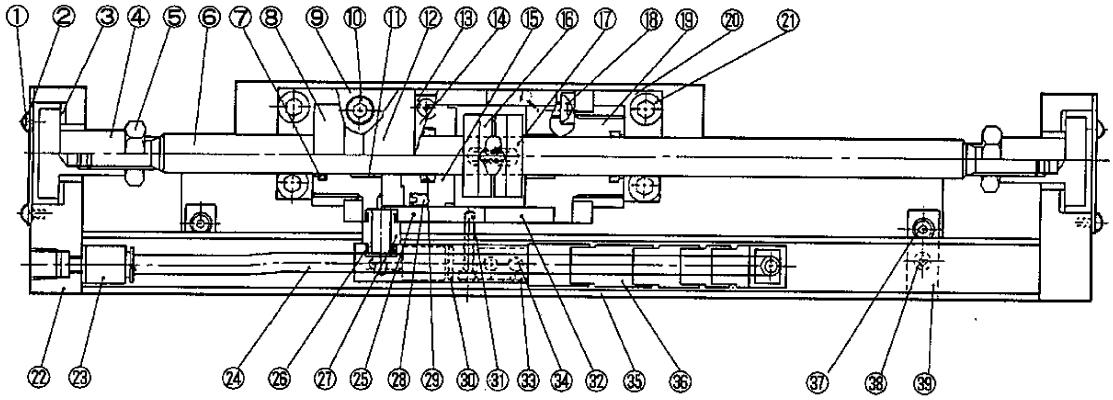
Trouble	Cause	Correction
Brake does not release.	Insufficient pressure to the brake mechanism	Secure ample pressure.
	No signal to brake solenoid valve (In case NO type - Electric signal is there.)	Reaffirm the circuit to receive a signal. (Reaffirm the circuit to shut off a signal.)
	Solenoid valve for brake does not function	Check wiring and repair as required. Repair or replace solenoid valve as is required.
	Damage to packing for brake piston	Maker repairs
Table does not stop.	Electric signal is there. (In case NO type - No signal to brake solenoid.)	Reaffirm the circuit to shut off a signal. (Reaffirm the circuit to receive a signal.)
	Solenoid valve for brake does not function	Check the circuit and repair or replace solenoid valve as is required.
	Damage to packing for brake piston	Maker repairs
	Left manual release of brake	Remove the manually open status.
	Skips off the dog for brake a- Excessive cylinder speed b- Circuit is not self-holding circuit  a-Excessive speed [C7-500-A]	a- Slow down the speed or increase the dog length (ℓ). 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 larger effective sectional area.
	Either too thine or too long tubing of connecting solenoid valve for brake and brake port	Either replace tubing with the one of larger 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 sequencer.)
	Slackening of mounting a dog for brake signal.	Correct and remove the play.
	Remarkable wear and tear on the shape of the dog	Replace with new dog if wear and tear is excessive.

Trouble	Cause	Correction
Inaccurate positioning	a- Slant angle should 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.
	Fluctuation of cylinder speed a- Misalignment of the center lines between cylinder 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- Prevent off alignment using floating mounting etc. b- Alter cylinder with larger bore. 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- Reduce load ratio by altering cylinder with larger bore. 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.
Does not operate	No pressure or inadequate pressure	Provide an adequate pressure source.
	No signal to direction control valve	Correct the control circuit
	Misalignment of center lines at mounting	Correct the installation state.
	Damage to piston packing	Maker repairs
	Damaged seal belt	Maker repairs
Does not function smoothly	Misalignment of center lines at mounting	Correct the installation state.
	Exertion of moment	Install a guide. Revise the installation state .
	Excessive load	Increase the pressure itself Use the tube of larger ID.
	Speed control valve is built in the way of "Meter in" circuit	Change the direction of the speed control valve.
Breakage and/or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load Install a mechanism with more secured cushion effect (e.g. external cushion mechanism).
	Moment is exceeding tolerable value.	Install a guide. Reverse the installation state and/or change the supporting system.

Trouble	Cause	Correction
Switch does not function	Position discrepancy of switch	Re-set the position of switch within the zone of HD as explained in Article 7, 7.1, 1), page 15.
	Switch is electrically damaged	Re-build the circuit to eliminate excessive current and/or voltage. (Replace the switch) See if there is any sharp bending of lead cord and occurring internal short circuit (Replace the switch)
	Switch is mechanically damaged	Replace switch. Remove any external obstacles.
	Abnormal distribution of magnetic flux in a magnet to actuate the switch.	Clean and remove the magnetizing foreign particles around switch base.

5.3 Maintenance

1) Internal structure and expendable parts



No.	Part name	Materials	No.	Part name	Materials
1	Cross-recessed head screw	Steel	21	Hex. socket head bolt	Steel
2	Joint section cover	Aluminum plate	22	End flange	Aluminum alloy
3	Slide plate	Steel + Resin	23	Push-in joint	——
4	Floating joint	Steel	24	Tube	Ulethane rubber
5	Nut	Steel	25	Body A	Aluminum alloy
6	Brake shaft	Steel	26	Gasket	Nitrile rubber
7	Scraper	NBR	27	Socket	Steel
8	Fixing nut	Steel	28	Brake piston packing	Nitrile rubber
9	Brake mounting base	Aluminum alloy	29	Brake rod packing	Nitrile rubber
10	Hex. socket head bolt	Steel	30	Push-in joint	——
11	Bush bearing	DBB Bushing	31	Hex. socket head bolt	Steel
12	Cross-recessed head screw	Steel	32	Body B	Aluminum alloy
13	Cover	Aluminum plate	33	Adaptor	Aluminum alloy
14	Release pistoon	Cast iron	34	Cross-recessed head screw	Steel
15	Brake plate A	Special steel	35	Cable holder	Aluminum alloy
16	Spring	Spring steel	36	Cable bear	Special plastic
17	Brake plate B	Special steel	37	Hex.socket button head screw	Steel
18	Hex.socket button head screw	Steel	38	Cable holder mounting plate	Steel
19	Brake end cover	Aluminum alloy	39	Cross-recessed head screw	Steel
20	Brake axial foot	Steel			

6. HOW TO ORDER

● Without Switch

SRT — LB — 32 — B — 200

● With Switch

SRT — LB — 32 — B — 200 — M0H — D — Y

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ Ⓖ

Ⓐ Mounting type		Ⓑ Tube bore (mm)		Ⓒ Cushion	
OO	Basic type	32	ϕ 32 Equiv.	B	Cushion on both ends
LB	Foot type, along cylinder axis	40	ϕ 40 Equiv.	R	Cushion on R end
		50	ϕ 50 Equiv.	L	Cushion on L end
		63	ϕ 63 Equiv.	N	No cushion

Right and Left ends are as viewing cylinder facing to port side.

Ⓓ Stroke (mm)	
Standard stroke	Max. stroke
200 , 300	Max. stroke up to Equiv. to ϕ32, ϕ40 1500mm Equiv. to ϕ50, ϕ63 2000mm on order
400 , 500	
600 , 700	
800 , 900	
1000	

Ⓔ Model coding of switch						Ⓕ Number of	
Lead outlet straight type	Lead outlet L type	Application			Lamp	R	1 ea., R end
						L	1 ea., L end
M0H※	M0V※	for Relay and PC	Cont-act point	2-cord	Monochrome without lamp	D	2 ea.
M5H※	M5V※	for Relay, PC, IC circuit or Series connection				T	3 ea.
						4	4 ea.
M2H※	M2V※	for PC	Proximity		Monochrome	5	5 ea.
—	M2WV※				2-color	● Numeric figure is used to specify more than 4 each.	
M3H※	M3V※	for Relay, PC, IC circuit or Compact solenoid		3-cord	Monochrome		
—	M3WV※				2-color		

※ mark denotes the length of lead cord.

※ Length of lead cord	
No code	1m (Standard)
3	3m (Option)
5	5m (Option)

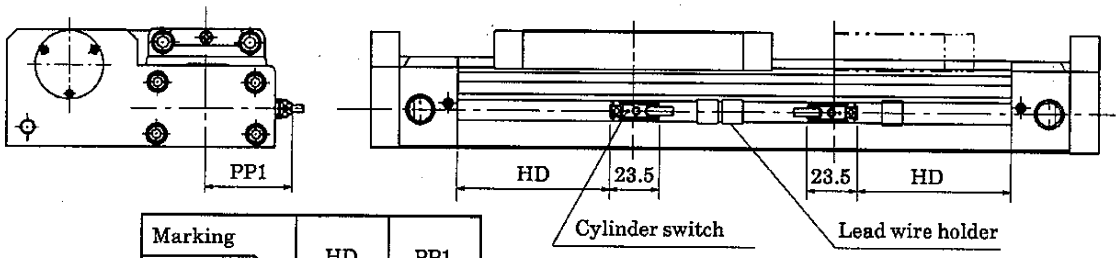
Ⓖ Option & accessories	
Y	Floating joint
C	C-mount

7. OPERATIONAL CAUTION OF CYLINDER WITH SWITCH

7.1 Common Caution for both cylinders mounted with either Non contact switch or Contact point switch

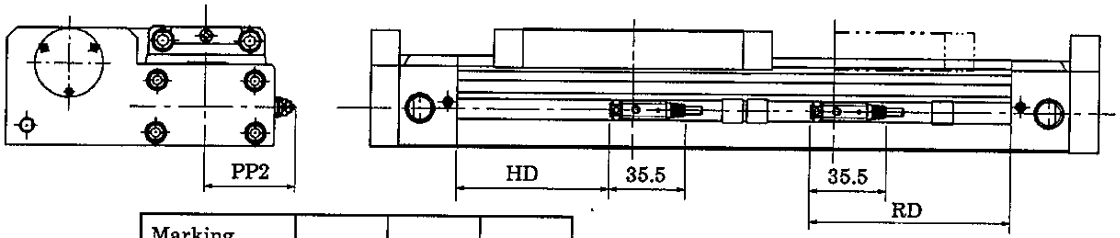
1) Although the cylinder switches are positioned, prior to delivery, at the location specified in the following table (the mostly sensitive position), it is recommendable to confirm it prior to start using the cylinder. It is, of course, mandatory to confirm it when cylinder and switches are independently purchased or an additional switch is to be mounted.

● With cylinder switch SRT-※※-※※-※※※-M※V※
(Lead outlet L type)



Marking / Model	HD	PP1
SRT-※※-32	74	41.5
SRT-※※-40	80	48.5
SRT-※※-50	79	56.5
SRT-※※-63	98	67.5

● With cylinder switch SRT-※※-※※-※※※-M※H※
(Lead outlet straight type)



Marking / Model	HD	RD	PP1
SRT-※※-32	74	96	43
SRT-※※-40	80	102	50
SRT-※※-50	79	101	58
SRT-※※-63	98	120	69

2) How to relocate switches

After loosening mounting screw (machine screw), slide the switch together with a bracket along cylinder tube to the appropriate position, then tighten the screw.

3) As for replacing switch, take out switch from bracket by loosening mounting screw (Machine screws). Leave, at this time, bracket on cylinder. Mount a new switch onto the bracket and tighten screws after finding an appropriate location over the cylinder. (Apply torque of 49 - 68 N · cm for tightening screws.)

4) Determining mounting position of the switch at an intermediate part of the stroke.

(1) Comply with the following principle to find out the location of mounting switch at an intermediate part of the stroke.

① Models M0, M2, M3 and M5

Tentatively lock the piston at the desired point to stop. Slide the switch forward and backward over the position of piston to find out where the switch turns On on each direction. Tighten the mounting screw while holding the switch at the center of these two points as it is the most sensitive point of the switch.

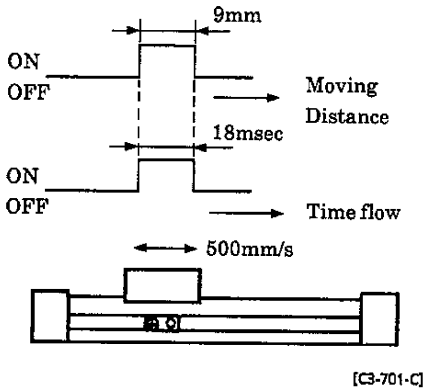
② Models M2W or M3W two-color indicating type proximity switches.

Slide the switch over the piston to find out where a green lamp is lit. Tighten the mounting screw while holding the switch at the point as it is the most sensitive point of switch.

- Two-color indicating proximity switch turns red lamp On while it is within the range of responding stroke where as turning green lamp On at the most sensitive point (thus, it is easily locate the mostly adequate position to set the switch).

  There is no harm to the switch to let the switch function within the range of red lamp zone.

(2) In case an intermediate sensing is required, cylinder speed is usually high. Therefore, such particular consideration as described below may be necessary because there are going to be such problems never be expected during sensing the speed at stroke end sometimes take place.



[C3-701-C]

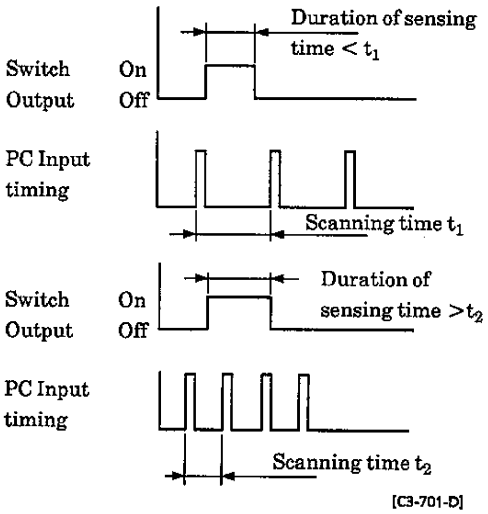
Does control circuit affirmatively respond? (such as Relay circuit, Programmable controller circuit · program).

- Cylinder responding time itself is such high speed as 1 msec. But there are going to be only limited responding time allowance calculated out of the following formula.

$$\text{Sensing time allowance (sec)} = \frac{\text{Range of responding distance (mm)}}{\text{Cylinder speed (mm/s)}}$$

Example : Of 9mm responding distance with cylinder speed 500mm/s, there are only 18msec. sensing time allowance. (Par timing chart on previous page.)

- Response has to be carried out taking signal affirmatively during the duration of within this limited responding time allowance. Build a self-holding circuit in the system, if it is necessary.
- For input of programmable controller particularly, time length including program scanning time has to be shorter than this limited responding time allowance.



- The following is the Table of switch responding range.

(mm)

Model	Range of Responding		
	Non contact point switch (M2V.M2H.M3V.M3H)	Non contact point switch (M2WV.M3WV)	Contact point switch (MOV.MOH.M5V.M5H)
SRT-32	7.5~15	8~14	7~13.5
SRT-40	11.5~17.5	10~16.5	10~16
SRT-50	16.5~24	14~21	14.5~21.5
SRT-63	16~24	14~21	14~21.5

- Refer to "Operation Manual, SM-7648, Super rodless cylinder, SRL2".as for operational cautions of Cylinder switch.