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CKD

SM-227148-A

INSTRUCTION MANUAL

LINEAR SLIDE CYLINDER

LCY · LCY-A SERIES

- 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

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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Linear Slide Cylinder
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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.

1. PRODUCT

1.1 Cylinder Specifications

Model code / Item	LCY Basic type	LCY-A Reduced piping type
Media	Compressed Air	
Max. Working pressure MPa {kgf/cm²}	0.7 {7.14}	
Min. Working pressure MPa {kgf/cm²}	0.15 {1.53}	0.20 {2.04}
Guaranteed proof pressure MPa {kgf/cm²}	1.0 {10.2}	
Ambient temperature °C	−10~60 (no freezing)	
Tube bore mm	φ10, φ16, φ20, φ25	
Connecting port dia.	M5	
Tolerance of stroke mm	0~−5	
Working speed of piston mm/s	50~300	
Cushion	with rubber cushion	
Lubrication	Not required (Use Turbine oil Class 1, ISO, VG32 if and when lubrication is needed.)	

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1 PRODUCT

1.2 Switch Specifications

Kind and Model code	Non contact type switch			
Item	K2H/V	K2YH/V (2-color indicating)	K3H/V	K3YH/V (2-color indicating)
Application	For Programmable controller, exclusive		For Programmable controller or Relay	
Voltage of source of power	——		DC10~28V	
Load voltage	DC10~30V		DC30V or lower	
Load current	5~25mA (※ 2)		50mA or less	
Power consumption	——		10mA or less at DC24V (While Power is ON)	
Internal voltage drop	4V or less		0.5V or less by 50mA	
Lamp	LED (Lights while power is ON)	LED (Red/Green) (Lights while power is ON)	LED (Lights while power is ON)	LED (Red/Green) (Lights while power is ON)
Current leak	1 mA or less		10μA or less	
Length of lead cord (※1)	1m (Oil proof vinyl, Cabtyre cord, 2-core, 0.2mm²)	1m (Oil proof vinyl, Cabtyre cord, 3-core, 0.3mm²)	1m (Oil proof vinyl, Cabtyre cord, 3-core, 0.2mm²)	
Max. shock	980m/s² {100G}			
Insuration resistance	20MΩ or more by DC 500V megger	100MΩ or more by DC 500V megger	20MΩ or more by DC 500V megger	100MΩ or more by DC 500V megger
Insuration voltage	No abnormalities upon charging AC1000V for one minute.			
Ambient temperature	−10~+60℃			
Protective structure	IEC Standard IP67, JIS C0920 (Intrusion type without water), Oil proof			

Kind and Model code	Contact type switch	
Item	K0H/V	K5H/V
Application	For Programmable controller or Relay	For programmable controller, relay or IC circuit (not including Lamp), for Series connection
Voltage of source of power	——	
Load voltage	DC12/24V, 5~50mA	DC12/24V, 50mA or less
Load current	AC100V, 7~20mA	AC100V, 20mA or less
Power consumption	——	
Internal voltage drop	2.4V or lower	0V
Lamp	LED (Lights while power is ON)	——
Current leak	0 mA	
Length of lead cord (※1)	1m (Oil proof vinyl, Cabtyre cord, 2-core, 0.2mm²)	
Max. shock	294m/s² {30G}	
Insuration resistance	20MΩ or more by DC 500V megger	
Insuration voltage	No abnormalities upon charging AC1000V for one minute.	
Ambient temperature	−10~+ 60℃	
Protective structure	IEC Standard IP67, JIS C0920 (Intrusion type without water), Oil proof	

※1 : As for length of lead cord optional lengths of 3m and 5m are available.

※2 : Max.value (25mA) of Load current is that of 25℃. It drops lower than 25mA when the switch ambient temperature exceeds 25℃. (5-10mA by 60℃)

Discontinue

Model code / Item		Non contact type switch 3-core type	Non contact type switch 4-core type
		K2YFH / V	K3YFH / V
Application		for Programmable controller	for Programmable controller or Relay
Indicator	Mounting position adjustment part	Red/Green LED (Lights while power is ON)	
	Preventive maintenance output part	——	
Normal output Segment	Power voltage	——	DC10~28V
	Load voltage	DC10~30V	DC30V or lower
	Load current	DC5~20mA	DC50mA or less
	Internal voltage drop	4V or lower	0.5V or lower
	Current consumption	——	10mA or less
	Leak current	1mA or less	1μA or less
Preventive maintenance Segment	Load voltage	DC30V or less	
	Load current	DC20mA	DC50mA or less
	Internal voltage drop	0.5V or lower	
	Leak current	10μA or less	
	Signal holding (ton)	——	
	Signal release (toff)	——	
Length of lead cord (standard)		1 m (Oil proof vinyl, Cabtyre cord, 3-core, 0.2m²)	1 m (Oil proof vinyl, Cabtyre cord, 4-core, 0.2m²)
Insuration resistance		100mΩ or more by DC 500V megger	
Insuration voltage		No abnormalities upon charging AC1000V for one minute.	
Max. shock		980m/s² {100G}	
Ambient temperature		−10~+60°C	
Protective structure		JIS C0920 (Intrusion type without water), IP67, Oil proof	

Model code / Item		Non contact type switch 3-core type	Non contact type switch 4-core type
		K2YMH / V	K3YMH / V
Application		for Programmable controller	for Programmable controller or Relay
Indicator	Mounting position adjustment part	Red/Green LED (Lights while power is ON)	
	Preventive maintenance output part	Yellow LED (Lights while power is ON)	
Normal output Segment	Power voltage	——	DC10~28V
	Load voltage	DC10~30V	DC30V or lower
	Load current	DC5~20mA	DC50mA or less
	Internal voltage drop	4V or lower	0.5V or lower
	Current consumption	——	10mA or less
	Leak current	1.2mA or less	10μA or less
Preventive maintenance Segment	Load voltage	DC30V or less	
	Load current	DC5~20mA (※2)	DC50mA or less
	Internal voltage drop	4V or lower	2.4V or lower
	Leak current	10μA or less	
	Signal holding (ton)	Turns ON (0.4±0.2) seconds after the red LED turns ON at Mounting position adjustment part	
	Signal release (toff)	Turns OFF (0.7±0.2) seconds after the red LED turns ON at Mounting position adjustment part	
Length of lead cord (standard)		1 m (Oil proof vinyl, Cabtyre cord, 3-core, 0.2m²)	1 m (Oil proof vinyl, Cabtyre cord, 4-core, 0.2m2)
Insuration resistance		100mΩ or more by DC 500V megger	
Insuration voltage		No abnormalities upon charging AC1000V for one minute.	
Max. shock		980m/s² {100G}	
Ambient temperature		−10~+60°C	
Protective structure		JIS C0920 (Intrusion type without water), IP67, Oil proof	

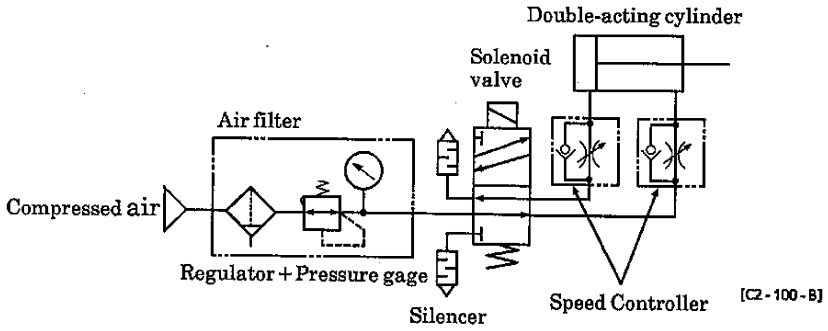
※1 : As for length of lead cord optional lengths of 3m and 5m are available.

※2 : Max.value (25mA) of Load current is that of 25℃. It drops lower than 25mA when the switch ambient temperature exceeds 25℃. (5-10mA by 60°C)

[SM-227148-A]

1.3 Fundamental Circuit Diagram

1) Fundamental Circuit Diagram of Double-acting Cylinder (Oilless type)
Fundamental Circuit Diagram:



1.4 Selection of Related Equipment

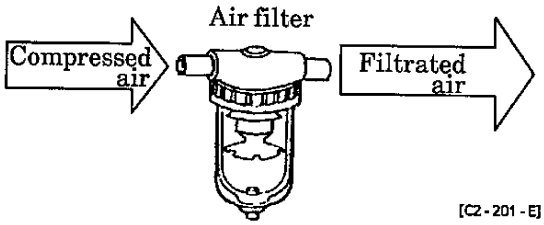
Related equipment on the basic circuit diagram in 1.3 above varies depending on the cylinder tube inner diameter and the speed. Select the appropriate equipment from the equipment guidance table shown below. (This table is an example of related equipment.)

Tube bore (mm)	Theoretical speed (mm/s)	Required flow (ℓ/min) (at P=0.5MPa {5kgf/cm²})	Solenoid valve		Speed Controller	Silencer	Piping (between solenoid valve and cylinder)
			Single Solenoid	Double Solenoid			
φ10	500	14	B5142	——	SC3G-M5-4	SL-M5	φ4×φ2.5 Nylon Tube
φ16	500	35	B5142	——	SC3G-M5-4	SL-M5	φ4×φ2.5 Nylon Tube
φ20	500	55	4KA110 4KB110	4KA120 4KB120	SC1-6	SL-M5 SLW-6A	φ6×φ4 Nylon Tube
φ25	500	86	4KA110 4KB110	4KA120 4KB120	SC1-6	SL-M5 SLW-6A	φ6×φ4 Nylon Tube

2. CAUTION

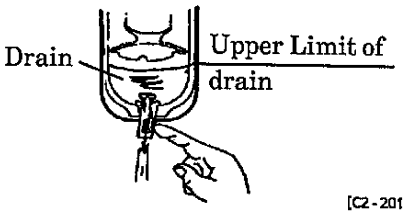
2.1 Fluid

1) It is necessary to use dehumidified air that has been filtered from compressed air. Carefully select an adequate filter that has an adequate filtration rate (preferably 5μm or less), flow rate and its mounting location (as nearest to the directional control valve as possible).



[C2-201-E]

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



[C2-201-F]

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

4) This cylinder does not require lubrication. It is recommended, however, to use Turbine oil Grade 1, ISO VG32 as a lubricant, if and when lubrication is needed.

3. OPERATION

3.1 Allowable Absorption Energy

1) The pressure supplied to the cylinder is shown in "1.1 Cylinder specification". Use a cylinder within this pressure range.
2) The cylinder is equipped with a rubber cushion. If motion energy is too large, provide an additional stopper. The allowable motion energy is shown below.
3) Attach the speed controller as shown in the basic circuit diagram on page 4 to set the piston speed within the product specification.
4) Do not provide load exceeding the allowable range on the table. Pay special attention to lateral load. Refer to the following to set the allowable load.

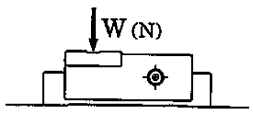
- Allowable load
  (1) Calculate all loads (W) and moments (M1, M2 and M3) for each load.
  (2) Divide each load by the maximum value shown in the table below to obtain the rates of load and moment. Make sure that the total is 1.0 or less.

$$\frac{W}{Wmax} + \frac{M1}{M1max} + \frac{M2}{M2max} + \frac{M3}{M3max} \leqq 1.0$$

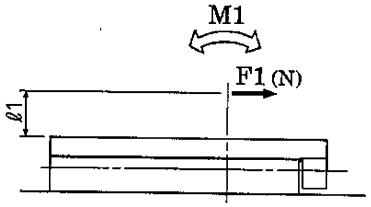
- Maximum allowable load

Item / Tube bore	Vertical load W (N) {kgf}	Bending moment M1 (N·m) {kgf·m}	Lateral bending moment M2 (N·m) {kgf·m}	Torsional moment M3 (N·m) {kgf·m}	ℓa (m)	ℓb (m)
ϕ10	3.92 {0.4}	0.58 {0.06}	0.58 {0.06}	0.29 {0.03}	0.034	0.009
ϕ16	9.80 {1.0}	1.17 {0.12}	1.17 {0.12}	0.58 {0.06}	0.041	0.0115
ϕ20	17.65 {1.8}	1.76 {0.18}	1.76 {0.18}	0.88 {0.09}	0.047	0.012
ϕ25	26.47 {2.7}	3.52 {0.36}	3.52 {0.36}	1.76 {0.18}	0.057	0.015

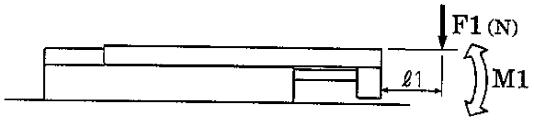
● Vertical load : W



● Bending moment : M1

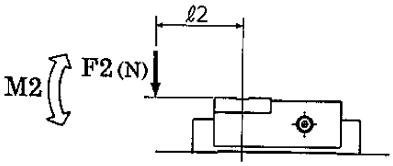


M1 = F1 × (ℓ1 + ℓb)

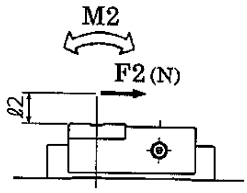


M1 = F1 × (ℓ1 + ℓa + stroke)

● Lateral bending moment : M2

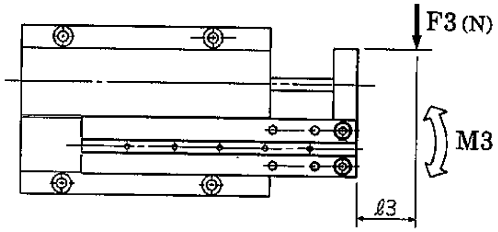


M2 = F2 × ℓ2

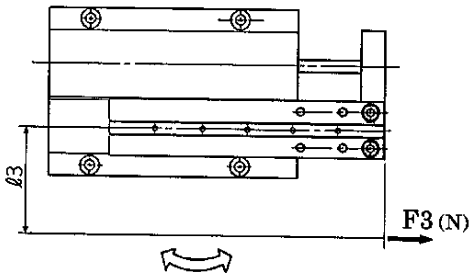


M2 = F2 × (ℓ2 + ℓb)

● Torsional moment : M3



M3 = F3 × (ℓ3 + ℓa + stroke)



M3 = F3 × ℓ3

5) Use a cylinder within the range of allowable absorption energy shown in the table below. If the motion energy exceeds this value, provide another damping device.

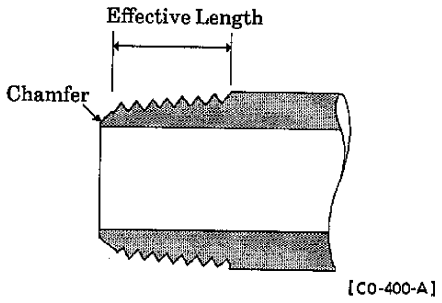
Tube bore (mm)	Rubber cushion	
	Allowable absorption energy J {kgf · cm}	
	PUSH	PULL
ϕ10	0.023 {0.23}	0.035 {0.36}
ϕ16	0.023 {0.23}	0.098 {1.0}
ϕ20	0.030 {0.31}	0.098 {1.0}
ϕ25	0.030 {0.31}	0.186 {1.9}

Note) If the stopper bolt is loosened in pushing to stop the cylinder with the cylinder rod bushing, there will be almost no absorption energy because the rubber cushion is not used. Use the stopper bolt to stop the cylinder.

4. INSTALLATION

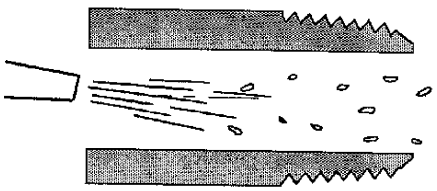
4.1 Piping

1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc. (Refer to Selection Guide Table for Related Equipment.)
2) See to it that the pipe connecting cylinder and solenoid valve has an effective sectional area which is needed for the cylinder to drive at the specified speed. (Refer to Selection Guide Table for Related Equipment.)
3) Install filter preferably adjacent to the upper-stream to the solenoid valve for eliminating rust and foreign substances in the drain of the pipe.
4) Be sure to adhere to the effective thread length of gas pipe and make a chamfer of approx. 1/2 pitch from the threaded end.



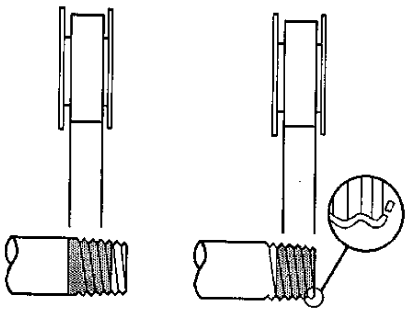
[C0-400-A]

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

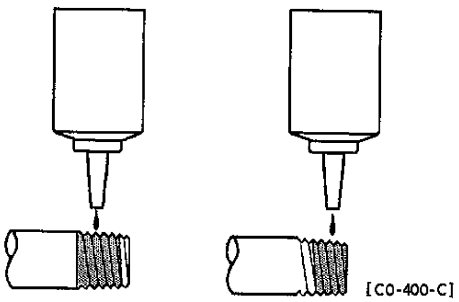

[C0-400-B]

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

● Seal Tape

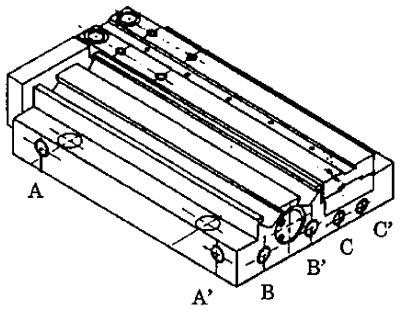


● Sealant (Paste or liquid)



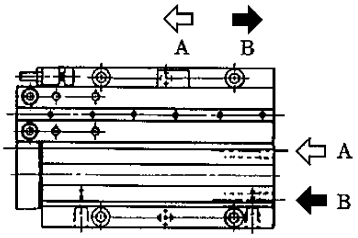
[C0-400-C]

7) Piping ports for each model are as shown below:

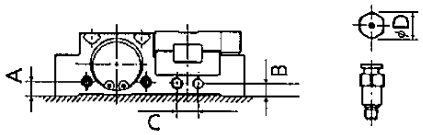


Model description	Port position	Function
All models	A · A'	Piping port for cylinder operation
LCY-10~25	B · B'	Piping port for cylinder operation
LCY-A-10 · 16	B · B'	Piping port for actuator operation for hand-chuck attachment
LCY-A-20 · 25	B · B'	Piping port for cylinder operation
LCY-A-20 · 25	C · C'	Piping port for actuator operation for hand-chuck attachment

8) If the piping ports at the back are used, make sure that the piping port position is correct for table movement before operation.



9) When the piping ports at the back and the reduced piping ports are used, the piping joints for use are limited. Refer to the following:



Piping ports at the back

Item / Tube bore (mm)	Port diameter	Port dimension A	Joint outer diameter φD	Joint for use
φ10	M5X0.8	5.5	φ11 or less	SC3G-M5-4, SC3G-M5-6, GMS4-M5, GMS4-M5-S, GML4-M5, GMS6-M5-S, GSS4-M5, GSL4-M5, GSL6-M5, FTS4-M5, FTL4-M5, FTS6-M5, FTL6-M5
φ16				
φ20				
φ25				

Piping port

Item / Tube bore (mm)	Port diameter	Port dimension A			Joint outer diameter φD	Joint for use
φ10	M5X0.8	5.5			φ11 or less	GMS4-M5, GMS4-M5-S, GML4-M5, GMS6-M5-S, GSS4-M5, GSL4-M5, GSL6-M5, FTS4-M5、FTL4-M5、FTS6-M5、FTL6-M5
φ16						
φ20			5	9	φ9 or less	GMS4-M5-S, FTS4-M5、FTL4-M5、FTS6-M5、FTL6-M5
φ25				10	φ10 or less	GML4-M5, GML4-M5-S, GSL4-M5, GSL6-M5, FTS4-M5、FTL4-M5、FTS6-M5、FTL6-M5

4.2 Stroke Adjustment

The linear slide cylinder has a stroke adjustment bolt for the amount of 0 ~ −5 mm at the piston rod end. Loosen the hex nut to set the required stroke and then tighten it with a lock.

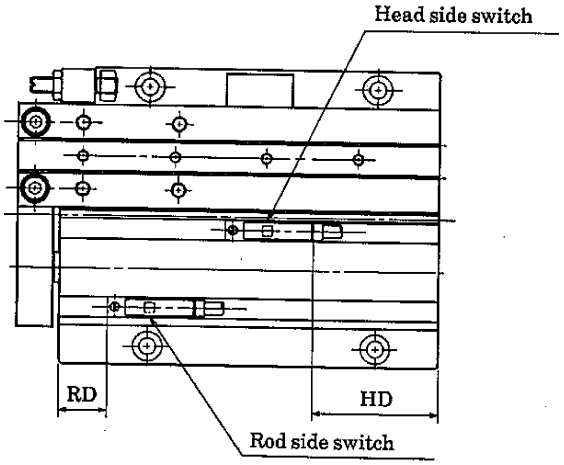
Do not use the cylinder without the stopper bolt.

4.3 Installation

1) Operate cylinder within the range (−10℃ ~ +60℃, standard) of tolerance ambient temperature.
2) Install cylinder directly on the mounting plate using hex. socket headed bolts.
3) If the fixing screw holes on the table are used, prevent protrusion of the bolts below the lower surface of the table. Pay attention to the bolt length to be used. If the bolt is in contact with the linear guide, malfunction may occur.

4.4 Switch Installation

1) Switch mounting positions
   (1) Stroke end mounting
   Mount it to each position of RD (rod side) and HD (head side) respectively so as to have a switch actuate at the most sensitive position.



   (2) Installation at the intermediate position
   If the piston stops during stroke motion, fix the piston at the stop position. Move the switch back and forth on the piston to find the position where it is first switched ON. The intermediate position between these two positions is the most sensitive for the piston. Thus, the switch is installed at the intermediate position.

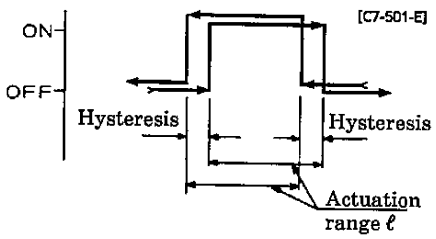
2) Actuation range

(1) It is the distance from where switch turns ON, while the piston strokes one way to the point where it turns OFF, while the piston continues to stroke in the same direction.

(2) The center of actuation range is the most sensitive point for the actuate switch. At this point, due to being the least of external magnetic disturbance, switch actuates most stably.

3) Hysteresis

(1) Switch turns ON while piston moves one way. Switch turns OFF while piston reverses its way after stopping at the point where switch turned ON once. The distance from ON point to OFF point is called hysteresis.



(2) When piston stops within the hysteresis, switch actuation becomes unstable as it easily is disturbed by an external magnetic field. Carefully avoid making it stop here.

4) Switch movement

Loosen the switch fixing screw (set screw) and move the switch along the cylinder tube. Tighten the screw at the specified position. (See Note 1.)

5) Switch replacement

Loosen the switch fixing screw (set screw) and pull the switch from the groove. Then, insert a switch for replacement into the groove and tighten the screw at the specified position. (See Note 1.)

Note1 : To tighten the switch fixing screw, use a flat tip screwdriver (a screwdriver for watch or precision work) with grip diameter of 5 ~ 6 mm, tip width of 2.4 mm or less and thickness of 0.3 mm or less. Tighten the screw to the tightening torque of 0.1 ~ 0.2 N·m (1 ~ 2 kgf·cm).

The maximum sensitivity position (HD, RD), operation range and hysteresis for installation of the stroke end.

Item	Non contact type switch (K2H/V, K3H/V)				Non contact type switch (K※Y※※)				Contact type switch (K0H/V, K5H/V)			
Tube bore (mm)	The most sensitive position		Actuation range	Hysteresis	The most sensitive position		Actuation range	Hysteresis	The most sensitive position		Actuation range	Hysteresis
	HD	RD			HD	RD			HD	RD		
ϕ10	20	9	1.5~5.5	1.5 or less	14.5	7.5	4.0~7.0	1.5 or less	21	8	4.5~9.0	3 or less
ϕ16	30.5	11.5	2.0~6.0		25	10	4.5~7.5		31.5	10.5	4.5~9.5	
ϕ20	34.5	14.5	3.0~8.0		29	13	5.5~8.5		35.5	13.5	6.0~12.0	
ϕ25	49	15	3.5~8.0		43.5	13.5	6.0~9.0		50	14	7.0~12.5	

Note1 : Cylinder is shipped ex-factory having switches mounted at HD & RD locations respectively.

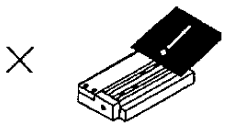
Note2 : The maximum sensitivity position (HD, RD) in this table is the value of straight type lead wire. Refer to pages with dimensions for values of L type lead wire .

Note3 : The operation range and hysteresis are reference values at 25°C.

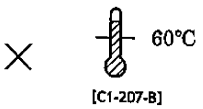
5. OPERATIONAL CAUTIONS OF SWITCHES

5.1 Cylinder With Switch

1) Do not put a product near the cylinder that may be adversely affected by the magnet.
The piston has a built-in magnet. Do not put a magnetic disk, magnetic card, magnetic tape, tester, etc. near the cylinder.

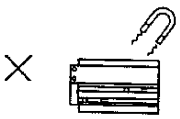


2) The cylinder cannot be operated at high temperature (exceeding 60°C).
Do not use the cylinder at high temperature, in order to protect magnetic components and electronic components.



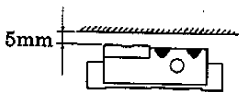
[C1-207-B]

3) The cylinder cannot be used in places with magnetic disturbances.
Since the switch is operated through a magnetic device, external magnetic forces may adversely affect the cylinder.

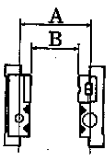
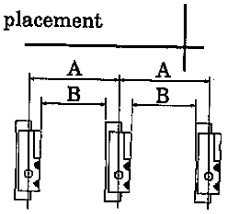


4) If magnetic material such as a steel plate is located near the cylinder switch, malfunction of the cylinder switch may occur. Allow clearance of at least 5 mm to the cylinder surface.

(Same clearance for all diameters)



5) If cylinders are used adjacently, observe the following installation pitch to prevent malfunction of the switch.

Adjacent conditions				ϕ10	ϕ16	ϕ20	ϕ25	Remark
Parallel setting of 2 cylinders	• Vertical placement The switch is installed facing the adjacent cylinder. 	A	K0、K5	32	30	40	51	Please note that if the driver length is longer than dimension B while the cylinder is installed, the switch position cannot be adjusted.
			K2、K3	30	34	42	52	
		B	K0、K5	15	8	12	17	
			K2、K3	13	12	14	18	
Parallel setting of 3 or more cylinders	• Vertical placement 	A	K0、K5	35	31	40	54	Please note that if the driver length is longer than dimension B while the cylinder is installed, the switch position cannot be adjusted.
			K2、K3	32	33	42	53	
		B	K0、K5	17	10	13	21	
			K2、K3	14	12	15	20	

6) Be careful with wiring so that repeated bending stress or tensile force is not applied to the wire. Use a flexible wire, such as an electric wire for robots, at the movable section.

7) If the switch is operated during stroke motion, the relay does not respond when the piston speed is too fast.

(Example) If the relay operation time is 20 ms and the switch operation range is 10 mm, set the piston speed at 500 mm/s or less.

8) Do not apply large vibration or impact during transportation of the cylinder, installation and adjustment of the switch.

5.2 Non Contact Type Switch (K2H/V, K2YH/V, K2YF/M HV, K3H/V, K3YH/V and K3YF/M H/V)

1) Change of lead wire color

The cylinder switch has a changed wire color and corresponding signals, according to the revision of the JIS proximity switch standard.
Be sure to check the wire color and corresponding signals on the documents for correct wiring. This brochure provides old wire colors in parentheses in addition to the new standard wire colors.

2) Lead wire connection

Connect the wire correctly according to the color of the lead wire. Be sure to turn off the power of the equipment's electric circuit before connection.

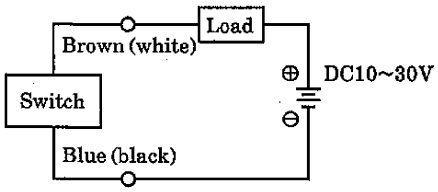


Fig. 1 K2(Y) Example of basic circuit

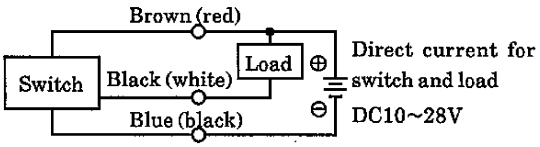


Fig. 2 K3(Y) Example of basic circuit (1)
(when the power for switch and load are the same)

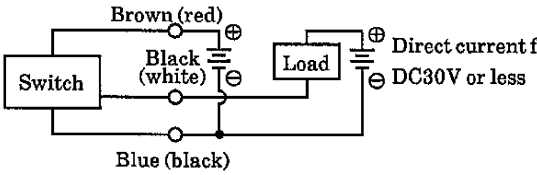


Fig. 3 K3(Y) Example of basic circuit (2)
(when the power for switch and load are not the same)

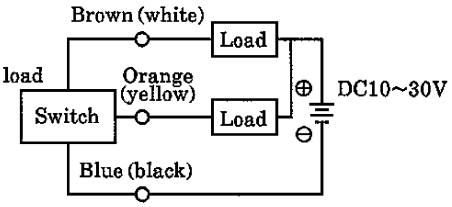


Fig. 4 K2YF/M Example of basic circuit

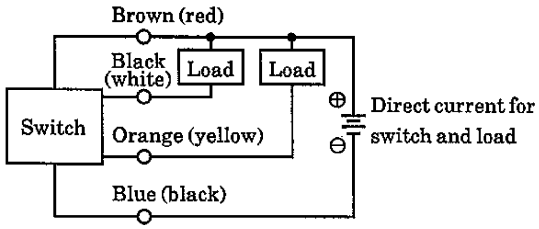


Fig. 5 K3YF/M Example of basic circuit (1)
(when the power for switch and load are the same)

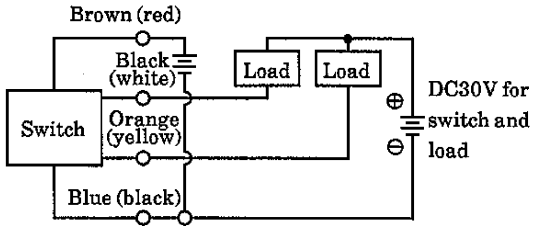


Fig. 6 K3YF/M Example of basic circuit (1)
(when the power for switch and load are the same)

3) Output circuit protection

To prevent damage to the switch or shortened life of the switch, provide a contact protection circuit for the following cases:

- When inductive load (relay, solenoid valve) is connected, surge voltage occurs when the switch is turned off. Be sure to provide the protection circuit shown in Fig. 7.
- When capacious load (capacitor) is connected, rush current occurs when the switch is turned on. Be sure to provide the protection circuit shown in Fig. 8.
- When the lead wire length is 10 m or more, be sure to provide the protection circuit shown in Figs. 9 and 10 (for K2) and Fig. 11 (for K3).

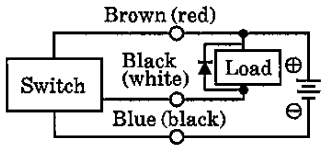


Fig. 7 Example of inductive load with surge absorption diode. Diode must be Hitachi V06C or equivalent.

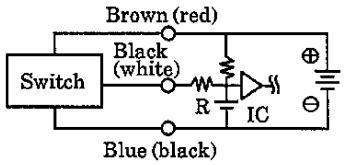


Fig. 8 Example of capacious load with current limit resistance R. Use the value from the following formula or higher for resistance R (Ω).

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

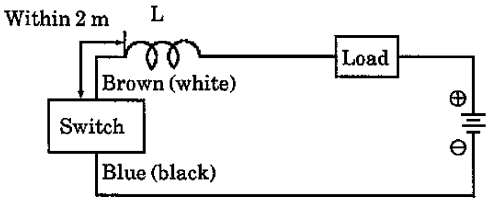


Fig. 9
- Choke coil
  L = several hundred μH ~ several mH
  Excellent in high frequency characteristics
- Wiring near the switch (within 2 m)

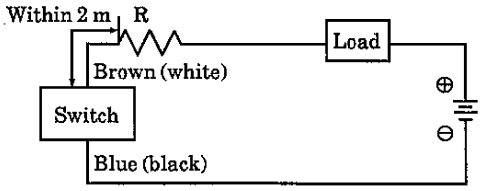


Fig. 10
- Rush current limit resistance
  R = Largest resistance allowable in the load circuit
- Wiring near the switch (within 2 m)

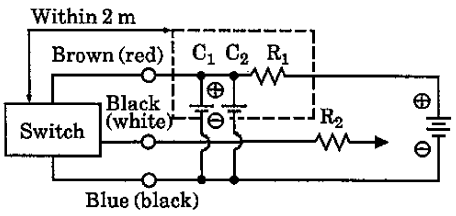


Fig. 11

- Power noise absorption circuit
  C_1 = 20~50μF electrolytic capacitor (withstand voltage of 50V or higher)
  C_2 = 0.01~0.1μF ceramic capacitor
  R_1 = 20~30Ω
- Rush current limit resistance
  R_2 = Largest resistance allowable in the load circuit
- Wiring near the switch (within 2 m)

4) Connection to programmable controller

Connection methods vary depending on the programmable controller type. Carry out connection according to Fig. 12 to Fig. 18.

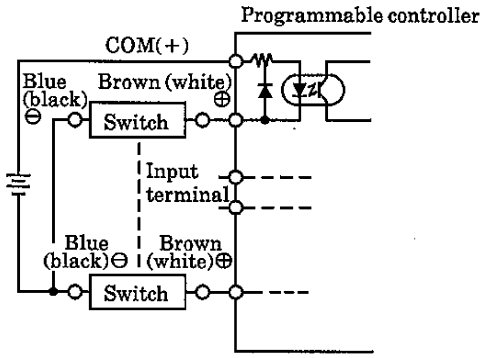


Fig. 12 Example of K2 connection to source input (external power) type

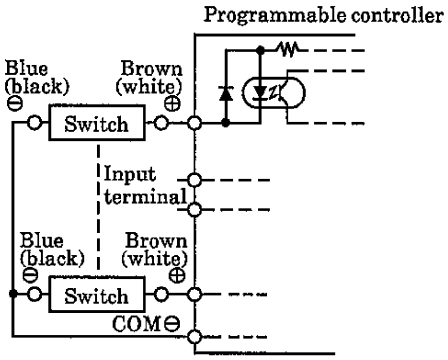


Fig. 13 Example of K2 connection to source input (internal power) type

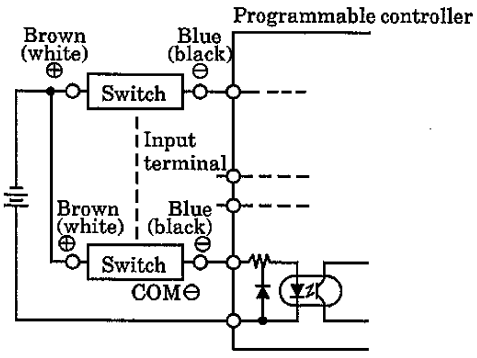


Fig. 14 Example of K2 connection to sink input type

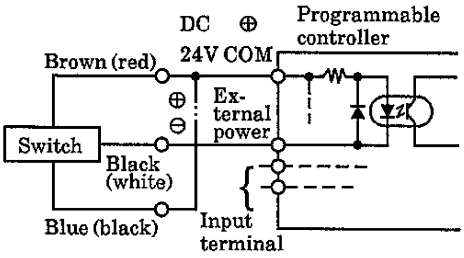


Fig. 15 Example of K3 connection to source input (external power) type

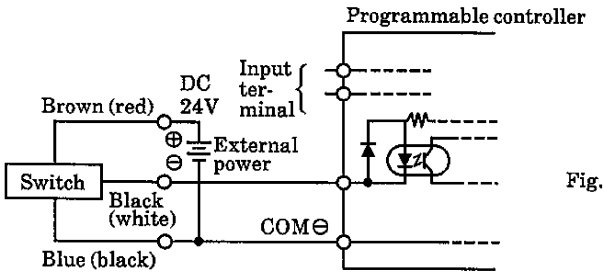


Fig. 16 Example of K3 connection to source input (internal power) type
K3 switch cannot be connected to the sink input programmable controller.

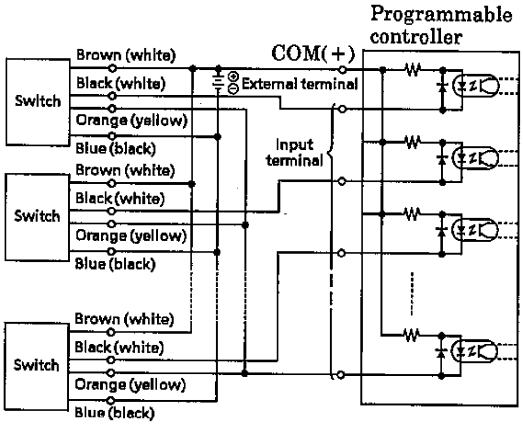


Fig. 17 Example of K3 YF/M connection to source input (external power) type

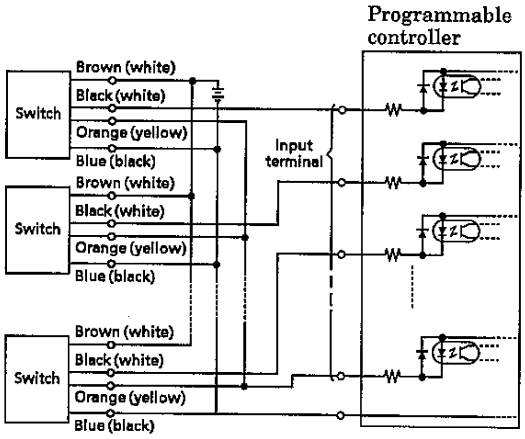
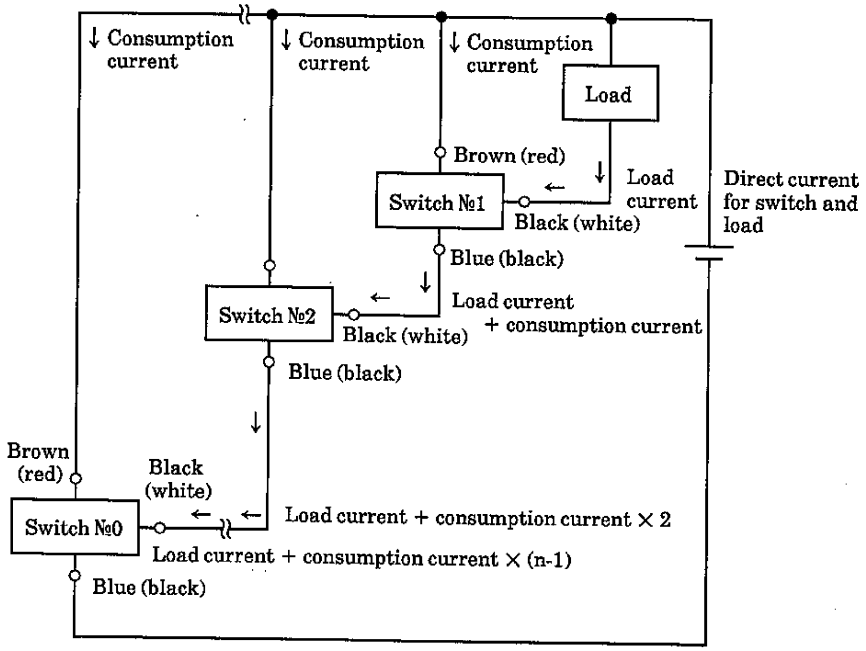


Fig. 18 Example of K3 YF/M connection to source input (internal power) type

5) Serial connection

① When multiple two-wire systems are connected in series, the voltage drop at the switch is the sum of all voltage drops of connected switches. The voltage applied to the loading side is the value achieved by subtracting the voltage drop at the switch from the source voltage. Check the input specification of the programmable controller being the load, and determine the number of connections.

② When multiple three-wire systems are connected in series, the voltage drop at the switch is the sum of all voltage drops of connected switches as in the two-wire system. The current in the switch is the sum of consumption current and load current on the switch connected, as shown figure in next page. Check the load specification and determine the number of connections so that the current may not exceed the maximum load current on the switch. The lamp illuminates only when all switches are ON.



6) Parallel connection

The two-wire system switch will have increased leak current for the number of connections. Check the input specifications of the programmable controller for the load, and determine the number of connections. However, there may be cases where the lamp goes dark or does not illuminate. During the interval between a switch ON and OFF, the voltage at both ends of the parallel connection switch is reduced to the value of the internal voltage drop when the switch is ON. The voltage is lower than the load voltage and other switches remain OFF. Check the input specifications of the programmable controller for the connection load before use. The three-wire system switch will have increased leak current for the number of connections. But the leak current is very minor (10 mA or less). It will not cause a problem under normal operation. The lamp will not go dark or will remain illuminated.

7) Magnetic environment

Do not use the switch near a strong magnetic field or large current (large magnet, spot welding machine, etc.). When cylinders with switches are closely installed in parallel or when a magnetic body moves close to the cylinder, interference may occur, resulting in poor sensitivity.

5.3 Contact Type Switch (K0H , K0V, K5H and K5V)

1) Connection of lead wire

Do not connect the switch lead wire directly to the power source. Be sure to connect the load in series. For K0, pay attention to Ⓐ and Ⓑ.

Ⓐ For DC, connect the brown wire to ⊕ and the blue wire to ⊖.
If this connection is opposite, the switch operates but the lamp does not illuminate.

Ⓑ For connection to AC relay and programmable controller, the switch lamp may not illuminate if half-wave rectification is made on the circuit. In this case, change the polarity of the switch lead wire to illuminate the lamp.

2) Contact capacity

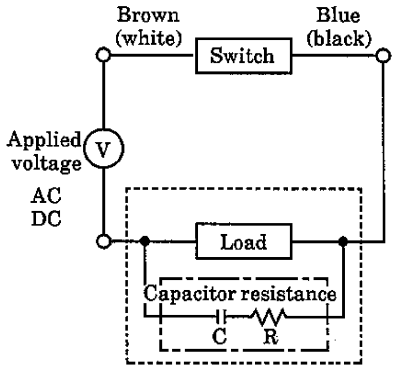
Do not use load that exceeds the maximum contact capacity of the switch. If the current is lower than the rated current, the switch lamp may not illuminate for K0.

3) Contact protection

If reed switch is used for inductive load such as a relay, be sure to provide the contact protection circuit as shown in Figs 1 and 2.
If the wire length exceeds the value in Table 1, provide the contact protection circuit as shown in Figs. 3 and 4.

Table 1

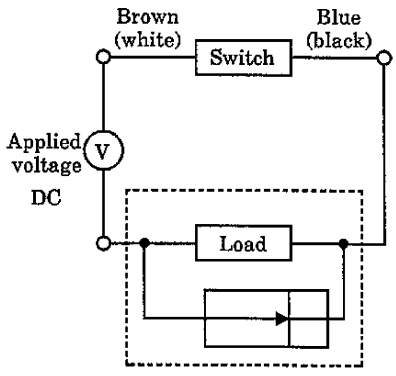
Voltage	Wire length
DC	50m
AC	10m



User wiring
Protection circuit (spark-quenching circuit)

Recommended value C capacitor 0.033~0.1μF
R resistance 1~3kΩ
Okatani Denki XEB1K1 or equivalent

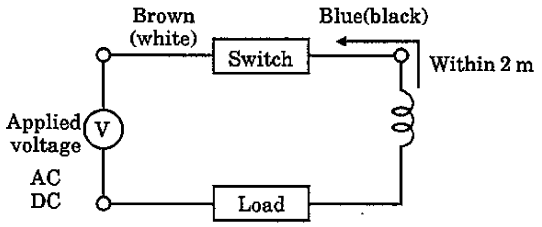
Fig. 1 When capacitor resistance is used



User wiring
Protection circuit

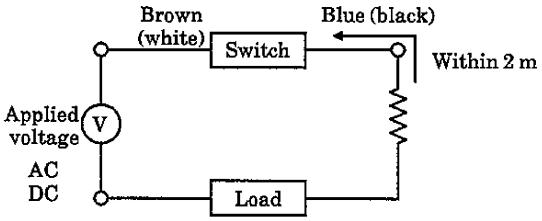
General rectification diode
Hitachi V06C or equivalent

Fig. 2 When diode is used



- Choke coil
  L= several hundred μH~several mH
  Excellent in high frequency characteristics
- Wiring near the switch (within 2 m)

Fig 3



- Rush current limit resistance
  R= Largest resistance allowable in the load circuit
- Wiring near the switch (within 2 m)

Fig 4

4) Relay

Use the following relay or equivalent:

- OMRON Corporation ..... Model MY
- FUJI ELECTRIC CORP ..... Model HH5
- Matsushita Electric Works Ltd. .. Model HC

5) Serial connection

When multiple K0 switches are connected in series, the voltage drop at the switch is the sum of all voltage drops of connected switches. If one K0 switch for operation check and K5 switches for the rest are used, the voltage drop is equivalent to a single K0 (approx. 2.4V). The lamp illuminates only when all switches are ON.

6) Parallel connection

When multiple switches are connected in parallel, the number of connections is not limited. For T0, the switch lamp may go dark or does not illuminate.

7) Magnetic environment

Do not use the switch near a strong magnetic field or large current (large magnet, spot welding machine, etc.). When cylinders with switches are closely installed in parallel or when a magnetic body moves close to the cylinder, interference may occur, resulting in poor sensitivity.

8) Change of switch lead wire color

Along with the revision of JIS and subsequent revision of NECA, the switch lead wire colors are being revised as shown in the right table. Pay attention to these colors.

The revised product has a "Caution label" (in yellow) describing the new color identification.

		Before revision	After revision
K type switch	2-wire system	White (+)	Brown(+)
		Black (−)	Blue(−)
	3-wire system	Red(+)	Brown(+)
		White (output)	Black (output)
		Black (−)	Blue(−)

6. MAINTENANCE

6.1 Periodical Inspection

1) Carry out regular inspections once or twice a year so that the cylinder may be used under optimum conditions. If the guide travels poorly or 100 km operation distance is achieved, apply lithium grease or oil to the rail groove.

2) Inspection items

ⓐ Make sure that the bracket at the piston rod end, mounting bolts and nuts are not loose.

ⓑ Check to see that the cylinder operates smoothly.

ⓒ Check any change of the piston speed and cycle time.

ⓓ Check for internal and external leakage.

ⓔ Check the piston rod for flaw (scratch) and deformation.

ⓕ Check the stroke for abnormality.

See "Troubleshooting", 6.2, should there be any trouble found, also carry out additional tightening if bolts, nuts, etc.are loose.

6.2 Troubleshooting

1) Cylinder

Troubles	Causes	Countermeasures
Does not operate	No pressure or inadequate pressure	Provide an adequate pressure source.
	Signal is not transmitted to direction control valve	Correct the control circuit.
	Improper or misalignment of installation	Correct the installation state and/or change the supporting system.
	Broken packing	Replace the packing.
Does not function smoothly	Lower speed than rated	Reduce the load. Consider the use of a hydraulic cylinder.
	Improper or misalignment of installation	Correct the installation state and/or change the supporting system.
	Exertion of transverse (lateral) load	Install a guide. Revise the installation state and/or change the supporting system.
	Excessive load	Increase the pressure itself and/or the inner diameter of the tube.
	Speed control valve is built in the way of "Meter in" circuit	Change the installation 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 cushion device with more efficiency. (External cushion)
	Exertion of transverse load	Install a guide. Revise the installation state and/or change the supporting system.

2) Switch

Troubles	Causes	Countermeasures
Lamp is not lit.	Deposited contact point	Replace the switch.
	Excessive load than rated capacity	Replace the relay (recommended one) Replace the switch
	Damage to the lamp	Replace the lamp.
	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
	Incorrect direction of switch mounting	Correct the direction of the switch.
	Relay is unable to respond properly within the piston stroke	Adjust speed slow Replace the relay
	Excessive load than rated capacity	Replace the relay (recommended one) Replace the switch
Switch does not return.	Piston is not moving	Correct to have piston move.
	Deposited contact point	Replace the switch
	Excessive load (relay) than rated capacity	Replace the relay (recommended one) Replace the switch
	Improper ambient temperature	Adjust the ambient temperature within the range of −10~60°C
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

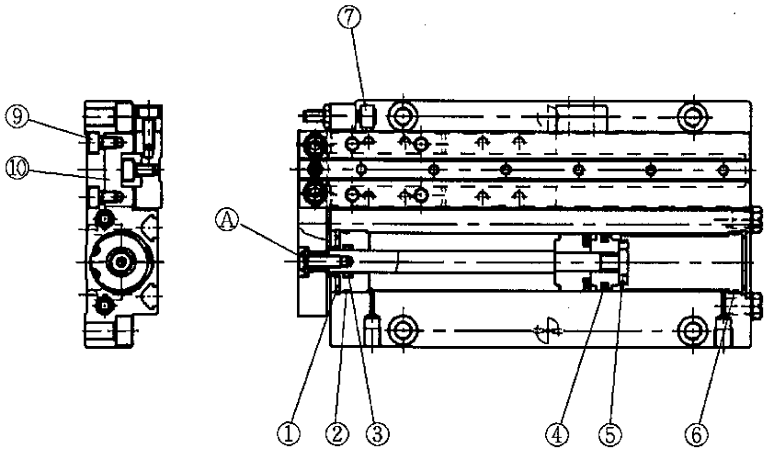
6.3 Disassembly

If air leakage occurs, disassemble the cylinder according to the construction drawing. Replace components on the consumable component list.

1) LCY (basic type)

(1) For disassembly, remove hex socket head button bolt Ⓐ (floating bushing for ϕ6) and eight hex socket head cap bolts ⑨. Remove linear guide ⑩ so that it may not come off the rail.
Then, remove snap ring ① and pull the piston rod together with the rod metal.
Assemble the components in the reverse order of this disassembly.
Be sure to apply grease to the packing and the guide. Apply adhesive to the bolts before tightening the piston rod, hex socket head button bolt AⒶ (floating bushing for ϕ6) and hex socket head cap bolts ⑨.

(2) Internal structure drawings



(3) Expendable Parts list

Tube bore (mm) / Part name / Kit No. / Part No.		②	③	④
		Cylinder gasket	Rod packing	Piston packing
ϕ 6	LCY-10K	F3-657978	DYR-4K	PSL-10S
ϕ 16	LCY-16K	F4-160909	DYR-6K	PSL-16S
ϕ 20	LCY-20K	F4-184239	DYR-8K	PSD-20
ϕ 25	LCY-25K	AS568-020	DYR-10SK	PSD-25

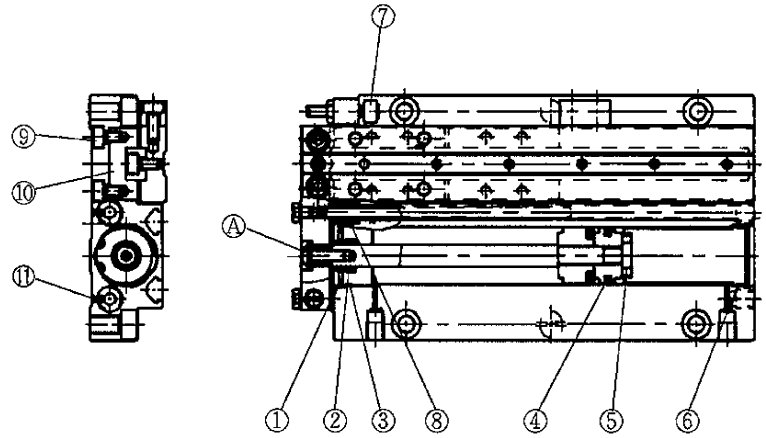
Tube bore (mm) / Part name / Kit No. / Part No.		⑤	⑥	⑦
		Cushion rubber (H)	Gasket	Stopper bolt
ϕ 6	LCY-10K	F4-659142	F3-657978	F4-200411
ϕ 16	LCY-16K	F4-659122	F4-160909	F4-200411
ϕ 20	LCY-20K	F4-659113	F3-657968	F4-200412
ϕ 25	LCY-25K	F4-659113	F3-657969	F4-200412

Designate the Kit No. when ordering.

2) LCY-A (reduced piping type)

(1) For disassembly, remove hex socket head button bolt Ⓐ (floating bushing for ϕ6) and eight hex socket head cap bolts ⑨. Remove linear guide ⑩ together with the pipe so that it may not come off the rail. Then, remove hex socket head cap screw ⑪ (M2×2) and remove the piping cap. Remove snap ring ① and pull the piston rod together with the rod metal. Assemble the components in the reverse order of this disassembly.
Be sure to apply grease to the packing and the guide. Apply adhesive to the bolts before tightening the piston rod, hex socket head button bolt Ⓐ (floating bushing for ϕ6), hex socket head cap bolts ⑨ and hex socket head cap screw ⑪.

(2) Internal structure drawings



(3) Expendable Parts list

Tube bore (mm) / Part name / Kit No. / Part No.		⑥	⑦⑨⑩	⑭	㉒
		Piping packing	Stopper Bolt	Cushion rubber (H)	Rod packing
ϕ 6	LCY-A-10K	DYR-3K	F4-200411	F4-659142	DYR-4K
ϕ 16	LCY-A-16K	DYR-3K	F4-200411	F4-659122	DYR-6K
ϕ 20	LCY-A-20K	DYR-3K	F4-200412	F4-659113	DYR-8K
ϕ 25	LCY-A-25K	DYR-3K	F4-200412	F4-659113	DYR-10K

Tube bore (mm) / Part name / Kit No. / Part No.		㉓	㉘	㉙
		Cylinder gasket	Piston packing	Gasket
ϕ 6	LCY-A-10K	F3-657978	PSL-10S	F3-657978
ϕ 16	LCY-A-16K	F4-160909	PSL-16S	F4-160909
ϕ 20	LCY-A-20K	F4-184239	PSD-20	F4-657968
ϕ 25	LCY-A-25K	AS568-020	PSD-25	F4-657969

Designate the Kit No. when ordering.

7. HOW TO ORDER

LCY — A — 10 — 15 — K2H — R
ⓐ ⓑ ⓒ ⓓ ⓔ

ⓐ Piping		ⓑ Tube bore		ⓒ Stroke (mm)	
No symbol	Basic type	10	ϕ10	ϕ10	15, 30, 50
		16	ϕ16	ϕ16	15, 30, 50, 75, 100
A	Reduced piping type	20	ϕ20	ϕ20	
		25	ϕ25	ϕ25	

※印は、リード線の長さを表します。

※Lead wire length	
No symbol	1m (standard)
3	3m (option)
5	5m (option)

ⓓ Switch model No.			
Lead wire straight type	Lead wire L type		
K0H※	K0V※	Contack type	2 wire
K5H※	K5V※		
K2H※	K2V※	Non contact type	3 wire
K3H※	K3V※		
K2YH※	K2YV※	Dual-color indication non contact type	2 wire
K3YH※	K3YV※		
K2YFH※	K2YFV※	Preventive maintenance non contact type	3 wire
K3YFH※	K3YFV※		4 wire
K2YMH※	K2YMV※		3 wire
K3YMH※	K3YMV※		4 wire

ⓔ No. of switches	
R	1 switch at the rod side
H	1 switch at the head side
D	2 switches

Individual switch model number

K2H
ⓔ
↓
Switch model number
(Refer to e above.)