CKD

SM－439314－A

INSTRUCTION MANUAL

LINEAR SLIDE CYLINDER

Position Locking Type

LCG－Q 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

The 3nd edition

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 applications, 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 operation manual carefully for proper operation.**

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

⚠ CAUTION :

- 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.

[SM-439314-A]

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LCG-Q Series
Linear Slide Cylinder
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Manual No. SM-439314-A

1. UNPACKING

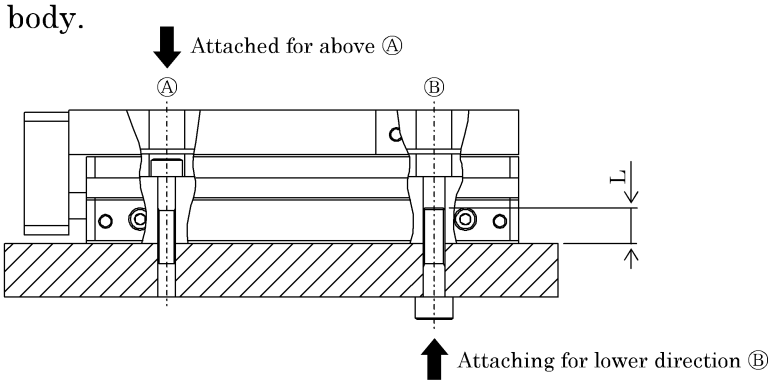
1) Make sure that the type No. on the nameplate of the delivered Selex Cylinder matches the type No. you ordered.
2) Check the appearance for any damage.
3) After opening the package, store the cylinder, away from heat and moisture, to prevent rusting.

2. INSTALLATION

2.1 Installation

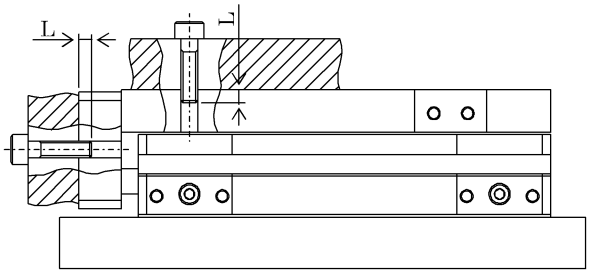
1) The ambient temperature for this cylinder is -10 to 60℃ (No freezing). Always operate the cylinder within this temperature.

2) Use the bolt threaded length and tightening torque below when installing the main body.



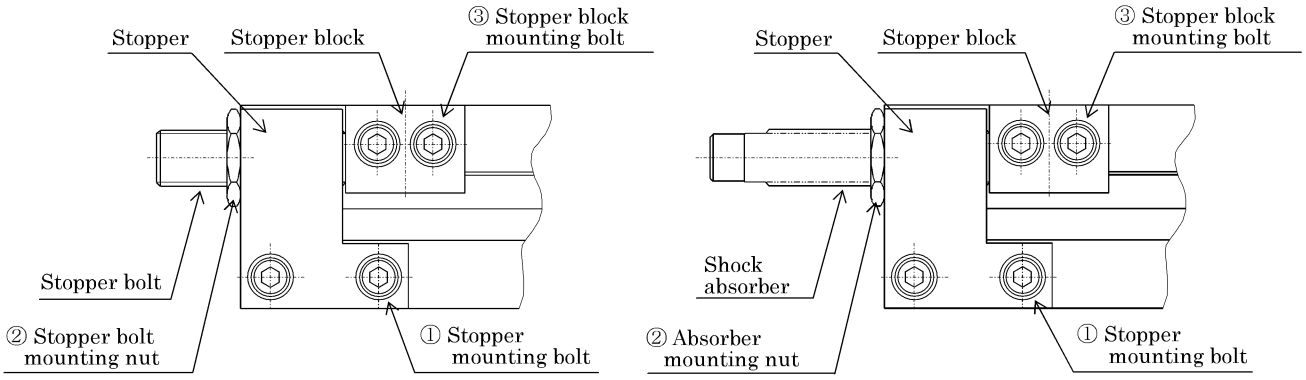
Item	Ⓐ		Ⓑ		
	Bolt	Torque (N・m)	Bolt	Torque (N・m)	Max thread length L (mm)
LCG-Q-8	M3×0.5	0.6 to 1.1	M4×0.7	1.4 to 2.4	6
LCG-Q-12	M4×0.7	1.4 to 2.4	M5×0.8	2.9 to 5.1	8
LCG-Q-16	M5×0.8	2.9 to 5.1	M6×1.0	4.8 to 8.6	9
LCG-Q-20					
LCG-Q-25	M6×1.0	4.8 to 8.6	M8×1.25	12.0 to 21.6	12

3) Use the bolt threaded length and tightening torque below when installing the jig onto the slide table or end plate.



Item	Bolt	Torque (N・m)	Max thread length L (mm)	
			Slide table	End plate
LCG-Q-8	M3×0.5	0.6	3	7
LCG-Q-12	M4×0.7	1.4	4	9
LCG-Q-16	M5×0.8	2.9	5	9
LCG-Q-20			5	11
LCG-Q-25	M6×1.0	4.8	6	11

4) Use the following bolt and nut tightening torques for the stopper section.



Model	① Stopper mounting bolt (N·m)	② Stopper bolt nut ② Absorber mounting nut (N·m)	③ Stopper block mounting bolt (N·m)
LCG-Q-8	0.4 to 0.5	1.2 to 2.0	0.6 to 0.8
LCG-Q-12	0.6 to 0.8		
LCG-Q-16		3.0 to 4.0	1.4 to 1.8
LCG-Q-20	2.9 to 3.5	4.5 to 6.0	
LCG-Q-25			2.9 to 3.5

2.2 Piping

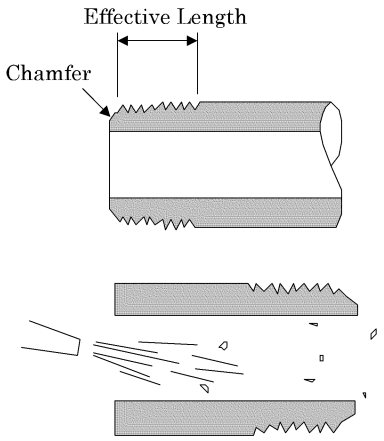
1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc.

2) See to it that the pipe connecting cylinder and solenoid valve has effective cross-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.

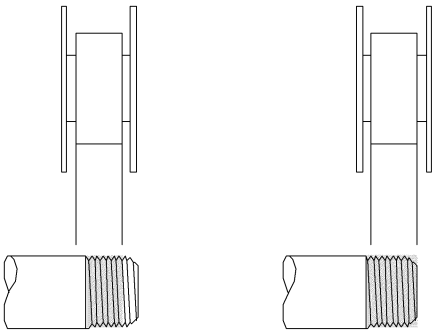
4) Be sure observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.

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



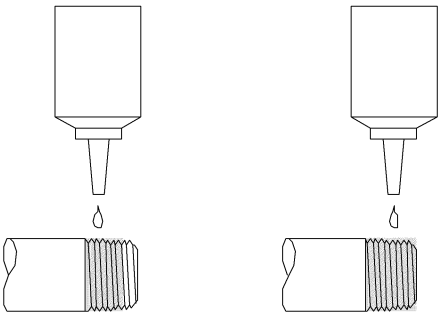
6) Refrain from mapplying sealant or sealing tape approx. two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.

● Seal Tape



(Correct) (Incorrect)

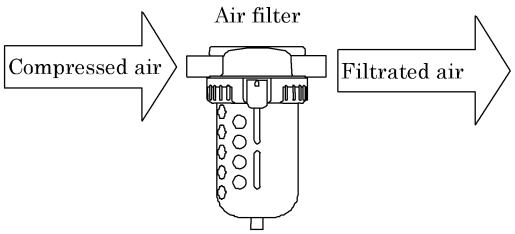
● Sealant (liquid)



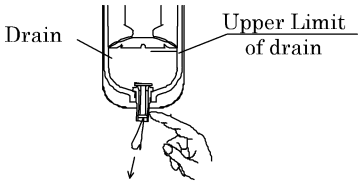
(Correct) (Incorrect)

2.3 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 5 μ m or less), flow rate and its mounting location (as nearest to the directional control valve as possible).



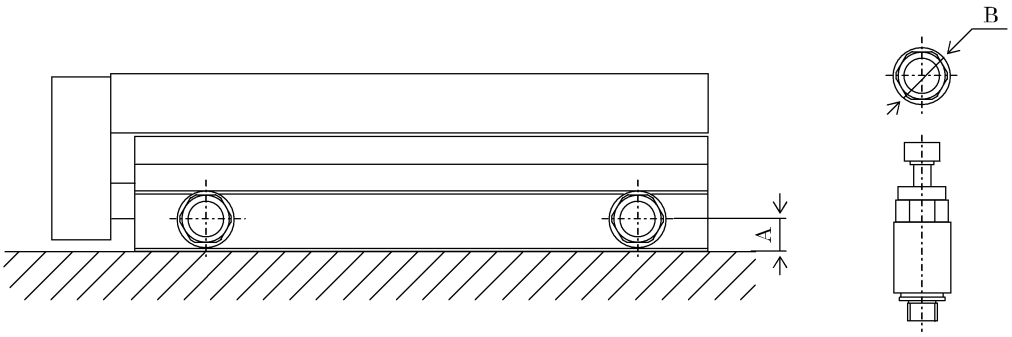
2) Be sure to drain out the accumulation in the filter periodically.



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.

5) Because the usable piping joint has limitations, for using it, see the note below.



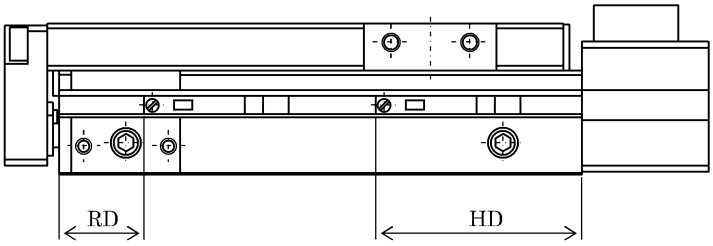
Item / Bore size (mm)	Port diam.	Port dimension A	Available joints	Joint OD ϕB
ϕ8	M5×0.8	5.5	SC3W-M5-4・6 GWS4-M5-S GWS4-M5	ϕ11or less
ϕ12				
ϕ16		6.5	SC3W-M5-4・6 GWS4-M5-S GWS4・6-M5 GWL4・6-M5	ϕ13 or less
ϕ20	Rc1/8	8	SC3W-6-4・6・8 GWS4・6・8-6 GWL4-6-6	ϕ15 or less
ϕ25		9		

2.4 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 9 page) for the purpose of having switches function at the points of the maximum sensitive position.



(2) Intermediate of stroke

Move the piston where it is anticipated to stop and fix it tentatively slide a switch carefully along the side of cylinder over the piston to find out the spot where switch turns on.

This type spot should be located on both side of piston. The intermediate spot between those posits is of the maximum sensitive position and where the switch is supposed to be installed.

- Moving the switch

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

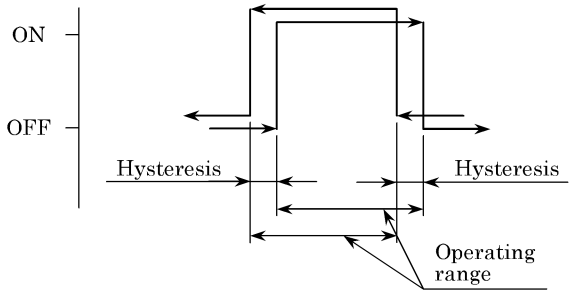
2) Operating range

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.



Maximum sensitive position (HD・RD), operating range and hysteresis.

(Unit: mm)

Bore size (mm) \ Maximum sensitive position		Stroke length									Solid state (F2H/V, F3H/V)		Solid state (F2YH/V, F3YH/V)	
		10	20	30	40	50	75	100	125	150	Operating range	Hysteresis	Operating range	Hysteresis
φ8	HD	25			34			—			2 to 4	1 or less	3.5 to 6	1 or less
	RD	24	14					—						
φ12	HD	29					38		—				3 to 4.5	
	RD	41.5	31.5	21.5			21.5		—					

(Unit: mm)

Bore size (mm) \ Maximum sensitive position		Stroke length									Solid State (T2H/V, T3H/V)		Reed (T0H/V, T5H/V)	
		10	20	30	40	50	75	100	125	150	Operating range	Hysteresis	Operating range	Hysteresis
φ16	HD	38.5					55.5			—	2 to 4	1 or less	5 to 9	1 or less
	RD	37	27	17						—				
φ20	HD	51.5					63				2 to 5.5		6.5 to 11	
	RD	36	26	16										
φ25	HD	61					81.5				2.5 to 6		8 to 12	
	RD	38.5	18.5	28.5			18.5							

(Unit: mm)

Bore size (mm) \ Maximum sensitive position		Stroke length									Solid state (T2H/V, T3H/V)	
		10	20	30	40	50	75	100	125	150	Operating range	Hysteresis
φ16	HD	36					53			—	3 to 4.5	1 or less
	RD	39.5	29.5	19.5						—		
φ20	HD	49					60.5				4 to 5.5	
	RD	38.5	28.5	18.5								
φ25	HD	58.5					79				3.5 to 6	
	RD	41	31	21			21					

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

3. OPERATION

3.1 Operating the Cylinder

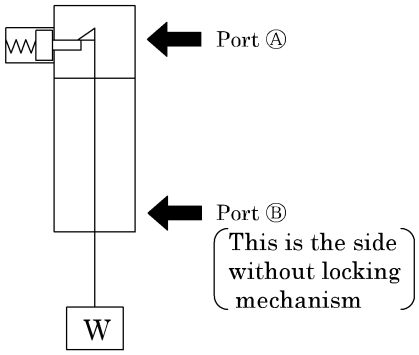
1) See to it that the air supply pressure to the cylinder is as show in the “7.1 product specifications”. Operate the cylinder within this pressure range.

2) Although a rubber cushion is internally provided for this type of cylinder, it is advisable to install an additional external stopper when the kinetic energy is excessive. Allowable energy absorption is as the graphs below indicate.

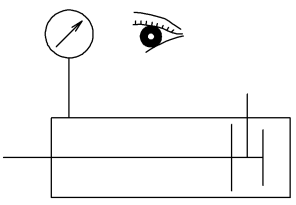
Bore size	ϕ 8	ϕ 12	ϕ 16	ϕ 20	ϕ 25
Allowable energy absorption (J)	0.058	0.112	0.176	0.314	0.314

3) Adjust the working piston speed with the speed controller mounted.

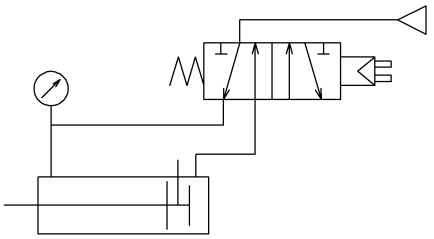
4) To release to release the locking, be sure to remove the load to locking mechanism by supplying pressure to the port B first where no locking mechanism is installed.
It is quite dangerous to supply pressure to the A direct while piston is being locked after both ports A and B are exhausted because the piston rod is apt to pop out all the sudden due to the load on the tip of piston rod. When the port A is pressurized, at the same moment, pilot line releases the locking mechanism.



5) Confirm by an air gage, before starting daily operation, that the cylinder chamber where no locking device mounted (port B) is adequately pressurized.



6) During the design of circuit layout, make sure the pressure delivery just before starting daily operation is so arranged as shown on the illustration.
Do not use a 3-position valve.
Do not use this cylinder combined with a 3-position valve, especially that with a closed center metal seal. The lock will not be applied if pressure is sealed on the port having a locking mechanism. Even if the lock is applied, air that leaks from the valve may enter the cylinder or the lock may be released over time.



7) The locking mechanism functions at stroke limit, so if the stopper is applied with the external stopper in the middle of a stroke, the locking mechanism will not function and the load may drop. Check that the locking mechanism functions before setting the load.

8) Supply pressure exceeding the model's minimum working pressure to the port at the side on which the locking mechanism is installed.

9) If piping on the side with the locking mechanism is long and thin, or if the flow control valve is separated from the cylinder port, exhaust speed may drop and it may take longer for the lock to be applied. This may also occur if a silencer installed on the solenoid valve EXH. port is clogged.

10) There is approx. 1 mm play along piston rod axis under locking status.

11) If lowering speed is to be increased with the quick exhaust valve, the cylinder may move out faster than the lock pin and prevent the lock pin from being released correctly. Do not use a quick exhaust valve with a position locking type cylinder.

12) If backpressure is applied to the locking mechanism, the lock may be released. Use a discrete solenoid valve, or use an individual exhaust manifold.

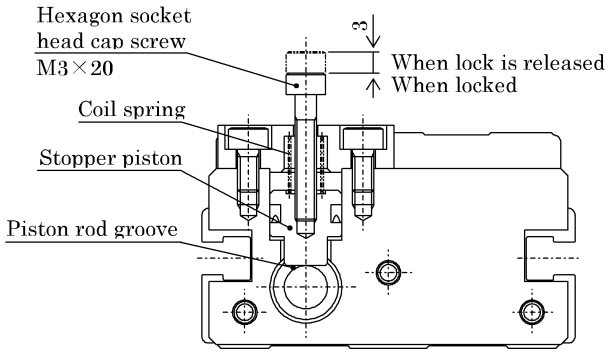
13) If the locking mechanism has been manually operated, check and then return it to the original position manually. Do not use manual operation for other than adjustment, or this may be very hazardous.

14) Release the lock when installing or adjusting the cylinder.
The lock may be damaged if the cylinder is installed while the lock is applied.

15) Do not use multiple cylinders together.
Do not move one work piece using more than one end lock cylinder.
It may not be possible to release one of the cylinder's locks.

16) Use the flow control valve with meter-out control.
It may not be possible to release locks used with meter-in control.

●Release
Screw a hexagon socket head cap screw (M3×20) into the stopper piston, and pull the bolt up 3 mm with a force of 20 N over. The stopper piston moves and the lock is released during no-load horizontal installation or with rod port pressurized. When the hand is released, the stopper piston returns by the internal spring and enter the piston rod groove, locking the cylinder.



3.2 How to Use the Switches

3.2.1 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) Operating 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.

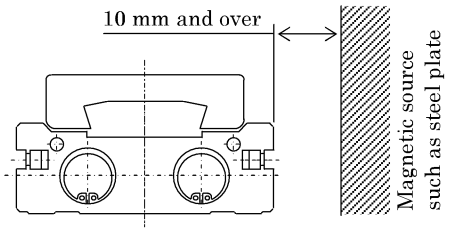
The maximum detectable working piston speed is :

$$V(\text{mm/s}) = \frac{\text{Cylinder switch operation range (mm)}}{\text{Load operation time (s)}}$$

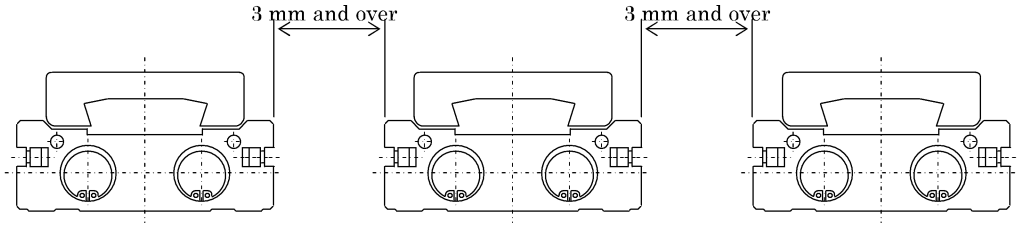
Refer to the minimum value of the table on page 9 about cylinder switch operating range.

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

6) Sources of magnetism such as steel plates near the cylinder switch could cause the cylinder to malfunction. Keep at least 10 mm from the cylinder. (Same for all bore size)



7) If cylinders are adjacent, the cylinder switch could malfunction. Check that the following distance is maintained between cylinder surfaces. (Same for all bore size)



3.2.2 Operational Cautions, Solid state switch (F2, F3)

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

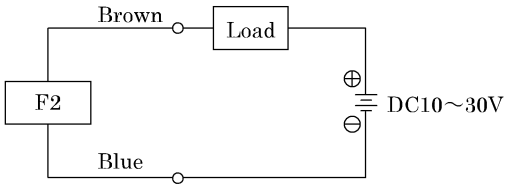


Fig.1 Fundamental circuit Example of F2

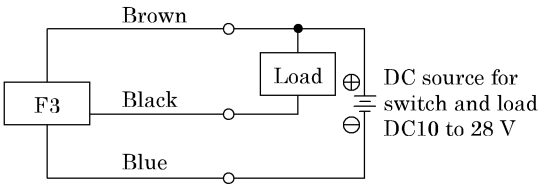


Fig.2 Fundamental circuit Example of F3 (1)
(In case the same source of power is used.)

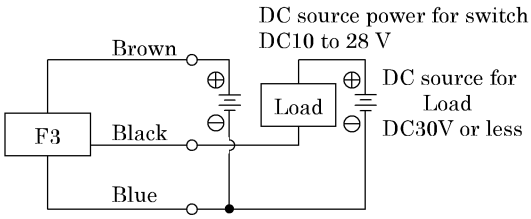


Fig.3 Fundamental circuit Example of T3 (2)
(In case individual sources of power are used.)

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 F2) and Fig 8 (in case of model F3).

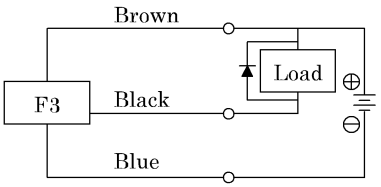
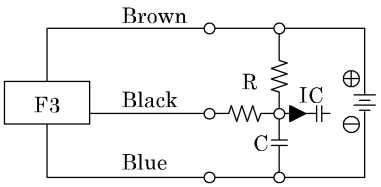


Fig.4 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)



Flg.5 An example of using capacitor type load together with current regulating resister R.
Comply with the following formula to figure out required R.

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

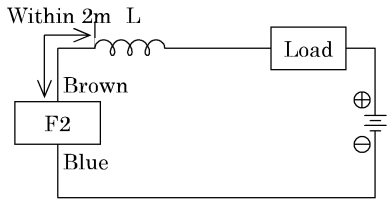


Fig.6 ・Choke coil
L = a couple hundred μH to a couple mH surpassing high frequency characteristic
・Install it near by a switch (within 2m).

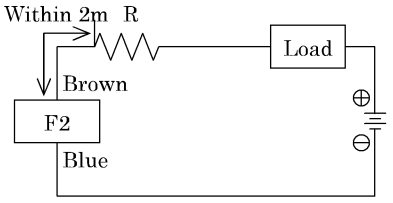


Fig.7 ・Dash current restriction resister.
R = As much large resister as the load circuit can afford.
・Install it near by a switch (within 2m).

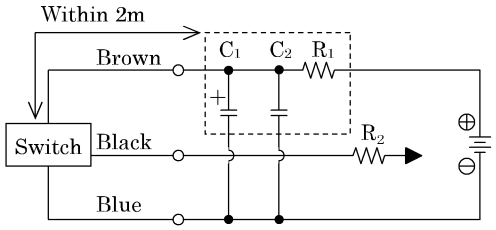


Fig8 ・Electric power noise absorptive circuit.
C_1=20 to 50 μF electrolytic capacitor
(Withstand voltage 50V or more)
C_2=0.01 to 0.1 μF ceramic capacitor
R_1=20 to 30 Ω

・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 to programmable controller (Sequencer).
Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig. 9 to 13 respectively.

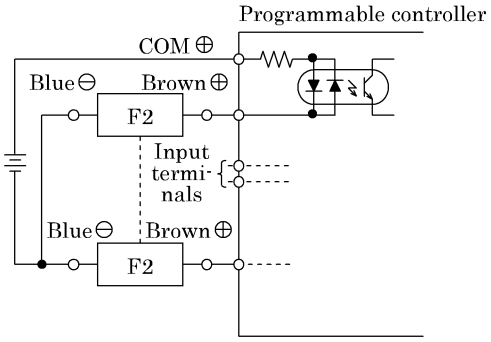


Fig.9 An example of F2 connection to source input type

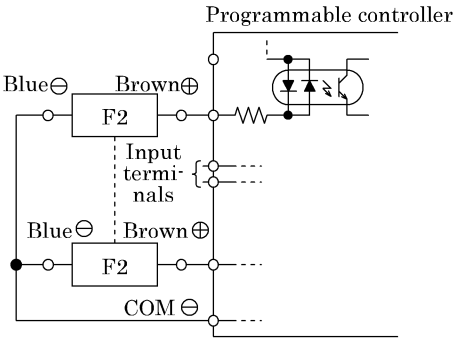


Fig.10 An example of F2 connection to source input type

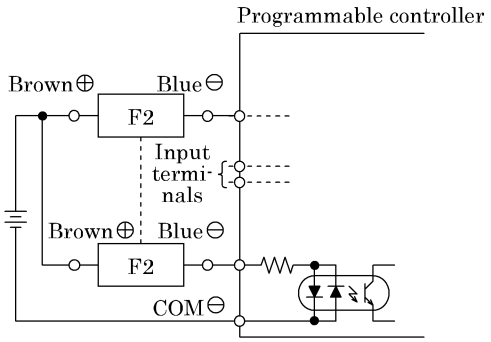


Fig.11 An example of F2 connection to sink input type

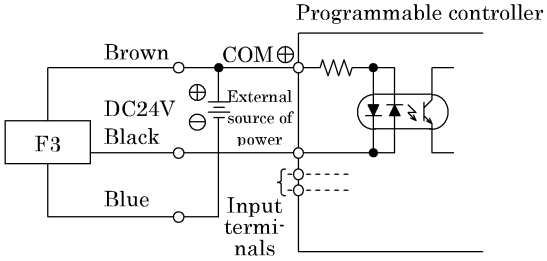


Fig.12 An example of F3 connection to source input type (an external power source)

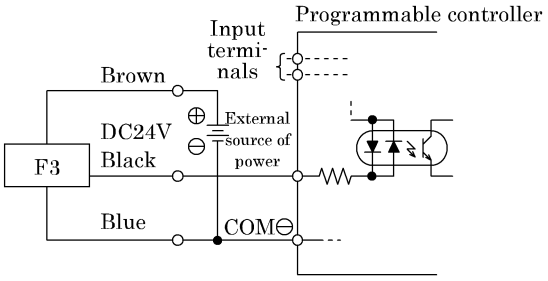


Fig.13 An example of F3 connection to source input type (an internal power source)

4) Series connection

The total voltage will decrease when the F2 switches connections have a leak. Therefore, confirm the input specifications for the programmable controllers, which are the connecting load. However, dimming or total failure of the indicator light may exist.

F3 switches hardly ever leak. When less than 10 μ A, then leakage may occur. Usually dimming and failure of the indicator light do not occur.

3.2.3 Operational Cautions, Solid State Switch (T1, T2, T3)

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.

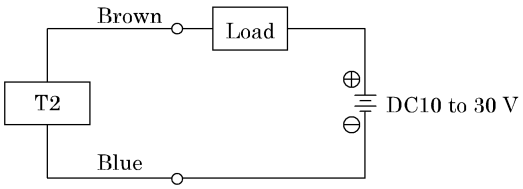


Fig.1 Fundamental circuit Example of T2

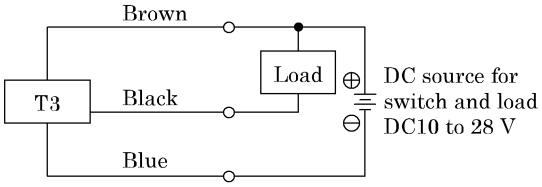


Fig.2 Fundamental circuit Example of (1)
(In case the same source of power is used.)

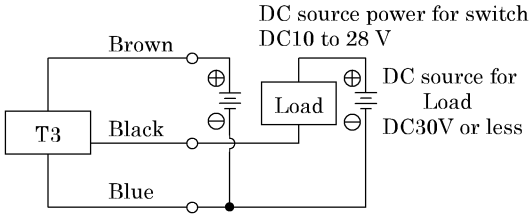


Fig.3 Fundamental circuit Example of (2)
(In case individual sources of power are used.)

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 T2) and Fig 8 (in case of model T3).

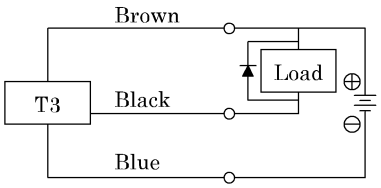
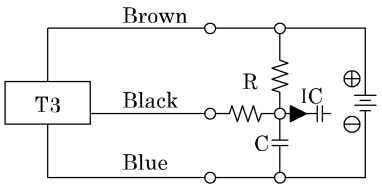


Fig.4 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)



Flg.5 An example of using capacitor type load together with current regulating resister R.
Comply with the following formula to figure out required R.

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

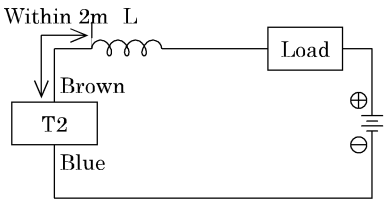


Fig.6 ・Choke coil
L = a couple hundred μH to a couple mH surpassing high frequency characteristic
・Install it near by a switch (within 2m).

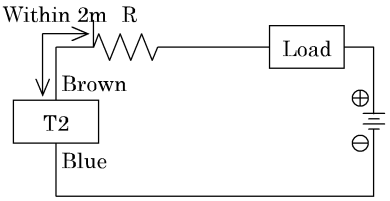


Fig.7 ・Dash current restriction resister.
R = As much large resister as the load circuit can afford.
・Install it near by a switch (within 2m).

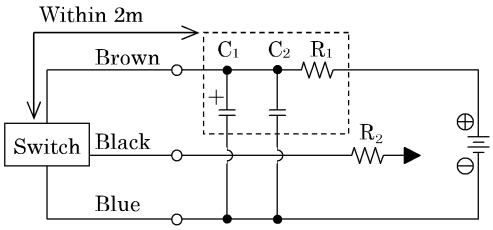


Fig8 ・Electric power noise absorptive circuit.
C_1=20 to 50 μF electrolytic capacitor (Withstand voltage 50V or more)
C_2=0.01 to 0.1 μF ceramic capacitor
R_1=20 to 30 Ω

・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 to programmable controller (Sequencer).
Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig. 9 to 13 respectively.

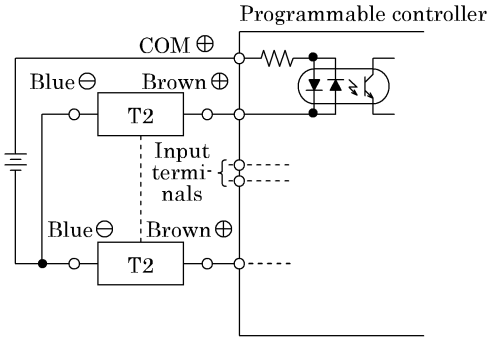


Fig.9 An example of T2 connection to source input type (an external power source)

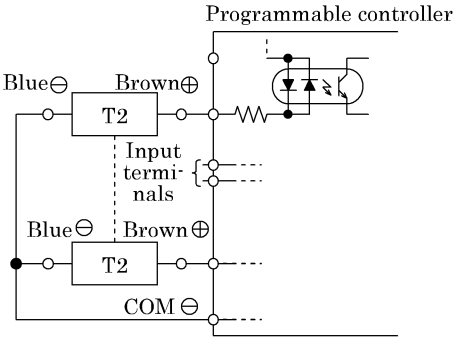


Fig.10 An example of T2 connection to source input type (an internal power source)

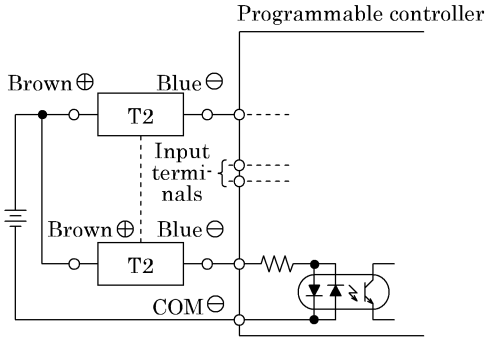


Fig.11 An example of T2 connection to source input type

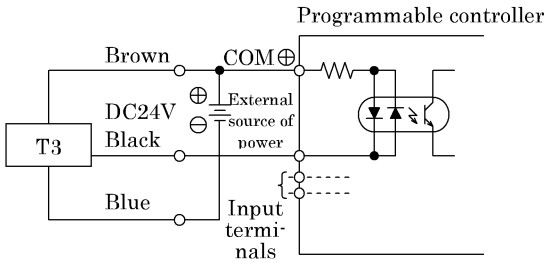


Fig.12 An example of T3 connection to source input type (an internal power source)

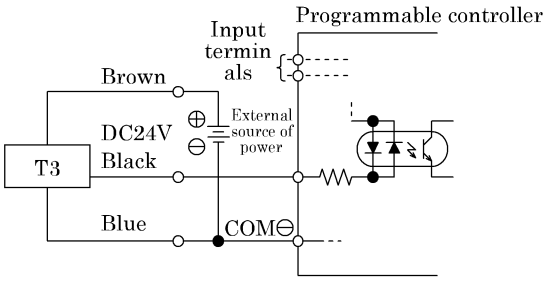


Fig.13 An example of T3 connection to source input type (an internal power source)

4) Parallel connection
The total voltage will decrease when the T2 switches connections have a leak. Therefore, confirm the input specifications for the programmable controllers, which are the connecting load. However, dimming or total failure of the indicator light may exist.

T3 switches hardly ever leak. When less than 10 μ A, then leakage may occur. Usually dimming and failure of the indicator light do not occur.

3.2.4 Reed switch (T0, T5, T8)

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 T0 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 indicator light is not lit.

Ⓑ When the switch is connected to an AC relay or a programmable controller input, the indicator light 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 indicator light may then be lit.

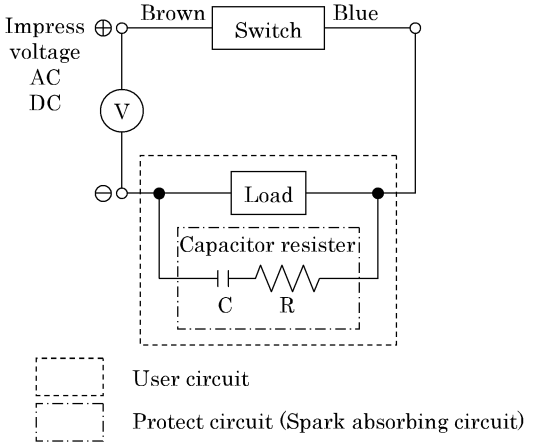
2) Contact capacity
Do not use a load exceeding the maximum contact capacity of the switch. Additionally, if the current is lower than the rated current value, the indicator light may not be lit.

3) 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

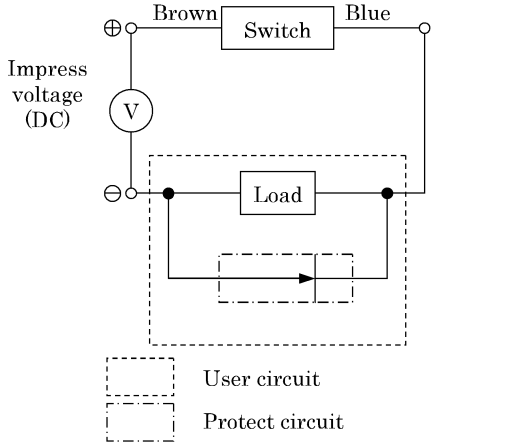
Electric power	Length of wire
DC	50m
AC	10m

(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

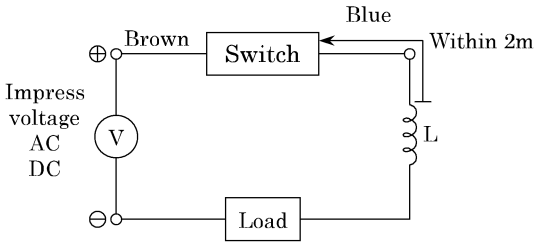
Fig.1 When capacitor resister
(In case the same source of power is used.)



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

Fig.2 When diode is used.

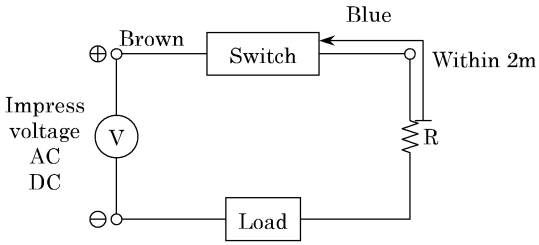
(2) Protective circuit when the wire length exceeds that stated Table 1.



・ 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

4) Relay
Always use the relays listed below.
Omron Corporation ····· MY type
Fuji Electric Co., Ltd. ····· HH5 type
Panasonic, Ltd. ····· HC type

5) Serial connection
Total voltage loss, when connected T0 switches in series, equals to the sum of respective voltage loss of each switch.
The total voltage loss becomes equivalent to one T0 (approx. 2.4V) when connecting the combination of one T0 for actuation confirming and rest of T5 switches. Indicator light is lit only when all switches turn on.

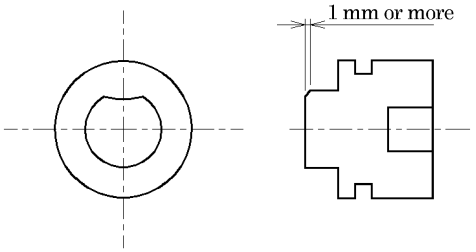
6) Parallel connection
There is no restriction in parallel connection number of switches of these types. Multi number connection of model T0, sometimes, cause a dimmed indicator light or complete indicator light failure.

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) Check to see that the cylinder operates smoothly.
   (2) Check any change of the working piston speed and cycle time.
   (3) Check for internal and/or external leakage.
   (4) Check the piston rod for flaw (scratch) and deformation.
   (5) Check the stroke for abnormality.
   (6) Check if the position locking mechanism is securely locked.
   (7) Check for Check for scratches, wear and tear on the position locking mechanism (sleeve, stopper piston, stopper packing, coil spring, etc.)
   When a permanent deformation of 1 mm or more is observed on the stopper piston, the stopper piston needs to be replaced.
   Since this may be caused by a permanent deformation of the sleeve, the sleeve also needs to be checked in this case.



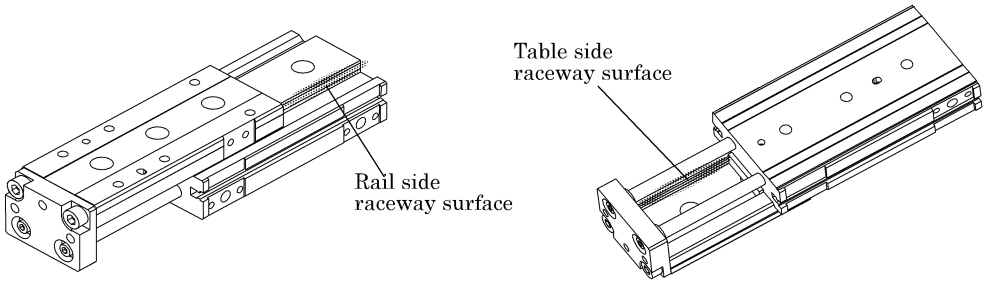
See "Trouble shooting", 5 should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.
Since the position locking mechanism is a safety mechanism, disassemble it and check for scratches, wear and tear on it without fail.

4.2 Disassembling

1) This cylinder is able to be disassembled.
If any failure occurs such as air leakage, disassemble the product, referring to the internal structural diagram, and exchange the parts in the consumable parts list.

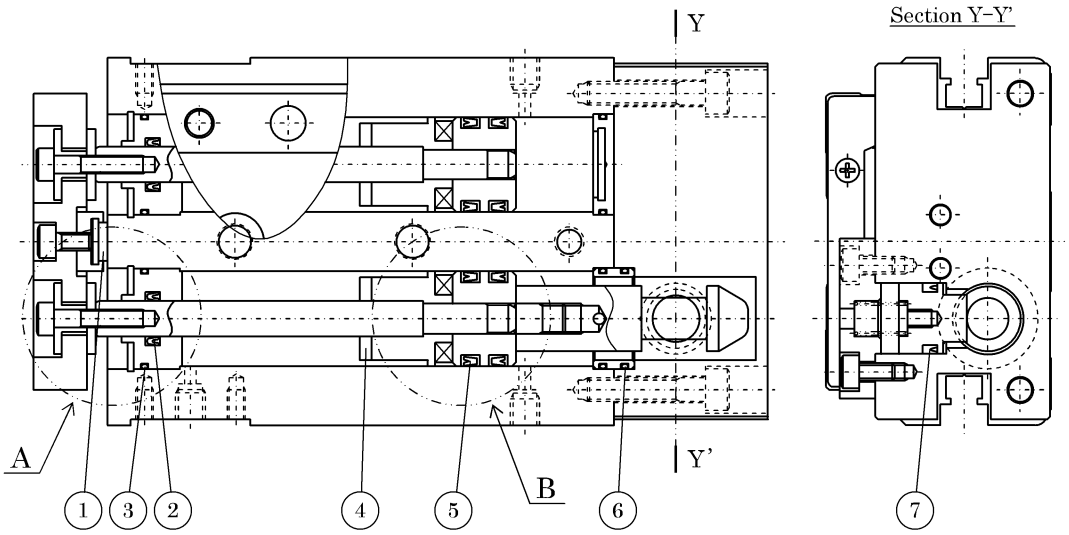
2) Disassemble the product with the cylinder pulled. Remove bolt (1). (In the case of ϕ 8, remove floating bush (2).) Remove floating bush (2) and plain washer (3). In this condition, fix slide table (24) to the main body using adhesive tape. (The linear guide does not have the stopper. If the slide table is not fixed, the guide might be dropped.) After removing hexagon socket set screw (22), remove type-C set ring (4) and pull piston rod (8) together with rod metal (7). Assemble the product in the reverse order of disassembly.
Do not forget to supply grease to the packing.

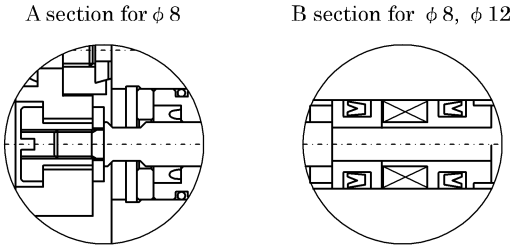
3) Apply grease to the guide rail in the following procedure.



Push the cylinder, and apply grease to the ball track surface on the table side and rail side. Slide the table several times after applying grease so that the grease can be entirely applied to the ball and track surface.

4) Internal structure and Expendable parts list





Repair parts list (Specify the Kit No., please, when ordering parts)

Bore size (mm) / Parts name / Kit No.	Parts number	①	②	③	④
		Cushion rubber (H)	Rod packing	O-Ring	Cushion rubber (R)
ϕ8	LCG-Q-8K	F4-160422	P12246-004	P12115-0825086	F4-252066
ϕ12	LCG-Q-12K	F4-659142	P12210-006	P12115-1160070	F4-166347
ϕ16	LCG-Q-16K	F4-659142	P12246-006	P12115-1500100	F4-160423
ϕ20	LCG-Q-20K	F4-659112	P12246-008	P12115-1900150	F4-160424
ϕ25	LCG-Q-25K	F4-659112	P12246-010S	P12056-020	F4-116102

Bore size (mm) / Parts name / Kit No.	Parts number	⑤	⑥	⑦
		Piston packing	O-Ring	Stopper packing
ϕ8	LCG-Q-8K	P12208-008	P12115-0825086	P12208-010
ϕ12	LCG-Q-12K	P12208-012	P12115-1160070	P12208-010
ϕ16	LCG-Q-16K	P12208-016	P12115-1500100	P12008-012
ϕ20	LCG-Q-20K	P12208-020	P12115-1850080	P12208-012
ϕ25	LCG-Q-25K	F4-348074	P12115-2350080	P12208-012

5. TROUBLE SHOOTING

1) Cylinder

Trouble	Causes	Remedies
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.
	Broken piston packing	Replace the piston packing.
Does not function smoothly.	Speed is below the low speed limit	Limit the load variation.
	Improper or misalignment of installation.	Correct the installation state.
	Exertion of transverse (lateral) load.	Install a guide. Revise the installation state.
	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 meter-out circuit of the speed control valve.
	Lack of grease on guide section	Apply grease to the guide ball track surface.
Breakage and / or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load and/or install a mechanism with more secured cushion effect (e.g.external cushion mechanism).
	Exertion of transverse load.	Install a guide. Reverse the installation state.

2) Cylinder position locking mechanism

Trouble	Causes	Remedies
No locking.	No operation up to the stroke end.	Operate the cylinder up to the stroke end.
	Residual pressure is present inside the cylinder room on the locking mechanism side.	Reduce the residual pressure to zero.
No lock is released	The external force is applied to the stopper piston.	After pressurizing the cylinder side on the side without position locking unit, actuate the cylinder.
	No pressure: the pressure is insufficient.	Maintain the pressure source.
Does not operate.	No pressure: the pressure is insufficient.	Maintain the pressure source.
	Signal is not transmitted to direction control valve.	Correct the control circuit.
	Broken stopper packing.	Replace the piston packing.
Does not function smoothly.	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 meter-out circuit of the speed control valve.
	Grease shortage.	Grease is spread.
Breakage and / or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load and/or install a mechanism with more secured cushion effect (e.g.external cushion mechanism).
	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 meter-out circuit of the speed control valve.
	Bounce on the end of stroke.	Eliminate a bounce on the end of stroke.

3) 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.
	Incorrect direction of switch mounting	Correct the direction of the switch mounting.
	Relay is unable to respond properly	Turn the speed down. Replace the relay with a recommended one.
	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 Product Number Coding

● Without switch

LCG-Q – 8 – 40 ——————— S1

● With switch

LCG-Q – 12 – 40 – T0H※ – R – A1DT

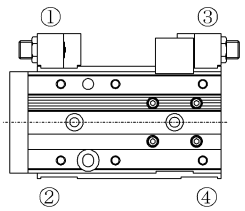
(a) (b) (c) (d) (e)

(a) Bore size (mm)		(b) Stroke length (mm)							(c) Switch model No.			
8	φ 8	Code	Standard stroke length	Bore size					Axial lead wire	Radial lead wire	Switch type	Lead wire
12	φ 12			φ 8	φ 12	φ 16	φ 20	φ 25				
16	φ 16	10	10mm	○	○	○	○	○				
20	φ 20	20	20mm	○	○	○	○	○	F2S		Solid state	2 wire
25	φ 25	30	30mm	○	○	○	○	○	F3S			3 wire
		40	40mm	○	○	○	○	○	F2H※	F2V※		2 wire
		50	50mm	○	○	○	○	○	F3H※	F3V※		3 wire
		75	75mm	○	○	○	○	○	F2YH※	F2YV※		2 wire
		100	100mm	—	○	○	○	○	F3YH※	F3YV※		3 wire
		125	125mm	—	—	○	○	○	T0H※	T0V※	Reed	2 wire
		150	150mm	—	—	—	○	○	T5H※	T5V※		
○ : Standard, — : Not available									T2H※	T2V※	Solid state	2 wire
									T3H※	T3V※		3 wire
									T2WH※	T2WV※		2 wire
									T3WH※	T3WV※		3 wire

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

(d) Qty. of switch		(e) Option					
R	One on rod side	S : stopper for adjustable stroke Adjustable stroke single side 5 mm			A : Shock absorber type stopper		
H	One on head side						
D	Two	S1※※	Stopper position ①	Refer to figure below for the stopper position	A1※※	Stopper position ①	Refer to figure below for the stopper position
		S2※※	Stopper position ②		A2※※	Stopper position ②	

Stopper position



Section ※※	
Blank	Stopper section port : No port
D (note3)	Stopper section port : side and bottom port
Blank	Stopper block material : Rolled steel
T (note3)	Stopper block material : alloy steel(nitriding)
With buffer	
B	Non switch groove
BL	With switch groove
Rust proof treatment	
Blank	Non option
U	Rust proof treatment (just a guide section)

Note1: Stroke adjustable range of Hexagon socket set screw type stopper with urethane rubber (standard) is 5 mm for one direction.
When changing adjustable stroke range, use a discrete stopper.
Note2: Standard port positions will be at (1) and (3) upper if no stopper is provided.
Note3: Selectable only when a stopper is used.

6.2 Component Parts Model Coding

(1) How to order switch

If ϕ 8 to ϕ 12 mm bore

SW – F2H

(c) → Switch model No. [Refer to (c) on previous page]

If ϕ 16 to ϕ 25 mm bore

SW – T2H3

(c) → Switch model No. [Refer to (c) on previous page]

Buffer section

SW – F 2 V 3

Output type	
2	Direct current 2-wire type Solid state
3	Direct current 3-wire type Solid state

Radial lead wire

Lead wire length	
Blank	1m
3	3m

(2) How to order stopper set

Set of stopper part and stopper for adjustable stroke or shock absorber type stopper.

Used when changing standard type to shock absorber type stopper or stopper for adjustable stroke.

LCG – 12 – S 2 D – S02

Bore size [Refer to (b) on previous page]

Stopper type	
S	Stopper for adjustable stroke
A	Shock absorber type stopper

Stopper mounting orientation	
1	Stopper position ①
2	Stopper position ②

Port at stopper section	
Blank	No port
D	With side and bottom port

Adjustable stroke range (note1), (note2)	
Blank	Adjustable stroke range 5mm
S02	Adjustable stroke range 15mm
S03	Adjustable stroke range 25mm

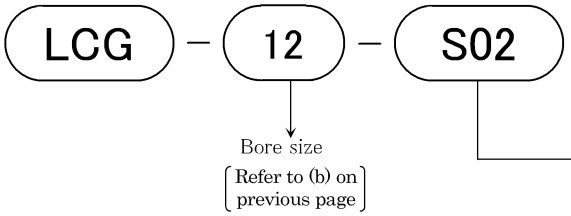
Note 1: "S03" is not used for ϕ 8.

Note 2: If Shock absorber type stopper is not selected.

(3) How to order discrete stopper for adjustable stroke

Hexagon socket set screw with urethane rubber

Used when changing adjustable stroke range or setting custom stroke length.



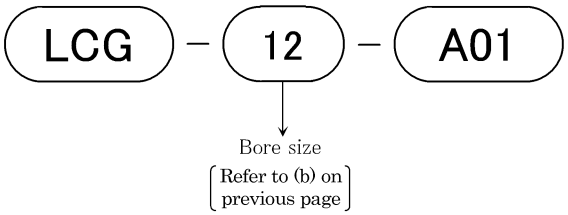
Adjustable stroke range	
S01	Single 5mm (standard)
S02	Single 15mm
S03	Single 25mm

"S03" is not used for ϕ 8.

(4) How to order discrete shock absorber type stopper

Shock absorber and stopper cap set

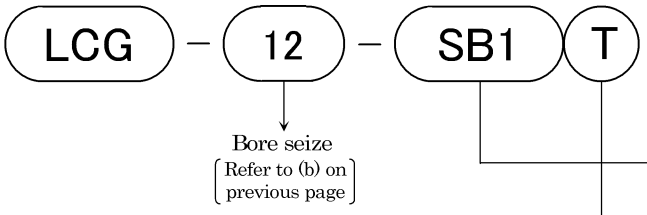
Used when changing from stopper for adjustable stroke to shock absorber type stopper.



Applicable Shock absorber model No.	
Model	Shock absorber model No.
LCG-Q-8	SKL-0805
LCG-Q-12	SKL-0805
LCG-Q-16	SKL-1006
LCG-Q-20	SKL-1208
LCG-Q-25	SKL-1208

(5) How to order discrete stopper block model No.

Used when changing standard type to shock absorber type stopper or stopper for adjustable stroke.



Stopper block	
SB1	8mm bore; 30 mm stroke or less
	12, 25mm bore; 50 mm stroke or less
SB2	8mm bore; 40 mm stroke or more
	12, 25mm bore; 75 mm stroke or more

Material	
Blank	Stopper block material : Rolled steel
T	Stopper block material : Alloy steel (nitriding)

7. SPECIFICATION

7.1 Product Specifications

Model / Item			LCG-Q				
Bore size		mm	φ 8	φ 12	φ 16	φ 20	φ 25
Actuation			Double acting				
Working fluid			Compressed air				
Max. working pressure		MPa	0.7				
Min. working pressure		MPa	0.15				
Proof pressure		MPa	1.0				
Ambient temperature		℃	−10 to 60 (No freezing) (note2)				
Port size	Port size		M5			Rc1/8	
	Rear body		None				
Stroke length tolerance		mm	$^{+2.0}_{0}$ (Note1)				
Working piston speed		mm/s	50 to 500				
Cushion			Rubber cushion				
Position locking mechanism			Head end				
Holding force		N	At PULL, theoretical thrust × 0.7 (at 0.7 MPa)				
Lubrication			Not required (when lubrication, use turbine oil Class 1 ISO VG32)				

Note 1: When using this without stopper, be careful about a small gap between end plate and floating bush.
Note 2: Use the stopper for adjustable the stroke between 50 and 200 mm/s.

7.2 Switch Specifications

1) Type of switch and Applications

Model / Descriptions			Applications (Purpose)
Solid state	2 wire	F2S	DC programmable controller
		F2H	
		F2V	
		F2YH	
		F2YV	
	3 wire	F3S	DC programmable controller, relay
		F3H	
		F3V	
		F3YH	
		F3YV	
	2 wire	T2H	DC programmable controller
		T2V	
		T2WH	
		T2WV	
	3 wire	T3H	DC programmable controller, relay
		T3V	
		T3WH	
		T3WV	
Reed	2 wire	T0H	AC / DC programmable controller, relay
		T0V	
		T5H	AC / DC programmable controller, relay, IC circuit (without indicator light), serial connection
		T5V	

Note: T※H designates lead cord outlet is straight out type as well as T※V designates lead cord outlet is L shape type.

2) Switch specifications

Descriptions	Solid state switch	
	F2S	F3S
Applications	Programmable controller	Programmable controller, relay
Switch output	—	NPN output
Power supply voltage	—	DC10 to 28V
Load Voltage	DC10 to 30V	DC30V or less
Load Current	5 to 20mA (Note 1)	50mA or less
Current consumption	—	10 mA or less at 24V DC (at ON state)
Internal voltage drop	4V or less	0.5V or less
Indicator light	Red LED (ON lighting)	
Leakage current	1mA or less	10 μA or less
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtire code 2-conductor 0.15mm²)	Standard 1m (Oil resistant vinyl cabtire code 3-conductor 0.15mm²)
Shock resistance	980m/s²	
Insulation resistance	20MΩ over at 500V DC megger	
Withstand Voltage	No failure at 1000VAC applied for one minute.	
Ambient temperature	−10 to 60℃	
Degree of protection	IEC standards IP67, JIS C0920 (water tight model), oil resistance	

Descriptions	Reed switch			
	T0H, T0V		T5H, T5V	
Applications	Programmable controller		Programmable controller relay, IC circuit (without indicator light), serial connection	
Power supply voltage	—			
Load Voltage	DC12/24V	AC110V	DC5/12/24V	AC110V
Load Current	5 to 50mA	7 to 20mA	50mA or less	20mA or less
Current consumption	—			
Internal voltage drop	2.4V or less		0V	
Indicator light	LED (ON lighting)		—	
Leakage current	0mA			
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtire code 2-conductor 0.2mm²)			
Shock resistance	294m/s²			
Insulation resistance	20MΩ over at 500V DC megger			
Withstand voltage	No failure at 1000VAC applied for one minute.			
Ambient temperature	−10 to 60℃			
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), oil resistance			

Descriptions	Solid state switch			
	F2H, F2V	F2YH, F2YV	F3H, F3V	F3YH, F3YV
Applications	Programmable controller		Programmable controller, relay	
Power supply voltage	—		DC10 to 28V	
Load Voltage	DC10 to 30V	DC24V±10%	DC30V or less	
Load Current	5 to 20mA (Note 1)		100mA or less	50mA or less
Current consumption	—		10 mA or less at 24V DC (at ON state)	
Internal voltage drop	4V or less		0.5V or less	
Indicator light	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)	Red/green LED (ON lighting)
Leakage current	1mA or less		10 μA or less	
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtire code 2-conductor 0.15mm²)		Standard 1m (Oil resistant vinyl cabtire code 3-conductor 0.15mm²)	
Shock resistance	980m/s²			
Insulation resistance	20MΩ over at 500V DC megger	100MΩ over at 500V DC megger	100MΩ over at 500V DC megger	100MΩ over at 500V DC megger
Withstand Voltage	No failure at 1000VAC applied for one minute.			
Ambient temperature	−10 to 60℃			
Degree of protection	IEC standards IP67, JIS C0920 (water tight model), oil resistance			

Descriptions	Solid state switch	Reed switch		
	T1H, T1V	T8H, T8V		
Applications	Programmable controller, relay, small solenoid	Programmable controller, relay		
Load Voltage	AC85 to 265V	DC12/24V	AC110V	AC220V
Load Current	5 to 100mA	5 to 50mA	7 to 20mA	7 to 10mA
Internal voltage drop	7V or less	3V or less		
Indicator light	LED (ON lighting)			
Leakage current	1mA or less, at AC100 2mA or less, at AC200	0mA		
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtire code 2-conductor 0.3mm^2)	Standard 1m (Oil resistant vinyl cabtire code 2-conductor 0.3mm^2)		
Shock resistance	980m/s^2	294m/s^2		
Insulation resistance	100MΩ over at 500V DC megger			
Withstand Voltage	No failure at 1500VAC applied for one minute.			
Ambient temperature	−10 to 60℃			
Degree of protection	IEC standards IP67, JIS C0920 (water tight model), oil resistance			

Descriptions	Solid state switch			
	T2H, T2V	T2WH, T2WV	T3H, T3V	T3WH, T3WV
Applications	Programmable controller		Programmable controller, relay	
Power supply voltage	—		DC10 to 28V	
Load Voltage	DC10 to 30V	DC24V±10%	DC30V or less	DC30V or less
Load Current	5 to 20mA (Note1)		100mA or less	50mA or less
Current consumption	—		10mA at DC24V or less	
Internal voltage drop	4V or less		0.5V or less	
Indicator light	LED (ON lighting)	Red/green LED (ON lighting)	LED (ON lighting)	Red/green LED (ON lighting)
Leakage current	1mA or less		10μA or less	
Lead wire length	Standard 1m (Oil-proof vinyl cabtyre cord, 2-wire, 0.2mm^2)		Standard 1m (Oil-proof vinyl cabtyre cord, 3-wire, 0.2mm^2)	
Shock resistance	980m/s^2			
Insulation resistance	20MΩ over at 500V DC megger			
Withstand voltage	No failure at 1000VAC applied for one minute.			
Ambient temperature	−10 to 60℃			
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), oil resistance			

Note 1: Maximum value, 25mA is at 25℃ of ambient temperature. Load current decreases less than 25mA when the ambient temperature exceeds 25℃. For example: it may be 5 to 10mA at 60℃.