CKD

SM－439012－A

INSTRUCTION MANUAL

LINEAR SLIDE CYLINDER

LCR 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 3th 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:

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

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

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

[SM-439012-A]

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

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

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LCR
Linear Slide Cylinder
Manual No. SM-439012-A

1. UNPACKING

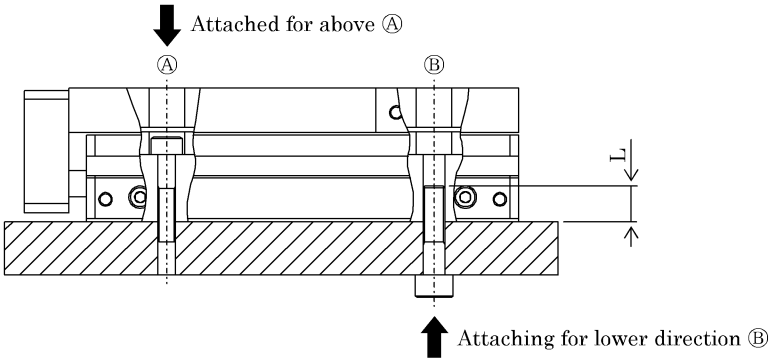
1) Make sure that the type No. on the nameplate of the delivered Selex Cylinder matches the type No. you ordered.
2) Check the appearance for any damage.
3) Stop up the piping port with a sealing plug to prevent the entry of foreign substances into the cylinder. Remove the sealing plug before piping.

2. INSTALLATION

2.1 Installation

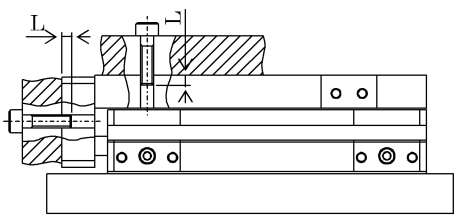
1) The ambient temperature for this cylinder is -10 to 60℃ (No freezing). Always operate the cylinder within this temperature.

2) Observe the following values for the bolt insertion length and tightening torque when installing this product.



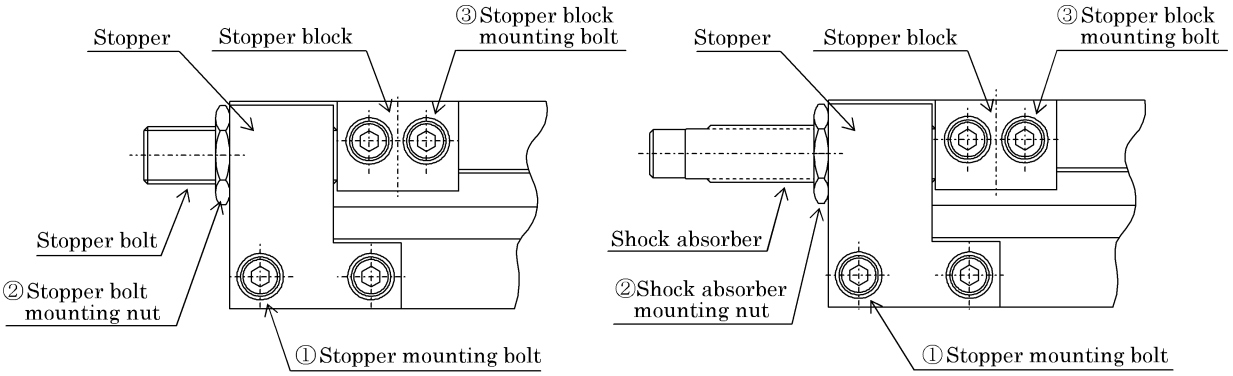
Descriptions	Ⓐ		Ⓑ		
	Applicable bolts	Tightening Torque (N・m)	Applicable bolts	Tightening Torque (N・m)	Max. screw depth L (mm)
LCR-6	M3×0.5	0.6 to 1.1	M4×0.7	1.4 to 2.4	6
LCR-8					
LCR-12	M4×0.7	1.4 to 2.4	M5×0.8	2.9 to 5.1	8
LCR-16	M5×0.8	2.9 to 5.1	M6×1.0	4.8 to 8.6	9
LCR-20					
LCR-25	M6×1.0	4.8 to 8.6	M8×1.25	12.0 to 21.6	12

3) Observe the following bolt insertion lengths and tightening torque when installing the jig on the slide table or end plate.



Descriptions	Bolt Applicable bolts	Torque (N・m)	Screw-in length L (mm)	
			Table	End plate
LCR-6	M3×0.5	0.6	3	4.5 to 6
LCR-8			3 to 4.5	4.5 to 7
LCR-12	M4×0.7	1.4	4 to 5.5	6 to 9
LCR-16	M5×0.8	2.9	5 to 6	7.5 to 9
LCR-20			5 to 6	7.5 to 11
LCR-25	M6×1.0	4.8	6 to 7	9 to 11

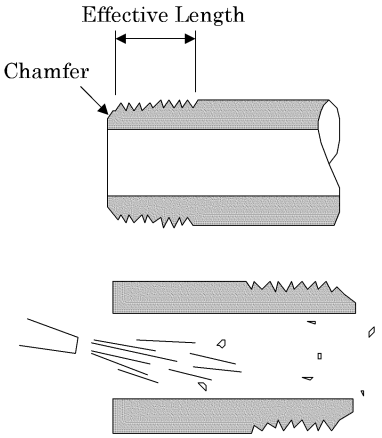
4) Observe the following values for bolts at the stopper and in nut tightening torque.



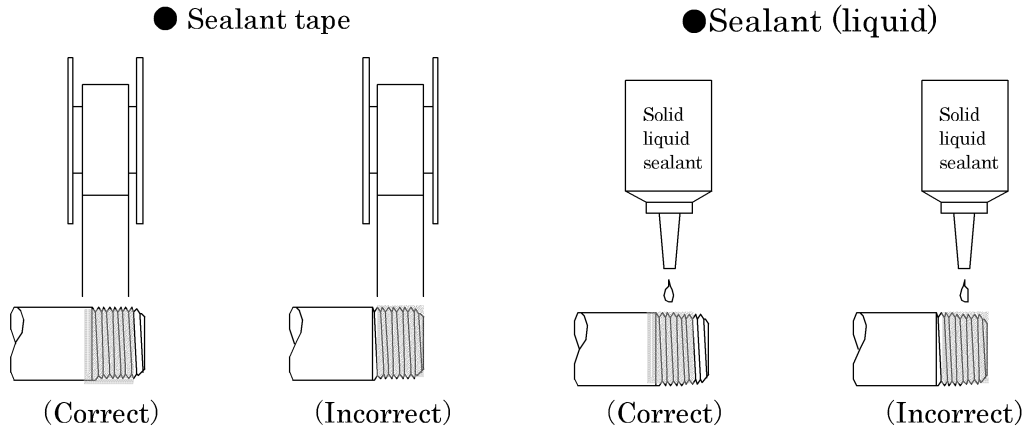
Model	① Stopper mounting bolt (N·m)	② Stopper bolt mounting nut ② Shock absorber mounting nut (N·m)	③ Stopper block mounting bolt (N·m)
LCR-6	0.4 to 0.5	1.2 to 2.0	0.6 to 0.8
LCR-8			
LCR-12	0.6 to 0.8		
LCR-16		3.0 to 4.0	1.4 to 1.8
LCR-20	2.9to 3.5	4.5 to 6.0	
LCR-25			2.9 to 3.5

2.2 Piping

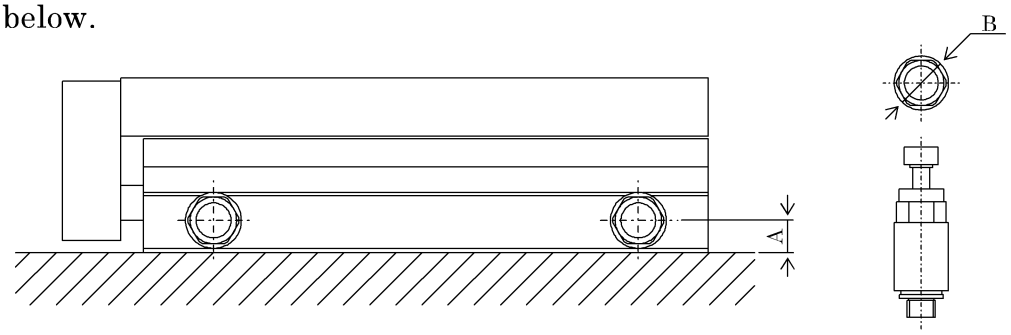
1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc.
2) See to it that the pipe connecting cylinder and solenoid valve has effective cross-sectional area which is needed for the cylinder to drive at the specified speed.
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 applying sealant approx. the tip of pipe to avoid to residual substances from falling into piping systems.

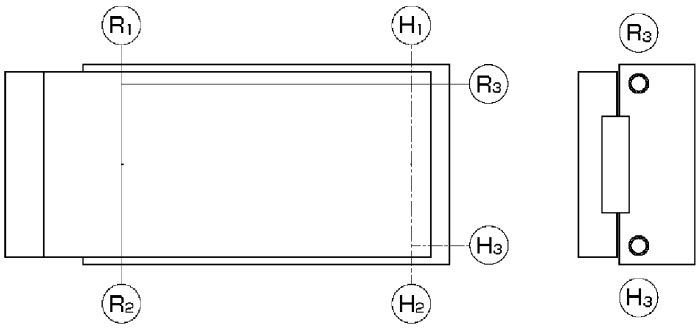


7) Because the usable piping joint has limitations, for using it, see the note below.



Descriptions / Bore size (mm)	Port size	Port dimension A	Applicable joints	Joint OD φB
φ6	M3	4	SC3W-M3-3.2・4 SC3WU-M3-3.2・4 GWS3-M3-S GWS4-M3-S	φ8 or less
φ8	M5	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-M5 GWL4-M5 GWS6-M5 GWL6-M5	φ13 or less
φ20	Rc1/8	8	SC3W-6-4・6・8 GWS4-6 GWS8-6 GWL6-6 GWS6-6 GWL4-6	φ15 or less
φ25		9		

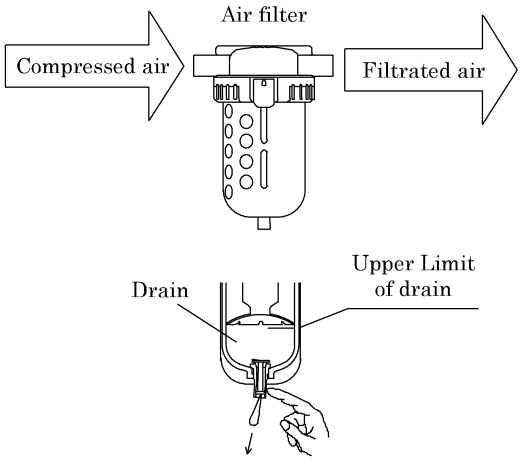
8) This product can be used with rear piping (port (R3), (H3) on figure above) except for ø6 and position locking models. When using this product, remove the plug sealing (R3) and (H3) , and seal ports (R1) and (H1) shown on the table to the right.



Descriptions	Plug
LCR-6	Port (R3) and (H3) do not exist.
LCR-8	M5 x 5 (hexagon socket head set screw)
LCR-12	
LCR-16	
LCR-20	R1/8 (hexagon socket head tapered screw plug)
LCR-25	Seal ports (R3) and (H3) with plugs used to seal ports (R1) and (H1).

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.

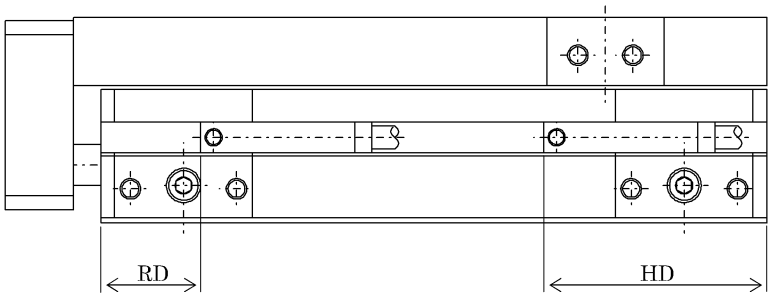
4) This cylinder does not require lubrication. It is recommended, however, to use Turbine oil Grade 1, ISO VG32 as a lubricant, if and when lubrication is needed.

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)

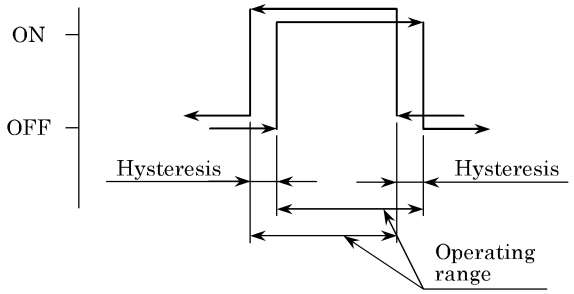
2) Operating range

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, 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
φ6	HD	33	23				—				2 to 4	1 or less	2.5 to 5.5	1 or less
	RD	15					—							
φ8	HD	34	24		33		—						3.5 to 6	
	RD	13					—							
φ12	HD	52.5	42.5		32.5		41.5		—				3 to 4.5	
	RD	16.5												

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	56.5	46.5		36.5		53.5			—	2 to 4	1 or less	5 to 9	1 or less
	RD	17								—				
φ20	HD	65	55		45		57.5				2 to 5.5		6.5 to 11	
	RD	20.5												
φ25	HD	78.5	68.5		58.5		79				2.5 to 6		8 to 12	
	RD	19												

Bore size (mm) \ Maximum sensitive Position		Stroke length									Solid state (T2WH/V, T3WH/V)	
		10	20	30	40	50	75	100	125	150	Operating range	Hysteresis
φ16	HD	54	44		34		51			—	3 to 4.5	1 or less
	RD	19.5								—		
φ20	HD	63	53		43		55.5				4 to 5.5	
	RD	22										
φ25	HD	76.5	66.5		56.5		77				3.5 to 6	
	RD	21										

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 6	ϕ 8	ϕ 12	ϕ 16	ϕ 20	ϕ 25
Allowable energy absorption (J)	0.025	0.058	0.112	0.176	0.314	0.314

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

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.

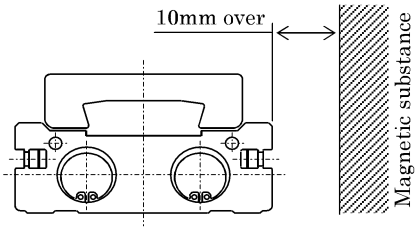
The maximum detectable working piston speed is :

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

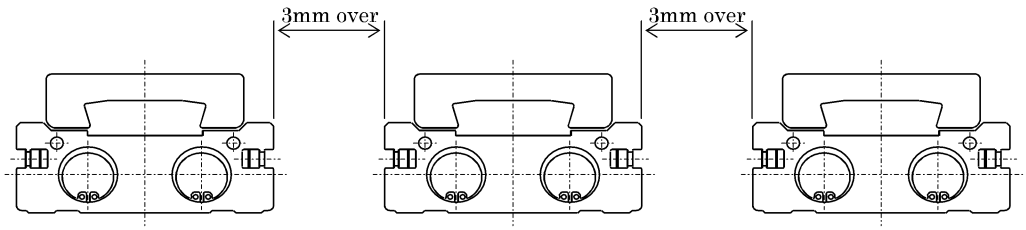
Refer to the minimum value of the table on page 11) about cylinder switch operating range.

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

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



7) The cylinder switch could malfunction if cylinders are installed adjacently. Check that the following distance is maintained between cylinder surfaces. (Same for all bore size)



3.2.1 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

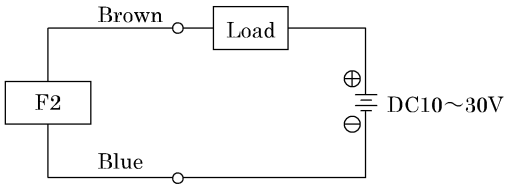


Fig.1 Fundamental circuit Example of F2

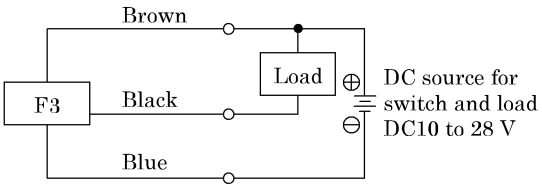


Fig.2 Fundamental circuit Example of F3 (1)
(In case the same source of power is used.)

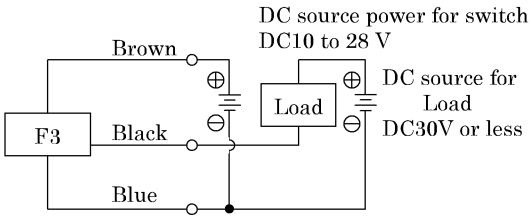


Fig.3 Fundamental circuit Example of T3 (2)
(In case individual sources of power are used.)

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).

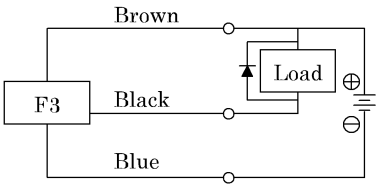
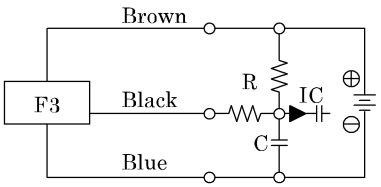


Fig.4 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)



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.

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

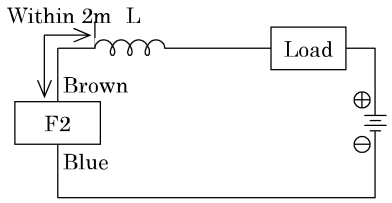


Fig.6 ・Choke coil
L = a couple hundred μH to a couple mH surpassing high frequency characteristic
・Install it near by a switch (within 2m).

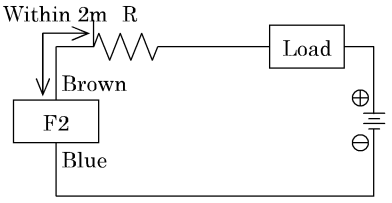


Fig.7 ・Dash current restriction resister.
R = As much large resister as the load circuit can afford.
・Install it near by a switch (within 2m).

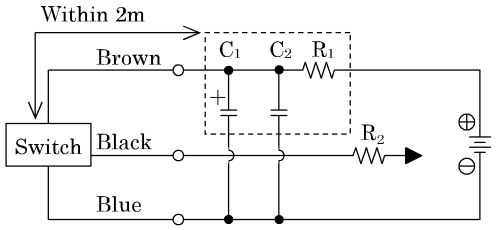


Fig8 ・Electric power noise absorptive circuit.
C_1=20 to 50 μF electrolytic capacitor
(Withstand voltage 50V or more)
C_2=0.01 to 0.1 μF ceramic capacitor
R_1=20 to 30 Ω

・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.

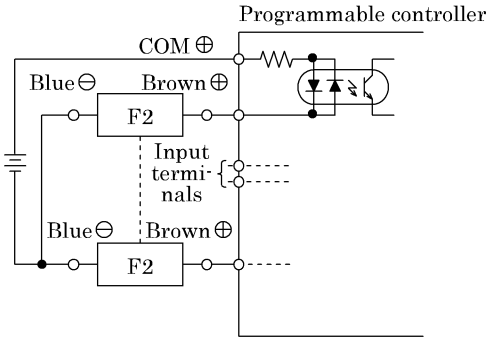


Fig.9 An example of F2 connection to source input type (an external power source)

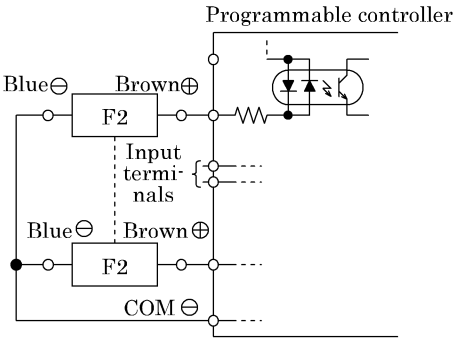


Fig.10 An example of F2 connection to source input type (an internal power source)

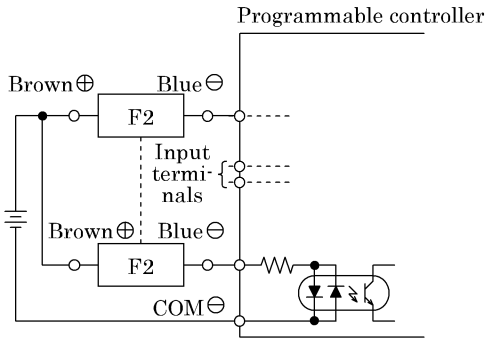


Fig.11 An example of F2 connection to sink input type

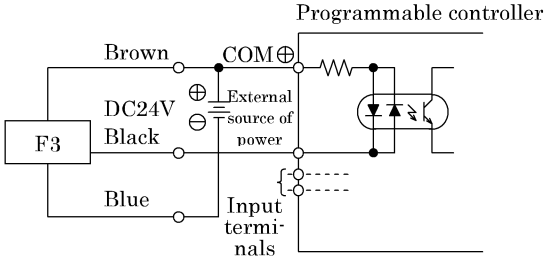


Fig.12 An example of F3 connection to source input type (an external power source)

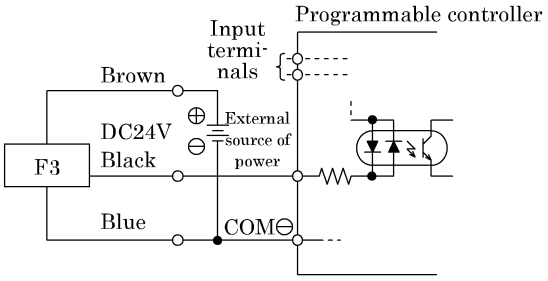


Fig.13 An example of F3 connection to source input type (an internal power source)

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 (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

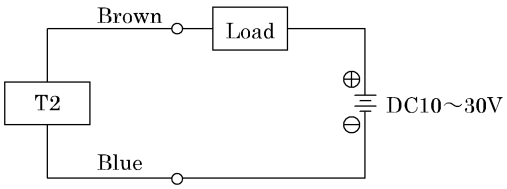


Fig.1 Fundamental circuit Example of T2

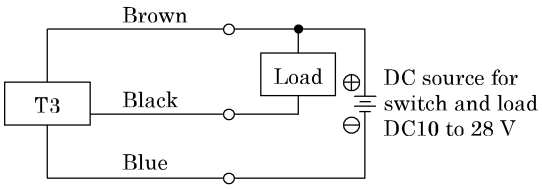


Fig.2 Fundamental circuit Example of T3(1) (In case the same source of power is used.)

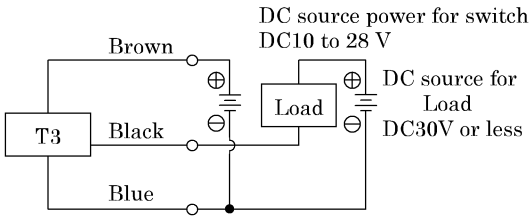


Fig.3 Fundamental circuit Example of T3 (2) (In case individual sources of power are used.)

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

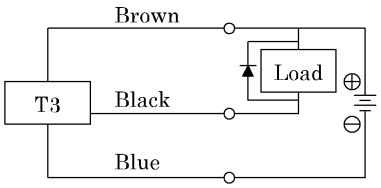
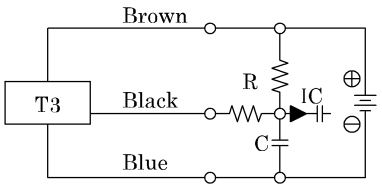


Fig.4 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)



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.

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

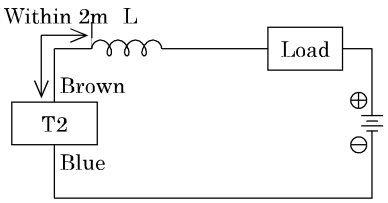


Fig.6 ・Choke coil
L = a couple hundred μH to a couple mH surpassing high frequency characteristic
・Install it near by a switch (within 2m).

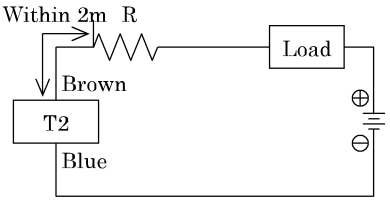


Fig.7 ・Dash current restriction resister.
R = As much large resister as the load circuit can afford.
・Install it near by a switch (within 2m).

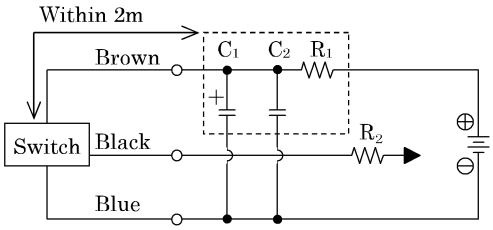


Fig8 ・Electric power noise absorptive circuit.
C_1=20 to 50 μF electrolytic capacitor (Withstand voltage 50V or more)
C_2=0.01 to 0.1 μF ceramic capacitor
R_1=20 to 30 Ω

・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.

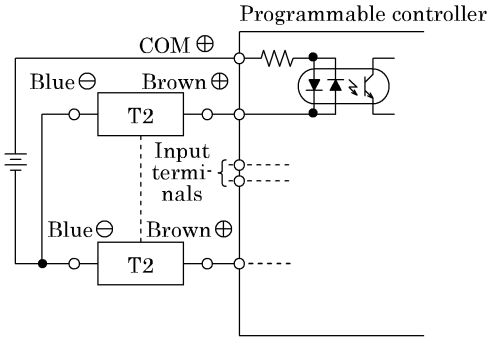


Fig.9 An example of T2 connection to source input type (an external power source)

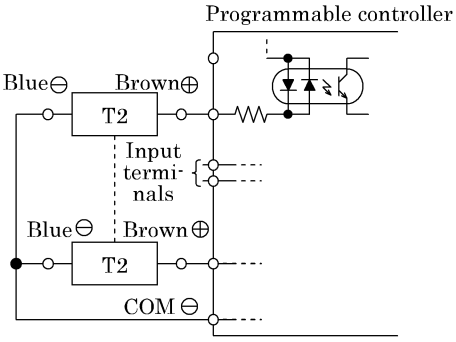


Fig.10 An example of T2 connection to source input type (an internal power source)

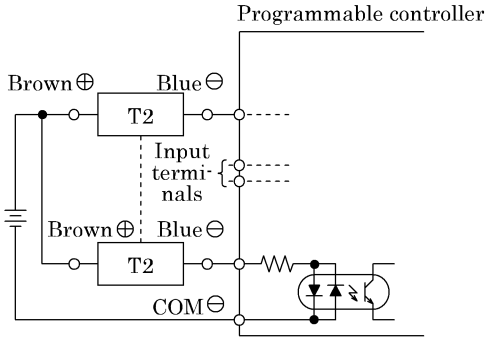


Fig.11 An example of T2 connection to source input type

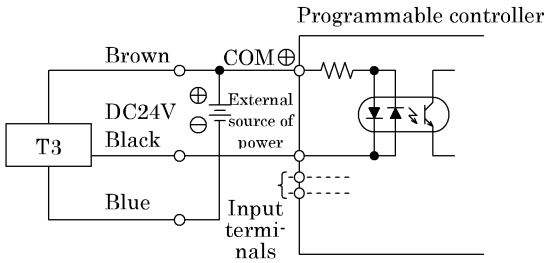


Fig.12 An example of T3 connection to source input type (an internal power source)

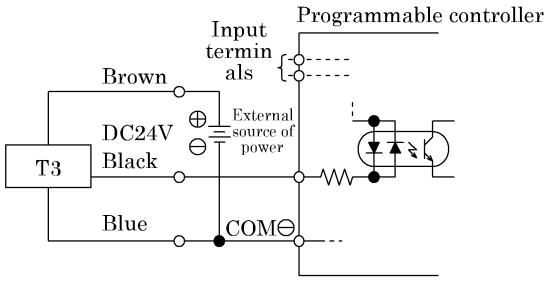


Fig.13 An example of T3 connection to source input type (an internal power source)

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)

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.

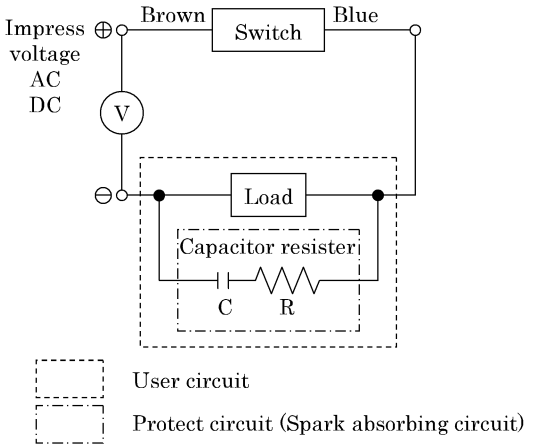
2) Contact capacity
Do not use a load exceeding the maximum contact capacity of the switch. Additionally, if the current is lower than the rated current value, the indicator light may not be lit.

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

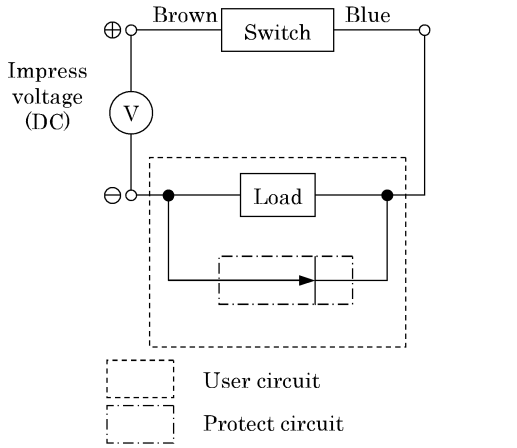
Electric power	Length of wire
DC	50m
AC	10m

(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

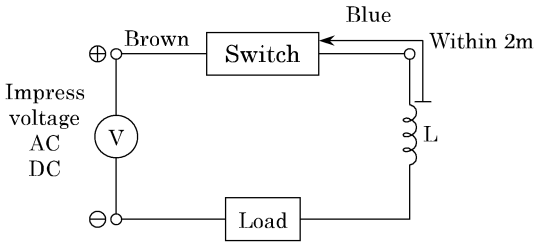
Fig.1 When capacitor resister
(In case the same source of power is used.)



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

Fig.2 When diode is used.

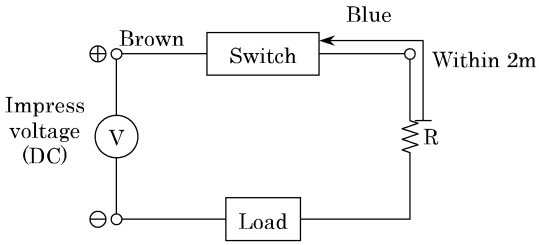
(2) Protective circuit when the wire length exceeds that stated Table 1.



・ 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.

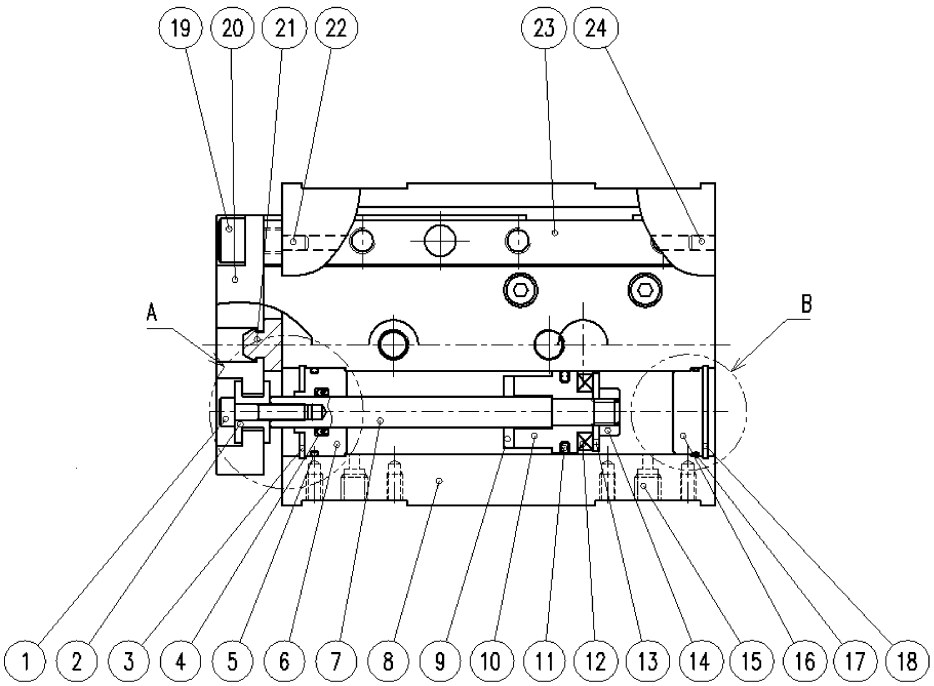
2) Inspection items
   (1) Check to see that the cylinder operates smoothly.
   (2) Check any change of the working piston speed and cycle time.
   (3) Check for internal and/or external leakage.
   (4) Check the piston rod for flaw (scratch) and deformation.
   (5) Check the stroke for abnormality.

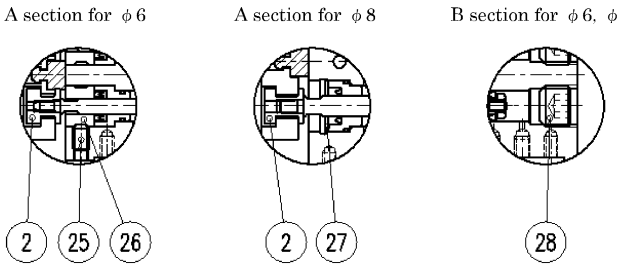
   See "Trouble shooting", 5 should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

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 φ6 orφ8, remove floating bush (2).) Remove floating bush (2) . In this condition, fix slide table (23) 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 (19), remove type-C set ring (3) and pull piston rod (7) together with rod metal (6). Assemble the product in the reverse order of disassembly.
   Do not forget to supply grease to the packing.

3) Internal structure and Expendable parts list





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

Bore size (mm)	Kit No.	Repair parts No.
ϕ6	LCR-6K	④ ⑤ ⑨ ⑪ ⑰ ㉑
ϕ8	LCR-8K	
ϕ12	LCR-12K	
ϕ16	LCR-16K	
ϕ20	LCR-20K	
ϕ25	LCR-25K	

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. Correct 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. Correct the installation state.

2) Switch

Troubles	Causes	Remedies
Indicator light is not lit.	Deposited contact point	Replace the switch.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
	Damaged indicator light	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
Switch does not function right.	Broken circuit	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
	Improper voltage	Correct voltage to specified.
	Incorrect location of switch	Correct its location.
	Aberrant position of switch	Set it back to original position and tighten the mounting device.
	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

LCR – 8 – 40 ——————————— S5

● With switch

LCR – 12 – 40 – T0H※ – R – A1DTN

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

(a) Bore size (mm)		(b) Stroke length (mm)								(c) Switch model No.			
6	φ6	Code	Standard stroke length	Bore size						Lead wire straight type	Lead wire L-shaped type	Switch type	Lead wire
8	φ8			φ6	φ8	φ12	φ16	φ20	φ25				
12	φ12	10	10mm	○	○	○	○	○	○				
16	φ16	20	20mm	○	○	○	○	○	○	F2S※		Solid state	2 wire
20	φ20	30	30mm	○	○	○	○	○	○	F3S※			3 wire
25	φ25	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						T8H※	T8V※		
										T1H※	T1V※	Solid state	2 wire
										T2H※	T2V※		3 wire
										T3H※	T3V※		2 wire
										T2WH※	T2WV※		3 wire
										T3WH※	T3WV※		

※ 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 5mm		A shock absorber type stopper	
H	One on head side				
D	Two	S1※※	Stopper position ①(changeable for ④)	A1※※	Stopper position ①(changeable for ④)
		S2※※	Stopper position ②(changeable for ③)	A2※※	Stopper position ②(changeable for ③)
		S3※※	Stopper position ③(changeable for ②)	A3※※	Stopper position ③(changeable for ②)
		S4※※	Stopper position ④(changeable for ①)	A4※※	Stopper position ④(changeable for ①)
		S5※※	Stopper position ① and ③)	A5※※	Stopper position ① and ③)
		S6※※	Stopper position ② and ④)	A6※※	Stopper position ② and ④)

※※ Section (Note 4)	
Blank	Port at stopper section: no port
D	Port at stopper section: side surface and bottom side ports presence
Blank	Stopper block material: Rolled steel
T	Stopper block material: Alloy steel (nitriding)
B with buffer	
B	Without switch groove
BL	With switch groove
Plug attached (Note 5)	
Blank	None
N	Plug for side piping attached
	(can not be selected for ø6 and ø25)

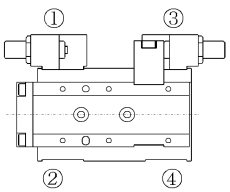
Note1: Stroke adjustable range of Hexagon socket set screw with urethane type stopper (standard) is 5 mm for one direction. When changing adjustable stroke range, use a discrete stopper.

Note2: Possible to change the stopper on the position (1) to the one on the position (4), and the stopper on the position (2) to the one on the position (3).
Be careful ; Impossible to change (1) to (2) and (3) to (4).

Note3: Standard port positions will be at (1) and (3) upper if no stopper is provided.

Note4: Selectable only when a stopper is used.

Note5: Select when using with rear piping.



6.2 Component Parts Model Coding

1) Switch

For ϕ6 to ϕ12

SW – F2H

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

For ϕ16 to ϕ25

SW – T2H

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

Buffer

SW – F 2 V 3

Output type	
2	2 wire solid state DC
3	3 wire solid state DC

Radial lead wire

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

2) How to order stopper set

Stopper section and stopper for adjustable stroke or shock absorber stopper set

Use when changing from standard to “with stopper for adjustable stroke” or “with shock absorber stopper”

LCR – 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	For stopper position 1 or 4
2	For stopper position 2 or 3

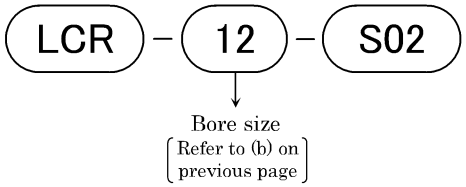
Port at stopper section	
Blank	No port
D	With ports on side and bottom

Port Adjustable stroke length at stopper section	
Blank	5mm Adjustable stroke range 5mm
S02	Adjustable stroke range 15mm
S03	Adjustable stroke range 25mm

Note 1:"S03" can not be selected with ø6 or ø8.

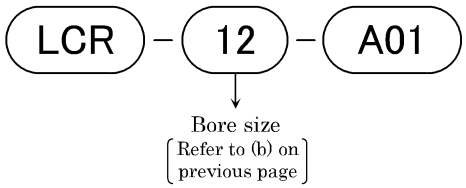
Note 2:Can not be selected with shock absorber type stopper "A".

3) How to order the discrete stopper for adjustable stroke
Hexagon socket head set screw with urethane
Used when changing the adjustable stroke range or setting to custom stroke length.



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

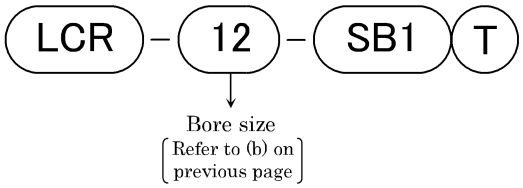
4) How to order the discrete shock absorber stopper
Sets of shock absorber and stopper cap
Use for changing from shock absorber type stopper to stopper for adjustable stroke.



Applicable shock absorber model no.

Model	Shock absorber model no.
LCR-6	SKL-0804
LCR-8	SKL-0805
LCR-12	SKL-0805
LCR-16	SKL-1006
LCR-20	SKL-1208
LCR-25	SKL-1208

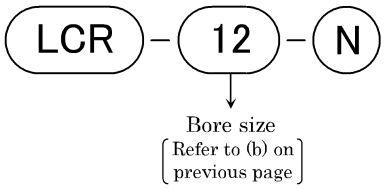
5) Discrete stopper block model no. display.
Used when changing standard type to stopper for adjustable stroke or shock absorber type stopper.



Stopper block	
SB1	ϕ6・ϕ8:30 mm stroke or less
	ϕ12 to ϕ25:50 mm stroke or less
SB2	ϕ6・ϕ8:40 mm stroke and over
	ϕ12 to ϕ25:75 mm stroke and over

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

6) Plug kit model no. display for side piping port



(2 piece/1 set)

7. SPECIFICATION

7.1 Product Specifications

Descriptions		LCR					
Bore size mm		φ6	φ8	φ12	φ16	φ20	φ25
Actuation		Double acting					
Working fluid		Compressed air					
Max. working pressure MPa		0.7					
Min. working pressure MPa		0.15 (note1)					
Proof pressure MPa		1.0					
Ambient temperature ℃		−10 to 60 (no freezing)					
Port size	Body side surface	M3	M5			Rc1/8	
	Rear body	M3				M5	Rc1/8
Relief port size		M3	M5			Rc1/8	
Stroke length tolerance mm		$^{+2.0}_{0}$ (note2)					
Working piston speed mm/s		50 to 500					
Cushion		Rubber cushioned					
Lubrication		Not required (when lubricating, use turbine oil Class 1 ISOVG 32.)					

Note1: 0.2MPa when using shock absorber type stopper of ø6.
Note2: When using without a stopper, be careful of the small gap between end plate and floating bush.
Note3: When use the stroke adjustment stopper, use it when it is 50 and 200 mm/s.

7.2 Switch Specifications

1) Type of switch and Applications

Model / Descriptions			Applications (Purpose)
Reed	2 wire	F2S	DC programmable controller
		F2H	
		F2V	
		F2YH	
		F2YV	
	3 wire	F3S	DC programmable controller, relay
		F3H	
		F3V	
		F3YH	
		F3YV	
	2 wire	T1H	DC programmable controller, relay, compact solenoid valve
		T1V	
		T2H	DC programmable controller
		T2V	
		T2WH	
		T2WV	
	3 wire	T3H	DC programmable controller, relay
		T3V	
		T3WH	
		T3WV	
Solid state	2 wire	T0H	AC / DC programmable controller, relay
		T0V	
		T5H	AC / DC programmable controller, relay, IC circuit (without indicator light), serial connection
		T5V	
		T8H	AC/DC programmable controller, relay
		T8V	

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	
	F2S	F3S
Applications	Programmable controller	Programmable controller, relay
Power supply voltage	—	DC10 to 28V
Load Voltage	DC10 to 30V	DC30V or less
Load Current	5 to 20mA (Note1)	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	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	Solid state	
	F2H, F2V	F3H, F3V
Applications	Programmable controller	Programmable controller, relay
Power supply voltage	—	DC10 to 28V
Load Voltage	DC10 to 30V	DC30V or less
Load Current	5 to 20mA (Note1)	100mA 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)	
Leakage current	1mA or less	10 μA or less
Lead wire length	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	Solid state	
	F2YH, F2YV	F3YH, F3YV
Applications	Programmable controller	Programmable controller, relay
Power supply voltage	—	DC10 to 28V
Load Voltage	DC24V±10%	DC30V or less
Load Current	5 to 20mA (Note1)	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/Green LED (ON lighting)	
Leakage current	1mA or less	10 μA or less
Lead wire length	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	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	

Note1: 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℃.

Descriptions	Reed					
	T0H, T0V			T5H, T5V		
Application	Programmable controller			Programmable controller relay, IC circuit (without indicator light), serial connection		
Load Voltage	DC12/24V	AC110V	AC220V	DC5/12/24V	AC110V	AC220V
Load Current	5 to 50mA	7 to 20mA	7 to 10mA	50mA or less	20mA or less	10mA or less
Current consumption	—					
Internal voltage drop	3V or less			0V		
Indicator light	LED (ON lighting)			Without indicator light		
Leakage current	0mA					
Lead wire length	1m (Oil resistant vinyl cabtire code 2-conductor 0.2mm^2)					
Shock resistance	294m/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					

Descriptions	Solid state	
	T2H, T2V	T3H, T3V
Application	Programmable controller	Programmable controller, relay
Power supply voltage	—	DC10 to 28V
Load Voltage	DC10 to 30V	DC30V or less
Load Current	5 to 20mA (Note1)	100mA or less
Current consumption	—	10mA or less at DC24V
Internal voltage drop	4V or less	0.5V or less
Indicator light	LED (ON lighting)	
Leakage current	1mA or less	10μA or less
Lead wire length	1m (Oil-proof cabtyre cord, 2-wire, 0.2mm^2)	1m (Oil-proof cabtyre cord, 3-wire, 0.2mm^2)
Shock resistance	980m/s^2	
Insulation resistance	20MΩ or more measuring with DC500V megger tester	
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	
	T2WH, T2WV	T3WH, T3WV
Application	Programmable controller	Programmable controller, relay
Power supply voltage	—	DC10 to 28V
Load Voltage	DC24V±10%	DC30V or less
Load Current	5 to 20mA (Note1)	100mA or less
Current consumption	—	10mA or less at DC24V
Internal voltage drop	4V or less	0.5V or less
Indicator light	Red / Green LED (ON lighting)	
Leakage current	1mA or less	10μA or less
Lead wire length	1m (Vinyl cabtyre cord, 2-wire, 0.2mm^2)	1m (Vinyl cabtyre cord, 3-wire, 0.2mm^2)
Shock resistance	980m/s^2	
Insulation resistance	20MΩ or more measuring with DC500V megger tester	
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	

Note1: 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℃.

Descriptions	Solid state	Reed		
	T1H, T1V	T8H, T8V		
Application	Programmable controller, relay, compact solenoid valve	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
Current consumption	—			
Internal voltage drop	7V or less	3V or less		
Indicator light	LED (ON lighting)			
Leakage current	1mA or less with AC100 2mA or less with AC200	0mA		
Lead wire length	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 type), oil resistance			

Note1: 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℃.