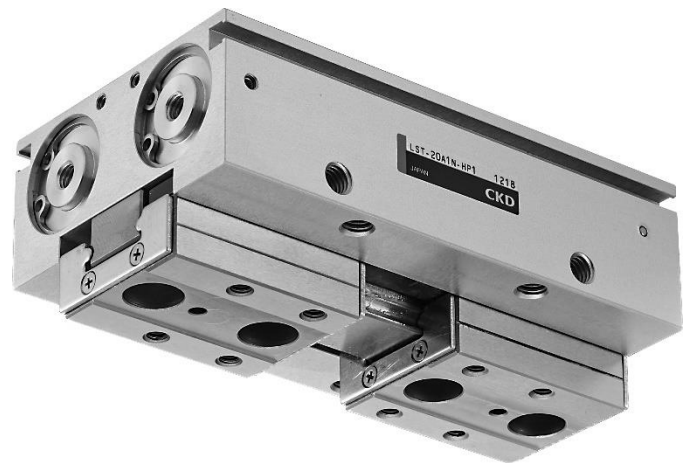


Thin Long Stroke Hand LST-HP1 Series

INSTRUCTION MANUAL

SM-A46855-A



- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

PREFACE

Thank you for purchasing CKD's **"LST-HP1 Series" Thin long stroke hand**.

This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.

Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product is intended for users who have basic knowledge about materials, piping, electricity, and mechanisms of pneumatic components. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur due to fluid, piping, or other conditions. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device, the fluid control circuit, and the electric system that controls such mechanism is ensured.

To ensure the safety of device design and control, observe organization standards, relevant laws and regulations, which include the following:

JIS B 8370 (the latest edition), the High Pressure Gas Safety Act, the Industrial Safety and Health Act, other safety rules, organization standards, relevant laws and regulations

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.

Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

 DANGER	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
 WARNING	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
 CAUTION	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation. All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.



Indicates general precautions and tips on using the product.

Precautions on Product Use

WARNING

The product must be handled by a qualified person who has extensive knowledge and experience.

The product is designed and manufactured as a device or part for general industrial machinery.

Use the product within the specifications.

The product must not be used beyond its specifications. Also, the product must not be modified and additional work on the product must not be performed.

The product is intended for use in devices or parts for general industrial machinery. It is not intended for use outdoors or in the conditions or environment listed below.

- In applications for nuclear power, railroad system, aviation, ship, vehicle, medical equipment, and equipment that directly touches beverage or food.
- For special applications that require safety including amusement equipment, emergency shut-off circuit, press machine, brake circuit, and safety measures.
- For applications where life or properties may be adversely affected and special safety measures are required.

(Exception is made if the customer consults with CKD prior to use and understands the specifications of the product. However, even in that case, safety measures must be taken to avoid danger in case of a possible failure.)

Do not handle the product or remove pipes and devices until confirming safety.

- Inspect and service the machine and devices after confirming the safety of the entire system. Also, turn off the energy source (air supply or water supply) and power to the relevant facility. Release compressed air from the system and use extreme care to avoid water or electric leakage.
- Since there may be hot or live parts even after operation has stopped, use extreme care when handling the product or removing pipes and devices.
- When starting or restarting a machine or device that incorporates pneumatic components, make sure that a safety measure (such as a pop-out prevention mechanism) is in place and system safety is secured.

Precautions on Design and Selection

WARNING

Install a protective cover as a safety measure if the moving workpiece can pose a risk to humans or if human fingers can get caught in the finger and/or the attachment.

Take proper measures to prevent the workpiece from falling so that people are not injured and machines and devices are not damaged.

If the circuit pressure drops due to a power failure or a problem with the air source, the gripping power may decrease and the workpiece may fall.

Precautions on Product Disposal

CAUTION

When disposing of the product, comply with laws pertaining to disposal and cleaning of wastes and have an industrial waste disposal company dispose of the product.

CONTENTS

PREFACE	i
SAFETY INFORMATION	ii
Precautions on Product Use	iii
Precautions on Design and Selection	iii
Precautions on Product Disposal	iv
CONTENTS	v
1. PRODUCT OVERVIEW	1
1.1 Model Number Indication.....	1
1.1.1 LST-HP1 Series.....	1
1.1.2 Switch model number.....	1
1.2 Specifications.....	2
1.2.1 Product specifications	2
1.2.2 Switch specifications	3
2. INSTALLATION	4
2.1 Environment.....	4
2.2 Unpacking	5
2.3 Mounting	5
2.3.1 Mounting the body.....	5
2.3.2 Finger.....	8
2.3.3 Mounting the switch.....	9
2.3.4 Changing the position of the switch	10
2.3.5 Replacing the switch	10
2.4 Piping	11
2.5 Wiring	13
2.5.1 Proximity switch.....	13
3. USAGE	16
3.1 Using the Hand	16
3.2 Using the Switch	17
4. MAINTENANCE AND INSPECTION	18
4.1 Periodic Inspection.....	19
4.1.1 Inspection item	19
4.1.2 Maintenance of the product.....	19
4.1.3 Maintenance of the circuit	19
4.1.4 Consumable parts	20
5. TROUBLESHOOTING	22
5.1 Problems, Causes, and Solutions	22
5.1.1 Finger (cylinder).....	22
5.1.2 Switch	23
6. WARRANTY PROVISIONS	24
6.1 Warranty Conditions	24
6.2 Warranty Period	24

1. PRODUCT OVERVIEW

1.1 Model Number Indication

1.1.1 LST-HP1 Series

■ Example of model number indication

Without switch (built-in magnet for switch)

LST - 08 A 1 N — HP1

With switch (built-in magnet for switch)

LST - 08 A 1 N - F2H - D - HP1

A Bore size (mm)

B Stroke length

C Port position

D High precision positioning hole

E Switches model number

F Switch quantity

Code	Description					
A Bore size (mm)						
08	ø8					
12	ø12					
16	ø16					
20	ø20					
B Stroke						
A	Short stroke length					
B	Middle stroke					
C	Long stroke					
C Port position						
1	Standard, axis direction					
2	Side piping					
D High precision positioning hole						
N	None					
A	Yes					
E Switch model No.						
Lead wire Straight	Lead wire L-shaped	Contact	Voltage AC DC		Display	Lead wire
-	F2S*	Proximity		●	1-color display	2-wire
-	F3S*			●		3-wire
F2H*	F2V*			●		2-wire
F3H*	F3V*			●		3-wire
F3PH*	F3PV*			●		3-wire
* Lead wire length						
Blank	1 m (standard)					
3	3 m (option)					
F Switch quantity						
R	1 on open side					
H	1 on closed side					
D	2					

1.1.2 Switch model number

SW - F2H*

Switch model No.
(above E item)

1.2 Specifications

1.2.1 Product specifications

Descriptions		LST-HP1											
		LST-08			LST-12			LST-16			LST-20		
		A	B	C	A	B	C	A	B	C	A	B	C
Bore size	mm	φ8×2			φ12×2			φ16×2			φ20×2		
Actuation		Double acting											
Max. working pressure	MPa	0.7											
Min. working pressure	MPa	0.15			0.1								
Ambient temperature		°C		-10 to 60 (no freezing)									
Port size		M3			M5								
Operating stroke length	mm	8	16	32	12	24	48	16	32	64	20	40	80
Repeatability		mm		±0.03									
Product weight	kg	0.09	0.12	0.16	0.19	0.24	0.34	0.42	0.54	0.79	0.78	1.03	1.49
Lubrication		Not required											

1.2.2 Switch specifications

Type/Model no.	Proximity 2-wire type	Proximity 3-wire type	
Descriptions	F2H/V, F2S	F3H/V, F3S	F3PH/V
Applications	Only for programmable controller	For programmable controller, relay	
Output method	-	NPN	PNP
Power supply voltage	-	10 VDC to 28 VDC	4.5 VDC to 28 VDC
Load voltage	10 VDC to 30 VDC	30 VDC or less	
Load current	5 mA to 20 mA ^{Note 2}	50 mA or less	
Current consumption	-	10 mA or less at 24 VDC	
Internal voltage drop	4 V or less	0.5 V or less	30 mA or less at 0.5 VDC
Indicator	Yellow LED (Lights up when turned on) ^{Note3,4}		Yellow LED (Lights up when turned on)
Leakage current	1 mA or less	10 μA or less	
Lead wire length ^{Note 1}	Standard is 1 m (Elasticity,Oil-resistant vinyl cabtyre 2 core cord, 0.15 mm ²)	Standard is 1 m (Elasticity,Oil-resistant vinyl cabtyre 3 core cord, 0.15 mm ²)	
Shock resistance	980 m/s ²		
Insulation resistance	20 MΩ or more with 500 VDC megger		
Withstand voltage	No abnormality after applying 1000 VAC for one minute		
Ambient temperature	-10°C to 60°C		
Degree of protection	IP 67 (IEC standard), JIS C 0920 (watertight), oil-resistant		

Note 1: 3 m lead wires are available as options.

Note 2: The maximum load current of 20 mA is the value when the ambient temperature is 25°C.

The current will be lower than 20 mA when the ambient temperature of the switch is higher than 25°C (5 mA to 10 mA at 60°C).

Note 3: The indicator is red LED for F2S and F3S.

Note 4: When mounting two F2S or F3S switches to one groove to detect both ends, mount the switches so that their set screws face outward.

※ "F□H" show Lead wire straight type, as well as "F□V" show Lead wire angled type.

2. INSTALLATION

2.1 Environment

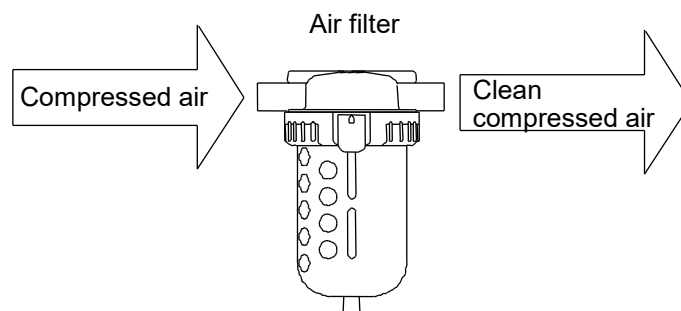
CAUTION

When using the product in a cutting, casting, or welding plant, install a cover to prevent foreign matters such as cutting fluid, chips, powder, and dust from entering.

Do not use the equipment in the following environments.

- Where cutting oil can splash onto the product (abrasives and polishing powder in the oil can abrade the sliding section)
- Where organic solvents, chemicals, acids, alkalis, and kerosene are present
- Where water can splash onto the product

- Use the product within the following ambient temperature range.
–10°C to 60°C (no freezing)
- For compressed air, use clean and dry air that has been passed through an air filter. Use an air filter in the circuit and be careful with the filtration rate (a filter that removes particles exceeding 5 µm is desirable), flow rate, and mounting position (install the filter near the directional control valve).



2.2 Unpacking

- Check that the model number ordered and the model number indicated on the product are the same.
- Check the exterior of the product for any damage.
- When storing the product, take proper measures to prevent foreign matters from entering the cylinder.

2.3 Mounting

WARNING

Install a protective cover as a safety measure if the moving workpiece can pose a risk to humans or if human fingers can get caught in the finger and/or the attachment.

Take proper measures to prevent the workpiece from falling so that people are not injured and machines and devices are not damaged.

If the circuit pressure drops due to a power failure or a problem with the air source, the gripping power may decrease and the workpiece may fall.

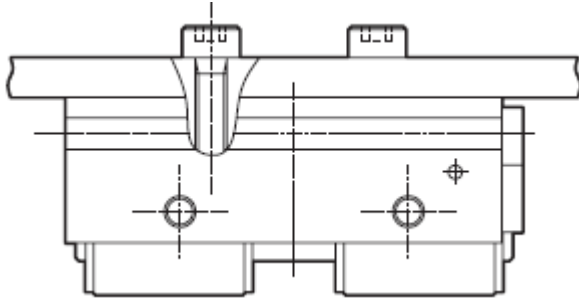
2.3.1 Mounting the body

The body can be mounted from four mounting surfaces with tap holes and one surface with through holes. Select the mounting direction appropriate for the application. Do not put any dents and scratches on the body mounting surface or the finger that may affect their flatness and perpendicularity.

■ Tightening Torque

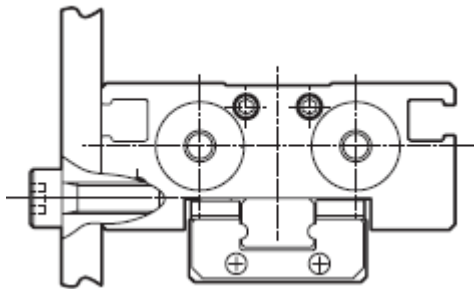
When mounting the product where vibrations may occur, take measures (such as installing a spring washer or applying an adhesive) to prevent the bolt from loosening.

● Top mounting



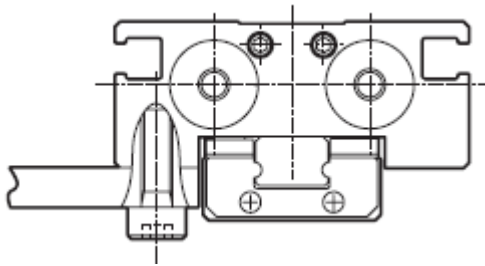
Model	Bolt size	Tightening torque (N·m)	Max. screw-in depth
LST-08	M3 × 0.5	0.88	7
LST-12	M4 × 0.7	2.1	10
LST-16	M5 × 0.8	4.3	12
LST-20	M6 × 1.0	7.3	15

● Front mounting



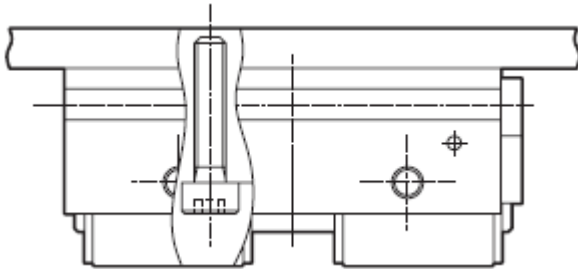
Model	Bolt size	Tightening torque (N·m)	Max. screw-in depth
LST-08	M3 × 0.5	0.59	4
LST-12	M4 × 0.7	1.6	5
LST-16	M5 × 0.8	3.3	5.5
LST-20	M6 × 1.0	5.8	6

● Bottom mounting



Model	Bolt size	Tightening torque (N·m)	Max. screw-in depth
LST-08	M3 × 0.5	0.59	4
LST-12	M4 × 0.7	1.6	5
LST-16	M5 × 0.8	3.3	5.5
LST-20	M6 × 1.0	5.8	6

● Using through holes



Model	Bolt size	Tightening torque (N·m)
LST-08	M2.5 × 0.45	0.32
LST-12	M3 × 0.5	0.88
LST-16	M4 × 0.7	2.1
LST-20	M5 × 0.8	4.3

■ Allowable load

For details, refer to the "Model selection" pages in the catalog.

2.3.2 Finger

■ Rigidity of the attachment

If the attachment is not rigid enough, sagging can result and cause the finger to twist or adversely affect operation.

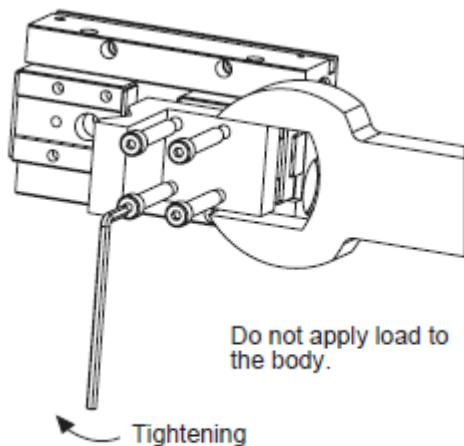
■ Mounting the attachment

The effect on the hand body must be taken into consideration when mounting the attachment to the finger. Support the attachment with a wrench when tightening it so as not to twist the finger.

Be careful not to apply a lateral load to the finger when mounting the attachment.

Backlash or damage may occur when an excessive lateral load or an impact load is applied.

Tighten with the following tightening torque when mounting.



Model	Bolt size	Tightening torque (N·m)
LST-08	M2.5 × 0.45	0.32
LST-12	M3 × 0.5	0.59
LST-16	M4 × 0.7	1.4
LST-20	M4 × 0.7	1.4

■ Clamping operation

Clamping operation is accurate when performed as softly as possible at a low speed. Repeatability is also stable.

■ Attachment

- Use attachments as short and lightweight as possible. If the attachments is long and heavy, inertia increases when opening and closing. This may cause play in the finger, and adversely affect durability.

- Refer to the catalog's "Model selection" page for length of attachment.

- The weight of the attachment affects durability, so check that the weight is less than the following value.

$$W < 1/4 H \text{ (1 pc.)}$$

W: Weight of attachment

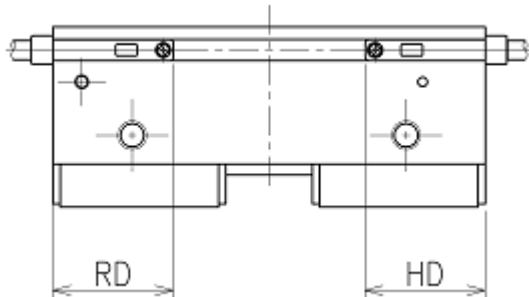
H : Product weight of Hand

2.3.3 Mounting the switch

■ Mounting position

<Mounting the switch at the open-side end position and/or the closed-side end position>

For the switch to function at maximum sensitivity, mount the switch at the RD dimension on the open-side end position and/or at the HD dimension on the closed-side end position (refer to the catalog).



<Mounting the switch at the intermediate position of the stroke>

For the switch to function at an intermediate position of the stroke, secure the piston at the position where the switch needs to function and then slide the switch on the piston back and forth to find the positions where the switch turns on when slid forward and when slid backward. The intermediate point between these two positions is where the switch functions at maximum sensitivity for that piston position and where the switch is to be mounted.

■ Operating range

This is the range from where the switch is turned on when the piston moves and to where the switch is turned off when the piston moves farther in the same direction.

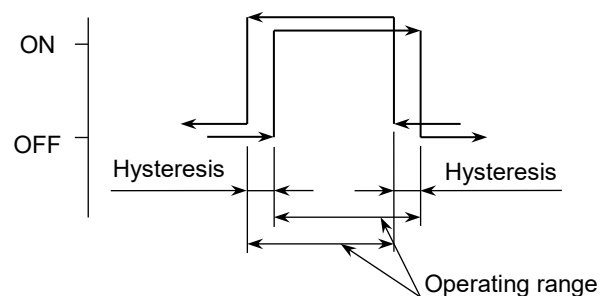
The center of the operating range is the maximum sensitivity position.

When the piston stop position is set at the maximum sensitivity position, disturbances are not easily received and the switch operation will be stable.

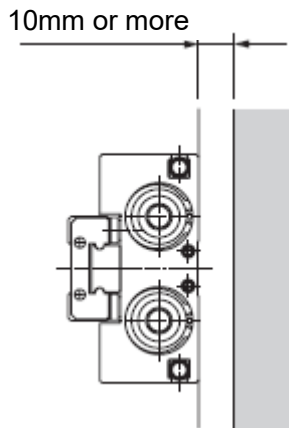
■ Hysteresis

This is the distance from where the switch is turned on when the piston moves and to where the switch is turned off when the piston moves in the opposite direction.

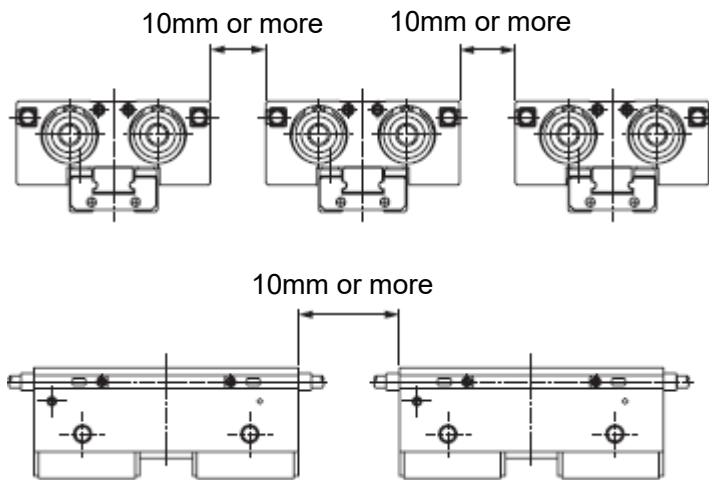
If the piston stops within this distance, the switch operation will become unstable and disturbances are easily received.



The cylinder switch may malfunction if there is a magnetic object such as a steel plate installed nearby. Make sure that there is a distance of at least 10 mm between the magnetic object and the surface of the hand.



The cylinder switch may malfunction if the hand units are placed adjacently. Make sure to provide the following distance between each unit.



2.3.4 Changing the position of the switch

- 1** Loosen the fastening screw (set screw).
- 2** Move the switch body along the groove on the side of the body and tighten it in place.

2.3.5 Replacing the switch

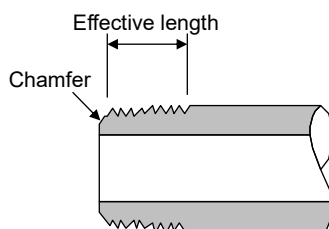
- 1** Loosen the fastening screw (set screw) and remove the switch body from the groove.
- 2** Put the replacement switch into the groove.
- 3** Determine where to position the switch and tighten the screw.
(The tightening torque for the fastening screw is 0.03N·m to 0.08 N·m for F2 and F3 switches.)

2.4 Piping

WARNING

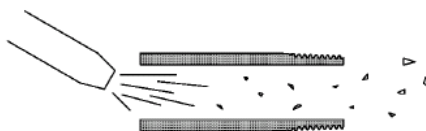
Insert the tube into the fitting until it firmly rests on the tube end and make sure that the tube does not come off before use.

- Use pipes that are made of corrosion-resistant materials after the filter such as zinc-plated pipes, nylon tubes, and rubber tubes.
- Use pipes with an effective cross-sectional area that allows the cylinder to achieve the predetermined piston speed.
- Install the filter for removing rust, foreign matters, and drainage from the piping as close as possible to the solenoid valve.
- Observe the effective thread length for the gas pipes.
- In addition, chamfer the threaded end of the pipes by about a 1/2 pitch.



■ Pipe cleaning

Before piping, blow air into the pipes to clean the interior and to remove cutting chips and foreign matters.



■ Seal material

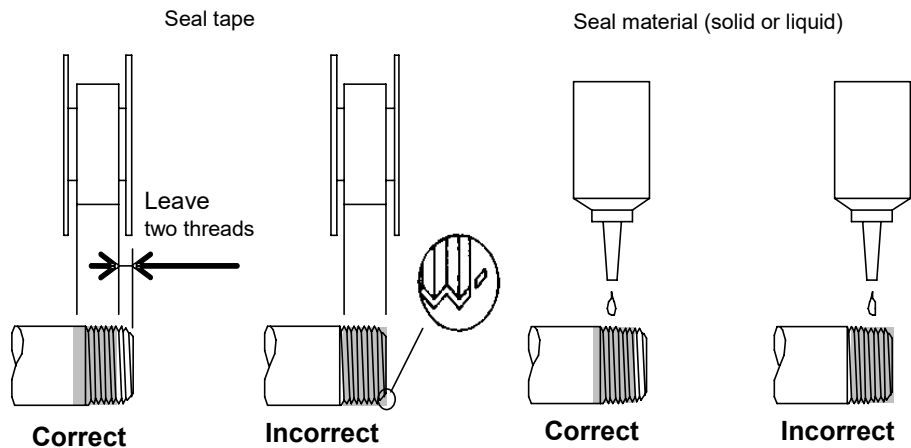
Use a seal tape or a seal material to stop leakage from piping.

Apply a seal tape or seal material to the screw threads leaving two or more threads at the pipe end uncovered or uncoated. If the pipe end is fully covered or coated, a shred of seal tape or residue of seal material may enter inside of the pipes or device and cause a failure.

When using a seal tape, wind it around the screw threads in the direction opposite from the screw threads and press it down with your fingers to attach it firmly.

When using a liquid seal material, be careful not to apply it to resin parts. The resin parts can become damaged and this may lead to a failure or malfunction.

Also, do not apply seal material to the internal threads.



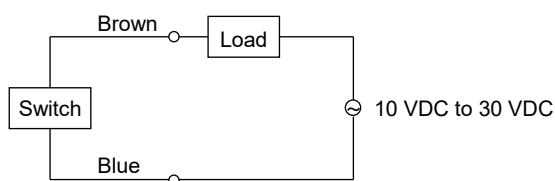
2.5 Wiring

2.5.1 Proximity switch

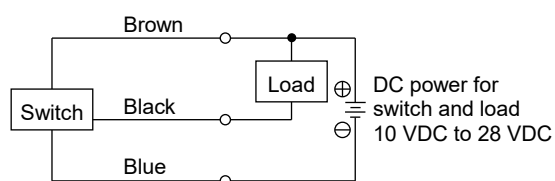
■ Connection of lead wires

Turn off the power to the device in the electric circuit to which the switch is to be connected and connect the lead wires according to their color. Not turning off the power may cause damage to the electric circuit of the switch load.

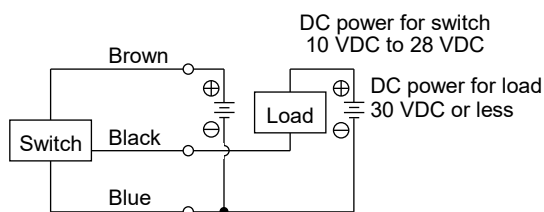
If the switch is not wired correctly or the load is short-circuited, it may cause damage not only to the switch but also to the electric circuit on the load side.



Example of 2-wire basic circuit



Example of 3-wire basic circuit (1)
(When same power is used for switch and load)

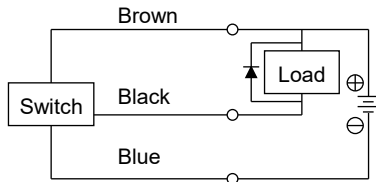


Example of 3-wire basic circuit (2)
(When separate power is used for switch and load)

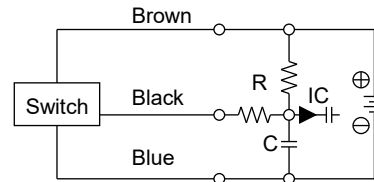
■ Protection of the output circuit

For the following cases, refer to the figures below and install a protection circuit:

- When an inductive load (relay or solenoid valve) is connected and used: See Ex. 1
Use a surge absorption element since a surge voltage is generated when the switch is turned off.
- When a capacious load (capacitor) is connected and used: See Ex. 2
Use a current regulating resistor since a starting current is generated when the switch is turned on.
- When the lead wire length exceeds 10 m: See Ex. 3 and 4 (2-wire type), Ex. 5 (3-wire type)

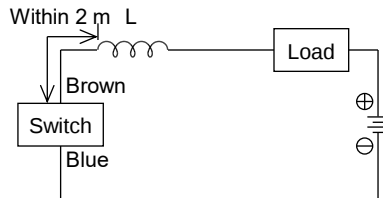


Ex. 1 Using inductive load with surge absorption element (diode). (For diode, use V06C manufactured by Hitachi or equivalent.)



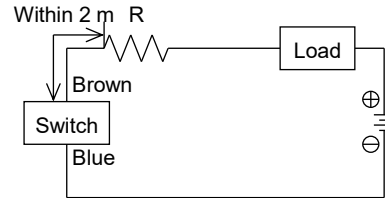
Ex. 2 Using capacious load with current regulating resistor R.
Use the following formula to figure out resistance R (Ω).

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



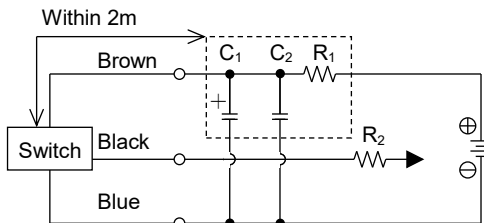
Ex. 3 - Choke coil
L = Several hundred μH to several mH
Excellent high frequency characteristic

- Wire near the switch (within 2 m).



Ex. 4 - Starting current restriction resistor
R = Highest possible resistance for the load circuit.

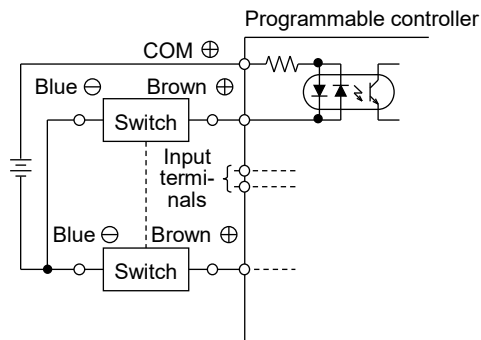
- Wire near the switch (within 2 m).



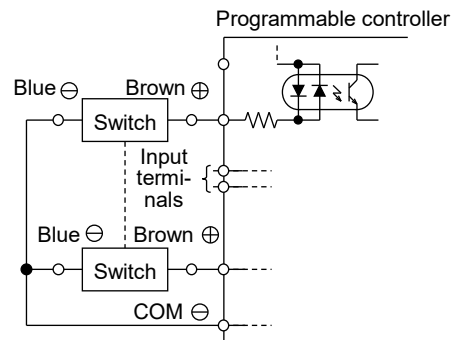
Ex. 5 - Power supply noise absorption circuit
C₁=20 μF to 50 μF electrolytic capacitor (withstand voltage 50V or more)
C₂=0.01 μF to 0.1 μF ceramic capacitor
R₁=20 Ω to 30 Ω
- Starting current restriction resistor
R₂= Highest possible resistance for the load circuit.
- Wire near the switch (within 2 m)

■ Connection to the programmable controller

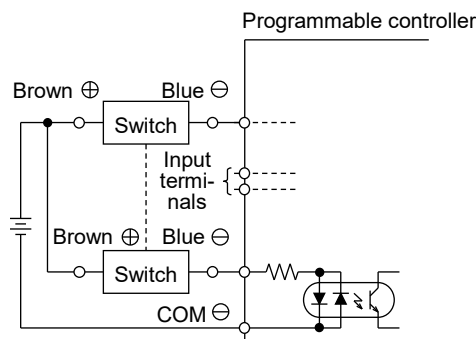
The connection method depends on the type of the programmable controller. Connect as shown below.



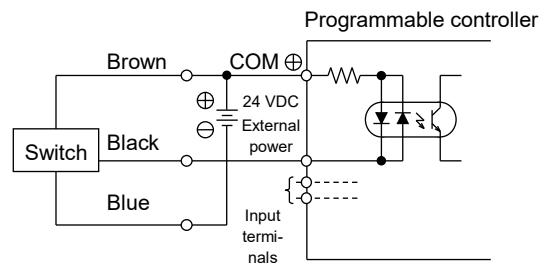
2-wire connection to source input
(external power)



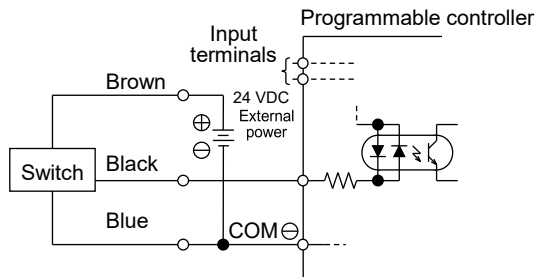
2-wire connection to source input
(internal power)



2-wire connection to sink input
(external power)



3-wire connection to source input
(external power)



3-wire connection to source input
(internal power)

■ Parallel connection

Since the leakage current of a 2-wire type switch increases according to the number of connected units, check the input specifications of the programmable controller, which is a connected load, to determine the number of switches to connect. For the 2-wire type switch, the indicator may become dim or not light up.

Although the leakage current of a 3-wire type switch increases according to the number of connected units, the leakage current is very small (10 μ A or less) and can generally be ignored. For the 3-wire type switch, the indicator will light up without dimming.

3. USAGE

3.1 Using the Hand

CAUTION

Do not apply excessive load to the finger when attaching, removing, or transferring the workpiece.

Scratches and dents may occur on the rolling surface of the finger linear guide and possibly cause a malfunction.

■ Adjustment of the piston speed

Adjust the opening and closing speeds of the hand with the speed controller (sold separately). When used at a high speed, backlash may occur sooner than expected. In addition, the workpiece may vibrate due to shocks from opening or closing and this may lead to erroneous handling, erroneous insertion of workpiece, and poor repeatability.

■ Prevention of condensation

Condensation (water drops) may occur in the piping under certain conditions if an actuator with small bore size or short stroke is operated at high frequency. Use a quick exhaust valve to prevent condensation.

3.2 Using the Switch

■ Magnetic environment

Do not use the switch in a place where there is a strong magnetic field or large current (such as a large magnet or welding machine). If switch mounted cylinders are installed close to each other and in parallel or if magnetic substances are moving close to the cylinder, the magnetic forces may interfere with each other and affect the detection accuracy.

■ Wiring of lead wires

When wiring, be careful not to apply bending stress and tension repeatedly to lead wires. For movable sections, use wiring material with the same level of bending resistance as the robot wire.

■ Ambient temperature

Do not use the switch in a high temperature environment (60°C or more). Using the switch in a high temperature environment may affect its performance due to the temperature characteristics of magnetic parts and electronic parts.

■ Shock

Do not subject the product to strong vibrations and shocks when transporting the cylinder and mounting and adjusting the switch.

4. MAINTENANCE AND INSPECTION

WARNING

Do not touch electrical wiring connections (bare live parts) of actuators equipped with switches, and other such actuators.

Do not touch live parts with bare hands.

An electric shock may occur.

CAUTION

Plan and perform daily and periodic inspections so that maintenance can be managed properly.

If maintenance is not properly managed, the product's functions may deteriorate significantly and this may lead to faults (such as short service life, damage, and malfunction) or accidents.

4.1 Periodic Inspection

In order to use the product under optimum conditions, perform a periodic inspection every six months or when the operation count reaches 5 hundred thousand times.

4.1.1 Inspection item

- Actuation state
- Air leakage
- Looseness of screws and bolts
- Backlash in the finger
- Stroke abnormality

Check the items above and refer to "5. TROUBLESHOOTING" to correct any abnormality found. If there are loose threaded connections, tighten them.

4.1.2 Maintenance of the product

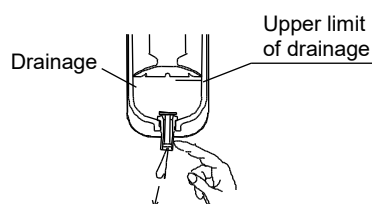
- Regularly grease the sliding section of the finger with grease. Regular greasing can extend service life further.

Manufacturer	Model
THK	AFF grease

- If a problem such as an air leakage occurs, disassemble the product referring to "Internal structure" page in the catalog and then replace the parts listed as consumable parts.

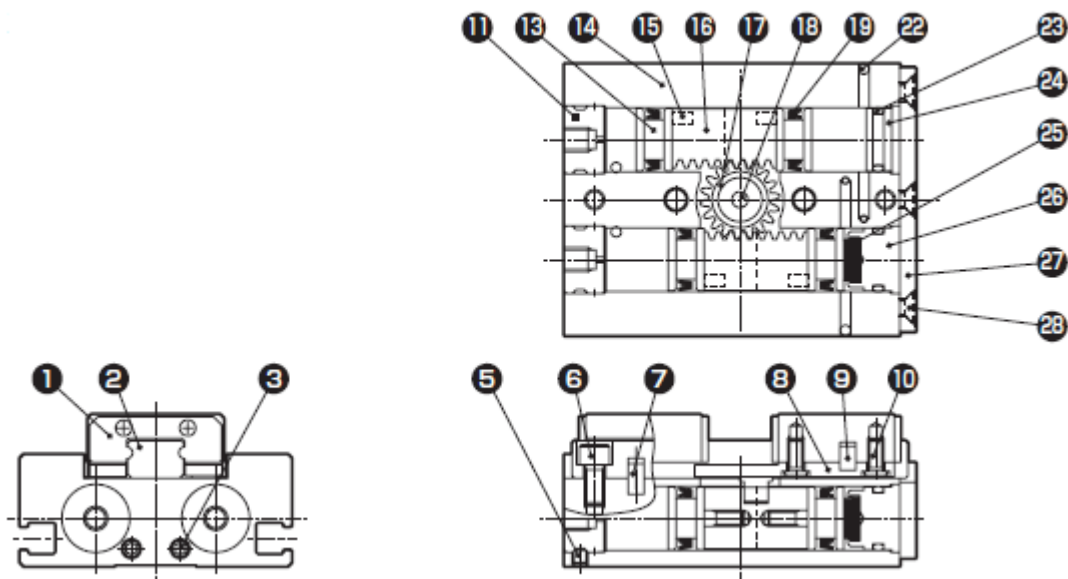
4.1.3 Maintenance of the circuit

- Discharge the drainage accumulated in the air filter periodically before it exceeds the specified line.
- Since foreign matters such as carbide (carbon or tar substance) from the compressor oil may contaminate the circuit and cause an operation fault of the solenoid valve or the cylinder, be careful when performing maintenance or inspection of the compressor.

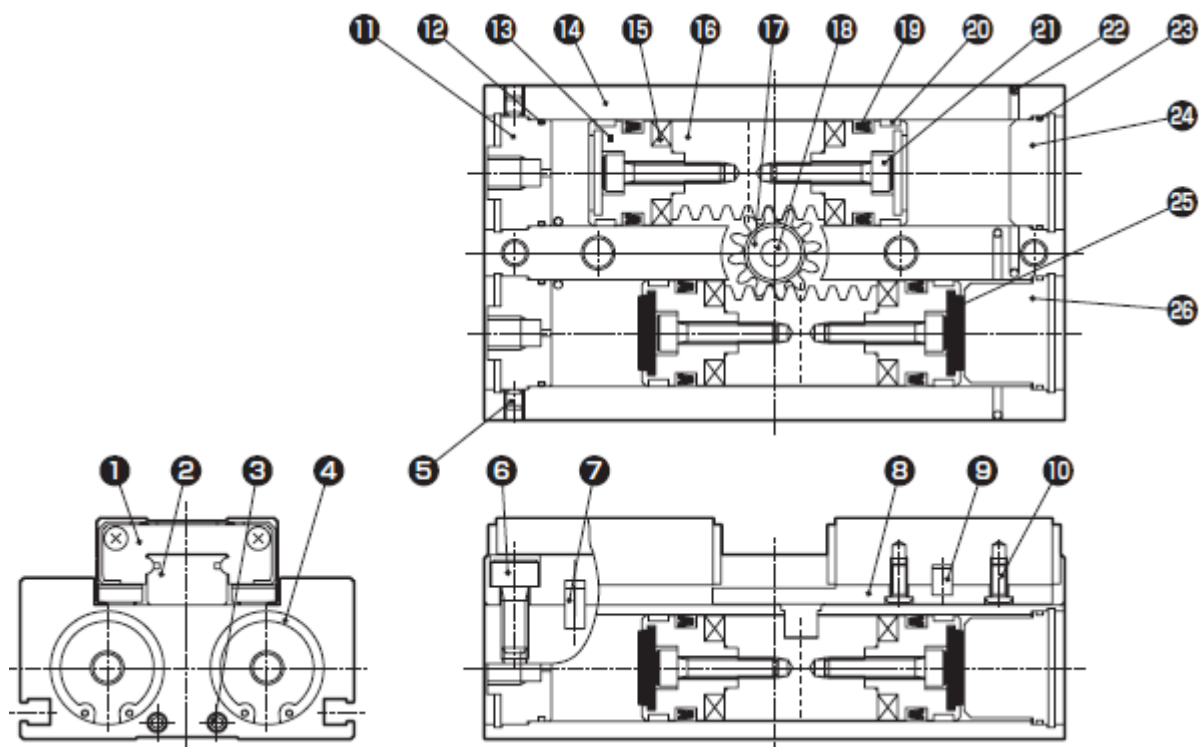


4.1.4 Consumable parts

LST-08A,B,C



LST-12 to 20A,B,C



Parts list

No.	Part name	Material	Remarks
1	Finger	Stainless steel	
2	Linear guide	Stainless steel	
3	Hexagon socket set screw	Stainless steel	
4	Round R-type stop ring	Steel	φ12
	C-type stop ring	Steel	φ16 to 20
5	Hexagon socket set screw	Stainless steel	
6	Hexagon socket head cap screw	Stainless steel	
7	Pin	Stainless steel	
8	Rack joint	Stainless steel	
9	Pin	Stainless steel	
10	Pan head machine screw	Stainless steel	
11	Port cover	Aluminum alloy	Chromate
12	O-ring	NBR	
13	Piston	Aluminum alloy	φ8 is stainless steel
14	Body	Aluminum alloy	Hard alumite
15	Magnet	—	
16	Rack	Stainless steel	
17	Pinion	Alloy steel	
18	Pin	Stainless steel	
19	Piston packing	NBR	
20	Wear ring	Acetal resin	Excluding φ8A and B
21	Hexagon socket head cap screw	Stainless steel	
22	Steel ball	Stainless steel	
23	O-ring	NBR	
24	Cover1	Aluminum alloy	Chromate
25	Cushion rubber	Urethane rubber	
26	Cover 2	Aluminum alloy	Chromate
27	Cover 3	Stainless steel	φ8 only
28	Cross-recessed flat head machine screw	Stainless steel	φ8 only

Consumable parts list

Bore size (mm)	Kit no.	Remarks
φ8	LST-08K-HP1	Part no. 12,19,20,23,25
φ12	LST-12K-HP1	
φ16	LST-16K-HP1	
φ20	LST-20K-HP1	

5. TROUBLESHOOTING

5.1 Problems, Causes, and Solutions

If the product does not operate properly, check the table below for a possible solution.

5.1.1 Finger (cylinder)

Problem	Cause	Solution
Finger does not operate.	No pressure or insufficient pressure is applied.	Secure sufficient pressure.
	No signal is input to directional control valve.	Repair the control circuit.
	Centers were not aligned when mounted.	Correct the way the cylinder is mounted. Change the mounting style.
	Piston packing is damaged.	Replace the packing.
Finger does not operate smoothly.	Speed is lower than minimum working piston speed.	Mitigate load fluctuation.
	Centers were not aligned when mounted.	Correct the way the cylinder is mounted. Change the mounting style.
	Lateral load is applied.	Install a guide. Correct the way the cylinder is mounted. Change the mounting style.
	Load is too large.	Increase the pressure. Enlarge the bore size.
	Speed control valve has meter-in circuit.	Change the mounting direction of the speed control valve.
Finger is damaged or deformed.	Force of shock due to high-speed actuation is excessive.	Decrease the speed. Lighten the load. Install a more effective cushion mechanism (external cushion mechanism).
	Lateral load is applied.	Install a guide. Correct the way the cylinder is mounted. Change the mounting style.

5.1.2 Switch

Problem	Cause	Solution
Switch turns on but indicator does not blink.	Contact is welded.	Replace the switch.
	Rating of load is exceeded.	Replace the relay with one recommended by CKD or replace the switch.
	Indicator is damaged.	Replace the switch.
	External signal is faulty.	Check the external circuit.
Switch does not turn on.	Cables are disconnected.	Replace the switch.
	External signal is faulty.	Check the external circuit.
	Voltage is wrong.	Use specified voltage.
	Switch is not mounted in right place.	Mount the switch in right place.
	Switch is not positioned correctly.	Position and tighten the switch correctly.
	Switch is facing opposite direction.	Mount the switch so that it faces the correct direction.
	Load (relay) cannot respond for intermediate position detection.	Lower the speed. Replace the relay with one recommended by CKD.
	Rating of load is exceeded.	Replace the relay with one recommended by CKD or replace the switch.
Switch does not turn off.	Piston is not moving.	Move the piston.
	Contact is welded.	Replace the switch.
	Rating of relay is exceeded.	Replace the relay with one recommended by CKD or replace the switch.
	Ambient temperature is too high or too low.	Use the switch at an ambient temperature of -10°C to 60°C .
	Magnetic field is nearby.	Install a magnetic shield.
	External signal is faulty.	Check the external circuit.

If you have any other questions or concerns, contact your nearest CKD sales office or distributor.

6. WARRANTY PROVISIONS

6.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.

However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure caused by incorrect use such as careless handling or improper management.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure that could have been avoided if the customer's machinery or device, into which the product is incorporated, had functions and structures generally provided in the industry.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.

When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

6.2 Warranty Period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer.