CKD

SM－220101－A

INSTRUCTION MANUAL

THIN PARALLEL HAND

HL $^{A}_{B}$ 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 2nd 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:

⚠ Precautions:

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

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HLA / HLB Series

Thin parallel hand

Manual No. SM-220101-A

Dec. 03. 1999

1. PRODUCTS

1.1 Specification

Item \ Model code		HLA-12CS	HLA-15CS	HLA-20CS	HLB-12CS	HLB-15CS	HLB-20CS
Working fluid		Compressed air					
Max. working pressure	MPa	0.7					
Min. working pressure	MPa	0.3			0.1		
Ambient Temperature	℃	5 to 60					
Stroke	mm	15	20	25	13	18	23
Bore size	mm	12	15	20	12	15	20
Volumetric capacity (reciprocating)	cm^3	1.69	3.53	7.85	1.47	3.18	7.22
Repeatability (Initial valve)	mm	±0.03			±0.01		
Product weight	g	170	300	540	230	410	740
Lubrication		Not required. (Use Turbine oil, Class 1, ISO VG32 when required.)					

1.2 Characteristics of Unit

1) Two types are available: the bushing guide type and the bearing guide type
Select the type suitable for your purpose, the bushing guide type (HLA) for high impact resistance and the precision bearing guide type for smooth operation (HLB).

2) Small size, lightweight, compact
Having low profiles, the HL series thin parallel hands can be installed in limited space.
The bodies are simply and compactly designed for convenient use.

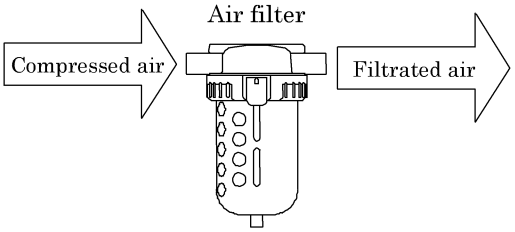
3) No dual-purpose adjustment required
The HL series thin parallel hands have long operating strokes, eliminating burdensome adjustments.

2
CAUTION

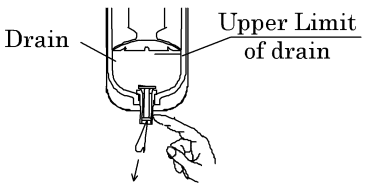
2. CAUTION

2.1 Fluid

1) It is necessary to use dehumidified air that has been filtered from compressed air. Carefully select an adequate filter that has an adequate filtration rate (preferably 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 before the level exceeds the mark line.



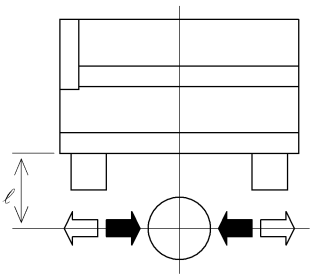
3) Note that the intrusion of carbide for the compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of the solenoid valve and the cylinder. Be sure to carry out thorough inspection and maintenance of the compressor.

4) This hand does not require lubrication. It is recommended, however, to use Turbine oil Class 1, ISO VG32 as lubricant if lubrication is preferred.

3. GRIPPING POWER

3.1 Gripping Power and Mass of Load

1) The table of Gripping Power on the next page represents the force with Claw length of l at either Opening motion or Closing motion and does not represent max. mass of load capable to grip.



2) Required gripping power varies remarkably depending on numerous elements.

- Friction coefficient between Load and Claws
- Moment of inertia of Load during transference
- Relative position between center of gravity of Load and Clamp location, also width of Claws
- Structure and configuration of Claws

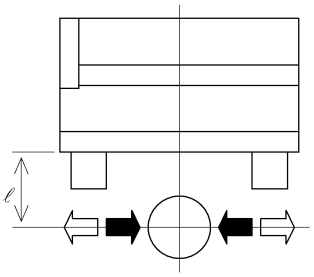
3.2 Guide line of Selecting appropriate model (required gripping power) comparing with mass of Load

Safety coefficients for holding power against mass of Load are set as follows although it varies depending on Coefficient between Load and Claw, Shape of Load and Claws, transferring condition etc. Make that brief guide line for selecting models.

- Holding only — 5 times or Over
- Normal transference — 10 times or Over
- Transference with high acceleration — 20 times or Over

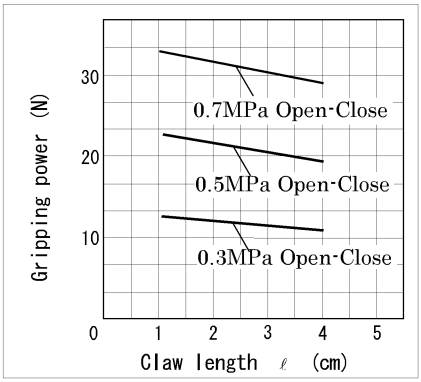
3.3 Data of Clumping Power

The following Tables represent the Gripping power in either opening motion or closing motion with Claw length ℓ of hand at 0.3, 0.5 & 0.7MPa of Supplying pressure.

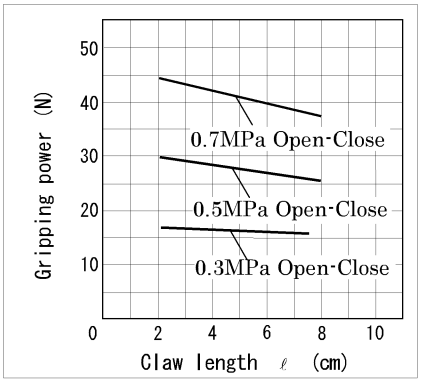


- Opening Motion (⇦) ---------- (Broken line)
- Closing Motion (➡) ———— (Full line)

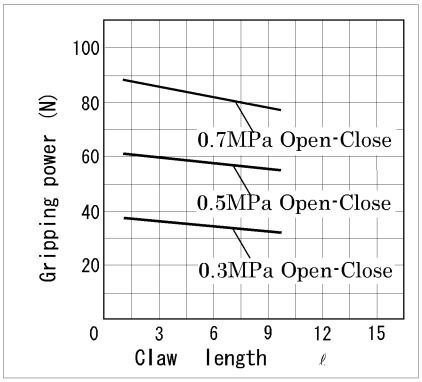
●HLA-12CS



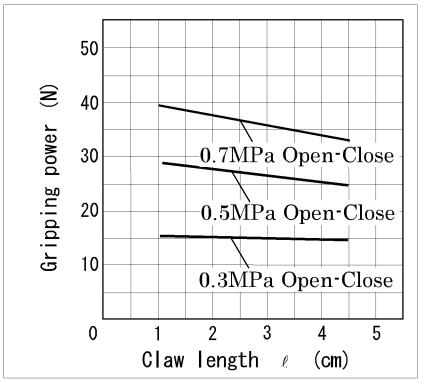
●HLA-15CS



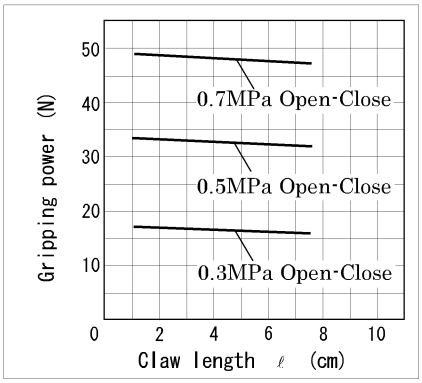
●HLA-20CS



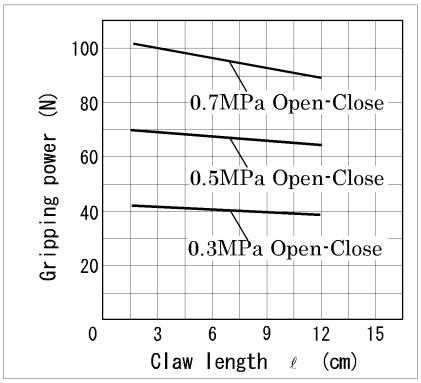
●HLB-12CS



●HLB-15CS



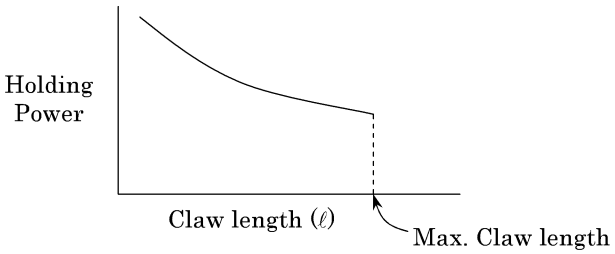
●HLB-20CS



3.4 Length of Claws

1) Make it short and light as much as possible because abrasion wear of moving parts of Master Jaw will be accelerated if claws are long and heavy.

2) Keep the claw length within the range of Tables above.



4. INSTALLATION

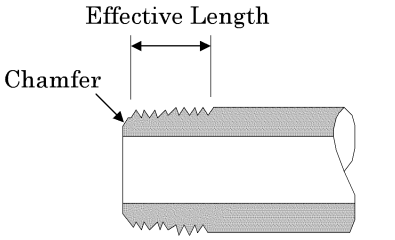
4.1 Piping

1) For piping beyond the filter, use pipes that hardly get corroded such as galvanized pipes, nylon tubes, rubber tubes, etc.

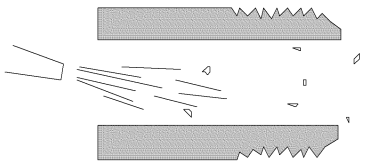
2) See to it that the pipe connecting cylinder and solenoid valve has effective cross-sectional area needed for the cylinder to drive at specified speed.

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.

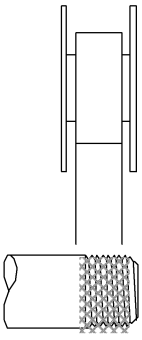


5) Flush air into the pipe to blow out foreign substances and chips before piping.



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

●Seal Tape



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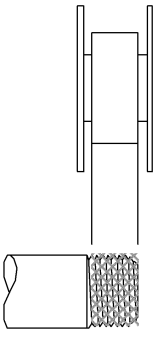

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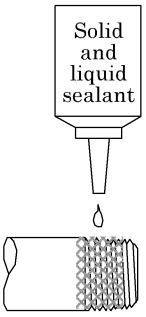
●Solid and liquid sealant



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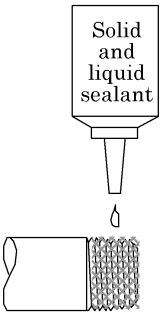
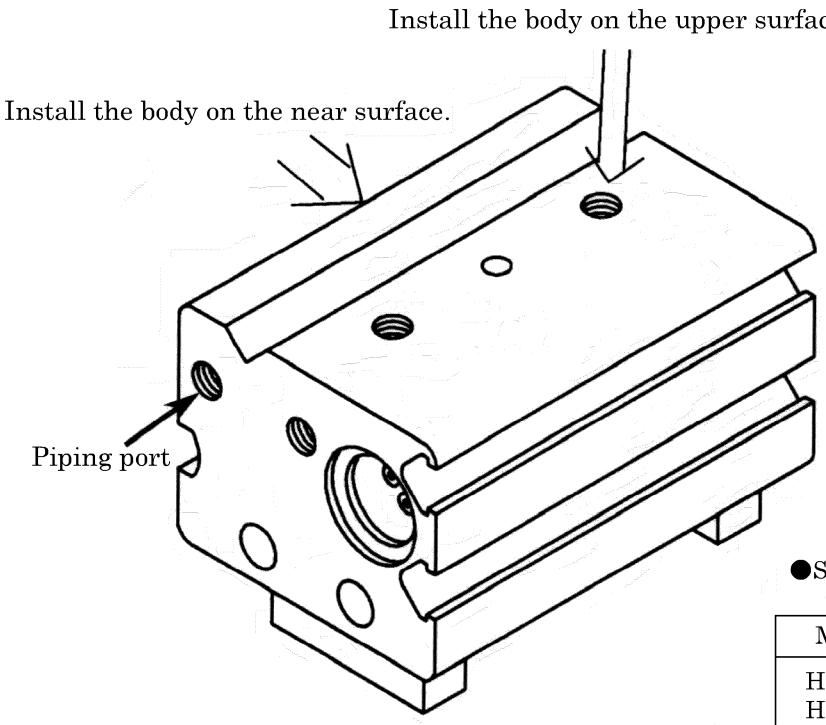


(Incorrect)

4.2 Installation

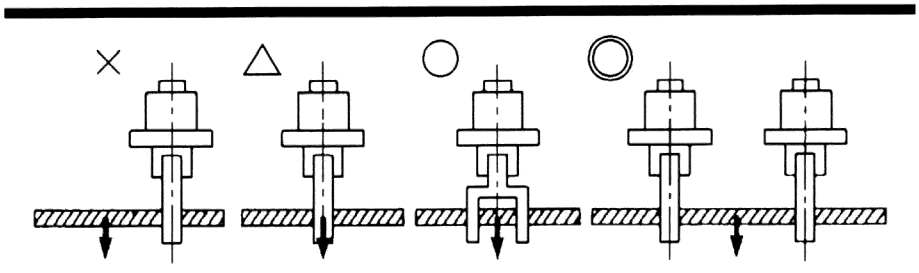
1) Ambient Temperature
   The range of temperature is 5 to 60℃ witch the hand of this type is serviceable.
2) Environmental Condition
   Provide some protection to the system with such as cover etc in the environment where much dust exist and splash of water or oil is foreseen.
3) Installation of Body
   Body mounting from either one of three sides is available. Select appropriate side to mount it depending upon the application of system.



●Screw diameter and depth for installation of the body

Model	Screw diameter and depth
HLA-12 HLA-15 HLA-20 HLB-12 HLB-15 HLB-20	M5 depth 10

4) It case of handling long material
   It is mandatory to grave it at the center of gravity for stable lifting, it may sometime be necessary to use dual hands for more stability.



5. MAINTENANCE

5.1 Periodic Inspection

In order to upkeep the Hand chuck in optimum condition, carry out periodic inspection every half a year or at every 500,000 times of actuation.

1) Inspection items
   (1) Apply grease to sliding portion.
   (2) Check whether its operation is smooth.
   (3) Check for any air leakage.
   (4) Check for any slackened bolts
   (5) Check for any play to master jaws.
   (6) Check if there are any abnormal strokes.

See "5.2 Trouble shooting", should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

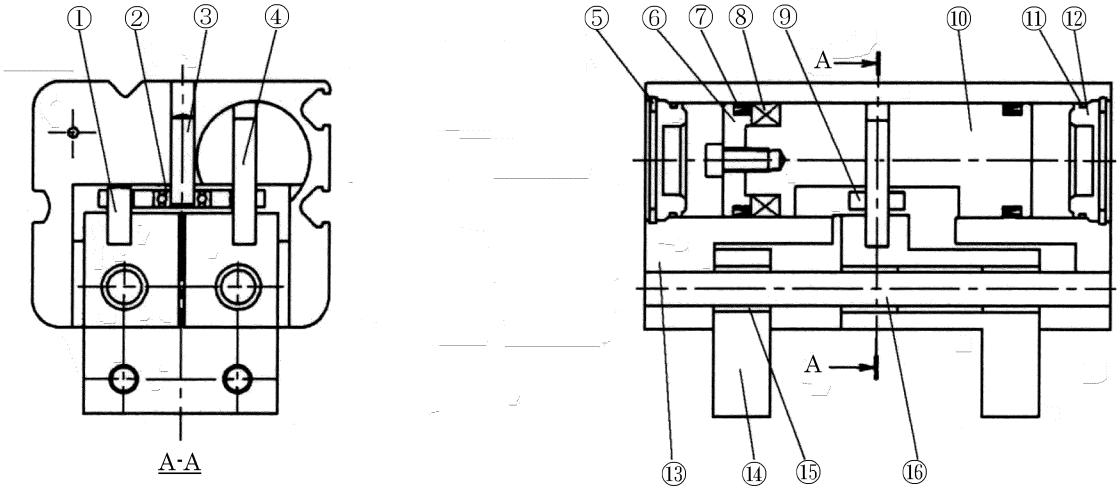
5.2 Trouble Shooting

Trouble	Possible Cause	Countermeasure
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
	Broken parts	Refer to Table of Damage or Deformation
	Broken packing	Replace the packing.
Does not function smoothly	Insufficient pressure	Increase the pressure.
	Chip or foreign particles caught	Clean and remove chips or particles.
	Broken packing	Replace packing.
Breakage and/or deforma-tion	Too heavy Claws	Make claws light.
	Too long Claws	Make claws short.
	Exertion working pressure	Reduce the pressure.
	External load is charged	1) Take some remedy to remove charging external load. 2) Review the model and the way using it. Correct the misusage.

5.3 Internal Structure and Lists of Parts

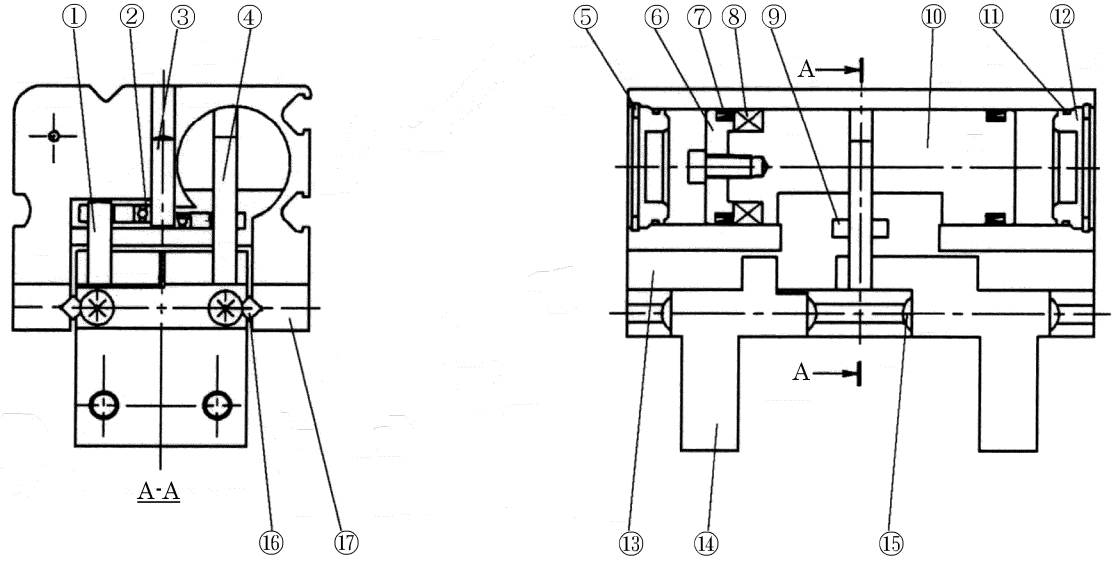
1) Internal Structure

●Bushing type



No.	Parts	Materials	Qty	Note
1	Needle roller A	High-carbon steel for bearing	1	
2	Small-diameter ball bearing		1	
3	Parallel pins	Steel	1	
4	Needle roller B	High-carbon steel for bearing	1	
5	Retaining ring	Stainless steel	2	
6	Magnet retainer	Aluminum alloy	1	
7	Piston packing	Nitril rubber	2	APH
8	Magnet		1	
9	Cam	Stainless steel	1	
10	Piston	Stainless steel	1	
11	Cylinder gasket	Nitril rubber	2	O-ring
12	Cylinder cover	Actar resin	2	
13	Body	Aluminum alloy	1	
14	Master key	Aluminum alloy	2	
15	Bushing	Actar resin	6	
16	Guide rod	Steel	2	

●Bushing type



No.	Parts	Materials	Qty	Note
1	Needle roller A	High-carbon steel for bearing	1	
2	Small-diameter ball bearing		1	
3	Parallel pins	Steel	1	
4	Needle roller B	High-carbon steel for bearing	1	
5	Retaining ring	Stainless steel	2	
6	Magnet retainer	Aluminum alloy	1	
7	Piston packing	Nitril rubber	2	APH
8	Magnet		1	
9	Cam	Stainless steel	1	
10	Piston	Stainless steel	1	
11	Cylinder gasket	Nitril rubber	2	O-ring
12	Cylinder cover	Actar resin	2	
13	Body	Aluminum alloy	1	
14	Master key	Aluminum alloy	2	
15	Truss screw	Stainless steel	8	
16	Cross rollers	High-carbon steel for bearing	20	24 cross rollers for HLB-20CS
17	Bearing guide	Steel	2	

6. OPEN-CLOSE CONFIRMATION SWITCH

6.1 Characteristic of Unit with Solid state Switch

1) Reliable detection accuracy
   Reliability is highly maintained due to being solid state switch having no moving components.
2) No chattering
   There is no chattering generated due to being solid state switch.
3) Remarkable saving of wiring man-hours (K2)
   Because of the same wiring as for reed switch is serviceable due to being two-wire type, it saves wiring man-hours remarkably.
4) No requirement of an independent source of power for switch (K2)
   Due to being two-wire type, no individual source of power for switch is required.
5) Semi permanent service life
   Its service life is almost semi permanent, of course.

6.2 Characteristic of Unit with Reed Switch

Double duty for AC/DC concurrently
Structures of models have been unified to serve for relays and programmable controllers of AC as well as DC.

6.3 Specifications of switches

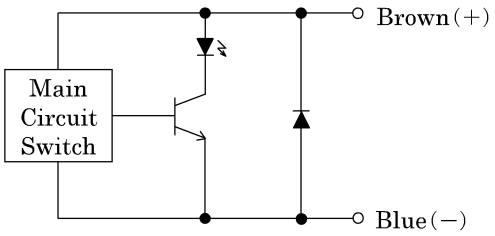
Type · Model / Item	Solid state Switch		Reed Switch			
	K2H·K2V	K3H·K3V	K0H·K0V		K5H·K5V	
Applications	For use exclusively with programmable controller	For use with programmable controller, relay	For use exclusively with programmable controller		For use with programmable controller, relay	
Power supply voltage	—	DC10V to 28V	—			
Load voltage	DC10V to 30V	DC30V or less	DC12/24V	AC100V	DC5/24V	AC100V
Load current	5 to 20mA (※1)	50mA or less	5 to 50mA	7 to 20mA	50mA or less	20mA or less
Current consumption	—	Less than 10mA when it is on at DC24V	—			
Internal voltage drop	4V or less	0.5V or less	2.4V or less		0V	
Indicator light	LED (ON lighting).		LED (ON lighting).		—	
Leakage current	1mA or less	10 μA or less	0mA			
Lead wire length	1m (Oil-resistant PVC insulated and cabtire cable, 2 cord, 0.2mm²)	1m (Oil-resistant PVC insulated and cabtire cable, 3-cord, 0.2mm²)	1m (Oil-resistant PVC insulated and cabtire cable, 2-cord, 0.2mm²)			
Shock resistance	980m/s²		294m/s²			
Insulation resistance	100MΩ or more measuring with DC500V megger tester					
Withstand voltage	AC1000V for 1 minute					
Ambient temperature	-10 to +60℃					
Degree of protection	IEC Standard IP67, JIS C 0920 (Water tight type), Oil-resistant					

Note 1 : Maximum load current capacity posted above is that of when ambient temperature is 25℃. Current capacity will drop less than this valve when temperature exceeds 25℃.

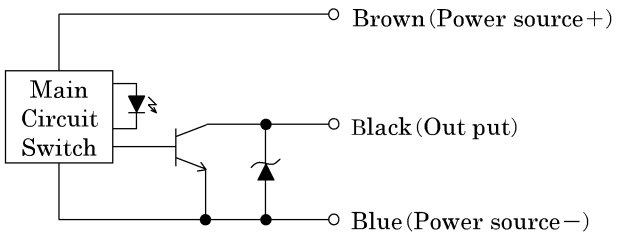
Note 2 : Installation of a K※Y series switch on a MRL series product is available by special order.

6.4 Internal Structure of Switch

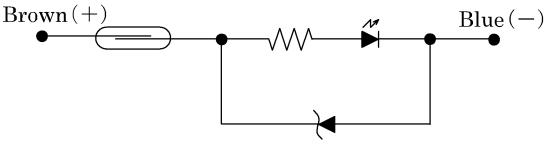
●K2H·K2V



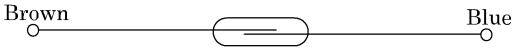
●K3H·K3V



●K0H･K0V

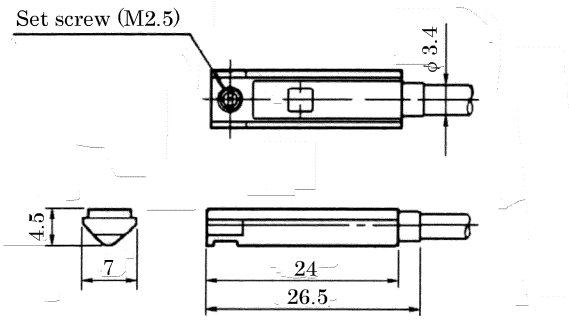


●K5H･K5V

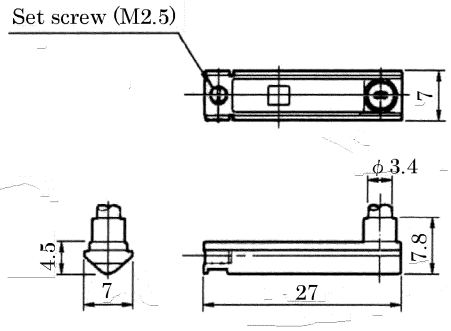


6.5 External dimensions of switches

●K※H series (axial lead wire)



●K※V series (radial lead wire)



6.6 Operational Cautions, Solid state switch, Model S2 and S3

1) Solid state switch - Model K2H･K2V･K3H and K3V

(1) Connection of lead wire

Comply with the color coding specified on the illustrations. Be sure to turn the power off before starting connecting work.

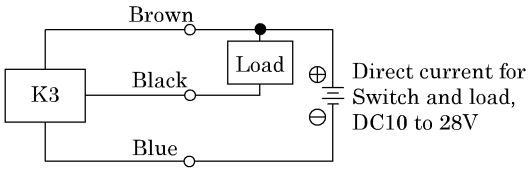


Fig1. An example (1) of fundamental circuit or K3
(In case the power for switch and load is the same.)
Direct current for switch.

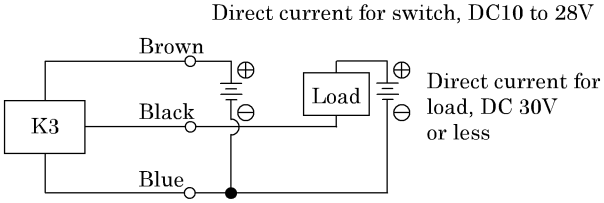


Fig2. An example (2) of fundamental circuit of K3
(In case the power for switch and load is independent.)

(2) Protection of output circuit

Install some protective circuit as per illustrated in Fig.3 when inducing type load (Relay or solenoid valve) are to be used because those types apt to generate surge current at turning switch off.

Install some protective circuit as per illustrated in Fig.4 when capacitor type load (Capacitor type) are to be used because those types apt to generate dash current at turning switch ON.

Install some protective circuit as per illustrated in Fig.5 or 6 (in case of model K2) and Fig.7 (in case of model K3) when length of lead wire is over than 10m.

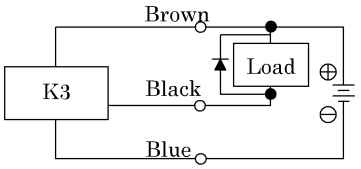


Fig3. An example of using inducting load together with surge absorptive element (diode).
(Hitachi Mfg. made diode V06C or equivalent is recommended.)

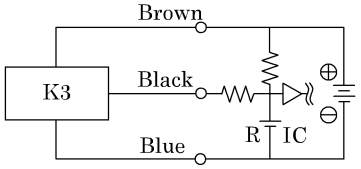


Fig4. An example of using capacitor type load together with current regulating resister R.
Comply with the following formula to figure out required R.

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

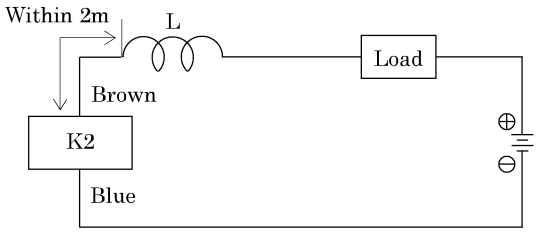


Fig5. ●Choke coil L
L = a couple hundred μH ～ a couple mH surpassing high frequency characteristic
●Install it near by a switch (within 2m).

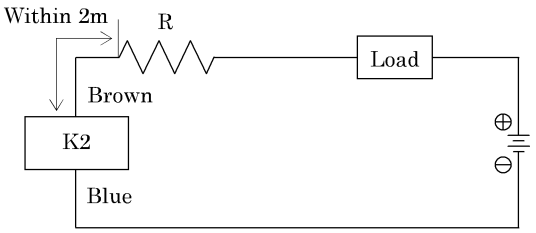


Fig6. ●Rush current restriction resister
R = As much large resister as the load circuit can afford.
●Install it near by a switch (within 2m).

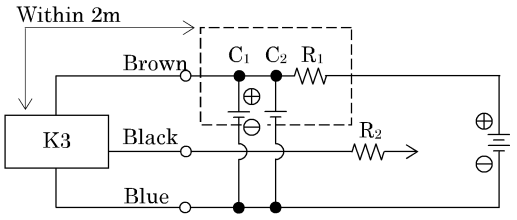


Fig.7

- Electric power noise absorptive circuit C_1
  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
  R_2 = As much large resister as the load circuit can afford
- Install it near by a switch (within 2m).

(3) Connection to a programmable controller (Sequencer)

Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig.8 to 12 respectively.

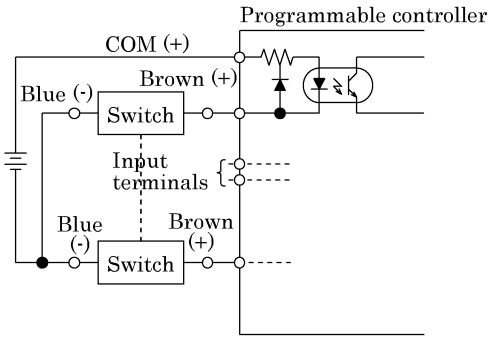


Fig8. An example of K2 model connection to source load input type (an external power of source).

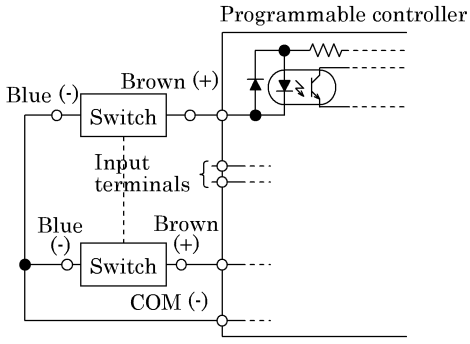


Fig9. An example of K2 model connection to source load input type (an external power of source).

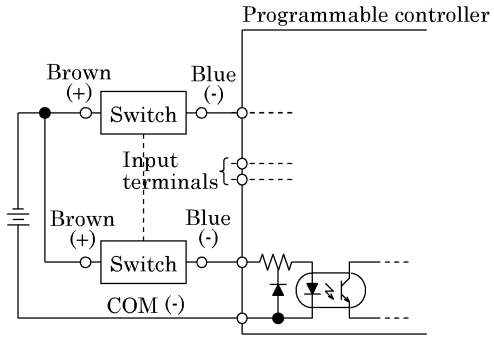


Fig10. An example of K2 model connection to sink load input type (an internal power of source).

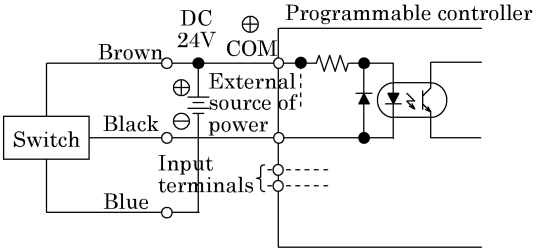


Fig11. An example of K3 model connection to source load input type (an external power of source).

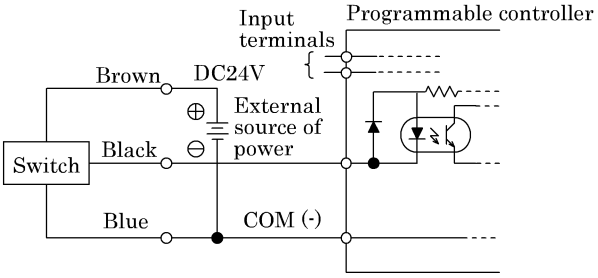


Fig12. An example of K3 model connection to source load input type (an internal power of source).

2) Reed switch - Model K0H·K0V·K5H and K5V

(1) Connection of lead wire

Instead of connecting a wire to the power source directly, always connect to the load in series. In case of model K0 connection, pay the following precautions.

Ⓐ For DC connection, use such polarities of wires as white + and black - . The switch still functions right with reversed polarities but indicator light is not lit.

Ⓑ For AC connection to either relay or input terminal to programmable controller, Switch indicator light sometimes is not lit in case when half-wave rectification is being carried out. Indicator light is lit, in this occasion, when polarities of cords for switch are reversed.

(2) Capacity of contact points

Avoid using a load exceeding the max. capacity of contact points. On the other hand, in case of K0 model, switch indicator light may not be lit sometimes when current is lower than rated current.

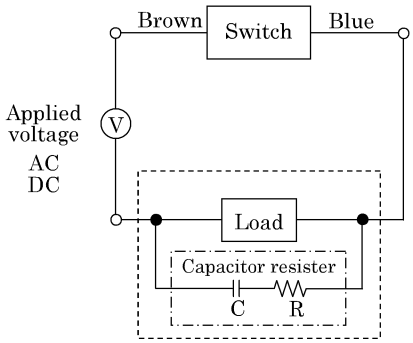
(3) Protection of contact point

Install such protective circuit as illustrated in either Fig.1 or 2, on the following page, when inducing type load such as relay is to be used.

Furthermore, install such protective circuit as illustrated in either Fig.3 or 4, on the following page, in case the wire length exceeds the length per the table 1, right.

Table 1

Current	Wire length
DC	50m
AC	10m

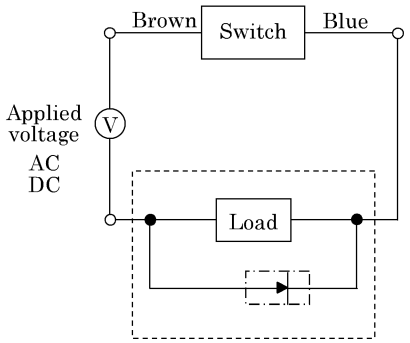


User circuit

Protective circuit (Spark absorbing circuit)

Recommended valve C (Capacitor) = 0.033 to 0.1 μF
R (Resister) = 1 to 3kΩ
KFB1K1 Okaya Denki Mfg. or equivalent

Fig.1 When capacitor resister is used.

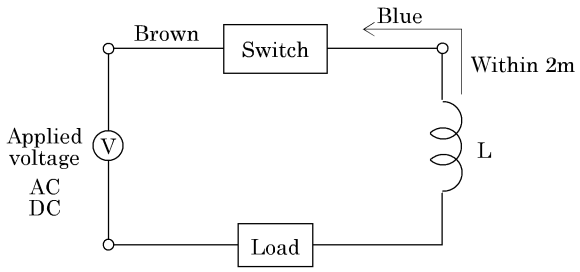


User circuit

Protective circuit

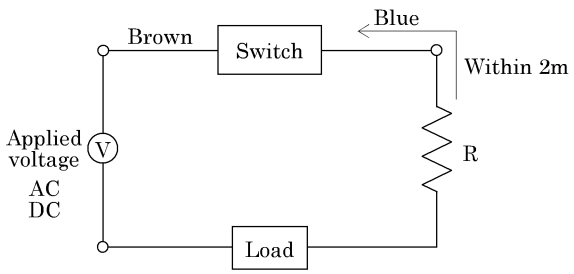
Rectifying diode, general use
Hitachi Mfg. product V06C or equivalent

Fig.2 When Diode is used.



● Choke coil L
L = a couple hundred μH to a couple mH surpassing high frequency characteristic

Fig.3



● Dash current restriction resister R
R = As much large resister as the load circuit can afford.

Fig.4

3) Relay
Use such products as specified below or equivalent.
- ○ Omron Corporation·····model MY
- ○ Fuji Electric Co., Ltd.·····model HH5
- ○ Tokyo Electric Co., Ltd.·····model MPM
- ○ Panasonic, ltd.·····model HC

4) Serial connection
(1) When plural two-wire switches are placed in series, the voltage drop at any switch is the sum of the voltage drops at all the connected switches. As the voltage placed on the load equals the power-supply voltage minus the voltage drops at the switches, select the number of the switches to be used with reference to the load.
(2) When plural three-wire solid state switches are placed in series, the voltage drop at any switch is the sum of the voltage drops at all the connected switches, as is the case with two-wire switches. As show in the figure below, the current passing through the switches is the sum of the power consumption for the installed switches and the load current. In order not to exceed the maximum load current of the switch, select the number of the switches to be used with reference to the load specification.
(3) The indicator light lights up only when all the switches are turned on.

5) Parallel connection
(1) When plural two-wire switches are placed in parallel, the leakage current varies according to the number of switches installed. Select the number of the switches to be used with reference to the load specification.
Please note that in certain cases, the switch indicator light may be less bright or not light up.

(2) Between the times one of the installed two-wire solid state switches is turned on and the time it is turned off, the voltage across any parallel switch reaches the internal voltage drop, going below the load voltage range. Accordingly the other switches do not turn on. To use two-wire solid state switches, be sure to refer to the input specifications of the programmable controller (the connected load).

(3) Three-wire solid state switches are free from the above-described problem since they have very small leakage voltages (10 μA or less).

6) Magnetic environment

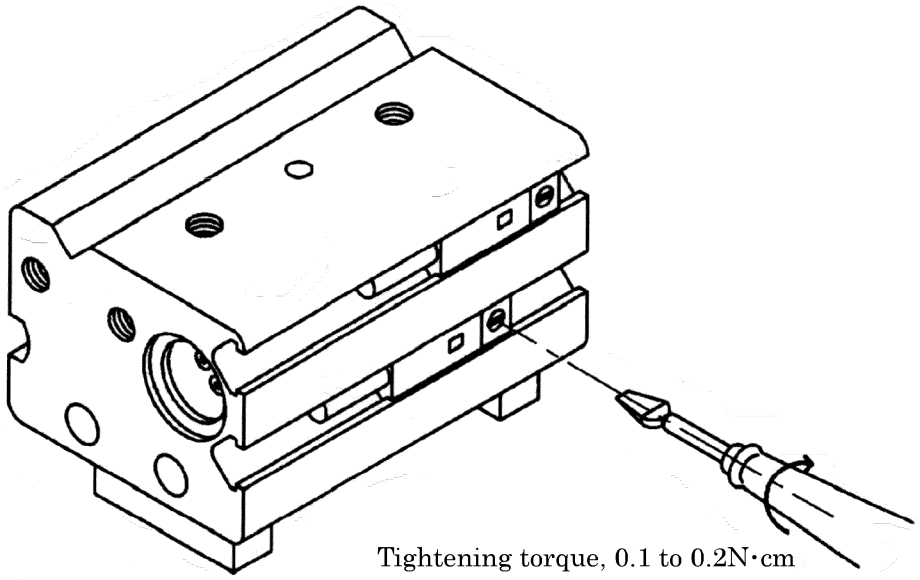
Avoid usage of these switches within the area where a strong magnetic field or large current exists. (such as a large magnet or spot welding equipment) Position censoring errors will be resulted when installing many cylinders with switch in parallel or magnetized piece come across the cylinder due to intervention among each other.

7) Protection of lead wire

Pay consideration to eliminate repeating bending stress or stretching of the lead cord while laying the cord. To the moving portion, use such cord of flexibility as for building a robot.

6.7 Switch Adjustment

To adjust the Open-close confirmation Switch, slide the switch first to find the location where Indicator light turns ON. Keep sliding the switch for further 0.3 to 0.5 further away, and then fix the switch at that position.



Tightening torque, 0.1 to 0.2N·cm

7. MODEL CODE

7.1 Model Code of Product itself

●Bushing type HLA — 12CS — K2H — R
ⓐ ⓑ ⓒ

●Bearing type HLB —

(a) Size	(b) Switch model code		(c) Qty of switch	
12CS	K2H※	Solid state・2-wire	R	1 ea. Open side
15CS	K2V※		H	1 ea. Close side
20CS	K3H※	Solid state・3-wire	D	2 ea.
	K3V※			
	K0H※	Reed・2-wire		
	K0V※			
	K5H※	Reed・3-wire		
	K5V※			
	※ Lead wire length			
	No cord	1m (Standard)		
	3	3m (Optional)		
	5	5m (Optional)		