CKD

SM－289008－A

# INSTRUCTION MANUAL

## THIN TYPE LONG STROKE PARALLEL HAND

## HLC 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 3rd 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.

# INDEX

HLC Series
Thin Type Long Stroke Parallel Hand
Manual No. SM-289008-A



2012. 07. 03

# 1. PRODUCT

## 1.1 Specifications

| Model / Item | | 08CS | 12CS | | 16CS | |
|---|---|---|---|---|---|---|
| | | Standard | Standard | L1 | Standard | L1 |
| Rod diameter | mm | ϕ 8×2 | ϕ 12×2 | | ϕ 16×2 | |
| Working fluid | | Compressed air | | | | |
| Max. working pressure | MPa | 0.7 | | | | |
| Min. working pressure | MPa | 0.2 | | | | |
| Ambient temperature | ℃ | 5～60 | | | | |
| Port size | | M3 | | | M5 | |
| Operational stroke length | mm | 20 | 30 | 60 | 40 | 80 |
| Volumetric capacity (reciprocating) | $cm^3$ | 2 | 6.8 | 13.6 | 16.1 | 32.2 |
| Repeatability | mm | ±0.03 | | | | |
| Product weight | kg | 0.14 | 0.29 | 0.44 | 0.71 | 0.85 |
| Lubrication | | Not required (Use Turbine oil, Class 1, ISO VG32 when required) | | | | |

| Model / Item | | 20CS | | 25CS | | 30CS | |
|---|---|---|---|---|---|---|---|
| | | Standard | L1 | Standard | L1 | Standard | L1 |
| Rod Diameter | mm | ϕ 20×2 | | ϕ 25×2 | | ϕ 30×2 | |
| Service Fluid | | Compressed air | | | | | |
| Max. working pressure | MPa | 0.7 | | | | | |
| Min. working pressure | MPa | 0.2 | | | | | |
| Ambient Temperature | ℃ | 5～60 | | | | | |
| Port size | | M5 | | | | | |
| Operational stroke length | mm | 50 | 100 | 60 | 120 | 70 | 140 |
| Volumetric capacity (reciprocating) | $cm^3$ | 31.4 | 62.8 | 58.9 | 117.8 | 99 | 198 |
| Repeatability | mm | ±0.03 | | | | | |
| Product weight | kg | 1.03 | 1.4 | 1.62 | 2.23 | 2.74 | 3.69 |
| Lubrication | | Not required (Use Turbine oil, Class 1, ISO VG32 when required) | | | | | |

## 1.2 Features

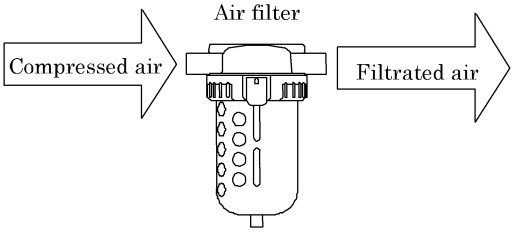
1) This hand is low height, but has long stroke because of double pistons methods (thin and large torque).

2) This is high rigidity because of long guide pitch of linear guide.

# 2. CAUTION

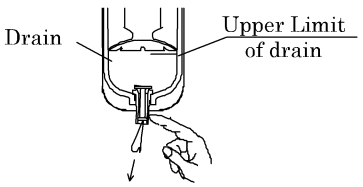
## 2.1 Fluid

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 $\mu$ 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.

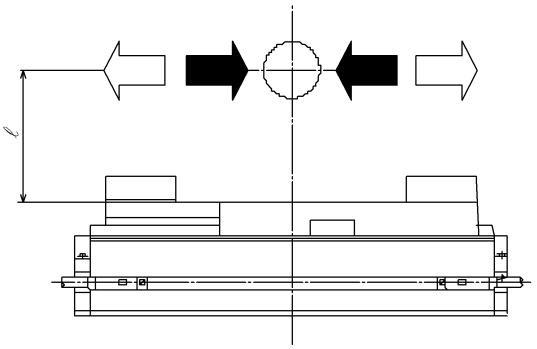



4) This hand does not require lubrication. It is recommended, however, to use Turbine oil Class 1, ISO VG32 as lubricant if lubrication is preferred.

# 3. HOLDING POWER

## 3.1 Holding Power and Weight of Load

1) The table of Holding Power on the next page represents the force with Claw length of □□at either Opening motion or Closing motion and does not represent max. weight of load capable to hold.



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

- Friction coefficient between Load and Claws
- Force 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

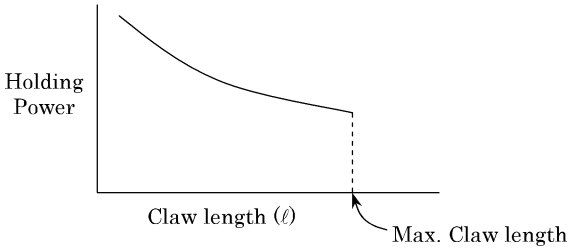
## 3.2 Guide line of selecting appropriate model (required gripping power) comparing with weight of Load

Safety coefficients for holding power against weight 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 guideline 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 Length of Claws

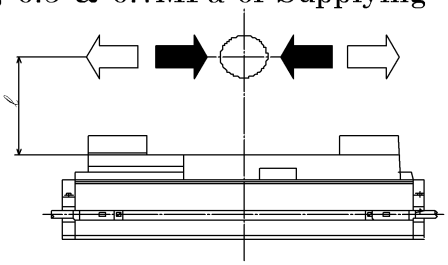
1) Make it short and light as much as possible because abrasion wear of moving parts of Master Key will be accelerated if claws are long and heavy.
2) Keep the claw length within the range to Tables above.



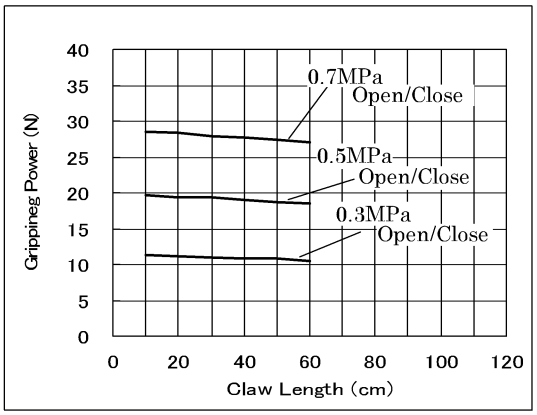
## 3.4 Data of Holding Power

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

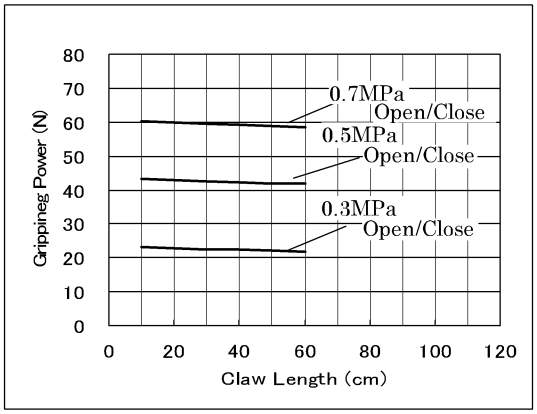
- Opening Motion ( ⇦ )
- Closing Motion ( ➡ )



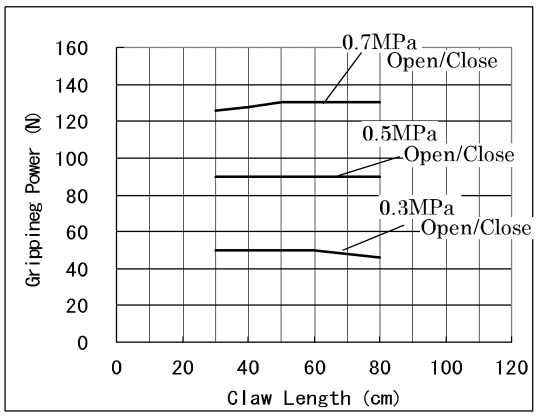
●HCL-08CS



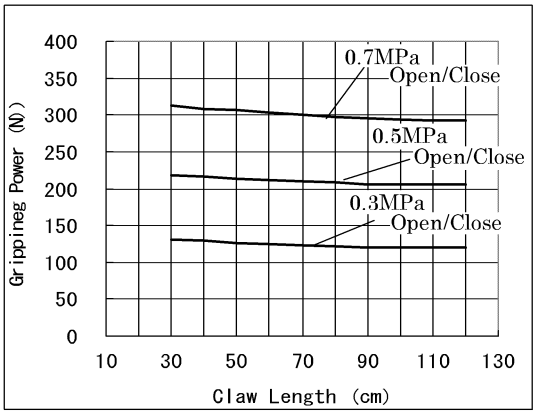

●HLC-12CS



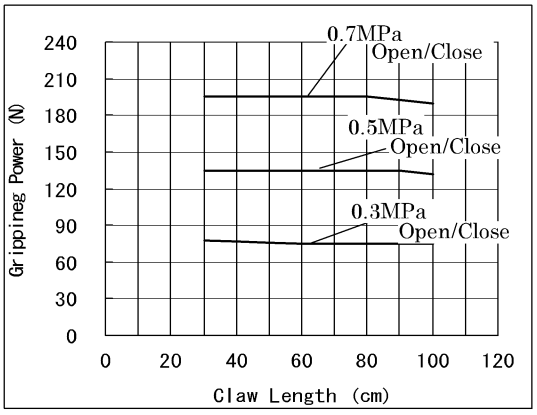

●HCL-16CS



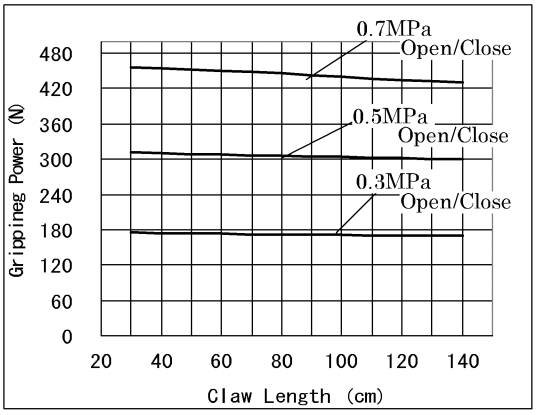

●HLC-20CS




●HLC-25CS




●HLC-30CS



# 4. INSTALLATION

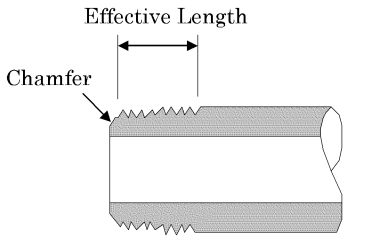
## 4.1 Piping

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

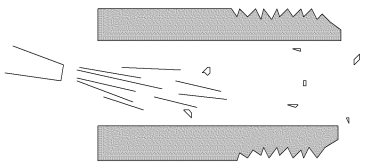
2) See to it that the pipe connecting cylinder and solenoid valve has effective cross-sectional area needed for the cylinder to drive at specified speed.

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.

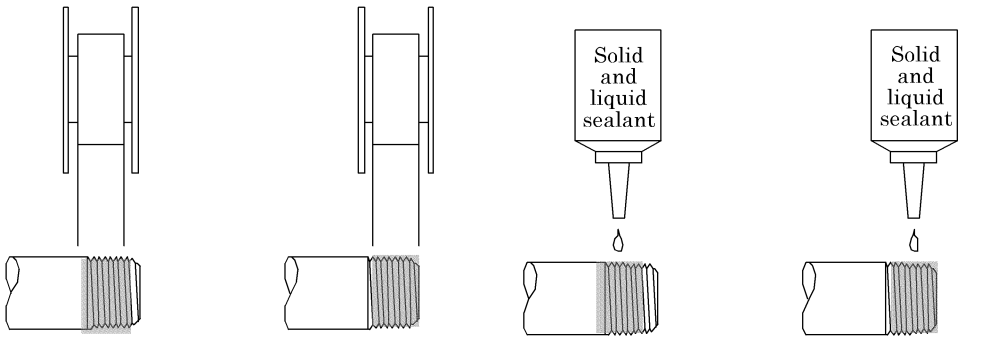



5) Flush air into the pipe to blow out foreign substances and chips before piping.



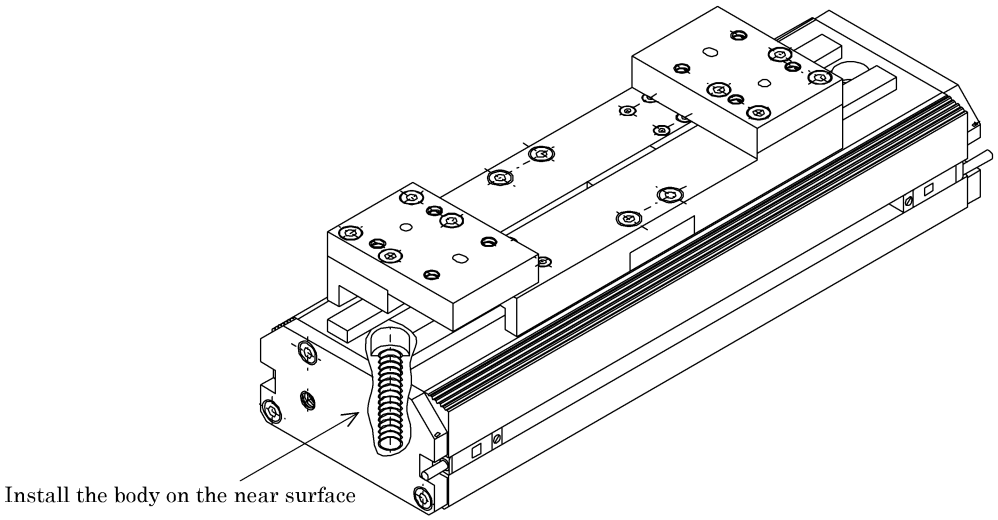
6) Refrain from applying sealant or sealing tape approx. two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.

●Seal Tape　　●Solid and liquid sealant



## 4.2 Installation

1) Ambient Temperature
   - The range of temperature is 5 to 60℃ where 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 dusts exist and splash of water or oil is foreseen.
3) Installation of Body




- Thread diameter and depth of Body mounting bolt

| Model | Dimensions of spot face | Diameter of thread and depth |
|---|---|---|
| HLC-16CS | ϕ 8 depth 4.5 | M6 through |
| HLC-20CS | ϕ 9.5 depth 5.5 | M8 through |
| HLC-25CS | ϕ 11 depth 6.5 | M10 through |
| HLC-30CS | ϕ 11 depth 6.5 | M10 through |

# 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 keys.
   (6) Check if there are any abnormal strokes.

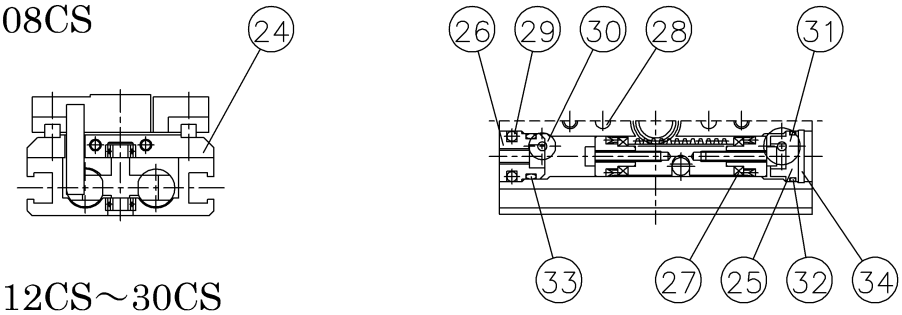
See "5.2 Trouble shooting", should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

## 5.2 Trouble Shooting

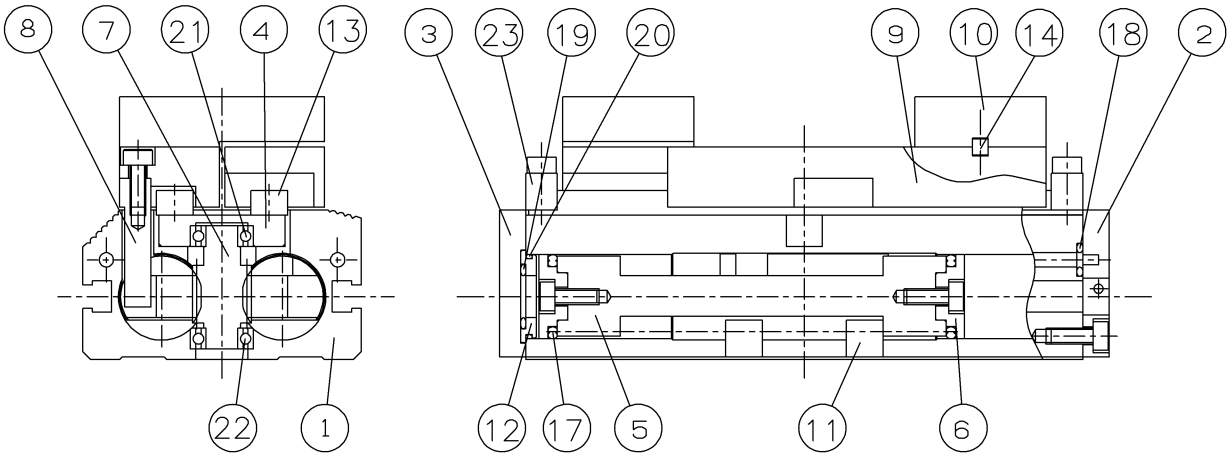
| Trouble | Possible Cause | Countermeasure |
|---|---|---|
| Does not operate | No pressure or inadequate pressure | Provide an adequate pressure source. |
| | Signal is not transmitted to direction control valve | Correct the control circuit |
| | Broken parts | Refer to Table of Damage or Deformation |
| | 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 the packing. |
| Breakage and/or deformation | 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.<br>2) Review the model and the way using it. Correct the misusage. |

## 5.3 Internal Structure and Lists of Parts

HLC-08CS

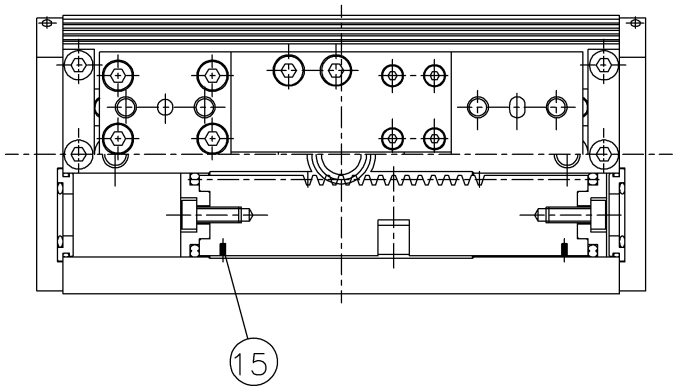



HLC-12CS～30CS




HLC-16S～25CS(Standard)

HLC-16CS～30CS-L1



| No. | Parts | Materials | Qty. | Note |
|---|---|---|---|---|
| 1 | Body | Aluminum alloy | 1 | |
| 2 | Side plate 1 | Aluminum alloy | 1 | Not for 08CS |
| 3 | Side plate 2 | Aluminum alloy | 1 | Not for 08CS |
| 4 | Bearing holder | Aluminum alloy | 1 | Not for 08CS |
| 5 | Rack | Stainless steel | 2 | |
| 6 | Piston | Acetar resin | 4 | |
| 7 | Pinion | Stainless steel | 1 | |
| 8 | Rack joint | Carbone steel | 2 | |
| 9 | LM plate | Aluminum alloy | 2 | Not for 08,12CS |
| 10 | Master key | Aluminum alloy | 2 | |
| 11 | Key | Carbone steel | 2 | Stainless steel for 30CS, Not for 08,12CS |
| 12 | Cylinder cover | Aluminum alloy | 4 | |
| 13 | LM guide | | 2 | |
| 14 | Key | | 4 | Not for 08,12CS |
| 15 | Semicircle magnet | | 4 | 2 in case of 30CS(Standard) |
| 16 | Steel ball | Stainless steel | 6 | |
| 17 | Piston seal | Nitril rubber | 4 | |
| 18 | Gasket | Nitril rubber | 4 | |
| 19 | Cylinder seal 1 | Nitril rubber | 4 | |
| 20 | Cylinder seal 2 | Nitril rubber | 4 | |
| 21 | Single row deep groove ball bearing | | 1 | |
| 22 | Single row deep groove ball bearing | | 1 | |
| 23 | Stiffening plate | Stainless steel | 2 | Only 16,20CS |
| 24 | Base mounting linear guide | Aluminum alloy | 1 | |
| 25 | Cylinder cover 1 | Acetar resin | 2 | |
| 26 | Cylinder cover 2 | Aluminum alloy | 2 | |
| 27 | Magnet | | 4 | |
| 28 | Dowel pin | Steel | 2 | |
| 29 | Stopper pin | Steel | 4 | |
| 30 | Gasket1 | Nitril rubber | 2 | |
| 31 | Gasket2 | Nitril rubber | 2 | |
| 32 | Cylinder seal 1 | Nitril rubber | 2 | |
| 33 | Cylinder seal 2 | Nitril rubber | 2 | |
| 34 | Snap ring | Stainless steel | 2 | |

# 6. OPEN-CLOSE CONFIRMATION SWITCH

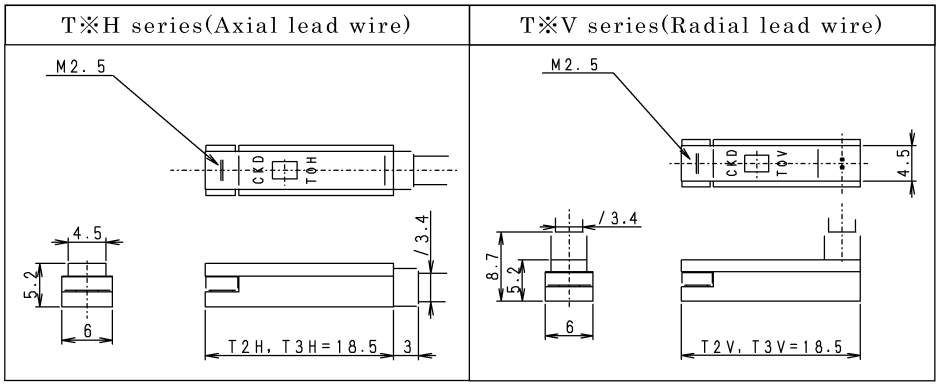
## 6.1 Features

1) Solid state switch
   Service life is almost infinite, also Open-close load capacity is large.
2) Indicator light
   It makes confirmation of actuation or maintenance inspection easy.
3) No restriction regarding its mounting location
   Its relocation is also carried out easily by just loosening fixing screw.

## 6.2 Specifications

| Type · Model / Item | Solid state Switch | |
|---|---|---|
| | T2H/V | T3H/V |
| Applications | 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 |
| Load current | 5 to 25mA (Note 1) | 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 | 10 $\mu$ A or less |
| lead wire length (Standard) | 1m { Oil-resistant PVC insulated and cabtyre cord 2 conductor 0.2mm$^2$ } | 1m { Oil-resistant PVC insulated and cabtyre cord 3 conductor 0.2mm$^2$ } |
| Shock resistance | 980m/s$^2$ | |
| Insulation resistance | 20MΩ or more measuring with DC500V megger tester | |
| Withstand voltage | No abnormality permissible after applying 1000V AC for 1 minute. | |
| Ambient temperature | −10 to +60℃ | |
| Product weight | IEC Standard IP67, JIS C 0920 (Watertight Type), oil-resistant | |

## 6.3 Dimensions



## 6.4 Operational Cautions

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.

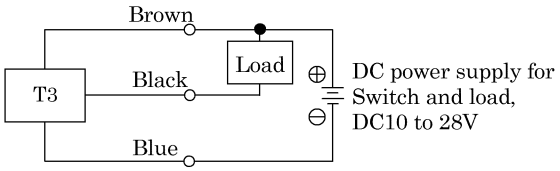



Fig1. An example (1) of fundamental circuit or T3
(In case the power for switch and load is the same.)

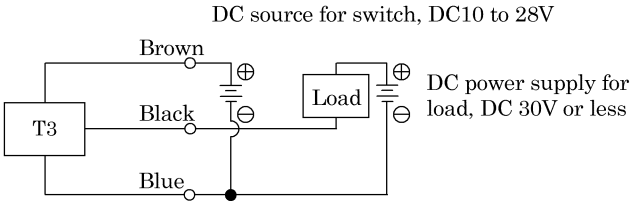



Fig2. An example (2) of fundamental circuit of T3
(In case the power for switch and load is independent.)

2) Protection of output circuit

Install the protective circuit of Fig.3 because it tends to generate surge voltage at turning switch off in case of using inductive load (Relay or solenoid valve).

Install the protective circuit of Fig.4 because it tends to generate rush current at turning switch on in case of using capacious load (Capacitor ).

Install the protective circuit of Fig.5 or 6 (in case of model T2) and Fig.7 (in case of model T3) when length of lead wire is over 10m.

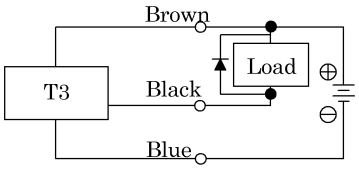



Fig3. An example of using surge absorptive element (diode) for inductive load
(Hitachi Mfg. made diode V06C or equivalent is recommended.)

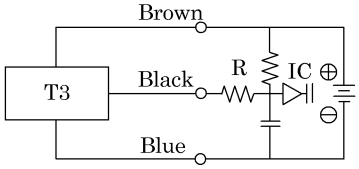



Fig4. An example of using current regulating resister R for capacious load
Use the R(Ω) calculated with the following formula and over.

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

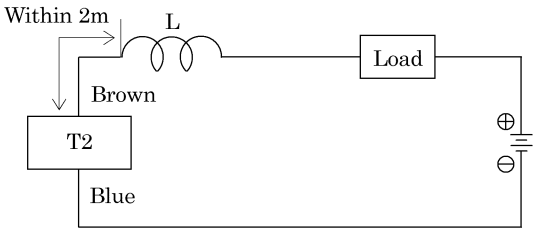



Fig5. ●Choke coil L
L = hundreds μH ～ several mH
good at high frequency characteristic
●Install it near by a switch (within 2m).

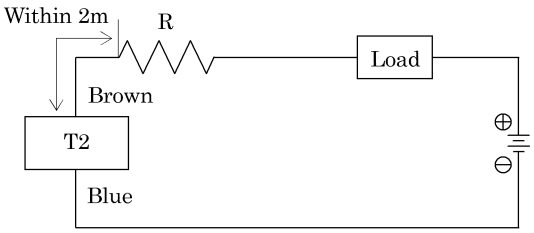



Fig6. ●Rush current restriction resister
R = as large as the load circuit allow.
●Install it near by a switch (within 2m).

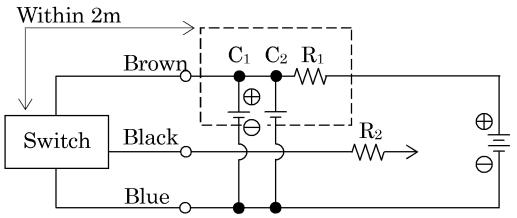



Fig.7

- Noise of source 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
- Rush current restriction resister $R_2$
  $R_2$ = as large as the load circuit allow
- Install it near by a switch (within 2m).

3) Connection to a programmable controller (Sequencer)

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

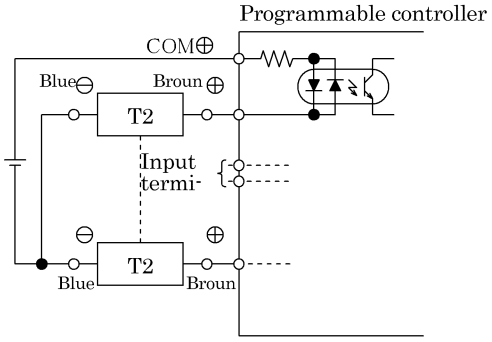



Fig8. An example of connection of T2 with source load input type (an external power)

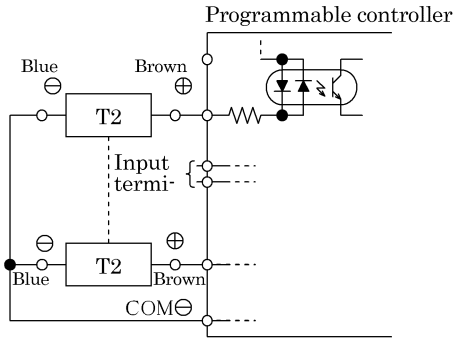



Fig9. An example of connection of T2 with source load input type (an external power)

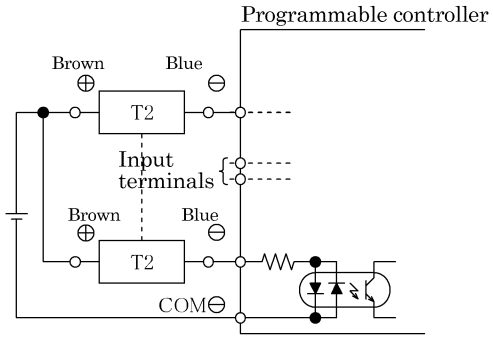



Fig10. An example of connection of T2 with sink load input type (an external power)

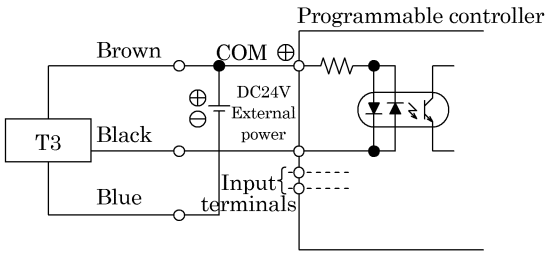



Fig11. An example of connection of T2 with sink load input type (an external power)

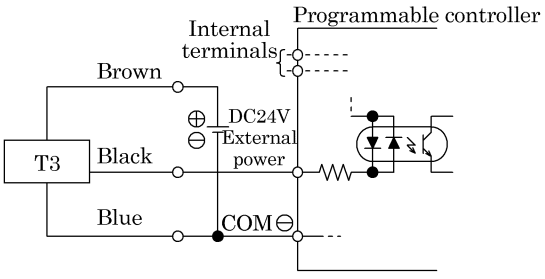



Fig12. An example of connection of T3 with source load input type (an internal power)

4) Hysteresis

There is hysteresis to cylinder switch as well as there is micro switch.

It is a distance between the point where a switch turns on moving piston and the point where it turns off moving the piston reversely.

5) 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). It will have an effect on detection accuracy due to interference each other, in case of installing cylinders with switches nearby parallel, or moving of magnetic substances close to the cylinder.

6) Protection of lead wire

Pay attention not to bend or stretch the lead wire repeatedly. To the movable part, use such wire with flexibility as one for building a robot.

7) Parallel connection

The leakage current increases with the number of T2 switches connected parallel. Therefore select the number of them with reference to input specifications of the programmable controller. Sometimes indicator light goes dark or does not turn on.

The leakage current increases with the number of T3 switches connected parallel. But it is no problem in use of regular because of the very small leakage current(10 $\mu$ A or less).

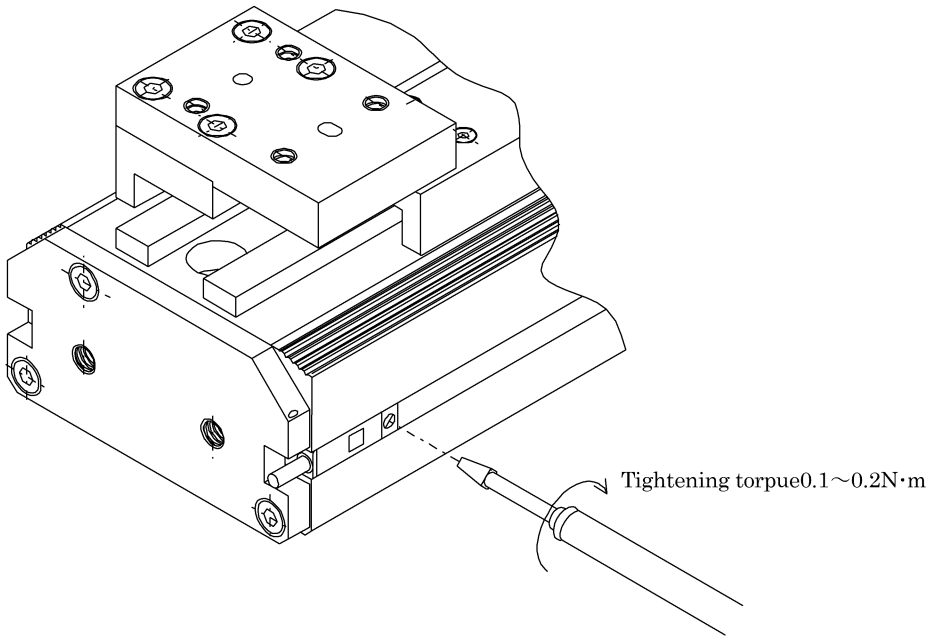
8) Serial connection

In case of using T2 switches connected serial, the voltage drop of the whole is the sum of the voltage drops of each connected switch. The voltage to loaded side equals the power-supply voltage minus the voltage drops at the switches. Therefore select the number of connected switches with reference to the load specification.

In case of using T3 switches connected serial, the voltage drop of the whole is also the sum of the voltage drops of each connected switch. Moreover the current through the switches is the sum of the current of load and the current consumption of each switch. Therefore select the number of the switches with reference to specification of the switch not to be over load current.

## 6.5 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.



# 7. MODEL

## 7.1 Model of Product itself

**HLC-20CS-L1-T2H-R**

[a] [b] [c] [d]

| Code | Descriptions | | |
|---|---|---|---|
| [a]Size | | | |
| 08CS | | | |
| 12CS | | | |
| 16CS | | | |
| 20CS | | | |
| 25CS | | | |
| 30CS | | | |
| [b]Option | | | |
| No code | Standard | | |
| L1 | Long stroke | | |
| [c]Switch model cord | | | |
| T2H※ | Solid state | 2 wire | Lead wire Axial type |
| T3H※ | | 3 wire | |
| T0H※ | Reed | 2 wire | |
| T5H※ | | | |
| T2V※ | Solid state | 2 wire | Lead wire Radial type |
| T2V※ | | 3 wire | |
| T0V※ | Reed | 2 wire | |
| T5V※ | | | |
| ※Length of lead wire | | | |
| No code | 1m(Standard) | | |
| 3 | 3m(Option) | | |
| 5 | 5m(Option) | | |
| [d]Qty of switches | | | |
| R | 1 ea. Open side | | |
| H | 1 ea. Close side | | |
| D | 2 ea. | | |

Example of model cord
HLC-29CS-L1-T2H-R

Model: Thin type long stroke parallel hand
[a]Size : 20CS
[b]Option : Long stroke
[c]Switch model : Solid state T2H switch, Lead wire 1m
[d]Qty of switch : 1 at Open side