CKD

SM—9399—A

INSTRUCTION MANUAL

LONG STROKE CHUCK

CK 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

For Safety Use

To use this product safely, 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 application, 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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1. PRODUCTS

1-1. Specifications

Model code / Item	CK-1CS	CK-1.5CS	CK-2CS
Service Fluid	Compressed air		
Max. Working Pressure MPa	0.7		
Min. Working Pressure MPa	0.3		
Ambient Temperature (°C)	5~60		
Stroke (mm)	20	20	40
Tube Bore (mm)	25	44	44
Rod Diameter (mm)	12	16	16
Volume of Piston one cycle (cm^3)	7.9	26.4	52.8
Repeating accuracy (Initial value) (mm)	±0.03	±0.03	±0.03
Weight (kg)	0.85	1.90	2.90
Lubrication	Not required. (Use Turbine oil, Class 1, ISO VG32 when required.)		

Specification and type of switches

Type & Model / Item	Non Contact Switch	
	T2H/V	T3H/V
Application	For use exclusively with programmable controller	For use with programmable controller, relay
Voltage of source of power	——	DC10~28V
Load voltage · Current	DC10~30V, 5~25mA (Note 1)	Less than DC30V, Less than 100mA
Lamp	Light emitted diode	

Note 1. Maximum value, 25mA is at 25°C of ambient temperature. Load current decreases less than 25mA when the ambient temperature exceeds 25 °C. (5~10mA at 60°C.)

1-2. Features

1) Powerful yet compact

Body is designed compactly and lightly for easy handling, yet provides powerful gripping force.

2) Open-close confirming switches

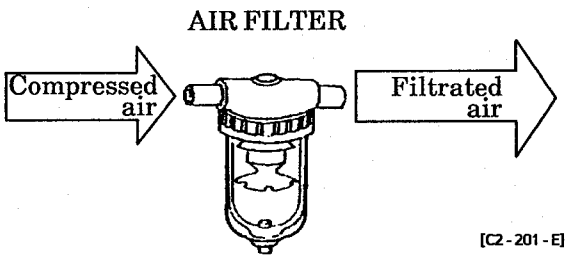
All models of this series are capable to accept up to two switches mounted on.

2
WARNING

2. CAUTION

2-1. Fluid

1) Use the compressed air, filtrated and dehumidified. Carefully select a filter of an adequate filtration rate (5μm or lower preferred), flow rate and its mounting location (as closest to directional control valve as possible).

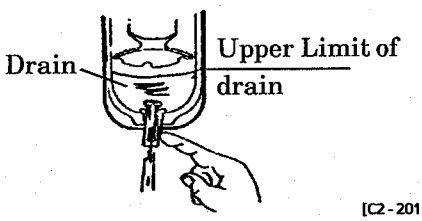


[C2-201-E]

2) Be sure to drain out the accumulation in filter periodically before the level exceeds the mark line.

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

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



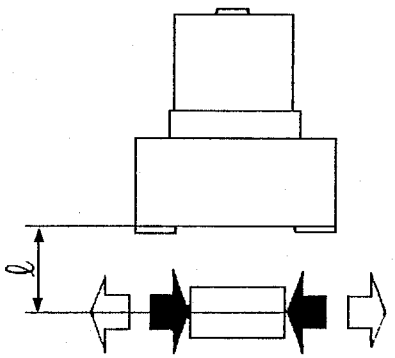
[C2-201-F]

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 to be gripped.

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



[M1-307-A]

- 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

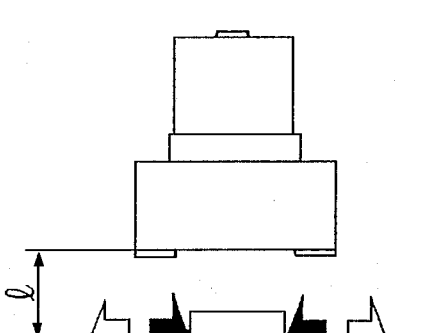
Safety coefficients for holding power against mass of Load are set as follows although it varies depending on Coefficient between Load and Claw, Shape of Load and Claws, transferring condition etc. Make those brief guide line for selecting models.

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

3-3. Data of Gripping 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 & 0.7 MPa of Supplying pressure.

- Opening Motion (⇦) ····· Broken line
- Closing Motion (⇨) —— Full line



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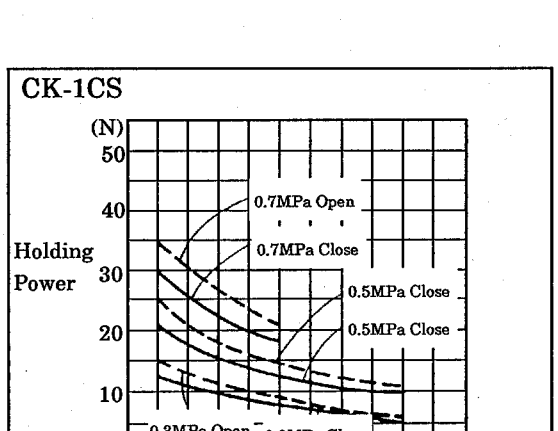
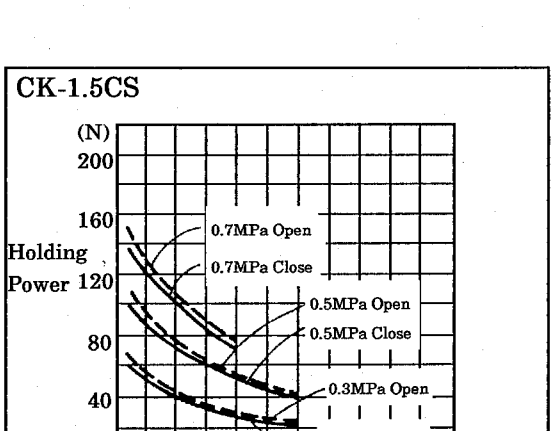
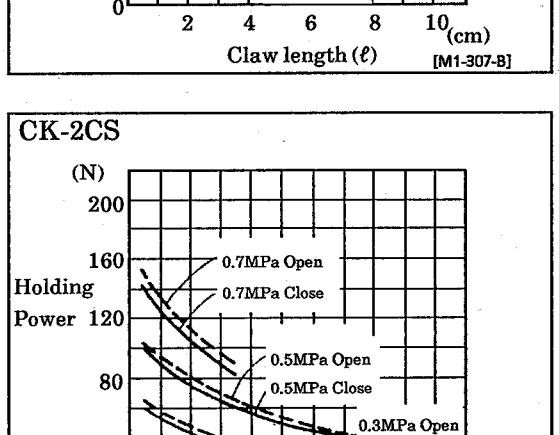






Note : Holding power of O type hand drops approx. 20~30% to that of double acting type.
Holding power of C type hand drops approx. 10~20% to that of double acting type.

3-4. Length of Claws

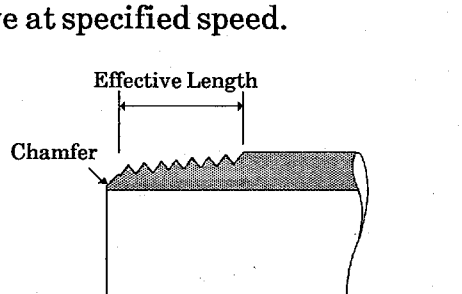
1) Make it short and light as much as possible because abrasion wear of moving parts of Master Jaw will be accelerated if claws are long and heavy.
2) Keep the claw length within the range of Tables, (P-4).

[M1-301-G]

4. INSTALLATION

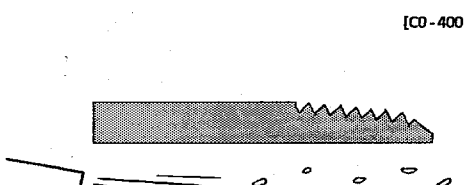
4-1. Piping

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 hand and solenoid valve has effective sectional area needed for the hand to drive at specified speed.
3) Install filter as close as possible to solenoid valve for eliminating rust, foreign substance and drain in the pipe.
4) Strictly observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.



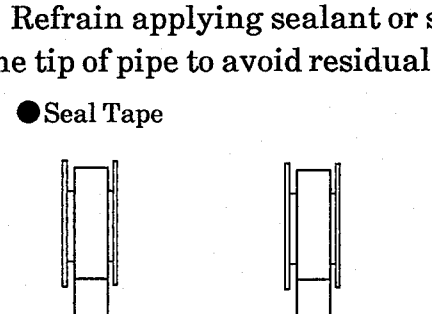
[C0-400-A]

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

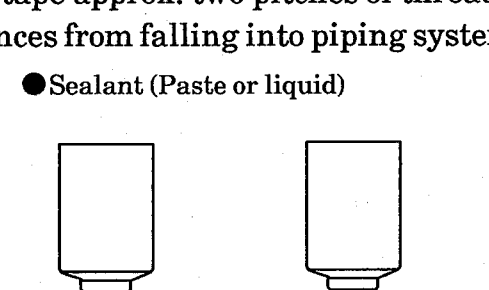

[C0-400-B]

6) Refrain 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

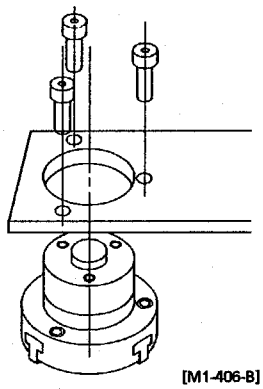

Correct Incorrect

● Sealant (Paste or liquid)


[C0-400-C]
Correct Incorrect

4-2. Installation

1) Ambient Temperature
   - The range of temperature is 5~60°C where the chuck 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) Mounting type
   - It is body mounting type for CK series.



[M1-406-B]

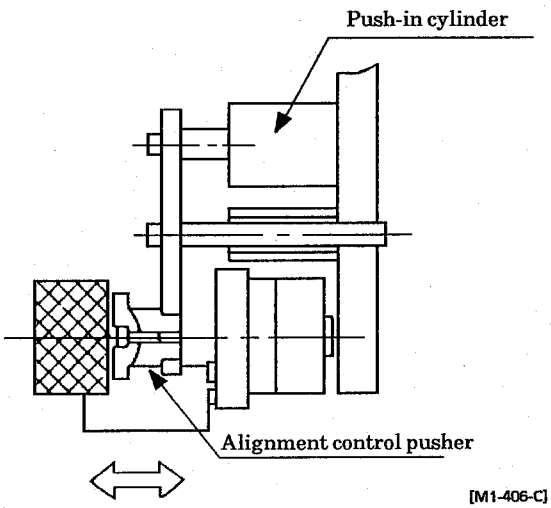
Body mounting

4) Thread diameter and depth of Body mounting bolt hole

Model	Diameter and Depth of threaded hole
CK-1CS	M5, Depth 12
CK-1.5CS	M6, Depth 15
CK-2CS	M8, Depth 15

5) In case a Push-in cylinder is put in use.

Note : It will shorten service life of small claw tremendously as work slides over claw. Pay consideration to design appropriate configuration of small claw.



[M1-406-C]

6) Others

Consult us prior to start additional machining work on unit to prevent such troubles as malfunction or air leakage etc.

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 is 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.

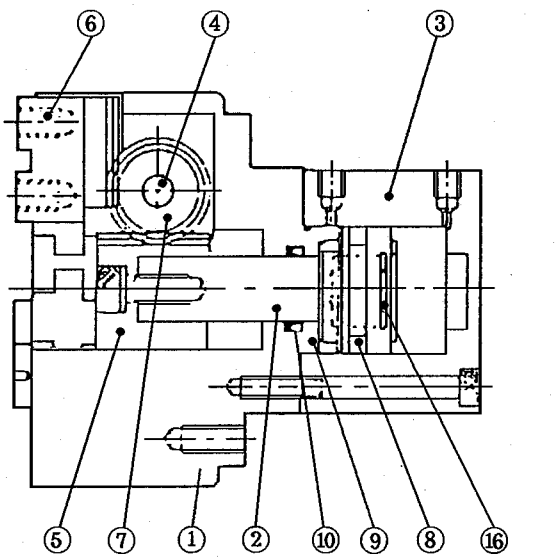
5-2. Trouble Shooting

Trouble	Possible Causes	Countermeasures
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 deformation	Too heavy Claws	Make claws light.
	Too long Claws	Make Claws short.
	Excessive 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 mis-usage.

5-3. Internal Structure and Lists of Parts

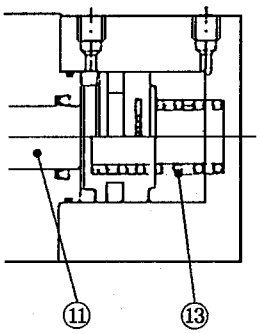
1) Internal Structure

Standard (Double acting)



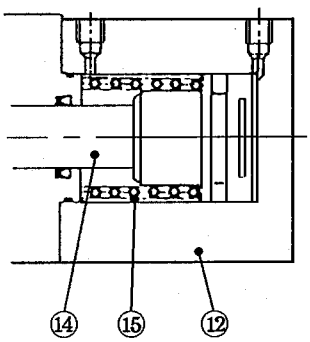
[M1-507-A]

O : Normally Open type



[M1-507-B]

C : Normally Closed type



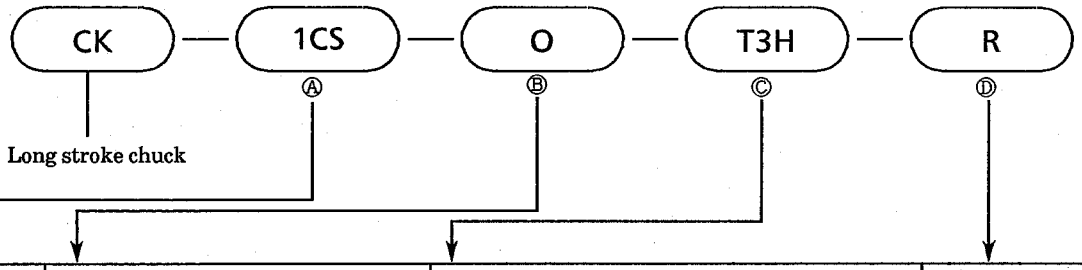
[M1-507-C]

2) Parts List

No.	Parts	Material	Remarks	No.	Parts	Material	Remarks
①	Chuck Body	Aluminum		⑨	Cylinder gasket	Nitril rubber	
②	Piston	Carbon steel		⑩	Rod packing	Nitril rubber	
③	Cylinder	Aluminum		⑪	Piston	Carbon steel	
④	Pinion gear axle	Carbon steel		⑫	Cylinder	Aluminum	
⑤	Rack	Carbon steel		⑬	Sprin	Piano wire	
⑥	Master Jaws	Carbon steel		⑭	Piston	Carbon steel	
⑦	Pinion gear	Carbon steel		⑮	Spring	Piano wire	
⑧	Piston packing	Nitril rubber		⑯	Magnet	MC	Nickel plated

6. MODEL CODE

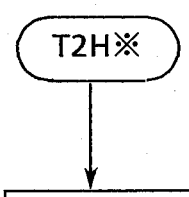
6-1. Model Code of Product itself



Ⓐ Size	Ⓑ Option		Ⓒ Switch model code				Ⓓ Qty. of Switches	
1 CS	No mark	Standard (Double acting)	Straight lead cord type	L shape lead cord type			R	1 ea. for opening
1.5CS	O	Single acting (Normally Open)					H	1 ea. for closing
2 CS			T2H※	T2V※	Non-contact	2-core	D	2 each
	C	Single acting (Normally Closed)	T3H※	T3V※		3-core		
	Y1	Small claws, material (S50C)	※ Mark specifies the length of Lead cord.					
	Y2	Small claws, material (MC nylon)						

Example of Model coding	CK-1CS-T3H-R It designates that it is Long stroke chuck, with 1 ea.of non-contact switch TH3, for opening.

6-2. Model code of switch



Model code of Switch			
Straight lead cord type	L shape lead cord type		
T2H※	T2V※	Non-contact	2-core
T3H※	T3V※		3-core

7. OPEN-CLOSE CONFIRMATION SWITCH

7-1. Features of non-contact switch

1) Highly reliable sensing
   Reliability is highly maintained due to being non-contact switch having no moving components.
2) No chattering
   There is no chattering generated due to being non-contact switch.
3) Remarkable saving of wiring man-hours (T2)
   Because of the same wiring as for contact point 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 (T2)
   Due to being two-wire type, no individual source of power for switch is required.
5) Bulk capacity of Load Open and Close
   T3 type directly Opens and Closes the load, max. 100mA, DC 30V.
6) Semipermanent service life
   Its service life is almost semipermanent, of course.
7) Supremely compact
   T type switches have been improved further compactly to such dimensions as 6mm width, 4.7mm height and 18.5mm length.

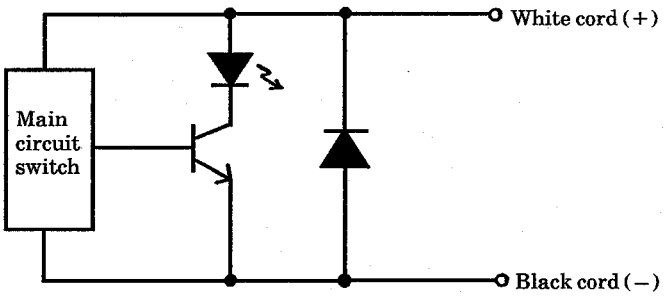
7-2. Specifications of Switches

Type & Model / Item	Non-contact switch	
	T2H · T2V	T3H · T3V
Application	For use exclusively with programmable controller	For use with programmable controller, relay
Voltage of source of power	——	DC10~28V
Load voltage · Current	DC10~30V, 5~25mA (Note 2)	Less than DC30V, Less than 100mA
Current consumption	——	Less than 10mA when it is on at DC24V
Internal voltage drop	Less than 4V	Less than 0.5V
Lamp	Light emitted diode (Lit when LED is on.)	
Leak current	Less than 1 mA	Less than 10μA
Length of lead cord (Note 1)	1m (Oil-proof vinyl cabtyre cord, 2-cord, 0.2mm^2)	1m (Oil-proof vinyl cabtyre cord, 3-cord, 0.2mm^2)
Max. Impact	100G	
Insulation resistance	20 MΩ or more measuring with DC500V megger tester	
Dielectric strength	AC1000V for 1 minute	
Ambient temperature range	−10~+60°C	
Protective structure	IEC Standard IP67, JIS C0920 (Water tight type), Oil resistance	

Note 1. 3m or 5m long lead cord is optionally available.
Note 2. Maximum load current capacity posted above is that of when ambient temperature is 25°C. Current capacity will drop less than this value when temperature exceeds 25°C. (for T2 type; 5~10mA at 60°C.)

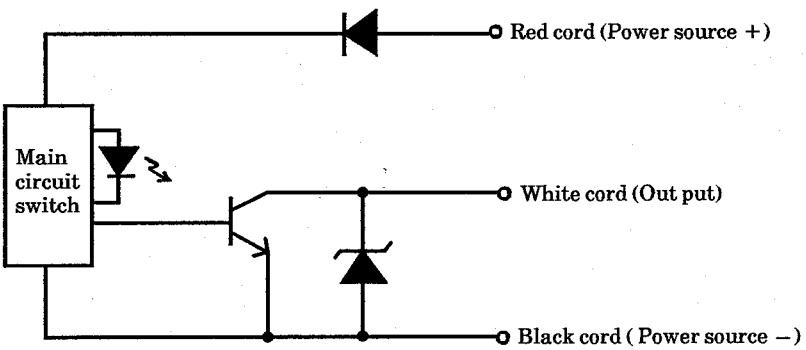
7-3. Internal circuit diagrams of Switch

- T2H/V



[X4-108-C]

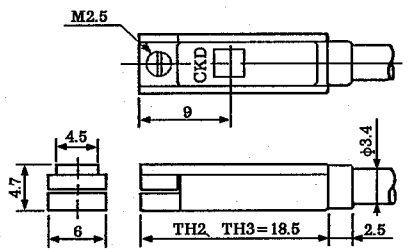
- T3H/V



[M1-705-A]

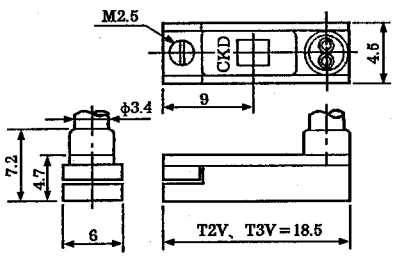
7-4. External dimensions of switches

- T※H Series (Straight lead cord type)



[M1-706-A]

- T※V Series (L shape lead cord type)



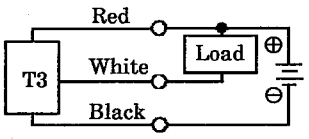
[M1-706-B]

7-5. Operational caution of switch

1) Non-contact switch - Models T2H/V and T3H/V

(1) Connection of lead cord

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

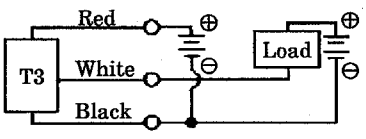


Direct current for switch and load, DC10~28V (T3) DC4.5~28V (S3)

[X4-401-A]

Fig. 1 An example (1) of basic circuit of T3, (In case the power for switch and load is the same.) Direct current for switch, DC10~28V (T3) DC4.5~28V (S3)

Direct current for switch, DC4.5~ 28V



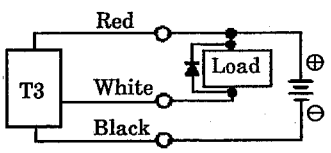
Direct current for load, DC 30V or less

[X4-401-B]

Fig. 2 An example (2) of basic circuit of T3, (In case the power for switch and load is independent.)

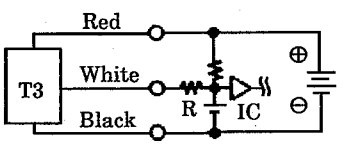
(2) Protection of output circuit

- 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 are apt to generate surge current at turning switch off.
- Install some protective circuit as per illustrated in Fig. 4 when capacitor type lord (Capacitor) are to be used because those types are 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 T2) and Fig 7 (in case of model T3), when lead cord exceeds 10m in length.



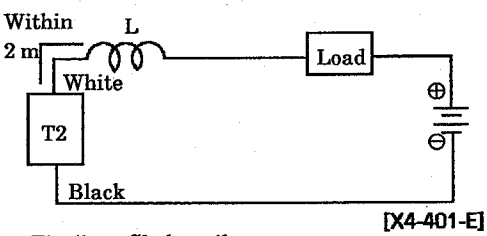
[X4-401-C]

Fig. 3 An example of using inducing load together with surge absorptive element (diode). (Hitachi Mfg. made diode V06C or equivalent is recommended.)



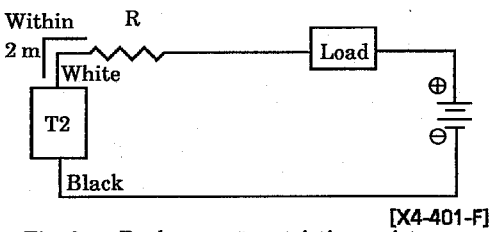
[X4-401-D]

Fig. 4 An example of using capacitor type load together with current regulating resister R. Use resister with R (Ω) valve bigger than $\frac{V}{0.10}$



[X4-401-E]

Fig. 5 • Choke coil
L= a couple hundred μH ~ a couple mH surpassing high frequency characteristic
• Install it near by a switch (within 2 m).



[X4-401-F]

Fig. 6 • Dash current restriction resister
R= As much large resister as the load circuit can afford.
• Install it near by a switch (within 2 m).

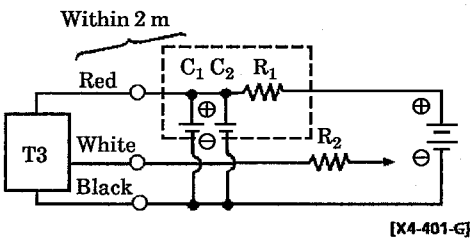


Fig. 7

- Electric power noise absorptive circuit
  C1 = 20~50μF electrolytic capacitor (withstanding 50V or more)
  C2 = 0.01~0.1μF ceramic capacitor
  R1 = 20~30Ω
- Dash current restriction resister
  R2 = As much large resister as the load circuit can afford.
- Install it near by a switch (within 2 m).

(3) Connection to a programmable controller (Sequencer)

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

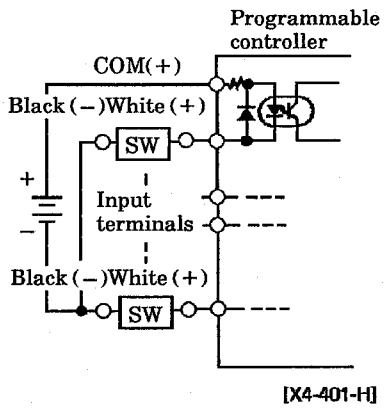


Fig. 8 T2 model connection to source load input type (an external power of source)

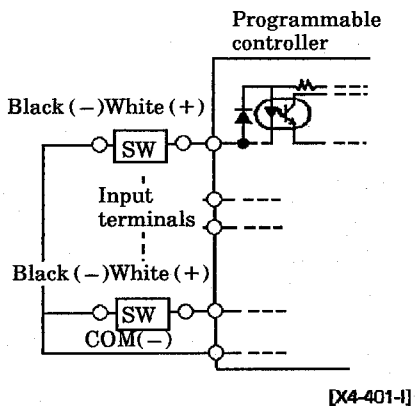


Fig. 9 An example of T2 model connection to source load input type (an internal power of source)

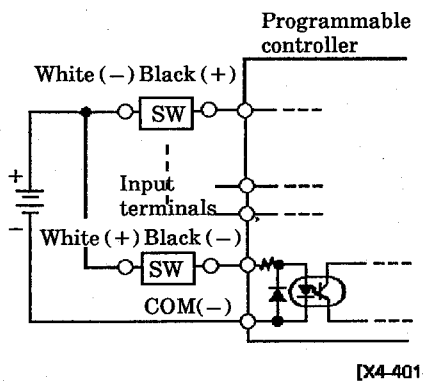


Fig. 10 An example of T2 model connection to sink load input type.

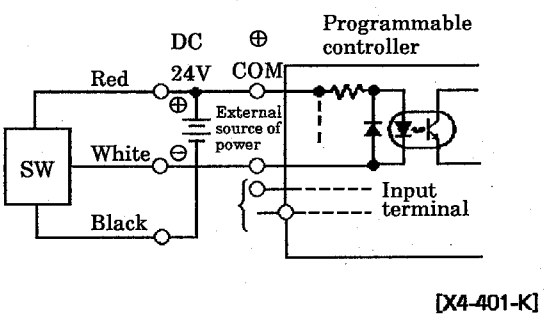


Fig. 11 An example of T3 model connection to source load input type (an external power of source)

※ SW=Switch

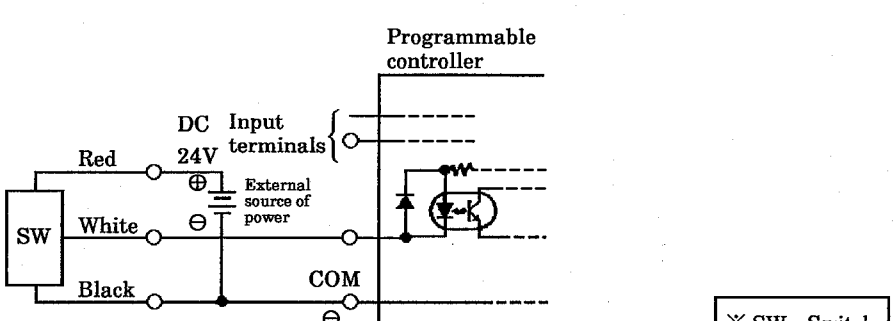


Fig. 12 An example of T3, S3 model connection to source load input type (an internal power of source)
T3, S3 switch is, however, unable to be connected to the sink load input sequencer.

(4) Series connection

The total voltage loss when series connected T2, S2 switches equals to the sum of respective voltage loss of each switch. Load side voltage is only the residual after total voltage loss. Therefore, confirm the required voltage to the programmable controller input before deciding the number of switches connected in series. It is recommended of consulting us prior to have plural number of T3, S3 switches connected.

(5) Parallel connection

When connecting T2 or S2 switches in parallel, leak current multiplies by the number connected. Also, the other switches tentatively become incapable to turn ON while one switch within the parallel connection is turned ON due to the voltage between switch terminals dropping down to the value of internal voltage drop. Therefore, confirm the required current to the programmable controller input before deciding the number of switches as connected load.

T3 or S3 on the contrary, connection of these switches creates very rare problem of multiplied leakage due to almost negligible leakage (less than 10 μA) of individual switch. It sometimes causes dimmed lamp or no lamp lit.

(6) Magnetic environment

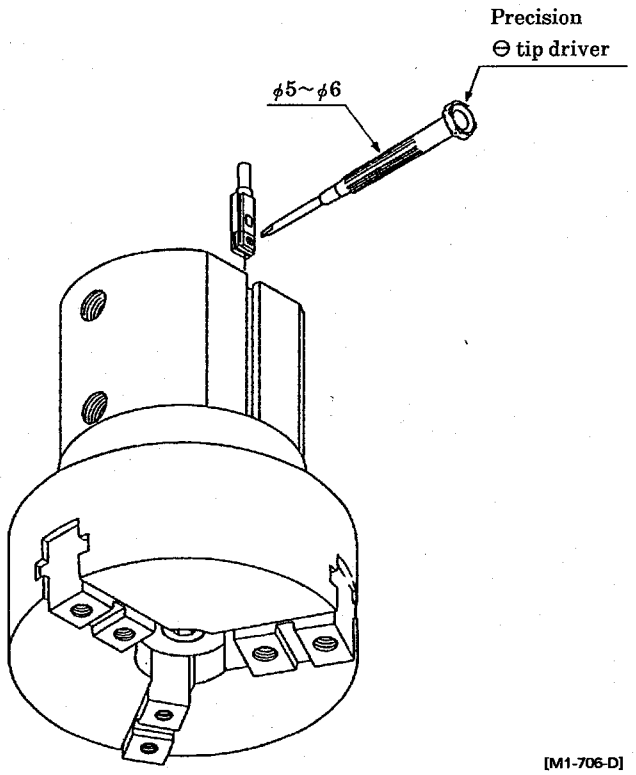
Avoid usage of these switches within the area where strong magnetic field or large current exists. (such as a large magnet or spot welding equipment) Position sensoring errors will be resulted when installing many cylinders with switch in parallel or magnetized piece come across the cylinder due to intervention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

(7) Protection of lead cord

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

7-6. Switch Adjustment

To fix the switch position, slide it in through a groove for switch from the position illustrated and tighten it with a precision screw driver, minus tip, after sensing its mounting position.



Note : Use a precision screw driver, minus tip, of handle diam. appox. 5mm to tighten set screw of switch, applying tightening torque of 10~20N · cm