CKD

SM－209021－A

INSTRUCTION MANUAL

SEL CYLINDER

CAV2(-S)　CAV2-N(S)

COV$^{P}_{N}$2(-S)　COV$^{P}_{N}$2-N(S)

- 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 5th 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:

⚠ CAUTION :

- 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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Sel Cylinder

Manual No. SM-209021-A

1. UNPACKING

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

2. INSTALLATION

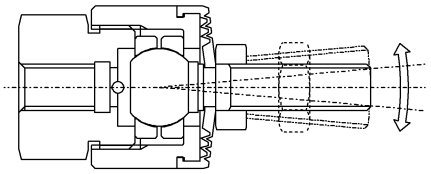
2.1 Installation

1) The Ambient temperature for this cylinder is -10 to 60℃. Always operate the cylinder within this temperature range.

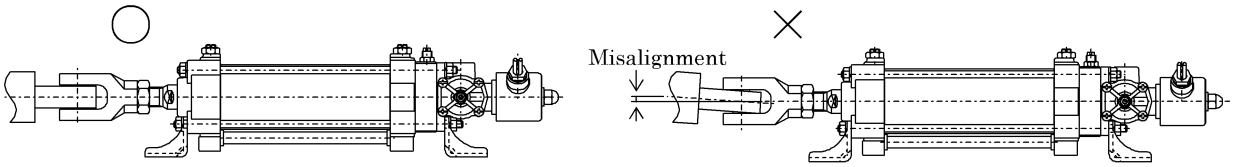
2) Use cylinder with bellows over its rod within the area with much dust.

3) Carefully avoid other object from hitting the tube. Otherwise, it may get the tube distorted and cause malfunction of the cylinder.

4) To prevent damages of threads at the tip of the piston rod or wear or seizing of the bush, be sure to use our floating connector (ball bearing) that does not cause twisting of stroke between the piston rod tip and load.

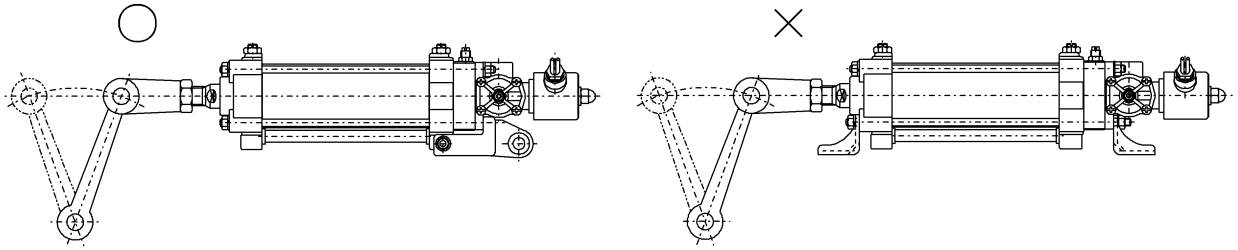


5) In case the direction of the load moving is not parallel to the rod axis, rod and tube may be twisted resulting in seizure or breakage. Let the rod axis align with the direction of load moving, accordingly.



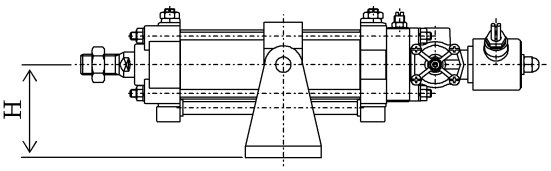
6) Install a support, in case that the cylinder stroke is long, in order to prevent the rod from sagging, the tube from deflection and the rod from damaging due to vibration and an external load.

7) It is not desirable to connect a fixed cylinder with an arm, which moves circularly. Connect the arm with a sway type cylinder in such a case.



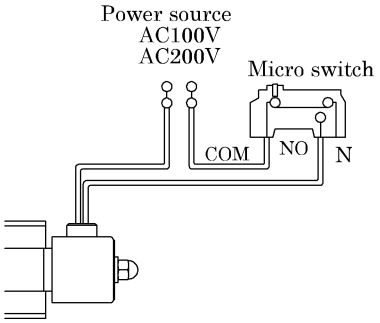
8) Use a sway type cylinder (clevis type or trunnion type) which rotates itself in a certain angle, in case the direction of load motion changes as the cylinder activates. Furthermore, install the connecting metal fittings (knuckle) at the rod end, so that it also moves in the same direction with the motion of the cylinder body.

9) Large clearance between a clevis or a trunnion and the opposite bearing cause the effect of bending action upon or an axis. Therefore, the clearance should not be excessive. (Recommended maximum fitting: H10/e8)
When the height (H) from attached surface of a bearing bracket to the bearing location is high, a large stress generated by a cylinder force at the attached area of a bracket may cause the failure of fitting bolt and the like.



10) Wiring

(1) COV※2, wiring
As one solenoid valve only is used, it is so designed to drive piston rod while the coil is energized and let piston rod return to the state of prior to energizing when the coil is de-energized. To have the piston rod complete its stroke, therefore, it is necessary to hold micro switch ON by means of cam or relay etc until piston rod completes one stroke.



- Wire in accordance with the diagram on the name plate of power source.
- Use electric cord of the sectional area of more than 0.75 mm^2.
- Build in a protective fuse. (Fuse capacity 1A.)
- Select switch of snap action relay in electric so long as possible.
- Build the circuit so as to keep voltage drop minimum.
- Confirm the function of solenoids before supplying operation medium, by repeatedly turning switch ON and OFF for several times. Click sounds should be heard when turning switch ON and OFF when it functions right.

(2) CAV2, Wiring

Momentary electrification to prospective solenoid for respective direction of piston motion enables solenoid to set holding because two individual solenoids have been installed to shift SEL cylinder CAV2. Therefore, a momentary electrification only is required instead of continuous current to shift cylinder motion for complete stroke.

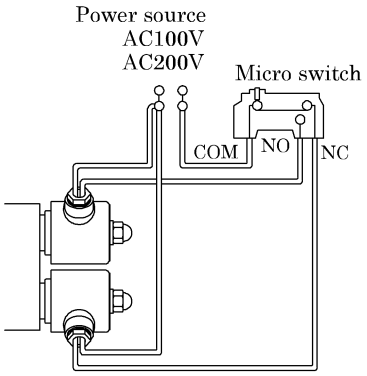


Fig. 1

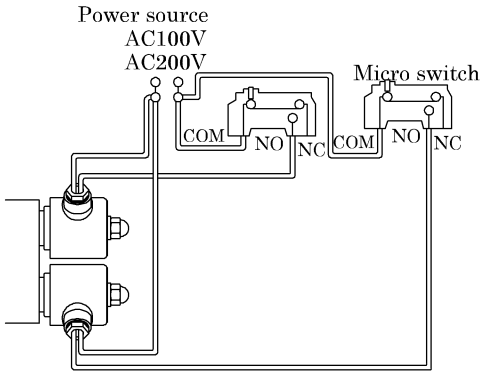


Fig. 2

- Wire in accordance with the diagram on the name plate of power source.
- Use electric cord of the sectional area of more than 0.75mm^2.
- Design wiring so as to have each one of two solenoids alters its actuation.
- Build in a protective fuse. (Fuse capacity 1A)
- Build the circuit so as to keep voltage drop minimum.
- Wire it as per illustrated in Fig. 1 above when intending to utilize one only micro switch.
- Wire it as per illustrated in Fig. 2 above when intending to utilize two micro switches.
- Confirm that solenoids function by turning switch ON and OFF without supplying operation medium. Click sounds should be heard when turning switch ON and OFF.

11) Modification between piston advancing type and retracting type when electrified.
The cylinder is normally assembled to be an advancing type at the time of shipping, ex-factory. Comply to the following modification knacks when retracting type is preferred.

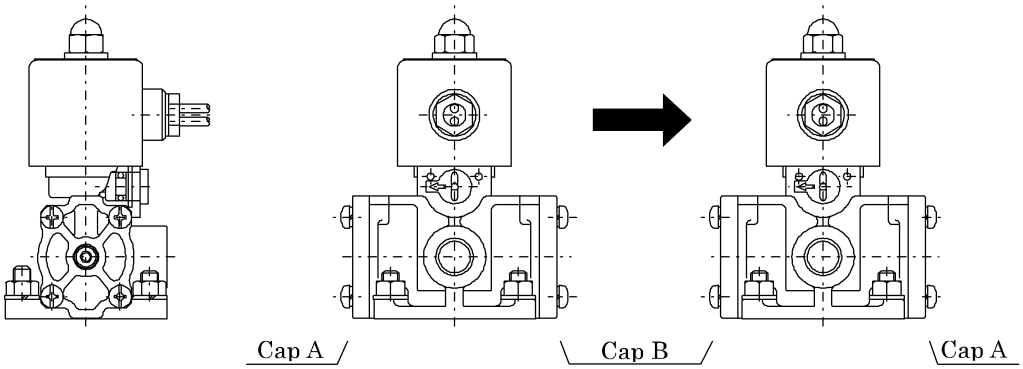


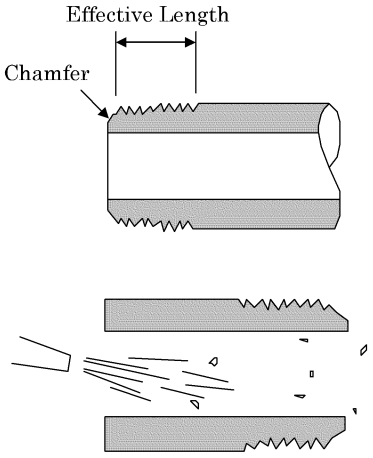
Fig.3 Fig.4

(1) Shift the locations of caps “A” and “B” mounted on both ends of valve with pan head machine screws, as per illustrated from Fig. 3 to Fig. 4.
(2) Be sure to place the marking of “SOL→” according to flow direction.
(3) Apply evenly spread torque to tighten pan head machine screws.

2.2 Piping

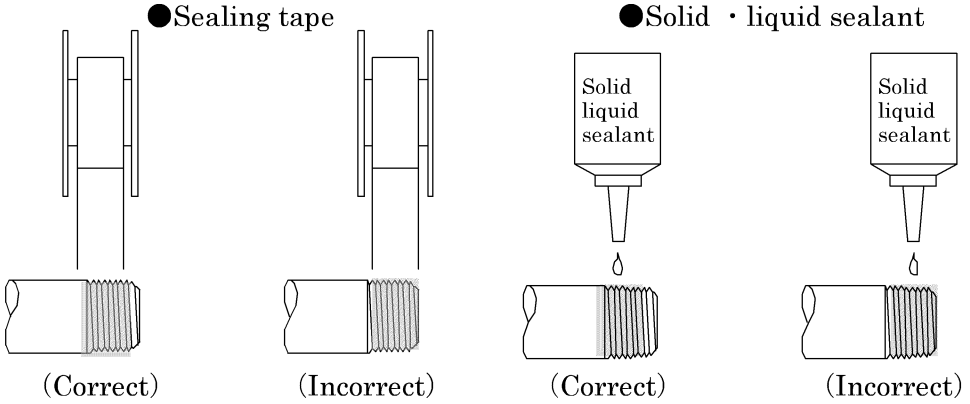
1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc. (The zinc-plating pipe is recommended before the air filter.)
2) Install filter preferably adjacent to the upper-stream to the cylinder for eliminating rust, foreign substance in the drain of the pipe.

3) Be sure observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.



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

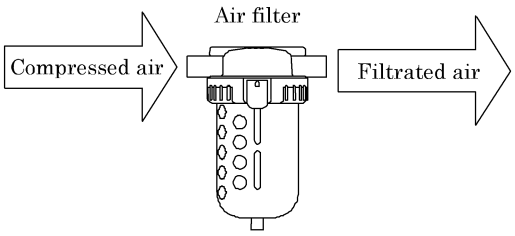
5) Refrain from applying sealant or sealing tape approx. two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.



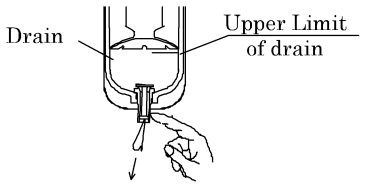
6) After connecting pipes, check leakage at the connecting sections with soap water etc. Wipe off detergent completely.

2.3 Fluid

1) It is necessary to use dehumidified air that has been filtered from compressed air. Carefully select an adequate filter that has an adequate filtration rate (preferably 5 μ m or less), flow rate and its mounting location.



2) Be sure to drain out the accumulation in the filter periodically.



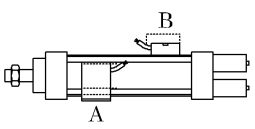
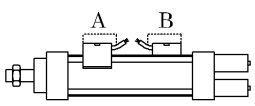
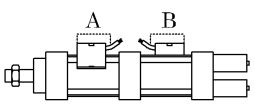
3) Note that the intrusion of carbide for the compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of the solenoid valve and the cylinder. Be sure to carry out thorough inspection and maintenance of the compressor.

4) When lubrication, use turbine oil Class 1 ISO VG32.

2.4 Location of mounting Switches on a Cylinder

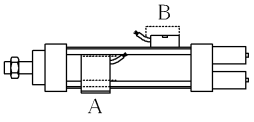
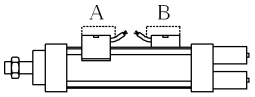
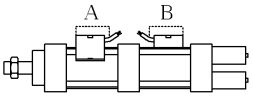
1) Location of mounting switches on a cylinder.
Switches are mounted at the maximum sensitive position on cylinder. The switch attachment method in the circumferential direction depends on the stroke. Refer to Table 1 and Table A.

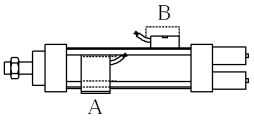
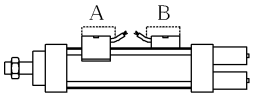
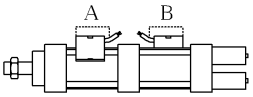
Table 1
Min. stroke length with switch (R type)

<table>
<tr><td colspan="3" rowspan="2">Item / Bore size (mm)</td><td colspan="2">When different surface installation</td><td colspan="2">When same surface installation</td><td colspan="2">When center trunnion type</td></tr>
<tr><td>Grommet</td><td>Terminal box</td><td>Grommet</td><td>Terminal box</td><td>Grommet</td><td>Terminal box</td></tr>
<tr><td>CAV2</td><td colspan="2">ϕ 50</td><td rowspan="3">20 or more</td><td rowspan="3">50 or more</td><td rowspan="3">100 or more</td><td rowspan="3">150 or more</td><td rowspan="2">140 or more</td><td rowspan="2">200 or more</td></tr>
<tr><td>COVP2</td><td colspan="2">ϕ 75</td></tr>
<tr><td>COVN2</td><td colspan="2">ϕ 100</td><td>150 or more</td><td>210 or more</td></tr>
<tr><td colspan="3">The minimum stroke for attaching the switch is the same for 1-switch type and 2-switch type.</td><td rowspan="3">Installation method</td><td rowspan="3">  </td><td rowspan="3">  </td><td rowspan="3">  </td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>Grommet (G)</td><td>Terminal box (B)</td></tr>
<tr><td>20</td><td>※ 50(20)</td></tr>
</table>

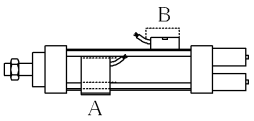
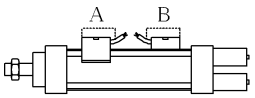
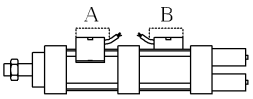
Face the conduit of the terminal block with ※ mark to the head cover side or rod cover side, so that the minimum stroke is 20 mm.

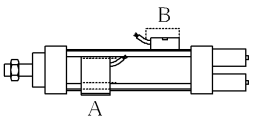
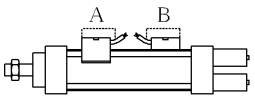
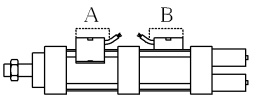
Table A
Min. stroke length with switch (T0/T5/T8 type)

Descriptions	When different surface installation				When same surface installation				When center trunnion type			
Non-cushion												
Switch q'ty	1	2	3	4	1	2	3	4	1	2	3	4
ϕ 50	9(9)	18(18)	35(35)	53(53)	9(9)	18(18)	49(48)	81(79)	215(215)	215(215)	215(215)	215(215)
ϕ 75	10(10)	19(19)	38(38)	57(57)	10(10)	19(19)	51(50)	82(81)	193(193)	193(183)	193(193)	193(183)
ϕ 100	10(10)	19(19)	38(38)	57(57)	10(10)	19(19)	51(50)	82(81)	83(71)	83(71)	83(71)	83(71)

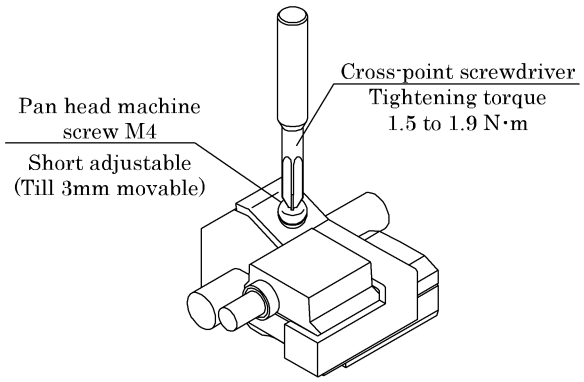
Descriptions	When different surface installation				When same surface installation				When center trunnion type			
Cushioned												
Switch q'ty	1	2	3	4	1	2	3	4	1	2	3	4
ϕ 50	9(9)	18(18)	35(35)	53(53)	9(9)	18(18)	49(48)	81(79)	241(241)	241(241)	241(241)	241(241)
ϕ 75	10(10)	19(19)	38(38)	57(57)	10(10)	19(19)	51(50)	82(81)	241(241)	241(241)	241(241)	241(241)
ϕ 100	10(10)	19(19)	38(38)	57(57)	10(10)	19(19)	51(50)	82(81)	120(108)	120(108)	120(110)	120(110)

Min. stroke length with switch (T1/T2/T3/T2Y/T3Y)

Descriptions	When different surface installation				When same surface installation				When center trunnion type			
Non-cushion												
Switch q'ty	1	2	3	4	1	2	3	4	1	2	3	4
ϕ 50	5(5)	10(10)	20(20)	30(30)	5(5)	10(10)	50(48)	89(88)	76(46)	76(46)	76(47)	76(47)
ϕ 75	5(5)	11(11)	21(21)	32(32)	5(5)	11(11)	50(49)	90(88)	54(24)	54(24)	54(26)	54(26)
ϕ 100	6(6)	12(12)	23(23)	35(35)	6(6)	12(12)	51(50)	91(89)	84(54)	84(54)	84(58)	84(58)

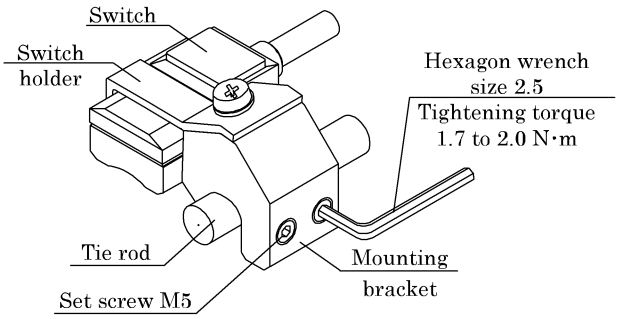
Descriptions	When different surface installation				When same surface installation				When center trunnion type			
Cushioned												
Switch q'ty	1	2	3	4	1	2	3	4	1	2	3	4
ϕ 50	5(5)	10(10)	20(20)	30(30)	5(5)	10(10)	50(48)	89(88)	102(72)	102(72)	102(73)	102(73)
ϕ 75	5(5)	11(11)	21(21)	32(32)	5(5)	11(11)	50(49)	90(88)	102(72)	102(72)	102(74)	102(74)
ϕ 100	6(6)	12(12)	23(23)	35(35)	6(6)	12(12)	51(50)	91(89)	121(91)	121(91)	121(95)	121(95)

2) Installation of switch (R type switch)
Follow the procedures (1) to (3) as described below.



(1) While holding a switch underneath of switch holder, tighten M4 ×10 pan headed machine screws to mount it on the bracket.

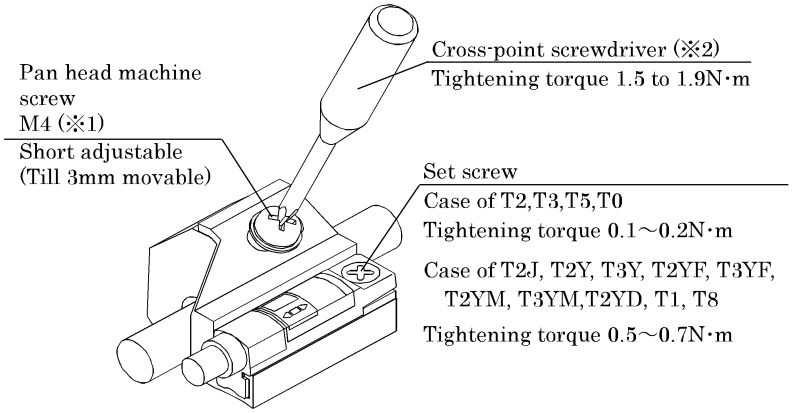
(2) Screw-in the set screws to mount the bracket on the tie rod. While letting the mounting bracket hook the tie rod, slightly screw further until it touches the rod. Thus, it eliminates the whole set of switch from falling off the rod, yet enables to slide the set along the rod. Make use this merit when engaged in adjusting location of the switch set.



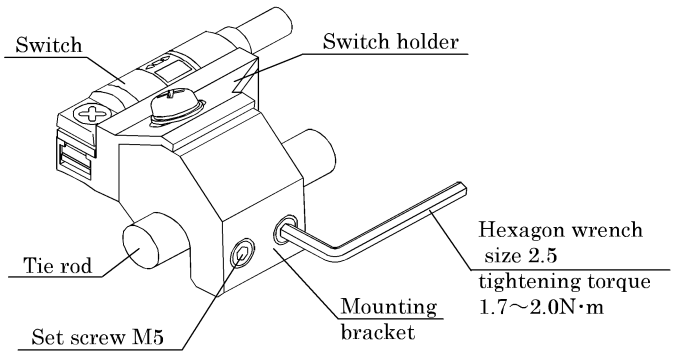
(3) To fix the mounting bracket on the tie rod, tighten screws while pressing bracket slightly against tube. Adequate torque of tightening screw is 1.7 to 2.0 N·m. It is considered to be sufficient, as a rule of thumb, when Hexagon wrench starts bending slightly.

3) Installation of switch (T type switch)
Follow the procedures (1) to (3) as described below.

(1) While holding a switch underneath of switch holder, tighten set screws to mount it on the bracket. Then, fix the switch holder to the attachment table with M4 pan-head machine screws.
(※1: Use the slotted hexagon bolt in the case of T2YD or T2YDT switch.)
(※2: Use the flat-blade screwdriver in the case of T2YD or T2YDT switch.)



(2) Screw-in the set screws to mount the bracket on the tie rod. While letting the mounting bracket hook the tie rod, slightly screw further until it touches the rod. Thus, it eliminates the whole set of switch from falling off the rod, yet enables to slide the set along the rod. Make use this merit when engaged in adjusting location of the switch set.



(3) To fix the mounting bracket on the tie rod, tighten screws while pressing bracket slightly against tube. Adequate torque of tightening screw is 1.7 to 2.0 N·m. It is considered to be sufficient, as a rule of thumb, when Hexagon wrench starts bending slightly.

4) At the stroke end

Take the size of RD (RD') and HD ('HD') in Table 2 so that the switch can function at the position with the maximum sensibility. Also attach the switch so that the lead wire faces inside as shown in the figure below.

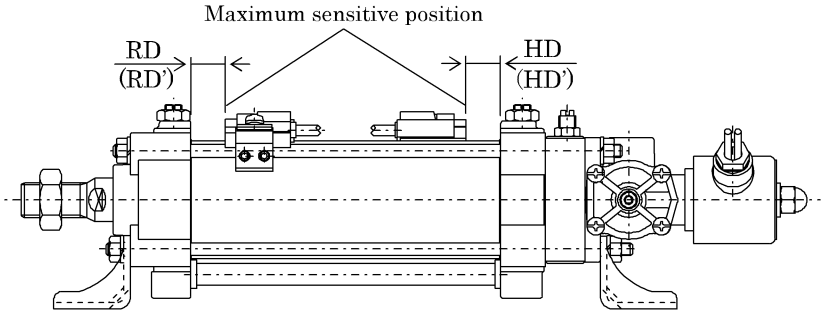


Table 2

Maximum sensitive position , operating range and hysteresis (R type switch) Unit : mm

Bore size	Rod side	Head side	Operating range		
	RD (RD')	HD (HD')	Reed		Solid state
			1 color indicator	2 color indicator	
φ 50	7.5 (20.5)	7.5 (20.5)	8 to 12.5	12 to 16	3.5 to 6.0
φ 75	8.5 (32.5)	8.5 (32.5)	6 to 11	12 to 16.5	5.5 to 7.5
φ 100	13 (31.5)	13 (31.5)	8 to 14	12 to 17	4.5 to 6.0

Note: Dimensions indicated in ( ) shows those for cushion equipped type (B).

Table B
Maximum sensitive position, operating range and hysteresis (T type switch)

Maximum sensitive position RD/HD (RD'/HD')

Bore size	T0H/V,T5H/V,T2H/V,T3H/V	T2YH/V,T3YHV,T2JH/V,T1H/V	T8H/V	T2WH/V,T3WH/V
ϕ 50	12.5 (25.5)	12.5 (25.5)	7 (20.5)	15.5 (28.5)
ϕ 75	13.5 (37.5)	13.5 (37.5)	8.5 (32.5)	16.5 (40.5)
ϕ 100	17.5 (36)	17.5 (36)	12.5 (31)	20.5 (39)

Operating range

Bore size	T0H/V,T5H/V,T8H/V	T1H/V,T2H/V,T3H/V,T2JH/V	T2YH/V,T3YH/V,T2WH/V,T3WH/V
ϕ 50	6.5 to 11.5	3 to 6.5	6.5 to 8
ϕ 75	7 to 13	3 to 6	3.5 to 6.5
ϕ 100	7 to 13	3.5 to 6.5	7 to 9.5

Hysteresis

Bore size	T0H/V,T5H/V,T8H/V	T1H/V,T2H/V,T3H/V,T2JH/V	T2YH/V,T3YH/V,T2WH/V,T3WH/V
ϕ 50～100	3 or less	1.5 or less	1.0 or less

3. OPERATION

3.1 Operating the Cylinder

1) The working pressure for this type of cylinder is 0.15 to 0.7. Operate the system within this range.
However, if kinetic energy such as load is heavy or speed is too fast, exceeding the values given in Table 3, consider of providing a shock absorber.

2) Though the cushion has been adjusted at no load when delivered, adjust the cushion needle when the change of cushion effect is required.
Tightening the needle (clockwise) makes cushion more effective. Tighten the needle lock nut all the way after adjustment.

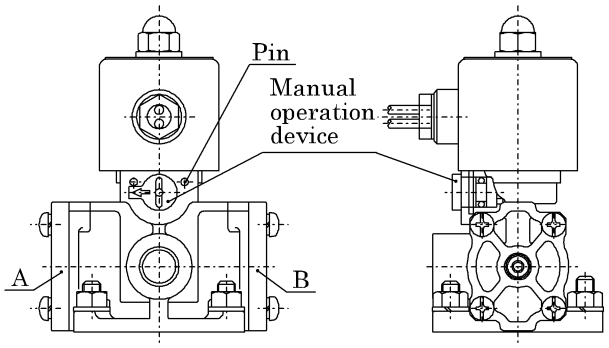
Table 3 Cushion characteristics

Bore size (mm)	Effective air cushion length (mm)	Allowable energy absorption (J)	
		Cushioned	Non cushion
φ50	6.5	1.37	(note)
φ75	6.5	3.33	
φ100	5	10.3	

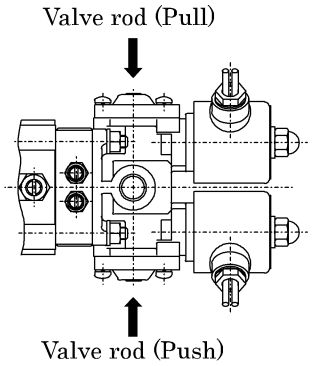
Note : If not cushioned, large load generated by external load cannot be absorbed.
CKD recommends use of an external shock absorber.

3) Working piston speed adjusts by speed adjusting needle.
When the speed adjusting needle is turned clockwise, the speed decreases, and increases when turned counterclockwise.

4) Manual shifting
(1) COV※2, Manual shifting
The structure of SEL cylinder (COV※2) is affordable of manual shifting. This feature is made use of during test runs while wiring is not completed and/or power failure. Manual operation becomes available when manual operating device is turned counterclockwise until its pin hits the stopper. (It is equivalent to electrified status during its automatic operation.)



(2) CAV2, Manual shifting
The structure of SEL cylinder (CAV2) is affordable of manual shifting. This feature is made use of during test runs while wiring is not sompleted and/or power failure. Manual operation is as such; pushing the valve rod or "Push end" with a screw driver makes piston rod advance while pushing the valve rod of "Pull end" makes rod retract.



3.2 How to use the Switches

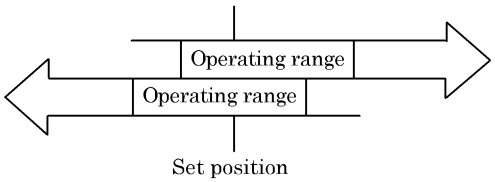
3.2.1 Cautions

1) Magnetic environment
Do not operate this product in a place where a strong magnetic field or large current (large magnet or spot welder, etc.) exists.
Apply the magnetic shield.
(e.g.) Put up the iron plate around the switch.

2) Lead wire wiring
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.

3) Operating temperature
Do not operate the product at a high temperature (40℃)
Always avoid operation of the product in a hot place due to temperature characteristics of magnetic and electronics parts.

4) Intermediate position detection
To set the switch at the center position of the stroke, fix the piston at the position to be set. Move the cylinder switch in both ways to find the operating position and operating range. The center position is the position with the maximum sensitivity, and the switch should be attached to the position.

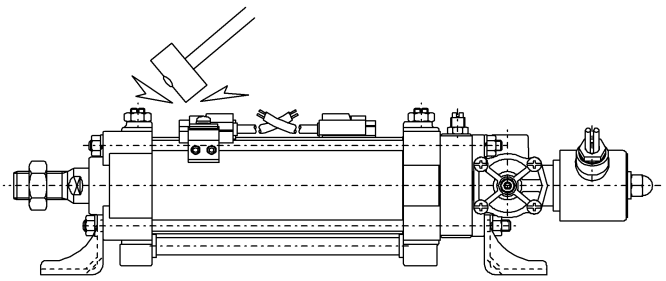


If the working piston speed is too high, the control device cannot respond properly and the correct operation for detecting the middle position is not possible.
The maximum detectable working piston speed is :

$$\frac{\text{Operating range of switch (mm)}}{\text{Response time of control unit (ms)}} \times 1000 \times 0.8 \text{ (safety factor)}$$

To detect the middle position when the response time of the control device is 25 ms or less and CAV2 be inside diameter is ϕ 75, the working piston speed should be 416 mm/s or less.

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



3.2.2 Reed switch (T0, T5, T8, R0, R4, R5, R6)

1) Lead wire connections
Do not connect the lead wires of the switch to the power supply directly. Always connect the loads in series. For T0、R0 switch, carefully check following items (1), (2).

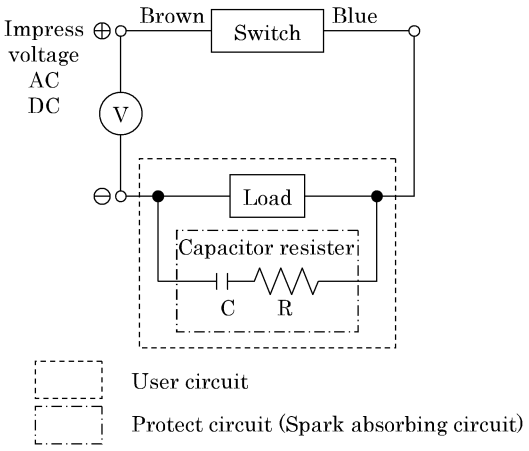
(1) When using the switch for DC power supply, connect the brown and blue lines to the positive and negative sides, respectively. If these lines are connected reversely, the switch is activated, but the indicator light is not lit.
(2) When the switch is connected to an AC relay or a programmable controller input, the indicator light on the switch is not lit if the half-wave rectification is performed in the connected circuit. If this occurs, reverse the polarities of the switch lead wire connection. The indicator light may then be lit.
Note that the R4 and R5 switches have no polarities.

2) Contact protective measures
When an inductive load, such as relay is used or the wire length exceeds that stated in Table 1, always install a contact protective circuit.

Table 1

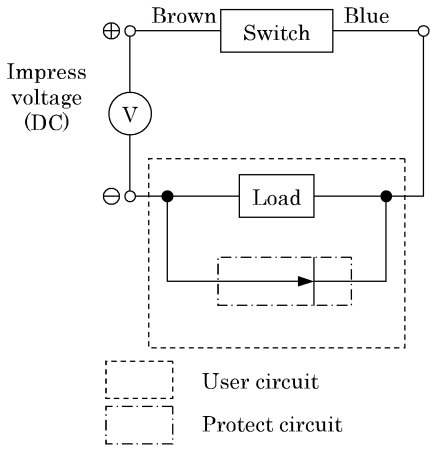
Switch	Electric power	Length of wire
T0, 5, 8, R0, 5, 6	DC	50m
T0, 5, 8, R0, 5,	AC	10m
R4	AC	50m

(1) Protective circuit when connecting an inductive type load.



Recommended value
C (Capacitor) 0.033 to 0.1 μF
R (Resister)1 to 3kΩ
XEB1K1 Okaya Denki Mfg or equivalent

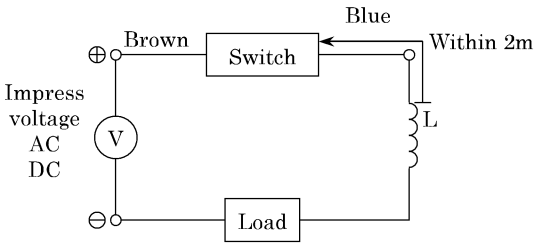
Fig.1 When capacitor resister is used.



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

Fig.2 When diode is used.

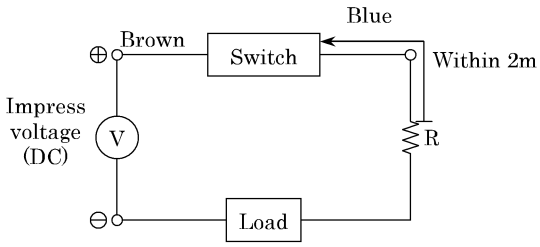
(2) Protective circuit when the wire length exceeds that stated Table 1



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

・ Install it near by a switch (within 2m).

Fig.3



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

・ Install it near by a switch (within 2m).

Fig.4

(3) Contact capacity

Do not use a load exceeding the maximum contact capacity of the switch. Additionally, if the current is lower than the rated current value, the indicator light may not be lit. (T0, R0, R6)

(4) Relay

Always use the relays listed below.
Omron Corporation ·····MY type
Fuji Electric Co., Ltd. ·····HH5 type
Panasonic, Ltd. ·····HC type

(5) Series connection

When multiple T0 and R0 switches are used with they connected in series, the voltage drop at the switch becomes the sum of voltage drop values of all switches.
Therefore, the voltage applied to the load becomes a voltage that the voltage drop at the switch is subtracted from the power supply voltage. Thus, always check the minimum operating voltage value of the load.

Example: The following shows the voltage drop at the switch when three T0 switches are connected in series.

$2.4V \times 3 = 7.2\ V$

Since the voltage drop at the T5 and R5 switch is 0V, as many switches as required can be connected in series. When one T0 or R0 switch is used for checking of operation and T5 and R5 switch is used for other switches, they can be used with the voltage drop equivalent to one T5 or R0 switch (2.4V). In this case, the indicator light is lit only when all switches are turned ON.
If two R4 switches are connected at 100V AC or three or more R4 switches are connected at 200V AC, the indicator light is not lit. Additionally, the R6 switch cannot be connected in series.

(6) Parallel connection

When multiple T0, T5, R0 and R5 switches are connected in parallel, there are no limitations on the number of switches. When multiple R4 and R6 switches are connected in parallel, the leakage current increases for the number of switches. Therefore, carefully check the load specifications to determine the number of switches to be connected.

However, if multiple T0, R0 and R6 switches are turned ON at the same time, the indicator light becomes dark or is not lit. For R4 switch, if even one R4 switch is turned ON, all indicator lights go off.

3.2.3 Solid state type switch (T1, T2, T3, R1, R2, R3)

1) Lead wire connections

Do not connect the lead wires of the switch to the power supply directly. Always connect the loads in series.

(1) For T2 and R2 switch, connect the brown and blue lines to the positive and negative sides, respectively. If these lines are connected reversely, the switch and load are always kept activated. In this case, the indicator light is not lit.

For T3 and R3 switch, pay special attention to Fig. 2 below.

(2) Always connect the lead wires while referring to the colors shown on the lead wires. At this time, turn OFF the power to the unit in the electrical circuit on the connection side before starting the wire connection work.

For T3 and R3 switch, if the wiring is performed incorrectly or the load is short-circuited, this may cause the switch, as well as the electrical circuit on the load side to break. Carefully connect the lead wires so that they are not connected incorrectly or short-circuited.

Additionally, the work with the power supplied may cause the switch and electrical circuit to break if the work is performed in an incorrect manner even though the incorrect wiring is not performed.

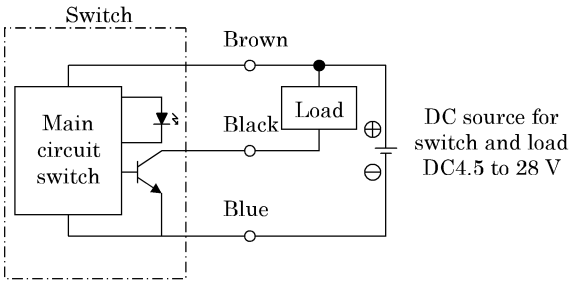


Fig.1 Fundamental circuit Example (1)
(In case the same source of power is used.)

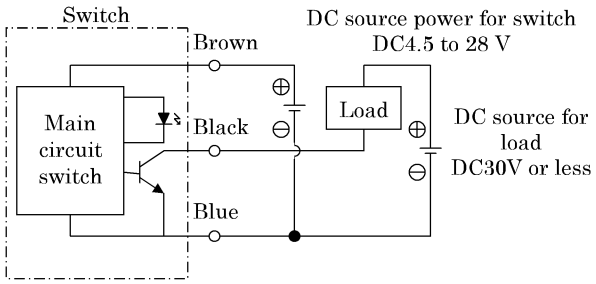


Fig.2 Fundamental circuit Example (2)
(In case individual sources of power are used.)

2) Connection load

The T1 and R1 switch can be connected to a load, such as AC programmable controller, relay, solenoid, or solenoid valve.

The T2 and R2 switch is specially designed as a programmable controller switch. Since this switch uses two wires, it is connected to either the sink input or source input.

The T3 and R3 switch can be connected to a load, such as digital IC, microcomputer, programmable controller, relay, solenoid, or solenoid valve.

When selecting or designing a load, carefully check the static electrical characteristics, as well as transient electrical characteristics (rush current when the switch is turned ON or surge voltage when the switch is turned OFF) so that they do not exceed the switch ratings. Additionally, if the electrical characteristics may exceed the switch ratings, appropriate protective measures are taken (surge absorbing element or rush current limiting resistance, etc.).

4. MAINTENANCE

4.1 Periodical Inspection

1) In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.
2) Inspection items
   (1) Check the mounting bolts and nuts of switch mounting for slackening.
   (2) Confirm the switch mounting position.
   (3) Lighting condition of indicator lights.
   (4) Check the mounting bolts and nuts of cylinder mounting.
   (5) Check the bolts and nuts fitting the piston rod end brackets and mounting brackets for slackening.
   (6) Check to see that the cylinder operates smoothly.
   (7) Check any change of the working piston speed and cycle time.
   (8) Check for internal and/or external leakage.
   (9) Check the piston rod for flaw (scratch) and deformation.
   (10) Check the stroke for abnormality.
   (11) Check any corrosion inside of each port.

   Carry out additional tightening, should there be any abnormal slackening.

3) Items of inspection by disassembly.
   (1) Flaw and corrosion on internal surface of tube.
   (2) Flaw and pealing of plating or rust.
   (3) Flaw and wear of bushing internal surface.
   (4) Scratch, wear, rust or flaw of the piston external surface.
   (5) Slackening threaded joint between piston and rod.
   (6) Corrosion or flaw of both end covers.
   (7) Wear and tear of sliding packings (dust wiper, rod packing, cushion packing, piston packing, wear ring, slide valve, spool packing).
   (8) Wear and tear of sliding parts of exhaust block.

   Repair or replace parts as required upon inspection.

4.2 TROUBLE SHOOTING

1) Cylinder

Trouble	Causes	Remedies
Does not operate.	No pressure or inadequate pressure.	Provide an adequate pressure source.
	Improper or misalignment of installation.	Correct the installation state and/or change the mounting style. Connection of floating connector
	Broken piston packing	Replace the piston packing.
Does not function smoothly.	Speed is below the low speed limit	Limit the load variation and consider the adoption of low pressure cylinder.
	Improper or misalignment of installation.	Correct the installation state and/or change the mounting style. Connection of floating connector
	Exertion of transverse (lateral) load.	Install a guide. Revise the installation state and/or change the mounting style.
	Excessive load.	Increase the pressure itself and/or the inner diameter of the tube.
Breakage and/or deformation	Impact force due to high speed operation	Use the cushion more effectively. Turn the speed down. Reduce the load and/or install a mechanism with more secured cushion effect (e.g.external cushion mechanism).
	Exertion of transverse load.	Install a guide. Reverse the installation state and/or change the mounting style.

2) Solenoid valve

Troubles	Causes	Defective	Remedies
Service medium does not flow	Electric circuit defective	Power supply・Voltage drop ・Frequency ・If it is alive Check a fuse Switching circuit defective	Power supply correction
	Coil defective	Improper coil voltage, improper frequency Connection defective (piping) Burnt of coil (Due to over load) Disconnection	Replace coil Check Replace it 〃
	Pressure	Higher than specifications Lower than specifications	Adjust it 〃
	Clogged	Clogged piping Clogged valve body Bad function of valve	Disassemble & clean 〃 〃
Insufficient flow	Electric circuit defective	Power supply (Voltage drop)	
	Foreign particle	Valve seat	Clean it
	Insufficient primary pressure	Piping circuit	Repair piping
Does not close	Electric circuit defective	Switch relay, or limit switch etc. Gages (Controller) Piping circuit	Correct or replace it 〃 〃
	Packless pipe defective	Valve, Core, Pipe	Replace it with new one
	Improper pressure	Piping	Correct
	Residual magnetism	Deteriorated spring	Replace it new one
Burnt out coil	Electric circuit defective	Improper power supply, Voltage over or under Frequency	Correct power supply
	Improper coil	Coil	Replace it with new coil
	Assembly defective	Improper Bonnet core, plunger	Reassemble
	Coil insulation defective	Coil	Replace it with new one
	Caught foreign particle	Plunger	Clean it
leakage	Lead form Out port Due to foreign particle Deteriorated spring	Plunger Valve seat Spring	Clean it Replace it with new one 〃
	Lead from other than Out port Twisted packing No packing by error Insufficient tightening or loosening Due to foreign particle Damage	Packing Core Core, O-ring Welded structure	Replace it Tighten additionally Clean it Replace it

3) Switch

Troubles	Causes	Remedies
Indicator light is not lit.	Deposited contact point	Replace the switch.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
	Damaged indicator light	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
Switch does not function right.	Broken circuit	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
	Improper voltage	Correct voltage to specified.
	Incorrect location of switch	Correct its location.
	Aberrant position of switch	Set it back to original position and tighten the mounting device. Tightening torque 1.5 to 1.9N・m
	Incorrect direction of switch mounting	Correct the direction of the switch mounting.
	Relay is unable to respond properly	Turn the speed down. Replace the relay with a recommended one.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
	The cylinder speed is too high when detecting the stroke.	Lower the speed.
Switch does not return.	Piston is not moving	Make the piston move.
	Deposited contact point	Replace the switch
	Excessive load (relay) than rated capacity	Replace the relay with a recommended one or replace the switch.
	The ambient temperature is out of the specification range	Adjust the ambient temperature within the range of -10 to 60℃
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

4.3 Disassembly & Assembly

In case of a failure, perform necessary repairs according to following disassembly procedures.

1) Prepare the tools for disassembly listed below;

Disassembling tools

Tool	Qty	Applications		Applicable Cylinder Inner Diameter (mm)
		CAV2-(N)	COV2-(N)	
Hexagon wrench (nominal 2.5)	1	⑰	⑰	All pipe sizes
Hexagon wrench (nominal 5)	1	For disassembling exhaust block		φ 75, φ 100
Spanner (nominal 10)	2	㉖ ㉝	㉖ ㉝	㉖ φ 50,㉝ : All pipe sizes
Spanner (nominal 13)	2	㉖ Cap nut	㉖ Cap nut	㉖ φ 75, All pipe sizes
Spanner (nominal 17)	2	㉖	㉖	φ 100
Spanner (nominal 13)	1	⑨	⑨	All pipe sizes
Minus headed screw driver (nominal 9×200)	1	⑦ ㉜	⑦ ㉜ ㊶	All pipe sizes
Cross-point screw driver (nominal 6×100)	1	㊺ ㊶	㊺	All pipe sizes
Wooden hammer	1	⑥ ⑫ ㉔	⑥ ⑫ ㉔	All pipe sizes
Eyeleteer	1	③ ⑦ ⑩ ㉔	③ ⑦ ⑩ ㉔	All pipe sizes

2) Disassembly

Cylinder disassembly procedure

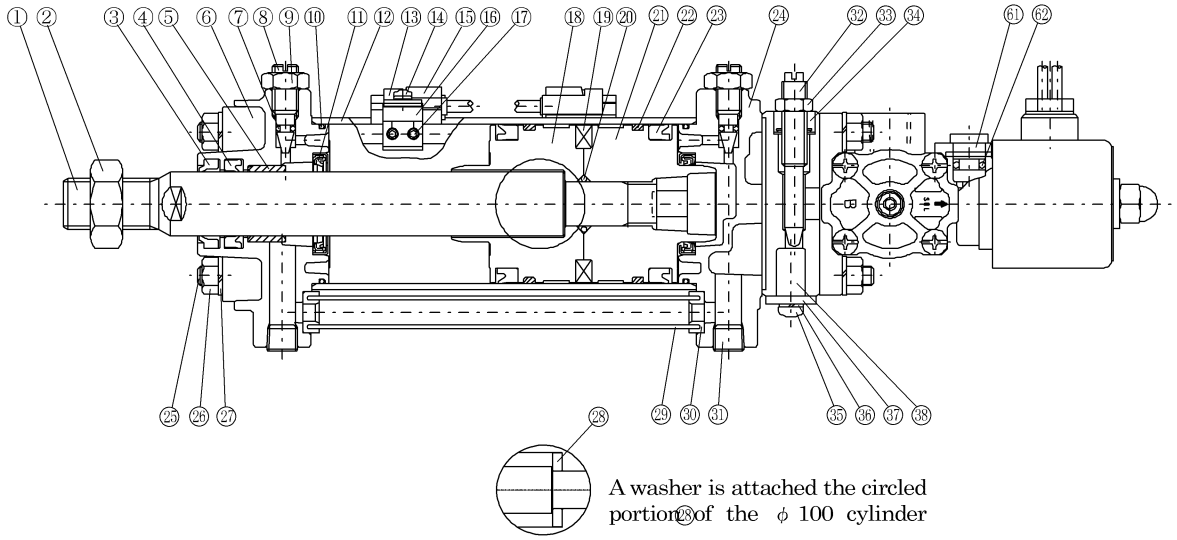
(1) Disconnect the solenoid valve and the wiring, and remove the load from the cylinder. Finally, unfasten cylinder mounting bolts.
(2) Remove the hexagon nut ㉖. the rod cover ⑥, the cylinder tube ⑫, the head cover ㉔, the pass pipe ㉙, etc. can be disassembled.
(3) To remove the rod packing ④, and the dust wiper ③, detach the rod cover first, then remove them using an eyeleteer.

Solenoid valve disassembly procedure

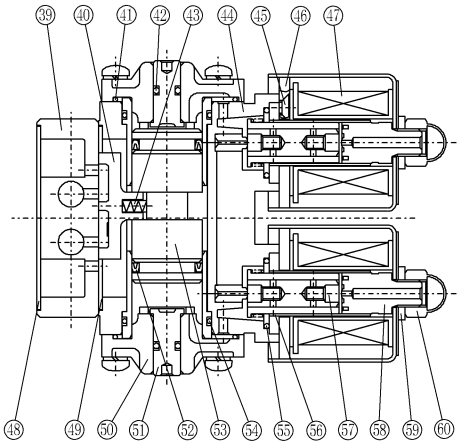
(1) The spool packing ㊷ and ㊸ can be replaced by removing the cap bolt.
(2) For φ 50…The slide valve ㊵ can be replaced by removing the hexagon nut ㉖.
(3) For φ 75 and φ 100…The slide valve ㊵ can be replaced by unfastening the solenoid vale locking hexagon socket bolt.
(4) The plunge ㊼ can be replaced by removing the cap nut ㊿ and the ring core bolt ㊺.

note) When removing the coil, do not pull the lead wires.

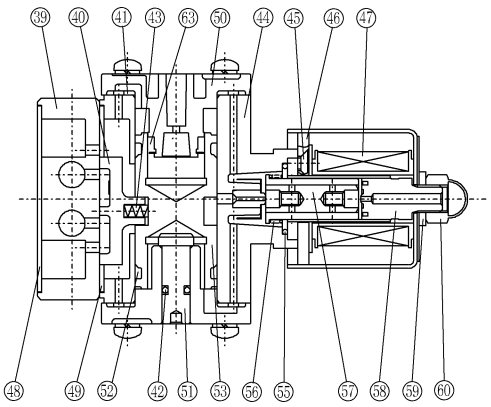
Internal structure drawings and Parts list



● CAV2, CAV2-N (double solenoid type)



● COVP2, COVN2, COVP2-N, COVN2-N (single solenoid type)



Part No.	Part name	Material	Note
1	Piston rod	Steel	Electroplated coatings of chromium for engineering purpose
2	Hexagon nut	Steel	Zinc chromate
3	Dust wiper	Nitrile rubber	
4	Rod packing	Nitrile rubber	
5	Bushing	Oil impregnated bearing alloy	
6	Rod cover	Aluminum alloy die casting	Painting
7	Needle gasket	Nitrile rubber	
8	Cushion needle	Copper alloy	
9	Needle nut	Copper alloy	
10	Cylinder gasket	Nitrile rubber	
11	Cushion packing	Urethane rubber, steel	Special
12	Cylinder tube	Aluminum alloy	Hard anodic oxide corting
13	Switch holder	Stainless steel	
14	Cross Recessed Pan Head Machine Screw	Steel	
15	Cylinder switch	—	
16	Switch mounting base	Aluminum alloy	
17	Set screw	Steel	
18	Piston (R)	Aluminum alloy die casting	
19	Magnet	Plastic	
20	Piston gasket	Nitrile rubber	
21	Piston (H)	Aluminum alloy die casting	
22	Wear ring	Polyacetal resin	
23	Piston packing	Nitrile rubber	
24	Head cover	Aluminum alloy die casting	Painting
25	Tie rod	Steel	Zinc chromate
26	Hexagon nut	Steel	Zinc chromate
27	Spring washer	Steel	Zinc chromate
28	Washer	Steel	Zinc chromate, ϕ 100 only
29	Pass pipe	Stainless steel	
30	Pipe gasket	Nitrile rubber	Special
31	Plug	Steel	Blacking
32	Speed regulating needle	Steel	Nickeling
33	Lock nut	Steel	Zinc chromate
34	U nut	Steel	Zinc chromate
35	Cross Recessed Pan Head Machine Screw	Steel	Zinc chromate (lubrication type only)
36	Spring washer	Steel	Zinc chromate (lubrication type only)
37	Muffler holder plate	Steel	Zinc chromate (lubrication type only)
38	Element	Resin	
39	Exhaust block	Aluminum alloy die casting (copper alloy die casting)	Hard anodic oxide corting (electroplated coatings of chromium for engineering purpose)
40	Slide valve	Polytetrafluoroethylene resin	
41	Cap gasket	Nitrile rubber	
42	Rod gasket	Nitrile rubber	
43	Port spring	Stainless steel	
44	Port body	Aluminum alloy die casting	
45	Cross Recessed Countersunk Head Machine Screw	Steel	Zinc chromate
46	Ring core	Steel	
47	Coil	—	Wound (CAV2), molded (COV2)
48	Exhaust block gasket	Nitrile rubber	
49	Port body gasket	Nitrile rubber	
50	Cap	Aluminum alloy die casting	
51	Valve rod	Aluminum alloy	
52	Spool packing	Nitrile rubber	
53	Spool	Aluminum alloy	
54	Gasket	Nitrile rubber	
55	Gasket	Nitrile rubber	
56	Plunger spring	Stainless steel	

Part No.	Part name	Material	Note
57	Plunger	Stainless steel, Nitrile rubber	
58	Core assembly	Stainless steel, copper	
59	Spring washer	Steel	
60	Cap nut	Steel	
61	Manual knob	Polyacetal resin	COV※2 only
62	Manual gasket	Nitrile rubber	COV※2 only
63	Spool packing	Nitrile rubber	COV※2 only

Note 1: The non cushion type kit does not include parts of ⑦, ⑧, ⑨ and ⑪. Note 2: Including () is non lubrication type.

3) Expendable parts
When placing an order, specify the kit number.

Expendable cylinder parts list

Tube bore (mm) / Kit No. \ Parts No. / Part name	③	④	⑦	⑩
ϕ 50	Dust wiper	Rod packing	Needle gasket	Cylinder gasket
ϕ 75				
ϕ 100				

Tube bore (mm) / Kit No. \ Parts No. / Part name	⑪	㉒	㉓	㉚
ϕ 50	Cushion packing	Wear ring	Piston packing	Pipe gasket
ϕ 75				
ϕ 100				

Note : The non cushion type kit does not include parts of ⑦ and ⑪.

Expendable solenoid valve parts list

Solenoid valve / Kit No. \ Parts No. / Part name	㊵	㊶	㊷	㊸
Double solenoid	Slide valve	Cap gasket	Rod gasket	Port spring
Single solenoid				

Solenoid valve / Kit No. \ Parts No. / Part name	㊽	㊾	㊿	(55)
Double solenoid	Exhaust block gasket	Port body gasket	Spool packing	Gasket
Single solenoid				

Solenoid valve / Kit No. \ Parts No. / Part name	(56)	(57)	(63)
Double solenoid	Plunger spring	Plunger	Spool packing
Single solenoid			

Mounting bracket materials

Mounting bracket type	Material	Note
LB	Steel	Blacking
FA	Steel	Blacking
CA	Cast iron	Painting
TC、TF	Cast iron	Painting

4) Assembly

● Cylinder assembly

(1) Take all possible measures during assembly to prevent dust from entering the cylinder. Clean the removed parts with a trichloroethylene solution or kerosene. (Replace the rubber parts because they may be swelled.)

(2) Assemble the parts with extreme care as not to damage the packings. Otherwise, malfunctioning or air leakage will occur.

(3) Apply quality grease (lithium soap group grease No.1, No.2, etc.) to the inside of the cylinder and the packings.

● Solenoid valve assembly

Assemble the parts, taking care to prevent dust intrusion or damage to the valve seat and the packings.

5) Inspection

(1) Performance inspection

Manually operate, energize and de-energize the solenoid valve to verify that the piston rod moves smoothly.

Inspection condition

Supply pressure: 0.15 MPa or working pressure.

5. HOW TO ORDER

5.1 Product Number Coding

● Without switch

CAV2 – LB – 50 B – 50 – 1 ———— Z Y

● With switch

CAV2 – LB – 50 B – 50 – 1 – R0 – R – Z Y

(a) (b) (c) (d) (e) (f) (g) (h) (i) (j)

(a) Model name			(b) Mounting bracket type		(c) Bore size (mm)	
CAV2	Lubrication type	Double acting, double solenoid	LB	Axial foot type	50	ϕ 50
COVP2		Double acting, single solenoid, extrusion type when energized	FA	Rod side flange type	75	ϕ 75
			CA	Clevis type	100	ϕ 100
COVN2		Double acting, single solenoid, retraction type when energized	TC	Center trunnion type (shaft type)		
CAV2-N	Non-lubrication type	Double acting, double solenoid	TF	Center trunnion type (hole type)		
COVP2-N		Double acting, single solenoid, extrusion type when energized				
COVN2-N		Double acting, single solenoid, retraction type when energized				

(d) Cushion		(e) Stroke (mm)				(f) Voltage	
N	With out cushion	Standard stroke		Maximum stroke (mm)		1	AC100V
B	With cushion on both sides	50	150	Bore size	Stroke	2	AC200V
		75	200	ϕ 50	500		
		100	300	ϕ 75	600		
				ϕ 100	800		

(g1) Switch model code						(g2) Switch model code				
Grommet type	Terminal box		Switch type	Indicator light	Lead wire	Axial lead wire	Radial Lead wire	Switch type	Indicator light	Lead wire
	Std. type	Splash-prf.								
R1※	R1B	R1A	Solid state	1 color indicator	2 wire	T0H※	T0V※	Reed	1 color indicator	2 wire
R2※	R2B	R2A				T5H※	T5V※			
R2Y※	R2YB	R2YA		2 color indicator		T8H※	T8V※			
R3※	R3B	R3A		1 color indicator	3 wire	T1H※	T1V※	Solid state		
R3Y※	R3YB	R3YA		2 color indicator		T2H※	T2V※			
R0※	R0B	R0A	Reed	1 color indicator	2 wire	T3H※	T3V※			3 wire
R4※	R4B	R4A				T2YH※	T2YV※		2 color indicator	2 wire
R5※	R5B	R5A				T3YH※	T3YV※			3 wire
R6※	R6B	R6A				T2WH	T2WV			2 wire
						T3WH	T3WV			3 wire

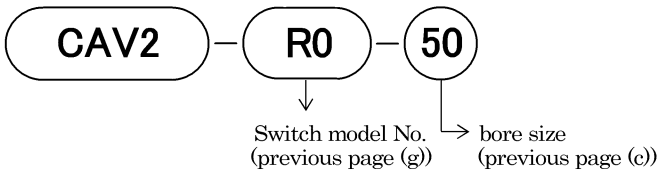
※ Indicates lead length.

※ Lead wire length		(h) Switch Qty		(i) Option		(j) Accessory	
Blank	1m (standard)	R	One on rod side	J	Bellows, nylon tarpaulin	I	Rod eye
3	3m (option)	H	One on head side	TB1	Round type terminal box	Y	Rod clevis
5	5m (option)	D	Two	TB2	Square terminal box (not available for single solenoid type).	B2	Clevis bracket
		T	Three	MF1	Types with muffler (not available for pre-lubricated type).		
				Z	Molded coil (not available for single solenoid type).		
				Q	Air supply block		

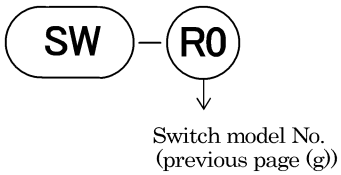
5.2 Component parts Model coding

1) How to order switch

● Switch main body + mounting bracket

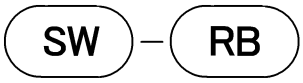


● Only switch body

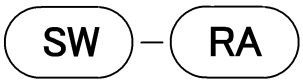


● Terminal box only

・For R□B

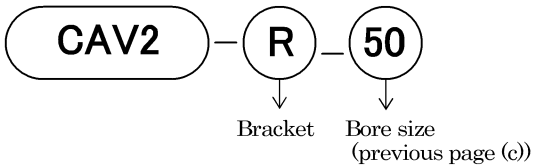


・For R□A

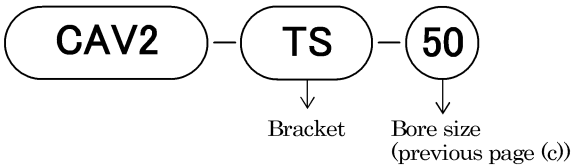


● Mounting bracket

※R type switch



※T type switch



2) Mounting bracket model No.

Bore size (mm) / Mounting bracket	ϕ 50	ϕ 75	ϕ 100
Foot (LB)	CAV2-50-LB	CAV2-75-LB	CAV2-100-LB
Flange (FA)	CAV2-50-FA	CAV2-75-FA	CAV2-100-FA
Clevis (CA)	CAV2-50-CA	CAV2-75-CA	CAV2-100-CA
Axis type trunnion (TC)	CAV2-50-TC	CAV2-75-TC	CAV2-100-TC
Supporting hole (TF)	CAV2-50-TF	CAV2-75-TF	CAV2-100-TF

3) Repair parts

(1) Cylinder repair parts

Bore size (mm)	Kit number
ϕ 50	CAV2-50BK
ϕ 75	CAV2-75BK
ϕ 100	CAV2-100BK

(2) Valve repair parts

Valve	Kit number
Double solenoid type	CAV2-N-K
Single solenoid type	COV2-N-K

6. SPECIFICATION

6.1 Product Specifications

Item \ Model code note 1		CAV2 CAV2-S			CAV2-N CAV2-NS			COV_N^P2 COV_N^P2-S			COV_N^P2-N COV_N^P2-NS		
Bore size	mm	φ50	φ75	φ100	φ50	φ75	φ100	φ50	φ75	φ100	φ50	φ75	φ100
Actuation		Double acting / with solenoid valve											
No. of solenoid		Double solenoid						Single solenoid					
Working fluid		Compressed Air											
Max. working pressure	MPa	0.7											
Min. working pressure	MPa	0.15											
Proof pressure	MPa	1											
Ambient temperature	℃	5 to 40											
Prot size		Rc1 / 4											
Stroke tolerance	mm	$^{+0.9}_{0}$ (to 360)、$^{+1.4}_{0}$ (361 to)											
Working piston speed	mm/s	50 to 750	50 to 450	50 to 250	50 to 750	50 to 450	50 to 250	50 to 750	50 to 450	50 to 250	50 to 750	50 to 450	50 to 250
Cushion		Cushioned or non-cushion can be selected.											
Effective air cushion length	mm	6.5	6.5	5	6.5	6.5	5	6.5	6.5	5	6.5	6.5	5
Lubrication		Required note 2			Not required			Required note 2			Not required		
Allowable energy absorption	J Cushioned	1.37	3.33	10.3	1.37	3.33	10.3	1.37	3.33	10.3	1.37	3.33	10.3
	Non cushion	If not cushioned, large load generated by external load cannot be absorbed. CKD recommends use of an external shock absorber.											

Note 1 : If the model No. includes "S", it indicates the short type with a cushion.

Note 2 : When lubrication, use turbine oil Class 1 ISO VG32.

6.2 Solenoid Valve Specifications

Valve specifications			
Rated voltage	V	AC100V(50 / 60Hz)	AC200V(50 / 60Hz)
Starting current	A	0.9 / 0.27	0.15 / 0.14
Holding current	A	0.11 / 0.09	0.06 / 0.04
Power consumption	W	6 / 5	6 / 5
Voltage fluctuation range		±10%	
Thermal class		Class A (CAV)	Class B (COV)

6.3 Switch Specification

1) R type switch

Descriptions	Solid state type switch		
	R1	R2	R2Y (2-color)
Applications	For use with programmable controller, relay, compact solenoid valve	For use exclusively with programmable controller	
Power supply voltage	—		
Load voltage	AC85 to 265V	DC10 to 30V	
Load current	5 to 100mA	5 to 30mA (Note 2)	
Current consumption	—		
Internal voltage drop	7V or lower	4V or lower	
Indicator light	LED (ON lighting)		LED (Red/Green) (ON lighting)
Leakage current	1mA or lower at AC110V 2mA or lower at AC220V	1mA or lower	1.2mA or lower
Lead wire length (Note 1)	Standard 1 m (Oil-proof vinyl cabtyre cord, 2-wire, 0.3mm^2)		
Shock resistance	980m/s^2		
Insulation resistance	20 MΩ or more measuring with DC500V megger tester		
Withstand voltage	AC1,500V for 1 minute	AC1,000V for 1 minute	
Ambient temperature	-10 to 60℃		
Degree of protection (Note 3)	For Grommet - IEC Standard IP67, JIS C 0920 (water tight type), Oil resistance		

Descriptions	Solid state type switch	
	R3	R3Y (2-color)
Applications	For use with programmable controller, relay, IC circuit, compact solenoid valve	
Power supply voltage	DC4.5 to 28V	
Load voltage	DC30V or lower	DC30V or lower
Load current	200mA or lower	150mA or lower
Current consumption	10mA or lower when it is on at DC24V	16mA or lower when it is on at DC24V
Internal voltage drop	0.5V or lower at 150mA	0.5V or lower
Indicator light	LED (ON lighting)	LED (Red/Green) (ON lighting)
Leakage current	10 μA or lower	
Lead wire length (Note 1)	Standard 1 m (Oil-proof vinyl cabtyre cord, 3-wire, 0.2mm^2)	
Shock resistance	980m/s^2	
Insulation resistance	20 MΩ or more measuring with DC500V megger tester	
Withstand voltage	AC1,000V for 1 minute	
Ambient temperature	-10 to 60℃	
Degree of protection (Note 3)	For Grommet - IEC Standard IP67, JIS C 0920 (water tight type), Oil resistance	

Descriptions	Reed type switch				
	R0			R4	
Applications	For use with relay, programmable controller			For use with high capacity relay, solenoid valve	
Load voltage	DC12/24V	AC110V	AC220V	AC110V	AC220V
Load current	5 to 50mA	7 to 20mA	7 to 10mA	20 to 200mA	10 to 200mA
Internal voltage drop	2.4V or lower			2V or lower	
Indicator light	LED (ON lighting)			Lit when neon lamp is off	
Leakage current	0mA			1mA or lower	
Lead wire length (Note 1)	1m (Oil-proof vinyl cabtyre cord, 2-wire, 0.3mm^2)				
Shock resistance	294m/s^2				
Insulation resistance	20 MΩ or more measuring with DC500V megger tester				
Withstand voltage	No abnormalities should occur after applying AC1,500V for 1 minute				
Ambient temperature	-10 to 60℃				
Degree of protection (Note 3)	For Grommet - IEC Standard IP67, JIS C0920 (water tight type), Oil resistance				

Descriptions	Reed type switch			
	R5			R6
Applications	For use with programmable controller, relay, IC circuit (without indicator light), series connection			For use exclusively with programmable controller (with DC self-holding function)
Load voltage	DC12/24V	AC100V	AC200V	DC24V
Load current	50mA or lower	20mA or lower	10mA or lower	5 to 50mA
Internal voltage drop	0V			5V or lower
Indicator light	Without			LED (ON lighting)
Leakage current	0mA			0.1mA or lower
Lead wire length (Note 1)	1m (Oil-proof vinyl cabtyre cord, 2-wire, 0.3mm^2)			
Shock resistance	294m/s^2			
Insulation resistance	20 MΩ or more measuring with DC500V megger tester			
Withstand voltage	No abnormalities should occur after applying AC1,500V for 1 minute			
Ambient temperature	-10 to 60℃			
Degree of protection (Note 3)	For Grommet - IEC Standard IP67, JIS C0920 (water tight type), Oil resistance			

Note1: 3m or 5m long lead wire is optionally available.

Note2: Maximum value, 30mA is at 25℃ of ambient temperature. Load current decreases less than 30mA when the ambient temperature exceeds 25℃.

Note3: R※B terminal box is not water-proof. The water-proof R※A type box (Matsushita Denko made) is the order made item.

2) T type switch

Descriptions	Reed type switch			
	T0H/V		T5H/V	
Applications	Programmable controller, relay		Programmable controller, relay, IC circuit (without indicator light), series connection	
Power supply voltage	—			
Load voltage	DC12/24V	AC110V	DC5/12/24V	AC110V
Load current	5 to 50mA	7 to 20mA	50mA or less	20mA or less
Current consumption	—			
Internal voltage drop	2.4V or less		0V	
Indicator light	LED (ON lighting)		Without indicator light	
Leakage current	0mA			
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtire cord 2 conductor 0.2mm^2)			
Shock resistance	294m/s^2			
Insulation resistance	20MΩ over at DC500V megger			
Withstand voltage	No abnormalities should occur after applying AC1,000V for 1 minute			
Ambient temperature	-10 to 60℃			
Degree of protection	IEC Standards IP67, JIS C0920 (water tight type), oil resistance			

Descriptions	Reed type switch		
	T8H/V		
Applications	Programmable controller, relay		
Power supply voltage	—		
Load voltage	DC12/24V	AC110V	AC220V
Load current	5 to 50mA	7 to 20mA	7 to 10mA
Current consumption	—		
Internal voltage drop	3V or less		
Indicator light	LED (ON lighting)		
Leakage current	0mA		
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtire cord 2 conductor 0.3mm^2)		
Shock resistance	294m/s^2		
Insulation resistance	100MΩ over at DC500V megger		
Withstand voltage	No abnormalities should occur after applying AC1,500V for 1 minute		
Ambient temperature	-10 to 60℃		
Degree of protection	IEC Standards IP67, JIS C0920 (water tight type), oil resistance		

Descriptions	Solid state type switch		
	T2H/V	T2JH/V	T2YH/V
Applications	Programmable controller		
Power supply voltage	—		
Load voltage	DC10 to 30V		
Load current	5 to 20mA (Note 2)		
Current consumption	—		
Internal voltage drop	4V or less		
Delay hour off	—	200±50ms	—
Indicator light	LED (ON lighting)		Red/green LED (ON lighting)
Leakage current	1 mA or less		
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtire cord 2 conductor 0.2mm)	Standard 1m (Oil resistant vinyl cabtire cord 2 conductor 0.3mm)	
Shock resistance	980m/s^2		
Insulation resistance	20MΩ over at DC500V meggeer	100MΩ over at DC500V megger	
Withstand voltage	No abnormalities should occur after applying AC1,000V for 1 minute		
Ambient temperature	-10 to 60℃		
Degree of protection	IEC Standards IP67, JIS C0920 (water tight type), oil resistance		

Descriptions	Solid state type switch	
	T3H/V	T3YH/V
Applications	Programmable controller, relay	
Power supply voltage	DC10 to 28V	
Load voltage	DC30V or less	
Load current	100 mA or less	50mA or less
Current consumption	10mA or less at DC24V	
Internal voltage drop	0.5V or less	
Indicator light	LED (ON lighting)	Red/green LED (ON lighting)
Leakage current	10 μ A or less	
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtire cord 3 conductor 0.2mm^2)	
Shock resistance	980m/s^2	
Insulation resistance	20MΩ over at DC500V meggeer	100MΩ over at DC500V megger
Withstand voltage	No abnormalities should occur after applying AC1,000V for 1 minute	
Ambient temperature	-10 to 60℃	
Degree of protection	IEC Standards IP67, JIS C0920 (water tight type), oil resistance	

Descriptions	Solid state type switch
	T1H/V
Applications	Programmable controller, relay, compact solenoid valve
Load voltage	AC85 to 265V
Load current	5 to 100mA
Internal voltage drop	7V or less
Indicator light	—
Leakage current	1.0mA or less at AC100V, 2.0mA or less at AC200V
Lead wire length (Note1)	Standard 1m (Oil resistant vinyl cabtire cord 2 conductor 0.3mm^2)
Shock resistance	980m/s^2
Insulation resistance	100MΩ over at DC500V megger
Withstand voltage	No abnormalities should occur after applying AC1,500V for 1 minute
Ambient temperature	-10 to 60℃
Degree of protection	IEC Standards IP67, JIS C0920 (water tight type), oil resistance

Note1 : 3m or 5m long lead wire is optionally available.
Note2 : Maximum value, 20mA is at 25℃ of ambient temperature. Load current decreases less than 20mA when the ambient temperature exceeds 25℃. (For example: it may be 5 to 10mA at 60)