# CKD

# INSTRUCTION MANUAL

# SELTOP CYLINDER

# JSC3（φ40 to φ100）

● 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:

# ⚠ 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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# INDEX

JSC3 ($\phi$ 40 to $\phi$ 100)
Seltop Cylinder (Medium bore size)
Manual No. SM-6643-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.
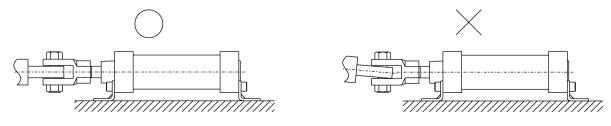
# 2. INSTALLATION

## 2.1 Installation

1) Use such bearing of low coefficient of skin friction and of low expansion ratio as ball bearing or roller bearing for the guide of cylinder load for the purpose of retaining positioning accuracy.

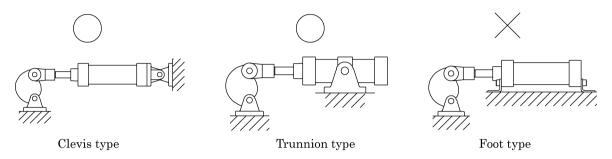2) Use these cylinders within the following range of ambient temperature.

JSC3　　　(Standard)　　　　　　　　　　　　　　　　　-10 to 60℃ (No freezing)
JSC3-V　(Built-in solenoid valve for brake )　　　　　-5 to 50℃ (No freezing)
JSC3-L2(With strong magnetic field proof switch)　-10 to 60℃ (No freezing)
JSC3-H　(Low pressure hydraulic oil type)　　　　　　5 to 50℃
JSC3-T　(Heat resistance type)　　　　　　　　　　　　5 to 120℃

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

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

5) For the purpose of retaining improved positioning accuracy within the cushion chamber stroke;
   (1) Avoid to plan to stop position within 40mm from stroke end during coming away stroke from cushion chamber.
   (2) Avoid to plan to make an intermediate stop of piston within the cushion chamber stroke.

6) When cylinder is fixed and rod end is guided:
   In case the piston rod of cylinder and the load are misaligned, the bushes and packings of the cylinder are extremely worn out. Hence, connect them with CKD floating connector (spherical bearing).

7) When cylinder is fixed and rod end is connected with pin joint;
   In case the load acting direction is not parallel with the rod axial center, the rod and tube may get entangled causing seizure, etc. Hence, make sure that the rod axial center and the load transfer direction are aligned to each other.

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8) When the load acting direction changes with the cylinder operation:
Use an oscillating cylinder (clevis type or trunnion type) capable of making revolution to a certain angle. Furthermore, install the rod and connecting metal (knuckle) so that it moves in the same direction as the cylinder main body does.

Clevis type · Trunnion type · Foot type

## 2.2 Fundamental Circuit

1) To retain an accurate operation, comply the following fundamentals and design such circuit as illustrated below.

① Supply the pressure to both side of piston when piston is stopped.
(This is to eliminate the piston from popping out on succeeding start.)

② To make thrust balanced (including the load), install a regulator with a check valve within the circuit which provides larger thrust.

③ Install the solenoid valve for brake as close to the brake port as possible.

| | |
|---|---|
| In case of horizontal load | The ray-out per Fig.1 prevents the piston rod from popping out at the moment the brake system is released as the pressure is delivered on both sides of piston when the cylinder motion is stopped by shifting the solenoid valve to its neutral position. Keep balancing by installing a regulator with a check valve to the circuit of cylinder head side. |

Fig.1



| SOL1 | | SOL2 | Actuating |
|---|---|---|---|
| a | b | | |
| OFF | OFF | OFF | Halt |
| ON | OFF | ON | Retract |
| OFF | ON | ON | Advance |

★ Pressure within the regulator $= \dfrac{(D^2-d^2)}{D^2} P$

$\begin{bmatrix} D & : \text{Cylinder bore [mm]} \\ d & : \text{Diameter of rod [mm]} \\ P & : \text{Working pressure [MPa]} \end{bmatrix}$

| | |
|---|---|
| In case of downward load | When the lay-out of circuit is as shown in Fig.2, install a reducing valve with a check valve to the circuit of cylinder head side for the purpose of reducing the downward thrust of the rod and keeping a balance because the cylinder rod is apt to be suddenly pulled down due to the load at the moment the brake system is released. |

Fig.2



| SOL1 | | SOL2 | Actuating |
|---|---|---|---|
| a | b | | |
| OFF | OFF | OFF | Halt |
| ON | OFF | ON | Advance |
| OFF | ON | ON | Retract |

★ Pressure within the regulator $= \dfrac{\pi (D^2-d^2)P-4W}{\pi D^2}$

$\begin{bmatrix} D & : \text{Cylinder bore [mm]} \\ d & : \text{Diameter of rod [mm]} \\ P & : \text{Working pressure [MPa]} \\ W & : \text{Load [N]} \end{bmatrix}$

| | |
|---|---|
| In case of upward load | When the load is upward as shown in Fig.3, install a reducing valve with a check valve to the circuit of piston rod side for the purpose of reducing reversed thrust of the rod and keeping a balance because the cylinder rod is apt to be pushed backward due to the load at the moment the brake system is released. |

Fig.3



| SOL1 | | SOL2 | Actuating |
|---|---|---|---|
| a | b | | |
| OFF | OFF | OFF | Halt |
| ON | OFF | ON | Retract |
| OFF | ON | ON | Advance |

★ Pressure within the regulator $= \dfrac{\pi D^2 P-4W}{\pi (D^2-d^2)}$

$\begin{bmatrix} D & : \text{Cylinder bore [mm]} \\ d & : \text{Diameter of rod [mm]} \\ P & : \text{Working pressure [MPa]} \\ W & : \text{Load [N]} \end{bmatrix}$

2) Keeping a balance of propulsion
Keep a balance of propulsion by regulator with check valve as per fundamental circuit diagram posted in "2.2 Fundamental Circuit".
Adjust pressure in the duration of raising it instead of reducing it. Guide line value is calculated out of formulae posted in "2.2 Fundamental Circuit" (★ marked on page 5).
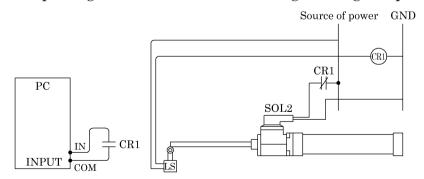
## 2.3  Electric Control Circuit

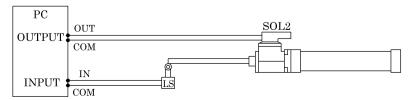Carefully observe the following items as position accuracy is influenced by each control equipment as well as circuit.

① Select the equipment with a quick response time and high accuracy.

② So design to have brake release signal and cylinder control signal are put out simultaneously or have brake release signal is put out a moment ahead of cylinder control signal to avoid piston rod from popping out.

③ Make the sensor switch of stop signal self-holding circuit.

④ Select sensor switch of stop signal out of either cylinder switch, roller plunger type limit switch, proximity switch or that of photo tube.

⑤ Caution when sequencer is built in a circuit.
Positioning accuracy is ruined to extent of such as ±3mm to ±5mm when brake circuit is built through a sequencer because of dispersion of brake release timing due to dispersion of scanning time (±20ms to 30ms).
Design the brake circuit directly through a relay instead of through sequencer.

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※ Scanning time ·········Time requirement a program routine executed one cycle

※ Dispersion ···············Dispersion is ±1.5mm when scanning time is 30ms at the cylinder speed of 100mm/s

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◯ Example of good circuit which does not go through sequencer



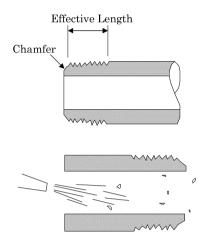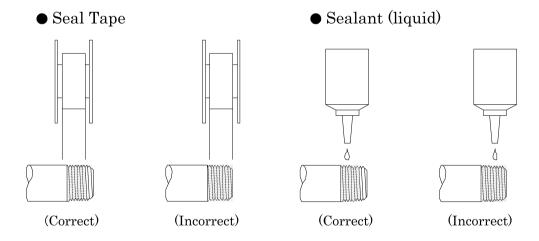✕ Example of undesirable circuit which goes through sequencer

## 2.4 Piping

1) For piping beyond the filter, use pipes that are tough against corrosion 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 which is needed for the cylinder to drive at the 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.
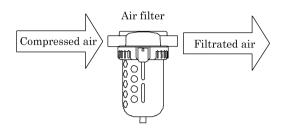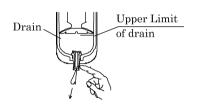
● Seal Tape                    ● Sealant (liquid)

(Correct)        (Incorrect)        (Correct)        (Incorrect)

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## 2.5 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.
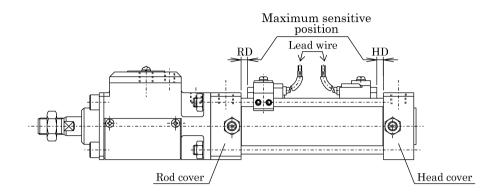
4) This cylinder does not require lubrication. It is recommended, however, to use Turbine oil Grade 1, ISO VG32 as a lubricant, if and when lubrication is needed.

Air filter

Compressed air

Filtrated air

Drain

Upper Limit of drain

## 2.6 Location of mounting Switches on a Cylinder

1) Location of mounting switches on a cylinder.



(1) At the stroke end
Refer the illustration above. Mount switches within the rod side dimension RD as well as the head side dimension HD for the purpose of having switches function at the points of the maximum sensitive position.

(2) Intermediate of stroke
Move the piston where it is anticipated to stop and fix it tentatively Slide a switch carefully along the side of cylinder over the piston to find out the spot where switch turns on. This type spot should be located on both side of piston. The intermediate spot between those posits is of the maximum sensitive position and where the switch is supposed to be installed.
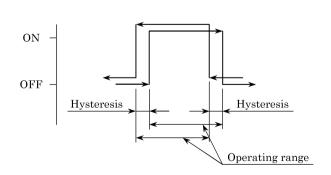
(3) Location around the circumference of cylinder
There is no restriction. Install switch(es) wherever easy to utilize it.

2) Operating range
The switch turns on first and turns off as the piston moves along its stroke. Precise operating range deviate slightly depending upon the direction of piston movement as shown right.

3) Hysteresis
Precise operating range deviate slightly depending upon the direction of piston movement as shown right.

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4) Maximum sensitive position (HD・RD), operating range and hysteresis.

(Unit : mm)

| Item<br><br>Bore size (mm) | Maximum sensitive position<br><br>HD, RD | Solid state switch (R1, R2, R3) | | | | Reed switch (R0, R4, R5, R6) | |
|---|---|---|---|---|---|---|---|
| | | Operating range | | Hysteresis | | Operating range | Hysteresis |
| | | 1 color type | 2 color type | 1 color type | 2 color type | | |
| φ40 | 5.5 | 6.5 to 11.5 | 10 to 14 | 1.5 or less | 1.0 or less | 9.5 to 12.5 | 3 or less |
| φ50 | 7.5 | 8 to 12.5 | 12 to 16 | | | 10.5 to 14.5 | |
| φ63 | | 7.5 to 12.5 | | | | | |
| φ80 | 9 | 8 to 13.5 | | | | 11.5 to 15.5 | |
| φ100 | 13 | 8 to 14 | 12 to 17 | | | 12 to 16 | |

| Item<br><br>Bore size (mm) | Maximum sensitive position<br><br>HD, RD | Strong magnetic field proof Reed switch (H0※) | |
|---|---|---|---|
| | | Operating range | Hysteresis |
| φ50 | 4 | 4 to 7.5 | 3 or less |
| φ63 | 6 | | |
| φ80 | 7.5 | 5 to 8 | |
| φ100 | 11.5 | | |

5) Location of switches mounted at ex-factory

Switches are mounted at the maximum sensitive position on cylinder. The location along circumference of cylinder differs in accordance with stroke. Refer the table below.

(Unit : mm)

| Item<br><br>Bore size | Different surface installation | Same surface installation | Center trunnion installation |
|---|---|---|---|
| Rough sketch |  Port |  Port |  Port |
| φ40 | 10 | 34 | 86 (66) |
| φ50 | | | |
| φ63 | — | 10 | 91 (71) |
| φ80 | | | 96 (76) |
| φ100 | | | 106 (86) |

| Item<br><br>Bore size | Rod side trunnion installation | Head side trunnion installation |
|---|---|---|
| Rough sketch |  Port<br><br>The position at rod side stroke end cannot be detected. |  Port<br><br>The position at rod side stroke end cannot be detected. |
| φ40 | 38 (28) | 38 (28) |
| φ50 | 36 (26) | 36 (26) |
| φ63 | 41 (31) | 41 (31) |
| φ80 | 44 (34) | 44 (34) |
| φ100 | 50 (40) | 50 (40) |

Note : Value in ( ) for R※B(terminal box type).
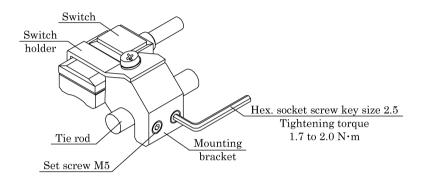
6) Relocation of switch
Loosen the set screws (2 ea.) for approx. 1/2 to 3/4 turn. It enables the switch to slide along the tie rod without letting screws drop off.
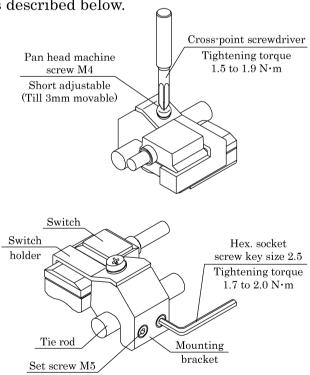After setting the new location of switch, hold switch holder against the tube surface and tighten set screws to the tie rod. Adequate torque of tightening it is 1.7 to 2.0 N・m. It is considered to be sufficient, as a rule of thumb, when Allen wrench starts bending slightly.

Switch

Switch holder

Hex. socket screw key size 2.5
Tightening torque
1.7 to 2.0 N・m

Tie rod

Mounting bracket

Set screw M5

7) Installation of 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.

Cross-point screwdriver
Tightening torque
1.5 to 1.9 N・m

Pan head machine screw M4

Short adjustable
(Till 3mm movable)

Switch

Switch holder

Hex. socket screw key size 2.5
Tightening torque
1.7 to 2.0 N・m

Tie rod

Mounting bracket

Set screw M5

(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 Allen wrench starts bending slightly.

# 3. OPERATION

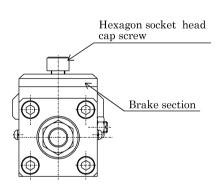## 3.1 Operating the Cylinder

1) Range of working pressure
   Operate the system within following working pressure.

| Model | Working pressure for brake | Working pressure for cylinder |
|---|---|---|
| JSC3, JSC3-T | 0.3 to 1.0MPa | 0.1 to 1.0MPa |
| JSC3-V | 0.3 to 0.7MPa | |
| JSC3-H | 0.3 to 1.0MPa | 0.2 to 1.0MPa |

2) Manual release of brake
   Brake are released when release bolt is screwed in to the position at which rotation stops into the female thread on the top of the brake section (side of the brake release port). (Remove the release bolt before starting normal operation.)
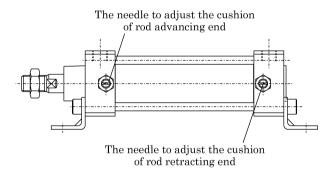   Use the dedicated release bolt with the product when manually releasing brakes.
   (If a commercially-available bolt is screwed in too far, the brakes may not function.)

Hexagon socket head cap screw

Brake section

Note : So long as the model JSC3-V is concerned, (as solenoid valve for brake mechanism is built-in) brake is also able to be released by manually operating the solenoid valve but it requires independent pressure air line to actuate the brake mechanism.

3) 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.

The needle to adjust the cushion of rod advancing end

The needle to adjust the cushion of rod retracting end

However, if kinetic energy such as load is heavy or speed is too fast, exceeding the values given in Table 1, consider of providing a shock absorber.

Table1. Cushion characteristic chart

| Bore size (mm) | Effective air cushion length (mm) | Allowable energy absorption (J) | |
|---|---|---|---|
| | | With cushion | Without cushion |
| $\phi$ 40 | 14.6 | 4.29 | 0.067 |
| $\phi$ 50 | 16.6 | 8.37 | 0.079 |
| $\phi$ 63 | 16.6 | 15.8 | 0.079 |
| $\phi$ 80 | 20.6 | 27.9 | 0.201 |
| $\phi$ 100 | 23.6 | 49.8 | 0.301 |

4) Adjust the working piston speed with the speed controller mounted.

## 3.2  How to use the Switches

### 3.2.1  Common items

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.  If a cylinder with the switch is installed in parallel to this product or the magnetic substance moves near the cylinder, the mutual interference may occur and affect the detection accuracy.

2) Protection of lead cord
Pay consideration to eliminate rapeating 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 (60℃)
Always avoid operation of the product in a hot place due to temperature characteristics of magnetic and electronics parts.
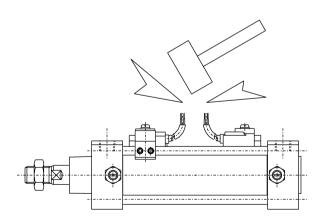
4) Intermediate position detection
When activating the switch halfway of the stroke, the relay may not respond if the working piston speed is too fast.
(Example) Operate cylinder with the speed of less than 500mm/s in case the relay actuation time is 20ms.

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

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## 3.2.2  Reed switch (R0, R4, R5, R6, H0, H0Y)

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 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 2, always install a contact protective circuit.

Table 2

| Switch | Electric power | Length of wire |
|--------|----------------|----------------|
| R0, 5, 6 | DC | 100m |
| R0, 5 | AC | 10m |
| R4 | AC | 50m |

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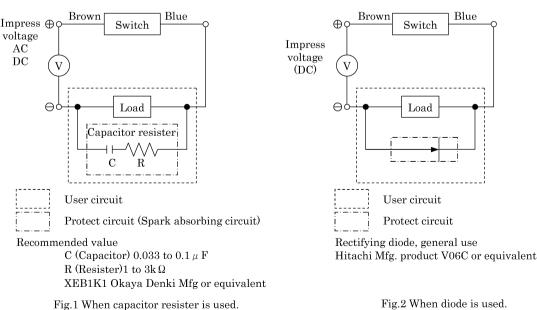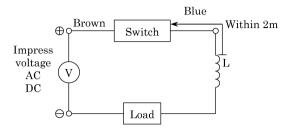


Fig.1 When capacitor resister is used.
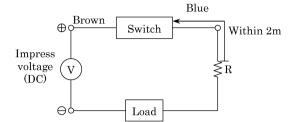
Fig.2 When diode is used.

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



· Choke coil
  L=a couple hundred $\mu$ H 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. (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 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 R0 switches are connected in series.
    $2.4V \times 3 = 7.2$ V

Since the voltage drop at the R5 switch is 0V, as many switches as required can be connected in series. When one R0 switch is used for checking of operation and R5 switch is used for other switches, they can be used with the voltage drop equivalent to one 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.
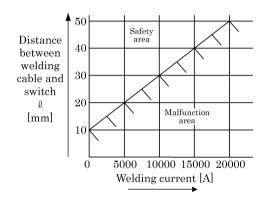
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(6) Parallel connection

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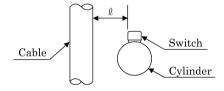
However, if multiple R0 and R6 switches are turned ON at the same time, the indicator light becomes dark or is not lit. For R4 switch, if even one R4 switch is turned ON, all indicator lights go off.

3) Strong magnetic field proof switch
- External magnetic field proof performance
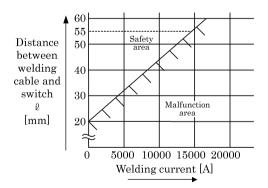  (spot welding current – switch output malfunction distance characteristics)

In case of H0



- The characteristics shown on the left may vary depending on the following layout between the cable and switch. (Outside diameter of cable: $\phi$ 36 mm)



- The external magnetic field proof characteristics of H0 are obtained when the switch is mounted in an area of maximum sensitive position $\pm 1$ mm.

In case of H0Y



- The external magnetic field proof characteristics of H0Y are obtained when the switch is mounted in its optimal mounting area (green LED lit range).

- For both H0 and H0Y, if two or more welding cables exist and the power is supplied to these cables at the same time, the magnetic flux may increase. Therefore, the characteristics shown on the left may not apply. Additionally, if the switch is located within the loop of the welding cable, the characteristics shown on the left cannot be used.

- The minimum mounting stroke shall be designed to 25 mm or more. If the minimum mounting stroke is 25 mm or less, the performance shown on the left is not satisfied.

## 3.2.3  Solid state switch (R1, R2, R3, T2YD)

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 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 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 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
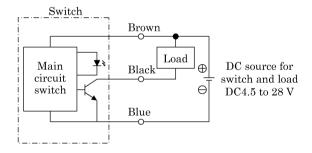       even though the incorrect wiring is not performed.



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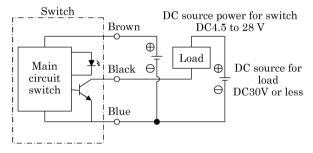(In case the same source of power is used.)

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

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

3) Strong magnetic field proof switch (T2YD)
- External magnetic field proof performance (at welding current of AC14000A)

   This strong magnetic field proof switch can be used for all T-type strong magnetic field solid state switch (T2YD) built-in cylinder models or operated in a status that the welding cable is in contact with the cylinder or switch. However, this switch cannot be used for two or more welding cables or within the cable loop.

   Note : If this switch is used at a welding current of more than AC14000A, the welding cable must be made 35 mm or more apart from the cylinder tube surface.
   (Testing conditions: Outside diameter of the cable is $\phi$ 36.)

# 4. MAINTENANCE

## 4.1 Periodic 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 brake mechanism.
   ② Check of release operation of brake. (Check whether brake release operates by minimum working pressure 0.35MPa.)
   ③ Check the mounting bolts and nuts of cylinder.
   ④ Check the mounting bolts and nuts to the piston rod end brackets and mounting brackets for slackening.
   ⑤ Check that the cylinder operates smoothly.
   ⑥ Check any change of the working piston speed and cycle time.
   ⑦ Check for internal and /or external leakage.
   ⑧ Check the piston rod for flaw(scratch) and deformation.
   ⑨ Check the stroke for abnormality.
   ⑩ Check whether overrun length of piston rod is large.
   ⑪ Check any corrosion inside of each port.

See "Trouble shooting", 5 should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

Do not disassemble the brake section for an important section. When inspecting the inside of brake, it takes over and inspects by our company. Consult with CKD.
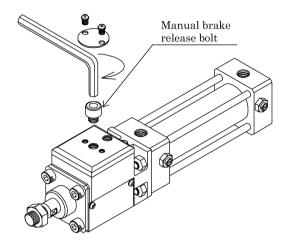
## 4.2 Disassembling ・Assembling

Should any air leakage occur, take the following corrective actions.

1) Dismounting of the brake unit

(1) Remove the dust cover on the brake unit by taking out 2 each of dust cover mounting screws (Cross headed pan).
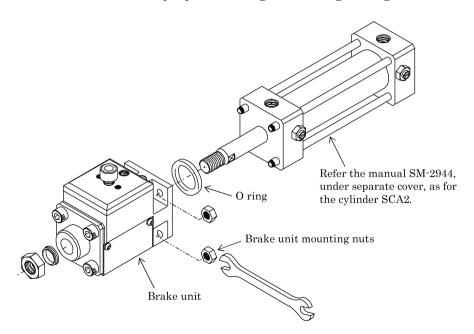Manually release brake by screwing hexagon socket head cap screw into flame threaded hole (side of the break release port). (Refrain from over tightening it than necessary.)

Manual brake release bolt

Refer the table below as for the size of hexagon socket head cap screw.

| Bore size | Thread size |
|-----------|-------------|
| $\phi$ 40, $\phi$ 50 | M10 |
| $\phi$ 63 | M12 |
| $\phi$ 80 | M14 |
| $\phi$ 100 | M16 |

2) Take the brake unit away by removing mounting hexagon nuts.

O ring

Refer the manual SM-2944, under separate cover, as for the cylinder SCA2.

Brake unit mounting nuts

Brake unit

Refer the table below as for the size of hexagon nut.

| Bore size | Thread size |
|-----------|-------------|
| $\phi$ 40, $\phi$ 50, $\phi$ 63 | M8 |
| $\phi$ 80, $\phi$ 100 | M12 |

Note：Refrain from disassembling the brake unit to retain high performance.

2) Mounting the brake unit

Take reverse procedure (2) to (1) as per described in paragraph 4.2 1) to mount the unit back to cylinder.

Pay attention on the following items during the course of assembling.

① Do not apply grease to piston rods. (Applying grease may result in a drop in holding force of brake.)

② Wipe the grease off the piston rod should there be any grease over it.

③ Apply grease over metal seal (O ring) and carefully assemble them back without giving any scratch mark on it.

④ While tightening the mounting bolts over brake unit, tighten the pair of bolts diagonally to avoid twisting unit.

⑤ Keep the socket headed bolt for manual release of brake removed except when required.
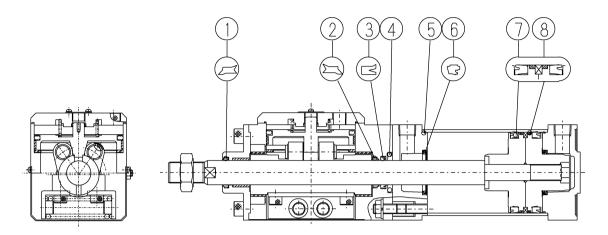
3) Inspect the following items.

① Scratch marks on the boar surface of the tube

② Scratch marks on the surface of piston rod, peel-off of plating and rusting

③ Scratch marks and wear inside of the bush

④ Scratch marks, wear and crack of the surface of piston

⑤ Loosened connection of piston and rod

⑥ Crack of both end covers

⑦ Scratch marks and wear of packing in sliding part. (Dust wiper, rod packing, cushion packing and piston packing)

Check all of above items.  If any abnormality is found, repair it or replace the parts, when defective.

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4) Followings are expendable parts.
   Specify the kit No. when ordering.



※ This type of brake unit hardly suffers from mechanical trouble.  Should there be any difficulties occurs, replace in its entirety as a unit.

Expendable Parts List

| Bore size (mm) / Kit No. | Part No. Part name | ①, ② Dust wiper | ③ Rod packing | ④ Metal seal | ⑤ Cylinder gasket |
|---|---|---|---|---|---|
| φ40 | JSC3-40K | SDR-16K | PNY-16 | P-22A | F4-667115 |
| φ50 | JSC3-50K | SDR-20K | PNY-20 | P-28 | F4-667116 |
| φ63 | JSC3-63K | SDR-20K | PNY-20 | P-28 | F4-667117 |
| φ80 | JSC3-80K | SDR-25K | PNY-25 | P-35 | F4-667118 |
| φ100 | JSC3-100K | SDR-30K | PNY-30 | P-45 | F4-667119 |

| Bore size (mm) / Kit No. | Part No. Part name | ⑥ Cushion packing | ⑦ Piston packing | ⑧ Wear ring | Needle gasket |
|---|---|---|---|---|---|
| φ40 | JSC3-40K | F4-650636 | PMY-40 | F4-650239 | P-3 |
| φ50 | JSC3-50K | F4-650637 | PMY-50 | F4-650240 | P-3 |
| φ63 | JSC3-63K | F4-650637 | PMY-63 | F4-650241 | P-3 |
| φ80 | JSC3-80K | F4-650638 | PMY-80 | F4-650242 | P-3 |
| φ100 | JSC3-100K | F4-650639 | PMY-100 | F4-650243 | P-3 |

Note : Specify kit No. on your purchase order, but brake unit is excluded. Specify JSC3-B- [ bore size ] for ordering brake unit.

# 5. TROUBLE SHOOTING

## 1) Cylinder

| Trouble | Cause | Correction |
|---|---|---|
| Brake does not release. | Insufficient pressure to the brake mechanism. | Secure ample pressure. |
| | No signal to brake solenoid valve.<br>(In case NO type-Electric signal is there.) | Reaffirm the circuit to receive a signal.<br>(Reaffirm the circuit to shut off a signal.) |
| | Solenoid valve for brake does not function. | Check the circuit and repair the matter as is required.<br>Repair or replace solenoid valve as is required. |
| | Damage to packing for brake piston. | Replace the brake unit. |
| Rod does not stop | No signal to brake solenoid valve.<br>(In case NO type-Electric signal is there.) | Reaffirm the circuit to receive a signal.<br>(Reaffirm the circuit to shut off a signal.) |
| | Solenoid valve for brake does not function. | Check the circuit and repair the matter as is required.<br>Repair or replace solenoid valve as is required. |
| | Damage to packing for brake piston. | Replace the brake unit. |
| | Left manual release of brake. | Release the manually open status. |
| | Skips off the dog for brake signal<br>a. Excessive cylinder speed<br><br>b. Circuit is not self-holding circuit<br><br><br><br>a. Excessive cylinder speed | a. Either slow down the speed or increase the dog length.<br>b. Revise the circuit to that of self-holding. |
| | Cylinder switch does not function. | Correct or remove the cause of malfunction. |
| Inaccurate positioning. | Effective cross-sectional area of solenoid valve for brake is not large enough. | Replace the solenoid valve with the one of large effective cross-sectional area. |
| | Either too fine or too long tubing of connecting solenoid valve for brake and brake port. | Either replace tubing with the one of large diameter or shorten it if possible.<br>As an alternative, connect the solenoid valve directly. |
| | Too low response of solenoid valve for brake. | Replace the solenoid valve with the one of high response. |
| | Too low response of signal sensor switch to solenoid valve for brake. | Replace the sensor switch with the one of high response. |
| | Relays within signal circuit of brake control are actuated sequentially. | Revise the signal circuit. (Carefully review the response time, particularly when using sequencer. |
| | There is a slackening of mounting a dog for brake signal. | Correct and remove the play. |
| | Remarkable wear and tear on the shape of the dog.<br>a. Slant angle is to be maintained less than 30° when using roller plunger type limit switch.<br><br>b. More length of dog than over run length is required when making an interlocking by means of dog. | a. The larger angle cause load variation and results inaccurate positioning.<br>⎡The slant angle can be up to 60° when using roller lever.⎤<br>b. When relay is used for self-holding circuit, dog length is required to provide an appropriate time length of relay actuating. |

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| Trouble | Cause | Correction |
|---|---|---|
| Inaccurate positioning. | Fluctuation of cylinder speed.<br>a. Misalignment of the center lines between piston rod and load guide.<br>b. The momentum inertia of load is excessive in comparison with thrust to cylinder.<br>[ Particularly when the positioning pitch is too small ]<br>c. See if the stopping position is within the cushion chamber or just after piston comes out of cushion chamber. | a. Eliminate misalignment by using free joint or equivalent parts.<br>b. Either use larger bore cylinder or revise to hydraulic oil cylinder of low pressure range.<br><br>c. Install a check valve to cushion in the event that stopping piston just when getting out of cushion chamber. |
| | Piston rod is apt to pop out.<br>a. Incorrect setting of pressure balancing regulator.<br>b. Delayed timing of stop release. | a. Reset the pressure regulator.<br><br>b. Shorten the timing of stop release.<br>(See if supply line is chalked, also.) |
| | Fluctuation of load<br>a. Feeding load change along curvature variation of copying profile. (Steady change)<br>b. Remarkable change of load due to perpendicular load (Step change) | a. Revise the specification to adopt hydraulic cylinder of low pressure range.<br>b. Revise the circuit by building plural number of regulators for pressure balancing in the event that the range of load variation is relatively small or load changes stepping trend. |
| Piston rod does not move. | No signal to direction control solenoid valve. | Correct the control circuit. |
| | Misalignment of center lines at mounting cylinder. | Correct the installation state and/or change the mounting style. |
| | Damage to piston packing. | Replace piston packing. |
| Unsteady motion of rod | Misalignment of center lines at mounting. | Correct the installation state and/or change the mounting style. |
| | Exertion of transverse (lateral) load. | Install guide, correct the installation state and/or change the mounting style. |
| | Speed is less than the low speed limit. | Relieve the load change.<br>Use the cylinder of larger bore. |
| | Excessive load. | Raise the pressure.<br>Use the cylinder of larger bore. |
| | Speed control valve is built in the way of "Mater in" circuit. | Revise the installation direction of speed control valve. |
| Damage or distortion | Shock due to high speed operation | Raise the cushion effect.<br>Lower the speed.<br>Reduce the load.<br>Improve cushion mechanism.<br>(Such as adopting external cushion mechanism.) |
| | Exertion of transverse load. | Install guide, correct the installation state and/or change the mounting style. |

## 2) 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 is 1.5 to 1.9 N·m |
| | Incorrect direction of switch mounting | Correct the direction of the switch mounting. |
| | Relay is unable to respond properly | Replace the relay with a recommended one. |
| | Excessive load than rated capacity | Replace the relay with a recommended one or replace the switch. |
| | Excessive speed of piston if it is to sense an intermediate point of stroke | Reduce the speed of piston. |
| 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. |

Note 1. Refer "2.6 Location of mounting Switches on a Cylinder" as for replacing a switch and correcting its location.

# 6. HOW TO ORDER

## 6.1 How to order product

Without switch

( JSC3-V )－(LB)－(40)(B)－(50)－(1)──────────(S)(I)

With switch

( JSC3-V )－(LB)－(40)(B)－(50)－(1)－(R0)－(R)－(S)(I)

With strong magnetic field proof switch (H0, H0Y)

( JSC3-L2 )－(LB)－(40)(B)－(50)──────(H0)－(D)－(S)(I)

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

| (a) Model | | (b) Mounting style (Note1) | | (c) Bore size (mm) | | (d) Cushion | |
|---|---|---|---|---|---|---|---|
| JSC3 | Double acting | 00 | Basic type | 40 | $\phi$40 | B | Both side cushions |
| JSC3-V | With solenoid valve for brake | LB | Axial foot type | 50 | $\phi$50 | R | Rod side cushion |
| | | FA | Rod side flange type | 63 | $\phi$63 | H | Head side cushion |
| JSC3-H | Low hydraulic type | FB | Head side flange type | 80 | $\phi$80 | N | No cushion |
| JSC3-T | Heat resistance type | FC | Special head side flange type | 100 | $\phi$100 | | |
| | | CA | Eye bracket type | | | | |
| | | CB | Clevis bracket type | | | | |
| | | TC | Center trunnion type | | | | |
| | | TA | Rod side trunnion type | | | | |
| | | TB | Head side trunnion type | | | | |

| (e) Stroke(mm) | | (f) Valve voltage | | (g) Switch model No. (Note2) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 300 | 1 | AC100V | Grommet type | Terminal box type | | Switch type | Indicator light | | Lead wire |
| 75 | 350 | 2 | AC200V | | Standard type | Splash-proof | | | | |
| 100 | 400 | 3 | DC24V | R1※ | R1B | R1A | Solid state | 1 color indicator | | 2 wire |
| 150 | 450 | 4 | DC12V | R2※ | R2B | R2A | | | | |
| 200 | 500 | | | R2Y※ | R2YB | — | | 2 color indicator | | |
| 250 | | | | T2YD※ | — | — | | Strong magnetic field | | |
| | | | | T2YDT※ | — | — | | Strong magnetic field | | |
| | | | | R3※ | R3B | R3A | | 1 color indicator | | 3 wire |
| | | | | R3Y※ | R3YB | — | | 2 color indicator | | |
| | | | | R0※ | R0B | R0A | Reed | 1 color indicator | | 2 wire |
| | | | | R4※ | R4B | R4A | | | | |
| | | | | R5※ | R5B | R5A | | | | |
| ※ Lead wire length | | | | R6※ | R6B | R6A | | | | |
| No code | 1m (standard) | | | H0※ | — | — | | Strong magnetic field | | 2 wire |
| 3 | 3m (option) | | | H0Y※ | — | — | | Strong magnetic field 2 color indicator proof | | |
| 5 | 5m (option) | | | | | | | | | |

※ mark indicates the length of lead wire.

| (h) Switch quantity | | (i) Option (Note4) | | | | | (j) Accessory | |
|---|---|---|---|---|---|---|---|---|
| R | One on rod side | | | Max. ambient | Instant. max. | | I | Rod eye |
| H | One on head side | J | Bellows | 100℃ | 200℃ | | Y | Rod clevis |
| D | Two | L | Bellows | 250℃ | 400℃ | | B1 | Eye bracket |
| T | Three | M | Piston rod material change (stainless steel) | | | | B2 | Clevis bracket |
| 4 | With 4 switches (Note3) | No code | Cushion needle position R (standard) | | | | B3 | Eye bracket |
| | | S | Cushion needle position S | | | | | |
| | | T | Cushion needle position T | | | | | |
| | | G | With indicator | | | | | |

Note1： Mounting bracket is assembled to product when shipping. (When shipping, special head side flange type is attached.)
Note2： T2YD, T2YDT, H0, H0Y are strong magnetic field proof switches. Consult with CKD about details.
Note3： If more than 4 switches, indicate switch quantity.
Note4： Refer to each dimensions to confirm position indication of "S","T","G".
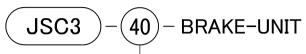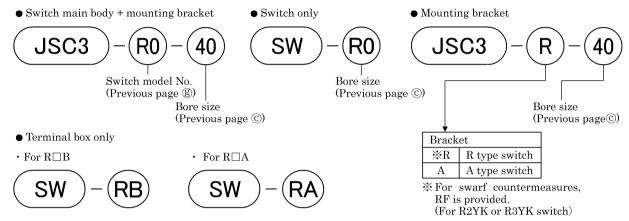
## 6.2  How to order brake unit

$\boxed{\text{JSC3}}$ — $\boxed{40}$ — BRAKE-UNIT
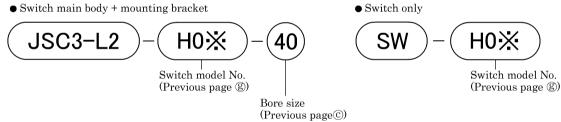
　　　　　Bore size (Previous page ©)

## 6.3  How to order switch

### (1)  How to order R type switch

● Switch main body + mounting bracket

$\boxed{\text{JSC3}}$ — $\boxed{\text{R0}}$ — $\boxed{40}$

Switch model No.
(Previous page ⓖ)

Bore size
(Previous page ©)

● Switch only

$\boxed{\text{SW}}$ — $\boxed{\text{R0}}$

Bore size
(Previous page ©)

● Mounting bracket

$\boxed{\text{JSC3}}$ — $\boxed{\text{R}}$ — $\boxed{40}$

Bore size
(Previous page©)

| Bracket | |
|---|---|
| ※R | R type switch |
| A | A type switch |

※ For swarf countermeasures,
　RF is provided.
　(For R2YK or R3YK switch)

● Terminal box only

・For R□B

$\boxed{\text{SW}}$ — $\boxed{\text{RB}}$

・For R□A

$\boxed{\text{SW}}$ — $\boxed{\text{RA}}$
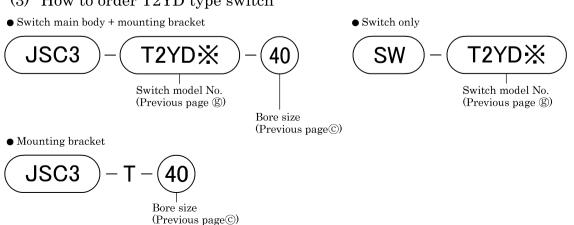
### (2)  How to order H type switch

● Switch main body + mounting bracket

$\boxed{\text{JSC3-L2}}$ — $\boxed{\text{H0※}}$ — $\boxed{40}$

Switch model No.
(Previous page ⓖ)

Bore size
(Previous page©)

● Switch only

$\boxed{\text{SW}}$ — $\boxed{\text{H0※}}$

Switch model No.
(Previous page ⓖ)

● Mounting bracket

$\boxed{\text{JSC3-L2}}$ — H — $\boxed{40}$

Bore size
(Previous page©)

### (3)  How to order T2YD type switch

● Switch main body + mounting bracket

$\boxed{\text{JSC3}}$ — $\boxed{\text{T2YD※}}$ — $\boxed{40}$

Switch model No.
(Previous page ⓖ)

Bore size
(Previous page©)

● Switch only

$\boxed{\text{SW}}$ — $\boxed{\text{T2YD※}}$

Switch model No.
(Previous page ⓖ)

● Mounting bracket

$\boxed{\text{JSC3}}$ — T — $\boxed{40}$

Bore size
(Previous page©)

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# 7. SPECIFICATION

## 7.1 Product Specifications

| Model / Item | JSC3 (With switch) | | | | | JSC3-V (With switch) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bore size                          mm | φ40 | φ50 | φ63 | φ80 | φ100 | φ40 | φ50 | φ63 | φ80 | φ100 |
| Actuation | Double acting | | | | | Double acting/With solenoid valve for brake | | | | |
| Working fluid | Compressed air | | | | | | | | | |
| Max. working pressure          MPa | 1.0 | | | | | 0.7 | | | | |
| Min. working pressure — Brake section    MPa | 0.3 | | | | | | | | | |
| Min. working pressure — Cylinder section  MPa | 0.1 | | | | | | | | | |
| Proof pressure                 MPa | 1.6 | | | | | | | | | |
| Ambient temperature             ℃ | -10 to 60 (No freezing) | | | | | -5 to 50 (No freezing) | | | | |
| Port size — Brake section | Rc1/8 | | Rc1/4 | | Rc3/8 | Rc1/8 | | Rc1/4 | | Rc3/8 |
| Port size — Cylinder section | Rc1/4 | | Rc3/8 | | Rc1/2 | Rc1/4 | | Rc3/8 | | Rc1/2 |
| Working piston speed          mm/s | 50 to 1000 (use within the range of allowable energy absorption) | | | | | | | | | |
| Cushion | Cushion can be selected. | | | | | | | | | |
| Effective air cushion length    mm | 14.6 | 16.6 | 16.6 | 20.6 | 23.6 | 14.6 | 16.6 | 16.6 | 20.6 | 23.6 |
| Lubrication | Must be oil free. | | | | | | | | | |
| Stoppage accuracy              mm | ±1.0 (300mm/s at no load) | | | | | | | | | |
| Holding force                   N | 980 | 1569 | 2451 | 3922 | 6178 | 980 | 1569 | 2451 | 3922 | 6178 |
| Allowable energy absorption J — Cushioned | 4.29 | 8.37 | 15.8 | 27.9 | 49.8 | 4.29 | 8.37 | 15.8 | 27.9 | 49.8 |
| Allowable energy absorption J — No cushion | 0.067 | 0.079 | 0.079 | 0.201 | 0.301 | 0.067 | 0.079 | 0.079 | 0.201 | 0.301 |

Note：No cushion type can not absorb a large energy generated by an external load.
　　　We recommend to use an external shock absorber together.

| Model / Item | JSC3-H (With switch) | | | | | JSC3-T | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bore size                          mm | φ40 | φ50 | φ63 | φ80 | φ100 | φ40 | φ50 | φ63 | φ80 | φ100 |
| Actuation | Double acting/Low hydraulic type | | | | | Double acting/Heat resistance type | | | | |
| Working fluid | Hydraulic fluid (Note1) | | | | | Compressed air | | | | |
| Max. working pressure          MPa | 1.0 | | | | | | | | | |
| Min. working pressure — Brake section    MPa | 0.3 | | | | | | | | | |
| Min. working pressure — Cylinder section  MPa | 0.2 | | | | | 0.1 | | | | |
| Proof pressure                 MPa | 1.6 | | | | | | | | | |
| Ambient temperature             ℃ | 5 to 50 | | | | | 5 to 120 | | | | |
| Port size — Brake section | Rc1/8 | | Rc1/4 | | Rc3/8 | Rc1/8 | | Rc1/4 | | Rc3/8 |
| Port size — Cylinder section | Rc1/4 | | Rc3/8 | | Rc1/2 | Rc1/4 | | Rc3/8 | | Rc1/2 |
| Working piston speed          mm/s | — | | | | | 50 to 1000 [Use within the range of allowable energy absorption] | | | | |
| Cushion | Cushion can be selected. | | | | | | | | | |
| Effective air cushion length    mm | 14.6 | 16.6 | 16.6 | 20.6 | 23.6 | 14.6 | 16.6 | 16.6 | 20.6 | 23.6 |
| Lubrication | — | | | | | Must be oil free. (Note2) | | | | |
| Stoppage accuracy              mm | ±0.2 (50mm/s at no load) | | | | | ±1.0 (300mm/s at no load) | | | | |
| Holding force                   N | 980 | 1569 | 2451 | 3922 | 6178 | 980 | 1569 | 2451 | 3922 | 6178 |
| Allowable energy absorption J — Cushioned | 4.29 | 8.37 | 15.8 | 27.9 | 49.8 | 4.29 | 8.37 | 15.8 | 27.9 | 49.8 |
| Allowable energy absorption J — No cushion | 0.067 | 0.079 | 0.079 | 0.201 | 0.301 | 0.067 | 0.079 | 0.079 | 0.201 | 0.301 |

Note1：Brake is operated by compressed air.
Note2：Apply heat proof greace periodically.
Note　：No cushion type can not absorb a large energy generated by an external load.
　　　　We recommend to use an external shock absorber together.

## 7.2  Switch Specifications

| Model | Reed 2 wire | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item | R0 | | | R4 | | R5 | | |
| Applications | Relay, programmable controller | | | High capacity relay, solenoid valve | | Programmable controller, relay, IC circuit (without indicator light), serial connection | | |
| Load voltage | DC12/24V | AC110V | AC220V | AC110V | AC220V | DC5/12/24V | AC110V | AC220V |
| Load current (Note2) | 5 to 50mA | 7 to 20mA | 7 to 10mA | 20 to 200mA | 10 to 200mA | 50mA or less | 20mA or less | 10mA or less |
| Internal voltage drop | 2.4V or less | | | 2V or less | | 0V | | |
| Indicator light | LED (ON lighting) | | | Neon light OFF (OFF lighting) | | None | | |
| Leakage current | 0mA | | | 1mA or less | | 0mA | | |
| Lead wire length (Note1) | 1m (oil resistant vinyl cabtire code 2 conductor 0.3mm$^2$) | | | | | | | |
| Shock resistance | 294m/s$^2$ | | | | | | | |
| Insulation resistance | 20MΩ over at 500V megger | | | | | | | |
| Withstand voltage | No failure at AC1500V impressed for one minute | | | | | | | |
| Ambient temperature | -10 to 60℃ | | | | | | | |
| Degree of protection (Note3) | Grommet type IEC standard IP67, JIS C 0920 (water tight type), oil resistance | | | | | | | |

| Model | Reed 2 wire | | |
|---|---|---|---|
| Item | R6 | H0 | H0Y (2 color indicator) |
| Applications | Programmable controller (DC self hold function) | Programmable controller, relay | Programmable controller |
| Load voltage | DC24V | DC12/24V — AC110V | DC24V |
| Load current (Note2) | 5 to 50mA | 5 to 50mA — 7 to 20mA | 5 to 20mA |
| Internal voltage drop | 5Vor less | 5V or less | 6V or less |
| Indicator light | LED (ON lighting) | Green LED (ON lighting) | Red /Green LED (ON lighting) |
| Leakage current | 0.1mA or less | 10 μA or less | 10 μA or less |
| Lead wire length (Note1) | 1m (oil resistant vinyl cabtire code 2 conductor 0.3mm$^2$) | 1m (flame resistance cabtire code 2 conductor 0.5mm$^2$) | |
| Shock resistance | 294m/s$^2$ | | |
| Insulation resistance | 20MΩ over at 500V megger | 100MΩ over at 500V megger | |
| Withstand voltage | No failure at AC1500V impressed for one minute | No failure at AC1000V impressed for one minute | |
| Ambient temperature | -10 to 60℃ | | |
| Degree of protection (Note3) | Grommet type IEC standard IP67, JIS C 0920 (water tight type), oil resistance | | |

| Model | Solid state 2 wire | | |
|---|---|---|---|
| Item | R1 | R2 | R2Y (2 color indicator) |
| Applications | Programmable controller, relay, small solenoid valve | Programmable controller | |
| Load voltage | AC85 to 265V | DC10 to 30V | |
| Load current (Note2) | 5 to 100mA | 5 to 30mA | |
| Internal voltage drop | 7V or less | 4V or less | |
| Indicator light | LED (ON lighting) | | Red/Green LED (ON lighting) |
| Leakage current | 1mA or less at AC100V 2mA or less at AC220V | 1mA or less | 1.2mA or less |
| Lead wire length (Note1) | 1m (oil resistant vinyl cabtire code 2 conductor 0.3mm²) | | |
| Shock resistance | 980m/s² | | |
| Insulation resistance | 20MΩ over at DC500V megger | | |
| Withstand voltage | No failure at AC1500V impressed for one minute | No failure at AC1000V impressed for one minute | |
| Ambient temperature | −10 to 60℃ | | |
| Degree of protection (Note3) | Grommet type IEC standard IP67, JIS C 0920 (water tight type), oil resistance | | |

| Model | Solid state 3 wire | | Solid state 2 wire |
|---|---|---|---|
| Item | R3 | R3Y (2 color indicator) | T2YD※ (Note6) |
| Applications | Programmable controller, relay, IC circuit, solenoid valve | | Programmable controller |
| Power supply voltage | DC4.5 to 28V | | —— |
| Load voltage | DC30V | DC30V or less | DC24V±10% |
| Load current (Note2) | 200mA or less | 150mA or less | 5 to 20mA |
| Current consumption | At DC24V (at ON state) | | —— |
| | 10mA or less | 16mA or less | |
| Internal voltage drop | 0.5V or less at 150mA | 0.5V or less | 6V or less |
| Indicator light | LED (ON lighting) | RED/Green LED (ON lighting) | RED/Green LED (ON lighting) |
| Leakage current | 10μA or less | | 1.0mA or less |
| Output delay time (ON delay, OFF delay) (Note4) | —— | | 30 to 60mS |
| Lead wire length (Note1) | 1m (oil resistant vinyl cabtire code 3 conductor 0.2mm²) | | 1m (oil resistant vinyl cabtire code 2 conductor 0.5mm²) (Note5) |
| Shock resistance | 980m/s² | | |
| Insulation resistance | 20MΩ over at DC500V megger | | 100MΩ over at DC500V megger |
| Withstand voltage | No failure at AC1000V impressed for one minute | | |
| Ambient temperature | −10 to 60℃ | | |
| Degree of protection (Note3) | Grommet type IEC standard IP67, JIS C 0920 (water tight type), oil resistance | | |

Note 1 : 3m or 5m long lead wire is optionally available.
Note 2 : Max. load current above is value at 25 ℃. The current will be lower if the temperature around switch is higher than 25 ℃. (50% at 60℃).
Note 3 : R※B terminal box is not water-proof. The water-proof R※A type box (Matsushita Denko made) is the order made item.
Note 4 : This shows a period of time between detection of the magnet by the magnetic sensor and sending of switch output.
Note 5 : Non-flammable cabtyre cable available as option.
Note 6 : T2YD※ is not available in direct-current magnetic field.