CKD

SM-8162-A

# INSTRUCTION MANUAL

## PICOSOL

## 4SA0, 4SB0, M4SA0, M4SB0

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

# For Safety Use

To use this product safely, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (to the level pursuant to JIS B 8370 Pneumatic System Rules).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your application, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, read this instruction manual carefully for proper operation.

Observe the cautions on handling described in this manual, as well as the following instructions:

## ⚠ Precautions

- Do not touch electric wiring connections (exposed live parts) : this will cause an electric shock. During wiring, keep the power off. Also, do not touch these live parts with wet hands.

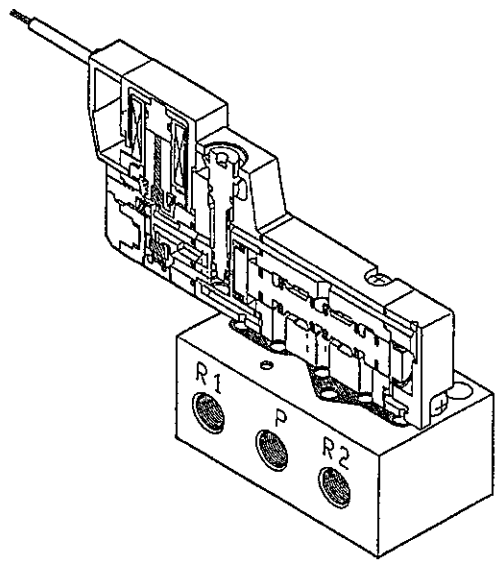
# INDEX

4SA0, 4SB0, M4SA0, M4SB0
Picosol
SM-8162-A

# 1. PRODUCTS

## 1.1 General description and special features.

1) Compact, width 10mm
   It is able to build the total system smaller as this valve is designed compactly.
2) Effective sectional area 2mm$^2$
   It is the most suitable to drive cylinder of bore up to $\phi$25.
3) Low wattage design (1W)
   41.7mA (with lamp) at DC24V. It is capable to be connected directly to electronics controls.
4) Broad varieties of connecting cable.
   It allows to make a choice of lead cord, series of C type connecters or D type connecters and also combination with lamp and surge killer.




## 1.2 Specifications

1) Common Specifications
   (1) Fluid specifications

| Item | | Specification |
|---|---|---|
| Media | | Pneumatic pressure |
| Actuation type | | Pilot (Soft spool) |
| Withstanding pressure | MPa | 1.05 |
| Ambient temperature | ℃ | 5~50 (Not to be frozen) |
| Service fluid temperature | ℃ | 5~50 |
| Lubrication | | Not required (Use Turbine oil, Class 1, ISO VG32 if lubrication is preferred.) |
| Protective Structure | | Dust prevention |
| Manual operation device | | Non lock type (Standard), Lock type (Optional) |

## (2) Electrical specification

| Item | Specification | |
|---|---|---|
| Rated voltage (V) | DC24V | DC24V |
| Holding current (mA) | 37.5 | 75 |
| Power consumption (W) (w/Lamp and surge killer) | 0.9 (1.0) | |
| Temperature raise (℃) | 50 | |
| Range of voltage fluctuation | ±10% | |
| Insulation class | Class B | |
| Wire connecting style | Grommet lead wire, C type connecter, D type connecter | |
| Option | w/surge killer, w/lamp indicator | |

## 2) Model code and specifications

### (1) 4SA0 series

| No. of position and No. of solenoid | Model code | Connecting port dia. | Effective sectional area ($mm^2$) | Working fluid pressure (MPa) | Response time (ms) | Mass (g) |
|---|---|---|---|---|---|---|
| 2-position · Single | 4SA010 | M3 | 2.0 | 0.15~0.7 | 30 | 23 |
| 2-position · Double | 4SA020 | | | 0.1~0.7 | | 35 |
| 3-position · All ports block | 4SA030 | $\phi$4 Barbed fitting ($R_1$ · $R_2$ are M3) | 0.9 (T4 spec.) | 0.2~0.7 | 30 | 39 |
| 3-position· ABR connection | 4SA040 | | | | | |
| 3 position· PAB connection | 4SA050 | | | | | |

### (2) M4SA0 series

| Model / Item | | M4SA0 |
|---|---|---|
| Type of Manifold | | Single Block Manifold |
| Applicable Solenoid | | 4SA0 Series |
| Effective Sectional Area | $mm^2$ | 0.9 |
| No. of Blocks | | 2 blocks~20 blocks |
| Kind of Manifold | | Concentrated Supply Air and Concentrated Exhaust |
| Connecting Style of Electric Cord | | Grommet Lead Cord (C type or D type connectors) |
| Plumbing | P port | Side M5 |
| | A · B port | Top M3 (Top $\phi$4 Barbed fitting : option) |
| | R port | Side (Rc1/8) Pilot exhaust is released to air. |
| Manual Operation Device | | Non locking type (Stardad), Locking type (Optional) |

### (3) 4SB0 series

| No. of position and No. of solenoid | Model code | Connecting port dia. | Effective sectional area ($mm^2$) | Working fluid pressure (MPa) | Response time (ms) | Mass (g) |
|---|---|---|---|---|---|---|
| 2-position · Single | 4SB010 | M5 | 1.8 | 0.15~0.7 | 30 | 43 |
| 2-position · Double | 4SB020 | | | 0.1~0.7 | | 55 |
| 3-position · All ports block | 4SB030 | | 1.5 | 0.2~0.7 | 30 | 50 |
| 3-position· ABR connection | 4SB040 | | | | | |
| 3 position· PAB connection | 4SB050 | | | | | |

## (4) M4SB0 series

| Model / Item | | M4SB0 |
|---|---|---|
| Type of Manifold | | Single Block Manifold |
| Applicable Solenoid | | 4SB0 Series |
| Effective Sectional Area | $mm^2$ | 1.8 ( 1.5 : 4SB030, 4SB040, 4SB050 ) |
| No. of Blocks | | 2 blocks~20 blocks |
| Kind of Manifold | | Concentrated Supply Air and Concentrated Exhaust |
| Connecting Style of Electric Cord | | Grommet Lead Cord |
| Plumbing | P port | Side (M5) (Rc1/8 Option) |
| | A · B port | Side (M5, $\phi$4 snap join, $\phi$4, $\phi$6 Barbed fitting : option) |
| | R port | Side (Rc1/8) Pilot exhaust is centralized to R port. |
| Manual Operation Device | | Non locking type (Stardad), Locking type (Optional) |

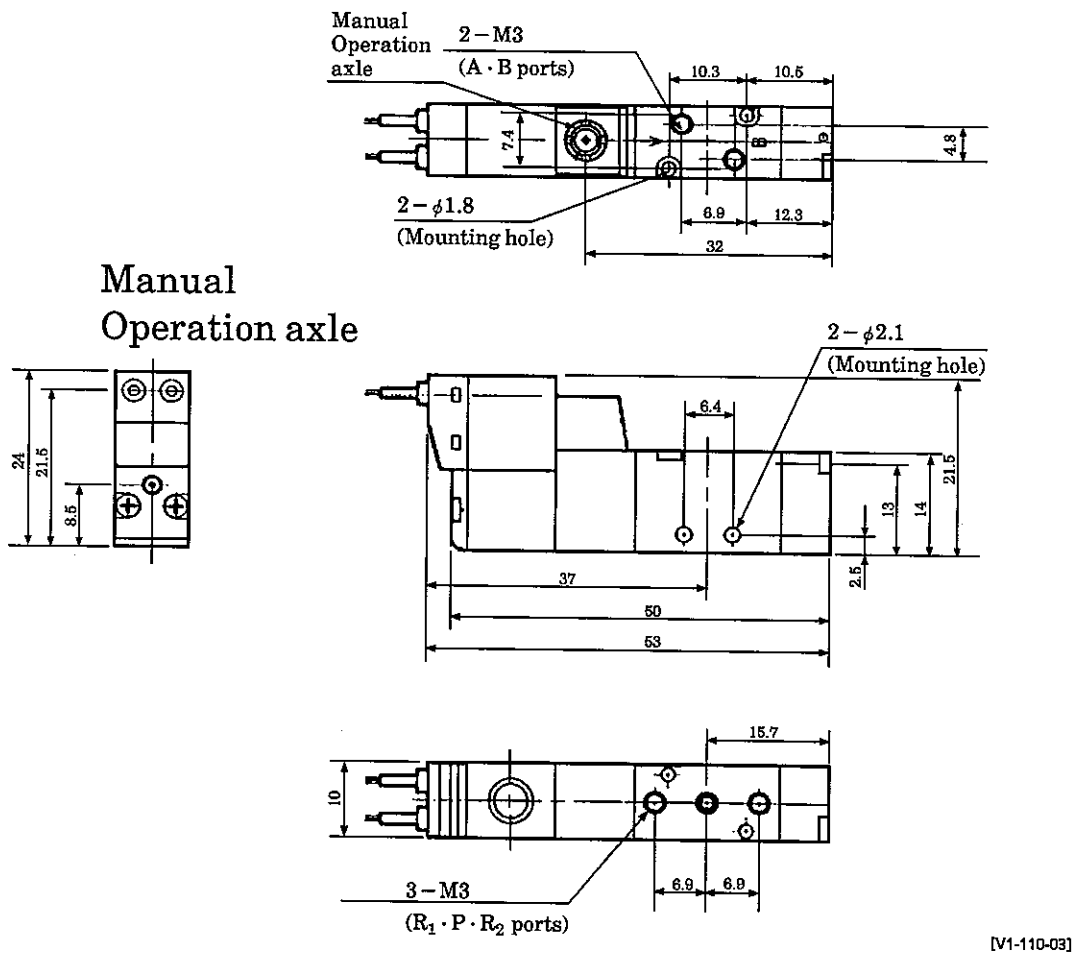
## 1.3 External dimensions

1) 4SA series

- 4SA010

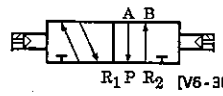
[V1-110-02]

- 4SA010-M3 (Grommet lead wire)

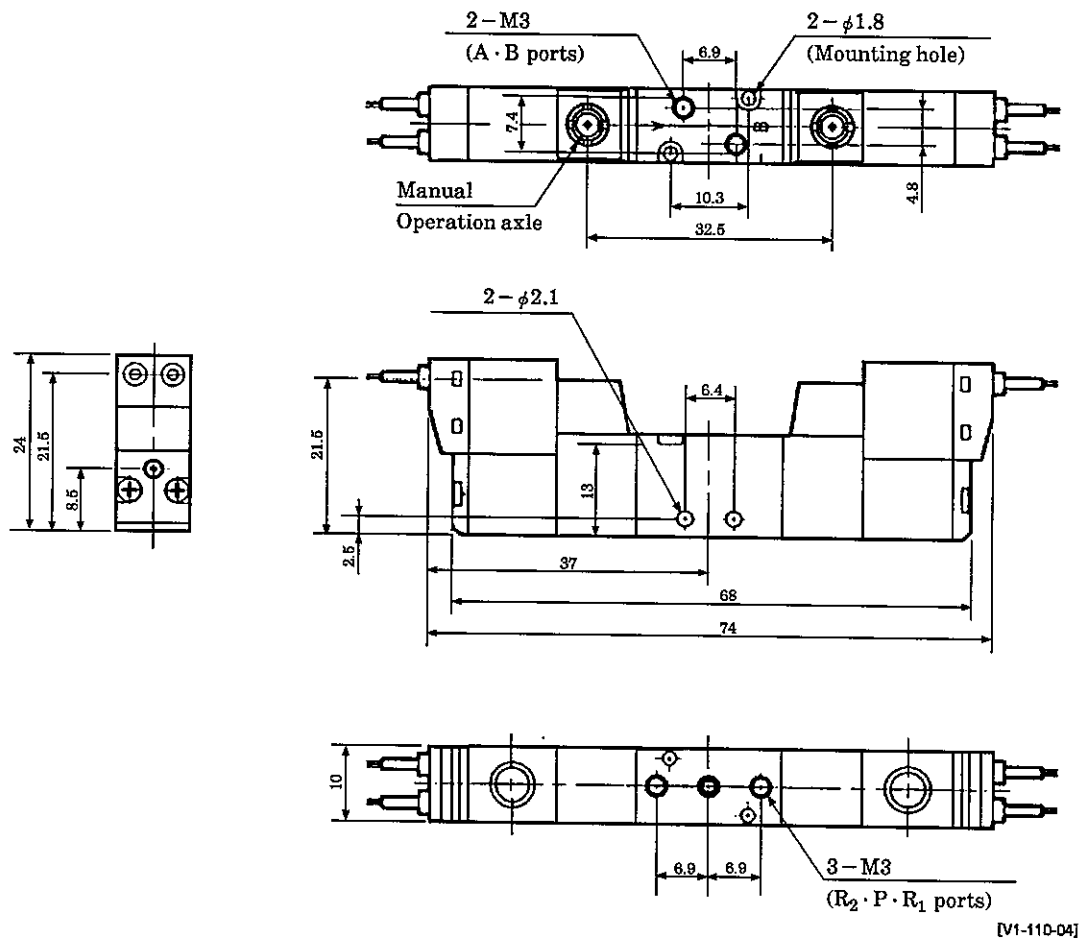


[V1-110-03]

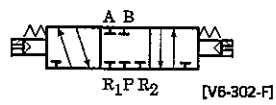
- 4SA020




- 4SA020-M3 (Grommet lead wire)



● 4SA030



[V6-302-F]

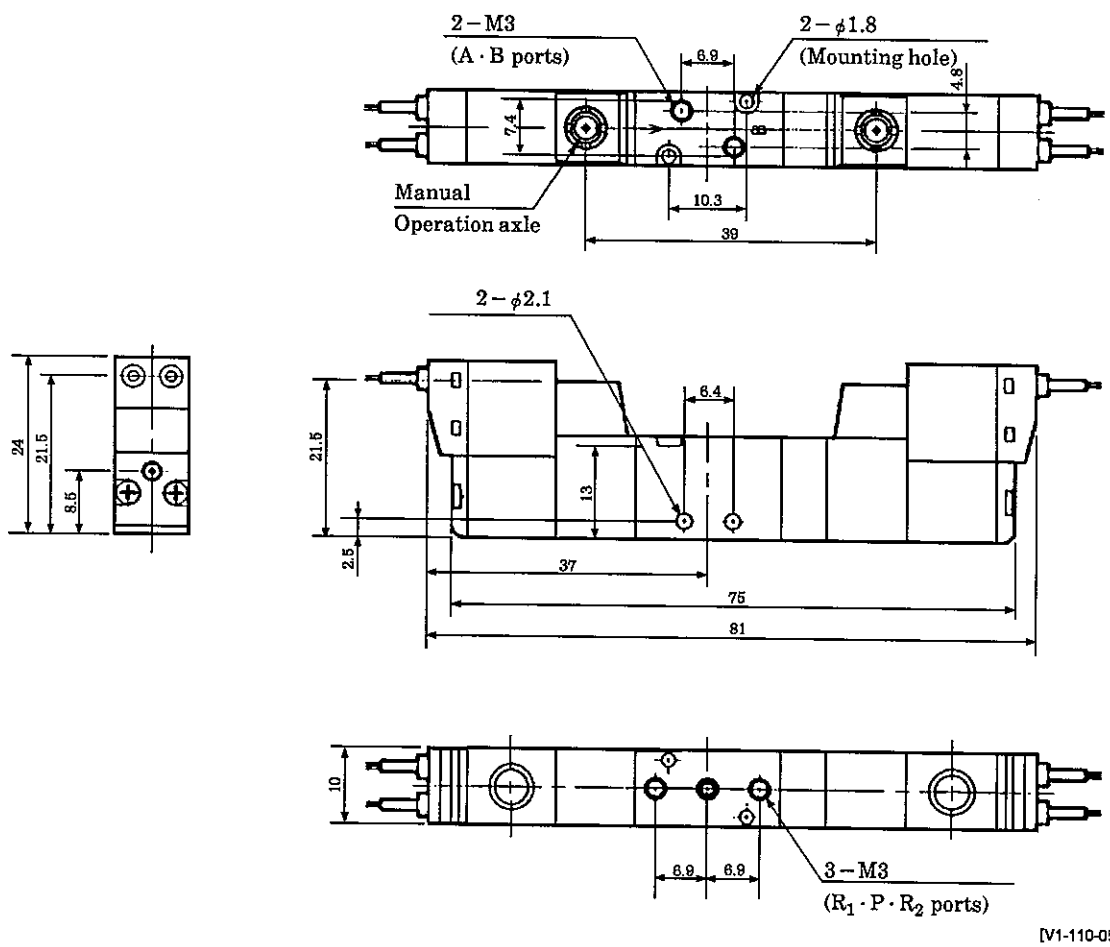
● 4SA040

[V6-302-G]

● 4SA050

[V6-302-H]

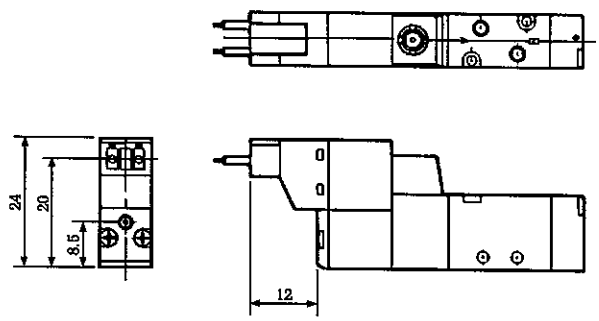
● 4SA0340, 040, 050-M3 (Grommet lead wire)



[V1-110-05]

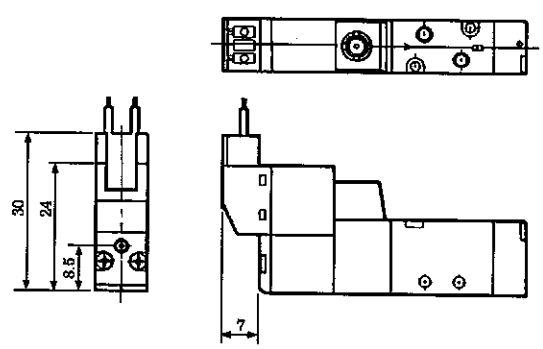
2) 4SA0 series options

● 4SA0 1/2/3/4/5 — 0-M3- C, $C_1$, $C_2$, $C_3$ (C type connecter)



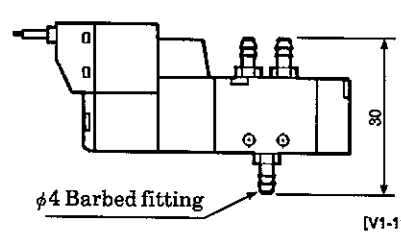

[V1-110-06]

● 4SA0 1/2/3/4/5 — 0-M3- $D_1$, $D_2$, $D_3$, $D_4$ (D type connecter)



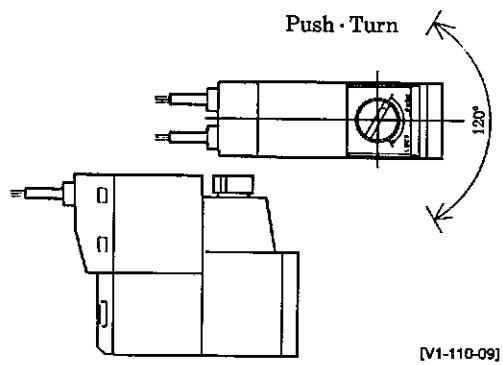

[V1-110-08]

● 4SA0 1/2/3/4/5 — 0-T4



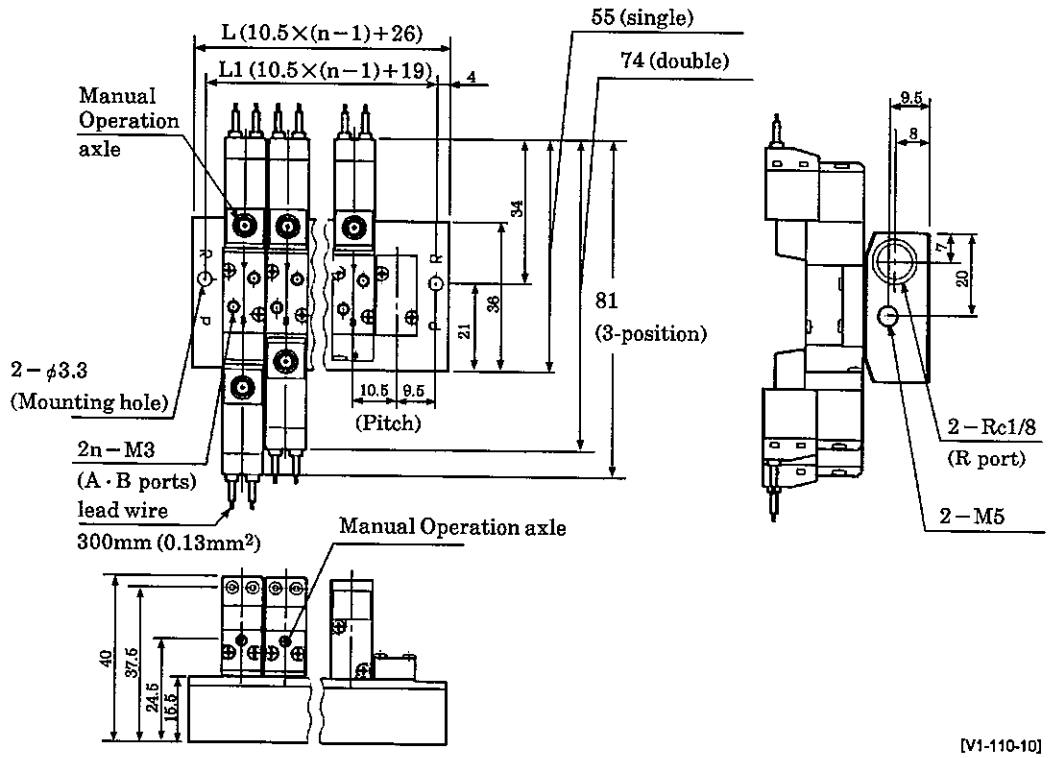

[V1-110-07]

- 4SA0 1 2 3 4 5 — M3-M1 (Lock type manual operation)



### 3) M4SA series

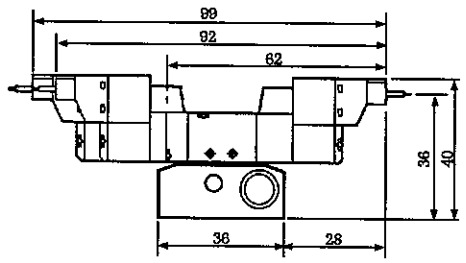
- **M4SA0※0-M3 (Grommet lead wire)**




| Block No. / Symbol | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 29.5 | 40 | 50.5 | 61 | 71.5 | 82 | 92.5 | 103 | 113.5 | 124 | 134.5 | 145 | 155.5 | 166 | 176.5 | 187 | 197.5 | 208 | 218.5 |
| L | 36.5 | 47 | 57.5 | 68 | 78.5 | 89 | 99.5 | 110 | 120.5 | 131 | 141.5 | 152 | 162.5 | 173 | 183.5 | 194 | 204.5 | 215 | 225.5 |

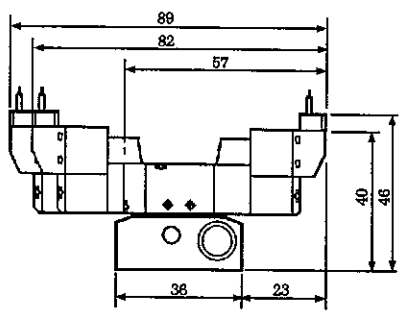
Options

- M4SA0※0-M3- C, $C_1$, $C_2$, $C_3$ (C type connecter)



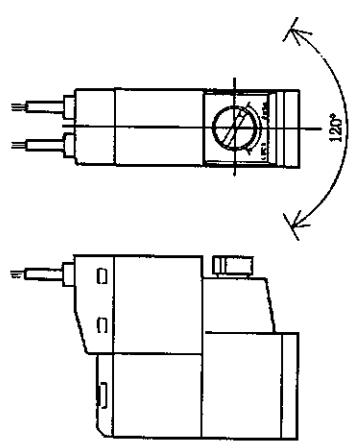

[V1-110-11]

- M4SA0※0-M3- D, $D_1$, $D_2$, $D_3$ (D type connecter)




[V1-110-12]

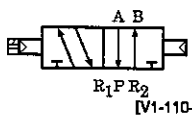
- M4SA0※0-※※-M1 (Lock type manual operation)




[V1-110-13]

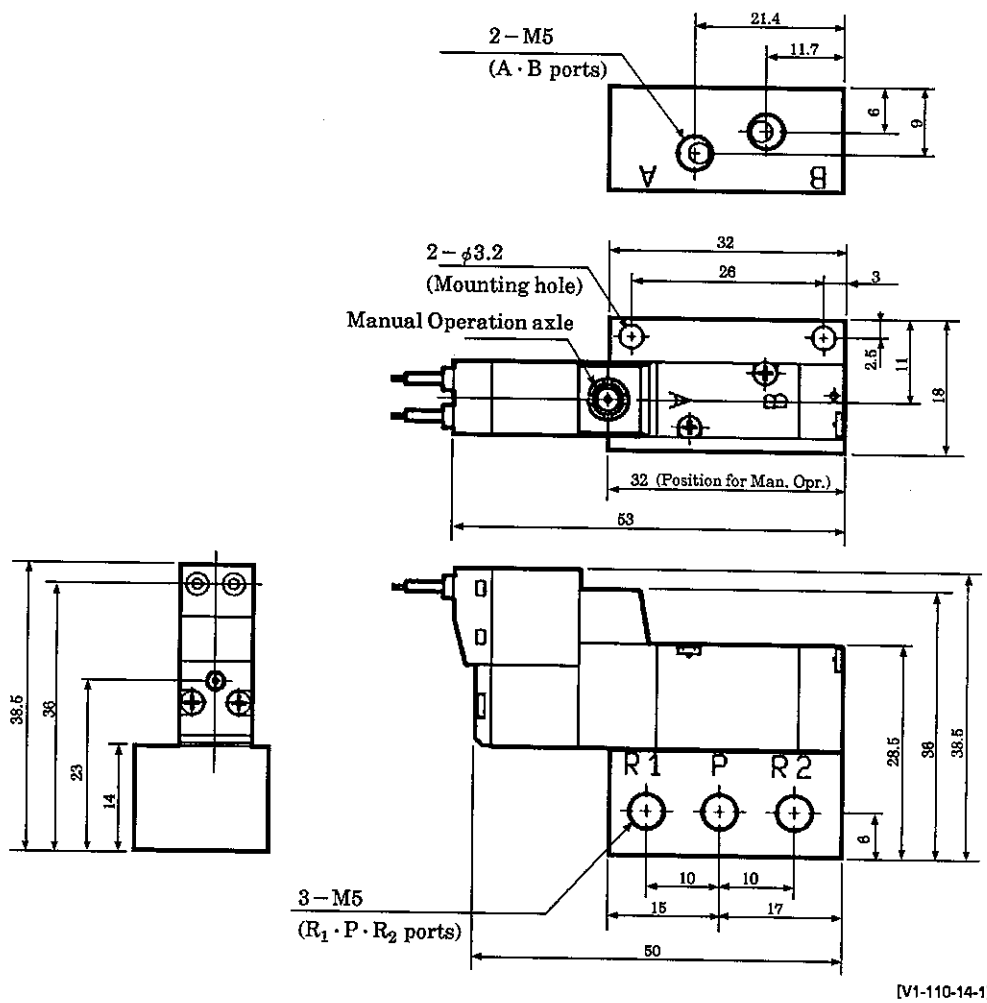
4) 4SB series

- 4SB010



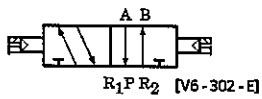
[V1-110-02]

- 4SB010-M5 (Grommet lead wire)

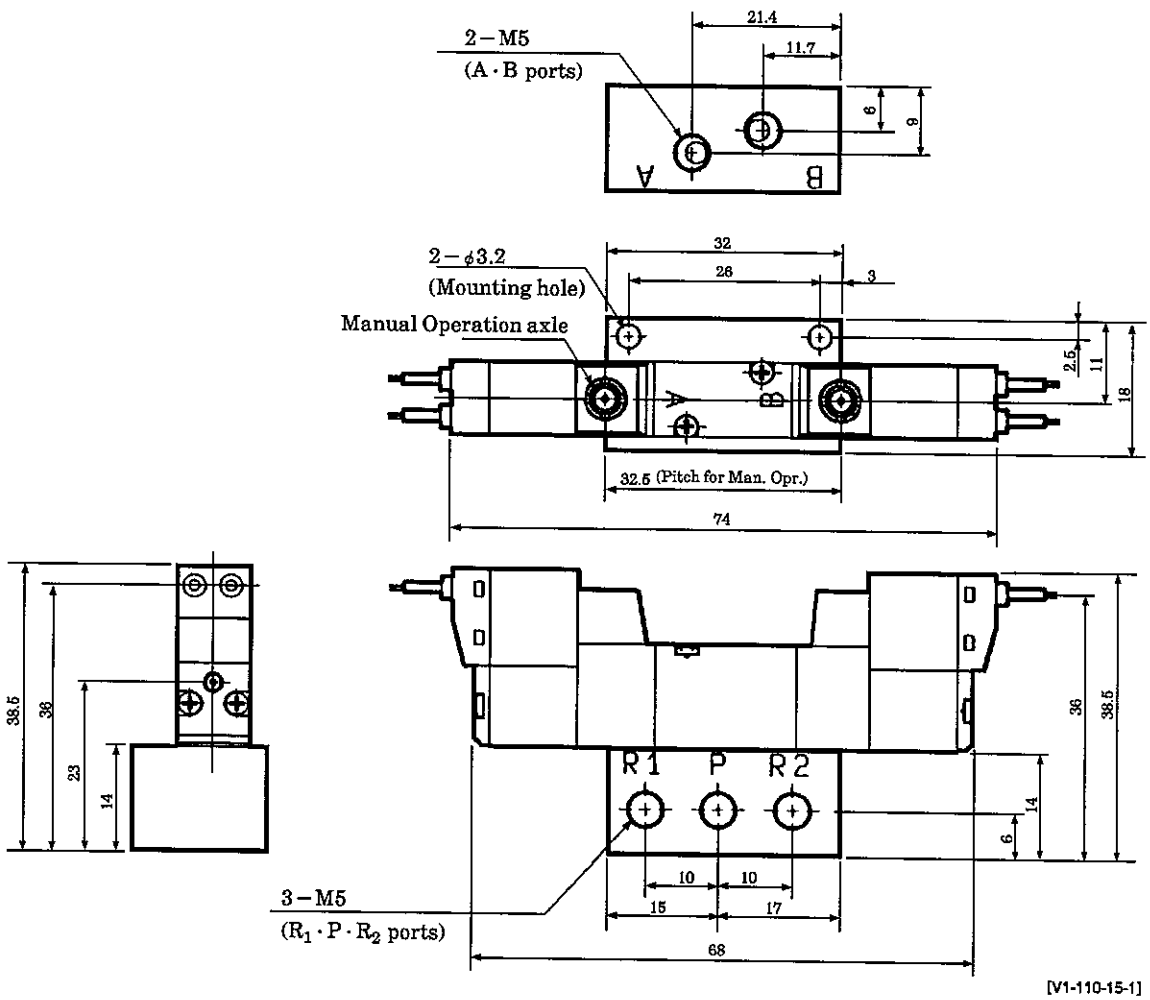


[V1-110-14-1]

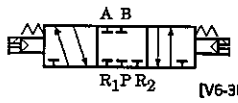
- 4SB020




- 4SB020-M5 (Grommet lead wire)

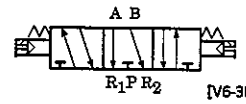


● 4SB030



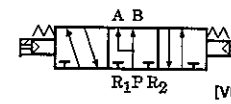
[V6-302-F]

● 4SB040



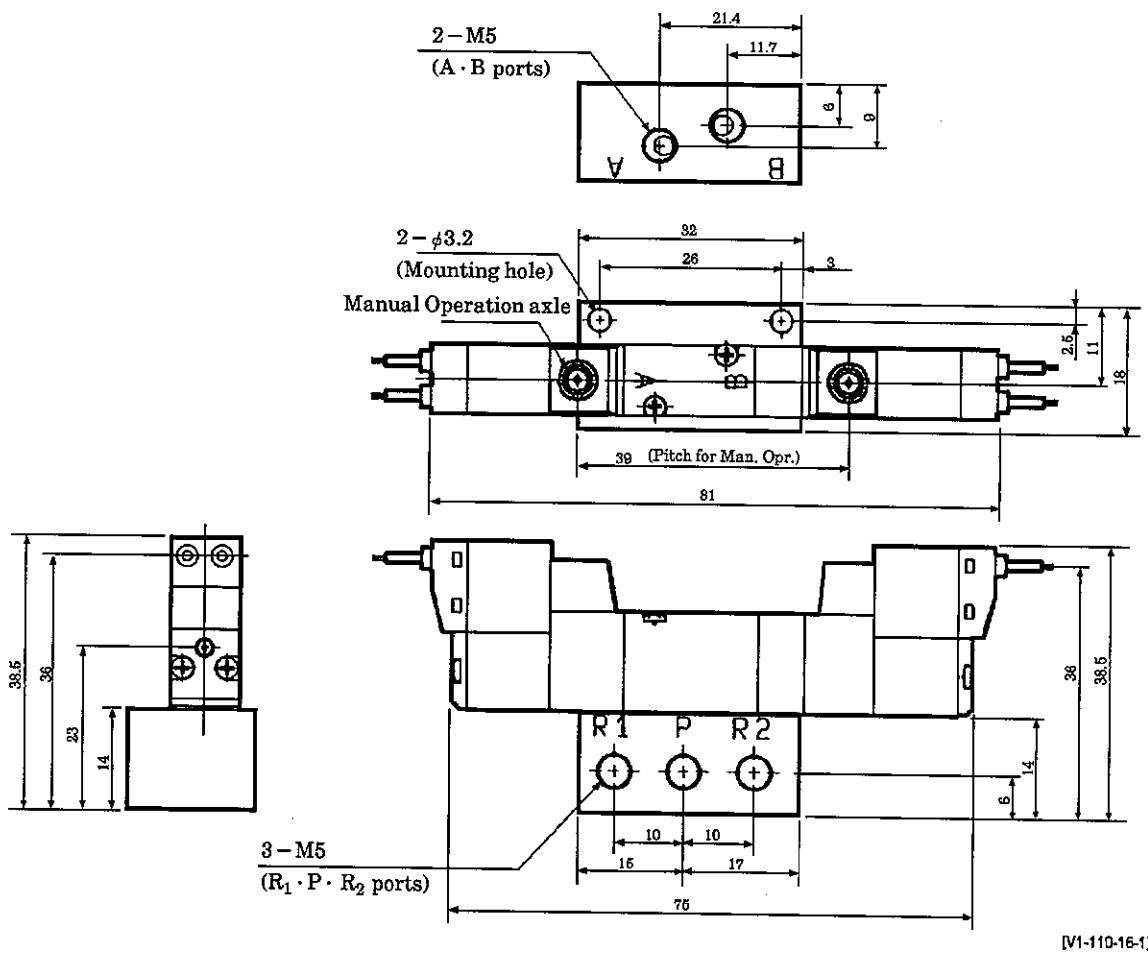
[V6-302-G]

● 4SB050



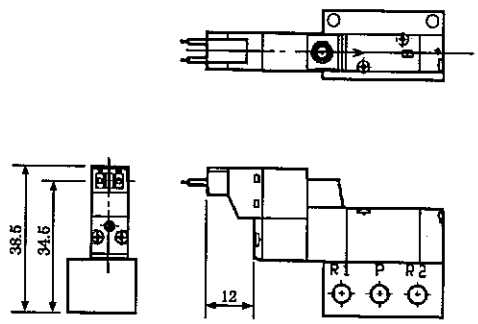
[V6-302-H]

● 4SB030, 040, 050-M5 (Grommet lead wire)



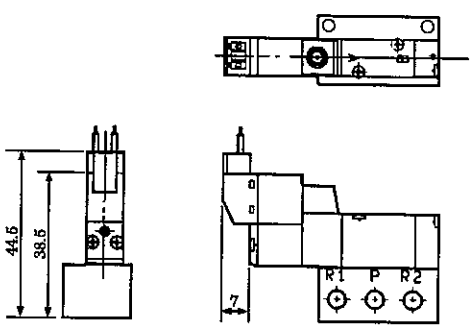
5) 4SB series options

● 4SB0 1/2/3/4/5 — 0-M5- C, C1, C2, C3 (C type connecter)



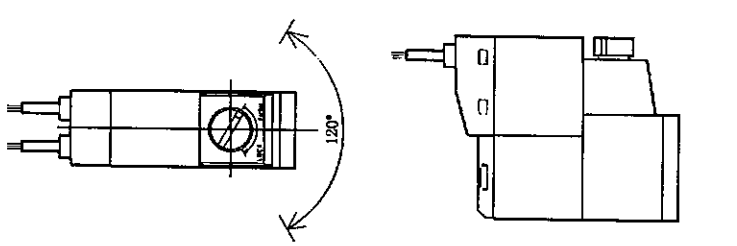

[V1-110-17]

● 4SB0 1/2/3/4/5 — 0-M5- D, D1, D2, D3 (D type connecter)




[V1-110-18]

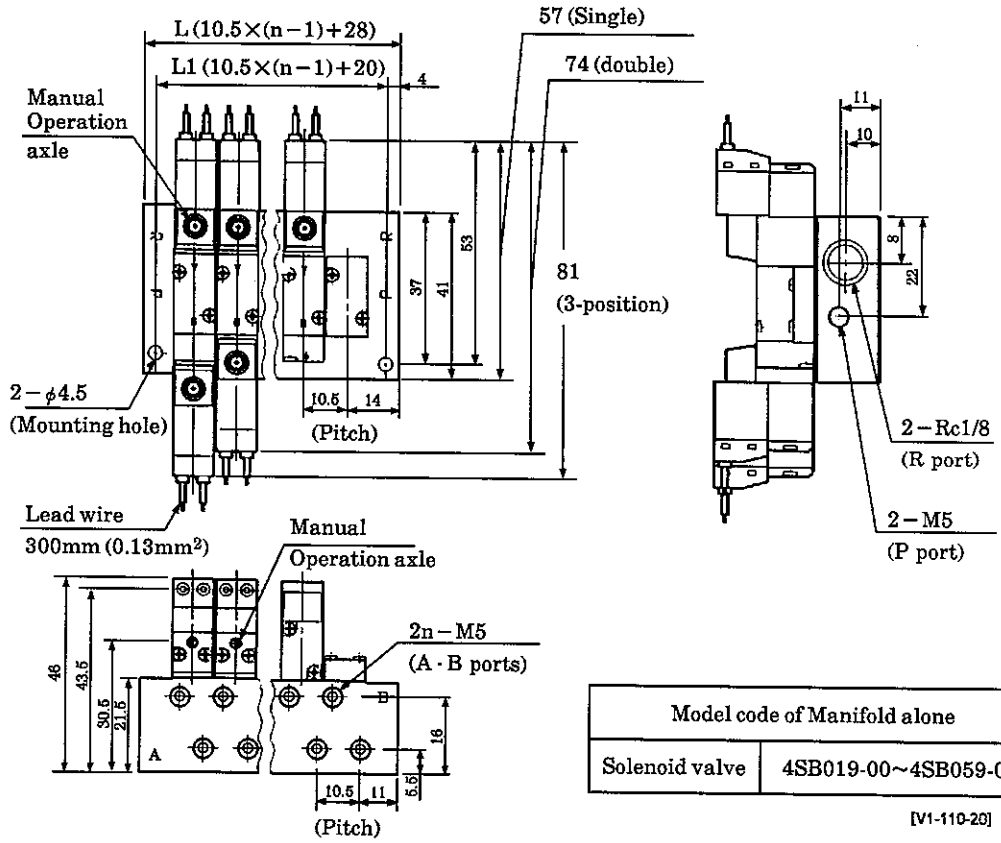
● 4SB0 1/2/3/4/5 — 0-M5- M1 (Lock type Manual operation)




[V1-110-19]

## 6) M4SB0 series

- M4SB0※0-M5 (Grommet lead wire)



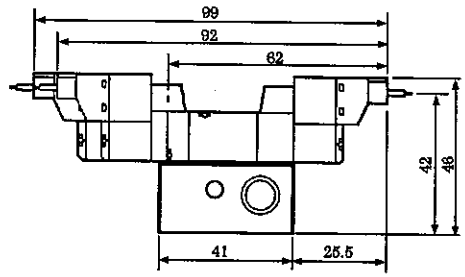

| Model code of Manifold alone | |
|---|---|
| Solenoid valve | 4SB019-00~4SB059-00 |

[V1-110-20]

| Block No. / Symbol | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 30.5 | 41 | 51.5 | 62 | 72.5 | 83 | 93.5 | 104 | 114.5 | 125 | 135.5 | 146 | 156.5 | 167 | 177.5 | 188 | 198.5 | 209 | 219.5 |
| L | 38.5 | 49 | 59.5 | 70 | 80.5 | 91 | 101.5 | 112 | 122.5 | 133 | 143.5 | 154 | 164.5 | 175 | 185.5 | 196 | 206.5 | 217 | 227.5 |

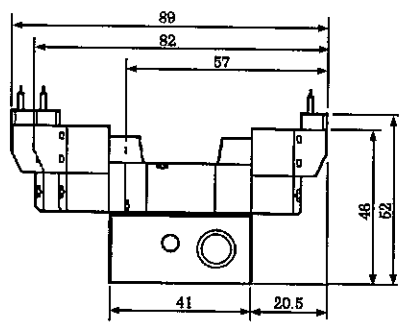
## Options

- M4SB0※0-※※- C, $C_1$, $C_2$, $C_3$ (C type connecter)



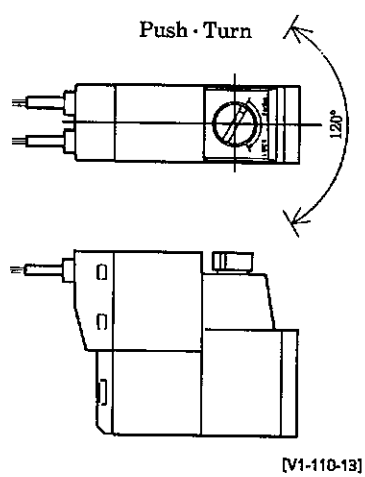

[V1-110-21]

- M4SB0※0-※※- D, $D_1$, $D_2$, $D_3$ (D type connecter)



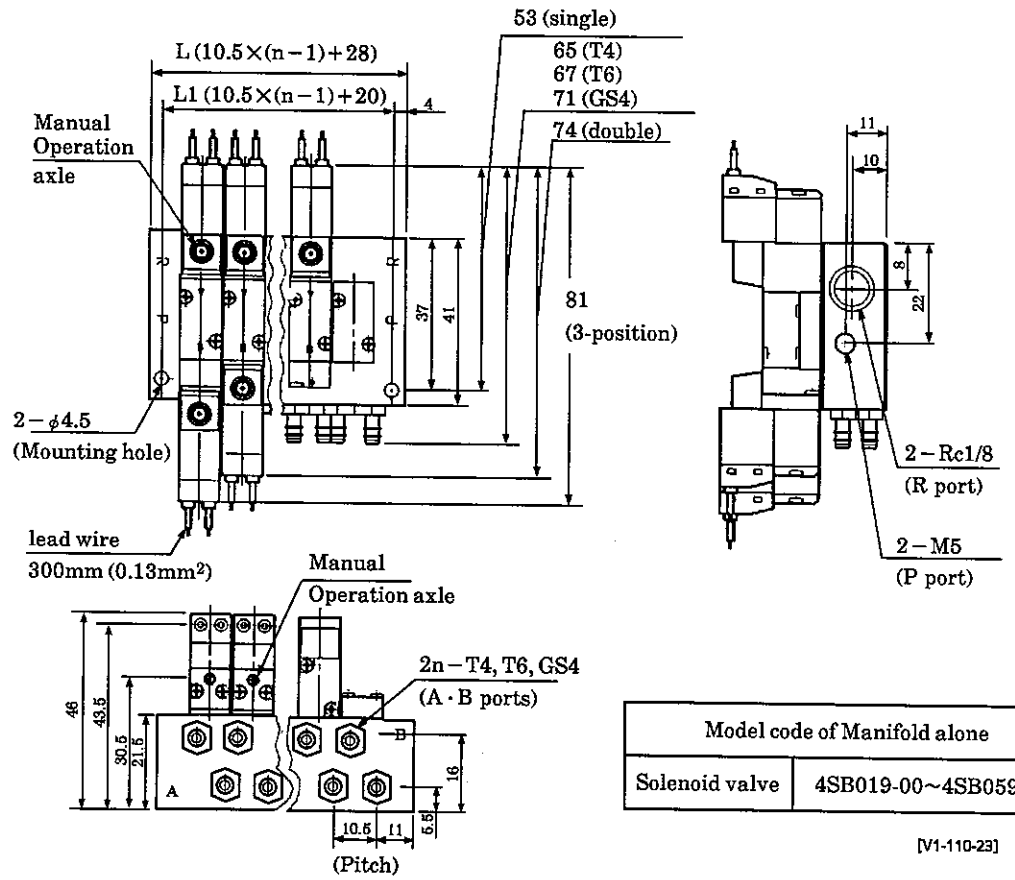

[V1-110-22]

- 4SB0※0- ※※-M1 (Lock type manual operation)




[V1-110-13]

## ● M4SB0※0- GS4, T4, T6 (Grommet lead wire)



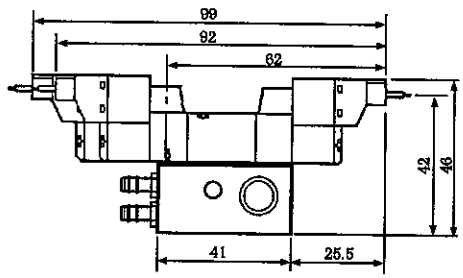

| Model code of Manifold alone | |
|---|---|
| Solenoid valve | 4SB019-00~4SB059-00 |

[V1-110-23]

| Block No. / Symbol | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 30.5 | 41 | 51.5 | 62 | 72.5 | 83 | 93.5 | 104 | 114.5 | 125 | 135.5 | 146 | 156.5 | 167 | 177.5 | 188 | 198.5 | 209 | 219.5 |
| L | 38.5 | 49 | 59.5 | 70 | 80.5 | 91 | 101.5 | 112 | 122.5 | 133 | 143.5 | 154 | 164.5 | 175 | 185.5 | 196 | 206.5 | 217 | 227.5 |

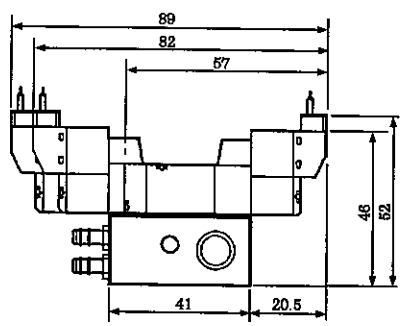
## Options

- M4SB0※0-※※※- C, $C_1$, $C_2$, $C_3$ (C type connecter)



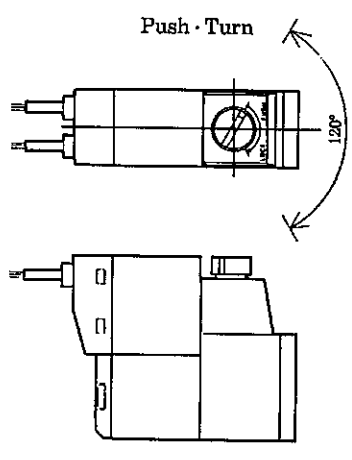

[V1-110-24]

- M4SB0※0-※※※- D, $D_1$, $D_2$, $D_3$ (C type connecter)




[V1-110-25]

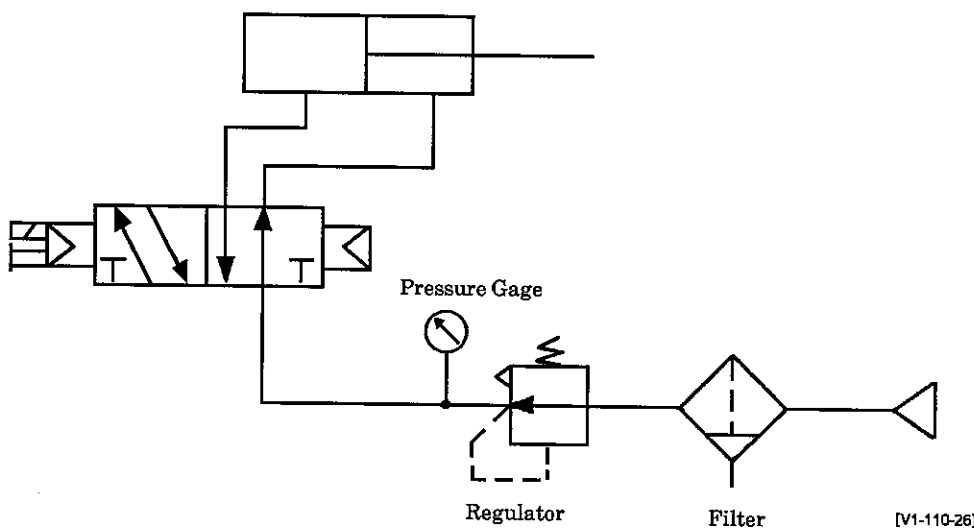
- M4SB0※0- ※※-M1 (Lock type manual operation)



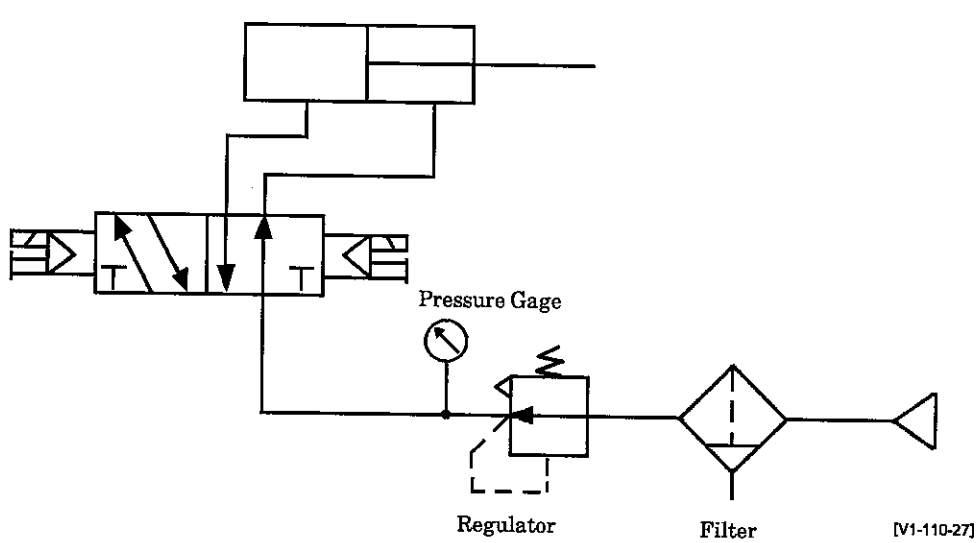

[V1-110-13]

## 1.4 Fundamental circuit diagrams

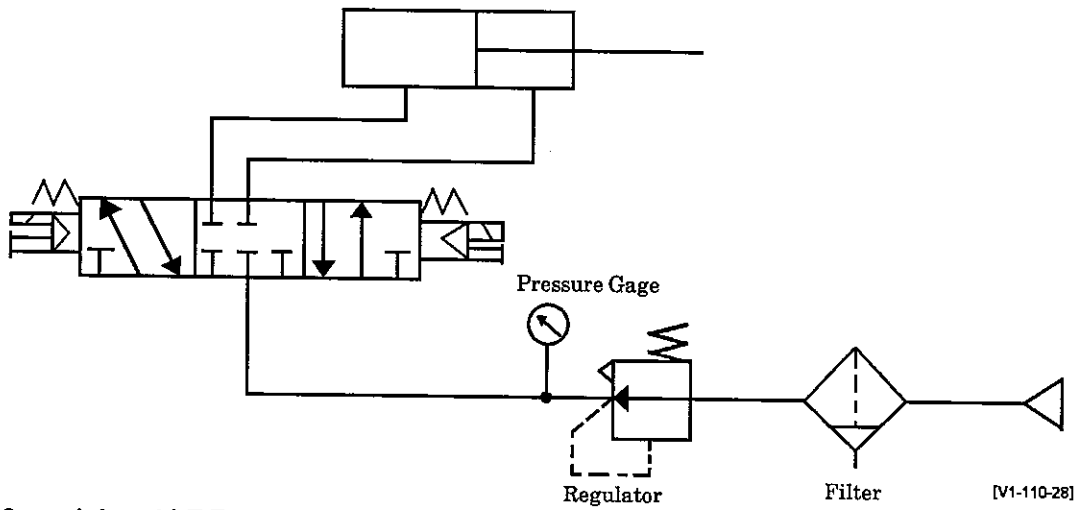
1) Single
4SA010, 4SB010



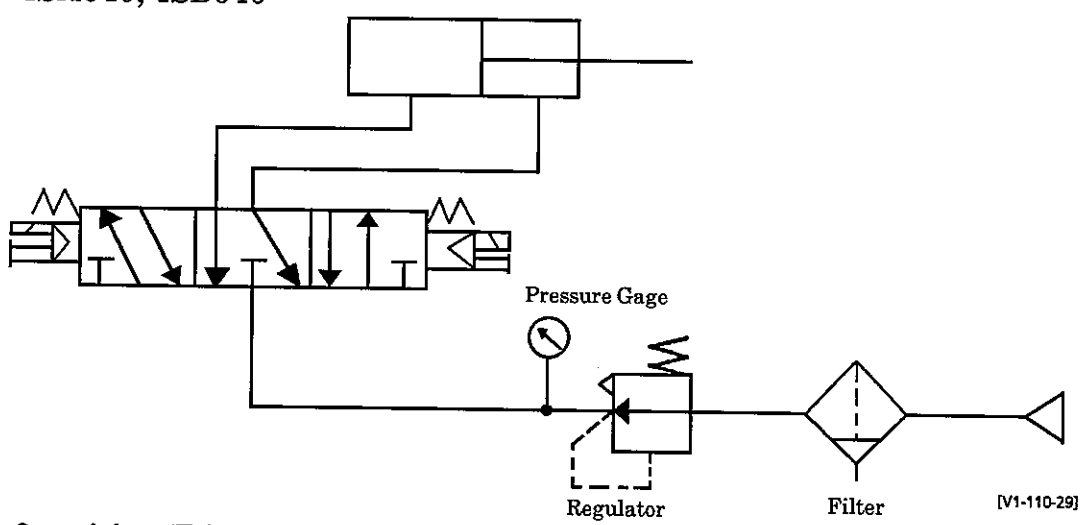

2) Double
4SA020, 4SB020



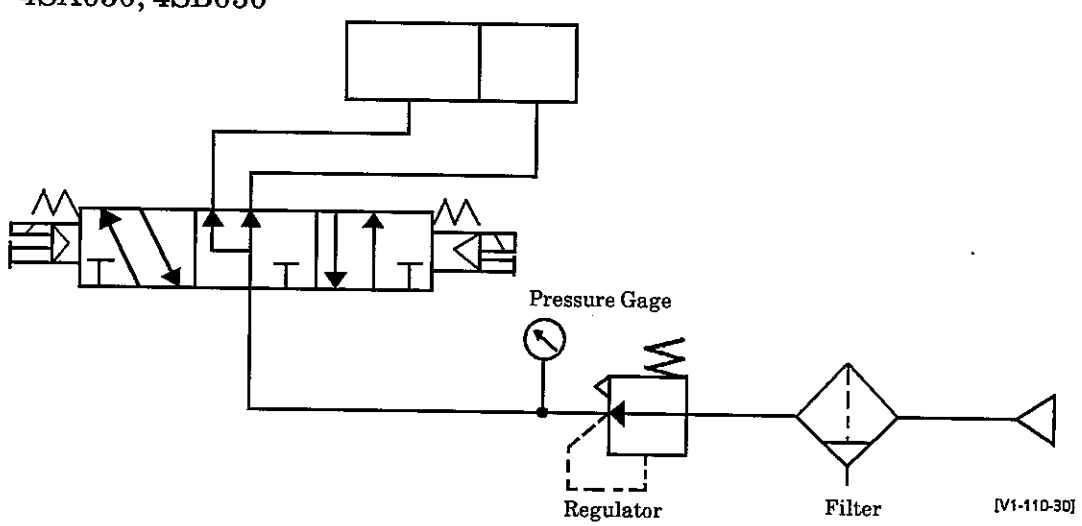
3) 3 position (All ports blocked)
4SA030, 4SB030




4) 3 position (ABR connection)
4SA040, 4SB040




5) 3 position (PAB connection)
4SA050, 4SB050



# 2. CAUTION

## 2.1 Quality of Compressed air

Much sludge (such as condensed humidity, oxide oil, tarry compound and foreign particles) is apt to be contained within the compressed air which destructs the reliability of pneumatic equipment remarkably. Consider the following remedies of removing such sludge.

Improve the quality of compressed air by dehumidifying using after-cooler dryer.

1) How to purge drain (sludge)
   - Dehumidifying the air by means of after-cooler dryer
   - Removal foreign particles and material by means of filter
   - Removal tarcarbide by means of tar-removing filter

## 2.2 Cautions to build system with manifold

1) Direction of flow

   Both Compressed air supply (P) ports and Exhaust (R) ports are provided at both end of manifold block. Make use either one of them.

2) Number of blocks limitation

   When anticipating to operate more than 6 valves simultaneously, connect Air supply lines to P ports on both end of manifold block and lead exhaust to open air at both R ports. Otherwise, it may cause malfunction of valves.

3) Connecting pipe diameter

   Use the pipe of diameter corresponding to P port size of manifold. Insufficient flow or pressure may cause either malfunction of valve or short propelling force of cylinders.

4) Cylinder malfunction

   There may be possible malfunction of cylinders when intending to drive double acting cylinders with 3-position ABR connection on manifold or to drive single acting cylinder making use 4-position valve in place of 3-position valve due to the exhaust pressure coming through a round-about route when the other solenoid valve is actuated. Connect an isolated solenoid valve alone to build a cylinder driving circuit as for preventive measure of such trouble.

   It is further recommended, however, to contact nearest CKD dealer when intending to use manifold blocks.


## 2.3 Cautions to mount subplate onto manifold

Tighten 2es. of mounting screws uniformly with tightening torque of 0.25 to 0.3 N · m.

## 2.4 Manual Operation Devices

1) P port pressure

Even though using the device, main valve will not be shifted unless P port is pressurized, due to its structure of being an Internal pilot type spool valve.

2) Non-lock type manual operation device

Press manual operation axles till it hits the bottom. Valve will be shifted to the same position as if solenoid coil is energized and remain there while the button is pressed as for 3-position type.

As for 2-position double solenoid valve, it will be shifted to the same position as if A side (B side) Solenoid is energized when Manual operation button on A side (B side) is pressed and remain the position even after the button is released. Press opposing button to release its position.

3) Lock type manual operation device

The valve is shifted to the position as if coil is energized when button is pressed with a small screw driver until it hits the bottom and is locked when button is turned about 120° clockwise. Carefully avoid turning it forcibly beyond the limitation to prevent its damage. Make sure to release locking of manual operation device prior to starting normal operation.

## 2.5 Responding time

1) Supplying pressure

Responding time posted on a catalog is for the case of energizing with Non-lubricat at the pressure of 0.5MPa.

2) Lubrication

There may be a delay of responding time in case of excessive volume of lubrication or low pressure.

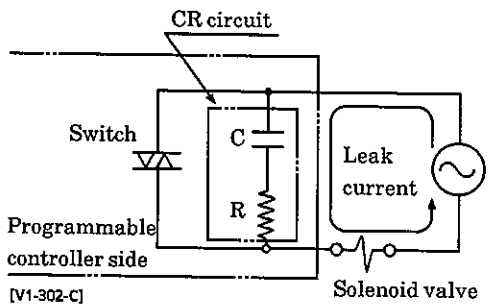
## 2.6 Range of Supply pressure

At least lower limited pressure or more is required due to its structure of being Internal pilot type spool valve. Always confirm the line pressure.

## 2.7 Solenoid valve

1) Limitation of Leak current

Make sure that the leak current of programmable controller output is less than DC24V, 1mA when anticipating to drive solenoid coil valve with programmable controller, etc. Otherwise, it may cause malfunction of coil.




2) Polarity of solenoid coil

There is a polarity of DC solenoid coil with lamp and surge killer. Confirm the electric circuit.

## 2.8 Ambient Conditions

1) Dust

Mount either silencer or elbow joint to R port keeping its open end downward within the area of much dust or floating foreign particles, to provide protective measurement of keeping those foreign particles from falling into R port.

2) Water drops and cutting coolant

Instead of leaving water or cutting coolant dripping over the solenoid, either provide a cover or install the solenoid within enclosed panel as it may causes short circuit or coil burning. Prevent allowing cutting coolant drip over cylinder rod because it will result malfunction of solenoid valve due to penetrated coolant to secondary piping of solenoid through cylinder. Contact nearest CKD dealer if the case is as such.

3) Continuous charging

When it is installed within enclosed control box or charging time is long, take some measure of ventilation or radiation. Otherwise it may cause rising temperature excessively.

4) Corrosive gas ambient

Prevent installation the valve within the corrosive gas such as sulfurous acid gas. Contact nearest CKD dealer for installation valve in the ambient of sea breeze or splash of sea water.

5) Ambient temperature

Contact nearest CKD dealer for installation valve in the ambient of high temperature higher than 50°C or such lower temperature as below 5°C.

6) Vibration and Shock

Prevent installation of valve within the area of 50m/s$^2$ or higher vibration and/or 300m/s$^2$ or higher shock.

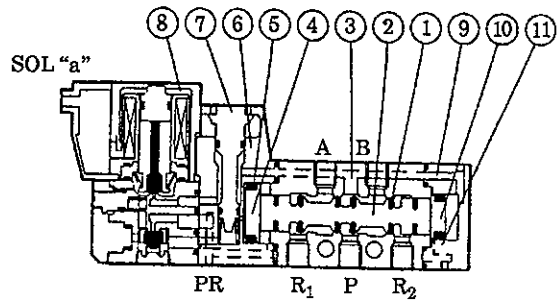
# 3. OPERATION

## 3.1 Function

1) 4SA series

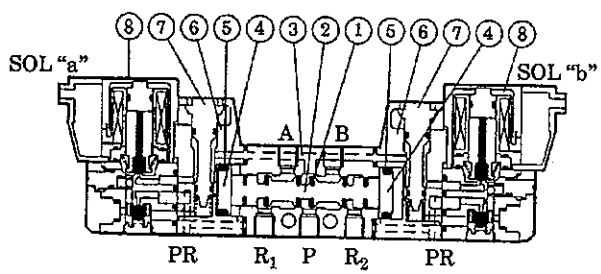
- 4SA010

No signal current
(Illustrated)
P→B
A→$R_1$ ($R_2$ port is closed.)
When actuated
P→A
B→$R_2$ ($R_1$ port is closed.)
PR is pilot exhaust port.



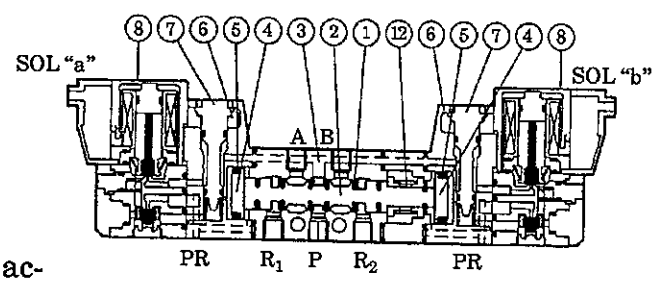

- 4SA020

When Sol "a" is actuated
P→A
B→$R_2$ ($R_1$ port is closed.)
When Sol "b" is actuated
(Illustrated)
P→B
A→$R_1$ ($R_2$ port is closed.)
New position of the spool is held where it is even after the solenoid is deactuated.




- 4SA030, 4SA040, 4SA050

No signal current to 4SA030
(Illustrated)
P · A · B · $R_1$ · $R_2$ are closed.
No signal current to 4SA040
P (Closed)
A→$R_1$
B→$R_2$
No signal current to 4SA050
P→A · B
$R_1$ . $R_2$ (Closed)
Refer 4SA020 as to the cases actuating Sol "a" or Sol "b".



| No. | Parts | Material | | Remarks |
|---|---|---|---|---|
| ① | Spool packing | NBR | Nitril rubber | |
| ② | Spool | A6061 | Aluminum | |
| ③ | Body | ADC12 | Die casted aluminum | Painting finish |
| ④ | Piston D | POM | Polyacetal | |
| ⑤ | Piston packing D | NBR | Nitril rubber | |
| ⑥ | Piston chamber | PPS | Polyphenilene sulfide | |
| ⑦ | Manual operation axle | POM | Polyacetal | |
| ⑧ | Coil ass'y | — | — | |
| ⑨ | Cap | PPS | Polyphenilene sulfide | |
| ⑩ | Piston S | POM | Polyacetal | |
| ⑪ | Piston packing S | NBR | Nitril rubber | |
| ⑫ | Spring | SUS304 | Stainless steel | |

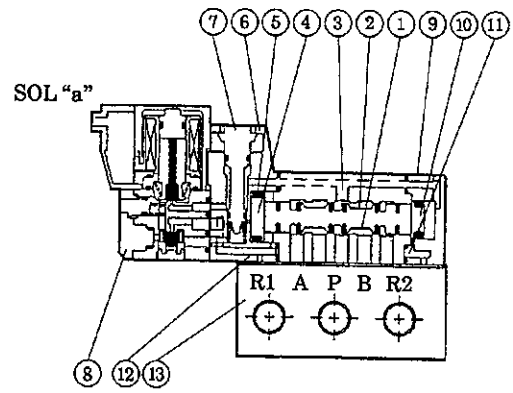
## Expendable Parts list

| Parts No. · Parts / Model code | ⑧ Coil ass'y |
|---|---|
| 4SA010 | 4S0 - [Connecting wire] - Coil - [Voltage] |
| 4SA020 | |
| 4SA030 | |
| 4SA040 | No marking for Grommet lead wire |
| 4SA050 | |

2) 4SB series

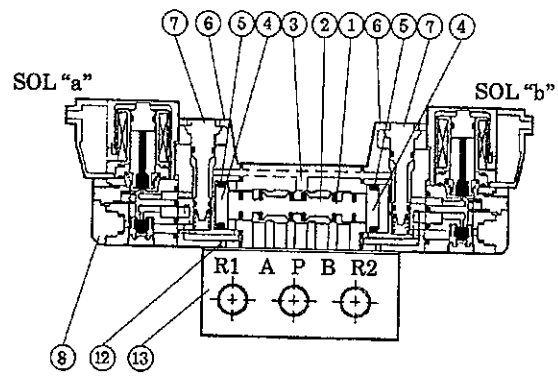
- 4SB010

No signal current
(Illustrated)
P→B
A→$R_1$ ($R_2$ port is closed.)
When actuated
P→A
B→$R_2$ ($R_1$ port is closed.)



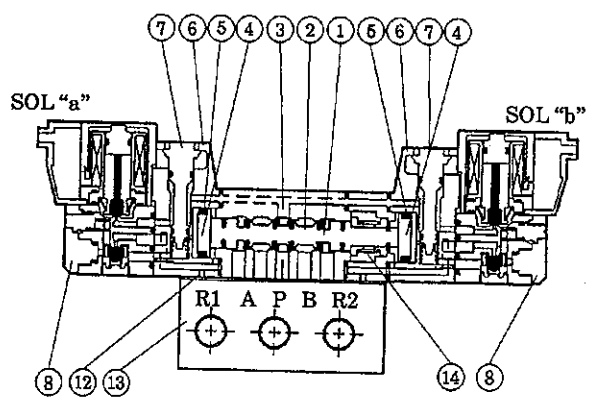

- 4SB020

When Sol "a" is actuated
P→A
B→$R_2$ ($R_1$ port is closed.)
When Sol "b" is actuated
(Illustrated)
P→B
A→$R_1$ ($R_2$ port is closed.)
New position of the spool is held where it is even after the solenoid is deactuated.




- 4SB030, 4SB040, 4SB050

No signal current to 4SB030
(Illustrated)
P · A · B · $R_1$ · $R_2$ are closed.
No signal current to 4SB040
P (Closed)
A→$R_1$
B→$R_2$
No signal current to 4SB050
P→A · B
$R_1$ . $R_2$ (Closed)
Refer 4SB020 as to the cases actuating Sol "a" or Sol "b".



| No. | Parts | Material | | Remarks |
|---|---|---|---|---|
| ① | Spool packing | NBR | Nitril rubber | |
| ② | Spool | A6061 | Aluminum | |
| ③ | Body | ADC12 | Die casted aluminum | Painting finish |
| ④ | Piston D | POM | Polyacetal | |
| ⑤ | Piston packing D | NBR | Nitril rubber | |
| ⑥ | Piston chamber | PPS | Polyphenilene sulfide | |
| ⑦ | Manual operation axle | POM | Polyacetal | |
| ⑧ | Coil ass'y | — | — | |
| ⑨ | Cap | PPS | Polyphenilene sulfide | |
| ⑩ | Piston S | POM | Polyacetal | |
| ⑪ | Piston packing S | NBR | Nitril rubber | |
| ⑫ | Gasket | NBR | Nitril rubber | |
| ⑬ | Subplate | A6063 | Aluminum | |
| ⑭ | Spring | SUS304 | Stainless steel | |

## Expendable Parts list

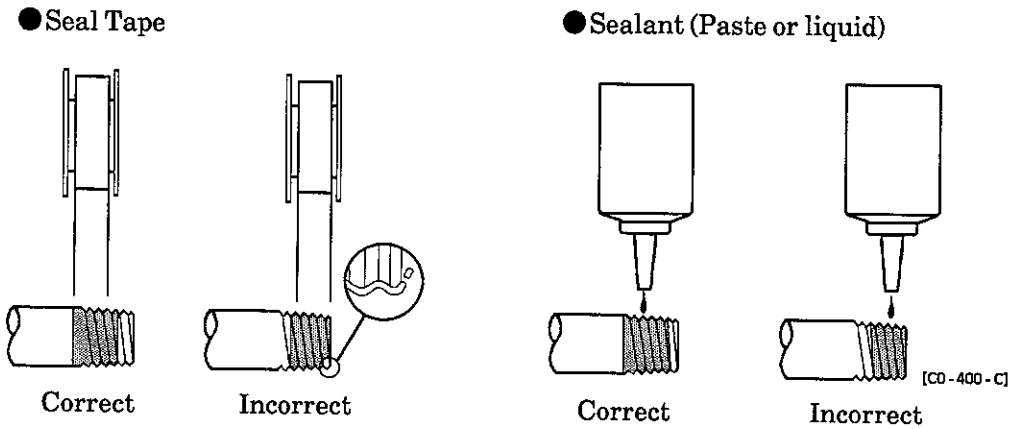
| Parts No. · Parts / Model code | ⑧ Coil ass'y |
|---|---|
| 4SB010 | 4S0 - [Connecting wire] - Coil - [Voltage] ↑ No marking for Grommet lead wire |
| 4SB020 | |
| 4SB030 | |
| 4SB040 | |
| 4SB050 | |

# 4. INSTALLATION

## 4.1 Piping

1) Application of sealant

Carefully apply it so as to prevent it from flowing into pipe but sufficient to prevent air leakage.




When applying the seal tape of Fluorine resin over threaded pipe, apply it 2~3 layers leaving blank 1 to 2 pitches of thread off the end of pipe and press it with finger nail to make it stick to thread. Leave the same blank of thread when applying sealant sufficiently but not excessive to prevent it from falling into pipe. Never apply sealant to female threaded part.

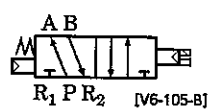
2) Rust scale or dust in pipes cause malfunction of valve seat leakage. Install a filter preferably adjacent upper-stream to solenoid valve for eliminating rust, foreign substance and drain from falling into the system.

3) Flush air into the pipes, solenoid valve and peripheral equipment to blow out foreign substances and chips before piping.

4) Flow direction

Note arrangement of ports such as A and B, and $R_1$ and $R_2$, of 4SO series is in a reverse order with that of 4K series. Carefully confirm flow direction to prevent reversed actuation of valve.

Comparison table of port symbols

| | 4K series | 4S0 series |
|---|---|---|
| Single solenoid |   |   |

5) Mounting posture

There is no restriction as to its mounting posture.

6) Air supply piping

Avoid piping to let A port and B port exhaust to open air. Also prevent chalking P port line as it may cause malfunction of valve. Carefully select pipes of sufficiently large enough diameter particularly when working pressure is low.

7) Piping of 3-position all port block type

Make sure that there is no external leakage from piping between solenoid valve and cylinder.when making cylinder stop at an intermediate position while controlling it with 3-position all port block valve. Also select cylinder with no leakage through rod packing and piston packing. Otherwise, cylinder may be unable to make intermediate stop even when shifted to all port block position due to its leakage.

Select cylinder with brake (such as SELTOP cylinder, CKD products) when long holding at its intermediate stop position or stopping accuracy is required.

8) Tightening torque

Apply appropriate torque referring to the following table for the purpose of preventing leakage and damage.

| Connecting thread | Appropriate torque N·m |
|---|---|
| M3 | 0.3 to 0.6 |
| M5 | 1.0 to 1.5 |
| Rc1/8 | 3.0 to 5.0 |

Gasket (Model code: FGS) is used to seal M3 and M5. Avoid additional tightening while pressure is on. Design and build the system to provide ample room around piping for hand tools at later maintenance work.

## 4.2 Applicable tubes

1) Appropriate tubes

Select tubes specified by CKD for solenoid valves with fittings.

Soft nylon tube (F-1500 series)

Urethane (U-9500 series)

Carefully examine its Outside Diameter accuracy as well as its wall thickness and hardness when selecting commercially available tubes. As for urethane tube hardness, select 93° or over (Rubber hardness gage).

OD tolerance

| | |
|---|---|
| Soft·hard nylon | ±0.1mm |
| Urethane φ4, 6 | +0.1mm<br>−0.15mm |

Wall thickness of tube

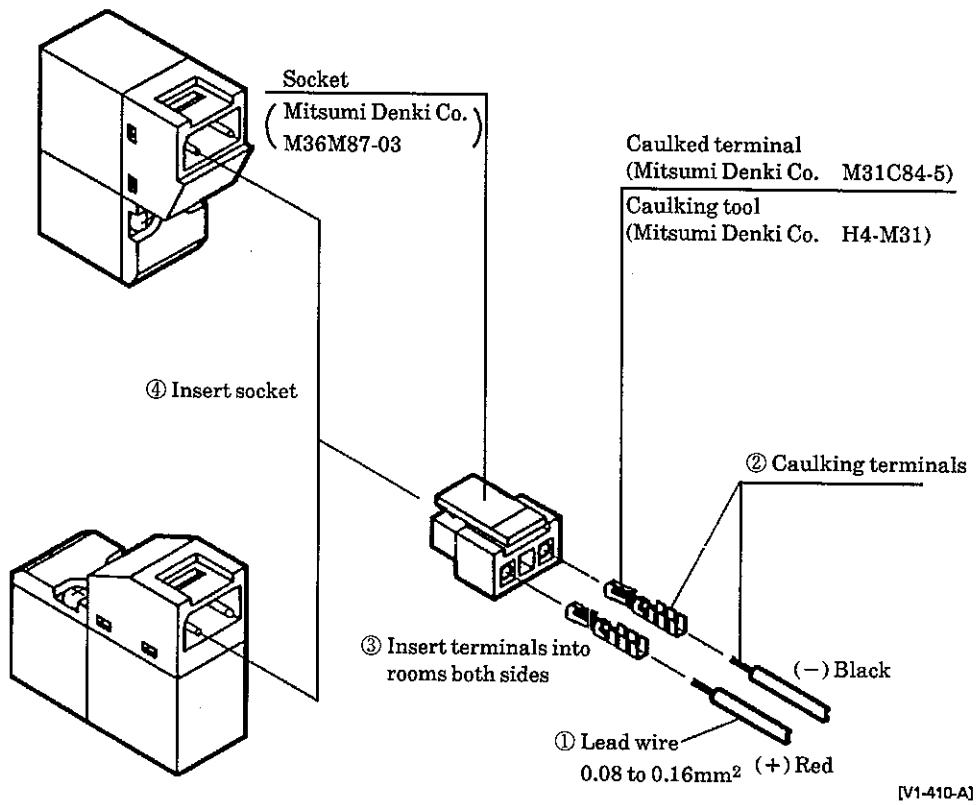
| OD mm | ID mm | |
|---|---|---|
| | Nylon | Urethane |
| φ4 | φ2.5 | φ2 |
| φ6 | φ4 | φ4 |

2) Apply tube bending radius more than the least bending radius posted in the table below. Otherwise it may cause slipping off or leakage.

| Tube diam. | Least bending radius mm | |
|---|---|---|
| | Nylon | Urethane |
| φ4 | 10 | 10 |
| φ6 | 20 | 20 |

## 4.3 Wire connection to C type and D type connecters.

Refer to the following illustration and comply with steps ① to ④.




Note : Confirm the polarity when it is the type with lamp and surge killer.
It results no short circuit but valve does not function.

## 4.4 Installation of Peripheral equipments

1) Air filter

Select the air filter with a filter element of 5$\mu$m mesh or smaller.(Refer to CKD's SELEX air filter catalog.) Also, periodically purge drain.

2) Lubricator

Models 4SA, 4SB series are serviceable with no lubrication. It is recommended, if lubrication is preferred due to peripheral equipment, to use Turbine oil, Class 1, ISO VG32 (Additive free) or equivalent, but maintain volume only to the extent of reasonable.

Spindle oil, machine oil are inappropriate because packings will be swollen causing malfunction of equipment.

# 5. MAINTENANCE

## 5.1 Trouble Shooting

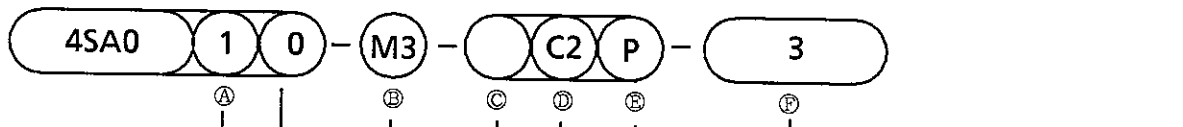
| Motion troubles | Suspected cause | Remedies |
|---|---|---|
| Does not actuate | No electric signals | Turn on the power |
| | Damage to signal wiring system | Repair the control circuit |
| | Excessive fluctuating range of current or voltage | Reaffirm the power capacity. (within ±10% of voltage pressure fluctuation) |
| Malfunctions | Excessive leaking current | Correct control circuit and/or set a bleed circuit |
| | Chattering | Inspect switching system and/or tighten each loosen terminal screw |
| | Voltage deviates than specified on the name plate | Rectify the voltage to meet the specification |
| | Damaged or short circuited coil | Replace the coil |
| | Erroneous shut off pressure source | Turn on the power source |
| | Insufficient pressure | Reset the pressure reducer valve or install a pressure raising valve |
| | Insufficient flow of fluid | Rectify the size of pipe or install a surge tank |
| | Pressure supplied through exhaust port | Rectify the piping system |
| | Erroneous piping, erroneous omitting some piping | Rectify the piping system |
| | Speed control valve completely closed by error | Reset the needle valve |
| | A port or B port is directly released to an open air | Install pipe joints to A and B ports with diameter equal to or smaller than that of to P port joint. |
| | Valve is frozen | Add remedies of avoiding freezing (Heating system or dehumidifying system etc.) |
| | Delayed return of a plunger (Excessive oil, existence of tar) | Check the quality of the lubricant. (Turbine oil class 1, ISO VG 32 or equivalent) |
| | 〃 | Rectify the quantity of lubricant drip |
| | 〃 | Install a tar removing filter |
| | Clogged-up exhausting port with dust | Install a cover or silencer and clean it regularly |
| High actuating pressure is required | Bulged or decomposed packings | Check the quality of the lubricant. (Turbine oil class 1, ISO VG 32 or equivalent) |
| | 〃 | Relocate the valves away from splashing area of cutting coolant |
| | 〃 | Keep organic chemicals away from valves. |
| | Release of A and/or B port to an open air directly | Rectify the piping to an external pilot system. Grease it up |
| | Foreign particles cut into packing lips | Remove the foreign particle away from the packing |
| Malfunctions when manifold is used | Delayed response when multiple blocks are used | Install Sup. (P) piping to P ports on both sides of manifold block |
| | 〃 | Connect Exh. (R) piping to R ports on both sides of manifold block so as to exhaust to an open air through |
| | Adjacent cylinder pops out (Single-acting cylinder connected with 3-position valve or 3-position ABR connection) | Rewire to have the solenoid valve in question is actuated prior to others sequentially. Install a locking system to the cylinder |

## 5.2 Disassembly

It is not recommended to disassemble this equipment in field due to it consistency of precision components.

# 6. HOW TO ORDER

## 6.1 4SA0




| Ⓐ Position and status | |
|---|---|
| Marking | Content |
| 1 | 2-position, single |
| 2 | 2-position, Double |
| 3 | 3-position, All port block |
| 4 | 3-position, ABR connection |
| 5 | 3-position,PAB connection |

| Ⓑ Connecting port dia. | | |
|---|---|---|
| Marking | P · A · B port | $R_1$ · $R_2$ port |
| M3 | M3 | |
| T4 | ϕ4 Barbed fitting | M3 |

| Ⓒ Manually Operation device | |
|---|---|
| Marking | Content |
| No mark | Non-locking type manually operating. device |
| M1 | Locking type manually operating device |

| Ⓓ Wiring type | |
|---|---|
| Marking | Content |
| No mark | Grommet lead wire (std) |
| C | C type connecter, lead wire 300mm |
| C1 | C type connecter, without lead wire |
| C2 | C type connecter, lead wire 300mm w/lamp and surge killer |
| C3 | C type connecter, without lead wire w/lamp and surge killer |
| D | D type connecter, lead wire 300mm |
| D1 | D type connecter, without lead wire |
| D2 | D type connecter, lead wire 300mm w/lamp and surge killer |
| D3 | D type connecter, without lead wire w/lamp and surge killer |

| Ⓔ Other options | |
|---|---|
| Marking | Content |
| No mark | wo/ mounting plate |
| P | with mounting plate |

Mounting plate is available to 4SA010 only.

| Ⓕ Voltage | | |
|---|---|---|
| Marking | Content | |
| 3 | DC24V | Standard |
| 4 | DC12V | Option |
| DC6V | DC6V | |
| DC5V | DC5V | |

## 6.2 M4SA0

Solenoid valve only for manifold ※1: 4SA0 1 9 – M3 – C2 ——— 3

Manifold alone: M4SA0 1 0 – M3 – C2 – 2 – 3

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

Operational style of Solenoid

| Ⓐ Position and status | |
|---|---|
| Marking | Content |
| 1 | 2-position, single |
| 2 | 2-position, Double |
| 3 | 3-position, All port block |
| 4 | 3-position,ABR connection |
| 5 | 3-position,PAB connection |

| Ⓑ Connecting port dia. | | | |
|---|---|---|---|
| Marking | A・B port | P port | R port |
| M3 | M3 | M5 | Rc1/8 |
| T4 | $\phi$4 Barbed fitting | | |

※ To build T4, barbed fitting FTS4-M3 is screwed into A port as well as B port.

| Ⓒ Manually Operation device | |
|---|---|
| Marking | Content |
| No marking | Non-locking type manually operating. device |
| M1 | Locking type manually |

| Ⓓ Wiring type | |
|---|---|
| Marking | Content |
| No marking | Grommet lead wire (std) |
| C | C type connecter, lead wire 300mm |
| C1 | C type connecter, without lead wire |
| C2 | C type connecter, lead wire 300mm w/lamp and surge killer |
| C3 | C type connecter, without lead wire w/lamp and surge killer |
| D | D type connecter, lead wire 300mm |
| D1 | D type connecter, without lead wire |
| D2 | D type connecter, lead wire 300mm w/lamp and surge killer |
| D3 | D type connecter, without lead wire w/lamp and surge killer |

| Ⓔ No. of blocks | |
|---|---|
| Marking | Content |
| 2 | 2 blocks |
| 〃 | 〃 |
| 20 | 20 blocks |

| Ⓕ Voltage | | |
|---|---|---|
| Marking | Content | |
| 3 | DC24V | Standard |
| 4 | DC12V | Option |
| DC6V | DC6V | |
| DC5V | DC5V | |

## When building a system using one kind of manifold

Example of building a series of manifold blocks with same model : M4SA010-M3-7-3 : It denotes to be a 4SA0 Manifold, 2-position single solenoid, A · B port, M3, 7 blocks, DC 24V.

## Mixed Manifold

- Describing procedure of Combination concept

When ordering mixed combined manifold (marking 8 in column of Ⓐ), affix the solenoid valve information (type of function, quantity intended and sequential location in combination). An example of coding description depending upon individual function (marking left block No.1) and its sequential location is shown in the last line of this note.

When function list is as follows :

| Marking | Function |
|---|---|
| S1 | 2-positon, Single |
| S2 | 2-position, Double |
| S3 | 3-position, All port block |
| S4 | 3-position, ABR Connection |
| S5 | 3-position, PAB Connection |
| MP | Masking plate |

| | |
|---|---|
| 1 | 2-pos. Single, (S1) |
| 2 | 2-pos. Double, (S1) |
| 3 | 3-pos. All port block, (S3) |
| 4 | 3-pos. All port block, (S3) |
| 5 | 2-pos. double, (S2) |
| 6 | 2-pos. Single, (S1) |
| 7 | 3-pos. All port block, (S3) |

The model coding is as follows when intending to line up 7 blocks of combined blocks of A · B port connection, M3, DC 24V line numbered as above example.

M4SA080-M3-7-3-

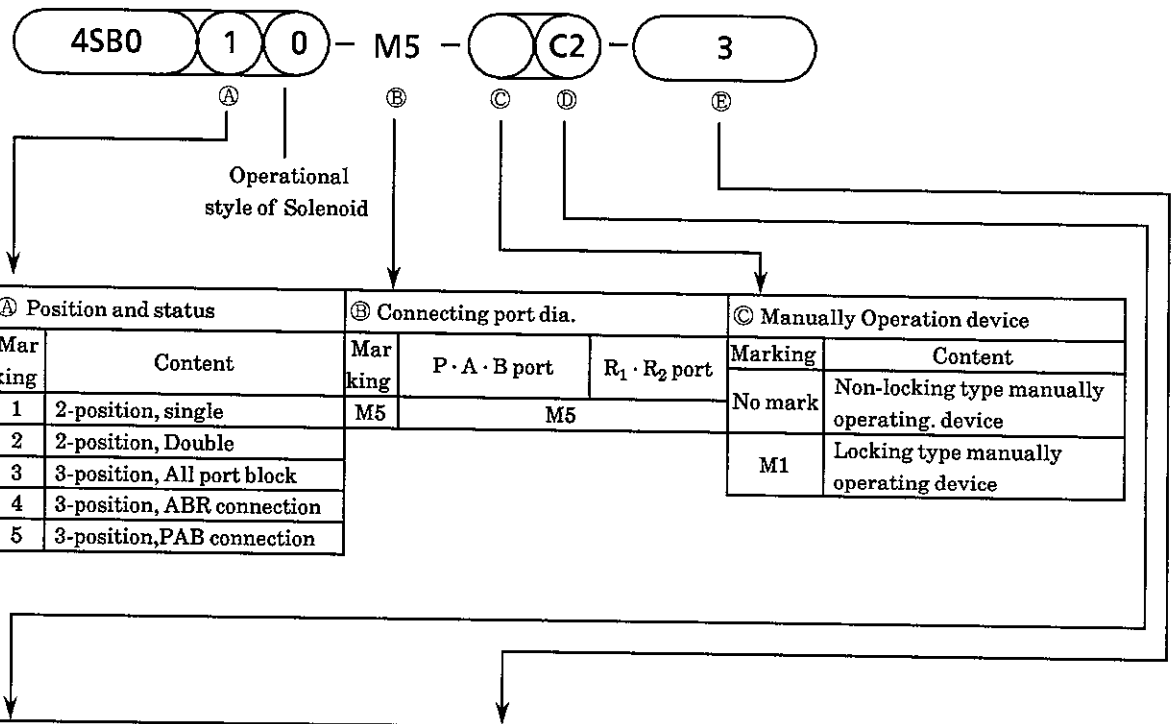
| 2 | 2 | 2 | 0 | 1 | 0 |
|---|---|---|---|---|---|
| S1 | S2 | S3 | S4 | S5 | MP |

Show 0 for blocks not scheduled to use.
(S1 = 1.6、S2 = 2.5、S3 = 3.4、S5 = 7)

Use alphabetic letters in sequence when anticipating to use more than blocks of same model to build up mix manifolds.

| Number of actuators scheduled | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|
| Alphabettic marking | A | B | C | D | E | F | G | H | I | J |

## 6.3 4SB0




| Ⓐ Position and status | |
|---|---|
| Marking | Content |
| 1 | 2-position, single |
| 2 | 2-position, Double |
| 3 | 3-position, All port block |
| 4 | 3-position, ABR connection |
| 5 | 3-position,PAB connection |

| Ⓑ Connecting port dia. | | |
|---|---|---|
| Marking | P · A · B port | $R_1 \cdot R_2$ port |
| M5 | M5 | |

| Ⓒ Manually Operation device | |
|---|---|
| Marking | Content |
| No mark | Non-locking type manually operating. device |
| M1 | Locking type manually operating device |

| Ⓓ Wiring type | |
|---|---|
| Marking | Content |
| No mark | Grommet lead wire (std) |
| C | C type connecter, lead wire 300mm |
| C1 | C type connecter, without lead wire |
| C2 | C type connecter, lead wire 300mm w/lamp and surge killer |
| C3 | C type connecter, without lead wire w/lamp and surge killer |
| D | D type connecter, lead wire 300mm |
| D1 | D type connecter, without lead wire |
| D2 | D type connecter, lead wire 300mm w/lamp and surge killer |
| D3 | D type connecter, without lead wire w/lamp and surge killer |

| Ⓔ Voltage | | |
|---|---|---|
| Marking | Content | |
| 3 | DC24V | Standard |
| 4 | DC12V | Option |
| DC6V | DC6V | |
| DC5V | DC5V | |

## 6.4 M4SB0

Solenoid valve only for manifold ※1: 4SB0 1 9 – 00 – C2 – 3

Manifold alone: M4SB0 1 0 – M5 – C2 – 2 – 3

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

| Ⓐ Position and status | |
|---|---|
| Marking | Content |
| 1 | 2-position, single |
| 2 | 2-position, Double |
| 3 | 3-position, All port block |
| 4 | 3-position,ABR connection |
| 5 | 3-position,PAB connection |

| Ⓑ Connecting port dia. | | | |
|---|---|---|---|
| Marking | A・B port | P port | R port |
| M5 | M3 | M5 | Rc1/8 |
| GS4 | φ4 Snap joint | | |
| T4 | φ4 Barbed fitting | | |
| T6 | φ6 Barbed fitting | | |
| PM5 | M5 | Rc1/8 | Rc1/8 |
| PGS4 | φ4 Snap joint | | |
| PT4 | φ4 Barbed fitting | | |
| PT6 | φ6 Barbed fitting | | |

| Ⓒ Manually Operation device | |
|---|---|
| Marking | Content |
| No marking | Non-locking type manually operating. |
| M1 | device Locking type manually |

- To build GS4, snap joint GMS4-M5-S is screwed into A port as well as B port.
- To build T4 and T6, barbed fitting FTS4-M5 and FTS6-M5 respectively is screwed into A port as well as B port.

| Ⓓ Wiring type | |
|---|---|
| Marking | Content |
| No marking | Grommet lead wire (std) |
| C | C type connecter, lead wire 300mm |
| C1 | C type connecter, without lead wire |
| C2 | C type connecter, lead wire 300mm w/lamp and surge killer |
| C3 | C type connecter, without lead wire w/lamp and surge killer |
| D | D type connecter, lead wire 300mm |
| D1 | D type connecter, without lead wire |
| D2 | D type connecter, lead wire 300mm w/lamp and surge killer |
| D3 | D type connecter, without lead wire w/lamp and surge killer |

| Ⓔ No. of blocks | |
|---|---|
| Marking | Content |
| 2 | 2 blocks |
| ⟆ | ⟆ |
| 20 | 20 blocks |

| Ⓕ Voltage | | |
|---|---|---|
| Marking | Content | |
| 3 | DC24V | Standard |
| 4 | DC12V | Option |
| DC6V | DC6V | |
| DC5V | DC5V | |

## When building a system using one kind of manifold

Example of building a series of manifold blocks with same model : M4SB010-M5-7-3 : It denotes to be a 4SB0 Manifold, 2-position single solenoid, A · B port, M5 side piping, 7 blocks, DC 24V.

## Mixed Manifold

- Describing procedure of Combination concept

  When ordering mixed combined manifold (marking 8 in column Ⓐ), specify required function markings (refer to the following tables) and sequential block number starting from left end block (No. 1), beside normal specifications.

  When function list is as follows :

| Marking | Function |
|---|---|
| S1 | 2-positon, Single |
| S2 | 2-position, Double |
| S3 | 3-position, All port block |
| S4 | 3-position, ABR Connection |
| S5 | 3-position, PAB Connection |
| MP | Masking plate |

| | |
|---|---|
| 1 | 2-pos. Single, (S1) |
| 2 | 2-pos. Double, (S1) |
| 3 | 3-pos. All port block, (S3) |
| 4 | 3-pos. All port block, (S3) |
| 5 | 2-pos. double, (S2) |
| 6 | 2-pos. Single, (S1) |
| 7 | 3-pos. All port block, (S3) |

The model coding is as follows when intending to line up 7 blocks of combined blocks of A · B port connection, M5 side piping, DC 24V line numbered as above example.

M4SB080-M5-7-3- | 2 | 2 | 2 | 0 | 1 | 0 |
S1 S2 S3 S4 S5 MP

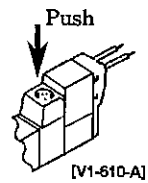
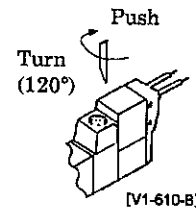
Show 0 for blocks not scheduled to use.
(S1=1.6、S2=2.5、S3=3.4、S5=7)

Use alphabetic letters in sequence when anticipating to use more than blocks of same model to build up mix manifolds.

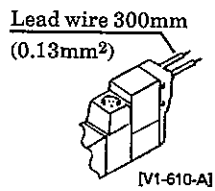
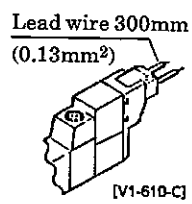
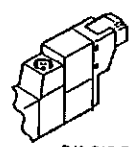
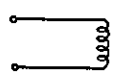
| Number of actuators scheduled | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|
| Alphabettic marking | A | B | C | D | E | F | G | H | I | J |

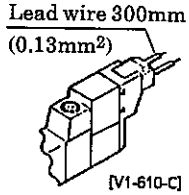
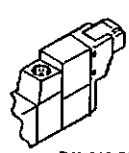
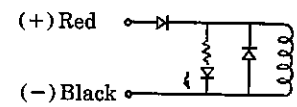
## Additional explanation of Articles Ⓒ and Ⓓ in Model coding

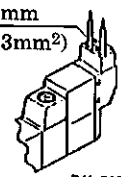
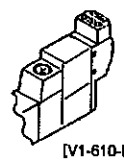
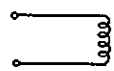
### Ⓒ Manual operation device

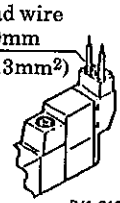
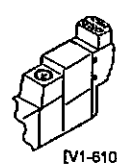
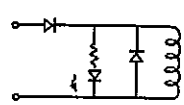
| Device name | Non-locking type manually operating device | Locking type manually operating device |
|---|---|---|
| Option marking | No marking | M1 |
| Shape |  [V1-610-A] |  [V1-610-B] |

### Ⓓ Wiring concept

| Device name | Grommet lead wire(Standard) | C type connecter, with lead wire | C type connecter, without lead wire |
|---|---|---|---|
| Option marking | No marking | C | C1 |
| Shape |  [V1-610-A] |  [V1-610-C] |  [V1-610-D] |
| Circuit |  [V6-405-E] | | |

| Device name | C type connecter, with lead wire w/surge killer and lamp | C type connecter, without lead wire w/surge killer and lamp |
|---|---|---|
| Option marking | C2 | C3 |
| Shape |  [V1-610-C] |  [V1-610-D] |
| Circuit |  [V1-610-G] Carefully confirm the polarity. | |

| Device name | D type connecter, with lead wire | D type connecter, without lead wire |
|---|---|---|
| Option marking | D | D1 |
| Shape | Lead wire 300mm ($0.13mm^2$)  [V1-610-E] |  [V1-610-F] |
| Circuit |  [V6-405-E] | |

| Device name | D type connecter, with lead wire w/surge killer and lamp | D type connecter, without lead wire w/surge killer and lamp |
|---|---|---|
| Option marking | D2 | D3 |
| Shape | Lead wire 300mm ($0.13mm^2$)  [V1-610-E] |  [V1-610-F] |
| Circuit | (+) Red<br>(−) Black  [V1-610-G] Carefully confirm the polarity. | |