CKD

SM-11583-A/5

Instruction Manual

Electric Ball Valve (2-Port Valve)

MXB1-10 to 50

MXB1F-15 to 40

- Be sure to read this instruction manual before using the product.
- Read the safety instructions carefully.
- Keep this instruction manual in a safe place so that it can be taken out and read immediately when needed.

5th edition

CKD

To Use This Product Safely

When designing and manufacturing equipment using our company's products, you have an obligation to ensure the safety of the system operated by the equipment's mechanical mechanism, pneumatic or water control circuit, and the electrical control that governs them, and to manufacture safe equipment.
To use our products safely, it is important to select, use, and handle them properly, and perform proper maintenance management for them.
To ensure the safety of equipment, be sure to observe the warnings and precautions.
Furthermore, we ask that you check that the safety of the equipment can be ensured and manufacture safe equipment.

⚠ Warning

1. **This product has been designed and manufactured as equipment and components for general industrial machinery.**
   Therefore, handling should be performed by persons with sufficient knowledge and experience.

2. **Be sure to use the product within its specifications.**
   The product cannot be used outside its specifications. In addition, never modify or add to the product.
   Furthermore, this product is intended for use in general industrial equipment and components, and is therefore not applicable for outdoor use or for use under the following conditions or in the following environments.
   (However, if you consult us before adopting the product and agree to our product's specifications, its use will be permitted, but please take safety measures to avoid danger in the unlikely event of a failure.)
   ① Use in equipment and applications that come into direct contact with nuclear equipment, railway, aviation, ship, vehicle, medical equipment, beverage, food, etc., and applications where a high level of safety is required, such as entertainment equipment, emergency shutdown circuit, press machine, brake circuit, and safety-related applications.
   ② Use in applications where significant impacts on people and property are expected and where safety is particularly important.

3. **Be sure to observe all applicable organization standards, laws, and regulations regarding safety related to equipment design and management.**
   ISO4414, JIS B 8370 (General rules for pneumatic systems)
   JFPS2008 (Principles for pneumatic cylinder selection and use)
   High Pressure Gas Safety Act, Industrial Safety and Health Act and other safety regulations, organization standards, laws, etc.

4. **Never handle this product or remove any pipes or equipment until safety has been confirmed.**
   ① Before inspecting or maintaining machinery or equipment, be sure to confirm that all systems involving this product are safe.
   ② Even when machinery or equipment is not operating, there may be hot or live parts present, so be careful.
   ③ When inspecting or maintaining equipment, shut off the energy sources (air supply, water supply) and the power to the relevant equipment, exhaust any compressed air in the system, and take care to avoid water and electrical leakage.
   ④ When starting or restarting machinery or equipment that uses pneumatic equipment, be sure to check that the safety of the system has been ensured, including measures to prevent the machinery or equipment from jumping out, and proceed with caution.

5. **To prevent accidents, be sure to observe the warnings and precautions on the following pages.**

■ The safety precautions shown here are categorized into "Danger," "Warning," and "Caution."

⚠ **Danger**	Cases where improper handling may result in death or serious injury, and where the urgency (degree of imminence) of the danger is high.
⚠ **Warning**	Cases where improper handling may result in a dangerous situation that could cause death or serious injury.
⚠ **Caution**	Cases where improper handling may cause a dangerous situation that could result in minor injury or material damage only.

Even the matters described under "Caution" may lead to serious consequences depending on the situation.
All safety precautions contain important information, so be sure to observe them.

Warranty Precautions

- Warranty Period
  The warranty period for our products is one year after delivery to the location specified by you.

- Warranty Coverage
  If a failure occurs during the above warranty period that is clearly our responsibility, we will provide a replacement product or necessary replacement parts free of charge, or repair the product at our factory free of charge.
  However, the following cases will be excluded from the scope of this warranty.

  ① Handling or use under conditions or environments other than those described in the catalog or specifications
  ② Cases where the cause of the failure is due to reasons other than the product
  ③ Cases where the product is used in a way other than its intended use
  ④ Cases where the cause is modifications or repairs that we are not involved in
  ⑤ Cases where the cause is unforeseeable with the technology in use at the time of delivery
  ⑥ Cases where the cause is a natural disaster or other disaster that is not our responsibility

  The warranty here covers only the delivered product and excludes any damage caused by defects in the delivered product.

- Compatibility Check
  It is the customer's own responsibility to verify the compatibility of our products with the systems, machines, and equipment used by the customer.

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1. Unpacking

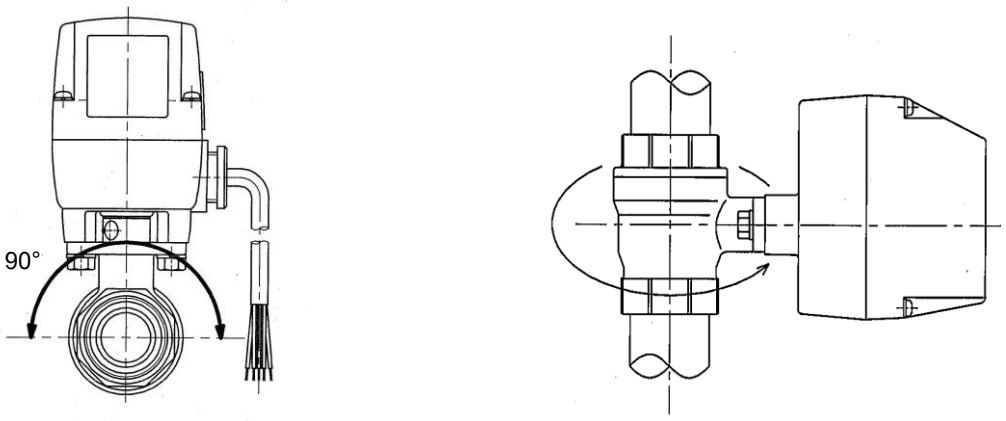
- Check that the model number of the product you ordered is the same as the model number on the product nameplate.
- Check that the rated voltage and rated frequency match.
- Check that there is no external damage.
- During storage, keep the seal plug attached to the valve to prevent foreign matter from getting inside.
  When piping, remove the seal plug.

2. Construction

2.1. Installation conditions

2.1.1 Installation position

- The installation position should be within the range of ±90° with the actuator facing upward. (Figure 1)

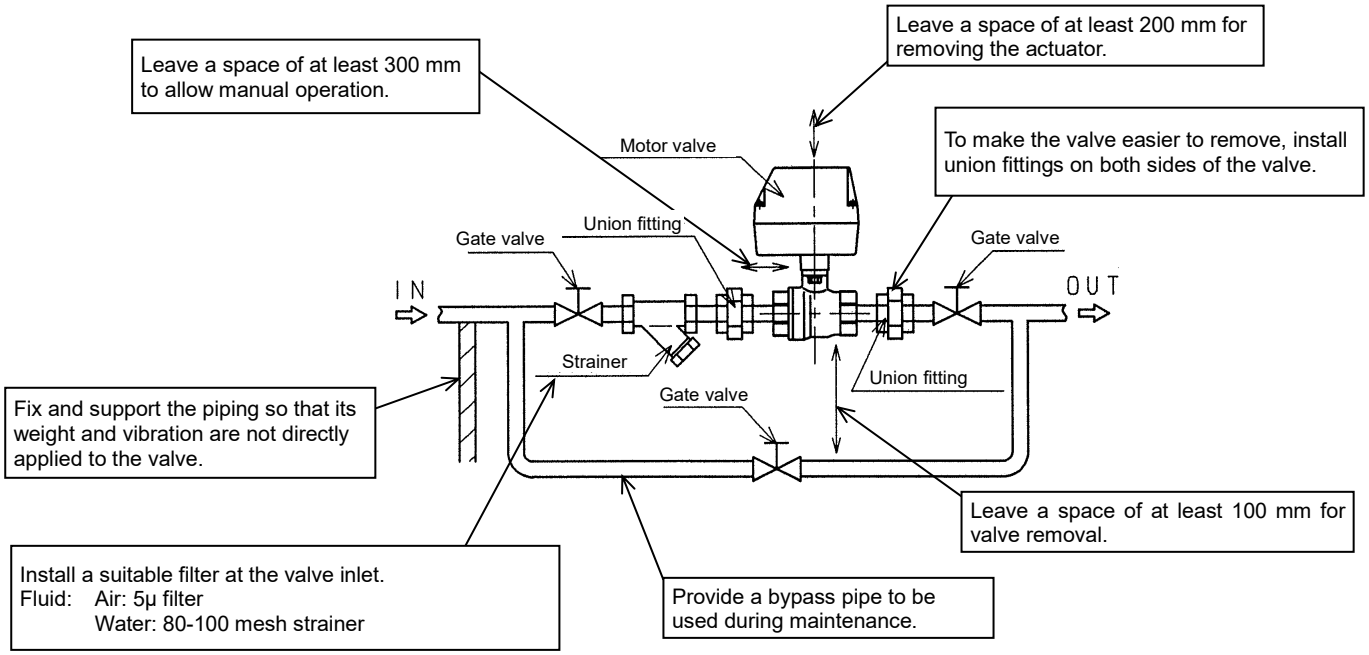


<For horizontal piping>　　<For vertical piping>

(Figure 1. Installation position)

2.1.2 Maintenance Space

Secure sufficient space for safely performing maintenance and troubleshooting. (Figure 2)



(Figure 2. Piping model)

2.1.3 Product Protection

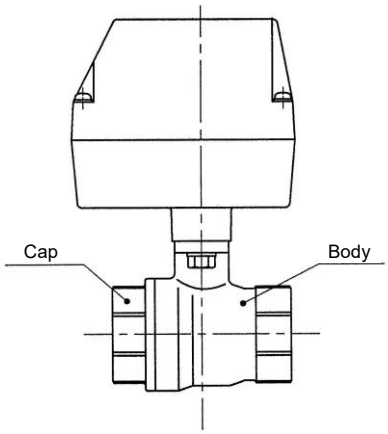
- If using the product in a cold region, take appropriate anti-freeze measures.
- When using this product in machinery or equipment cleaned with a water jet (hose), protect it with a cover or other means to prevent water from getting on it.
  This product is dustproof and waterproof according to the IEC-529 standard IPX3.
- Avoid using it outdoors.

2.2. Piping

- When handling or installing the product, be sure to hold the body.
- When connecting piping to this product, the valve has no specified flow direction.
- For the piping on the cap side, secure the cap with a wrench or similar tool and screw it in.
- For the piping on the body side, secure the body with a wrench or similar tool and screw it in.
- Fix and support the piping so that its weight and vibration are not directly transmitted to the valve.
- When using insulation, do not cover the actuator.
- Refer to Table 1 for tightening torque during piping.

Table 1. Recommended piping tightening torque

Nominal diameter of pipe	Pipe tightening torque (recommended value)
Rc 3/8	31–33 [N·m]
Rc 1/2	41–43 [N·m]
Rc 3/4	62–65 [N·m]
Rc 1	83–86 [N·m]
Rc 1 1/4	97–100 [N·m]
Rc 1 1/2	104–108 [N·m]
Rc 2	132–136 [N·m]



(Figure 3. External View)

- Before installing the piping, check that there is no foreign matter, chips, or burrs on the piping material.
  To clean, spray air at a pressure of 0.3 MPa or more to remove foreign matter, chips, and burrs from inside the pipe.
- When using sealant, be careful not to let it get inside the piping and ensure that it does not leak outside.
  When wrapping sealing tape around a threaded part, leave 2 to 3 threads at the tip of the screw. (Figure 4)
  When using liquid sealant, apply it sparingly, leaving 2 to 3 threads at the tip of the screw.
  Do not apply sealant to the female thread side of the equipment.

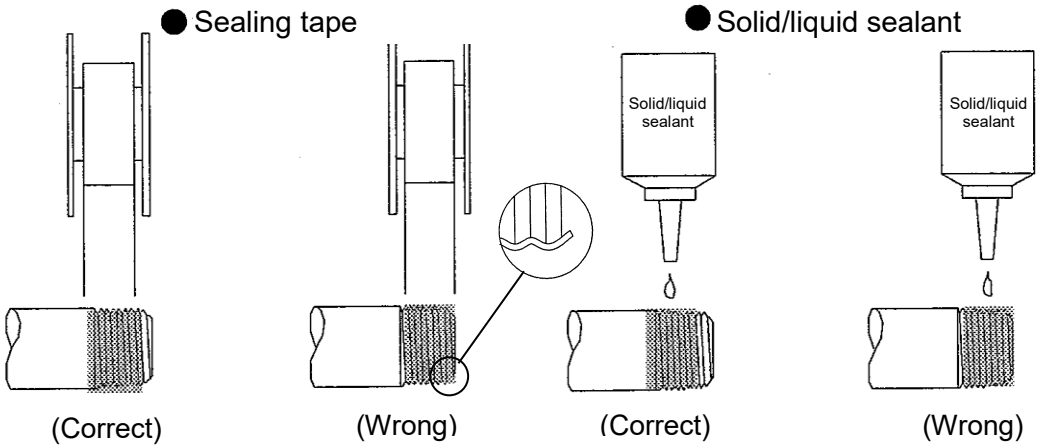
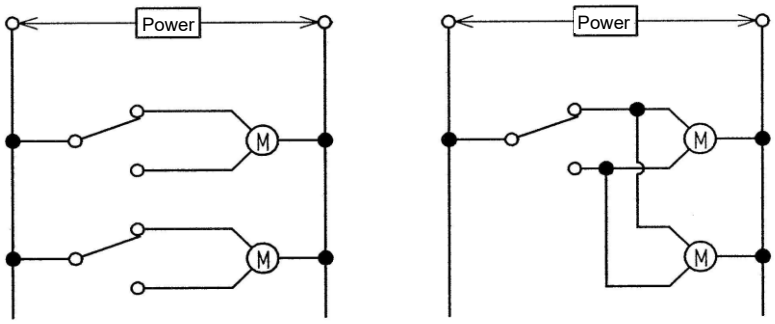


Figure 4

2.3. Wiring work

⚠ **Caution**	When connecting to the power supply, connect correctly according to the motor valve wiring diagram (displayed on the product). If you make a mistake, it may cause a short circuit.

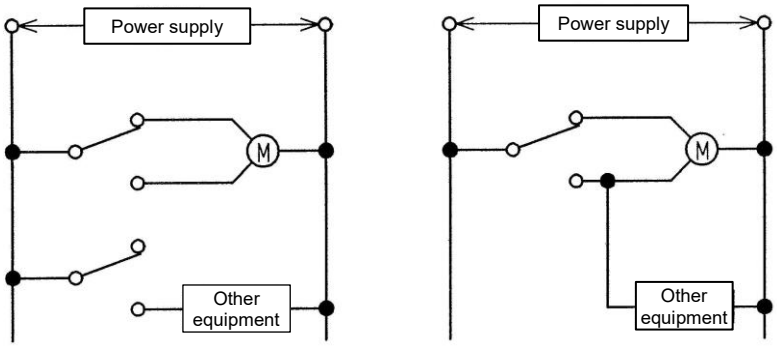
- When wiring two or more motor valves, separate the contacts. (Figure 5)



Good example　　Bad example

(Figure 5. Wiring method for two or more motor valves)

- When wiring the motor valve to other equipment, separate the contacts. (Figure 6)

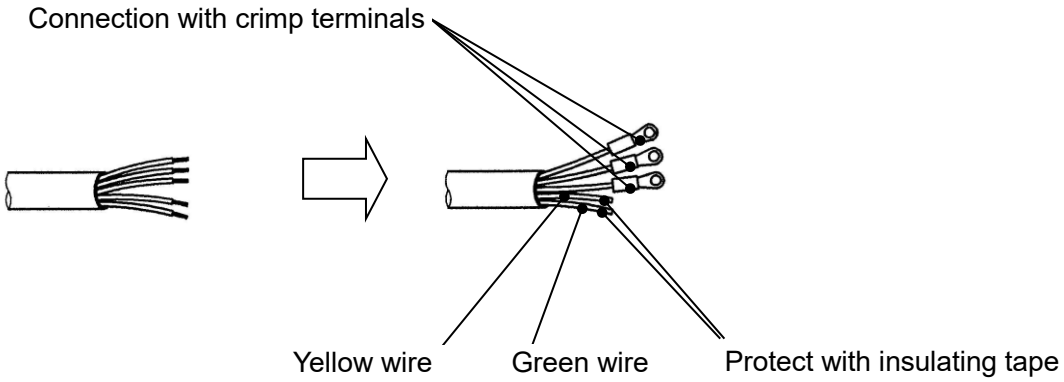


(Good example)　　(Bad example)

(Figure 6. How to wire to other equipment)

- Secure the lead wire with a wire band or similar to prevent it from being pulled.
  When using in a location where there is a risk of damage to electrical wiring, take safety measures such as installing electrical conduit wiring.
- When using a DC type, use a power supply with sufficient capacity.
  Full-wave and half-wave rectifier circuits are susceptible to ripples, so be sure to use a stabilized power supply.
- Avoid using switches that may allow signals to be input at the same time.
- When using a signal taking-out line for high-capacity loads, micro loads, etc., use it within the micro switch's specified operating range. (Omron SS-5)
- When using the product in a location where it may be exposed to water, be sure to take appropriate protective measures for the lead wire connections.
- When wiring a terminal box with a lamp, do not remove the cover by pulling it with excessive force.
  The crimp terminals inside may bend, causing the lamp to malfunction and poor insulation.

- When you do not use the yellow and green wires for signal check, cut off the exposed core wires and be sure to insulate them with insulating tape. (Figure 7)



(Figure 7. Core wire processing)

- For circuit diagrams and operating instructions, see pages 13–15.

  The power-on time required to open and close the valve is shown in Table 2-1.

  If the product is not used for more than one day, the initial activation time may become longer by about 1 to 5 seconds.

2-1 Table 2-1. Activation time

Model	AC voltage specification (50Hz/60Hz)	DC voltage specification
MXB1-10 to 25	10/8 seconds	8 seconds
MXB1F-15 to 20		
MXB1-32 to 50	13/11 seconds	10.5 seconds
MXB1F-25 to 40		

- When switching the valve open/close signal, make sure that the next signal is input only after the valve has finished operating.

  If the valve is stopped midway or switched during operation, it may cause malfunction and reduce durability.

3. Check before Use (Post-Installation Check)

3.1. External Check

⚠ Caution	Stop the fluid flow. (Close the main valve) Turn off the power.

- Push the ball valve body by hand to make sure it is securely fixed to the pipe.
- Check that threaded parts such as hexagon bolts are not loose.

3.2. Electricity Check

⚠ Caution	Turn off the power.

- Make sure the wiring is correct according to the motor valve wiring diagram indicated on the product.
- Insulation resistance check

  Measure the insulation resistance between the ball valve body and the live part. (Table 3-1)

  Table 3-1. Insulation resistance

Power source type	Applied voltage	Insulation resistance
AC voltage specification	DC 1000 V megger	100 MΩ or more
DC voltage specification	DC 500 V megger	100 MΩ or more

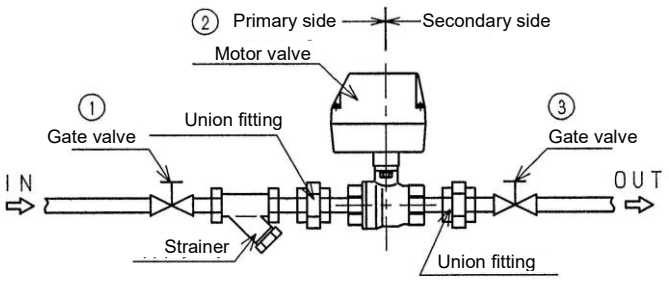
3.3. Leak Check

- Turn on the power.
- Apply fluid pressure and check for leaks from the connections.
  To check for leaks, it is recommended to supply compressed air (0.3 to 0.5 MPa), apply soapy water, and check for bubble generation.

<Procedure>

a) After closing the motor valve (2), open the gate valves (1) and (3) in this order, and make sure that there is no leakage to the outside or the secondary side.

b) With gate valve (1) open, close gate valve (3), then open motor valve (2), and make sure that there is no leakage to the outside.



（Figure 8 Piping diagram)

4. Proper Use

⚠ Caution	Be sure to observe the operating frequency (energization frequency). (Table 4-1) The thermal protector may be activated and cause the unit to shut down. When locked, the unit will remain continuously energized, which puts a strain on the gear and coil. So, immediately stop energization and resolve the problem. Continued use may result in malfunction or reduced durability.

Table 4-1. Operation frequency

Model	AC voltage specification	DC voltage specification
MXB1-10 to 25	2 times/minute or less	1 times/minute or less
MXB1F-15 to 20		
MXB1-32 to 50	1 time/minute or less	0.5 times/minute or less
MXB1F-25 to 40		

- The power-on time required for opening and closing is shown in Table 2-1. See page 6.
  If the product is not used for more than one day, the initial activation may become longer by about 1 to 5 seconds.
- If the valve has not finished operating even after the operating time in Table 2-1 has elapsed, the following may be the cause:
  (1) Lock phenomenon due to valve jamming
  (2) Failure of electrical parts
  ⇒Refer to “7. Troubleshooting.”
- Do not apply an external force of 0.5 N·m or more to the actuator.
- Keep the voltage fluctuations within ±10% of the rated voltage.
- When switching the valve signal, make sure that the next signal is input only after the valve has finished operating.
- If the valve is stopped midway or switched during operation, it may cause malfunction and reduce durability.
- In the event of a power failure, the valve will remain in the state it was in before the power failure. Operate the gate valve in the piping model shown on page 3 (Figure 2), or perform the manual operation on page 10.

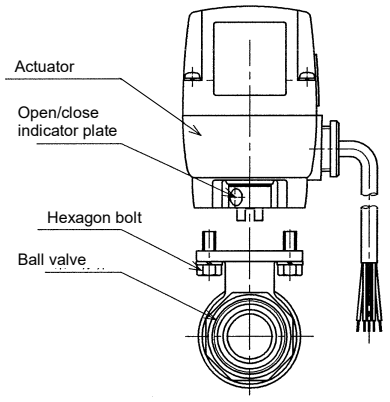
5. Disassembly and Assembly

5.1. Actuator replacement

5.1.1 Disassembly procedure

⚠ Caution	Turn off the power and stop the fluid before starting work.

- Remove the wiring.
- Loosen the hexagon bolts with a wrench.
- Lifting the actuator up separates it from the ball valve body.



(Figure 9)

5.1.2 Assembly procedure

- Align the open/close position of the ball valve body with the open/close indicator hole on the new actuator.
- Tighten the hexagon bolts to a torque of 5 to 7.5 N·m.
- Attach crimp terminals to the lead wires.
- Carry out wiring according to the wiring diagram.
- Measure the insulation resistance between the ball valve and the live part.
- AC specification: Measure with a DC 1000 V megger; it should be 100 MΩ or more.
- DC specification: Measure with a DC 500 V megger; it should be 100 MΩ or more.
- Turn on the power and activate the fluid circuit.

5.2. Ball valve replacement

5.2.1 Disassembly procedure

⚠ **Caution**	Turn off the power and stop the fluid before starting work.

- Loosen the hexagon bolts and separate the actuator.
  In so doing, be careful not to apply a tensile force to the lead wires.
- Loosen the piping of the ball valve.

5.2.2 Assembly procedure

- Install a new ball valve in the piping.
  When installing the piping on the cap side, secure the cap with a wrench. When installing the piping on the body side, secure the body with a wrench.
- Assemble the actuator to the ball valve.
  Tighten the hexagon bolts to a torque of 5 to 7.5 N·m.
- Apply fluid pressure and check that the fluid is not leaking out.
- Turn on the power and put the fluid circuit into operation.

6. Maintenance

⚠ **Caution**	**Never Remove the Bonnet.** Touching the internal electrical components may result in electric shock. **Do Not Disassemble.** If a problem occurs, do not disassemble the product; contact your nearest distributor or our sales office. If you disassemble the product, it will be impossible to investigate the cause.

6.1. Maintenance and inspection

- To ensure optimal use of this product, inspect it regularly, usually once every six months.
- For inspection details, refer to "3. Check before Use".

6.2. Maintenance parts

- Actuator
  Replace it if an electrical failure or abnormality is detected. As a guideline, it can be operated 100,000 times.
- Ball valve body
  Replace it if any abnormalities such as leakage or sticking of the valve are found during use. As a guideline, it can be operated 50,000 times.

7. Troubleshooting

- In the event of a power failure or an emergency such as an abnormal operation, perform manual operation as follows.

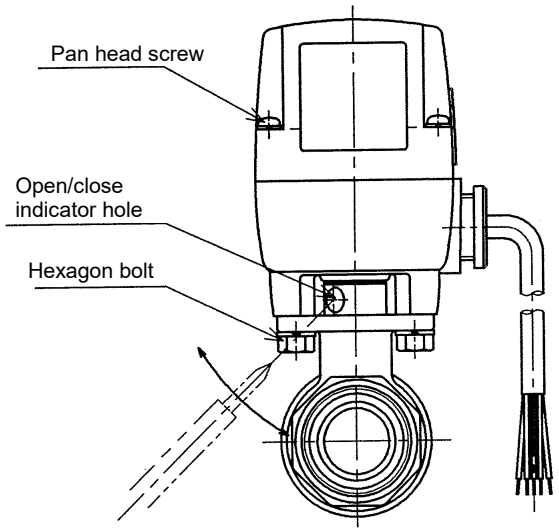
⚠ Caution	Products MXB1-32 to 50 and MXB1F-25 to 40 cannot be operated manually unless they are manual option products. There is a risk of damaging the motor gear inside the actuator. Use a product model with the manual operation option.

<Manual operation method>

- Turn off the power.
- For small bore sizes (standard bore: Rc3/8 to Rc1, full bore: Rc1/2 to Rc3/4), insert a rigid tool (H2 type, No. 2) such as a Phillips screwdriver into the open/close indicator hole of the intermediate bushing of the electric-operated valve and turn it slowly.
- For large bore sizes (standard bore: Rc1 1/4 to Rc2, full bore: Rc1 to Rc1 1/2), insert a rigid object such as a Phillips screwdriver under the connection key in the intermediate bushing. With the clutch disengaged, turn it slowly.
- Operate the valve from closed to open and from open to closed in about 20 seconds.
- For both small and large bore sizes, turning the valve counterclockwise when viewed from above sets it to "open," while turning it clockwise sets it to "close."

<Precautions before a manual operation>

- Be sure to turn off the power before performing this operation.
- When turning, do not apply a sudden, large force. This will result in damage to the gears.
- After the manual operation of a large bore size (standard bore: Rc1 1/4 to Rc2, full bore: Rc1 to Rc1 1/2), return the clutch to its original position and make sure that it is securely re-engaged before use.
- Do not perform manual operation except in an emergency.



(Figure 10. External view)

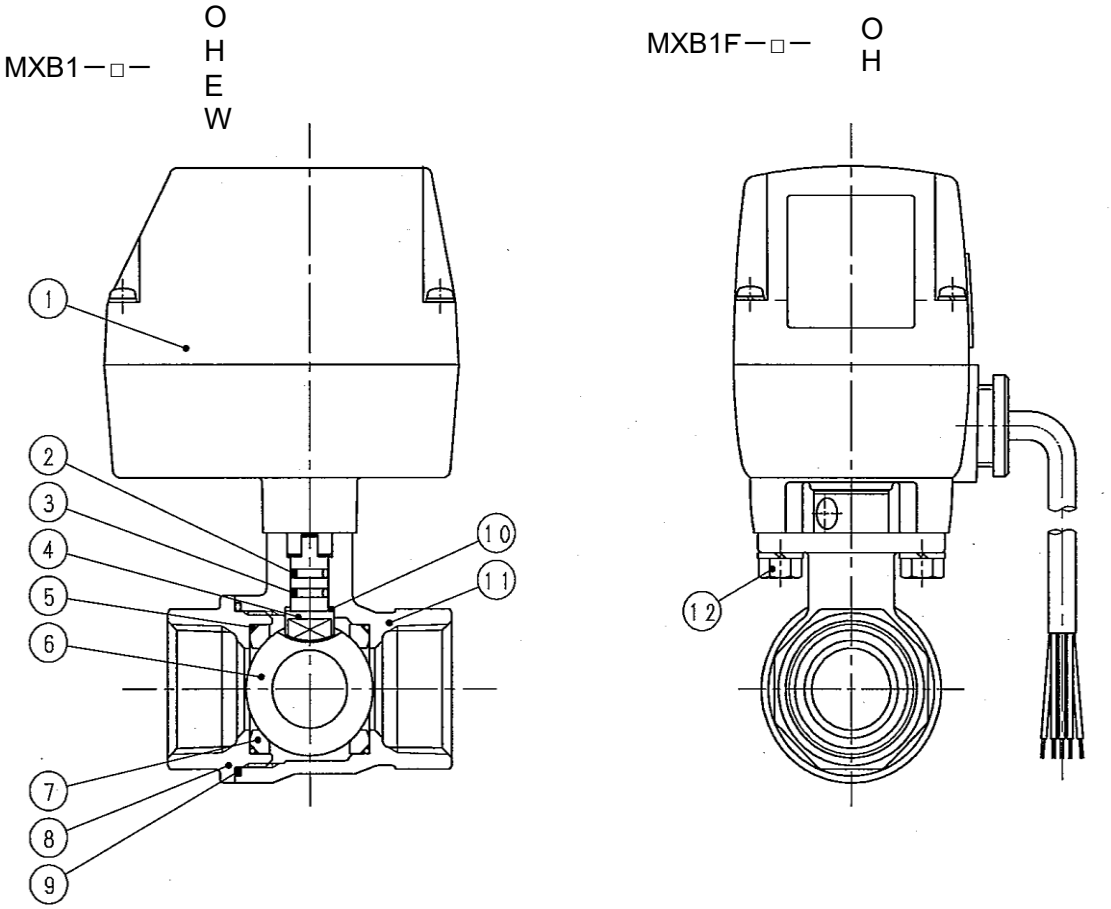
If the motor valve does not operate as intended, inspect it according to the table below.

Table 7-1. Troubleshooting

Fault condition	Cause	Countermeasure
Does not operate.	The power is not turned on.	Check the wiring and fuse, and then turn on the power.
	Below rated voltage.	Check the power supply and input the rated voltage.
	Foreign matter caught inside the ball valve.	Inspect the inside of the ball valve and remove the cause. Or replace the ball valve.
	Ball seat stuck.	
	Both open and close signals are input.	Check the switch and relay.
	Actuator failure.	Replace the actuator.
The valve operates but does not function normally. (The actuator vibrates. It stops midway.)	Two or more units are operated in parallel.	Use separate contacts such as relays for each signal circuit.
	Operates in reverse.	The open and close wiring connections are reversed. Correct the wiring connections.
	Foreign matter caught inside the ball valve.	Inspect the inside of the ball valve and remove the cause. Or replace the ball valve.
	Ball seat stuck.	
The motor moves, but the valve does not move.	Gearhead is damaged or has reached the end of its life.	Inspect the inside of the ball valve and remove the cause. If there is no abnormality in the valve, replace the actuator. If both are abnormal, replace the product.
It's leaking.	Foreign matter caught inside the ball valve.	Replace the ball valve.
	Worn ball seat.	
	The power is on for a short time and the valve is not fully closed.	Set the power-on time to the value or higher in Table 2-1.

- If you have any other questions, contact us or our distributor.

8. Internal Structure Diagram



(Figure 11)

Table 8-1. Parts List-1

Part No.	Part name	Quantity	Material
(1)	Actuator	1	
(2)	O-ring	1	NBR (FKM)
(3)	O-ring	1	FKM
(4)	Shaft	1	SUS303 (SUS304)
(5)	O-ring	2	FKM
(6)	Valve ball	1	C3771 Cr plating (SUS304)
(7)	Ball seat	2	PTFE
(8)	Cap	1	Low-lead bronze (SCS13)
(9)	O-ring *2	1	FKM
(10)	Spacer *2	1	PTFE
(11)	Body	1	Low-lead bronze (SCS13)
(12)	Hexagon bolt	2	SWCH

*1: Items in parentheses apply when the body material of the ball valve is stainless steel (E, W).

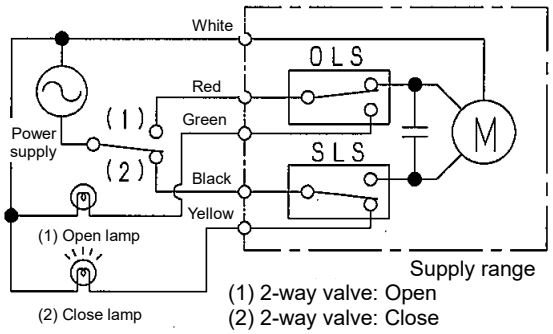
*2: When the body material of the ball valve is bronze (0, H), (9) O-ring and (10) spacer are not included.

9. Circuit Diagram and Operation Description

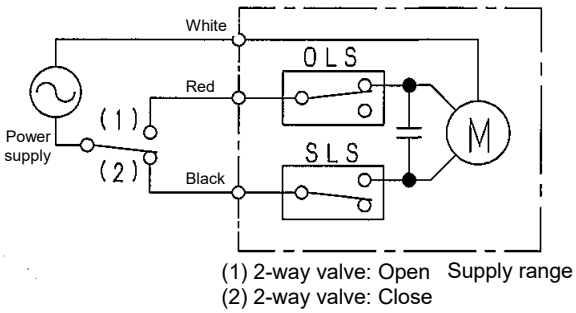
9.1. Circuit Diagram

9.1.1 AC Voltage Specification

- Standard type

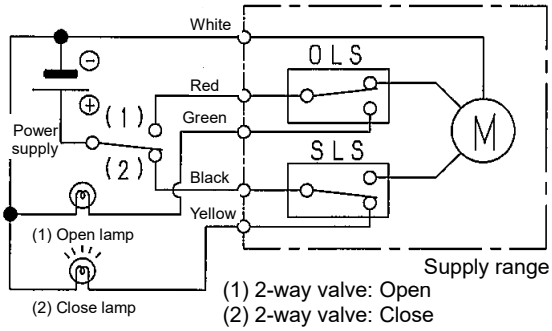


- Option (3-core cable)



(Figure 12)

9.1.2 DC Voltage Specification

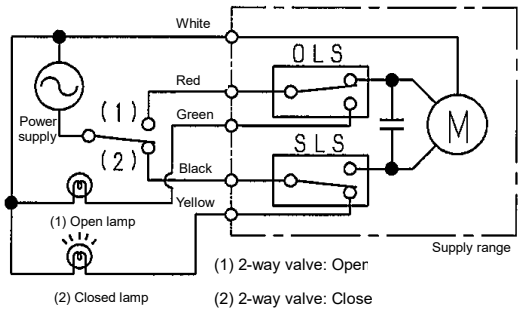


(Figure 13)

9.2. Operation Description

9.2.1 Standard (Option: Includes B)

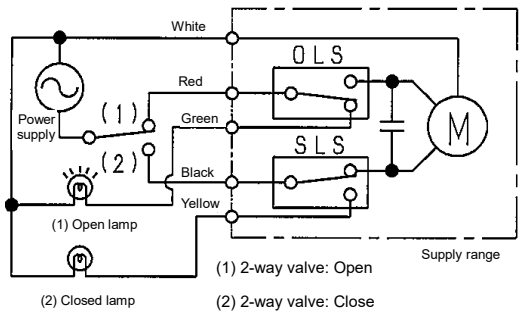
(1) Opening operation (fully closed -> fully open)



(Figure 14. At end of closing operation)

When the operation switch is switched to the (1) position in Figure 14 and electricity is applied between the white and red lead wires, the motor will start to rotate and the output shaft will turn counterclockwise (seen from the valve side from the top of the actuator).
When the valve is fully open, the OLS contacts switch, the motor stops, and the open lamp lights up.
If you connect a relay instead of the open lamp, you can operate other equipment.
(Figure 15)

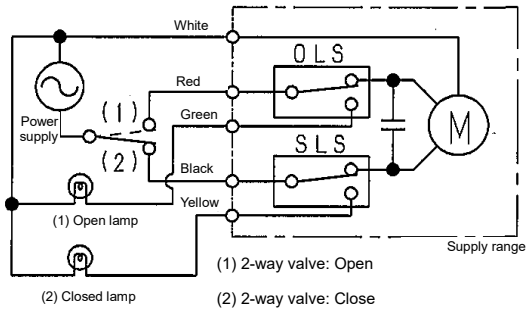
(2) Closing operation (fully open -> fully closed)



(Figure 15. At the end of opening operation)

When the operation switch is switched to the (2) position from the state shown in Figure 15 and electricity is applied between the white and black lead wires, the motor will start to rotate and the output shaft will turn clockwise (as viewed from the top of the actuator toward the valve side).
When the valve is fully closed, the SLS contacts switch, the motor stops, and the closed lamp lights up.
If you connect a relay instead of the closed lamp, you can operate other equipment.
(Figure 14)

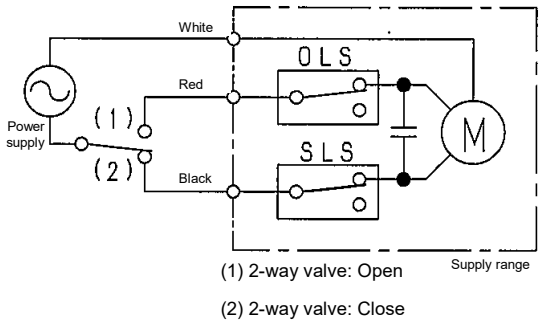
(3) During opening and closing operations



(Figure 16. During operation)

During operations (1) and (2), the OLS and SLS are in the state shown in the left figure, and the output shaft rotates according to the position of the operation switch.
However, reversing the operation may damage the gears.
(Figure 16)

9.2.2 Option: T (3-core cable)



(1) 2-way valve: Open

(2) 2-way valve: Close

(Figure 17)

1) Opening operation (fully closed -> fully open)
When the operation switch is switched to the (1) side and electricity is applied between the white and red lead wires, the motor will rotate. At the full open position, the cam will activate the OLS, switching the contacts and stopping the motor.

2) Closing operation (fully open -> fully closed)
When the operation switch is switched to the (2) side and electricity is applied between the white and black lead wires, the motor will rotate. At the fully closed position, the cam will activate the SLS, switching the contacts and stopping the motor.

9.2.3 Option: L (with open lamp)

The open lamp in Figure 14 is housed in the terminal box. (1) When the opening operation (fully closed -> fully open) is completed, the lamp on the terminal box lights up. It does not light up during operation. (Wiring is the same as option T.)

9.2.4 Option: R (with closed lamp)

The closed lamp in Figure 15 is housed in the terminal box. (2) When the closing operation (fully open -> fully closed) is completed, the lamp on the terminal box lights up. It does not light up during operation. (Wiring is the same as option T.)

10. Product Specifications

10.1. Model designation

MXB1
MXB1F – 32 – O B M – 1

A B C D E

A. Connection bore size

Symbol	Description	MXB1 (Standard bore)	MXB1F (Full bore)
10	Rc3/8	●	—
15	Rc1/2	●	●
20	Rc3/4	●	●
25	Rc1	●	●
32	Rc1 1/4	●	●
40	Rc1 1/2	●	●
50	Rc2	●	—

B. Body seal materials

Symbol	Description	
	Body	Seat
O	Bronze	PTFE
H		Reinforced PTFE
E	Stainless	PTFE
W		Reinforced PTFE

C. Options

Symbol	Description
No symbol	5-core cable (with signal output)
T	3-core cable
B	With round terminal box (5 terminals)
L	With round terminal box with lamp (lights up when open)
R	With round terminal box with lamp (lights up when closed)

D. Manual operation

Symbol	Description
No symbol	Without manual operation (standard)
M	With manual operation Note 2.

E. Voltage

Symbol	Description
1	AC 100 V (50/60 Hz)
2	AC 200 V (50/60 Hz)
3	DC 24 V
4	DC 12 V

Note 1. For connection bore size 10, although it is full bore, the model number is MXB1.
Note 2. For models with manual operation, in the case of MXB1, connection bore sizes 32, 40, and 50 can be selected, and in the case of MXB1F, connection bore sizes 25, 32, and 40 can be selected. For other connection bore sizes, manual operation is provided as standard.
Note 3. In the case of MXB1F, stainless steel body cannot be manufactured.
Note 4. When adding both the options without signal output T and the round terminal box B, specify TB. (Combination is possible only for TB)

10.2. Product Specifications

Table 10-1. Product Specifications

Common specifications

Model designation		MXB1F-15		MXB1F-20		MXB1F-25	MXB1F-32	MXB1F-40
		MXB1-10	MXB1-15	MXB1-20	MXB1-25	MXB1-32	MXB1-40	MXB1-50
Pressure resistance	MPa	2 (water pressure)						
Fluids used		Water, hot water, air, oil (500mm^2/s or less)						
Fluid pressure	MPa	0–1						0–0.5
Fluid temperature	℃	0-80 (provided it does not freeze)						
Ambient temperature	℃	-10 to 50						
Ambient humidity	%	95 or less						
Power consumption W	AC	7				15		
	DC 24 V	17				24		
Operation frequency		2 times/min or less (DC: 1 time/min)				1 time/min or less (DC: 1 time/2 min)		
Allowable voltage fluctuation		Rated voltage ±10%						

Specifications by model

MXB1－□－ O H E W

Model number \ Value	Connection bore size	Orifice Diameter (mm)	Cv value	Weight (kg)
MXB1-10	Rc3/8	10	10	1.2 (1.2)
MXB1-15	Rc1/2	10	6	1.2 (1.2)
MXB1-20	Rc3/4	15	16	1.4 (1.4)
MXB1-25	Rc1	20	29	1.5 (1.5)
MXB1-32	Rc1 1/4	25	50	2.5(2.6)
MXB1-40	Rc1 1/2	32	98	3.0 (3.1)
MXB1-50	Rc2	40	125	3.7 (3.8)

( ) indicates when the ball valve body material is stainless steel.

MXB1F－□－ O H

Model number \ Value	Connection bore size	Orifice Diameter (mm)	Cv value	Weight (kg)
MXB1F-15	Rc1/2	15	23	1.4
MXB1F-20	Rc3/4	20	51	1.5
MXB1F-25	Rc1	25	66	2.5
MXB1F-32	Rc1 1/4	32	114	3.0
MXB1F-40	Rc1 1/2	40	176	3.7