

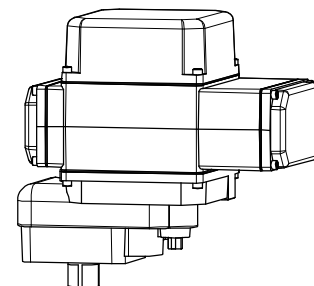
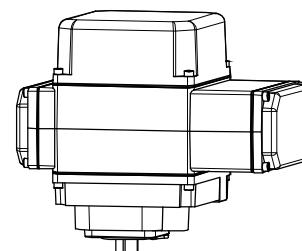
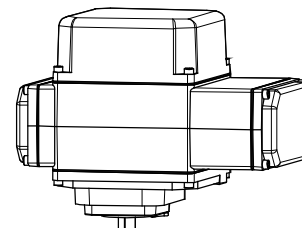


**Please read this manual before installation and use.**

**GENERAL**

It built in a high reliability brushless DC motor and a non-contact potentiometer.  
 Actuator has a long life built-in battery, It opens or closes when a power failure occurs.  
 The battery can be expected a service life over 8 to 9 years at 25 °C.

PBX : For AC / DC power



**PRODUCT CODE**

P B X - <input type="text"/> - <input type="text"/> - <input type="text"/> - <input type="text"/>				
(1)	(2)	(3)	(4)	(5)
(1) Actuator	(2) Torque	(3) Voltage	(4) Operation mode	(5) Power failure
PBX	300	1 : 100 / 110 V AC	Nil : Mode A	Nil : SHUT
	700	2 : 200 / 220 V AC	J : Mode B	P : OPEN
	02K	0 : 24 V DC		
	06K	3 : 24 V AC		

**ELECTRIC ACTUATOR SPECIFICATIONS**

3 way valve: SHUT / Position①, OPEN / Position②

Actuator type (□:Voltage code)	PBX-300-□	PBX-700-□	PBX-02K-□	PBX-06K-□
Voltage	100 / 110 V AC ±10 % 50/60 Hz (Code: 1) 200 / 220 V AC ±10 % 50/60 Hz (Code: 2) 24 V AC ±10 % 50/60 Hz (Code: 3) 24 V DC (Code: 0) Cannot use a half or full-wave DC power supply.			
Rated torque [N·m]	21	50	140	400
Operation time [s]	AC: 1.2 to 2.5 DC: 2 to 2.5 (Max 8)	AC: 3.5 to 7 DC: 4.5 to 7 (Max 22)	AC: 11 to 23 DC: 15 to 23 (Max 78)	AC: 35 to 70 DC: 45 to 70 (Max 230)
	The operation time is the time when it is operated by the override switch. Operation time with the override switch cannot be adjusted with S.C. trimmer. At factory shipment, the S.C trimmer is set to the fastest position.			
Power consumption (Max) [VA]	120			
Motor	Brushless DC motor (PWM Control)			
Overload protection	Current limiter			
Method of operation	Proportional control			
Input signal	4 to 20 mA / 1 to 5 V (Input resistance: 250 Ω)			
Operation *1	[Mode A] SHUT by decreased signal ↔ OPEN by increased signal (Standard) [Mode B] SHUT by increased signal ↔ OPEN by decreased signal (Option: J) [Forced open / shut] It takes priority over the input signal. C-S is ON → SHUT C-O is ON → OPEN Common in mode A / B			
Power failure *2	SHUT at power failure (Standard) OPEN at power failure (Option: P)			
Backup time	About 4 minutes			
Battery	Compact seal lead acid battery: 12 V 2.5 Ah * It is recommend to exchange a battery for every 5 years (at 25 °C).			
Charge system	Constant voltage charge current			
Indication signal	0 mA : SHUT ↔ 1 mA : OPEN (External load resistance: less than 3 kΩ) Common in mode A / B			
Override switch	It takes priority over the input signal. Common in mode A / B Dry contact / Transistor, Open collector. (Input signal current: 6 mA 15 V DC)			
Operating range	SHUT: 0 to 40 % OPEN: 50 to 100 %			
Resolution	Less than 0.2 %			
Duty cycle	100 %			
Ambient temperature	-20 to 50 °C			
Space heater	Built in to the control board			
Manual operation	Manual over-ride with clutch. (Direct operation / 06K: Operation by manual shaft.)			
Enclosure	Equivalent to IP65 (IEC 60529)			
Housing material	AC4C Aluminum alloy die cast (acrylic resin baking finish)			
Wire connection	Terminal Block: M3, Ground terminal: M3			
Conduct port	2-G1/2 Attachments: Cable gland (for Φ6 to 12 mm cable), plug.			

\*1 Change by DIP switch. (Standard → Mode B)

\*2 Change by DIP switch. (Standard → OPEN at power failure)

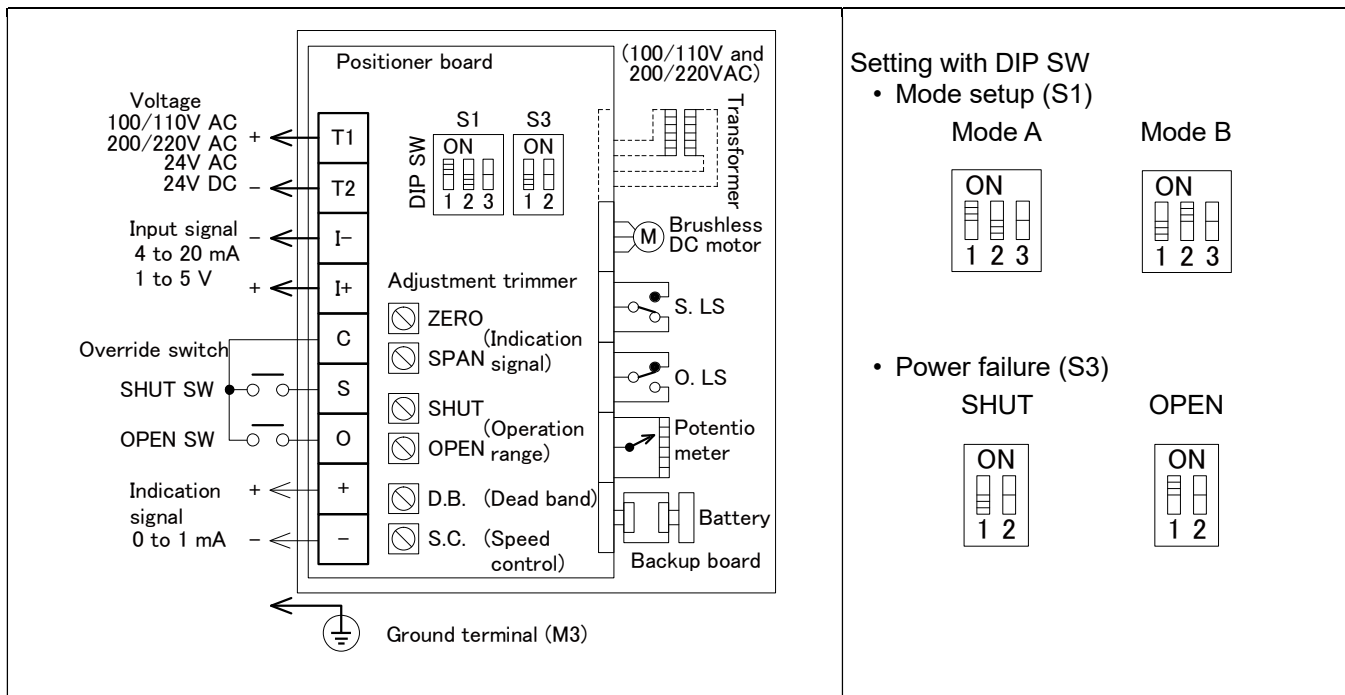
**OPERATION MODE / POWER FAILURE**

	Power failure	Option code
Mode A	SHUT	Standard (Nil)
	OPEN	Option: P
Mode B	SHUT	Option: J
	OPEN	Option: J-P

**ELECTRIC ACTUATOR SPECIFICATIONS**

3 way valve: SHUT / Position①, OPEN / Position②

**WIRING**



Note) Input signal circuit is non-isolated. Do not connect DC (minus) wire to other DC (minus) common.

**ADJUSTMENT OF ACTUATOR**

- ① Dead band
 

Turn the trimmer clockwise for wide the dead band as necessary. It is useful to prevent the hunting reaction of actuator. \*Each trimmer on a built-in control board.
- ② Operating range
 

Turn clockwise and adjust valve/damper to open side.

  - Adjust the closed position by SHUT trimmer.
  - Adjust the open position by OPEN trimmer.
- ③ Operating speed (Speed control)
 

Slow by turn the S.C. trimmer counterclockwise.  
Fast by turn the S.C. trimmer clockwise.

Note) The operation time is the time when it is operated by the override switch.  
Operation time with the override switch cannot be adjusted with S.C. trimmer.  
At factory shipment, the S.C. trimmer is set to the fastest position.

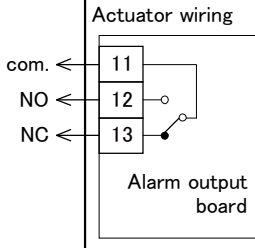
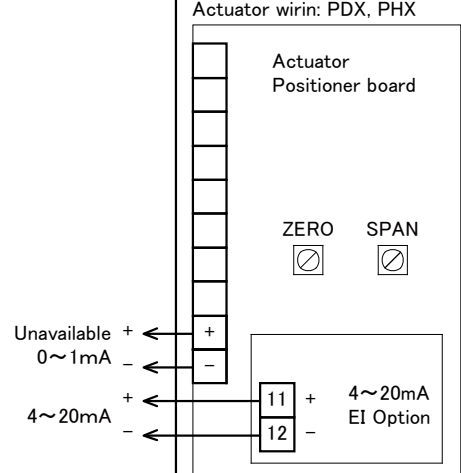
**OPTIONAL PARTS**

Specifications	Code No.	Remarks
Operation mode	SHUT by decreased signal ↔ OPEN by increased signal	Nil
	SHUT by increased signal ↔ OPEN by decreased signal	J
Power failure	SHUT at power failure	Nil
	OPEN at power failure	P
Alarm output board	EA	E1 and EA cannot be used together.
4 to 20 mA Indication signal board	E1	

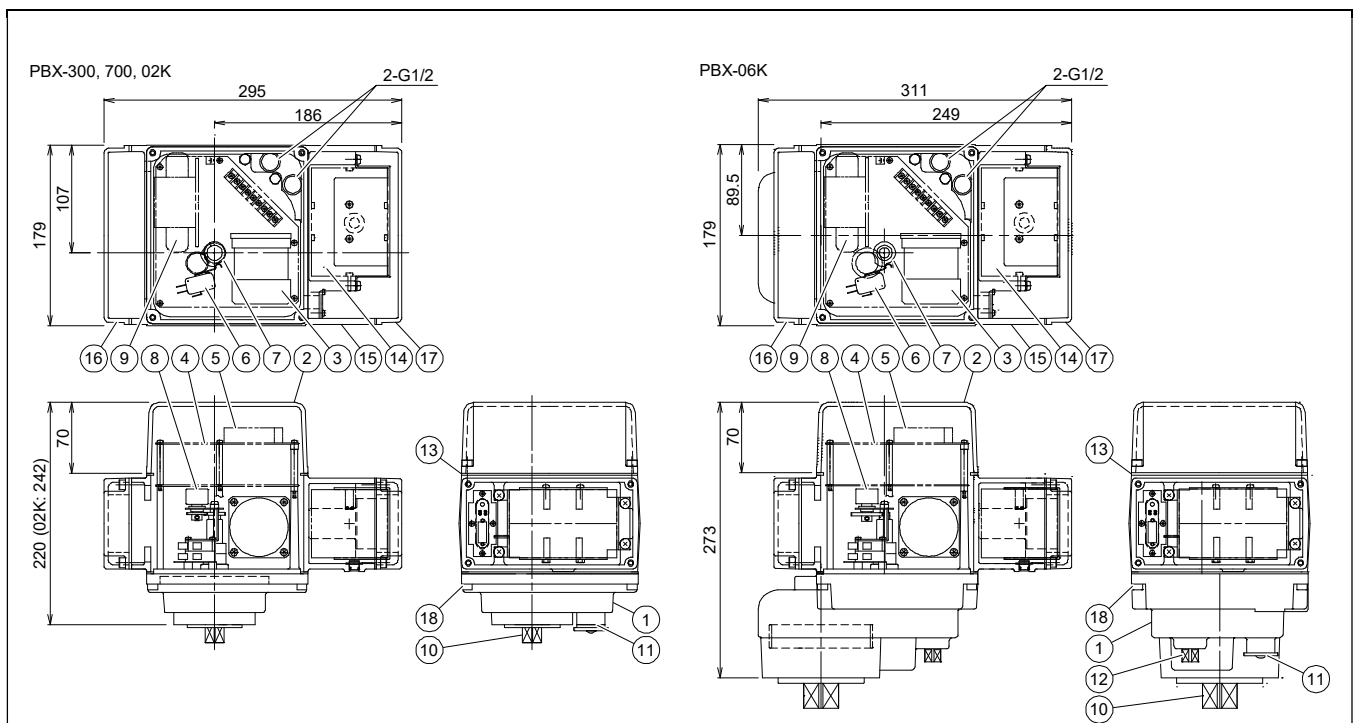
**ELECTRIC ACTUATOR SPECIFICATIONS**

3 way valve: SHUT / Position①, OPEN / Position②

**WIRING (OPTION)**

<p><b>EA Alarm output board</b></p>  <p>com. ← 11 NO ← 12 NC ← 13</p> <p style="text-align: center;">Alarm output board</p> <p>NO : Normally open NC : Normally closed</p> <p>Alarm SW will be ON, when overload protector works.</p> <p>Error → 11 and 12 is ON. Normal → 11 and 13 is ON.</p> <p style="text-align: center;">Cannot be used with EI option.</p>	<p><b>EI 4 to 20 mA Indication signal board</b></p>  <p>Actuator wiring: PDX, PHX</p> <p>Actuator Positioner board</p> <p>ZERO SPAN</p> <p>Unavailable + ← + 0~1mA - ← -</p> <p>4~20mA + ← 11 + 4~20mA EI Option - ← 12 -</p> <p>The angle range of 4 to 20 mA can be adjusted by ZERO / SPAN trimmer on control board. Output signal (0 to 1 mA) cannot be used together.</p>
--	--

**DIMENSIONS**



**Parts name**

1	Body	6	Limit switch	11	Manual clutch	16	Option cover
2	Motor cover	7	SW setting cam	12	Manual shaft (For 06K)	17	Battery cover
3	Motor	8	Potentiometer	13	Rubber packing	18	Body cover part screw
4	Control board	9	Transformer	14	Battery		
5	Terminal block	10	Drive shaft	15	Body cover		

**INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS**

**HANDLING & STORAGE**

①HANDLING

Proper care in handling the actuator should be taken to prevent damage. Do not drop or throw it.

②STORAGE

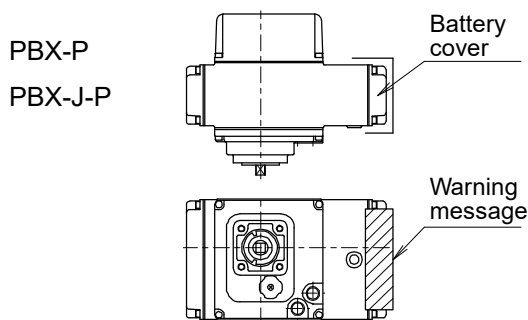
- Store the actuator in the protected area from dust, moisture, and direct sunlight. If possible, should be kept in the original packaging.
- If it is not used more than 30 days, remove a battery from actuator and keep it in a place with little humidity.

③CHECKING

- Check the product code, power supply, and voltage before installation.
- Make sure that the bolts are not loose.
- DIP switch be sure perform set up before a power supply injection.

④BATTERY CONNECTOR (Option: P, J-P)

- For the following models, Battery connector is not connected before shipment. Please connect before use.



- It may move unexpectedly by connecting the battery connector. Please be careful.

**INSTALLATION**

①ENVIRONMENT

- Do not install in place where corrosive gas is present or where vibration is heavy (0.5 G or more).
- When radiant heat causes the surface temperature of the control unit to exceed 50 °C, provide an appropriate shielding plate.
- If there is a possibility that the fluid and drive part freeze, please take measures to prevent freezing.

②POSITIONING

- Should be positioned through 90° upward from horizontal. Provide space around the product to allow manual operation, inspection and replacement work.
- Be sure to enough space around the actuator for battery replacement.

Maintenance space for upper part of actuator.	
PBX	More than 70 mm

③OTHER NOTES

Until the wiring is completed there must be no condensation or flooding in the interior of the actuator, after piping. Protective caps on the cable gland are not waterproof.

**INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS****WIRING****① PRECAUTIONS**

- Remove the actuator cover before wiring.
- Two G1/2 electrical connections are provided with a cable gland and plug. Usable cable size is  $\Phi 6$  to 12 mm.
- When using a flexible tube, dew condensation may occur inside the actuator due to respiration from the inside of the tube and malfunction may result. Seal the flexible tube connector part with a sealant.
- Sealants that affect the electrical contacts should not be used inside the electric actuator.
- If long distance wiring or low voltage operation, check that terminal voltage is in the proper range.
- Input signal circuit is non-isolated. Do not connect DC (minus) wire to other DC (minus) common.
- Do not remove the body cover lower screw.

**② CONNECTION**

- Do not wiring outdoors on a rainy day.
- Check the power supply and voltage. Connect the signal as shown in the wiring diagram. Do not connect unnecessarily terminal.
- Check whether the MODE change DIP SW on a circuit board substrate is set up correctly.
- When wiring, if wiring of a signal is mistaken, it will not operate correctly. Contact us when you use two valve or more by one controller or indicator.
- Actuator should be electrically grounded. Use the terminal marked ( $\oplus$ ) inside the actuator.

**PREVENT DEW CONDENSATION**

- When installing the cover after wiring, perform the bolt by the temporary tightening procedure and the permanent tightening procedure to tightly and securely tighten the rubber packing so that water does not enter from the outside.
- Tighten the cable gland nut so that there is no leakage from the wire entrance.

**CONTROL****① INPUT SIGNAL**

- Use shielded wire for signal wiring where high level noise is generated or when the wiring distance is long.
- Control with a 1 to 5 V input signal becomes an input resistance 250  $\Omega$ . Provide a voltage that can safely 20 mA or more than.

**② DC POWER SUPPLY**

- Battery or full wave rectification can be used.
- Consider an inrush current of motor. (It is 1.5 to 3 times of consumed current.)
- When using a DC voltage, be selected the wire thickness by the wiring distance.
- Do not use power supply that require more than 1 second with rise and fall time.

**③ INPUT SIGNAL AND OPERATION MODE**

The input signal and operation mode are set as follows. (Factory shipped)

Input signal	4 to 20 mA or 1 to 5 V
Operation mode	Mode A
Operation	SHUT by decreased signal. OPEN by increased signal.
Power failure	SHUT

**OPERATION****① PBX-P, PBX-J-P. (Power failure: OPEN)**

Battery connector is not connected before shipment. Please connect before use.

**② TESTING**

- Before operation, charge of 24 hours or more is performed.
- Make sure that power supply voltage is correct. Also check operating position, wiring, speed and signals.
- During trial operation, check that valve movement and output signal are correct.

**③ CONFIRM THE OPERATING CONDITION**

- Adjust fluid condition, controller setting, sensor etc. so that stable control is achieved.
- When used in an unstable control state, the life of the actuator and the valve will be shortened.
- The desired control state is stable at the target value. Adjust the PID setting value of the controller when overshooting the target value greatly, when not converging for a long time or hunting operation. Also, when the time delay is large, please consider the sensor position.

**④ ATTENTION**

- Do not change an unnecessary dip switch. Be sure to set the DIP-SW before turning on the power supply.
- Keep power supplied for built-in space heater to prevent condensation inside actuator.
- Do not touch the moving parts of actuator in operation.
- Be sure to set the DIP-SW before turning on the power supply.
- Never put anything on the actuator or make it into a foothold.

## INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

### BATTERY

#### ① HANDLING

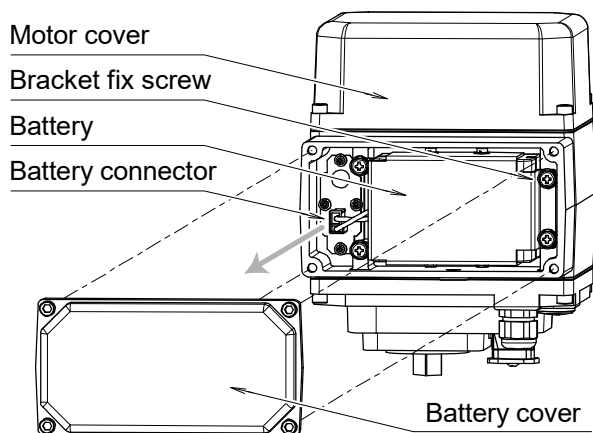
- The battery can be expected a service life over 8 to 9 years at 25 °C.
- Built-in battery should be keep reliability of operation, we recommend you to exchange every 5 years.

#### ② AFTERCARE

- Battery exchange can use during the power supplying.
- Please follow the attachment exchange manual or procedure with battery.
- Dispose of used batteries in the correct way. Order industrial waste disposers, or send them back to us.

### BATTERY REPLACEMENT

#### ① Remove a battery cover.



#### ② Remove a battery connector.

Note) Do not pull electric wire by any means.

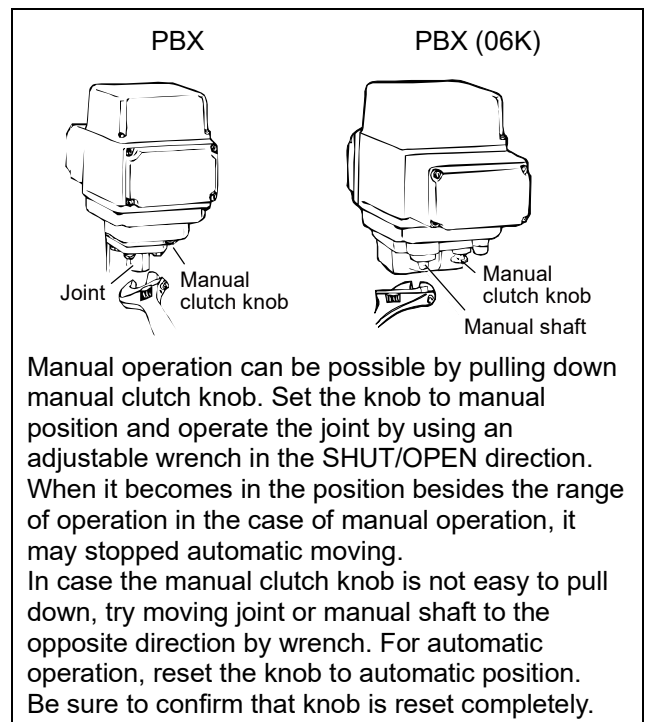
- ③ Removed a bracket fix screw and remove battery.
- ④ New battery is attached with a battery fixed screw.
- ⑤ Attach the battery connector.
- ⑥ Attach the battery cover.
- ⑦ Make sure that operation by battery is securely performed.

### MANUAL OPERATION

#### ① PRECAUTIONS

- Be sure to turn off the power before manual operation. Please note that a power failure may cause the actuator built-in battery to operate. Remove the battery connector before manual operation.
- Operate manually with reference to the opening degree label. Do not turn beyond the fully open / fully closed position. Operation failure may occur during automatic operation.

#### ② THE WAY OF OPERATION



Before automatic operation, be sure to remove wrench.

### MAINTENANCE

- To prevent electric shock, be sure to turn off the power when removing the actuator cover.
- Do the routine maintenance at least once in half a year.

#### Inspection items

- Confirm operation of opening and closing.
- Confirm that an actuator is not hot excessively.
- Confirm existence of abnormal noise and vibration during operation.
- Confirm whether screws are loose or not.
- Confirm that water or condensation no remains in the actuator.
- Turn off the power and check if the valve operates normally with built-in battery.

**INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS****TROUBLE SHOOTING**

Problem	Cause	Solution
Actuator does not move.	Faulty wiring.	Correct the wiring.
	Voltage and input signal are not coming.	Check the voltage and input signal.
	Incorrect voltage.	When it's burned out by excess voltage, replace the actuator.
	Connection or wiring is not correct.	Correct the miswiring and misconnection. Be careful not to mistake the plus and minus of wiring.
	Short the circuit, contact failure.	Review wires and connection.
	Motor is too old.	Replace the actuator. Repair in our factory.
	Battery lifetime.	Replace the battery.
Operation is unstable.	Excess surge or voltage was applied.	<ul style="list-style-type: none"> <li>• Replace the control board or limit switch. (Repair in our factory)</li> <li>• Replace the actuator.</li> </ul>
	Rainwater entered the actuator.	<ul style="list-style-type: none"> <li>• Dry the inside.</li> <li>• Replace the actuator.</li> </ul>
	Added high harmonics noise from an inverter.	Attachment a filter for each inverter maker option.
	Effect of high level noise.	Use the shielded wire and ground the wiring. Separate signal wire from power line.

Problem	Cause	Solution
Stop in the mid position. (Input signal 1 to 5 V)	Signal voltage source capacity shortage.	Use a voltage source that can be made to flow more than 20 mA. Please contact us.
Stop in the mid position.	Biting of valve seat.	Manually operate an actuator and remove a foreign object.
	Overload protector runs because of over-torque.	Motor protection circuit returns by the signal of operation of an opposite direction. Turn on the power again.
	Battery is worn out.	Replace the battery.
Stop automatic moving after manual operation.	Manual clutch knob is not reset.	Reset manual clutch knob.
	Out of operating range. (06K)	Reset by manual operation.

For more information contact  
NIPPON VALVE CONTROLS, INC. for consultation.