NIPPON VALVE CONTROLS, INC.

Instruction manual

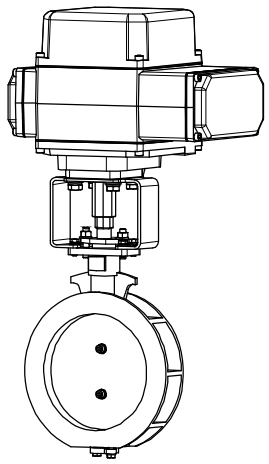
Electric Actuated Butterfly Damper WT

SP-1519

Please read this manual before installation and use.

GENERAL

It composed of wafer type butterfly damper and high-power electric actuator.
(Proportional control)
The actuator operates at the time of power loss by
the built-in high-performance shielded battery.



Actuator

PBX : For AC / DC power

Damper

WT type With heat-resistant damper material this series can be used at fluid temperatures ranging from -40 °C to +550 (600) °C.

PRODUCT CODE

WT type	(Without seat)	P	B	X	W	T	□	□	2	T	G	0	-	□	□	□	-	□	□	-	□	-	□
	(With SUS316 seat)	P	B	X	W	T	□	□	2	T	G	S	-	□	□	□	-	□	□	-	□	-	□
		(1)		(2)			(3)	(4)	(5)	(6)	(7)	(8)		(9)				(10)			(11)		(12)

(1) Actuator
PBX

(2) Damper
WT

(3) Voltage
1 : 100 / 110 V AC
2 : 200 / 220 V AC
0 : 24 V DC
3 : 24 V AC

(4) Sizing code
0 : Standard
1 : Light
2 : Heavy

(5) Connection
2 : JIS 5K

(6) Body material
T : SCS13A

(7) Packing material
G : Expansion graphite

(8) Seat material
0 : (Zero) None
S : SUS316

(9) Size [mm]
ex. 80 A → 080

(10) Option
EI : 4 to 20 mA Indication signal board
EA : Alarm output board

(11) Operation mode
Nil : Mode A
J : Mode B

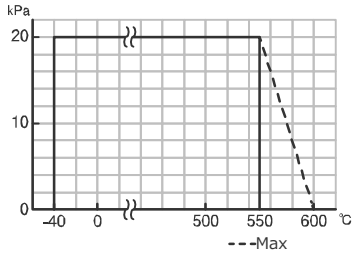
(12) Power failure
Nil : SHUT
P : OPEN

DAMPER SPECIFICATIONS

Water Oil Air, Gas Steam Chemicals Sea water Slurry Negative pressure

Damper type		WT (Without seat)		WT (With SUS316 seat)
Design		2-way, Wafer		2-way, Wafer
Connection		JIS Flanges 5K		JIS Flanges 5K
Fluid				
Max pressure		20 kPa		20 kPa
Size [mm]		040 to 250	300 to 400	040 to 400
Material	Body	SCS13A		SCS13A
	Disc	SUS420J2	SUS420J1	SUS410S / SUS420J2
	Seat	None		SUS316
Stem seal	Packing	Expansion graphite		Expansion graphite

PRESSURE & TEMPERATURE RATING

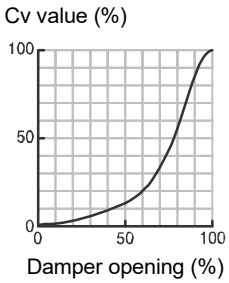


Temperature range : -40 to 600 °C

SEAT LEAKAGE VOLUME

	Damper size [mm]	Remarks
WT-2TG0 (Without seat)	040 to 050	Less than 2 % of rated Cv.
	065 to 400	Less than 1 % of rated Cv.
WT-2TGS (With SUS316 seat)	040	Less than 1 % of rated Cv.
	050	Less than 0.5 % of rated Cv.
	065	Less than 0.2 % of rated Cv.
	080 to 400	Less than 0.1 % of rated Cv.

INHERENT FLOW CHARACTERISTIC



Range ability 50:1

ELECTRIC ACTUATOR SPECIFICATIONS

PBX type

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)

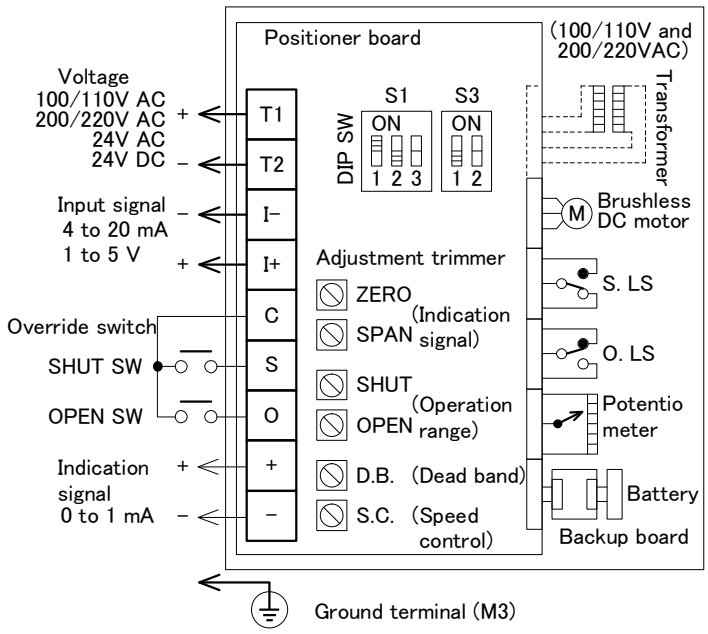
OPERATION MODE / POWER FAILURE

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

ELECTRIC ACTUATOR SPECIFICATIONS

WIRING

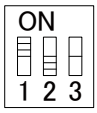
PBX



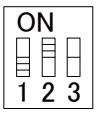
Setting with DIP SW

- Mode setup (S1)

Mode A



Mode B



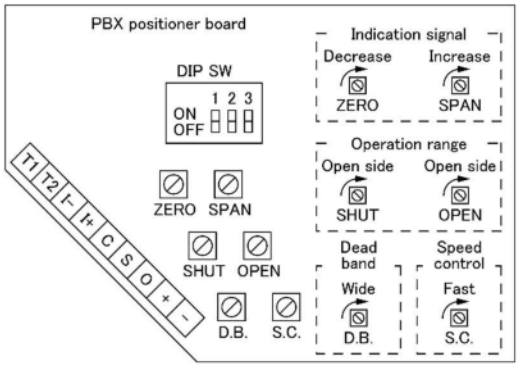
- Power failure (S3)

SHUT

OPEN

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.

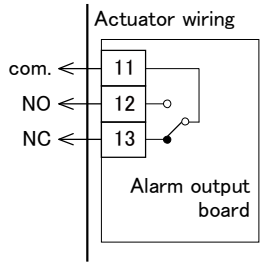
OPTIONAL PARTS

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

ELECTRIC ACTUATOR SPECIFICATIONS

WIRING (OPTION)

EA	Alarm output board	EI	4 to 20 mA Indication signal board

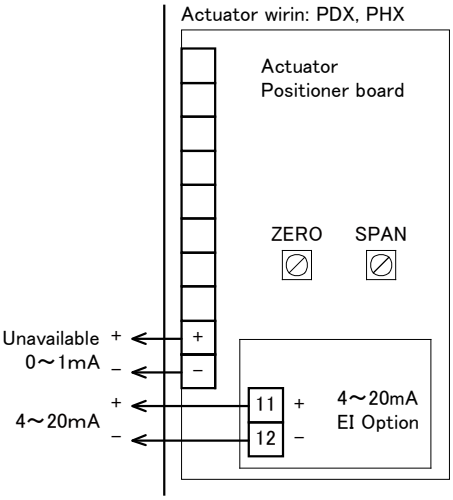


NO : Normally open
NC : Normally closed

Alarm SW will be ON, when overload protector works.

Error → 11 and 12 is ON.
Normal → 11 and 13 is ON.

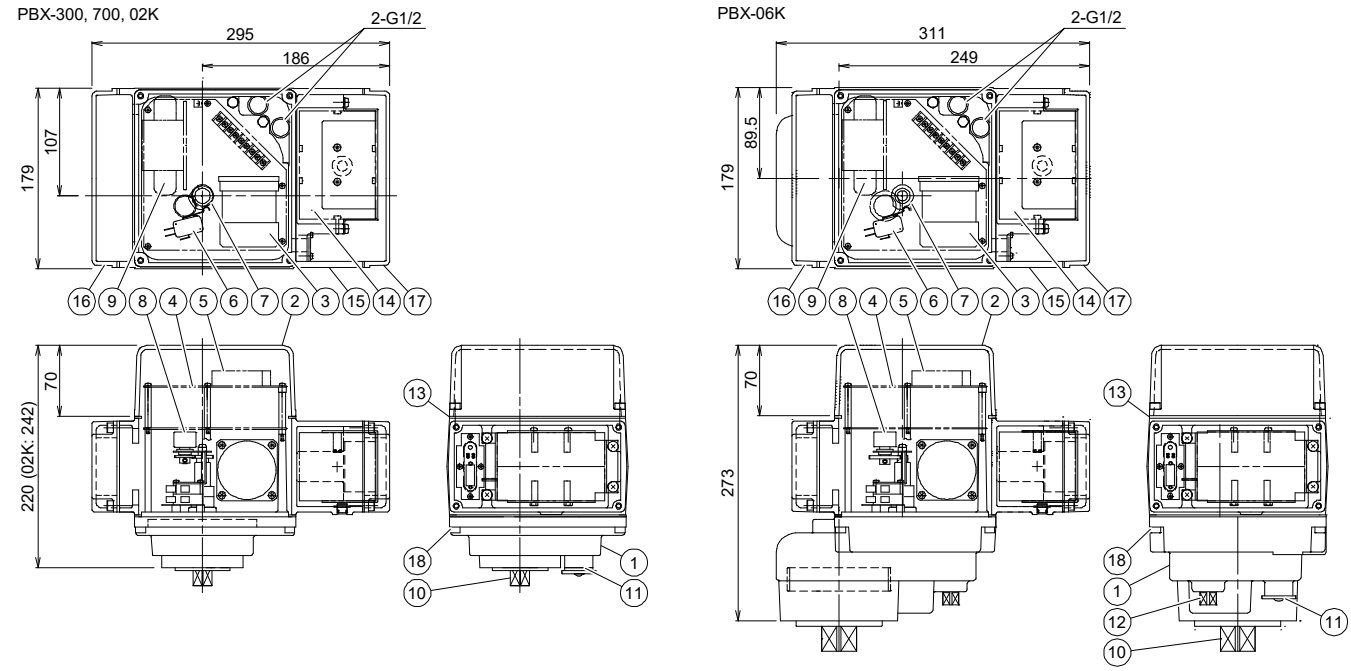
Cannot be used with EI option.



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.

DIMENSIONS

PBX



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		

HANDLING & STORAGE

①HANDLING

Do not drop or throw the product as it may break.

②STORAGE

- Store away from dust, moisture and direct sunlight. If possible, store in the original package.
- Do not remove a dust proof cap until the piping.
- If it is not used more than 30 days, remove a battery from actuator and keep it in a place with little humidity.

③CHECKING

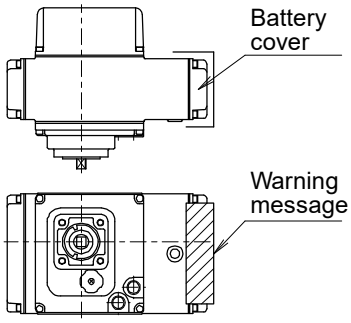
- Check the product code, power supply, and voltage before installation.
- Make sure that the bolts are not loose.
- The DIP switch should be set up before the power is turned on. Do not touch unnecessary switches.

④BATTERY CONNECTOR (Option: P, J-P)

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

PBX-P

PBX-J-P

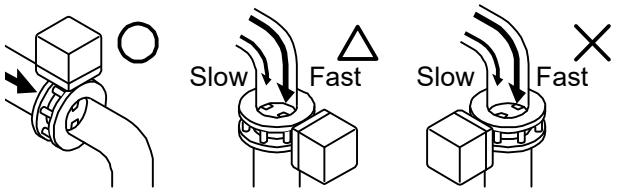


- It may move unexpectedly by connecting the battery connector. Please be careful.

INSTALLATION

①PRECAUTIONS

- Flush the pipeline carefully before installing the damper. Foreign particles, such as sand or pieces of welding electrode, will damage the disk and seats.
- For dampers with specified flow direction (WT), check the arrows on the product before piping.
- Damper is shipped closed. (allows quick piping.)
- The butterfly damper should be piped upstream of the elbow. When piping downstream from the elbow, considered a straight line that is at least five times the length of the pipe.



- The damper stem should be mounted perpendicular to the flow for biased fluid.
- Disc interference may also occur when damper is installed in pipeline with smaller than normal inside diameter such as thick wall pipe, or lining pipe. Suitable corrective measurement must be taken (taper boring the pipe or pipe liner, etc.)

②PIPING FLANGES

- Gasket should be selected appropriately to suit the fluid, pressure and temperature. Use spring washer to prevent from decreasing surface pressure gasket when the temperature change happens frequently.
- Wafer type butterfly damper is put between two seats of flanged-end and tightened with long bolts.
- Before bolts are tightened, damper should be centered within the bolts to prevent possible disc interference or damage by contact with the pipe or flange.
- Tighten all bolts using crossover method to load the joint evenly.

③ENVIRONMENT

- 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.

④POSITIONING

- 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.

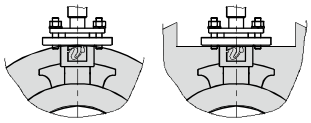
Maintenance space for upper part of actuator.	
PBX	More than 70 mm

⑤OTHER 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.

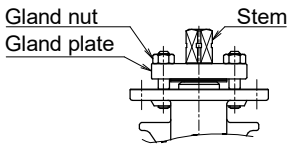
⑥INSULATION WORK

- For maintenance of gland packing, insulation should be below the ground part.
- The upper part of the ground plate part is a heat dissipation part, do not insulate it.



TIGHTEN THE GLAND NUTS

- Check that there is no leakage from the gland packing.
- If it leakage, tighten gland nuts by alternately. Do not over-tighten the gland nuts.



Damper size [mm]	Recommended torques [N·m]
040 050 065	1
080 100 125	2
150 200 250 300	5
350 400	8

WIRING

①PRECAUTIONS

- Remove the actuator cover before wiring.
- Two G1/2 electrical connections are provided with a cable gland and plug. Usable cable size is Φ6 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.

②CONNECTION

- 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 damper or more by one controller or indicator.
- Actuator should be electrically grounded.
  Use the terminal marked (⏚) 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

①INPUT 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 Ω. Provide a voltage that can safely 20 mA or more than.

②DC 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.

③INPUT 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

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

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

②TESTING

- 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 damper movement and output signal are correct.

③CONFIRM 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 damper 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.

④ATTENTION

- 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.

BATTERY

①HANDLING

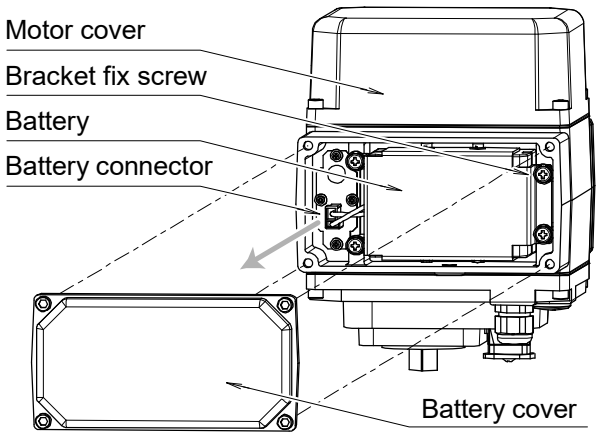
- The battery can be expected a service life over 8 to 9 years at 25 °C.
- Built-in battery should be keep reliability of operation, we recommend you to exchange every 5 years.

②AFTERCARE

- 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 the battery cover.



② Remove the battery connector.

Hold the connector body and pull it straight forward. Do not pull electric wire by any means.

③ Remove the bracket fix screw and battery.

④ New battery is attached with a bracket fix screw.

⑤ Insert the battery connector.

Please be sure to plug it straight in all the way.

⑥ Attach the battery cover.

⑦ Make sure that operation by battery is securely performed.

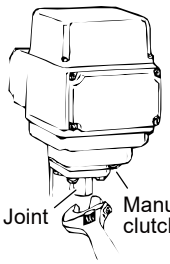
MANUAL OPERATION

①PRECAUTIONS

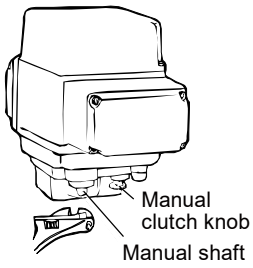
- Remove the battery connector before manual operation for safety. (Refer the battery replacement)
- Manual operation should be a temporary operation.
- Be sure to turn off the power before manual operation.
- Operate manually with reference to the opening degree label. Do not turn beyond the fully open / fully closed position. Operation failure may occur during automatic operation.

②THE WAY OF OPERATION

PBX



PBX (06K)



Manual operation can be possible by pulling down manual clutch knob. Set the knob to manual position and operate the joint by using an adjustable wrench in the SHUT/OPEN direction. When it becomes in the position besides the range of operation in the case of manual operation, it may stopped automatic moving.
In case the manual clutch knob is not easy to pull down, try moving joint or manual shaft to the opposite direction by wrench. For automatic operation, reset the knob to automatic position.
Be sure to confirm that knob is reset completely.

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 damper operates normally with built-in battery.
- Confirm the fluid temperature or pressure.
- Confirm the leak from damper stem.
- Confirm the bolt tightening torque.

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.	• Replace the control board or limit switch. (Repair in our factory) • Replace the actuator.
	Rainwater entered the actuator.	• Dry the inside. • Replace the actuator.
	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.	There is a foreign object in the damper.	Remove a foreign object.
	Damper is distorted.	Replace the damper.
	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.
Leakage from damper gland	Gland packing is worn or distorted.	Tighten the gland nut.
		Replace the gland packing.

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

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