



Instruction manual

Electric Actuated Butterfly Valve F FN FE FP

Please read this manual before installation and use.

GENERAL

It composed of wafer type butterfly valve and high-power electric actuator. (Proportional control)

Actuator

PDX : For AC / DC power.

PHX : For AC / DC power.

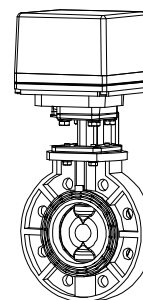
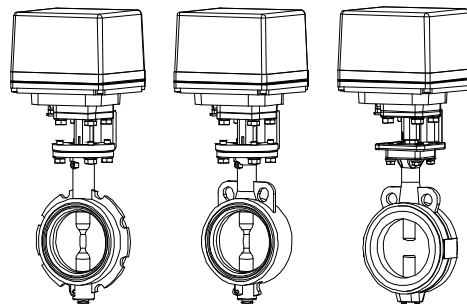
Valve

F type FCD450 body.

FN type FCD450 body.

FE type Aluminum alloy diecast body. (lightweight)

FP type For Corrosion resistance. (Polypropylene body)



PRODUCT CODE

F type	<input type="text"/>	F -	<input type="text"/>	<input type="text"/>	1	D	<input type="text"/>	<input type="text"/>	-	<input type="text"/>	-	<input type="text"/>	-	<input type="text"/>
FN type (For JIS 5K / 10K)	<input type="text"/>	FN	<input type="text"/>	<input type="text"/>	1	D	<input type="text"/>	<input type="text"/>	-	<input type="text"/>	-	<input type="text"/>	-	<input type="text"/>
FE type	<input type="text"/>	FE	<input type="text"/>	<input type="text"/>	1	L	T	<input type="text"/>	-	<input type="text"/>	-	<input type="text"/>	-	<input type="text"/>
FP type	<input type="text"/>	FP	<input type="text"/>	<input type="text"/>	1	Q	Q	E	-	<input type="text"/>	-	<input type="text"/>	-	<input type="text"/>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(9)		(10)		(11)

(1) Actuator PDX PHX	(4) Sizing code 0 : Standard 1 : Light 2 : Heavy	(7) Disc material D : FCD450 U : SUSF316 / SCS14 A : CAC703 T : SCS13A J : PPS Q : PP	(10) Option EA : Alarm output board EI : 4 to 20 mA Indication signal board L0 : Auxiliary limit switch L2 : Auxiliary limit switch
(2) Valve F- FN FE FP	(5) Connection 1 : JIS 10K	(8) Seat material E : EPDM B : NBR V : FKM	(11) Operation mode Nil : Mode A J : Mode B
(3) Voltage 1 : 100 / 110 V AC 2 : 200 / 220 V AC 0 : 24 V DC 3 : 24 V AC	(6) Body material D : FCD450 L : ADC12 Q : PP	(9) Size [mm] ex. 80 A → 080	(11) Input signal (PDX) It corresponds to various control input signals.

VALVES SPECIFICATIONS

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

F FN FE FP type

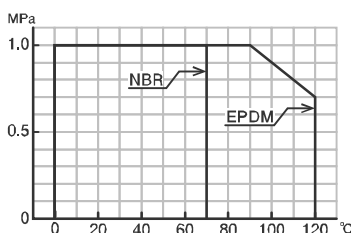
Valve type	F		FN	FE	FP	
Design	Wafer type		Wafer type	Wafer type	Wafer type	
Connection	JIS Flanges 10K		JIS Flanges 5K / 10K	JIS Flanges 10K	JIS Flanges 10K	
Fluid						
Max pressure	1 MPa	0.5 MPa	1 MPa	0.98 MPa	1 MPa	0.7 MPa
Size [mm]	050 to 250	300	050 to 200	040 to 300	040 to 150	200 to 300
Material	Body	FCD450		FCD450	ADC12	PP
	Disc	FCD450 (CNI plated) CAC703 SUSF316 / SCS14		FCD450 (CNI plated) CAC703 SUSF316 / SCS14	SCS13A	PP
	Seat	EPDM NBR	FKM	EPDM NBR	EPDM NBR	EPDM
Stem seal	O-ring	NBR	FKM	NBR	NBR	EPDM

PRESSURE & TEMPERATURE RATING

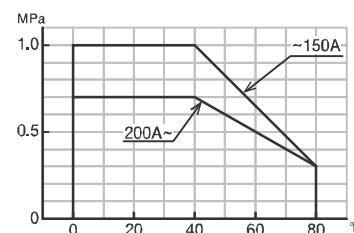
F FN

Seat material	Fluid temp.	Use
EPDM	-20 to +80 °C	
NBR	-10 to +60 °C	
FKM	-5 to +80 °C	

FE



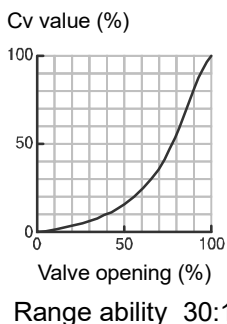
FP



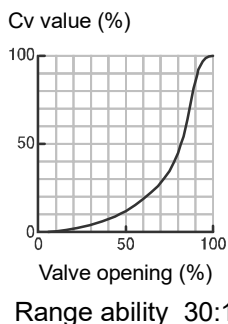
- NOTE)
- EPDM is not recommended for hydrocarbon-based oil or grease.
 - Hot water can be used at temperatures of up to 80 °C (FE: 90 °C). Steam cannot be used.
 - CAC703 and EPDM are suitable for seawater. (F, FN)

INHERENT FLOW CHARACTERISTIC

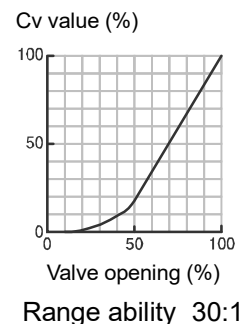
F FN



FE



FP



ELECTRIC ACTUATOR SPECIFICATIONS

PDX type

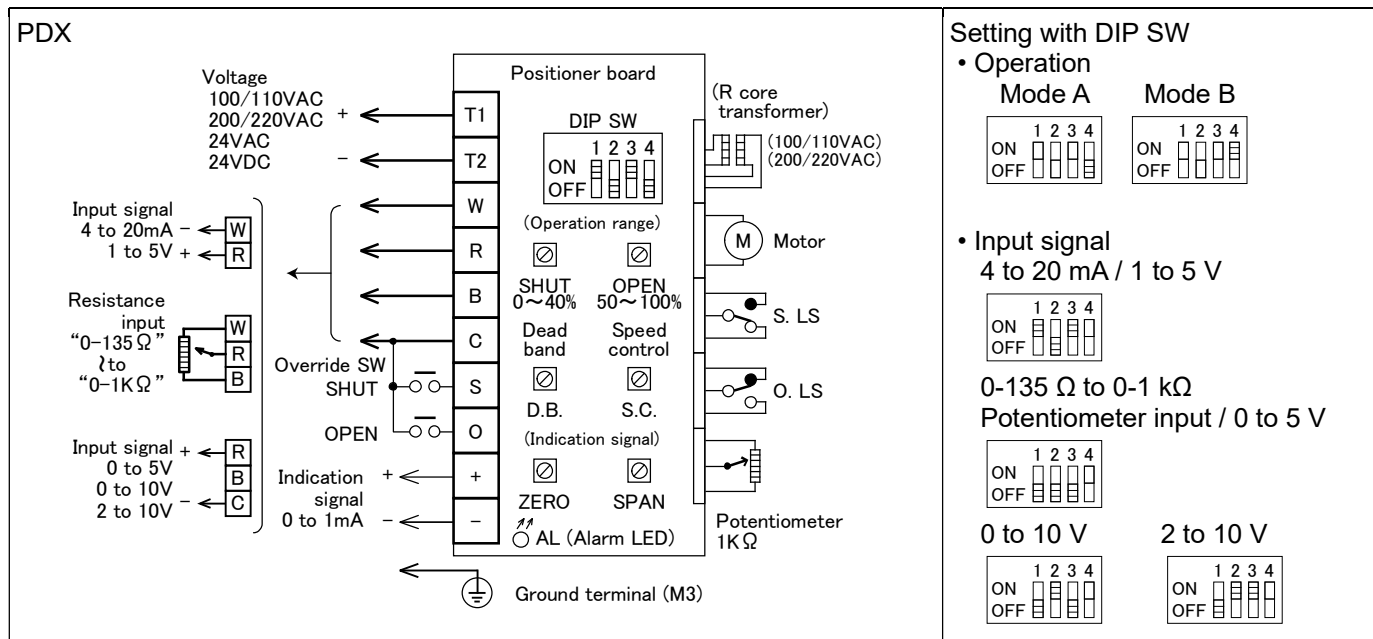
Actuator type (□:Voltage code)	PDX-300-□	PDX-700-□	PDX-02K-□	PDX-06K-□
Voltage	100 / 110 V AC ±10 % 50/60 Hz (Code: 1) 200 / 220 V AC ±10 % 50/60 Hz (Code: 2) 24 V AC ±10 % 50/60 Hz (Code: 3) 24 V DC (Code: 0)			
Rated torque [N·m]	21	50	140	400
Operation time [s]	6 to 20, Variable	15 to 50, Variable	30 to 100, Variable	90 to 300, Variable
Power consumption (Max) [VA]	AC power 100 DC power 80		AC power 150 DC power 120	
Motor	DC motor (VIC: voltage, current control)			
Overload protection	Current limiter			
Method of operation	Proportional control			
Input signal	4 to 20 mA 1 to 5 V (Input resistance: 250 Ω) (Standard) 0 to 5 V 0 to 10 V 2 to 10 V (Input resistance: more than 1 M Ω) 0-135 Ω to 0-1 kΩ Potentiometer input (Applied voltage: 5 V DC)			
Operation *1	[Mode A] SHUT by decreased signal ↔ OPEN by increased signal [Mode B] SHUT by increased signal ↔ OPEN by decreased signal [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			
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 15V DC)			
Operating range	SHUT: 0 to 40% OPEN: 50 to 100%			
Resolution	Less than 0.5 %	Less than 0.2 %		
Duty cycle	50% 30 min.			
Ambient temperature	-20 to 55 °C			
Space heater	3 W			
Manual operation	Manual over-ride with clutch. (Direct operation / 06K: Operation by manual shaft.)			
Enclosure	Equivalent to IP65 (IEC 60529)			
Housing material	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 → Potentiometer input or 0 to 5 V 0 to 10 V 2 to 10 V)

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

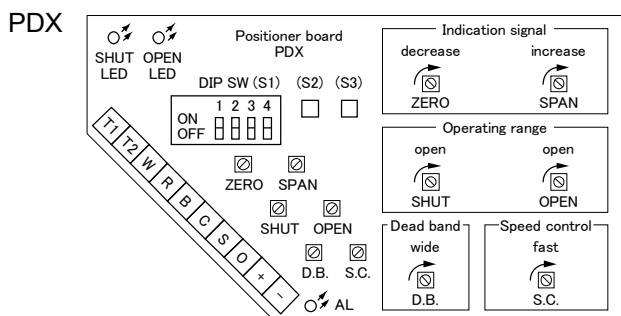
ELECTRIC ACTUATOR SPECIFICATIONS

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.

At factory shipment, the S.C trimmer is set to the mid position. Operation time with the override switch cannot be adjusted with S.C. trimmer.

ELECTRIC ACTUATOR SPECIFICATIONS

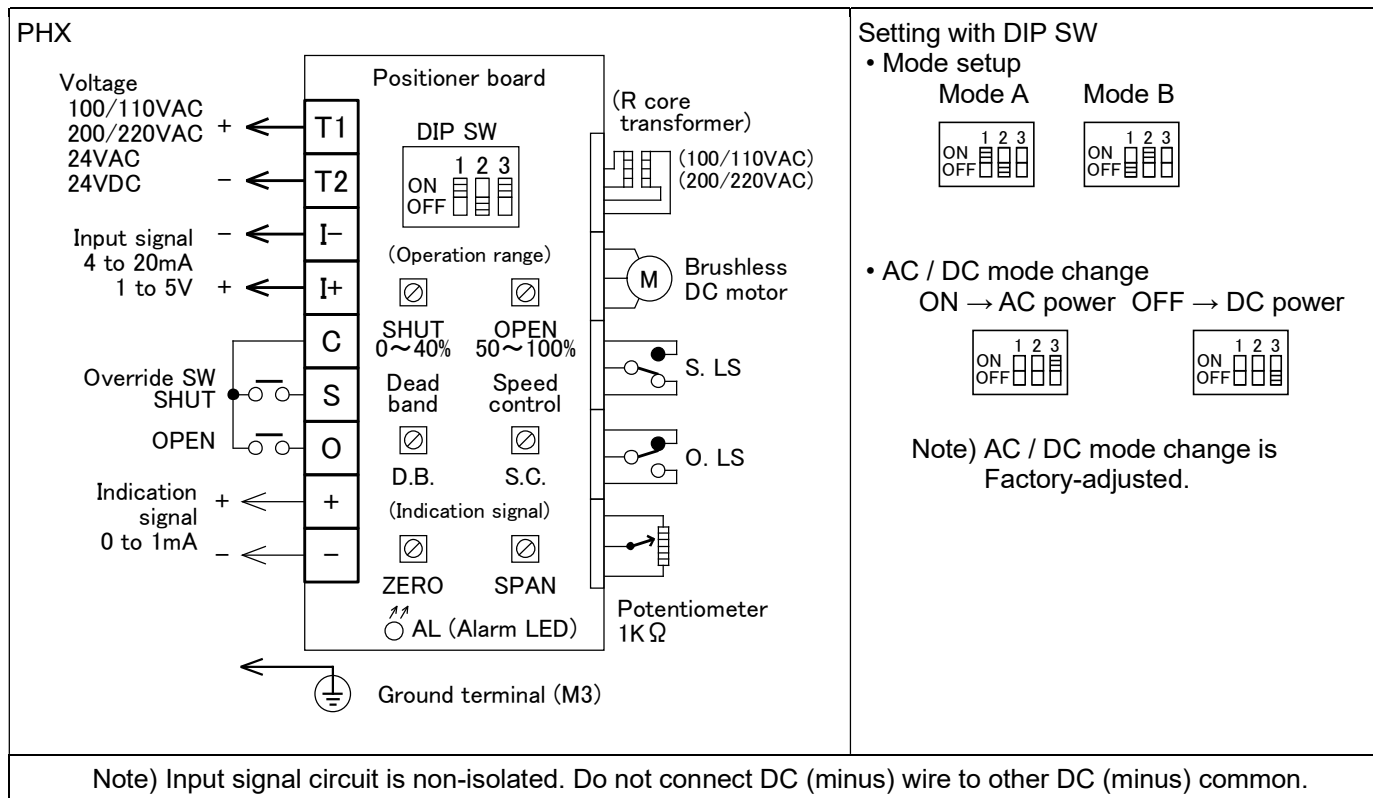
PHX type

Actuator type (□:Voltage code)	PHX-300-□	PHX-700-□	PHX-02K-□	PHX-06K-□
Voltage	100 / 110 V AC ±10 % 200 / 220 V AC ±10 % 24 V AC ±10 % 24 V DC	50/60 Hz (Code: 1) 50/60 Hz (Code: 2) 50/60 Hz (Code: 3) (Code: 0)		
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			
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 15V DC)			
Operating range	SHUT: 0 to 40 % OPEN: 50 to 100 %			
Resolution	Less than 0.2 %			
Duty cycle	100 %			
Ambient temperature	-20 to 55 °C			
Space heater	3 W			
Manual operation	Manual over-ride with clutch. (Direct operation / 06K: Operation by manual shaft.)			
Enclosure	Equivalent to IP65 (IEC 60529)			
Housing material	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.			

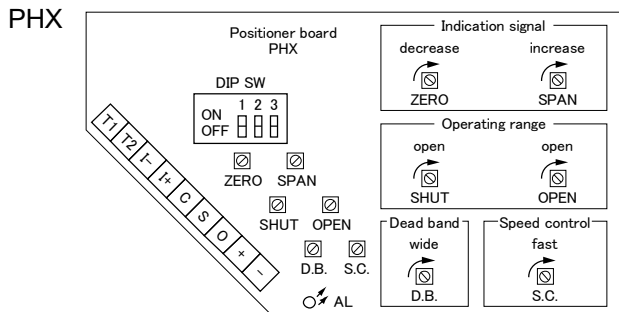
*1 Change by DIP switch. (Standard → Mode B)

ELECTRIC ACTUATOR SPECIFICATIONS

WIRING



ADJUSTMENT OF ACTUATOR



- 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.
- 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.
- 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.

ELECTRIC ACTUATOR SPECIFICATIONS

OPTIONAL PARTS

Specifications	Code No.	PDX	PHX	Remarks	
Input signal and operation	4 to 20 mA or 1 to 5 V	Nil	○	○	Mode A (Standard)
		J	○	○	Mode B
	0-135 Ω to 0-1 kΩ Potentiometer input or 0 to 5 V	F	○		Mode A
		K	○		Mode B
	0 to 10 V	G	○		Mode A
		N	○		Mode B
2 to 10 V	H	○		Mode A	
	M	○		Mode B	
Auxiliary limit switch (Select limit switch depending on the load)	L0	○	○	For standard signal	
	L2	○	○	For micro load signal	
Alarm output board	EA	○	○	EI and EA	
4 to 20 mA Indication signal board	EI	○	○	cannot be used together.	

*Auxiliary limit switch: Please refer to the specifications.

WIRING (OPTION)

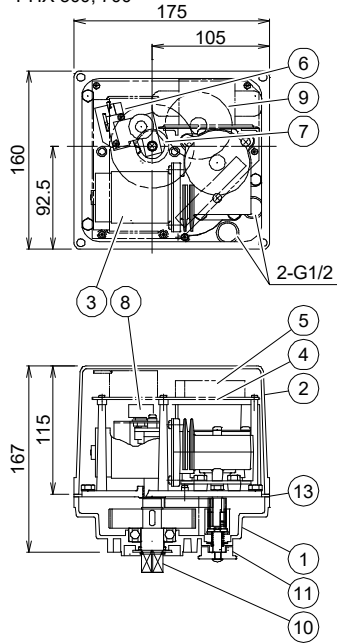
L0, L2	Auxiliary limit switch	EA	Alarm output board	EI	4 to 20 mA Indication signal board
	<p>At CLOSE side, LC and LS is ON. At OPEN side, LC and LO is ON.</p> <p>ON point can be reset by adjusting the cam.</p>		<p>NO : Normally open NC : Normally closed</p> <p>Alarm SW will be ON, when overload protector works.</p> <p>Error → 11 and 12 is ON. Normal → 11 and 13 is ON.</p> <p>Cannot be used with EI option.</p>		<p>Actuator wirin: PDX, PHX</p> <p>Actuator Positioner board</p> <p>ZERO SPAN</p> <p>Unavailable + ← + 0~1mA - ← -</p> <p>4~20mA + ← + - ← -</p> <p>11 + 4~20mA 12 - EI Option</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>

ELECTRIC ACTUATOR SPECIFICATIONS

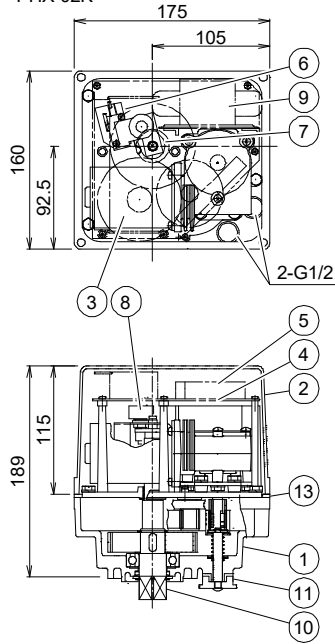
DIMENSIONS

PDX PHX

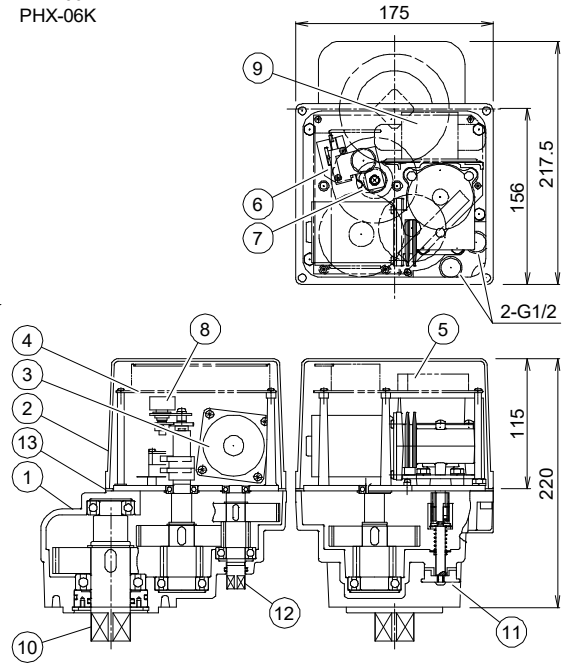
PDX-300, 700
PHX-300, 700



PDX-02K
PHX-02K



PDX-06K
PHX-06K



Parts name

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

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

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.

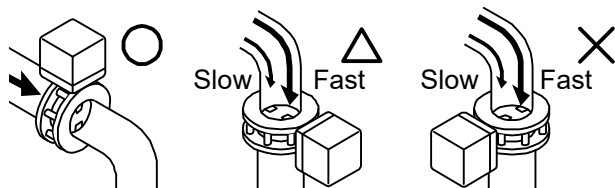
③CHECKING

- 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.

INSTALLATION

①PRECAUTIONS

- Flush the pipeline carefully before installing the valve. Foreign particles, such as sand or pieces of welding electrode, will damage the disk and seats.
- Seat has ribs for tight gasket seating. Do not use gasket.
- Valve is shipped closed. (allows quick piping.)
- The butterfly valve 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.



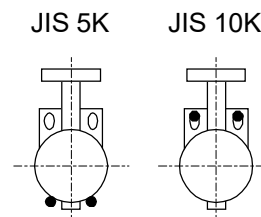
- The valve stem should be mounted perpendicular to the flow for biased fluid.
- Disc interference may also occur when valve is installed in pipeline with smaller than normal inside diameter such as thick wall pipe, or lining pipe. Suitable corrective measurement must be taken (taper boring the pipe or pipe liner, etc.)
- When you use a vinyl chloride flange, there is a caliber to be internal off the corners. Please cut off the corners with reference to the following. (F, FN)

Valve size [mm]		Chamfer [mm]
FN	F	
150	150	1.5
-	200	2.5
-	250	3
-	300	2

- Avoid oil or grease when using EPDM seat.

②PIPING FLANGES (F, FN, FE)

- Class JIS 5K and JIS 10K pipe flanges can be used for FN series. See the drawing below for centering the valve with bolts.



- Wafer type butterfly valve is put between two seats of flanged-end and tightened with long bolts.
- Before bolts are tightened, valve 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.
- When using a resin flange, if the connecting bolt is tightened too much, the flange may deform and leak.

Valve size [mm]			Recommended torque [N·m]
F	FN	FE	
050	050	040	20
065	065	050	
080	080	065	
100	100	080	
125	125	100	25
150	150	125	
200	200	150	
250	-	200	30
300	-	250	

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS**③CAUTION ON PLASTIC VALVE (FP)**

Flange connection

- Use same material as same as opposite piping flanged. For metal piping, use flanged washer and it is considered that there is no heavy piping stress.
- When the piping, wick gap between a pipe and a valve and a bending cause by an angle difference, it may cause switching incompatible breakage, and leakage from fluid.
- Shaft, face to face dimension distance and flanged angle unit correctly.
- Use the flanged bolt on by bolt side and nut side, tighten all bolts using crossover method to load the joint evenly.

Valve size [mm]	Recommended torques [N·m]
040 050 065 080	20
100 125 150	25
200 250 300	60

⑥OTHER 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.

Expansion measure of pipe line

- Heat expansion occurs in pipe line depends on by temperature change after piping and temperature condition of internal fluid. Compression or contraction by heat stress acts also on a valve. Especially for metal piping, it happens to plastic valve as weak in intensity. Perform expansion treatment before or after a valve and it is considered that a burden is not placed on valve.

④ENVIRONMENT

- 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 55 °C, provide an appropriate shielding plate.
- If there is a possibility that the fluid and drive part freeze, please take measures to prevent freezing.

⑤POSITIONING

Should be positioned through 90° upward from horizontal. Provide space around the product to allow manual operation, inspection and replacement work.

Maintenance space for upper part of actuator.

PDX PHX	More than 120 mm
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INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS**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 $\Phi 6$ 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.

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 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**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 20mA 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.

OPERATION**①TESTING**

- 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.

②CONFIRM 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.

③DUTY CYCLE (PDX)

Confirm that the operation frequency is within the specified duty cycle.
Use beyond the load time rate range will affect product life. Also, it may cause burnout.

Duty cycle is a value that regulates the opening / closing frequency of the actuator.
The meaning of 50 % 30 minutes for Duty cycle is that 15 minutes (50 % of 30 minutes) operation is possible. The calculated value obtained by dividing 15 minutes by the operation time is the number of times of operation within 30 minutes.

④ATTENTION

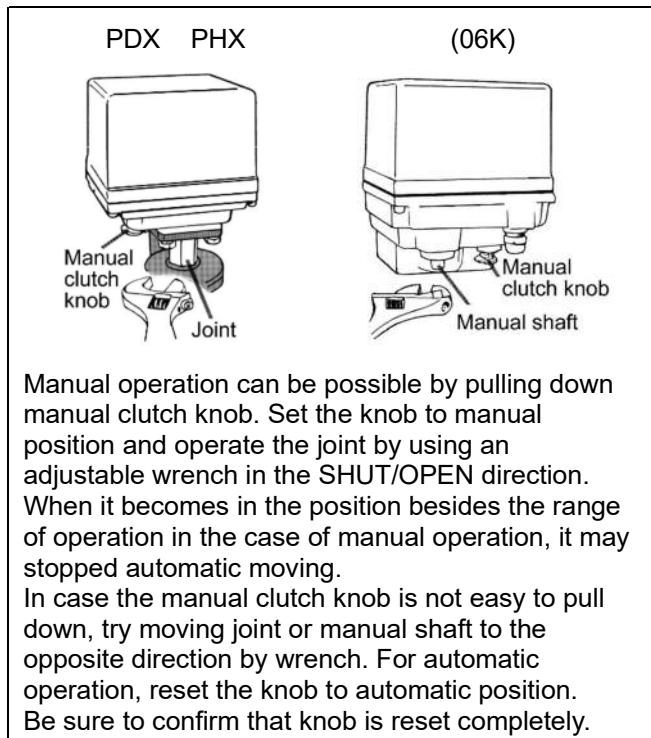
- Do not change an unnecessary dip switch.
- Keep power supplied for built-in space heater to prevent condensation inside actuator.
- Do not touch the moving parts of actuator in operation.
- Never put anything on the actuator or make it into a foothold.

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS**MANUAL OPERATION**

① PRECAUTIONS

- 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.

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.
- Confirm the fluid temperature or pressure.
- Confirm the leak from valve stem.
- Confirm the bolt tightening torque.

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.
Operation is unstable.	Excess surge or voltage was applied.	<ul style="list-style-type: none"> • Replace the control board or limit switch. (Repair in our factory) • Replace the actuator.
	Rainwater entered the actuator.	<ul style="list-style-type: none"> • 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.
	Stop in the mid position. (Input signal 1 to 5 V)	Signal voltage source capacity shortage.

Problem	Cause	Solution
Stop in the mid position.	There is a foreign object in the butterfly valve.	Remove a foreign object.
	Valve is distorted.	Replace the valve.
	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.
Alarm LED is lit.		
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 seat	Damaged on valve seat.	Replace the valve.
		Replace the seat F
Leakage from stem	O-ring is worn.	Replace the valve.
		Replace the O-ring F

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