



NIPPON VALVE CONTROLS, INC.

# Instruction manual

Electric Actuated Ball Valve BR VR GS TR LR L3

SP-1531

Please read this manual before installation and use.

## GENERAL

It composed of flange-end ball valve and high-power electric actuator.  
(proportional control)

### Actuator

PDX : For AC / DC power.

PHX : For AC / DC power.

### Valve

BR type For various fluids and general use.

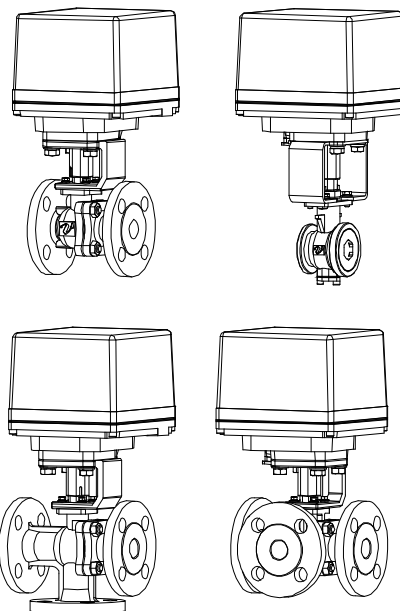
VR type For control

GS type For Wafer. (JIS 10K / 20K)

TR type For mixing / dividing.

LR type For mixing / dividing.

L3 type Trunnion structure. (L)



## PRODUCT CODE

BR type												
VR type												
(Standard port)												
GS type												
(V-port)												
(Full port)												
(Standard port)												
TR type												
LR type												
L3 type												
	(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) Ball material

T : SUS304 / SCS13A

U : SUS316 / SCS14A

### (10) Option

EA : Alarm output board

EI : 4 to 20 mA

Indication signal board

L0 : Auxiliary limit switch

L2 : Auxiliary limit switch

### (2) Valve

BR VR GS

TR LR L3

### (5) Connection

1 : JIS 10K

3 : JIS 20K

### (8) Seat material

F : F-PTFE

G : R-PTFE

R : R-F-PTFE

K : PEEK

I : API

C : R-PEEK

M : SUS316 + Stellite

P : R-PTFE

### (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

T : SCS13A

U : SCS14A








### (9) Size [mm]

ex. 25 A → 025












### (11) Input signal (PDX)

It corresponds to various control input signals.

## VALVES SPECIFICATIONS

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

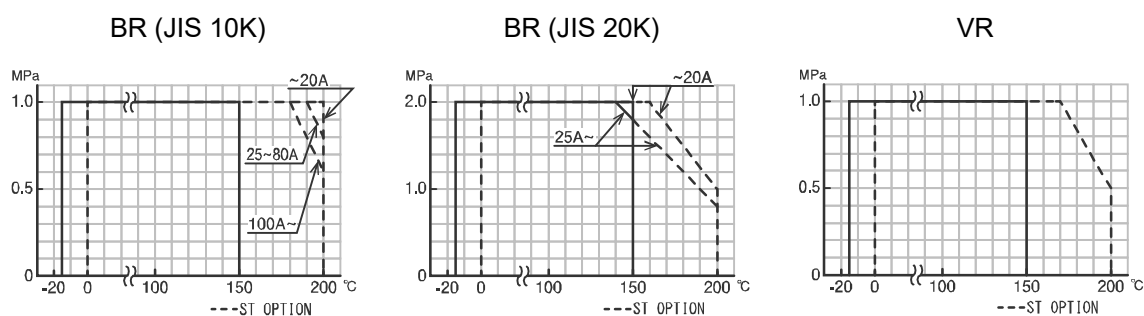
BR VR type

Valve type		BR			VR	
Design		2-way, Full port			2-way, V-port	
Connection		JIS10K Flanged-end		JIS20K Flanged-end	JIS10K Flanged-end	
Fluid		     			    	
Max pressure		1 MPa		2 MPa	1 MPa	
Size [mm]		015 to 100	015 to 150	015 to 080	R015	015 to 080
Material	Body	SCS14A	SCS13A	SCS13A	SCS14A	
	Ball	SCS14A	SCS13A	SCS13A	SUS316	SCS14A
	Seat	F-PTFE R-PTFE R-F-PTFE			R-PTFE	R-F-PTFE
Stem seal	Packing	R-PTFE			R-PTFE	
	O-ring	FKM			FKM	

The optional for steam fluids.

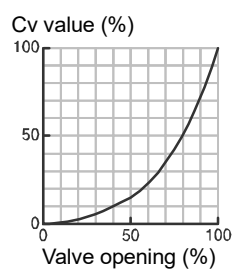
Valve type	Option code	O-ring
BR VR	ST	Replace (Steam resistant FKM)

## PRESSURE &amp; TEMPERATURE RATING



Note) Insulation options are required for use with fluids more than 150 °C.








## INHERENT FLOW CHARACTERISTIC (VR)








Range ability

VR-1UUG R 015	100:1
VR-1UUG - 015 to 080	50:1

## VALVES SPECIFICATIONS

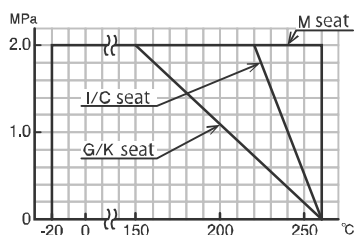
 Water
  Oil
  Air, Gas
  Steam
  Chemicals
  Sea water
  Slurry
  Negative pressure

GS type

Valve type	GS		
Design	2-way, Wafer		
	V-port	Full port	Standard port
Connection	JIS Flanges 10K / 20K		
Fluid	    		
Max pressure	2 MPa		
Size [mm]	V015 to V032	015 to 080	R040 to R150
Material	Body	SCS14A	
	Ball	SCS14A (HCr plated)	
	Seat	R-PTFE    PEEK    API    R-PEEK    SUS316 + Stellite	
Stem seal	Packing	R-PTFE	

Note) API cannot be used with steam fluid.

## PRESSURE &amp; TEMPERATURE RATING

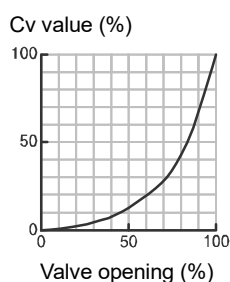


Note) • Option for use in fluid temperature more than 170 °C.  
 • We prefer to K seat depends on pressure or environmental conditions. Please consult us for your specifications.

## SEAT LEAKAGE VOLUME (JIS B 2005-4)

	Seat material	Leakage rate	Remarks
G	R-PTFE	None	
K	PEEK		
I	API		
C	R-PEEK	$10^{-4} \times \text{rated Cv value} \times 10^{-3}$ or less.	Class IV $\times 10^{-3}$ or less.
	R-PEEK (V-port)	$10^{-4} \times \text{rated Cv value} \times 10^{-3} \times 8$ or less.	Class IV $\times 10^{-3} \times 8$ or less.
M	SUS316 + Stellite	$10^{-4} \times \text{rated Cv value}$ or less.	Class IV or less.
	SUS316 + Stellite (V-port)	$10^{-4} \times \text{rated Cv value} \times 8$ or less.	Class IV $\times 8$ or less.








## INHERENT FLOW CHARACTERISTIC








## Range ability

GS-3UU□ V 015 to 032    50:1    (V-port)  
 GS-3UU□ - 015 to 080    200:1    (Full port)  
 GS-3UU□ R 040 to 150    100:1    (Standard port)

## VALVES SPECIFICATIONS

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

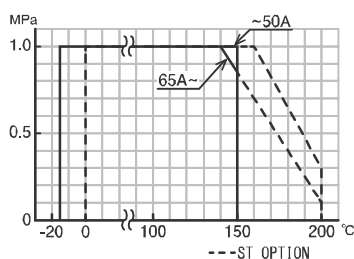
TR LR type

Valve type	TR LR	
Design	3-way, Full port	
Connection	JIS10K Flanged-end	
Fluid	    	
Max pressure	1 MPa	
Size [mm]	020 to 040	050 to 100
Material	Body	SCS13A
	Ball	SUS304 SCS13A
	Seat	R-PTFE
Stem seal	Packing	R-PTFE
	O-ring	FKM

The optional for steam fluids.

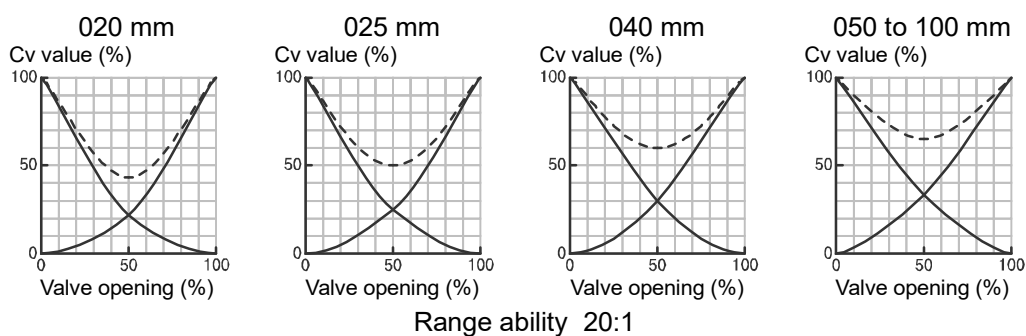
Valve type	Option code	O-ring
TR LR	ST	Replace (Steam resistant FKM)

## PRESSURE & TEMPERATURE RATING

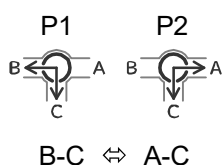


Note) Insulation options are required for use with fluids more than 150 °C.

## INHERENT FLOW CHARACTERISTIC



## FLOW PATHS (Position① / P1) (Position② / P2)








Note) When a closed path is exposed to high pressure, it may leak slightly to an open path.

VALVES SPECIFICATIONS

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

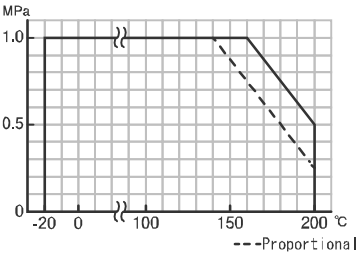
L3 type

Valve type		L3
Design		3-way, Full port
Connection		JIS10K Flanged-end
Fluid		    
Max pressure		1 MPa
Size [mm]		025 to 150
Material	Body	SCS13A
	Ball	SCS13A
	Seat	R-PTFE
Stem seal	Packing	PTFE

The optional for steam fluids.

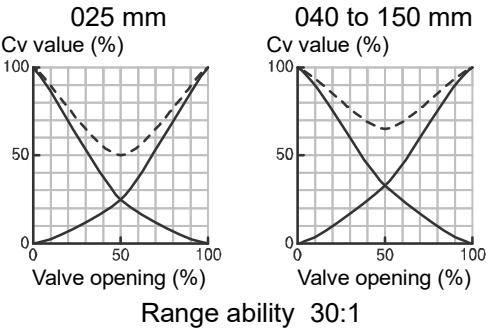
Valve type	Option code	O-ring
L3	ST-VF	Add (Steam resistant FKM)

PRESSURE & TEMPERATURE RATING

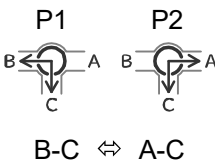


Note) Insulation options are required for use with fluids more than 170 °C.

INHERENT FLOW CHARACTERISTIC



FLOW PATHS (Position① / P1) (Position② / P2)



**ELECTRIC ACTUATOR SPECIFICATIONS**

3 way valve: SHUT / Position①, OPEN / Position②

PDX type

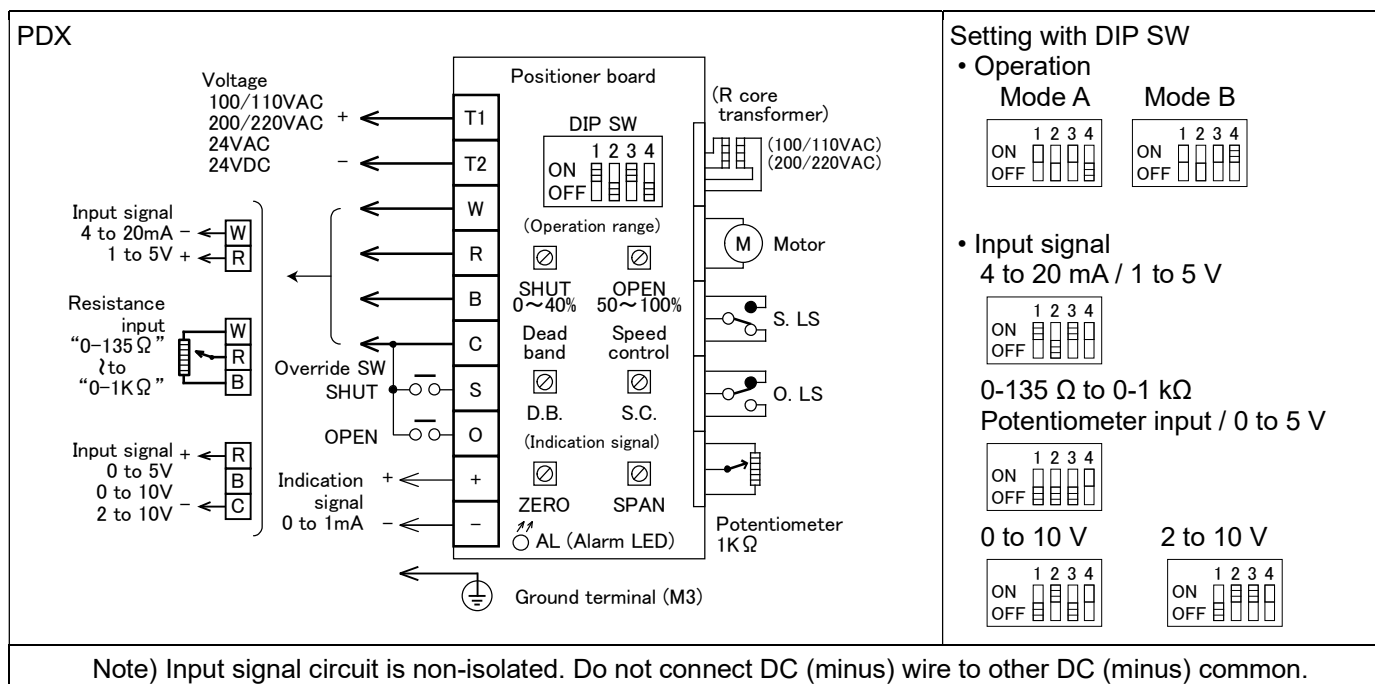
Actuator type (□:Voltage code)	PDX-300-□	PDX-700-□	PDX-02K-□	PDX-06K-□
Voltage	100 / 110 V AC ±10 % 50/60 Hz (Code: 1) 200 / 220 V AC ±10 % 50/60 Hz (Code: 2) 24 V AC ±10 % 50/60 Hz (Code: 3) 24 V DC (Code: 0)			
Rated torque [N·m]	21	50	140	400
Operation time [s]	6 to 20, Variable	15 to 50, Variable	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  $\rightarrow$  Potentiometer input or 0 to 5 V 0 to 10 V 2 to 10 V)\*2 Change by DIP switch. (Standard  $\rightarrow$  Mode B)

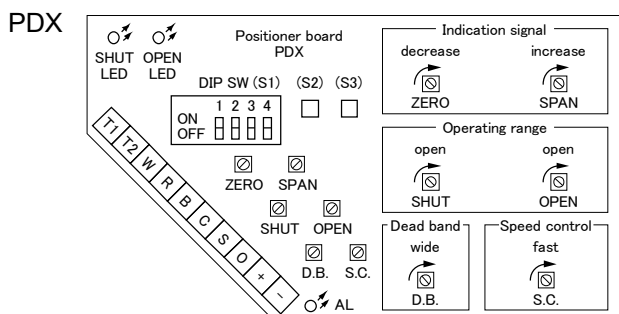
## ELECTRIC ACTUATOR SPECIFICATIONS

3 way valve: SHUT / Position①, OPEN / Position②

## WIRING



## 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.

PHX type

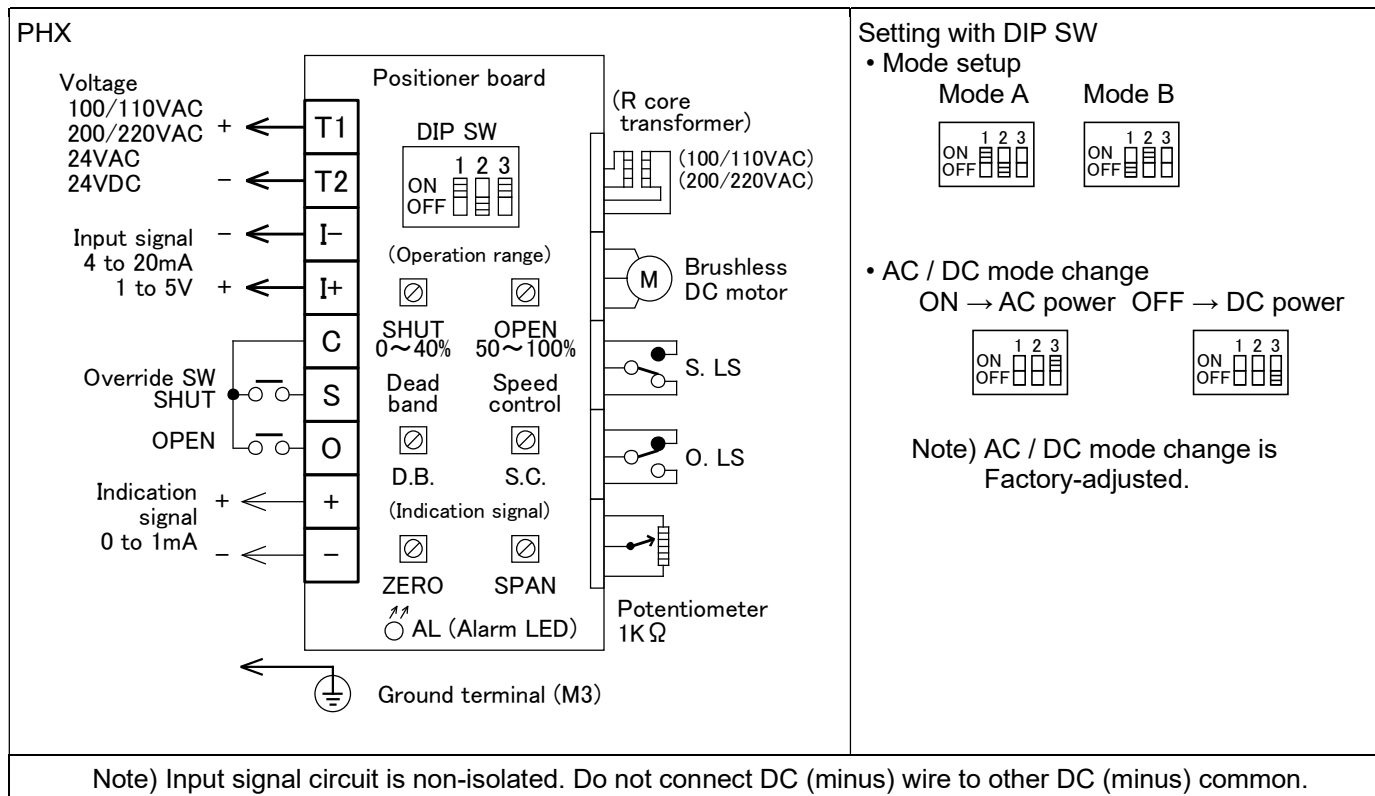
\*1 Change by DIP switch. (Standard → Mode B)



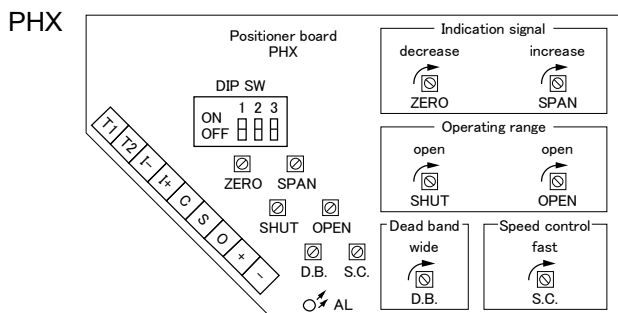
## ELECTRIC ACTUATOR SPECIFICATIONS

3 way valve: SHUT / Position①, OPEN / Position②

## 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**

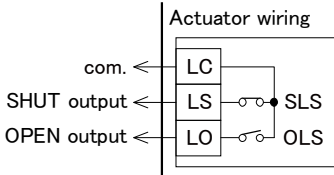
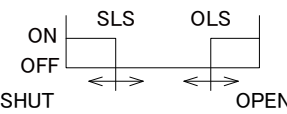
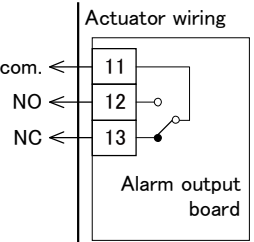
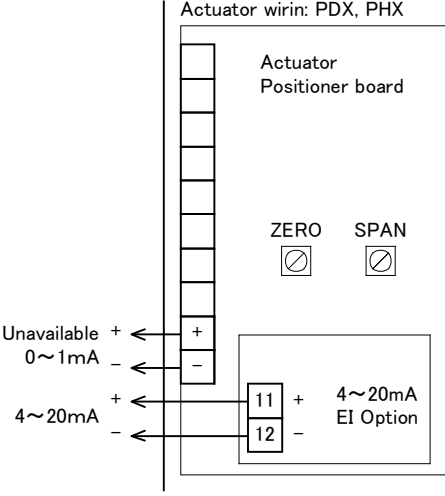
3 way valve: SHUT / Position①, OPEN / Position②

**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		L0	○	○	For standard signal
(Select limit switch depending on the load)		L2	○	○	For micro load signal
Alarm output board		EA	○	○	EI and EA
4 to 20 mA Indication signal board		EI	○	○	cannot be used together.

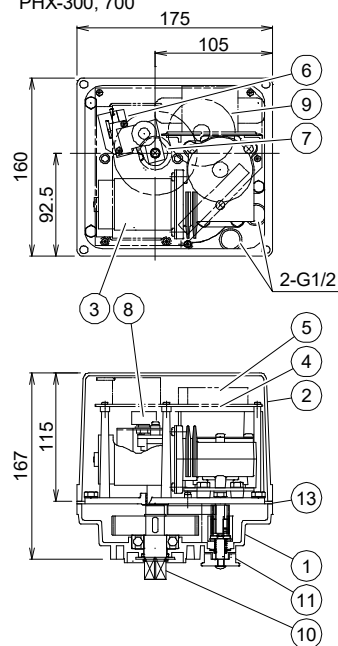
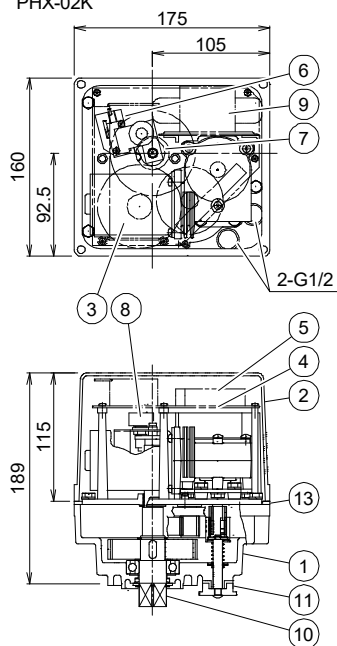
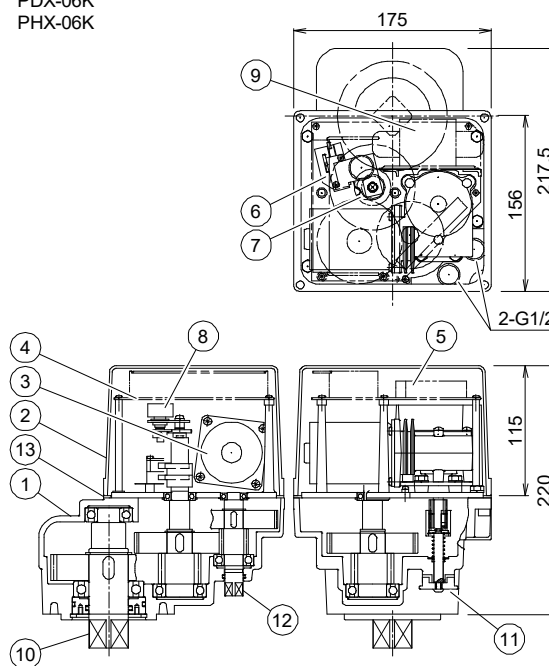
\*Auxiliary limit switch: Please refer to the specifications.

**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>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**

3 way valve: SHUT / Position①, OPEN / Position②

**DIMENSIONS****PDX PHX**PDX-300, 700  
PHX-300, 700PDX-02K  
PHX-02KPDX-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

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

#### 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.

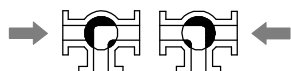
#### ③CHECKING

- 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 ball and seats.
- For valves with specified flow direction (GS, VR) or with ST / SC option, check the arrows on the product before piping.
- When the flow path is subjected to a high pressure from arrow, it may leak slightly to the low pressure port. (TR, LR)



#### 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.
- Tighten all bolts using crossover method to load the joint evenly.
- Wafer type ball valve is put between two seats of flanged-end and tightened with long bolts. (GS)

#### 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 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.

#### ④POSITIONING

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.

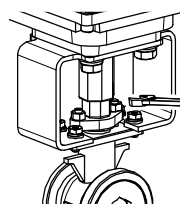
PDX PHX	More than 120 mm
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#### ⑤OTHER NOTES

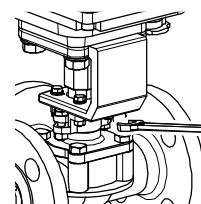
Until the wiring is completed there must be no condensation or flooding in the interior of the actuator, after piping. Protective caps on the cable gland are not waterproof.

#### ⑥CAUTIONS FOR MAINTENANCE (GS, L3)

Do not keep warm for maintenance of the valve gland.



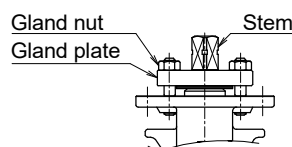
GS



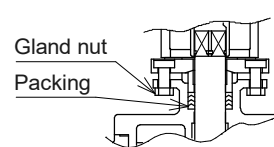
L3

#### TIGHTEN THE GLAND NUTS (GS, L3)

- 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.



GS



L3

Valve size [mm]				Recommended torques [N·m]
GS			L3	
V015 V020	015 020	-	-	2
V025 V032	025 032	R040	025	3.5
-	040 050	R050 R065	040 050	7
-	065 080	R080 R100	065 080	10
-	-	R125 R150	100 125	14
-	-	-	150	20

## 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  $\Omega$ . 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.

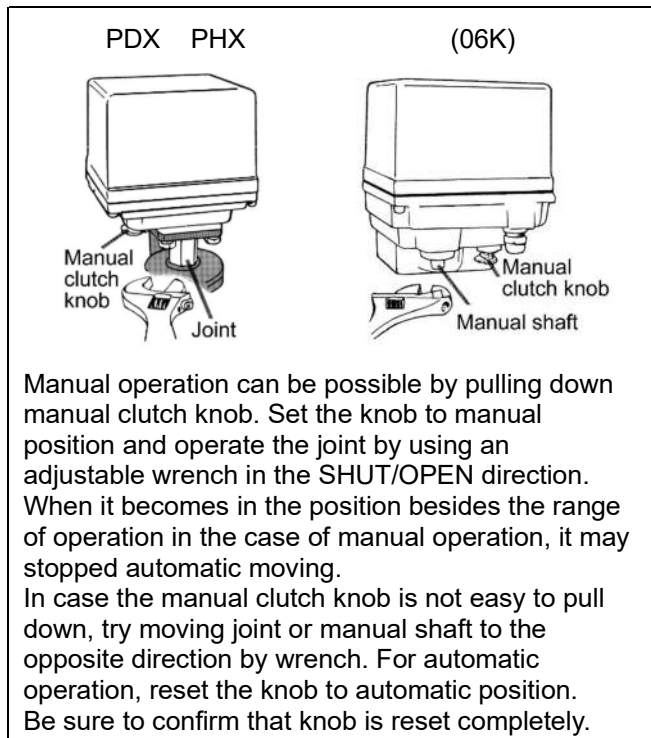
## INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

### MANUAL OPERATION

#### ①PRECAUTIONS

- 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



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"> <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.
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.

Problem	Cause	Solution
Stop in the mid position.	<ul style="list-style-type: none"> <li>• Biting of valve seat.</li> <li>• The scale has adhered to the valve ball.</li> </ul>	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.
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 valve body	<ul style="list-style-type: none"> <li>• Valve cap get loose.</li> <li>• Valve body is damaged.</li> </ul>	Replace the valve.
Leakage from valve seat	Seat is worn or damaged.	Replace the valve.
		Replace the valve seat.
Leakage from valve stem	Stem packing is worn or distorted.	Replace the valve.
		Replace the packing.
Leakage from valve gland GS L3	Gland packing is worn or distorted.	Tighten the gland nut.
		Replace the gland packing.

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