Electro-Pneumatic Positioner

**Vibration resistance**: No resonances 5 to 200Hz  
**Dust resistance**: Conforms to IEC 60529 IP65  

**Series IP8000/8100**  
(Lever type) (Rotary type)

- Fork lever joints (Rotary type)  
  Can absorb off-centering.
- A span adjuster achieves 1/2 split range
- Opening current transmission (4 to 20mA DC)  
  Can detect remote position, rotary type only.
- Mounting dimensions are same as conventional types, series IP6000/6100.

A centralized exhaust system employs the combination of the check valve and the labyrinth effect enhancing both dust resistance and water resistance performance.

100mm in height (shortened by 13% compared with IP6100)

- Pressure gauge (O.D. ø43)  
  Enlarged O.D. allows improved visibility.
- External scale plate (Rotary type)  
  Improved visibility of opening indicator.
- With terminal box  
  No terminal box also option also available.
Electro-Pneumatic Positioner

Series IP8000/8100

How to Order

Type
- 000 Lever type feedback
- 100 Rotary type

Pressure gauge
- 0 None
- 1 0.2MPa
- 2 0.3MPa
- 3 1.0MPa

Construction
- 0 No terminal box
- 1 With terminal box

Accessories
- A: ø0.7 Output restriction with pilot valve
- B: ø1.0 Output restriction with pilot valve
- C: Fork lever joint M
- D: Fork lever joint S
- E: For stroke 35 to 100mm with lever unit
- F: For stroke 50 to 140mm with lever unit
- G: Compensation spring (A)
- H: With external scale plate
- J: With opening current transmission (4 to 20mA DC) Clockwise operation
- JR: With opening current transmission (4 to 20mA DC) Counterclockwise operation

Note 1) If two or more accessories are required, the part numbers should be made according to alphabetical order. (ex. IP8000-011-AH)
Note 2) “A” is applied to approx 90cm³-capacity actuator. “B” is applied to approx 180cm³-capacity actuator.
Note 3) Standard lever is not attached.
Note 4) It is to be used together with “A” or “B” when tending to overshoot by the use of “A” or “B”.
Note 5) It is mounted to the body as a replacement of the standard compensation spring.
Note 6) Clockwise operation: The feedback shaft viewed from the positioner cover side moves clockwise in condition that the input signal and opening current transmission are increased. Counterclockwise operation: The feedback shaft moves counterclockwise in the above condition.

Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>IP8000</th>
<th>IP8100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Lever type lever feedback</td>
<td>Rotary type cam feedback</td>
</tr>
<tr>
<td>Single action</td>
<td>Double action</td>
<td>Single action</td>
</tr>
<tr>
<td>Double action</td>
<td></td>
<td>Double action</td>
</tr>
<tr>
<td>Input current</td>
<td>4 to 20mA (Note 1)</td>
<td></td>
</tr>
<tr>
<td>Input resistance</td>
<td>235±15Ω (4 to 20mA (DC)</td>
<td></td>
</tr>
<tr>
<td>Supply air pressure</td>
<td>0.14 to 0.7MPa</td>
<td></td>
</tr>
<tr>
<td>Standard stroke</td>
<td>10 to 85mm (Deflection angle 10 to 30°)</td>
<td>60 to 100° (Note 2)</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Within 0.1%F.S.</td>
<td>Within 0.5%F.S.</td>
</tr>
<tr>
<td>Linearity</td>
<td>Within ±1%F.S.</td>
<td>Within ±2%F.S.</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>Within 0.75%F.S.</td>
<td>Within 1%F.S.</td>
</tr>
<tr>
<td>Repeatability</td>
<td>Within 0.5%F.S.</td>
<td></td>
</tr>
<tr>
<td>Coefficient of temperature</td>
<td>Within 0.1%F.S. / °C</td>
<td></td>
</tr>
<tr>
<td>Supply pressure fluctuation</td>
<td>Within 0.3%F.S./0.01MPa</td>
<td></td>
</tr>
<tr>
<td>Output flow</td>
<td>80l/min (ANR) or more (SUP = 0.14MPa)</td>
<td>200l/min (ANR) or more (SUP = 0.4MPa)</td>
</tr>
<tr>
<td>Air consumption</td>
<td>5l/min (ANR) or less (SUP = 0.14MPa)</td>
<td>11l/min (ANR) or less (SUP = 0.4MPa)</td>
</tr>
<tr>
<td>Ambient and fluid temperature</td>
<td>–20 to 80°C</td>
<td></td>
</tr>
<tr>
<td>Air port</td>
<td>Rc 1/4 female</td>
<td></td>
</tr>
<tr>
<td>Electrical connection</td>
<td>G 1/2 female</td>
<td></td>
</tr>
<tr>
<td>Wiring method</td>
<td>Resin G 1/2 connector (option)</td>
<td></td>
</tr>
<tr>
<td>Exterior covering enclosure</td>
<td>JISF8007, IP65 (conforms to IEC Pub.529)</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Aluminum diecast body / epoxy resin</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>With terminal box 2.6kg (None 2.4kg)</td>
<td></td>
</tr>
</tbody>
</table>

Note 1) 1/2 Split range (Standard)
Note 2) Stroke adjustment: 0 to 60°, 0 to 100°
Accessory / Option

Pilot valve with output restriction (IP8000, 8100 type)

In general, mounting on a small-size actuator may cause hunting. For prevention, a pilot valve with a built-in output restriction is available. The restriction is removable.

<table>
<thead>
<tr>
<th>Actuator Capacity</th>
<th>Orifice size</th>
<th>Part number</th>
<th>Pilot unit part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>90cm³</td>
<td>ø0.7</td>
<td>P36801080</td>
<td>P565010-18</td>
</tr>
<tr>
<td>180cm³</td>
<td>ø1</td>
<td>P36801081</td>
<td>P565010-19</td>
</tr>
</tbody>
</table>

Fork lever joints (IP8100 type)

Two types of the fork lever joints are available dependent upon different mounting dimensions. This is recommended because it can absorb off-centering, compared with direct mounting type.

<table>
<thead>
<tr>
<th>Part name</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork lever assembly M</td>
<td>P368010-24</td>
</tr>
<tr>
<td>Fork lever assembly S</td>
<td>P368010-25</td>
</tr>
</tbody>
</table>

External feedback lever (IP8000 type)

Different feedback levers are available dependent upon valve strokes. Consult with SMC in case of 10mm or less stroke.

<table>
<thead>
<tr>
<th>Stroke</th>
<th>Unit number</th>
<th>Size M</th>
<th>Size N</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 to 85mm (Accessory &quot;Nil&quot;)</td>
<td>P368010-20</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td>35 to 100mm (Accessory &quot;E&quot;)</td>
<td>P368010-21</td>
<td>110</td>
<td>195</td>
</tr>
<tr>
<td>50 to 140mm (Accessory &quot;F&quot;)</td>
<td>P368010-22</td>
<td>110</td>
<td>275</td>
</tr>
</tbody>
</table>

Resin connector

Optional cable connectors are available for different cable sizes.

<table>
<thead>
<tr>
<th>Part name</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin-made cable clamp unit (A)</td>
<td>P368010-26</td>
</tr>
<tr>
<td>Resin-made cable clamp unit (B)</td>
<td>P368010-27</td>
</tr>
</tbody>
</table>

Cable connector (option)

<table>
<thead>
<tr>
<th>Part name</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin-made cable clamp unit (A)</td>
<td>P368010-26</td>
</tr>
<tr>
<td>Resin-made cable clamp unit (B)</td>
<td>P368010-27</td>
</tr>
</tbody>
</table>

Exploded View

Replacement Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Part no.</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pilot valve unit</td>
<td>P565010-7</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Base seal</td>
<td>P56501012-3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cover seal</td>
<td>P56501013</td>
<td>IP8000/8100</td>
</tr>
</tbody>
</table>
## Series IP8000/8100

### Piping

#### IP8000 / Lever type

<table>
<thead>
<tr>
<th>Single action</th>
<th>Double action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive operation</strong></td>
<td><strong>Reverse operation</strong></td>
</tr>
<tr>
<td>When the input signal is increased, the stem moves as allow mark.</td>
<td>When the input signal is increased, the stem moves as allow mark. (Positive valve operation by its reverse operation mode)</td>
</tr>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
</tr>
<tr>
<td>OUT2 is plugged.</td>
<td>OUT1 is plugged.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Diagram" /></td>
<td><img src="image4.png" alt="Diagram" /></td>
</tr>
<tr>
<td>OUT1 is plugged.</td>
<td>OUT2 is plugged.</td>
</tr>
</tbody>
</table>

#### IP8100 / Rotary type

<table>
<thead>
<tr>
<th>Single action</th>
<th>Double action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive operation</strong></td>
<td><strong>Reverse operation</strong></td>
</tr>
<tr>
<td>When the input signal is increased, the actuator shaft rotates in a clockwise direction.</td>
<td>When the input signal is increased, the actuator shaft rotates in a counter clockwise direction. (Reverse valve operation by its positive operation mode)</td>
</tr>
<tr>
<td><img src="image5.png" alt="Diagram" /></td>
<td><img src="image6.png" alt="Diagram" /></td>
</tr>
<tr>
<td>OUT2 is plugged.</td>
<td>OUT1 is plugged.</td>
</tr>
<tr>
<td><img src="image7.png" alt="Diagram" /></td>
<td><img src="image8.png" alt="Diagram" /></td>
</tr>
<tr>
<td>OUT1 is plugged.</td>
<td>OUT2 is plugged.</td>
</tr>
</tbody>
</table>

When the input signal is increased, the actuator shaft rotates in a clockwise direction.

When the input signal is increased, the actuator shaft rotates in a counter clockwise direction.

The cam of the positioner should be set on the DA surface.

The cam of the positioner should be set on the RA surface.
Installation

**IP8000 type (Lever type lever feedback)**

1. The unit should be mounted using bolts firmly fixed through mounting holes on the side or back of the positioner.

2. A connecting fitting or pin to transfer the displacement of valve stem should be mounted at a position so that the feedback lever is at right angles to the valve stem for an input current of 50%. The right figure is the configuration viewed from the front.

**Mounting examples**

![Mounting examples diagram]

**IP8100 type (Rotary type cam feedback)**

1. The positioner should be mounted so that the feedback shaft is aligned with the shaft of the rotary actuator.

**Mounting bracket conforming to DIN IEC 534**

Positioner IP8000 mounted using a bracket conforming to DIN IEC 534

Part number: **INI-224-0-56-1**

<table>
<thead>
<tr>
<th>No.</th>
<th>Qty.</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Pilot valve unit</td>
<td>INI-224-0-56</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Bolt</td>
<td>M8x16 DIN933-Zn5bkC8B</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>Bolt</td>
<td>M8x20 DIN933-Zn5bkC8B</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Nut</td>
<td>M8 DIN934-Zn5bkC8B</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>Washer</td>
<td>B8, 4 DIN125-Zn5bkC8B</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>Spring washer</td>
<td>B8 DIN127-Zn5bkC8B</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>Bracket</td>
<td>100 320-4480</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>Rod</td>
<td>M6x70</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>Nut</td>
<td>M6</td>
</tr>
</tbody>
</table>
When the input current increases, (11) the plate spring of (12) the torque motor will work as a pivot, (13) armature will receive a counter clockwise torque, (4) the counter weight will be pushed to the left, the clearance between (6) the nozzle and (5) the flapper will increase, and the nozzle back pressure will decrease. Consequently, (7) the exhaust valve of (1) the pilot valve moves to the right, the output pressure of OUT1 increases and (15) the diaphragm moves downwards. The motion of (15) the diaphragm acts on (10) the feedback spring through (8) the feedback lever, (14) the transmission lever and (9) the span adjustment lever to rest at the balance position generated by the input current. (2) The compensation spring is for direct feedback of the motion of (7) the exhaust valve to (4) the counter weight to increase the stability of the loop. The zero point should be adjusted by change of (3) the zero adjustment spring tension.

Single action positive operation

Block diagram
IP8100 / Rotary type

When the input current increases, (12) the plate spring of (13) the torque motor will work as a pivot, (14) the armature will receive a counter-clockwise torque, (4) the counter weight will be pushed to the left and the clearance between (6) the nozzle and (5) the flapper will increase, and the nozzle back pressure will decrease. Consequently, (7) the exhaust valve of (1) the pilot valve moves to the right, the output pressure of OUT1 increases that of OUT2 decreases and (16) the rotary actuator moves. The motion of (16) the actuator acts on (10) the feedback spring through (11) the feedback shaft, (8) the cam, (9) the span adjustment lever and (15) transmission lever to rest at the balance position generated by the input current. (8) the cam is set on the DA surface and operates positively while (16) the oscillating actuator shaft rotates in a clockwise direction when the input signal is increased. (2) The compensation spring is for direct feedback of the motion of (7) the exhaust valve to (4) the counter weight to increase the stability of the loop. The zero point should be adjusted by change of (3) the zero adjustment spring tension.

Double action positive operation

Block diagram
**Series IP8000/8100**

**Dimensions / IP8000 (Lever type)**

**IP8000-0□□0 (No terminal box)**

**IP8000-0□□1 (With terminal box)**

View A

With optional resin cable clamp
Applicable cable O. D.: ø7 to 9: P368010-26
Applicable cable O. D.: ø9 to 11: P368010-27

**Electric conduit 2 x G1/2**
Dimensions / IP8100 (Rotary type)

IP8100-0□0 (No terminal box)

View A

4 x M8 depth12
Female for rear mounting

2 x M8 depth12
Female for side mounting

With optional resin cable clamp
Applicable cable O. D. ø7 to 9: P368010-26
Applicable cable O. D. ø9 to 11: P368010-27

At accessory “H”:
(with external scale plate)

OUT1.Rc1/4
SUP.Rc1/4

OUT2.Rc1/4

IP8100-0□1 (With terminal box)

View A

2 x G1/2
Electric conduit

4 x M8 depth12
Female thread for rear mounting

2 x M8 depth12
Female thread for side mounting

At accessory “H”:
(with external scale plate)

OUT1.Rc1/4
SUP.Rc1/4

OUT2.Rc1/4

G1/2
Electric conduit
These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of "Caution", "Warning" or "Danger". To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

⚠️ Caution : Operator error could result in injury or equipment damage.

⚠️ Warning : Operator error could result in serious injury or loss of life.

⚠️ Danger : In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power – General rules relating to systems
Note 2) JIS B 8370: Pneumatic system axiom

### Warning

1. **The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.**
   Since the products specified here are used in various operating conditions, their compatibility with the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalogue information with a view to giving due consideration to any possibility of equipment failure when configuring a system.

2. **Only trained personnel should operate pneumatically operated machinery and equipment.**
   Compressed air can be dangerous if handled incorrectly. Assembly, handling or maintenance of pneumatic systems should be performed by trained and experienced operators.

3. **Do not service machinery/equipment or attempt to remove components until safety is confirmed.**
   1. Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of the driven object have been confirmed.
   2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
   3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back pressure.)

4. **Contact SMC if the product is to be used in any of the following conditions:**
   1. Conditions and environments beyond the given specifications, or if product is used outdoors.
   2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, clutch and brake circuit in press applications, or safety equipment.
   3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.
Electro-Pneumatic Positioner Precautions

Be sure to read before handling.

### Operation

**Warning**

1. Do not operate the positioner outside the specified range as this may cause problems. (Refer to the specifications.)
2. Design the system to include a safety circuit to avoid the risk of danger should the positioner suffer failure.
3. Covers for the terminal and body should be in place while operating.

**Caution**

1. Avoid impact to the positioner body or torque motor and any excessive force to the armature, as these actions may cause damage to the product.
   - Handle carefully while transporting and operating.
2. When exposed to possible moisture invasion, please take the necessary measures. For example, if the positioner is left on-site for long periods, a plug should be put in the piping port and an external cover fitted to avoid water penetration.
   - Take measures to avoid dew condensation inside the positioner if exposed to high temperature and humidity. Take enough measures against condensation especially when packing for export.
3. Keep magnetic field off the positioner, as this affects its characteristics.

**Air Supply**

**Caution**

1. Use only dehumidified and dust-extracted clean compressed clean air as the positioner contains extra-fine orifices such as restrictor and nozzle.
   - Do not use a lubricator.
2. Do not use compressed air containing chemicals, organic solvents, salinity or corrosive gases, as this may cause malfunction.
3. Use dehumidified and dust-extracted clean compressed air as an air supply.
4. When operating below the freezing point, protect the positioner from freezing.
5. Piping
   - Before piping make sure to clean away all chips, cutting oil, dust etc.
   - When installing piping or fitting into a port, ensure that sealant material does not enter the port inside.
   - When using seal tape, leave 1.5 to 2 threads exposed on the end of the pipe fitting.
6. Lubrication
   - The positioner has a fixed orifice and nozzle, which contain fine paths in them. Use filtered, dehydrated air and avoid the use of lubricators as this may cause malfunction of the positioner.
   - Ensure that the air supply system is filtered to 5 micron.

### Maintenance

**Warning**

1. After installation, repair or disassembly, connect compressed air and conduct tests to confirm appropriate function and leakage.
   - Do not use the positioner when noise from the bleeder sounds louder compared with the initial state, or when it does not operate normally. If these occur, check immediately if assembled and mounted correctly.
   - Never modify electrical construction.

**Caution**

1. Confirm whether the compressed air is clean.
   - Dust, oil, or moisture mixed within the equipment may result in malfunction and positioner problems. Perform periodic inspection of the air preparation equipment to ensure clean air is always supplied.
2. Improper handling of compressed air is dangerous. Not only observing the product specifications, but also replacement of elements and other maintenance activities should be performed by personnel having sufficient knowledge and experience pertaining to instrumentation equipment.
3. Perform annual inspections of the positioner.
   - Replace badly damaged seals and units such as diaphragm and O-ring during the inspection.
   - When used in tough environmental and/or service conditions such as seaside locations, replacements should be undertaken more frequently.
4. When performing inspections, demounting the positioner, or replacing the elements with the positioner still in its mounted position, first, stop the compressed air, then exhaust the residual pressure before undertaking operation.
5. Should the restrictor become clogged with carbon particles, etc., demount automatic/manual change-over screw (with built-in restrictor) and clean it using a ø0.2 wire.
   - Stop the compressed air and remove the screw to switch the pilot valve off before replacing the restrictor.
6. Apply just a small amount of grease to sliding parts (O-ring and exhaust valve) when disassemble a pilot valve.
   - Use silicone grease, for example, SH45 produced by Du Pont-Toray Co., Ltd.
7. Confirm air leakage from compressed air piping and junctions.
   - Air leakage from air piping results in reduced operational performance and a decline of characteristics, etc.
   - It is structurally necessary for air to be released from the bleeder, it is not abnormal as long as the air consumption is within the specified range.

### Installation

**Warning**

1. Do not install unless the safety instructions have been read and understood.
2. Since zero-point varies depending on the mounting position, the zero point should be adjusted after installation.
3. Avoid hitting the product with metallic objects!
4. Avoid using this product in non-explosive environments which can become explosive due to air leakage!