Electro-Pneumatic Positioner/Smart Positioner
(Lever type / Rotary type)

**Dustproof / Waterproof**
Passed by external organization on JIS F8007 (conforms to IEC 60529) IP65

A centralized exhaust system employs the combination of the check valve and the labyrinth effect enhancing both dustproof and waterproof performance.

**Monitoring function**

Electro-Pneumatic Positioner
- Opening current transmission analog (4 to 20 mA DC) continuous output

Smart Positioner
- Alarm point output function (2 points)
- Analog (4 to 20 mA DC) continuous output

**With internal opening indicator plate (X14 only)**

**Body with LCD window**
(Smart Positioner)

**With external scale plate (Rotary type)**

**Explosion-proof construction**

<table>
<thead>
<tr>
<th></th>
<th>Electro-Pneumatic Positioner</th>
<th>Smart Positioner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TIIS explosion-proof construction (Exd II BT5)</td>
<td>ATEX intrinsically safe explosion-proof construction (II 2G Ex ia II CT5/T6)</td>
</tr>
</tbody>
</table>

**Electro-Pneumatic Positioner**
- Universal mechanically controlled type
  - Series IP8000/8100

**New**
**Smart Positioner**
- Electronically controlled easy-adjustment transmitting type
  - Series IP8001/8101
Smart Positioner

Series IP8001/8101 added!

Built-in microcomputer and sensor allows easy remote parameter change and monitoring.

- Internal push button for easy setting of various parameters (Refer to parameter list)
- Zero point/span adjustment easier than with previous mechanical positioners

<table>
<thead>
<tr>
<th>Parameter List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes</td>
</tr>
<tr>
<td>Standard equipped functions</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Optional equipped functions</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Full Output Functions
Selecting models with output functions by model selection selects with alarm point output function (2 points) and analog (4 to 20 mA DC) continuous output function. This will allow remote detection of operating abnormalities.

Control State Display
Positioning, deviation, and input value are displayed (numerically) on the internal LCD, allowing visual verification of the control state.

Display example

<table>
<thead>
<tr>
<th>Positioning (%)</th>
<th>Input value (%)</th>
<th>Deviation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P 50.0</td>
<td>S 60.0</td>
<td>E 10.0</td>
</tr>
</tbody>
</table>

Features

- Handles 2-line Input for Existing Equipment
  Control furnished with conventional 2-line input signal (4 to 20 mA DC) not requiring separate power source.

- HART Transmission Function
  HART transmission function can be designated by model selection. Allows remote monitoring and setting change of positioner.

- Intercompatible Installation
  Dimensions of mounting parts same as previous mechanical series IP6000/IP8000 Electro-Pneumatic Positioner. External feedback lever and fork lever-type fitting for joining actuator and positioner are therefore also the same.

- Energy-saving
  Lever-type features 60% reduced air flow consumption compared with IP8000.
Electro-Pneumatic Positioner
(Lever type / Rotary type)
Series IP8000/8100

How to Order

ATEX directive compliance and connection

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Option</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>—</td>
<td>IP8000-X14, IP8100-X14</td>
</tr>
<tr>
<td>L</td>
<td>Low temperature (-40 to 60°C)</td>
<td>—</td>
</tr>
<tr>
<td>W</td>
<td>With internal opening indicator plate</td>
<td>—</td>
</tr>
</tbody>
</table>

IP8000 0 1 0 — — X14 —

IP8100 0 1 0 — —

Pressure gauge

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>0.2 MPa</td>
</tr>
<tr>
<td>2</td>
<td>0.3 MPa</td>
</tr>
<tr>
<td>3</td>
<td>1.0 MPa</td>
</tr>
</tbody>
</table>

Type

- **000** Electro-pneumatic lever type
- **100** Electro-pneumatic rotary type

Pressure gauge

- **0** None
- **1** 0.2 MPa
- **2** 0.3 MPa
- **3** 1.0 MPa

Connection

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Air</th>
<th>Electric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>M</td>
<td>Rc1/4</td>
<td>G1/2</td>
</tr>
<tr>
<td>N</td>
<td>Rc1/4</td>
<td>1/2NPT</td>
</tr>
<tr>
<td>1</td>
<td>1/4NPT</td>
<td>G1/2</td>
</tr>
<tr>
<td>2</td>
<td>1/4NPT</td>
<td>M20 x 1.5</td>
</tr>
<tr>
<td>3</td>
<td>1/4NPT</td>
<td>1/2NPT</td>
</tr>
<tr>
<td>4</td>
<td>G1/4</td>
<td>G1/2</td>
</tr>
<tr>
<td>5</td>
<td>G1/4</td>
<td>M20 x 1.5</td>
</tr>
<tr>
<td>6</td>
<td>G1/4</td>
<td>1/2NPT</td>
</tr>
</tbody>
</table>

Accessories

- **Nil** None (Standard)
- **A** 0.7 Output restriction with pilot valve
- **B** 1.0 Output restriction with pilot valve
- **C** Fork lever-type fitting M
- **D** Fork lever-type fitting S
- **E** For stroke 35 to 100 mm with lever unit
- **F** For stroke 50 to 140 mm with lever unit
- **G** Compensation spring (A)
- **H** With external scale plate
- **J** With opening current transmission (4 to 20 mA DC), Positive operation
- **JR** With opening current transmission (4 to 20 mA DC), Reverse operation

**Note 1)** For construction No.1 (with terminal box), the ambient and fluid temperatures are as follows:
- Exd II BT5 — 20 to 60°C
- Non-explosion proof (non hazardous locations only) — 20 to 80°C

**Note 2)** If two or more accessories are required, the part numbers should be made in alphabetical order. (ex. IP8100-011-AG)

**Note 3)** "A" is applied to approx 90cm³-capacity actuator.

**Note 4)** Fork lever-type fitting MX (Connection thread: M6 x 1) for IP8100-0

**Note 5)** Fork lever-type fitting SX (Connection thread: M6 x 1) for IP8100-C3-C-X14.

**Note 6)** Standard lever is not attached.

**Note 7)** It is to be used together with "A" or "B" when tending to overshoot by the use of "A" or "B".

It is mounted to the body as a replacement of the standard compensation spring.

**Note 8)** Symbol JUR is with terminal box, non-explosion proof specification. Select 1 for Construction. Positive operation signifies clockwise rotational direction by the main actuator shaft when positioner cover is viewed from the front.

**Note 9)** Combination of L and W is not available.
Smart Positioner
(Lever type / Rotary type)

Series IP8001/8101

How to Order

ATEX directive compliance
52
ATEX directive category 1
Intrinsically safe explosion-proof item

IP8001
03
0
4
3

Note) Scheduled availability for 2009

ATEX temperature
Symbol
Nil
M
N
1
2
3
4
5
6

ATEX temperature
T4
T5/T6

Applicable model
IP8001
IP8101

Connection
Symbol
Nil
M
N
1
2
3
4
5
6

Applicable model
Rc1/4
Rc1/4
1/4NPT
1/4NPT
1/4NPT
1/2NPT
G1/4
M20 x 1.5
G1/2
G1/2
M20 x 1.5
1/2NPT

Note) When the symbol is M, 2, or 5 for 52-ATEX directive items, a blue cable gland is included with the electrical connection.

CE marking
Nil
Q

CE marked product

Specifications
Symbol
Pressure gauge
1
0.2 MPa
2
0.3 MPa
3
1.0 MPa

Applicable model
IP8001
IP8101

Accessories
Symbol
NIL
C
D
E
F
H
W

Applicable model
IP8001
IP8101

Note 1) If two or more accessories are required, the part numbers should be given in alphabetical order. (ex: IP8101-010-CH)

Note 2) Standard lever is not attached.

Note 3) Combination with 52-IP8101 scheduled for availability in 2009.

Notes:
- Note 1)
- Note 2)
- Note 3)
## Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>IP8000</th>
<th>IP8100</th>
<th>IP8001</th>
<th>IP8101</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Electro-Pneumatic Positioner</td>
<td>Smart Positioner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lever type lever feedback</td>
<td>Single action</td>
<td>Double action</td>
<td>Single action</td>
<td>Double action</td>
</tr>
<tr>
<td>Rotary type cam feedback</td>
<td>Single action</td>
<td>Single action</td>
<td>Double action</td>
<td>Double action</td>
</tr>
<tr>
<td><strong>Input current</strong></td>
<td>4 to 20 mA DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Min. operating current</strong></td>
<td>—</td>
<td>3.85 mA DC or more</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Intra-terminal voltage</strong></td>
<td>—</td>
<td>12 V DC (equivalent to 600 Ω input resistance, at 20 mA DC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Max. supplied power</strong></td>
<td>—</td>
<td>1 W (Imax: 100 mA DC, Vmax: 28 V DC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Input resistance</strong></td>
<td>235 ±15 Ω (4 to 20 mA DC)</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supply air pressure</strong></td>
<td>0.14 to 0.7 MPa</td>
<td>0.3 to 0.7 MPa</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Standard stroke</strong></td>
<td>10 to 85 mm (allowable deflection 10 to 30°)</td>
<td>60 to 100° (Note 3)</td>
<td>10 to 85 mm (allowable deflection 10 to 30°)</td>
<td>60 to 100° (Note 3)</td>
</tr>
<tr>
<td><strong>Sensitivity</strong></td>
<td>Within 0.1% F.S.</td>
<td>Within 0.5% F.S.</td>
<td>Within 0.2% F.S.</td>
<td>Within 0.1% F.S.</td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>Within ±1% F.S.</td>
<td>Within ±2% F.S.</td>
<td>Within ±1% F.S.</td>
<td>Within ±1% F.S.</td>
</tr>
<tr>
<td><strong>Hysteresis</strong></td>
<td>Within ±2% F.S.</td>
<td>Within ±1% F.S.</td>
<td>Within ±1% F.S.</td>
<td>Within ±1% F.S.</td>
</tr>
<tr>
<td><strong>Coefficient of temperature</strong></td>
<td>Within 0.1 F.S./°C</td>
<td>Within 0.05 F.S./°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supply pressure fluctuation</strong></td>
<td>Within 0.3% F.S./0.01 MPa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Output flow</strong></td>
<td>800 d/min (ANR) or more (SUP = 0.14 MPa)</td>
<td>2000 d/min (ANR) or more (SUP = 0.4 MPa)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Air consumption</strong></td>
<td>5 d/min (ANR) or less (SUP = 0.14 MPa)</td>
<td>11 d/min (ANR) or less (SUP = 0.4 MPa)</td>
<td>2 d/min (ANR) or less (SUP = 0.14 MPa)</td>
<td>4 d/min (ANR) or less (SUP = 0.4 MPa)</td>
</tr>
<tr>
<td><strong>Ambient and fluid temperature</strong></td>
<td>TIIS explosion-proof: −20 to 60°C</td>
<td>ATEX intrinsically safe explosion-proof: −20 to 80°C (T4/T5)</td>
<td>−20 to 60°C (T6)</td>
<td>−40 to 80°C (T6) (L type low-temperature specification)</td>
</tr>
<tr>
<td><strong>Explosion proof construction</strong></td>
<td>ATEX intrinsically safe explosion-proof construction (Exd II BT5)</td>
<td>ATEX intrinsically safe explosion-proof construction (Exd II CT5/T6)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>ATEX intrinsically safe explosion-proof parameter (current circuit)</strong></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Alarm ON</strong></td>
<td>1.2 mA DC or less (Note 1)</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Alarm OFF (Leakage current)</strong></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Response time</strong></td>
<td>50 msec or less</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**Note 1:** Specification values are given at normal temperature (20°C).

**Note 2:** While there is no output changes due to pressure fluctuations, when the pressure supply setting is changed following calibration, once again adjust balance current and perform calibration.

**Note 3:** Ambient and fluid temperature (allowable deflection).

**Note 4:** Characteristics relating to accuracy differ depending on combination with other constituent loop equipment, such as positioners and actuators.

**Note 5:** Model selection required for explosion proof construction and HART transmission.

**Note 6:** Thread type can be specified by model selection.

## Optional Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>IP8000-01-L52408 (Non-explosion proof)</th>
<th>IP8100-01-L52408</th>
<th>52-IP8001-L52408</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Electro-Pneumatic Positioner</td>
<td>Smart Positioner</td>
<td></td>
</tr>
<tr>
<td><strong>Wiring</strong></td>
<td>2-line</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Output signal</strong></td>
<td>4 to 20 mA DC</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Power supply voltage</strong></td>
<td>12 to 35 V DC</td>
<td>10 to 28 V DC</td>
<td>5 to 28 V DC</td>
</tr>
<tr>
<td><strong>Load resistance</strong></td>
<td>Power supply voltage × 12 V = 20 mA DC or less</td>
<td>0 to 750 Ω</td>
<td>—</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±2% F.S. or less (Note 1)</td>
<td>±0.5% F.S. or less (Note 2)</td>
<td>—</td>
</tr>
<tr>
<td><strong>Hysteresis</strong></td>
<td>Within 1% F.S.</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**Note 1:** Indicates analog output accuracy with respect to actuator angle.

**Note 2:** Indicates analog output accuracy with respect to LCD display position value (P value).
Accessory / Option

Pilot valve with output restriction (IP8000 / 8100)
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>
<th>Model selection accessory</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 cm³</td>
<td>ø0.7</td>
<td>P36801080</td>
<td>P565010-18</td>
<td>A</td>
</tr>
<tr>
<td>180 cm³</td>
<td>ø1</td>
<td>P36801081</td>
<td>P565010-19</td>
<td>B</td>
</tr>
</tbody>
</table>

Note) Output orifice not required for Smart Positioner regardless of actuator capacity.

Fork lever-type fittings (IP8100 / 8101)
2 kinds of rotary type IP8100/8101 fork lever-type fittings, that differ by installation dimensions dependent on bracket installation method, and 2 kinds of installation portion thread sizes, are available. When installing on the side surface, using fork lever assembly M provides interchangeability with the installation dimensions of SMC IP610 positioner. When installing on the rear surface, using fork lever assembly S also provides interchangeability with the installation dimensions of SMC IP610 positioner.

<table>
<thead>
<tr>
<th>Part name</th>
<th>Unit number</th>
<th>Installation portion thread size</th>
<th>Model selection accessory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork lever assembly M</td>
<td>P368010-24</td>
<td>M8 x 1.25</td>
<td>C</td>
</tr>
<tr>
<td>Fork lever assembly S</td>
<td>P368010-25</td>
<td>M6 x 1</td>
<td>D</td>
</tr>
<tr>
<td>Fork lever assembly MX</td>
<td>P368010-36</td>
<td>M6 x 1</td>
<td>C (Note)</td>
</tr>
<tr>
<td>Fork lever assembly SX</td>
<td>P368010-37</td>
<td>M6 x 1</td>
<td>D (Note)</td>
</tr>
</tbody>
</table>

Note) Installation portion thread size is M6 x 1 for IP8100-0-X14 when accessory C or D are selected.

External feedback lever (IP8000 / 8001)
Different feedback levers are available dependent upon valve strokes. Order according to the valve stroke.

<table>
<thead>
<tr>
<th>Stroke</th>
<th>Unit number</th>
<th>Size M</th>
<th>Size N</th>
<th>Model selection accessory</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 to 85 mm</td>
<td>P368010-20</td>
<td>125</td>
<td>150</td>
<td>Standard accessory</td>
</tr>
<tr>
<td>35 to 100 mm</td>
<td>P368010-21</td>
<td>110</td>
<td>195</td>
<td>E</td>
</tr>
<tr>
<td>50 to 140 mm</td>
<td>P368010-22</td>
<td>110</td>
<td>275</td>
<td>F</td>
</tr>
<tr>
<td>6 to 12 mm</td>
<td>P368010-260</td>
<td>75</td>
<td>75</td>
<td>Available as special order</td>
</tr>
</tbody>
</table>

Resin connector (Non-explosion proof specification)
Optional cable connectors are available for different cable sizes. These are not for explosion proof applications. Recommended for use with indoor applications.

<table>
<thead>
<tr>
<th>Part name</th>
<th>Part number</th>
<th>Suited cable outer diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resin-made cable clamp unit (A)</td>
<td>P368010-26</td>
<td>ø7 to ø9</td>
</tr>
<tr>
<td>Resin-made cable clamp unit (B)</td>
<td>P368010-27</td>
<td>ø9 to ø11</td>
</tr>
</tbody>
</table>

Part name
Resin-made cable clamp unit (A)
Resin-made cable clamp unit (B)

Cable connector
G1/2
Exploded View

IP8000

- Body cover unit
- Feedback spring
- Mini-terminal unit (No terminal box)
- Span adjusting unit
- Torque motor unit
- Feedback shaft assembly
- Body unit

Terminal joint unit (No terminal box)

Terminal box unit

Pilot valve unit

Zero adjusting unit

Gain suppression spring

Cover seal

Replacement Parts (Common for IP8000/8100)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pilot valve unit</td>
<td>P565010-7</td>
</tr>
<tr>
<td>2</td>
<td>Base seal</td>
<td>P565010-48</td>
</tr>
<tr>
<td>3</td>
<td>Cover seal</td>
<td>P56501012-3</td>
</tr>
</tbody>
</table>

IP8101

- Body cover unit
- Base unit
- Balance spring unit
- Base bracket unit
- Potentiometer unit
- Feedback shaft unit
- Fork pin unit
- Fork lever assembly
- Torque motor unit
- Body unit

Double joint unit

Lead wire guard

Terminal joint unit

Pilot valve unit

Zero adjusting unit

Cover unit for base

Replacement Parts (Common for IP8001/8101)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pilot valve unit</td>
<td>P565010-322</td>
</tr>
<tr>
<td>2</td>
<td>Base seal</td>
<td>P565010-303</td>
</tr>
<tr>
<td>3</td>
<td>Cover seal</td>
<td>P56501012-3</td>
</tr>
</tbody>
</table>

Series IP8

Electro-Pneumatic Positioner

Smart Positioner

IP8000/8100

IP8001/8101

Replacement Parts (Common for IP8000/8100)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pilot valve unit</td>
<td>P565010-7</td>
</tr>
<tr>
<td>2</td>
<td>Base seal</td>
<td>P565010-48</td>
</tr>
<tr>
<td>3</td>
<td>Cover seal</td>
<td>P56501012-3</td>
</tr>
</tbody>
</table>

Replacement Parts (Common for IP8001/8101)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pilot valve unit</td>
<td>P565010-322</td>
</tr>
<tr>
<td>2</td>
<td>Base seal</td>
<td>P565010-303</td>
</tr>
<tr>
<td>3</td>
<td>Cover seal</td>
<td>P56501012-3</td>
</tr>
</tbody>
</table>
Piping

Note) When the input signal is discontinued, the pressure of OUT1 decreases, and the pressure of OUT2 increases.

**IP8000 / Lever type**

<table>
<thead>
<tr>
<th>Single action</th>
<th>Double action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive operation</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>Reverse operation</td>
<td>When the input signal is increased, the stem moves as allow mark. (Reverse valve operation by its positive operation mode)</td>
</tr>
</tbody>
</table>

**IP8100 / Rotary type**

<table>
<thead>
<tr>
<th>Single action</th>
<th>Double action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive operation</td>
<td>When the input signal is increased, the actuator shaft rotates in a clockwise direction. (Positive valve operation by its reverse operation mode)</td>
</tr>
<tr>
<td>Reverse operation</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>
</tbody>
</table>
### IP8001 / Lever type

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

### IP8101 / Rotary type

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

**IP8000/8001 (Lever type)**

1. Create brackets that are appropriate for the positioner and diaphragm valve mounting methods, and affix it firmly using the mounting hole on the side or rear surface.

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

3. Brackets for lever type positioners, which are compliant with NAMUR and DIN/IEC 60534-6-1 are now available.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bracket (NAMUR compliant) single unit</td>
<td>INI-224-0-56</td>
</tr>
<tr>
<td>Bracket (NAMUR compliant) kit Note)</td>
<td>INI-224-0-56-1</td>
</tr>
</tbody>
</table>

Note) Kits that include the bracket (NAMUR compliant) and mounting threads are also available. Delivery will be from SMC Germany.

**IP8100/8101 (Rotary type)**

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

**IP8000 / Lever type**

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 gain suppression 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

For reverse position, exchange the shaft of the span adjusting lever to the opposite side. The span adjusting screw faces upward in this condition. (See “Piping”)
Principle of Operation

IP8100 / Rotary type

When the input current increases, (12) the plate spring of (13) the torque motor will work as a pivot, (14) 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 gain suppression 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

For reverse position, set by turning over the cam and reversing connections of outlets OUT1 and OUT2.

Block diagram
IP8001 / Lever type

When the input current increases, the electrical current inside (12) the torque motor coil will change through (8) the plate's input process, operation process and output process, and (13) the armature will oscillate, with (11) the plate spring as its base. As a result, 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 causes (15) the diaphragm valve to move. The motion of (15) the diaphragm valve is transmitted to the displacement output process of (8) the board through (14) the feedback lever, (10) the feedback shaft and (9) angle sensor, and the calculated output position will match the input current.

Single action positive operation

Block diagram
Principle of Operation

**IP8101 / Rotary type**

When the input current increases, the electrical current inside (12) the torque motor coil will change through (8) the plate's input process, operation process and output process, and (13) the armature will oscillate, with (11) the plate spring as its base. As a result, 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 causes the output pressure of OUT2 to decrease, causing (14) the oscillating actuator to move. The motion of (14) the oscillating actuator is transmitted to the fork lever-type fitting, (10) the feedback shaft (9) angle sensor, and the displacement output process of (8) the board, and output position will match the input current.

**Single action positive operation**
Dimensions / IP8000 (Lever type)

IP8000-0□0 (Without terminal box)

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

With plug

OUT2.1/4 (Rc, NPT, G)

OUT1.1/4 (Rc, NPT, G)

SUP.1/4 (Rc, NPT, G)

1/2 (G, NPT), M20

Female thread for side mounting

Female thread for rear mounting

4 x M8 x 1.25 depth 12

2 x M8 x 1.25 depth 12

Female thread for rear mounting

Female thread for side mounting

At accessory "E": 110

At accessory "F": 110

At accessory "E": 195

At accessory "F": 275

A
Series IP8

Dimensions / IP8100 (Rotary type)

IP8100-0□0 (Without terminal box)

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

IP8100-0□1 (With terminal box)

Mounting with the fork lever joint (Option)
Dimensions inside ( ) are for fork lever joint S.
Electro-Pneumatic Positioner
Smart Positioner Series IP8

Dimensions / IP8001 (Lever type)

**IP8001-000**

OUT2.1/4 (Rc, NPT, G)
With plug

OUT1.1/4 (Rc, NPT, G)
SUP.1/4 (Rc, NPT, G)

1/2 (G, NPT), M20
Electric conduit
With optional resin cable clamp
Applicable cable O. D. ø7 to 9:P368010-26
Applicable cable O. D. ø9.1 to 11:P368010-27

**IP8001-00W**

OUT2.1/4 (Rc, NPT, G)
With plug

OUT1.1/4 (Rc, NPT, G)
SUP.1/4 (Rc, NPT, G)

2 x 1/2 (G, NPT), M20
Electric conduit
Resin cable gland
Applicable cable O. D. ø6 to 12
(Only supplied when the M20 is selected for intrinsically safe explosion proof products)

Note) The accessory body cover for LCD with viewing pane can be selected irrespective of specifications.
**Series IP8**

**Dimensions / IP8101 (Rotary type)**

**IP8101**

**Dimensions / IP8101 (Rotary type)**

**OUT2.1/4 (Rc, NPT, G)**

**SUP.1/4 (Rc, NPT, G)**

**OUT1.1/4 (Rc, NPT, G)**

**1/2 (G, NPT), M20**

**Electric conduit**

**With optional resin cable clamp**

Applicable cable O. D. ø7 to 9: P368010-26

Applicable cable O. D. ø9.1 to 11: P368010-27

**Resin cable gland**

(Only supplied when the M20 is selected for intrinsically safe explosion proof products)

**Positioner body**

**Holding spring**

**Fork pin unit**

**Fork lever joint**

**M8 x 12.5 or M6 x 1**

**Actuator main shaft**

**Mounting with the fork lever joint (Option)**

Dimensions inside ( ) are for fork lever joint S.

**Note**)

The accessory body cover for LCD with viewing pane can be selected irrespective of specifications.
**Technical data**

**Explosion proof**

1. TIIS explosion-proof construction
   The electro-pneumatic positioner IP8000/8100 becomes explosion proof, as certified by TIIS, according to the model selected. The explosion-proof grade has the following approval: Exd II BT5. Take extra care when handling the positioner as explosion-proof equipment.

   **To use as Exd II BT5**
   - **A) Pressure-proof packing.**
     As shown below in the chart, use "Cable gland" (Option).
   - **B) Metal Piping.**
     Attach the sealant fitting bracket near the cable port.
     (For details, refer to "The guideline on electric equipment explosion proof" published by the Technology Institution of Industrial Safety).

2. ATEX Intrinsically safe explosion-proof construction
   Pneumatic positioners IP8000/8100 and IP8001/8101 Smart Positioners are ATEX compliant, intrinsically safe and explosion proof, as certified by KEMA, the accreditation body for explosion-proof products. Take extra care when handling these explosion-proof products.

   - **In regards to explosion-proof grades,**
     - The Pneumatic Positioner IP8□□00 meets 22G Ex ib □ CT4/T5/T6, and
     - The Smart Positioner IP8□□01 meets the 21G Ex ia □ CT4/T5/T6. Check the positioner’s specifications and explosion-proof grades and use in the most optimal environment.

**Barrier**
   Connect the barrier as shown in the diagram below. Moreover, the user must select a barrier that is suitable for each function, based on the ATEX intrinsically safe explosion-proof parameters (current circuit). For IP8001/8101 type smart positioners, use a linear resistant type barrier that is based on the explosion-proof parameters.

**Barrier connection diagram**

Moreover, at SMC, the barriers listed in the chart below are used to check operations. To purchase, please contact PEPPER + FUCHS Inc. (Germany).

**Recommended barriers**

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Note</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector unit with pressure-proof packing</td>
<td>SMC</td>
<td>P368010-32</td>
<td>ø7.0 to ø10.0</td>
<td></td>
</tr>
<tr>
<td>Connector unit with pressure-proof packing</td>
<td>SMC</td>
<td>P368010-33</td>
<td>ø10.1 to ø12.0</td>
<td></td>
</tr>
</tbody>
</table>

**Cable gland with pressure-proof packaging (Option)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit Product No.</th>
<th>Applicable outside diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector unit with pressure-proof packing</td>
<td>P368010-32</td>
<td>ø7.0 to ø10.0</td>
</tr>
<tr>
<td>Connector unit with pressure-proof packing</td>
<td>P368010-33</td>
<td>ø10.1 to ø12.0</td>
</tr>
</tbody>
</table>

**HART transmission**

With smart positioners IP8001/8101, the user can operate the positioner using buttons and change parameter settings by viewing the LCD display (shown the right). Furthermore, depending on the model selected, the same button operation and parameter settings, and monitoring is possible from a remote location via HART transmission.

The table below lists an example of applications that are compatible with smart positioner IP8001/8101. Application selection must be made by the user. Please contact Emerson Process Management for further details.

**HART transmission compatible application**

<table>
<thead>
<tr>
<th>Product Name (Note)</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS™ Suite: Intelligent Device Manager® 375 Field Communicator</td>
<td>Emerson Process Management (US)</td>
</tr>
</tbody>
</table>

Note) AMS™ Suite: Intelligent Device Manager® is a registered trademark of Emerson Electric Co.
Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)*1, and other safety regulations.

*1) ISO 4414: Pneumatic fluid power – General rules relating to systems.
ISO 4413: Hydraulic fluid power – General rules relating to systems.
IEC 60204-1: Safety of machinery – Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots - Safety.

Caution: Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Warning: Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

Danger: Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.
   Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.
   The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.
   1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
   2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
   3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.
   1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
   2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
   3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
   4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.
Safety Instructions

Caution

1. The product is provided for use in manufacturing industries.
   The product herein described is basically provided for peaceful use in manufacturing industries.
   If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract
   if necessary.
   If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.
Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.\(^1\)
   Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest
   sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product
   or necessary parts will be provided.
   This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure
   of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified
   catalog for the particular products.
\(^2\) Vacuum pads are excluded from this 1 year warranty.
   A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
   Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of
   rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or
   any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws
   and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another
   country, assure that all local rules governing that export are known and followed.
**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. Be sure that exterior lead-in wiring to the terminal box is based on the guidelines for explosion-protection of manufactory electric equipment when being used as a flame proof, explosion proof construction.
4. Do not remove terminal cover in a hazardous location while the power is on.
5. Covers for the terminal and body should be in place while operating.
6. When using as an intrinsically safe explosion-proof product, do not wire in a hazardous location while the power is on.

**Caution**

1. Do not touch the actuator or valve's oscillating section when supply pressure has been added, as this is dangerous.
2. Make sure fingers do not get caught when mounting and aligning the cam.
   
   Cut off the pressure supply and always release the compressed air inside the positioner and actuator before performing this work.
3. Always use with the body cover unit mounted.
   
   Moreover, the positioner may not meet degrees of protection IP65 depending on the body cover mounting conditions. In order to meet degrees of protection IP65, tighten threads using the proper tightening torques (2.8 to 3.0 N·m).
4. Always flush the pipe's insides before piping to ensure foreign objects such as machining chips do not enter the positioner.
5. The actuator opening may become unstable when using the booster relay.
6. Always use a ground connection to prevent noise from the input current and to prevent damage because of static electricity.
7. Use the pressure reading on the supplied pressure gauge as an indication.
8. The supplied pressure gauge's needle will malfunction if the pressure supply to the internal mechanism or positioner freezes.

Ensure that the pressure gauge's internal parts do not freeze if using the pressure gauge in an operating environment with an ambient temperature of less than 0°C.

**For users**

1. Assemble, operate and maintain the positioners after reading the operation manual thoroughly and understanding the content.

**Handling**

**Caution**

1. Avoid excessive vibration or impact to the positioner body and any excessive force to the armature, as these actions may cause damage to the product. Handle carefully while transporting and operating.
2. If being used in a place where vibration occurs, using a binding band is recommended to prevent broken wires because of the vibration.
3. 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 a body cover unit fitted to avoid water penetration.
4. Keep magnetic field off the positioner, as this affects its characteristics.

**Air Supply**

**Caution**

1. Use only dehumidified and dust extracted clean compressed air as the air supply.
2. 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.
3. Do not use compressed air containing chemicals, organic solvents, salinity or corrosive gases, as this may cause malfunction.
4. When operating below the freezing point, protect the positioner from freezing.
### Operating Environment

**Caution**
1. Do not operate in locations with an atmosphere of corrosive gases, chemicals, seawater, or where these substances will adhere to the regulator.
2. Do not operate out of the indicated operation temperature range as this may cause damage to electronic parts and seal materials to deteriorate.
3. Do not operate in locations where excessive vibration or impact occurs.
4. If the body cover is being installed in a place where the body cover is exposed to direct sunlight, the use of a standard body cover without the LCD window is recommended.

### Maintenance

**Caution**
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 \( \varnothing 0.2 \) 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 silicone grease set by SMC to the sliding parts (O-ring and exhaust valve) when disassembling a pilot valve unit.
   Replacing the valve unit every three years is recommended.
7. Check for air leakage from pipes that pass compressed air and connecting parts.
   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 bleed-er, it is not abnormal as long as the air consumption is within the specified range.

**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 to maintain explosion-proof 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 conducted 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.
### Record of changes

<table>
<thead>
<tr>
<th>Edition B</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Addition of Smart Positioner Series IP8001/8101.</td>
</tr>
<tr>
<td></td>
<td>Number of pages from 12 to 24.</td>
</tr>
</tbody>
</table>

NS