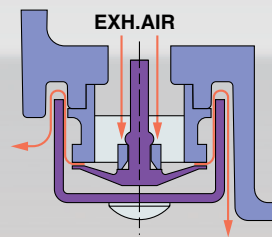


# Electro-Pneumatic Positioner



Vibration resistance : No resonances  
**5 to 200Hz**

Dust resistance : Conforms to  
**JIS F8007 IP65**

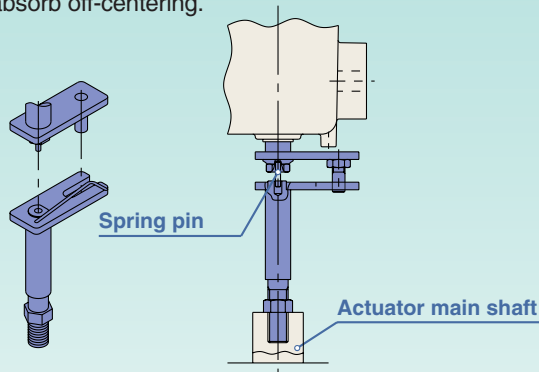


A centralized exhaust system employs the combination of the check valve and the labyrinth effect enhancing both dust resistance and water resistance performance.

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

## ●Folk lever joints (Rotary type)

Can absorb off-centering.



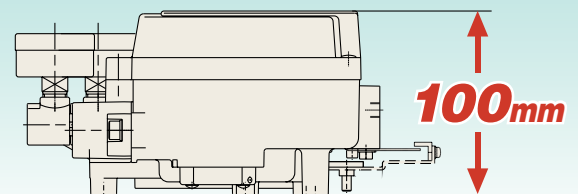
## ●A span adjuster achieves 1/2 split range

## ●Opening current transmission (4 to 20mA DC)

Can detect remote position. Non-explosion proof rotary type only.

## ●Mounting dimensions are same as convention types, series IP6000/6100.

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



Pressure gauge (O. D.  $\phi 43$ )

Enlarged O.D. allows improved visibility.

External scale plate (Rotary type)

Improved visibility of opening indicator



With terminal box (Explosion proof)

No terminal box (non-explosion proof) is available.

# Electro-Pneumatic Positioner

## Series *IP8000/8100*

### How to Order



IP8 000 — 0 0 0 —

#### Type

000	Lever type feedback
100	Rotary type

#### Pressure gauge

0	None
1	0.2MPa
2	0.3MPa
3	1.0MPa

#### Construction

0	1 Note 1)
No terminal box	With terminal box (Exsd II BT5)

#### Accessories Note 2)

Nil	None (Standard)	IP8000 has standard lever for stroke (10 to 85mm)
A Note 3)	ø0.7 Output restriction with pilot valve	Accessory for IP8000, 8100 small capacity actuator
B Note 3)	ø1.0 Output restriction with pilot valve	
C	Fork lever joint M	Accessory for IP8100
D	Fork lever joint S	
E Note 4)	For stroke 35 to 100mm with lever unit	Accessory for IP8000
F Note 4)	For stroke 50 to 140mm with lever unit	
G Note 5)	Compensation spring (A)	For IP8000, 8100
H	With external scale plate	Accessory for IP8100
J Note 6)	With opening current transmission (4 to 20mA DC)	Accessory for IP8100

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

The positioner body is Exd II BT5 labeled.

Note 2) If two or more accessories are required, the part numbers should be made according to alphabetical order. (ex. IP8000-011-AG)

Note 3) "A" is applied to approx 90cm<sup>3</sup>-capacity actuator.

"B" is applied to approx 180cm<sup>3</sup>-capacity actuator.

Note 4) Standard lever is not attached.

Note 5) 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 6) With terminal box, Non-explosion proof. Select "1" for the construction.

### Specifications

Type  Item	IP8000		IP8100	
	Lever type lever feedback		Rotary type cam feedback	
	Single action	Double action	Single action	Double action
Input current	4 to 20mADC <small>Note 1)</small>			
Input resistance	235±15Ω (4 to 20mADC)			
Supply air pressure	0.14 to 0.7MPa			
Standard stroke	10 to 85mm (Deflection angle 10 to 30°)		60 to 100° <small>Note 2)</small>	
Sensitivity	Within 0.1%F.S.	Within 0.5%F.S.		
Linearity	Within ±1%F.S.	Within ±2%F.S.		
Hysteresis	Within 0.75%F.S.	Within 1%F.S.		
Repeatability	Within 0.5%F.S.			
Coefficient of temperature	Within 0.1%F.S. / °C			
Supply pressure fluctuation	Within 0.3%F.S./0.01MPa			
Output flow	80ℓ/min (ANR) or more (SUP = 0.14MPa)			
	200ℓ/min (ANR) or more (SUP = 0.4MPa)			
Air consumption	5ℓ/min (ANR) or less (SUP = 0.14MPa)			
	11ℓ/min (ANR) or less (SUP = 0.4MPa)			
Ambient and fluid temperature	-20 to 80°C (Non-explosion proof)			
	-20 to 60°C (Flame proof and explosion proof)			
Explosion proof construction	Flame proof and explosion proof construction: Exd II BT5 (Certificate number: C15916 of Technology Institution of Industrial Safety)			
Air port	Rc 1/4 female			
Electrial connection	G 1/2 female			
Wiring method	Flame proof packing system, Sealant fitting system (explosion-proof)			
	Resin G 1/2 connector (Non-Explosion proof, option)			
Exterior covering enclosure	JISF8007, IP65 (conforms to IEC Pub.529)			
Material	Aluminum diecast body / epoxy resin			
Weight	With terminal box 2.6kg (None 2.4kg)			

Note 1) 1/2 Sprit range (Standard)

Note 2) Stroke adjustment: 0 to 60°C, 0 to 100°C

### Explosion Proof

This product has the following approvals.

Exd II BT5: Newly established standard based on international (IEC 79)

#### Use as Exd II BT5

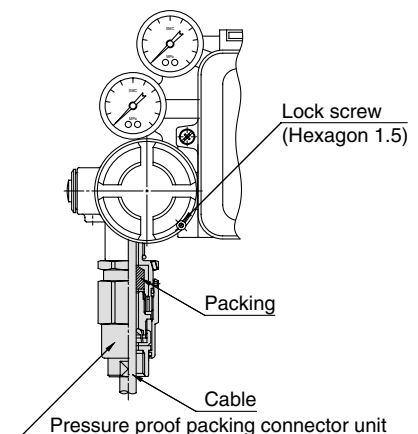
(A) Pressure-proof packing.

As shown below in the chart, use "Cable gland" (option).

(B) Metal Piping.

Attach the sealant fitting near the cable port.

(For details, refer to "The guideline on electric equipment explosion proof" published by the Technology Institution of Industrial Safety.)



#### Cable gland with flame proof packing (Option)

Part name	Part number	Suited cable outer diameter
Flame proof packing	P368010-32	ø7.0 to ø10.0
connector unit	P368010-33	ø10.1 to ø12.0

## Accessory / Option

### Pilot valve with output restriction (IP8000, 8100 type)

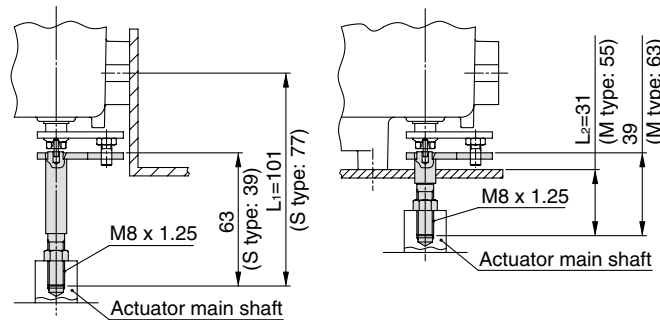
In general, mounting on a small-size actuator may cause hunting. For prevention, a pilot valve with a built-in output restriction is available. The restriction is removable.

Actuator Capacity	Orifice size	Part number	Pilot unit part number
90cm <sup>3</sup>	ø0.7	P36801080	P565010-18
180cm <sup>3</sup>	ø1	P36801081	P565010-19

### 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.

Part name	Part number
Fork lever assembly M	P368010-24
Fork lever assembly S	P368010-25



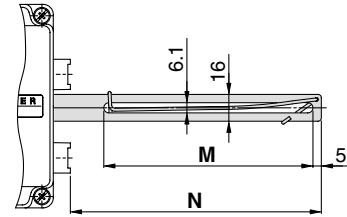
Side mounting with the fork lever assembly M

Side mounting with the fork lever assembly S

### External feedback lever (IP8000 type)

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

Stroke	Unit number	Size M	Size N
10 to 85mm (Accessory "Nil")	P368010-20	125	150
35 to 100mm (Accessory "E")	P368010-21	110	195
50 to 140mm (Accessory "F")	P368010-22	110	275

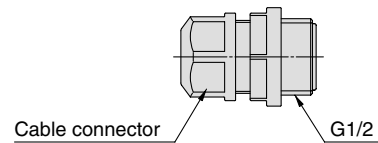


### Resin connector (Non-explosion proof specification)

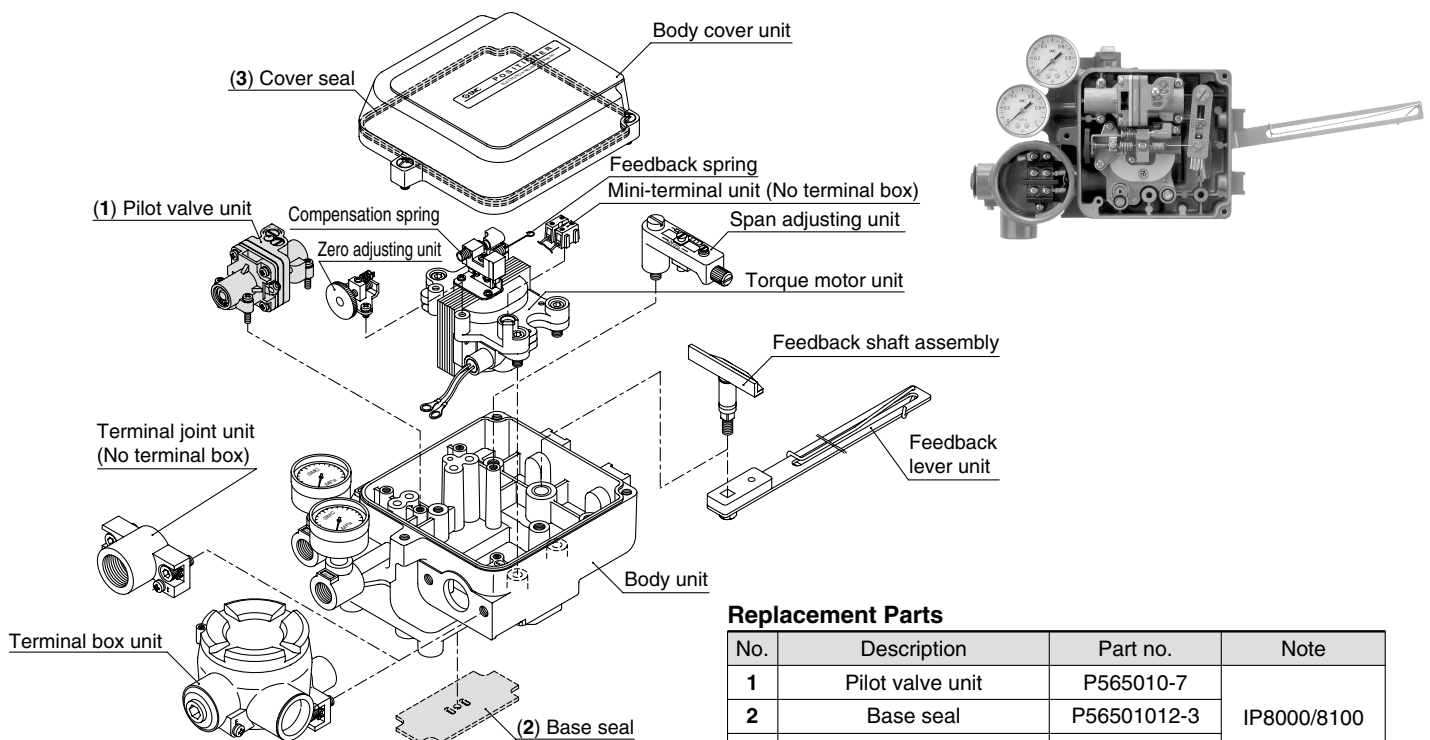
Optional cable connectors are available for different cable sizes. These are not for explosion proof applications.

#### Cable connector (option)

Part name	Part number	Suited cable outer diameter
Resin-made cable clamp unit (A)	P368010-26	ø7 to ø9
Resin-made cable clamp unit (B)	P368010-27	ø9 to ø11



## Exploded View

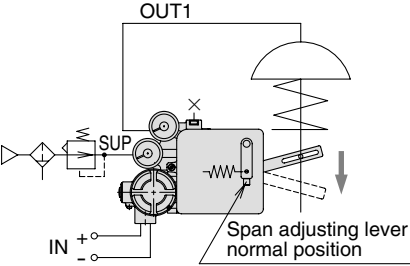
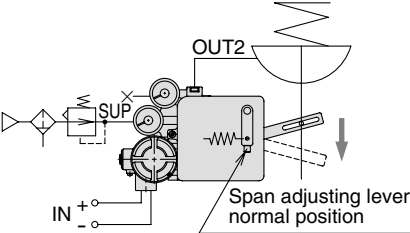
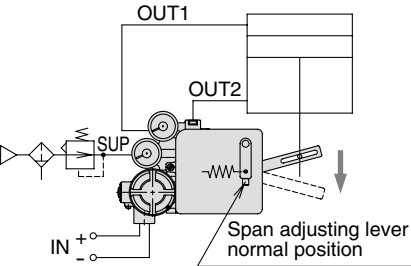
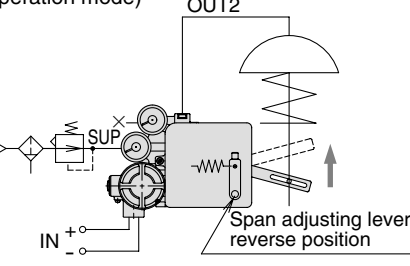
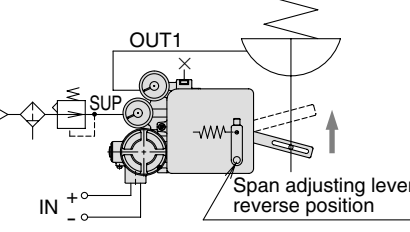
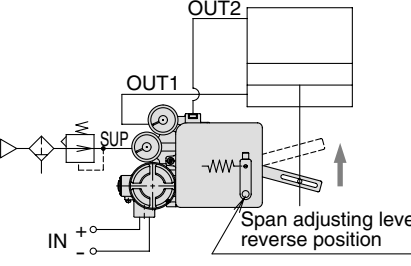


### Replacement Parts

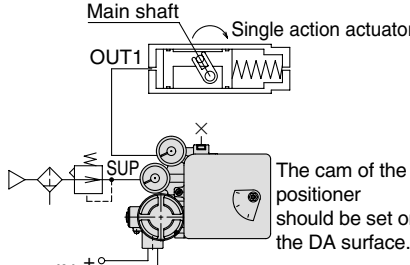
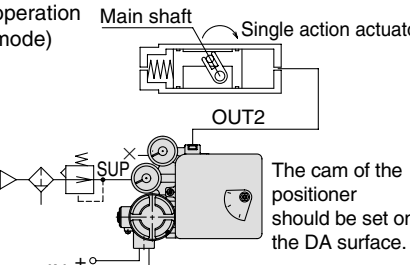
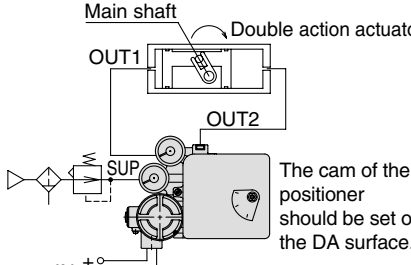
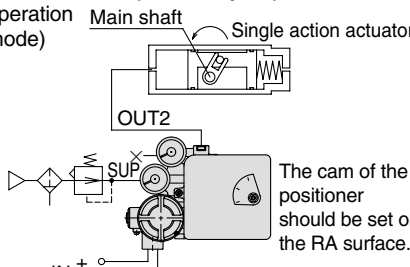
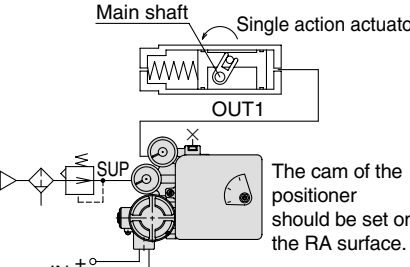
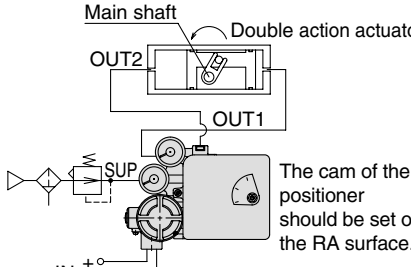
No.	Description	Part no.	Note
1	Pilot valve unit	P565010-7	IP8000/8100
2	Base seal	P56501012-3	
3	Cover seal	P56501013	

Piping

IP8000 / Lever type

	Single action		Double action
Positive operation	<p>When the input signal is increased, the stem moves as allow mark.</p>  <p>OUT2 is plugged.</p>	<p>When the input signal is increased, the stem moves as allow mark. (Positive valve operation by its reverse operation mode)</p>  <p>OUT1 is plugged.</p>	<p>When the input signal is increased, the cylinder rod moves as allow mark.</p>  <p>Span adjusting lever normal position</p>
	<p>When the input signal is increased, the stem moves as allow mark. (Reverse valve operation by its positive operation mode)</p>  <p>OUT1 is plugged.</p>	<p>When the input signal is increased, the stem moves as allow mark.</p>  <p>OUT2 is plugged.</p>	<p>When the input signal is increased, the cylinder rod moves as allow mark.</p>  <p>Span adjusting lever reverse position</p>

IP8100 / Rotary type

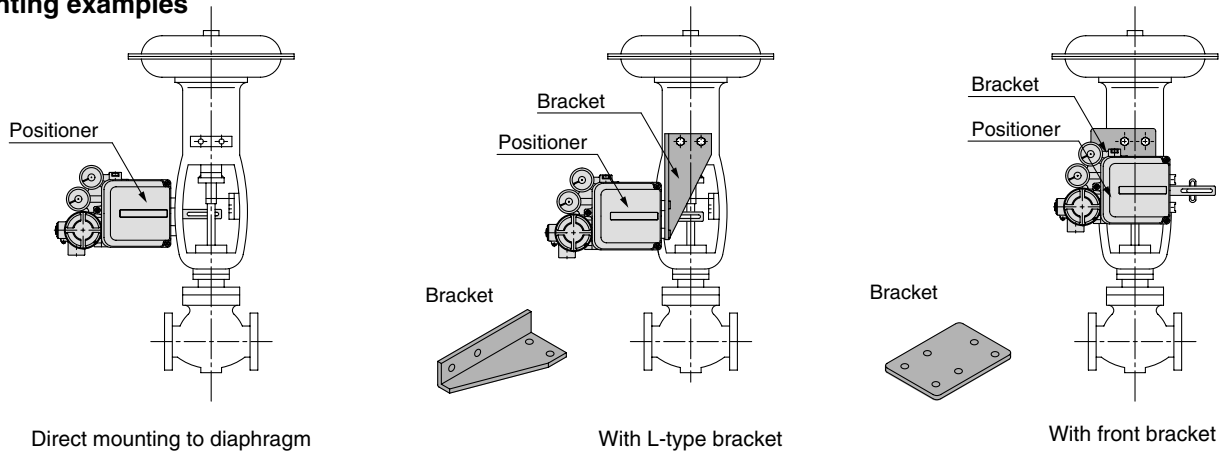
	Single action		Double action
Positive operation	<p>When the input signal is increased, the actuator shaft rotates in a clockwise direction.</p>  <p>OUT2 is plugged.</p>	<p>When the input signal is increased, the actuator shaft rotates in a clockwise direction. (Positive valve operation by its reverse operation mode)</p>  <p>OUT1 is plugged.</p>	<p>When the input signal is increased, the actuator shaft rotates in a clockwise direction.</p>  <p>The cam of the positioner should be set on the DA surface.</p>
	<p>When the input signal is increased, the actuator shaft rotates in a counter clockwise direction. (Reverse valve operation by its positive operation mode)</p>  <p>OUT1 is plugged.</p>	<p>When the input signal is increased, the actuator shaft rotates in a counter clockwise direction.</p>  <p>OUT2 is plugged.</p>	<p>When the input signal is increased, the actuator shaft rotates in a counter clockwise direction.</p>  <p>The cam of the positioner should be set on the RA surface.</p>

## Installation

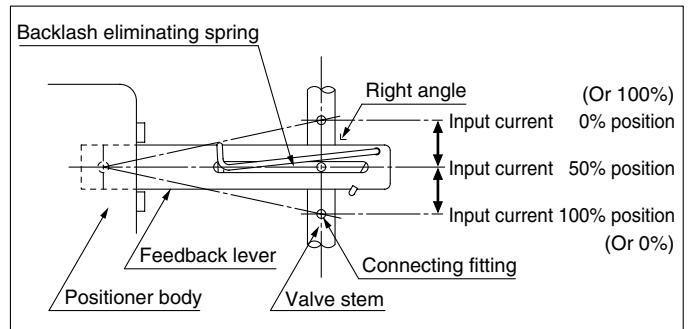
### IP8000 type (Lever type lever feedback)

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

#### Mounting examples

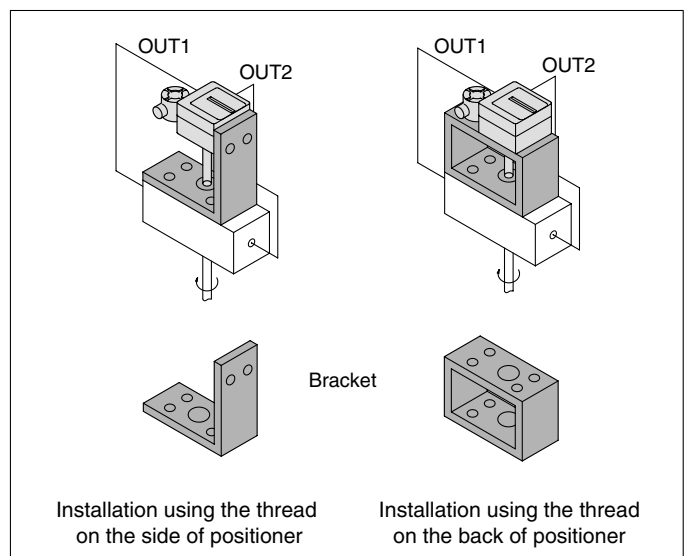


- 2 A connecting fitting or pin to transfer the displacement of valve stem should be mounted at a position so that the feedback lever is at right angles to the valve stem for an input current of 50%. The right figure is the configuration viewed from the front.



### 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.



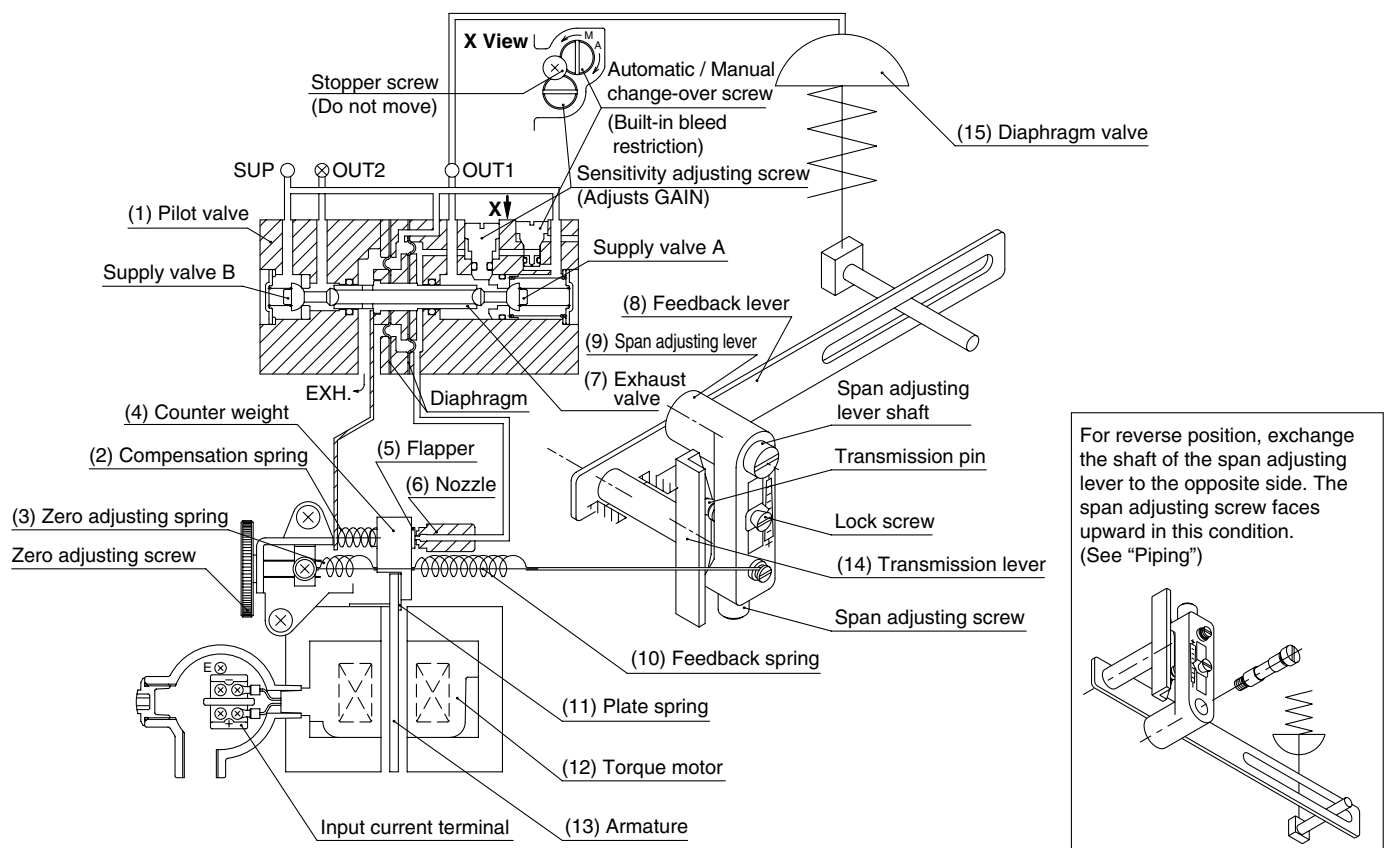
# Series IP8000/8100

## Principle of Operation

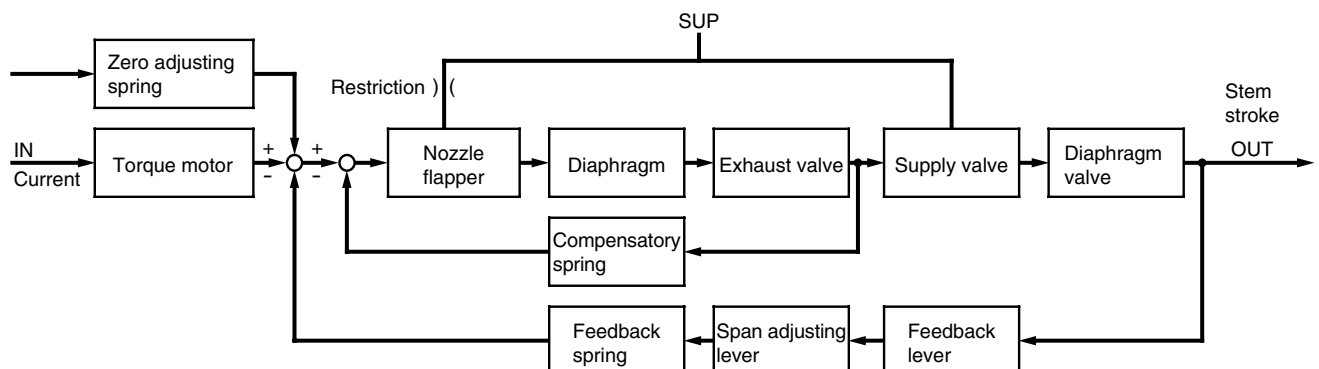
### IP8000 / Lever type

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 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



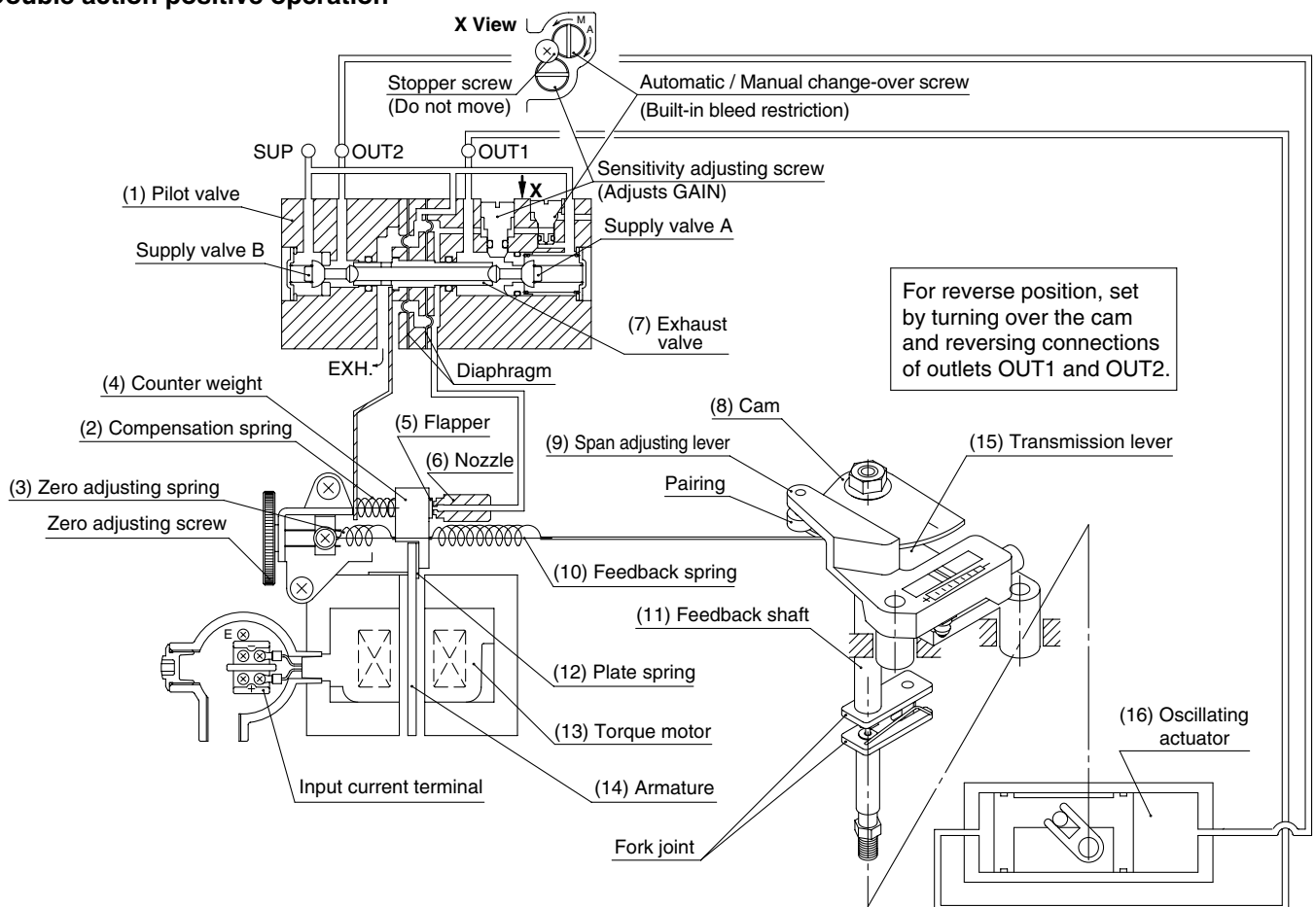
### Block diagram



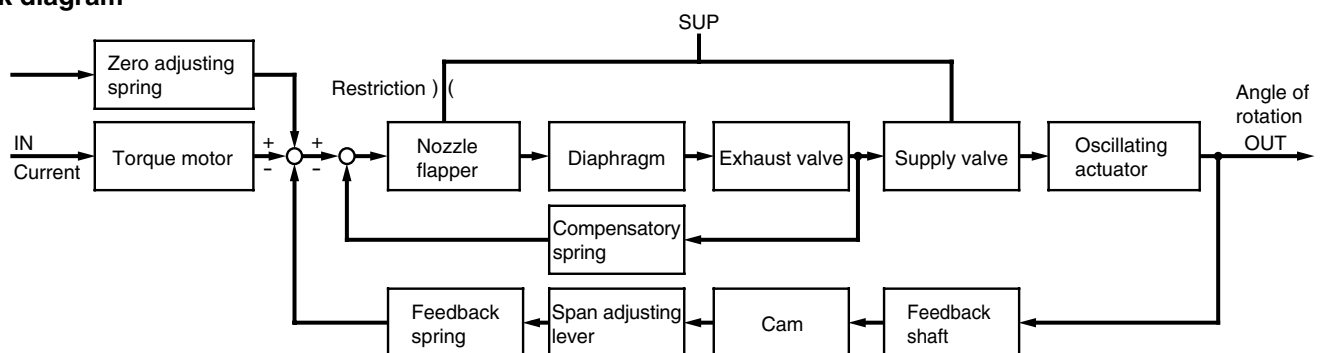
## IP8100 / Rotary type

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



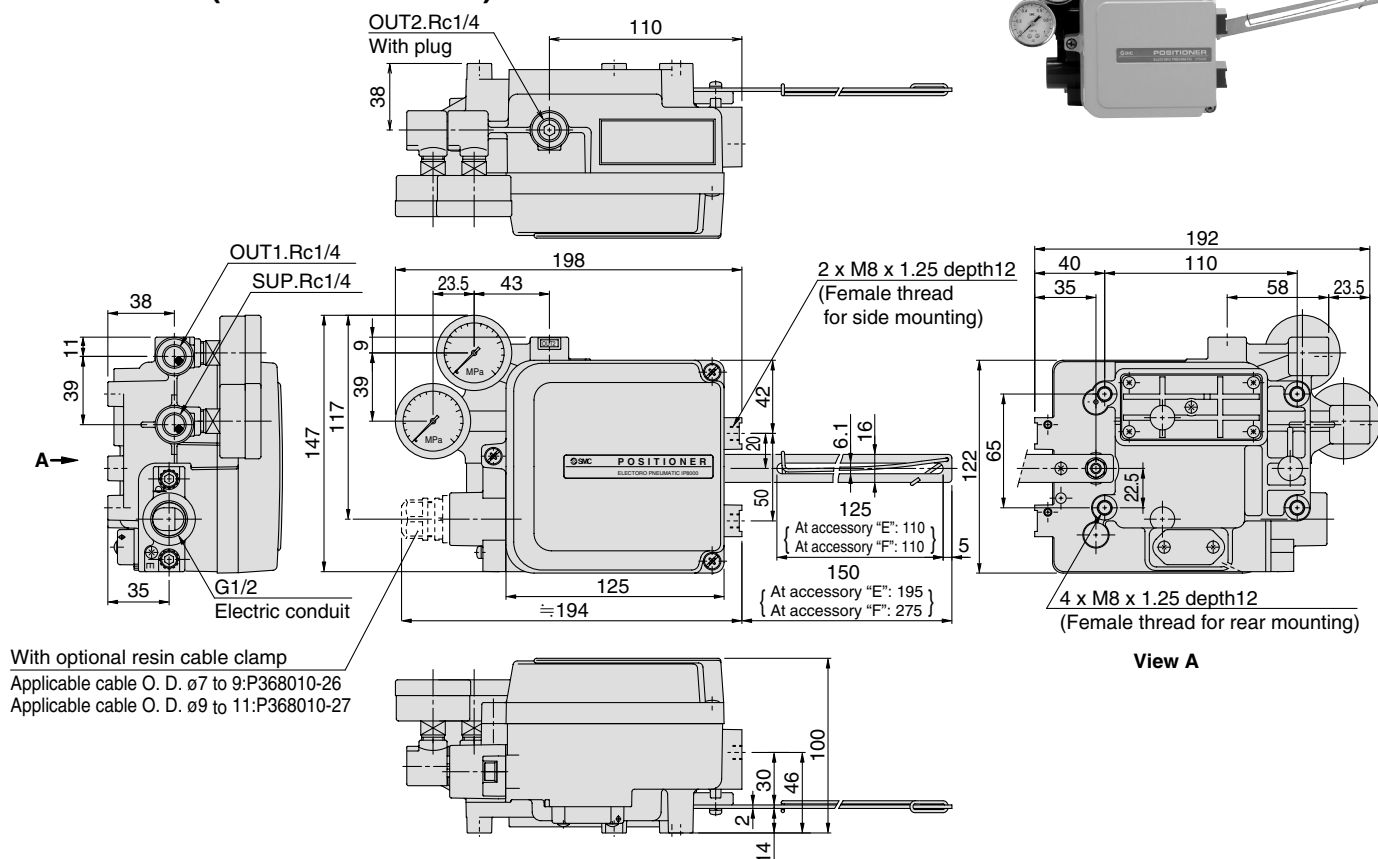
### Block diagram



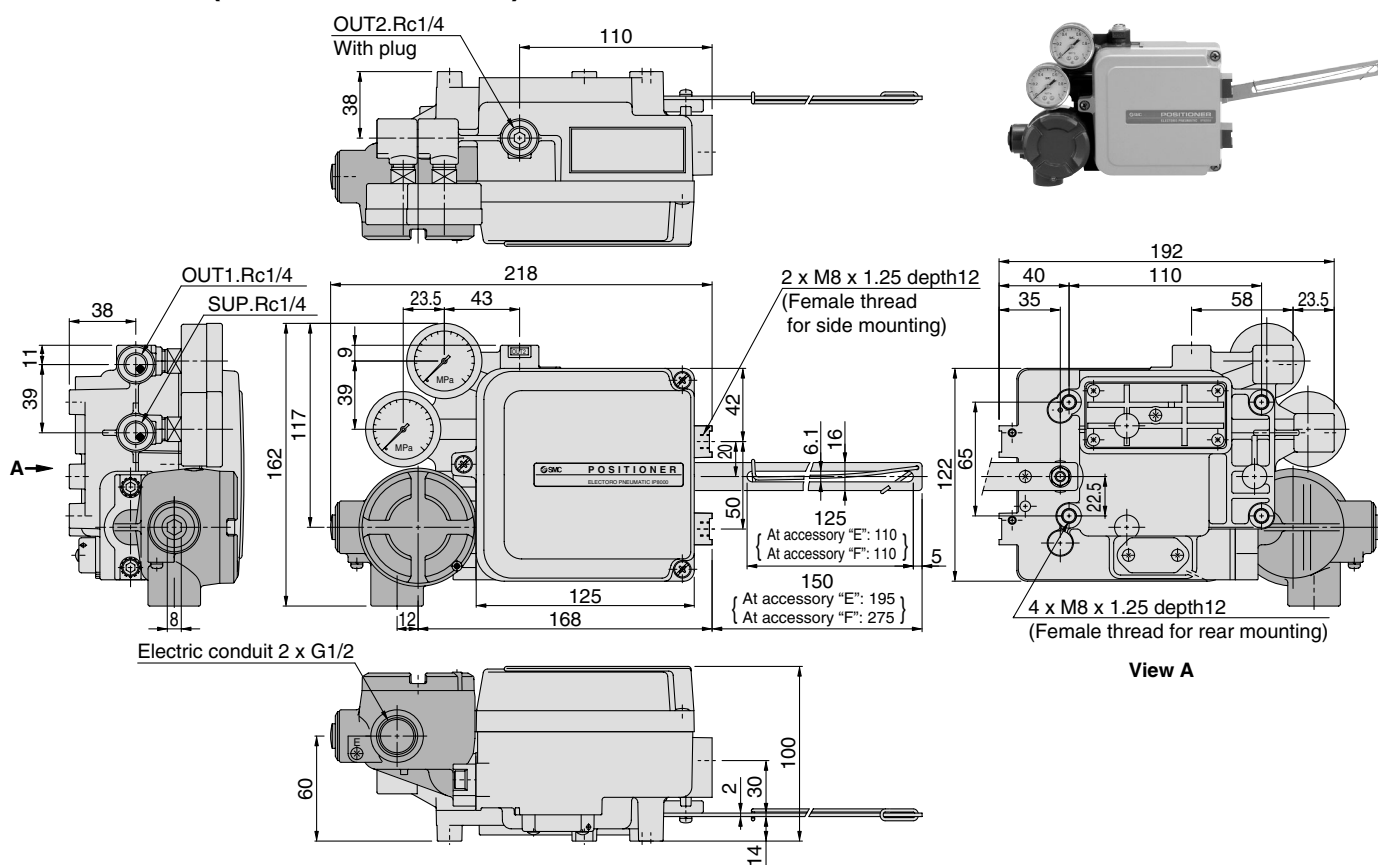
# Series IP8000/8100

## Dimensions / IP8000 (Lever type)

### IP8000-0□0 (No terminal box)



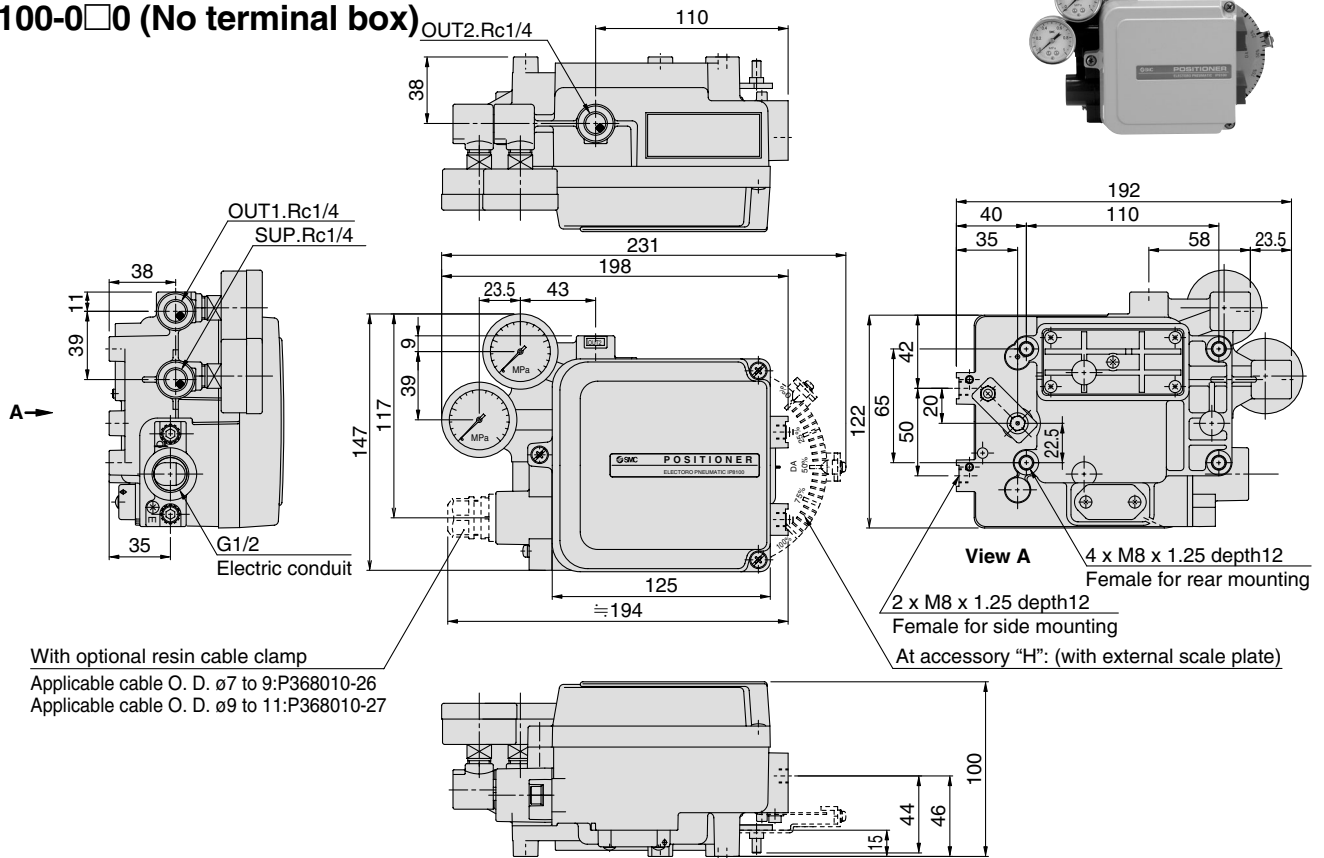
### IP8000-0□1 (With terminal box)



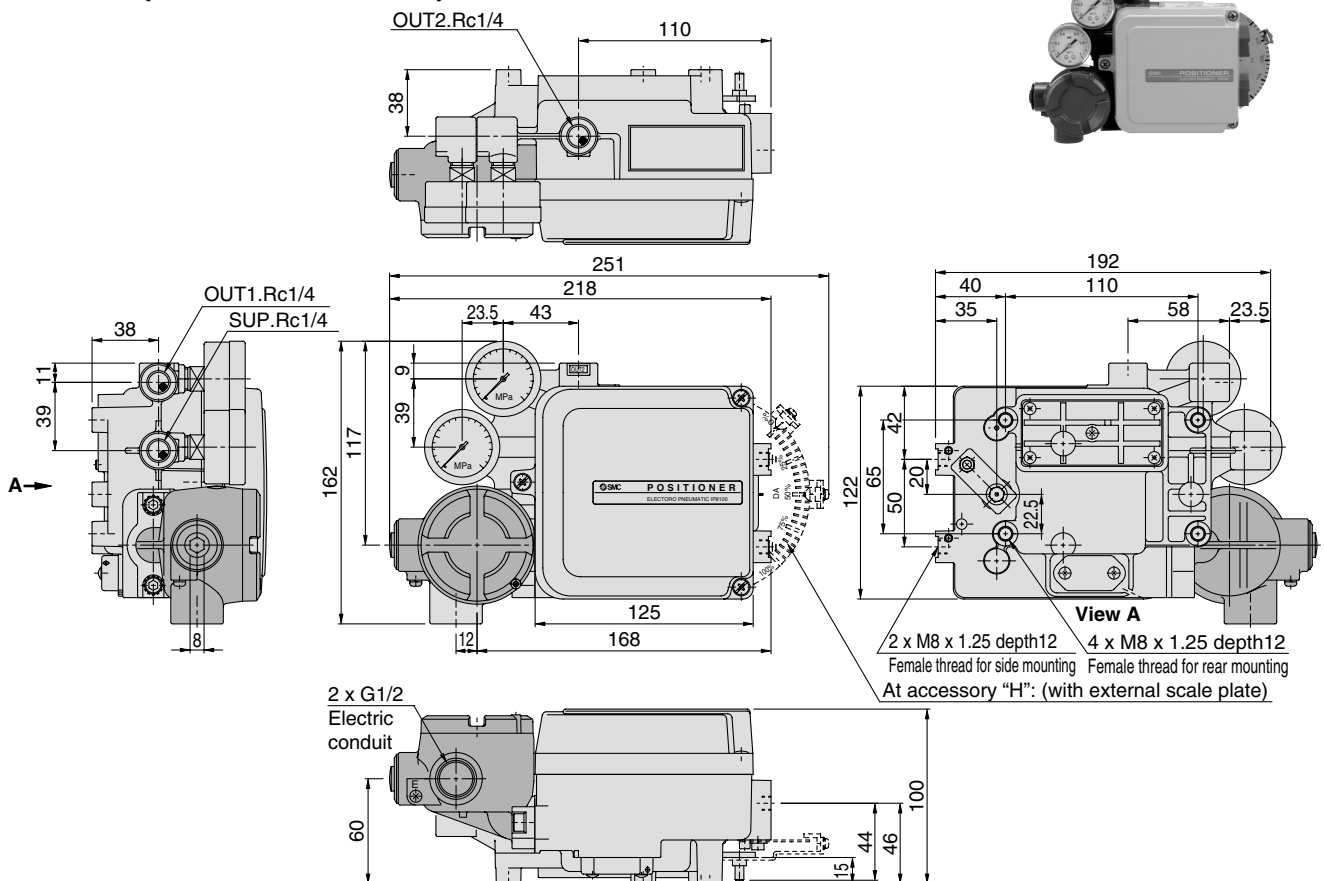


### **Dimensions / IP8100 (Rotary type)**

**IP8100-0□0 (No terminal box)**



**IP8100-0□1 (With terminal box)**








*Series IP8000/8100*

# Safety Instructions

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 <sup>Note 1)</sup>, JIS B 8370 <sup>Note 2)</sup> 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 catalog 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.



## Series IP8000/8100

# 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. 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.

### Handling

#### 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.

### Operating Environment

#### Caution

1. Do not operate in locations with an atmosphere of corrosive gases, chemicals, sea water, or where these substances will adhere to the regulator.
2. Do not operate in locations where excessive vibration or impact occurs.
3. Do not operate out of the indicated operation temperature range to avoid deterioration of the seals, as this may cause possible positioner problems.

### 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.

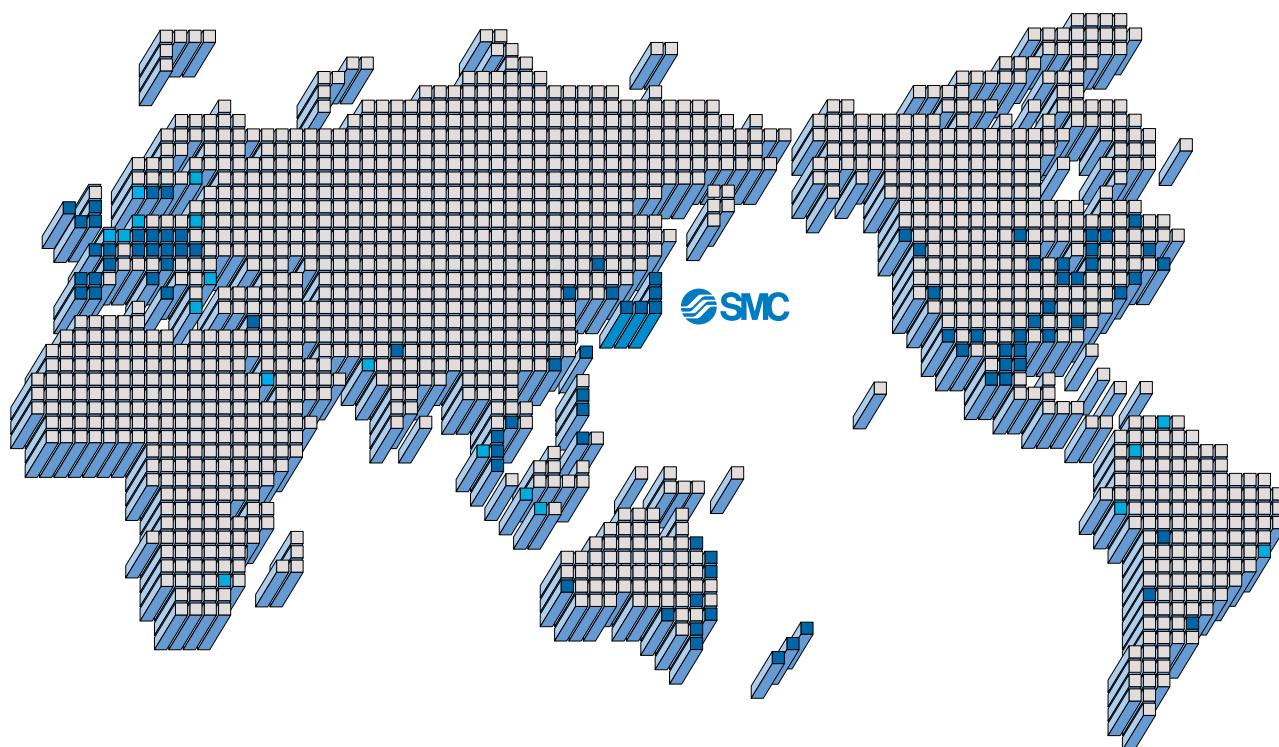
Never modify electrical construction to maintain explosion-proof construction.

#### 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 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  $\phi 0.2$  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 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.



## SMC'S GLOBAL MANUFACTURING, DISTRIBUTION AND SERVICE NETWORK



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