



No. : IP80-OM00003-C

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TITLE                    OPERATION MANUAL

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ELECTRO-PNEUMATIC POSITIONER

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IP 8 ✕ 0 0

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SMC CORPORATION

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## Introduction

IP8※00 Series Electro-pneumatic positioner controls the motion of actuator by the operation of pilot valve. This pilot valve is activated by signal current from adjustment unit mounted to air cylinder.

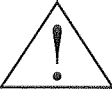


And this product get certification regarding explosion-protection construction from Technology institution of industrial safety Japan. If the positioner is used as the product with explosion -protection, use in accordance with “Recommended Practice for Explosion-Protected Electrical Installations in General Industries” by Technology institution of industrial safety Japan

## Safety Instructions

Be sure to read this operation manual before handling, and understand the contents to operate the product properly.

Keep this operation manual carefully to be able to refer to it whenever it is required, and ensure to give it to an end user.

These safety instructions are intended to prevent hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by labeling “Caution”, “Warning” or “Damage”. To ensure safety, be sure to observe ISO4414 (Note 1), JIS B 8370 (Note 2) and other safety practices.

	<b>Caution</b> : Operator error could result in injury or equipment damage.
	<b>Warning</b> : Operator error could result in serious injury or loss of life.
	<b>Danger</b> : In extreme conditions, there is a possibility of serious injury or loss of life

(Note 1) ISO 4414 Pneumatic fluid power-Recommendations for the application of equipment to transmission and control system.

(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 for the specific pneumatic system must be based on specifications provided by a person in charge of design and specification after analyzing and/or testing to meet your specific requirements. A guarantee of the expected performance and safety is in charge of a person who decides the compatibility for the system. System should be constructed by reviewing all specifications and considering possible failure of machinery according to the latest catalog and material.

2. **Only trained personal should operate pneumatically operated machinery and equipment.**

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

3. **Do not service machinery / equipment or attempt to remove component until safety is confirmed.**

A. Inspection and maintenance of machinery / equipment should only be performed after confirmation of safe locked-out control positions.

B. When equipment is removed, confirm the safety process as mentioned above. Cut supply pressure for the equipment, turn off the power, and exhaust all residual compressed air in the system.

C. Before machinery / equipment is restarted, take care safety of surroundings.

4. **Contact SMC if the product is to be used in any of the following conditions or environments.**

A. Conditions and environments beyond the given specifications, or if product is used outdoors.

B. Installation on equipment in conjunction with atomic energy, railway, aviation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.

C. An application, which has the possibility of having negative effects on people or properties, requiring special safety.

# 1. Specifications

Table 1 Specifications

Item \ Type	IP8000		IP8100	
	Lever type lever		Rotary type cam	
	Single action	Double action	Single action	Double action
Input current	4~20mADC (Standard)*1			
Input resistance	235 ± 15Ω (4~20mADC)			
Supply air pressure	0.14~0.7MPa			
Standard stroke	10~85mm (External lever allowable runout angle 10° to 30°)		60° to 100°*2	
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			
Thermal coefficient	Within 0.1%F.S/°C			
Output flow rate *3	80l/min (ANR) or more (SUP=0.14MPa)			
	200l/min(ANR) or more (SUP=0.4MPa)			
Air consumption *3	Within 5l/min (ANR) (SUP=0.14MPa)			
	Within 11l/min (ANR) (SUP=0.4MPa)			
Ambient and using fluid Temperature	-20°C to 80°C (When use in non-hazardous area)			
	-20°C to 60°C (When use at flameproof type Exd II BT5)			
Explosion-protected Construction	Flameproof type of explosion-protection (Exd II BT5), Technology institution of industrial safety Japan certified.			
Air connection port / Pressure gauge connection port	Rc1/4 female screw / Rc1/8 female screw			
Electric wiring connection Port	G1/2 female screw(M20×1.5, 1/2NPT *4 )			
Wiring	Metal conduit type Flameproof packing type G1/2 connector (option for non-explosion protection type)			
Material	Die-cast aluminum for the body			
Mass	Approx. 2.6kg with terminal box (Approx.2.4kg without terminal box)			
Classification of degree of Protection	JISF8007 IP65 (conform to IEC Pub.529)			

\* 1 : 1/2 split range is possible with the standard type (by adjusting the span).

\* 2 : The stroke is adjustable in 0 to 60°and 0 to 100°.

\* 3 : Standard air (JIS B0120):temp.20°C, absolute press.101.3KPa, ratio humidity 65%.

\* 4 : Two types of intrinsic safety type of explosion-protection electrical entry will be available.

For Europe : M20(ATEX)

For US : NPT1/2 (FM approval)

## 2. Operation Principle

### 2-1 Type IP8000

When the input current increases, armature (13) receives counter-clockwise rotating torque with leaf-spring (11) of torque motor (12) functioning as the support, counter-weight (4) is pushed towards left, the space between nozzle (6) and flapper (5) opens and the nozzle back pressure decreases. As the result, exhaust valve (7) of pilot valve (1) moves to right, the output pressure of OUT1 increases and diaphragm valve (15) moves downward. The movement of diaphragm valve (15) acts on feedback spring (10) through feedback lever (8), transmission lever (14) and span adjusting lever (9) and the actuator is balanced at the position where it is balanced with the force generated by the input current. Gain suppression spring (2) is used to immediately feedback the movement of exhaust valve (7) to counter-weight (4) and it increases the loop stability. For zero-point adjustment, change the tension of zero-adjust spring (3).

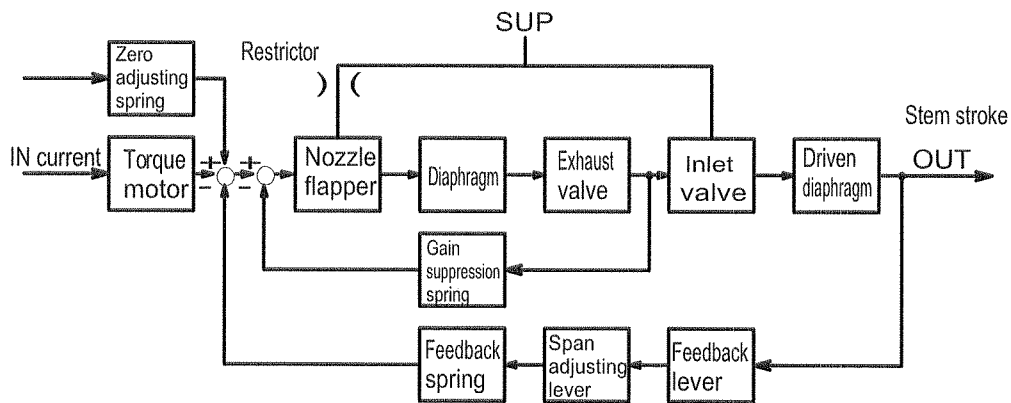


Fig. 1 Block diagram of Type IP8000

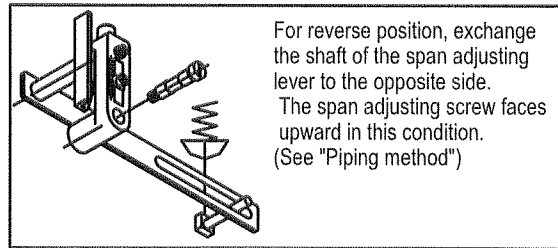
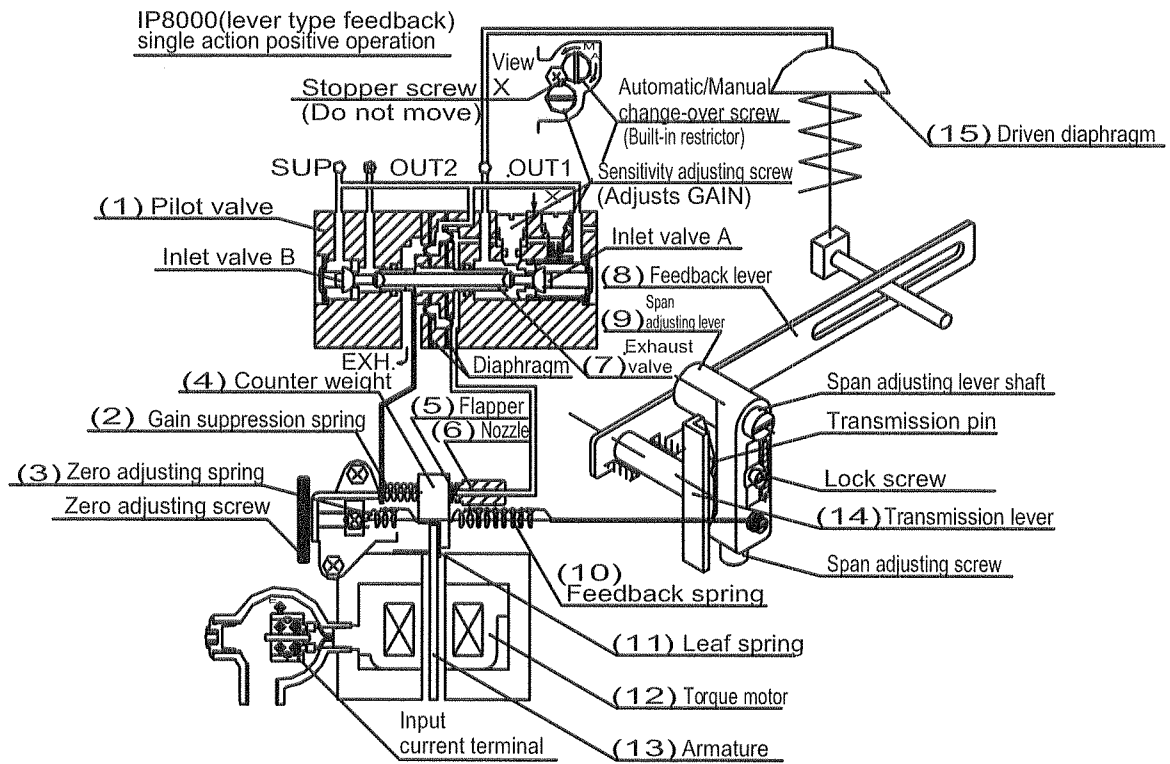


Fig.2. Drawing for IP8000 operation principle

## 2-2 Type IP8100

When the input current increases, armature (14) receives counter-clockwise rotation torque with leaf-spring (12) of torque motor (13) functioning as the support, counter-weight (4) is pushed towards left, the space between nozzle (6) and flapper (5) opens and the nozzle back pressure decreases. As the result, exhaust valve (7) of pilot valve (1) moves to right, the output pressure of OUT1 increases and the output pressure of OUT2 decreases, starting the rotation of rocking actuator (16). The movement of rocking actuator (16) acts on feedback spring (10) through feedback shaft, cam (8), span adjusting lever (9) and transmission lever (15) and the actuator is balanced at the position where it balances with the force generated by the input current. Fig.6 shows the case of cam DA structure normal actuation (the main shaft of rocking actuator (16) turns clockwise at the time the input current increases). Gain suppression spring (2) is used to immediately feedback the movement of exhaust valve to counter-weight (4) and it increases the loop stability. For zero-point adjustment, change the tension of zero-point adjust spring (3).

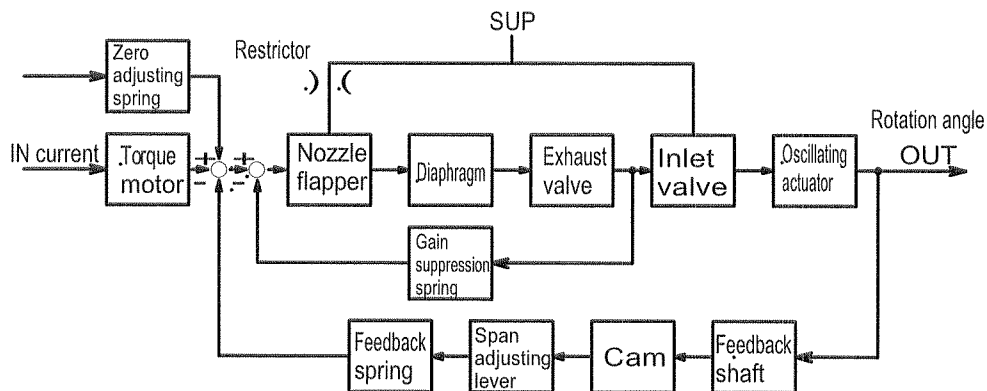


Fig.3 Block diagram of Type IP8100



IP8100(Rotary type cam feedback)  
double action positive operation

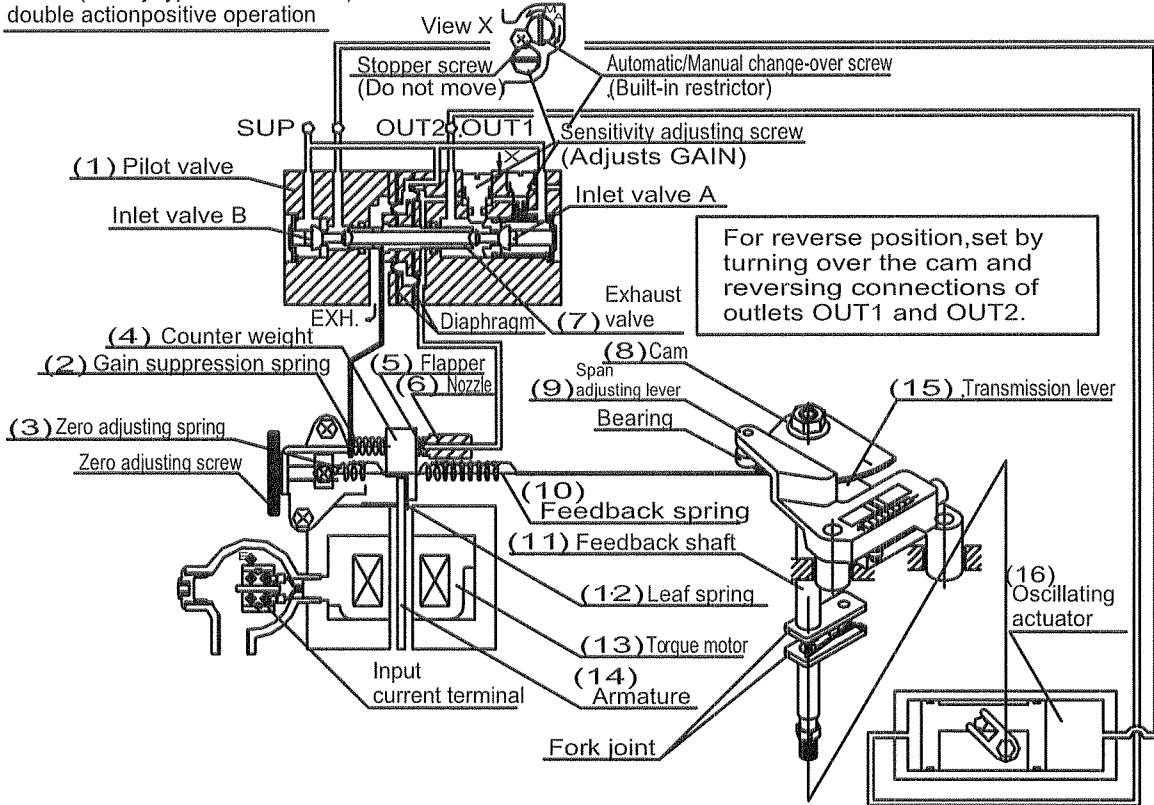


Fig.4 Drawing for IP8100 operation principle

### 3. Attaching



#### Warning

- (1) Make a space needed for maintenance on the setting area.
- (2) Care so that finger wouldn't be pinched during mounting and positioning cam. Cut supply pressure and release compressed air in positioner and actuator in advance.



#### Caution

- (1) Confirm actuator and positioner are connected properly and tightly.

#### 3-1. Type IP8000

##### 3-1-1 Example of attaching to actuator

The type IP8000 positioner is compatible with Type IP600 and IP6000 in the attaching pitch. If you are using IP600 and IP6000 already, the bracket for those positioner can be used to attach IP8000 to the actuator.

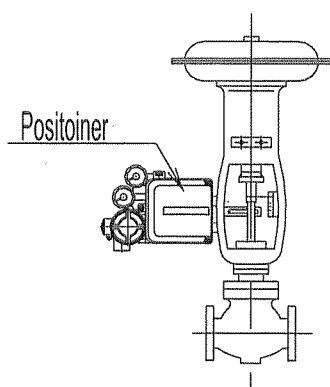


Fig.5 Directly attaching to diaphragm valve

Directly attach using the screw hole at a side of the positioner and the screw hole at the yoke side of diaphragm.

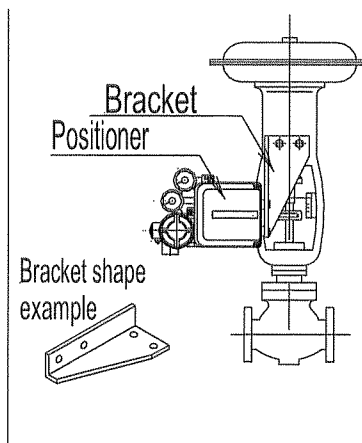


Fig.6 L-shape bracket

Attach using the screw hole at a side of the positioner and the screw hole at the front mount of diaphragm valve.

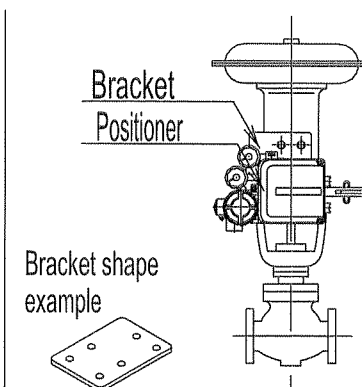


Fig.7 Front bracket

Attach using the screw hole at the positioner back and the screw hole at the front mount of diaphragm valve.

### 3-1-2 Connection with external feedback lever

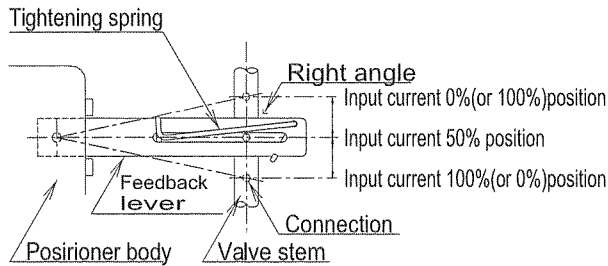


Fig.8 Attaching the feedback lever

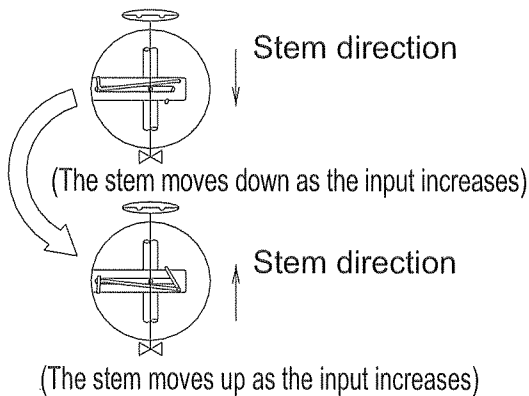


Fig.9 Use position of feedback lever

(1) Attach to the position that the valve stem and lever form the right angle when the input signal is 50%(distribute evenly with 50% input signal set as the reference).

(2) Attach to the position that the runout angle is within the range of 10° to 30°.

(3) To move the valve stem downward at the time of input current increase(normal actuation), attach to the position at which the tightening spring comes to the upper side of the connection, as shown in Fig.9.

To move the valve stem upward(reverse actuation), turn-over the feedback lever and attach to the position at which the tightening spring comes to the lower side of connection.

### 3-2 Type IP8100

#### 3-2-1 Example of attaching to actuator

The type PI8100 positioner is compatible with type IP610 and IP6100 in the attaching pitch. If you are using IP610 or IP6100 already, the bracket can be used to attach IP8100 to the actuator. If you change from IP6100 to IP8100 and select accessory H (with external scale plate), fork lever type fitting needs to be adjusted at lower position.

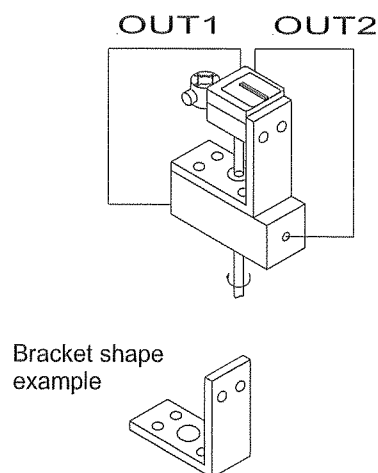


Fig.10 Mounting by positioner side screw

Attach using the screw hole at a side of the positioner and the screw hole at the actuator top.

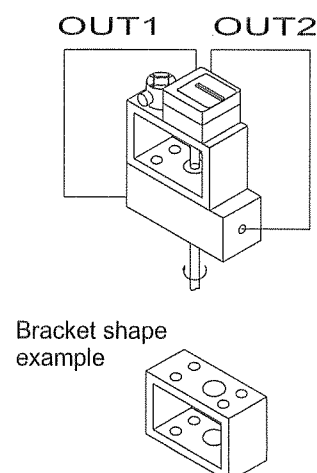
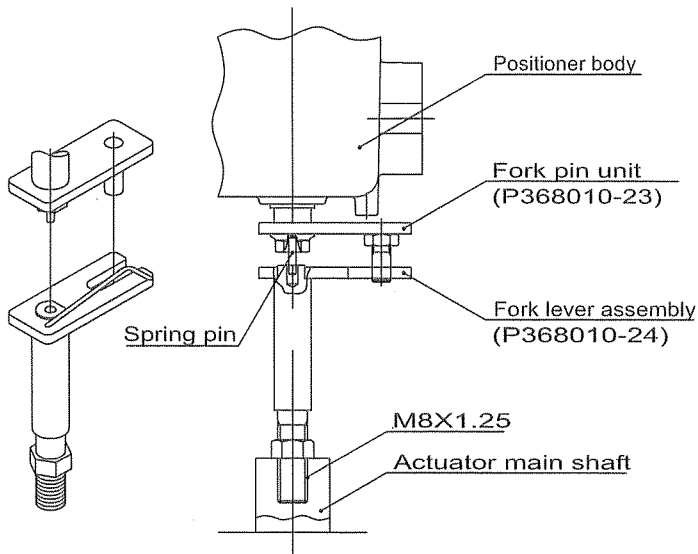


Fig.11 Mounting by positioner back screw

Attach using the screw hole at the positioner back and the screw hole at the actuator top.

### 3-2-2 Connection with feedback shaft



- (1) Attach to the position at which the positioner feedback shaft and the rotary actuator main shaft are almost concentric (range in which the spring pin of feedback shaft edge enters the hole of fork lever assembly shaft edge).
- (2) If the separation joint type for IP610 is made in a special specification, it can be used for this connection.

Fig.12 Example of attaching using fork lever type joint

### 3-2-3 Cam attaching procedure

- (1) Use the DA face of cam to turn the actuator main shaft clockwise (viewed from the positioner front cover side) at the time of input signal increase. Use the RA face to turn it counter-clockwise (reverse actuation). Correctly attach the cam to the flange part of feedback shaft.
- (2) Attach the cam in the procedure of loosening the hexagonal nut with flange first, setting the using actuator to the starting position and then setting the cam reference line and the bearing contact point of span adjusting arm unit to the matching position.
- (3) Do not apply the supply pressure when attaching the cam as otherwise it is very dangerous.
- (4) When the positioner is shipped from our plant, the cam is tentatively tightened to the shaft. Be sure to firmly lock the cam to the lock nut (Tightening torque 2.0~2.5 Nm)

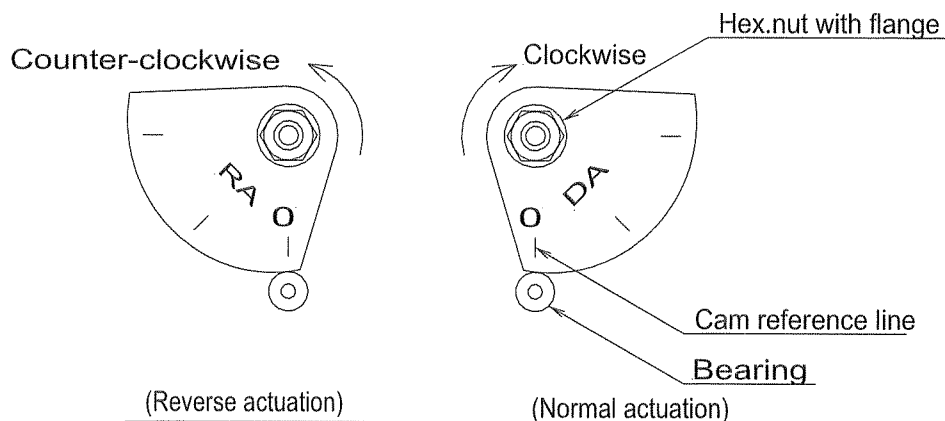
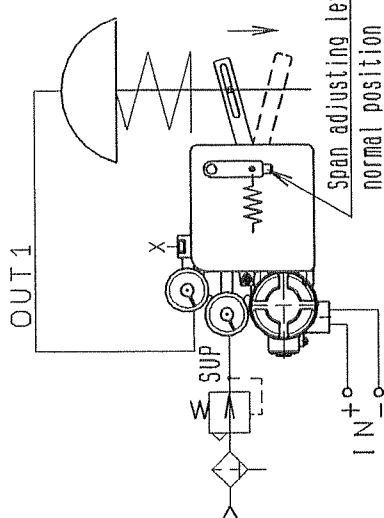
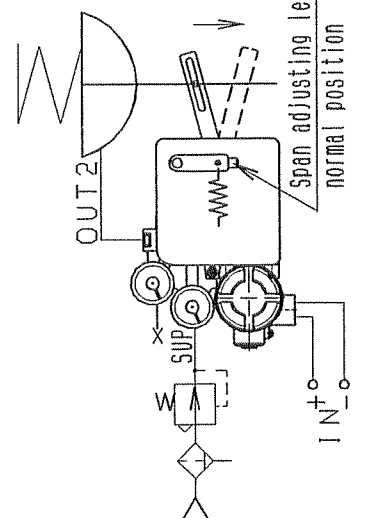
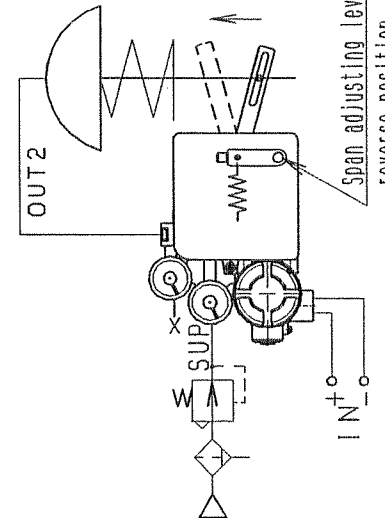
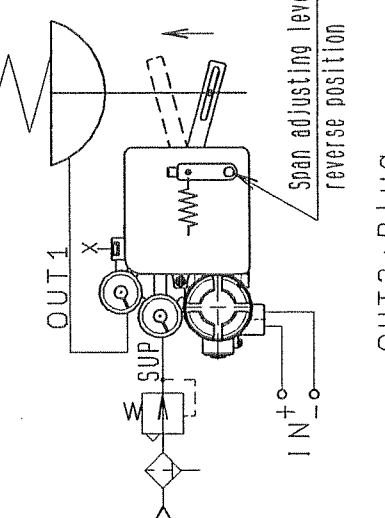


Fig.13 Example of cam attaching

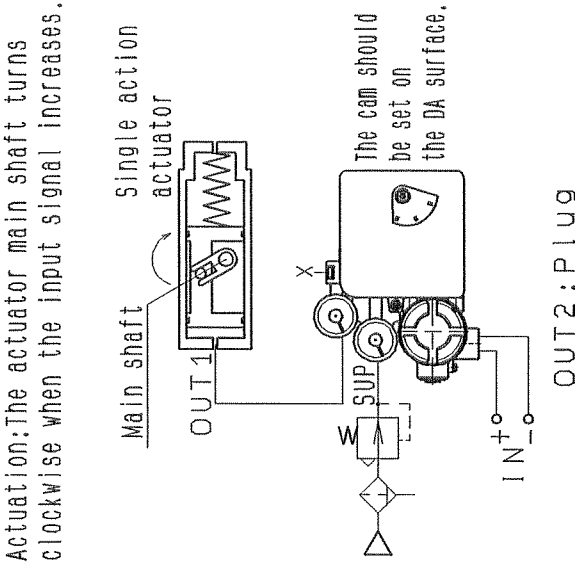
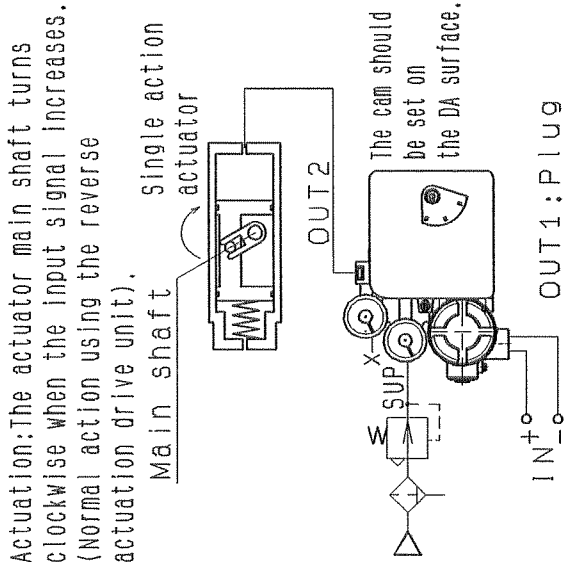
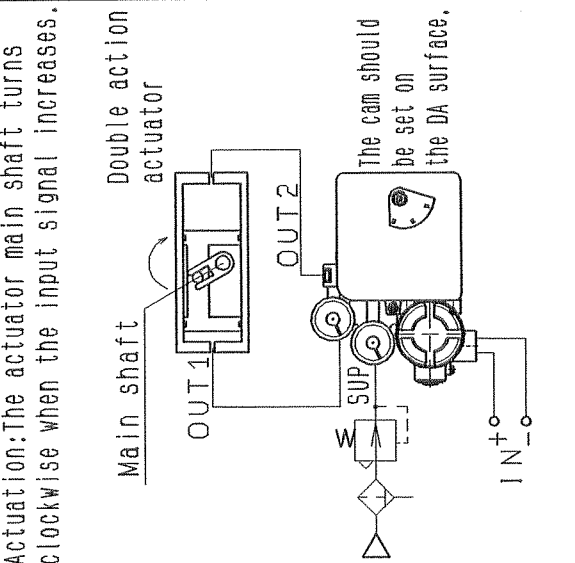
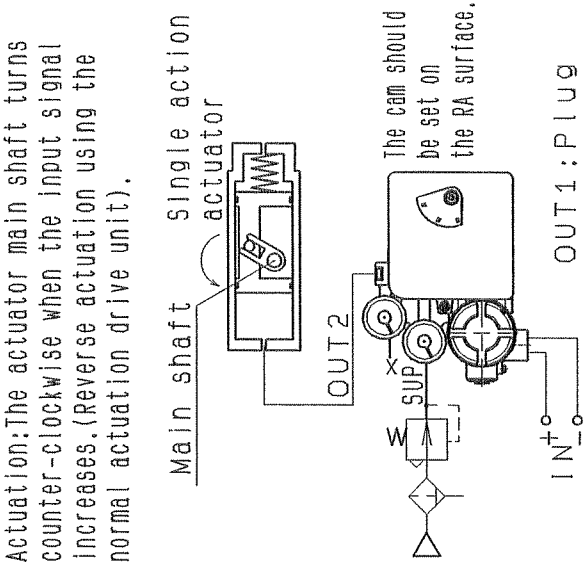
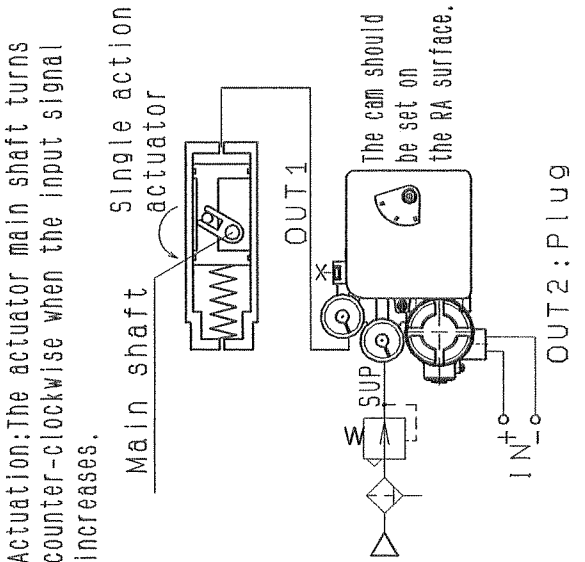
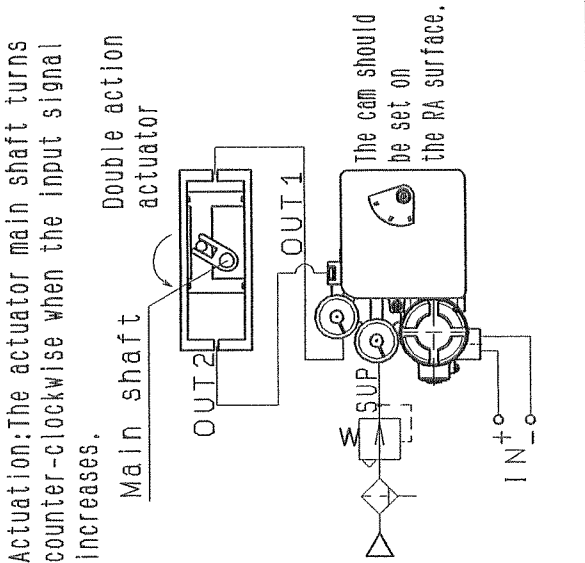
#### 4. Piping and Attaching of Internal Feedback Unit

Table 2 Piping for IP8000 (Lever type)

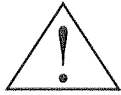
	Single action	Double action
<p>Normal action</p> <p>*Note</p>	<p>Actuation: The stem moves in the arrow direction when the input current increases.</p>  <p>OUT1: Plug</p> <p>OUT2: Plug</p>	<p>Actuation: The stem moves in the arrow direction when the input current increases. (Normal actuation using the reverse actuation drive unit).</p>  <p>OUT1: Plug</p> <p>OUT2: Plug</p>
<p>Reverse action</p> <p>*Note</p>	<p>Actuation: The stem moves in the arrow direction when the input current increases. (Reverse actuation using the normal actuation drive unit).</p>  <p>OUT1: Plug</p> <p>OUT2: Plug</p>	<p>Actuation: The stem moves in the arrow direction when the input current increases.</p>  <p>OUT1: Plug</p> <p>OUT2: Plug</p>

Note: Refer to Item(3) of 3-1-2 Connection with external feedback lever.

Table 3 Piping for IP8100 (Rotary type)

	Single action		Double action	
<p>Normal action *Note</p>	<p>Actuation: The actuator main shaft turns clockwise when the input signal increases. (Normal action using the reverse actuation drive unit).</p>  <p>Main shaft</p> <p>Single action actuator</p> <p>OUT1</p> <p>OUT2</p> <p>The cam should be set on the DA surface.</p> <p>IN<sup>+</sup> IN<sup>-</sup></p> <p>OUT2: Plug</p>	<p>Actuation: The actuator main shaft turns clockwise when the input signal increases. (Normal action using the reverse actuation drive unit).</p>  <p>Main shaft</p> <p>Single action actuator</p> <p>OUT2</p> <p>The cam should be set on the DA surface.</p> <p>IN<sup>+</sup> IN<sup>-</sup></p> <p>OUT1: Plug</p>	<p>Double action</p> <p>Actuation: The actuator main shaft turns clockwise when the input signal increases.</p>  <p>Main shaft</p> <p>Double action actuator</p> <p>OUT1</p> <p>OUT2</p> <p>The cam should be set on the DA surface.</p> <p>IN<sup>+</sup> IN<sup>-</sup></p>	
<p>Reverse action *Note</p>	<p>Actuation: The actuator main shaft turns counter-clockwise when the input signal increases. (Reverse actuation using the normal actuation drive unit).</p>  <p>Main shaft</p> <p>Single action actuator</p> <p>OUT2</p> <p>OUT1</p> <p>The cam should be set on the RA surface.</p> <p>IN<sup>+</sup> IN<sup>-</sup></p> <p>OUT1: Plug</p>	<p>Actuation: The actuator main shaft turns counter-clockwise when the input signal increases.</p>  <p>Main shaft</p> <p>Single action actuator</p> <p>OUT1</p> <p>The cam should be set on the RA surface.</p> <p>IN<sup>+</sup> IN<sup>-</sup></p> <p>OUT2: Plug</p>	<p>Double action</p> <p>Actuation: The actuator main shaft turns counter-clockwise when the input signal increases.</p>  <p>Main shaft</p> <p>Double action actuator</p> <p>OUT2</p> <p>OUT1</p> <p>The cam should be set on the RA surface.</p> <p>IN<sup>+</sup> IN<sup>-</sup></p>	

Note: Refer to 3-2-3 Cam attaching procedure



## Caution

Prior to piping, flush enough and remove chip, cutting oil and dust in tube so that obstruction wouldn't intrude into positioner.

Confirm specification and working direction of actuator, and mount pipes and internal feedback unit in accordance with table 2 and 3.

## 5. Electrical Wiring

### 5-1 Positioner with terminal box

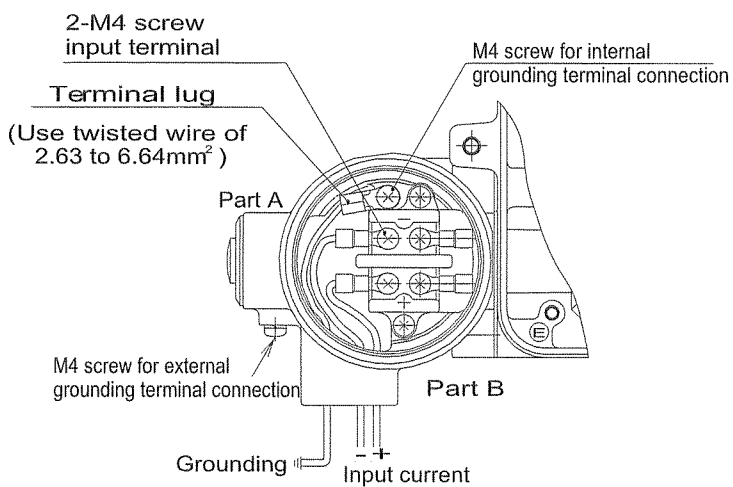


Fig 14. Positioner with terminal box

(1) Connect the (+) and (-) output terminals from the regulator with the (+) and (-) input terminals, respectively, of the positioner terminal box. The port diameter at the conduction wire drawing port is the size of G1/2 parallel screw for piping and the depth is for a 16.5mm female screw.

(2) Two drawing ports, marked as Part A and Part B in Fig.14, are provided. Use either one as fitted. (Part B is used in the figure).

### 5-2 Positioner without terminal box

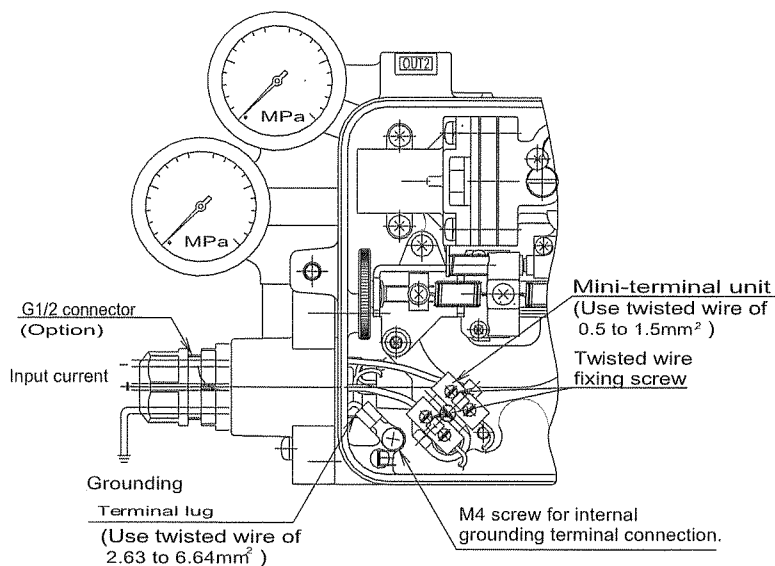


Fig.15 Positioner without terminal box

(1) Connect the (+) and (-) output terminals from the regulator with the (+) and (-) input terminals, respectively, of the positioner terminal box. The port diameter at the conduction wire drawing port is the size of G1/2 parallel screw for piping and the depth is for a 20 mm female screw.

## 6. Explosion-Protected construction



### Warning

If the positioner is used as the product with Flameproof type of Explosion-Protection, leading external conductors into a flameproof terminal box in accordance with “Recommended Practice for Explosion-Protected Electrical Installations in General Industries” by Technology institution of industrial safety Japan” .

(1) This product conforms to Exd II BT5 based on International Standard (IEC Standard 79).

Method of leading external conductors and cables into a terminal box shown as below.

In the case where this is used as Exd II BT5

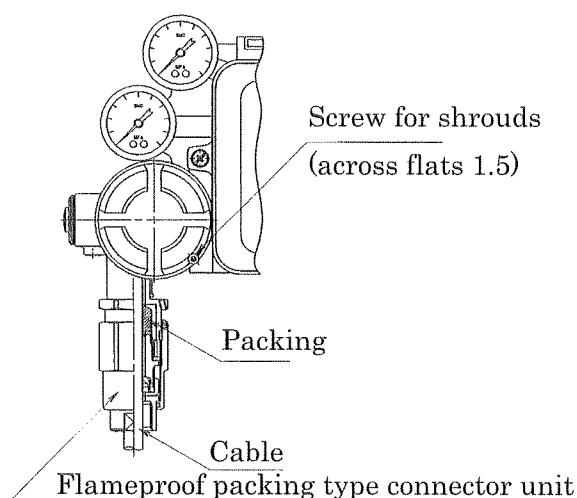
A) Flameproof packing type leading method.

Cable Ground (refer to Table4 Option) is used as shown in Fig.16.

B) Metal conduit leading method.

Sealing fittings should be attached to leading port of external conductor.

(Please refer to “Recommended Practice for Explosion-Protected Electrical Installations in General Industries” by Technology institution of industrial safety Japan” for details.)



Part name	Part number	Applicable Cable O.D.
Flameproof packing type connector unit	P368010-32	$\phi$ 7.0~10.0
	P368010-33	$\phi$ 10.1~ $\phi$ 12.0

Table4 Flameproof packing type cable ground (Option)

Fig.16 Flameproof packing type leading method



## 7. Adjustment



### Caution

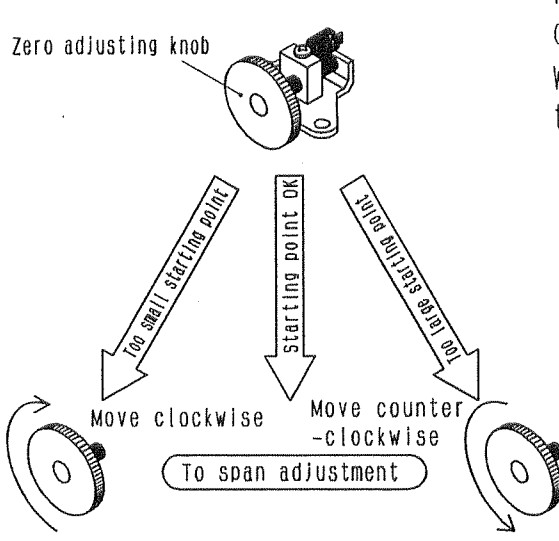
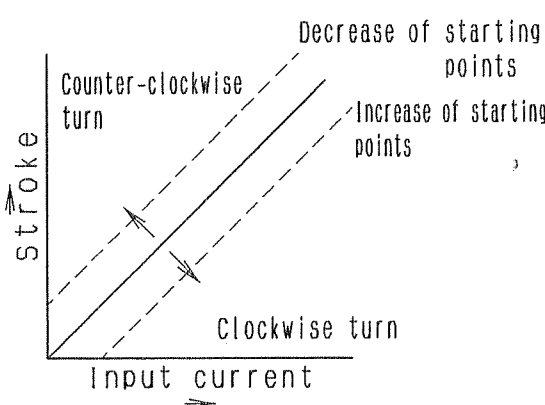
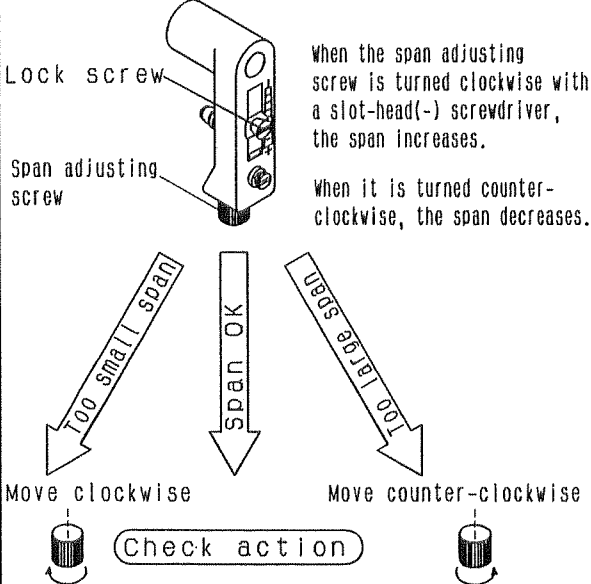
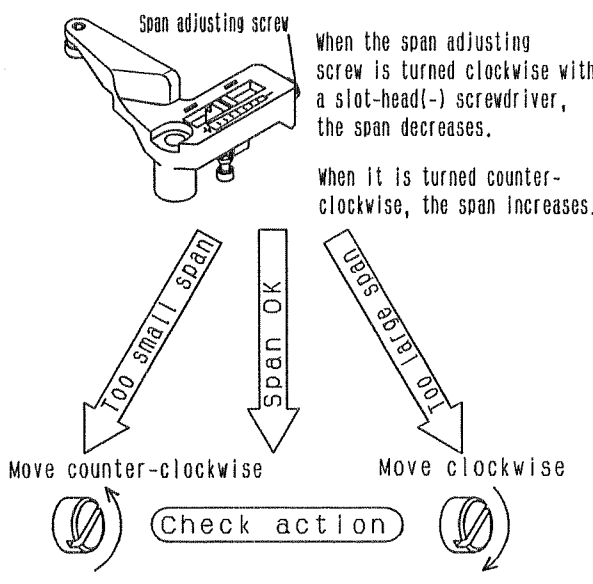
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- (1) For this positioner, span and zero point adjustment of each actuator is necessary. Adjustment shall be done based on each actuator size.
- (2) Keep in mind that span and zero point adjustment interfere in each other.
- (3) Characteristics changes due to change of mounting position, ambient temperature and supply pressure.
- (4) If it takes long time until operation after initial adjustment, check and adjust this product.
- (5) Sensitive adjustment is effective for only double acting actuator.
- (6) Manual change function is effective for single acting actuator which is controlled by using OUT1.

Check the following prior to start the adjustment.

- (1) Check that the pipeline is correctly connected with the pressure supply port and OUT1 and OUT2 ports.
- (2) Check that the wires are correctly connected with the (+), (-) and grounding terminals.
- (3) Check that the actuator and positioner are sturdily connected.
- (4) Check for locking of the auto/manual changeover screw of pilot valve (fully tightened in the clockwise direction).
- (5) Check that the span adjusting lever of internal feedback lever (Type IP8000) is attached to the correct (normal or reverse) position. (Refer to Tables 2.)
- (6) Check for correct use of the cam surface (normal or reverse) in Type IP8100 and that the flange nut is firmly locked.  
(Refer to Table 3.)

Table 5 Adjustment procedure

	TYPE IP8000	TYPE IP8100
Zero-point adjustment	 <p>Zero adjusting knob</p> <p>Too small starting point</p> <p>Starting point OK</p> <p>Too large starting point</p> <p>Move clockwise</p> <p>Move counter-clockwise</p> <p>To span adjustment</p>	<p>When the zero adjusting knob is turned clockwise, the starting point increases. When it is turned counter-clockwise, the starting point decreases.</p>  <p>Stroke</p> <p>Input current</p> <p>Decrease of starting points</p> <p>Increase of starting points</p> <p>Counter-clockwise turn</p> <p>Clockwise turn</p>
Span adjustment	 <p>Lock screw</p> <p>Span adjusting screw</p> <p>When the span adjusting screw is turned clockwise with a slot-head(-) screwdriver, the span increases.</p> <p>When it is turned counter-clockwise, the span decreases.</p> <p>Too small span</p> <p>Span OK</p> <p>Too large span</p> <p>Move clockwise</p> <p>Move counter-clockwise</p> <p>Check action</p>	 <p>Span adjusting screw</p> <p>When the span adjusting screw is turned clockwise with a slot-head(-) screwdriver, the span decreases.</p> <p>When it is turned counter-clockwise, the span increases.</p> <p>Too small span</p> <p>Span OK</p> <p>Too large span</p> <p>Move counter-clockwise</p> <p>Move clockwise</p> <p>Check action</p>
Adjusting procedure	<ol style="list-style-type: none"> <li>(1) Set the input current to 0% (4mADC in the standard specification) and turn the zero adjusting knob by hand to set it to the actuator starting point.</li> <li>(2) Then, set the input current to 100% (20mADC in the standard specification) and check the actuator stroke. At this point, depending on whether the span is too large or too small, loosen the lock screw and then adjust the span as shown in the illustration above.</li> <li>(3) Set the input current to 0% and conduct the zero-point adjustment, as done in Step (1) again.</li> <li>(4) Repeat the above operations until the predetermined stroke of the actuator is obtained to the input current.</li> </ol>	<ol style="list-style-type: none"> <li>(1) Set the input current to 0% (4mADC in the standard specification) and turn the zero adjusting knob by hand to set it to the actuator starting point.</li> <li>(2) Then, set the input current to 100% (20mADC in the standard specification) and check the actuator stroke. At this point, depending on whether the span is too large or too small, adjust the span as shown in the illustration above.</li> <li>(3) Set the input current to 0% and conduct the zero-point adjustment, as done in Step (1) again.</li> <li>(4) Repeat the above operations until the predetermined stroke of the actuator is obtained to the input current.</li> </ol>

## 7-2 Sensitivity adjustment

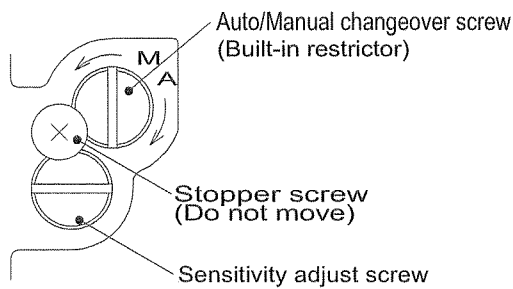


Fig.17 Pilot valve

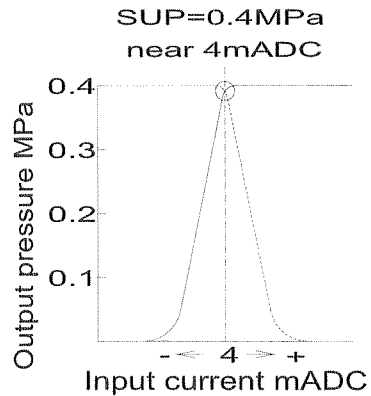


Fig.18 Input/output-pressure characteristic

Fig.18 shows the input current –output pressure characteristics of OUT1 and OUT2 of the pilot valve. When the positioner is shipped from our plant, the output pressure is set to the optimum state as shown in Fig.18 and this needs no adjustment ordinarily.



### Caution

The sensitivity adjustment of pilot valve is effective to the double action actuator only. If the sensitivity is poor because of the actuator type of load condition, turn the sensitivity adjust screw clockwise. If hunching occurs, turn the sensitivity adjust screw counter-clockwise.

(The amount of turning depends on actuators. Turn it by 1/16 to one turn. Do not loosen the stopper screw at this time since it is set to avoid the screw coming off.)

※ If hunching occurs with an actuator of small capacity, refer to the description in 11-1 (for both single action and double action.)

## 7-3 Manual switching

- (1) To operate the diaphragm valve manually, turn the Auto/Manual changeover screw of pilot valve towards M. The supply pressure and OUT1 output are conducted and the stroke can be adjusted by using the supply pressure setting reducing valve.(Refer to fig.17 Pilot valve)
- (2) To operate based on the input current, tighten the Auto/Manual changeover screw towards A. The screw is tightened up in the A direction when the positioner is shipped from our plant. (Refer to fig.17 Pilot valve)



### Caution

On this manual switching, SUP and OUT1 are conducted through the pilot valve and when the pilot valve becomes out of order, the manual switching is not functioning. Note that the stopper small screw set to the top is for prevention from coming off. Do not loosen it.

## 8. Maintenance and Check



### Warning

---

- (1) After installation, repair and disassembling, connect compressed air and perform a proper function test and a leak test. If bleed noise is louder than the initial state or operation is abnormal, stop operation and check if installation is proper or not.

And modification of electrical construction is prohibited due to maintaining Explosion-Protected construction function.

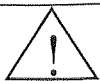


### Caution

---

- (1) Check if supply air is clean or not. Inspect compressed air cleaning system periodically and keep condition to be able to always get clean air so that dust, oil and humidity which cause malfunction and failure wouldn't include into the equipment.
- (2) If handled improperly, compressed air can be dangerous. Maintenance and replacement of unit parts should be performed only by trained and experienced personnel for instrumentation equipment as well as following the product specifications.
- (3) Check the positioner once a year. When you find excessively worn diaphragm, O-ring and other packing or any unit that has been damaged with new ones. Treatment at an early stage is especially important if the positioner is used in a place of severe environment like coastal area.
- (4) Before removing the positioner for maintenance or replacing unit parts after installation, make sure the supply pressure is shut off and all residual air pressure is released from piping.
- (5) When the fixed orifice is clogged with carbon particles or others, remove the pilot valve Auto/Manual changeover screw (built-in restrictor) and clean it by inserting a  $\phi 0.2$  wire into the aperture. If it must be replaced with new one, stop the supply pressure and remove the stopper screw of the pilot valve.
- (6) When you disassemble the pilot valve, coat grease to the O-ring of the sliding section.  
(Use the TORAY SILICONE SH45 grease.)
- (7) Check air leak from piping which compressed air flows. Air leak from air piping could deteriorate characteristics.  
Air is normally discharged from a bleed port, but this is a necessary air consumption based on the construction of the positioner, and is not an abnormality if the air consumption is within the specified range.

## 9. Caution on Handling



### Warning

### Operation

- (1) Do not use this positioner out of the range of its specifications as this can cause failure. (Refer to 1. Specifications.)
- (2) If the system is supposed to be in danger because of failure of the positioner, prepare the system with a safety circuit to avoid danger.
- (3) If the positioner is used as the product with Flameproof type of Explosion-Protection, leading external conductors into a flameproof terminal box in accordance with "Recommended Practice for Explosion-Protected Electrical Installations in General Industries"
- (4) Do not remove the terminal cover at a dangerous position during power conduction.
- (5) Be sure that the terminal cover and body cover are put on during the operation.



### Warning

### Handling

- (1) Avoid giving impact to the body and torque motor of positioner, and giving excessive force to armature because it leads to failure. Handle with care during transport and operation.
- (2) If you leave the positioner at the operation site for a long time without using it, put the cover on it so that the rain water does not enter the positioner. If the atmosphere is of high temperature or high humidity, take measures to avoid condensation inside. The condensation control measures must be taken thoroughly for export shipment.
- (3) Avoid to set positioner near magnetic field because characteristics are effected.



### Warning

### Air supply

- (1) Positioner has Restrictor and Nozzle which has fine paths in it. Therefore please use clean air which is dehydrated and filtered, and also avoid employing Lubricator which causes malfunction.
- (2) Avoid using compressed air containing chemicals, synthetic fluid including organic solvent, salinity, and corrosive gas as it may cause malfunction.
- (3) Use dehumidified and dust-removed clean air as the supplying air source.
- (4) If atmosphere is below freezing point, take measure to avoid condensation.

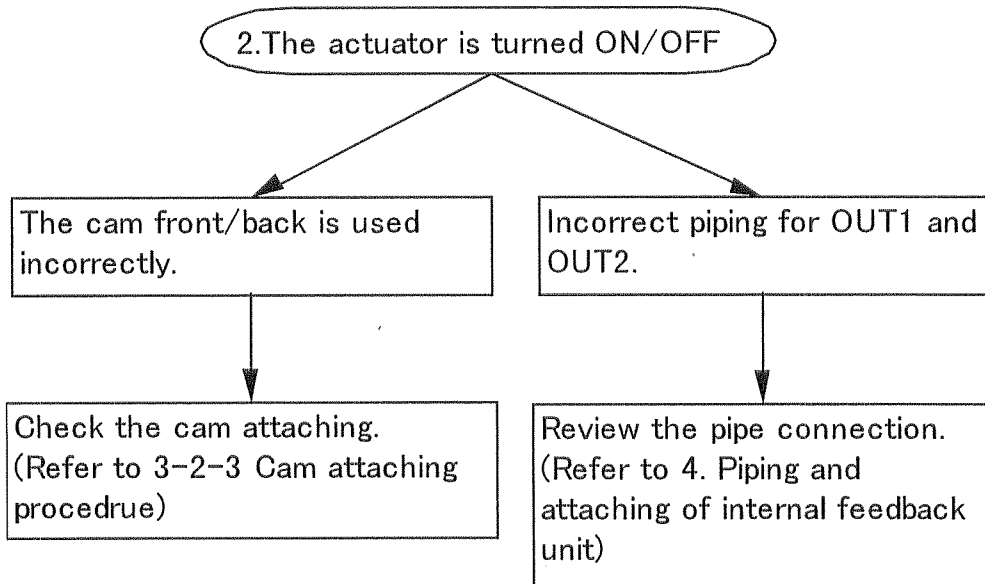
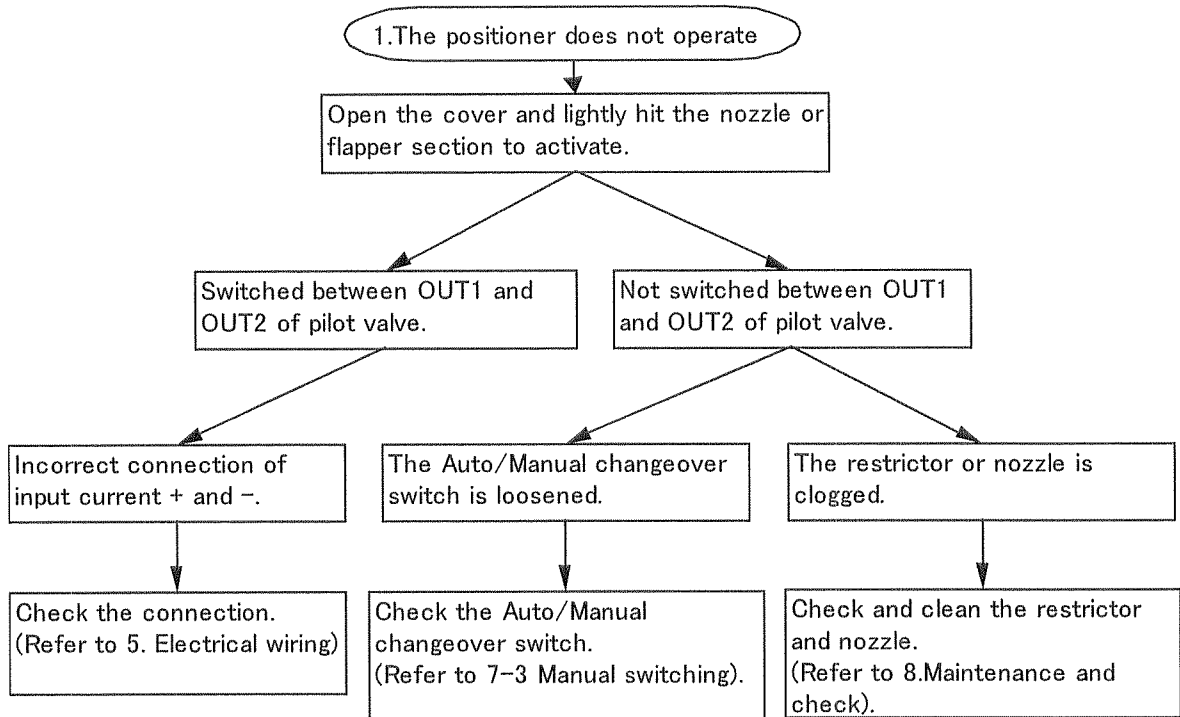


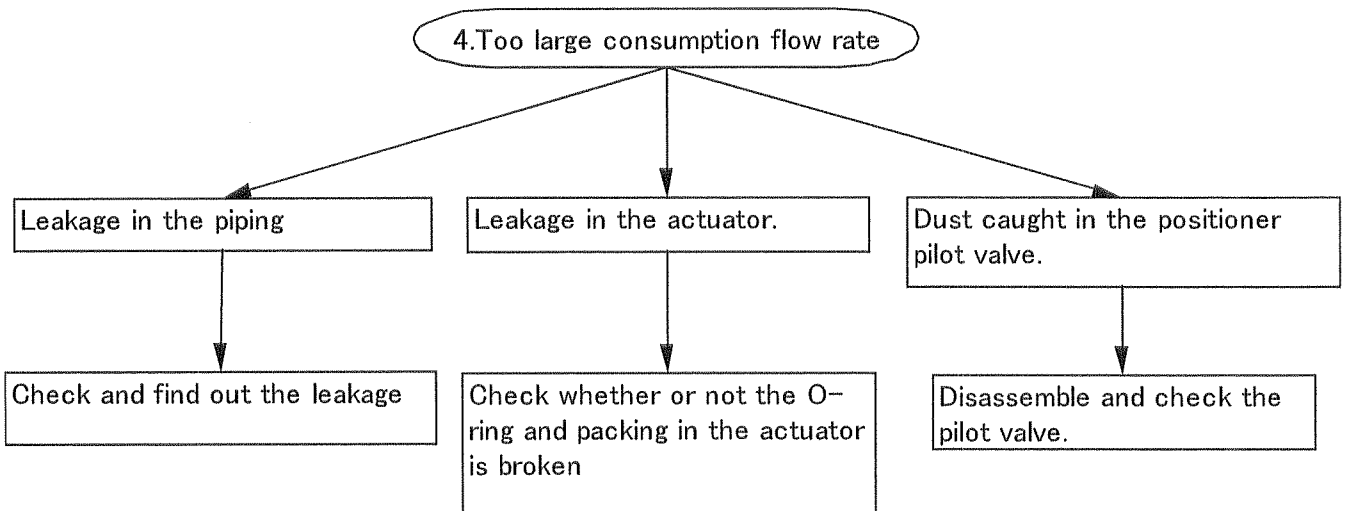
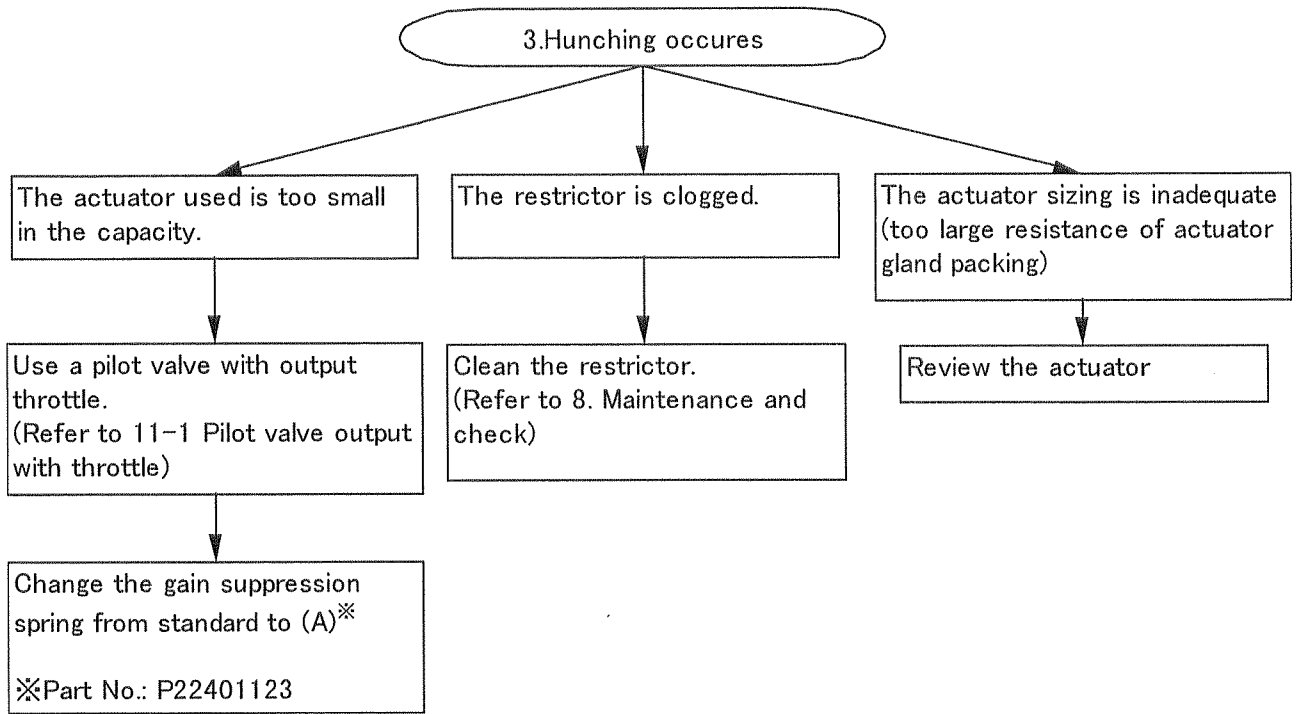
### Warning

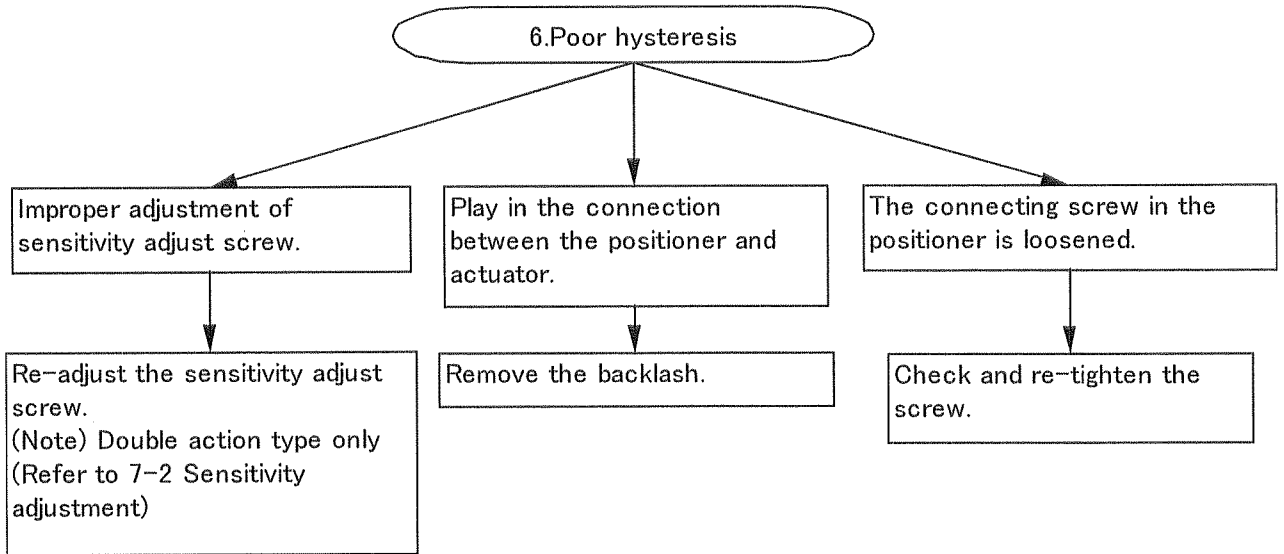
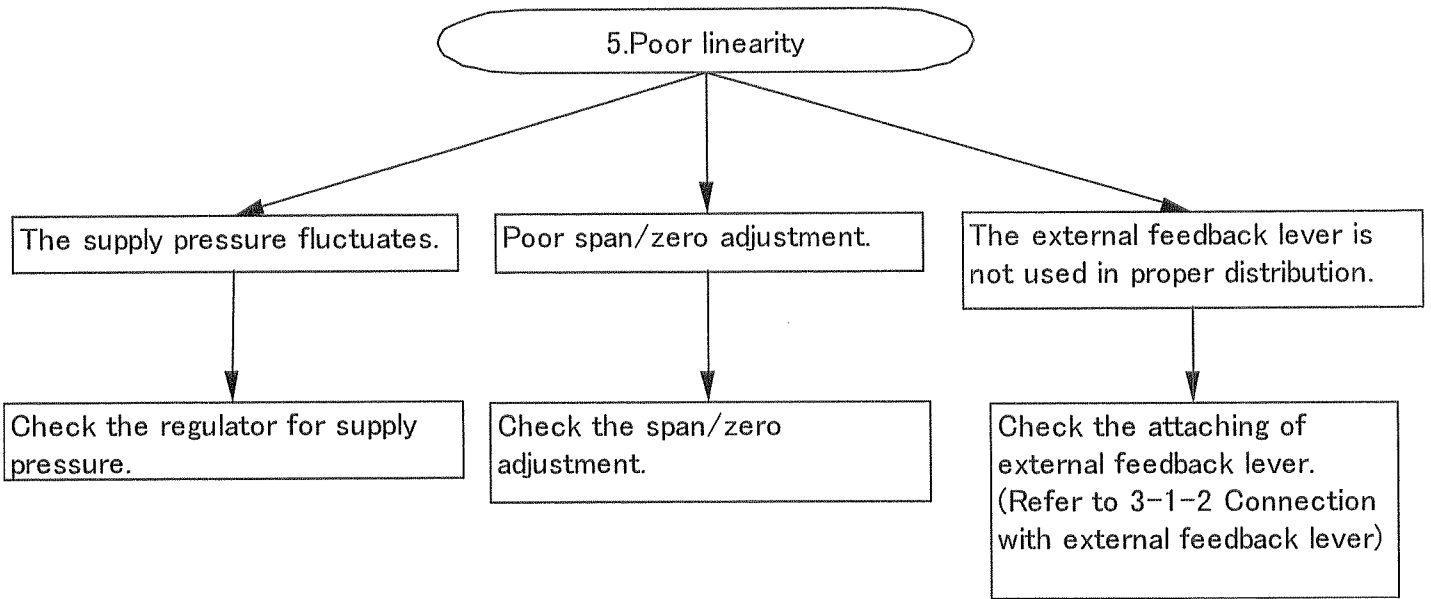
### Environment

- (1) Do not use in an environment where the product is exposed to corrosive gas, chemicals, salt water, water or steam.
- (2) Do not operate the product in a location where it is subject to strong vibration and/or shock.
- (3) If the positioner is used under temperature outside of the specification, the sealing materials deteriorate quicker and also the positioner may not operate normally.

## 10. Troubleshooting









## 11. Option

### 11-1 Pilot valve with output throttle

Hunching may occur when the positioner is attached to a small capacity actuator.

In such a case, use a pilot valve having a throttle for OUT1 and OUT2.

The throttle is removable.

(Refer to Figs.19 and 20 for mounting and dismounting the throttle.)

Table 6 Throttle types

Quite for actuator	Throttling diameter	Part No.	Pilot unit No. having the Throttle shown at left
90cm <sup>3</sup>	$\phi 0.7$	P36801080	P368010-28
180cm <sup>3</sup>	$\phi 1$	P36801081	P368010-29

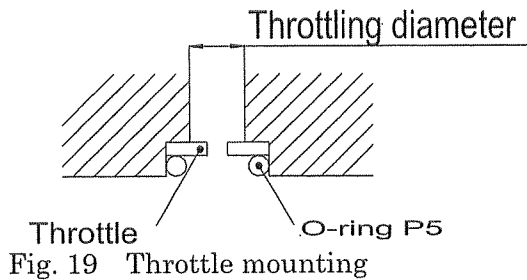


Fig. 19 Throttle mounting

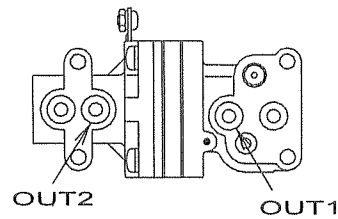


Fig. 20 Pilot valve bottom drawing

(Note 1) When mounting the throttle, pay attention not to let dust and others enter the port hole.

Be sure to mount an O-ring after mounting the throttle.

(Note 2) If the hunching does not stop even after mounting the throttle, use gain suppression spring(A), separately provided. 【Part No. P22401123】

### 11-2 Fork lever type joint (Type IP8100)

Two types of joint, having different attaching sizes for different bracket attaching methods, are available as the fork lever type joint of rotary type IP8100.

Table 7 Type of fork lever type joint

Description	Part No.
Fork lever assembly M	P368010-24
Fork lever assembly S	P368010-25

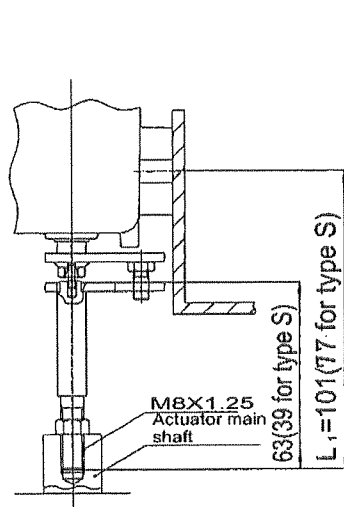


Fig.21 Example of side attaching using fork lever assembly M

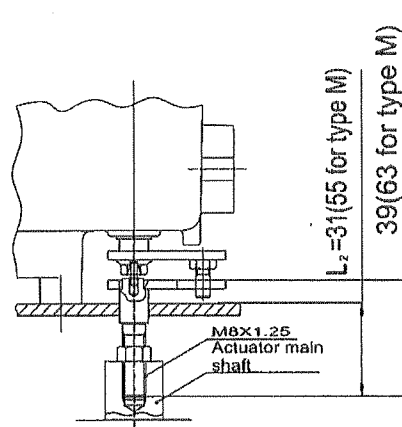


Fig.22 Example of backside attaching using fork lever assembly S

In the case of side attaching, if you use fork lever assembly M, it is compatible with our IP610 positioner in the attaching size. Also, in the case of backside attaching, if you use fork lever assembly S, it is compatible with our IP610 positioner in the attaching size.

### 11-3 External feedback lever ( Type IP8000 )

Levers having different stroke sizes are available for the feedback lever of lever type IP8000. Order them to match your valve stroke.

Table 8 Feedback lever types

Stroke	Unit No.
10~85mm(Standard accessory)	P368010-20
35~100mm	P368010-21
50~140mm	P368010-22

### 11-4 Resin cable clamp unit (Type non-explosion protection)

As non-explosion prove resin cable clamp unit used for type without terminal box (IP8※00-※※0), there are two types available which are compatible with different cable in diameter.

The cable is made of resin and available only in the indoor use.

Table 9 Cable clamp unit

Description	Part No.	Suitable cable dia.
Cable clamp unit (A)	P368010-26	$\phi 7 \sim \phi 9$
Cable clamp unit (B)	P368010-27	$\phi 9 \sim \phi 11$

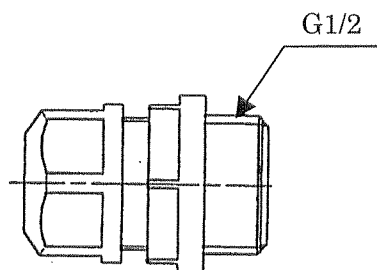


Fig.23 Non-explosion proof resin cable clamp unit

11-5 Scale plate unit



**Caution**

Locate scale plate with care not to make finger pinched between needle and plate.

Adjustment of scale plate

- (1) Perform adjustment of zero span in positioner before installing the positioner to either face of DA or RA with consideration of operating direction. (Refer to Fig. 24.)
- (2) Stop positioner at intermediate opening of actuator (where input signal of 50% finishes to enter to the positioner) and adjust the position of needle to meet with 50+% of scale plate. (Refer to Fig.25) If the needle can't be met with 50+% even with adjustment, stop pressure supply once, reposition fork lever type fitting and cam, and readjust zero span.
- (3) At the end of start and stop of actuator, confirm needle points 0% and 100% of scale plate respectively. If the needle points others, position the needle by loosening cross recessed hexagon bolt holding scale plate with spanner and sliding the scale plate. (Refer to Figure 26. 27.)

A

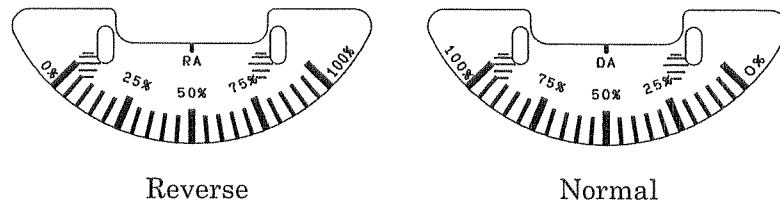


Fig.24 Scale plate

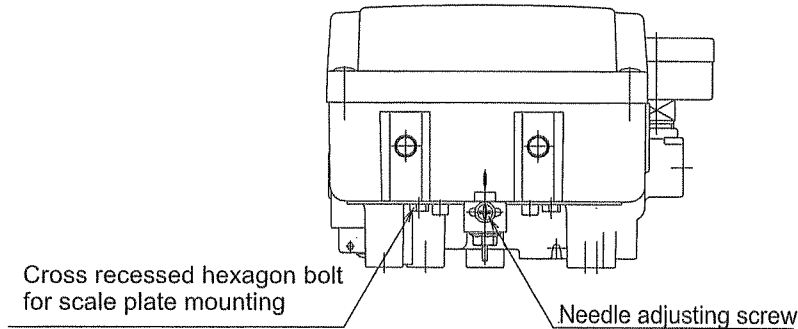


Fig.25 Positioning of needle

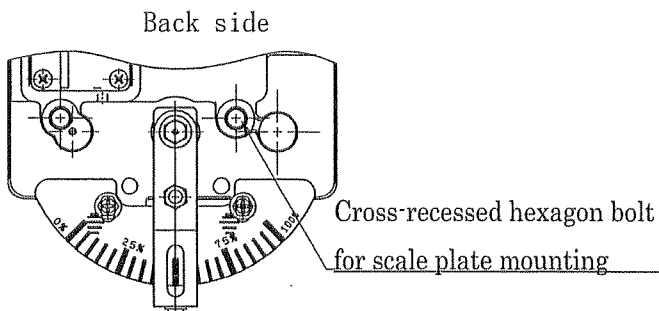


Fig.26 Scale plate (Back side)

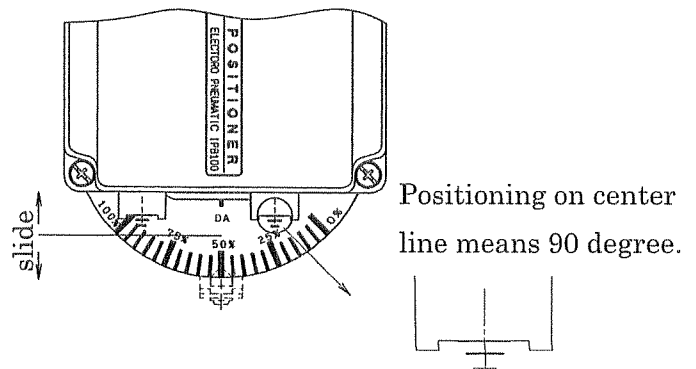
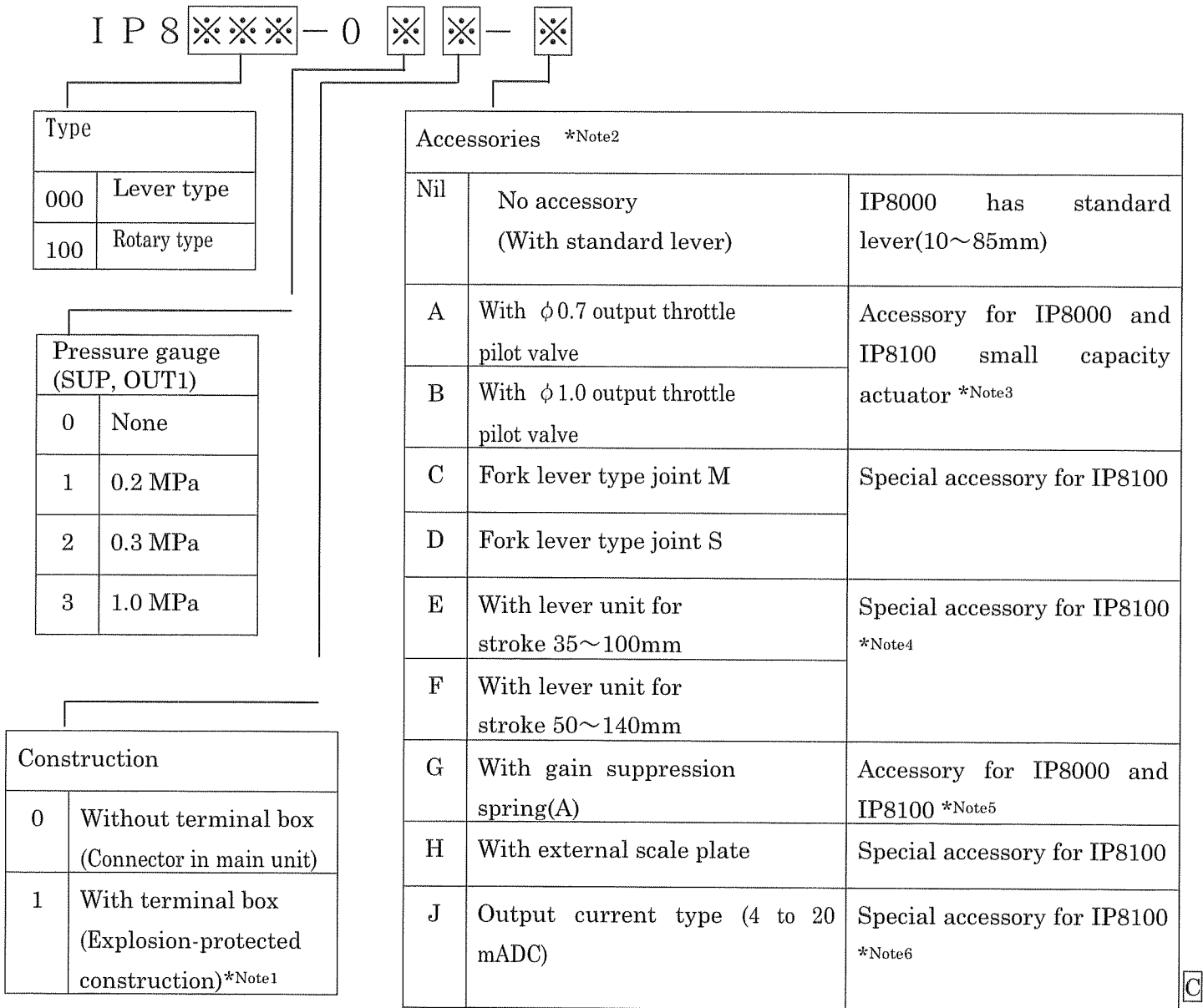


Fig.27 Positioning for Scale plate

### 1 3. How to order



Note1. 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

Label of Explosion-Protected specification(Exd II BT5) is on the body.

(See page3 Item:Explosion-protected construction)

Note2. If two or more accessories are required, the part numbers should be made according to alphabetical order (ex. IP8000-011-AG)

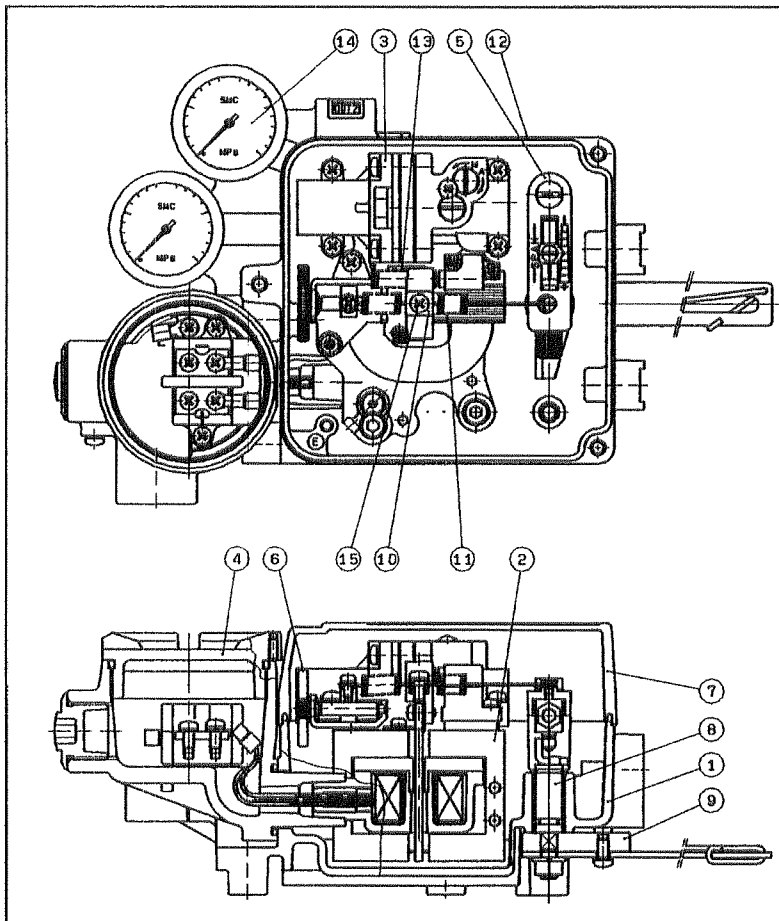
Note3. "A" is applied to approx. 90cm<sup>3</sup>-capacity actuator.

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

Note4. Standard lever is not attached.

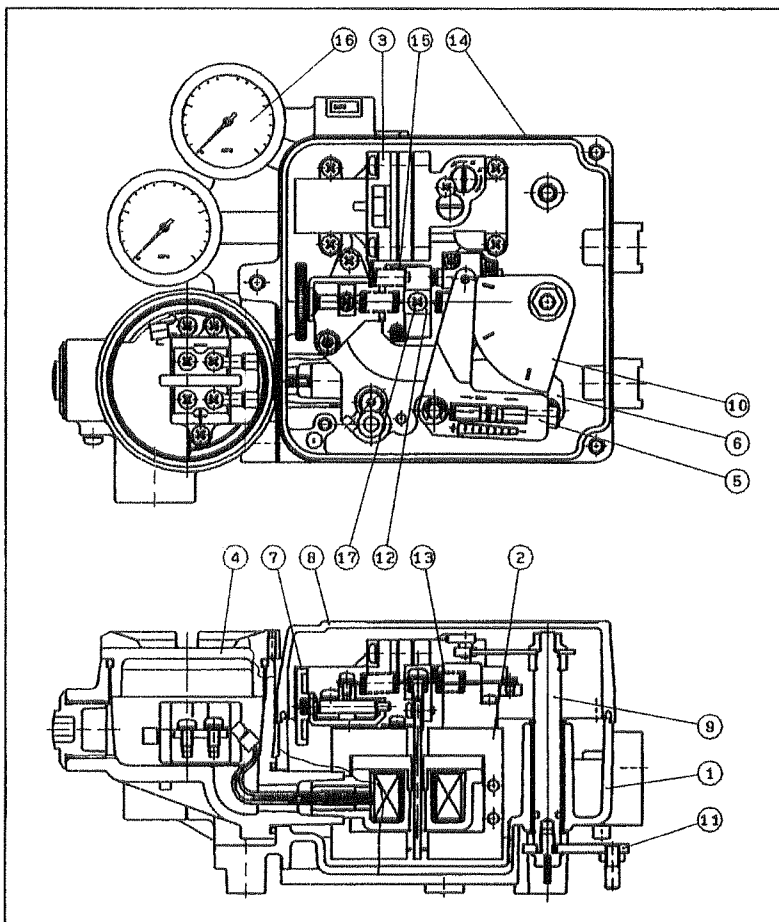
Note5. The following combinations are available: A+G or B+G

Note6. "J", non- Explosion-protected construction, is applicable only to type with terminal box.



15	M4x0.7x8	MACHINE SCREW AND WASHER ASSEMBLIES	STAINLESS STEEL	1
14	G43-W-01	PRESSURE GAUGE	STAINLESS STEEL	2
13	P3680106B	GAIN SUPPRESSION SPRING	STAINLESS STEEL	1
12	P5650102B	(Pressure proof) Specification label for Explosion-protected	POLYESTER	1
11	P56501023	FEEDBACK SPRING	STAINLESS STEEL	1
10	P36801054	SPRING HOLDER	STAINLESS STEEL	1
9	P368010-20	FEEDBACK LEVER UNIT	---	1
8	P565010-14	FEEDBACK SHAFT ASSEMBLY	---	1
7	P565010-12	BODY COVER UNIT	---	1
6	P368010-13	ZERO ADJUST UNIT	---	1
5	P368010-10	SPAN ADJUST UNIT	---	1
4	P565010-8	TERMINAL BOX UNIT	---	1
3	P565010-7	PILOT VALVE UNIT	---	1
2	P565010-5	TORQUE MOTOR UNIT(WITH TERMINAL BOX)	---	1
1	P565010-3	BODY UNIT	---	1
ITEM	PART NO	PART NAME	MATERIAL	QTY

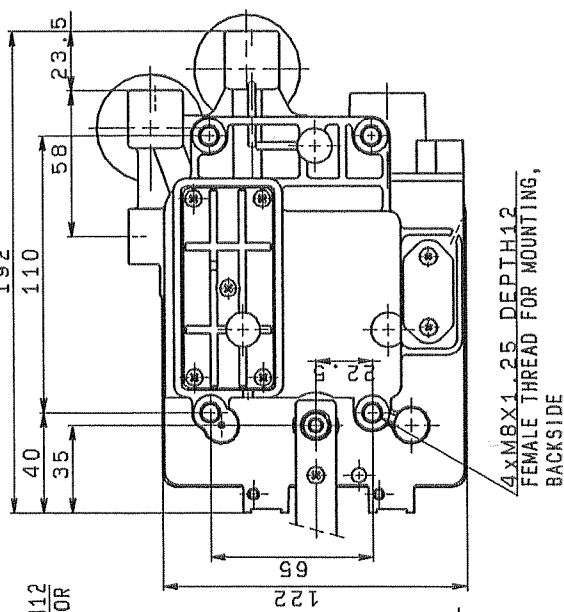
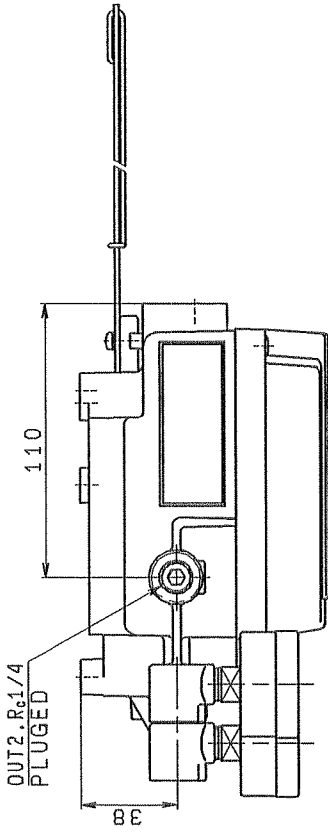
Structure of lever type  
IP8000-0\*1



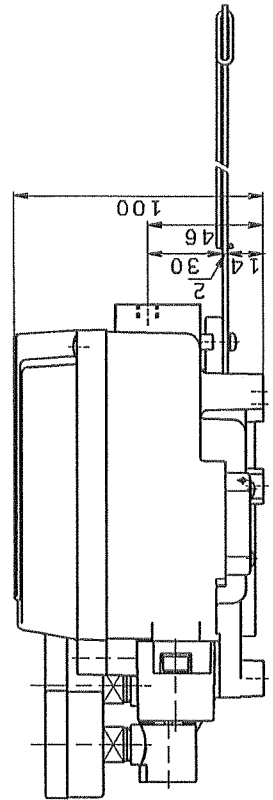
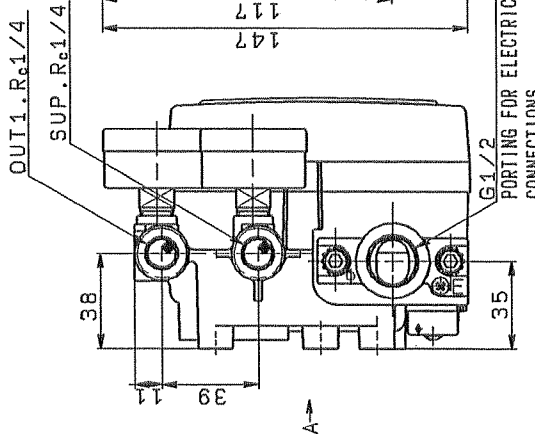
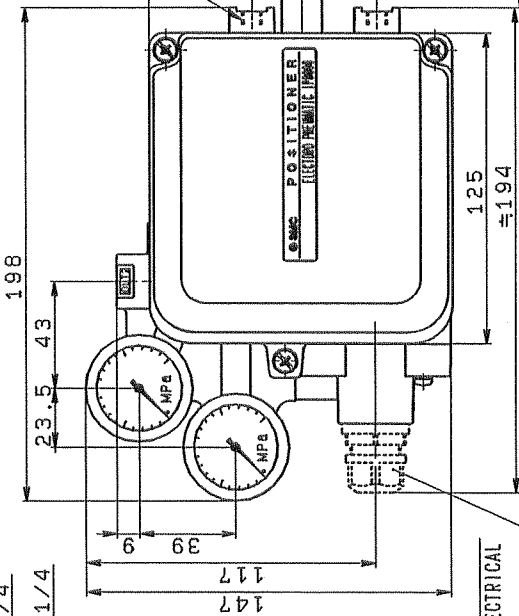
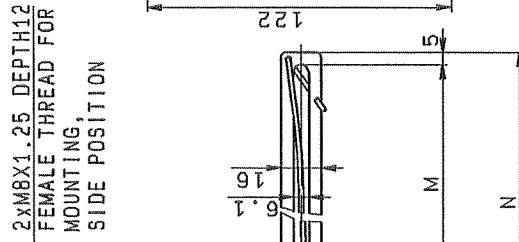
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16	G43-W-01	PRESSURE GAUGE	STAINLESS STEEL	2
15	P3680106B	GAIN SUPPRESSION SPRING	STAINLESS STEEL	1
14	P5650102B	(Pressure proof) Specification label for Explosion-protected	POLYESTER	1
13	P56501024	FEEDBACK SPRING R	STAINLESS STEEL	1
12	P36801054	SPRING HOLDER	STAINLESS STEEL	1
11	P368010-23	FORK PIN UNIT	---	1
10	P368010-18	CAM UNIT	---	1
9	P565010-15	FEEDBACK SHAFT ASSEMBLY	---	1
8	P565010-13	BODY COVER UNIT	---	1
7	P368010-13	ZERO ADJUST UNIT	---	1
6	P565010-11	TRANSMISSION LEVER UNIT	---	1
5	P565010-10	SPAN ADJUST UNIT	---	1
4	P565010-8	TERMINAL BOX UNIT	---	1
3	P565010-7	PILOT VALVE UNIT	---	1
2	P565010-5	TORQUE MOTOR UNIT (WITH TERMINAL BOX)	---	1
1	P565010-4	BODY UNIT	---	1
ITEM	PART NO	PART NAME	MATERIAL	QTY

Structure of rotary type  
IP8100-0\*1

VALVE STROKE	M	N
10 to 85 mm	125	150
35 to 100 mm	110	195
50 to 140 mm	110	275

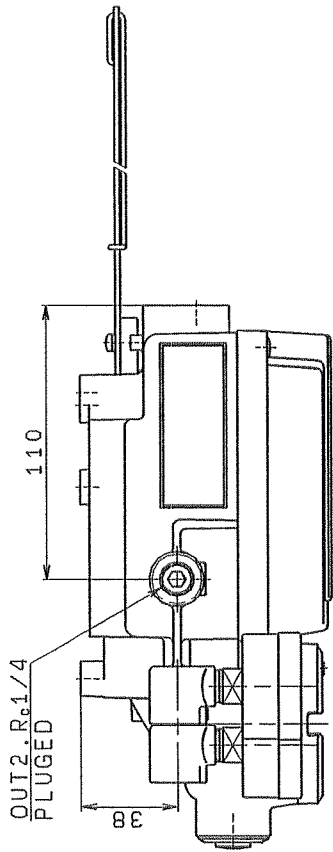


VIEW OF A

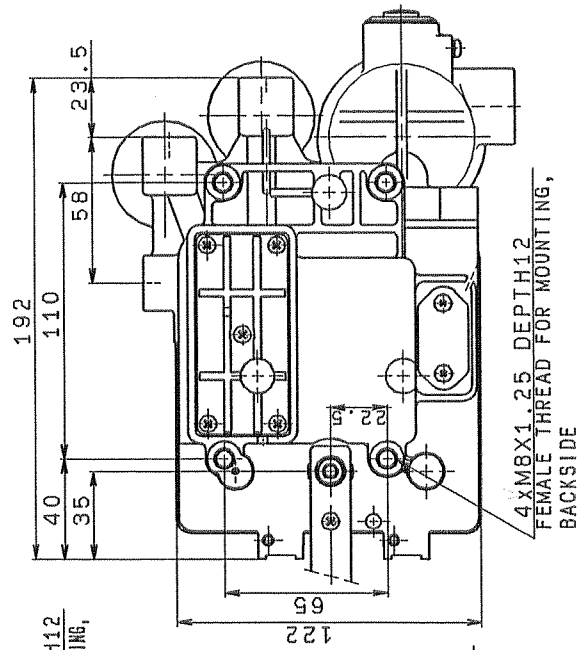


IN CASE OF OPTIONAL "RESIN CABLE CLAMP"  
 AVAILABLE CABLE DIA Ø7 ~ 9; P368010-26  
 AVAILABLE CABLE DIA Ø9 ~ 11; P368010-27

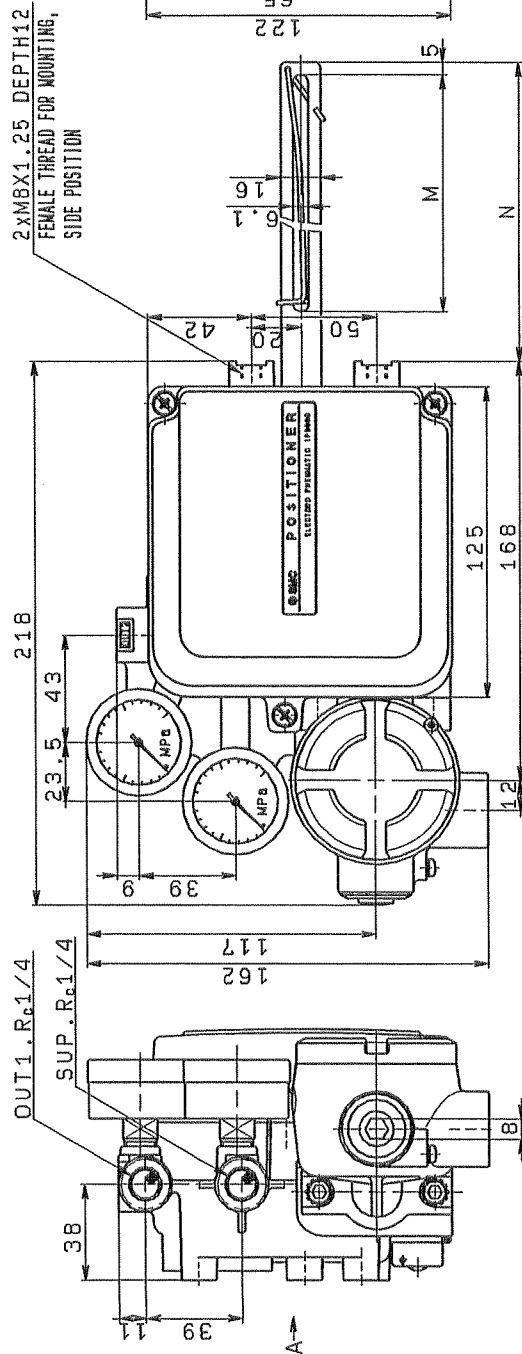
LEVER TYPE  
 (WITHOUT TERMINAL BOX)  
 IP8000-0\*0-\*



VALVE STROKE	M	N
10 to 85 mm	125	150
35 to 100 mm	110	195
50 to 140 mm	110	275

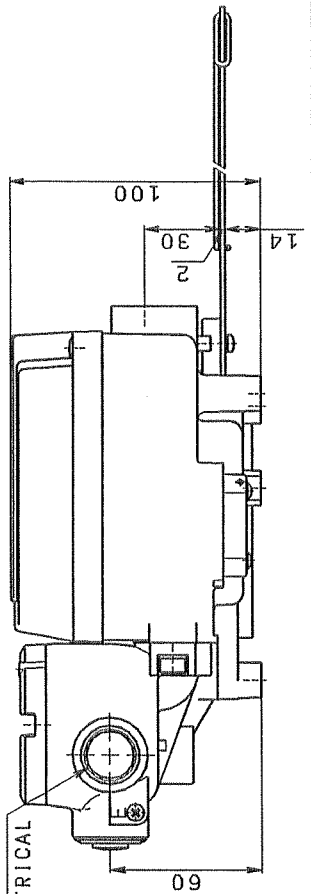


VIEW OF A



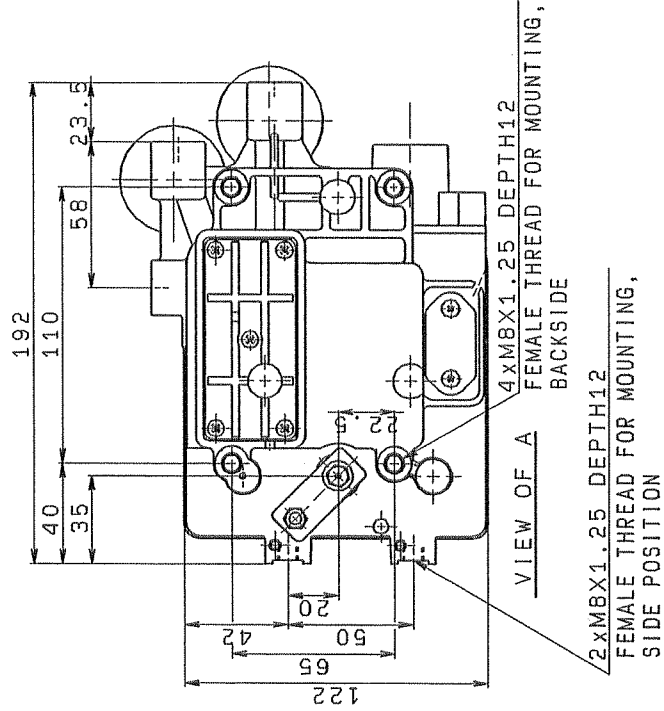
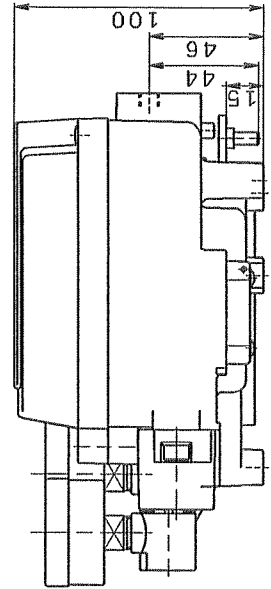
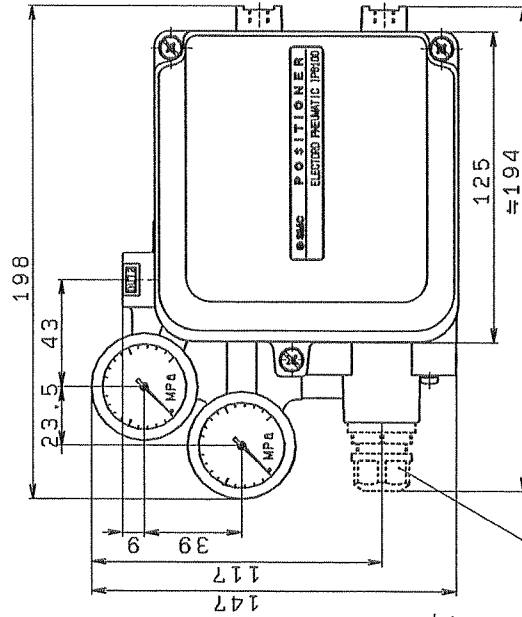
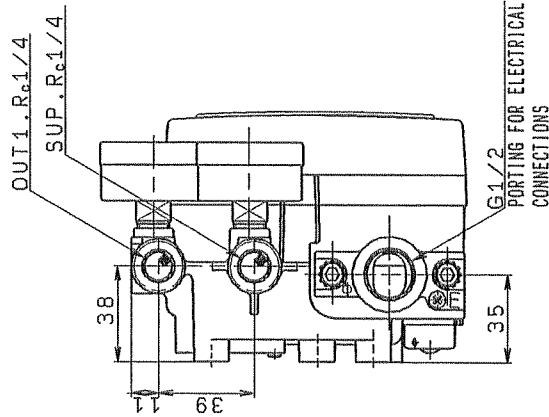
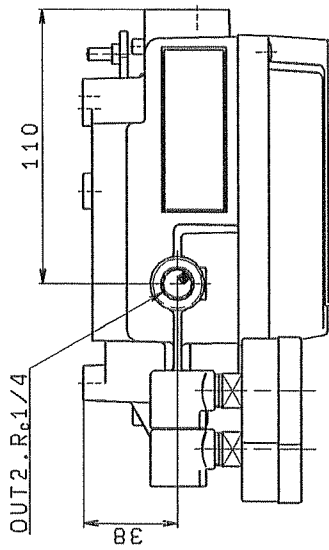
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PORTING FOR ELECTRICAL CONNECTIONS



LEVER TYPE  
(WITH TERMINAL BOX)

IP8000-0\*1-\*



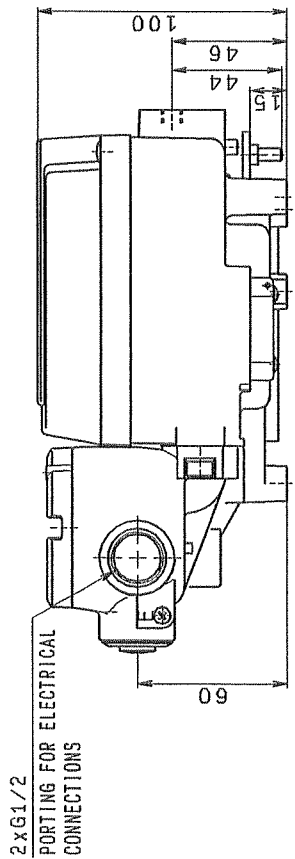
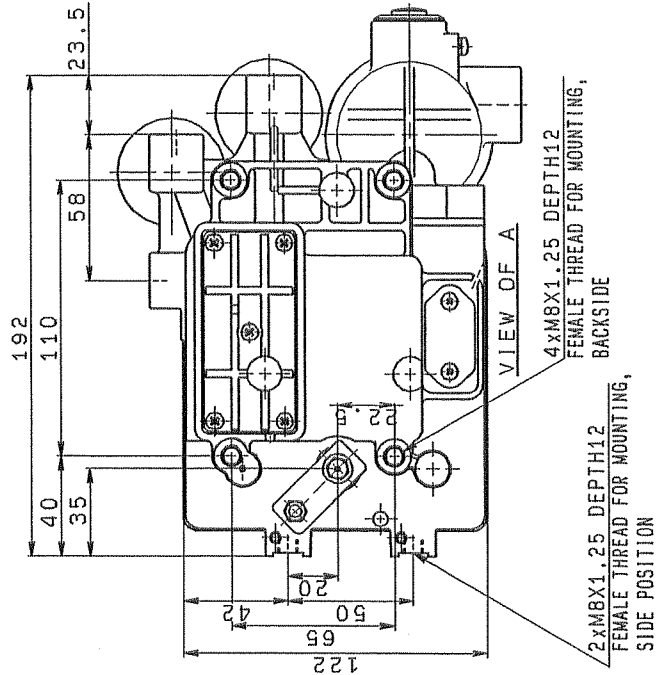
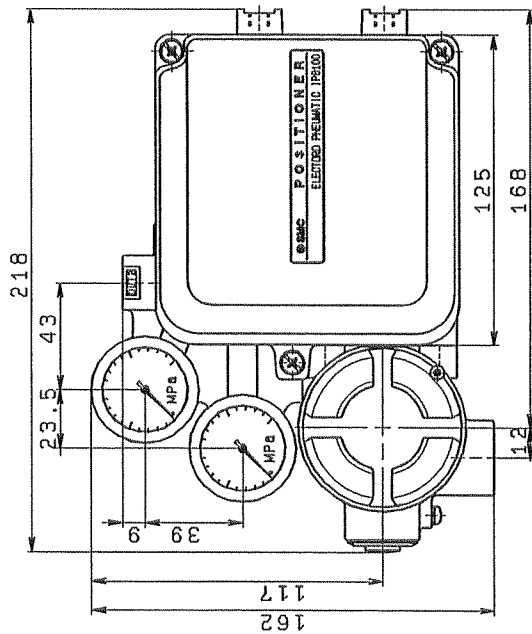
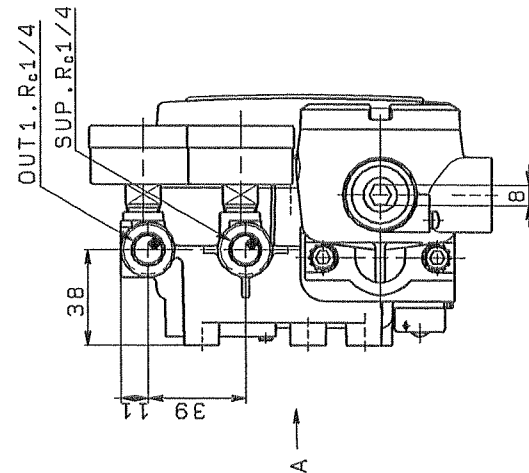
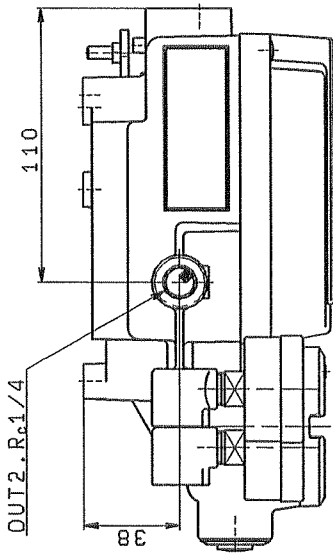
ROTARY TYPE  
(WITHOUT TERMINAL BOX)

IP8100-0\*0-\*

IN CASE OF OPTIONAL "RESIN CABLE CLAMP"  
AVAILABLE CABLE DIA Ø7 ~ 9:P368010-26  
AVAILABLE CABLE DIA Ø9 ~ 11:P368010-27

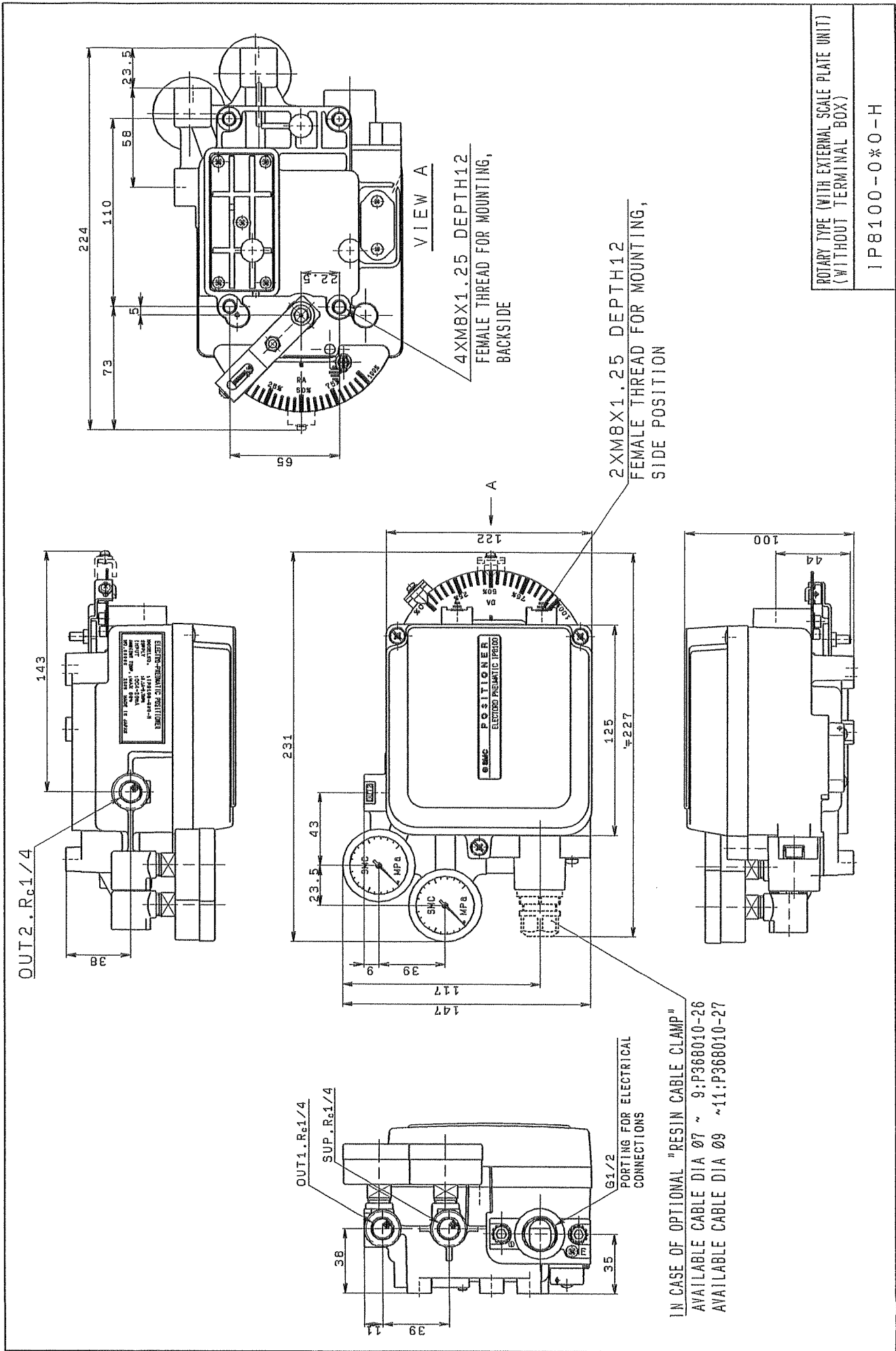
A →

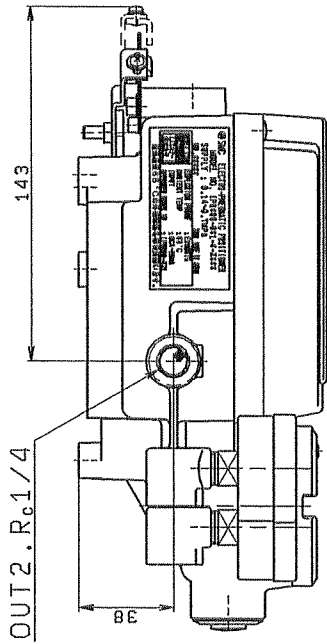




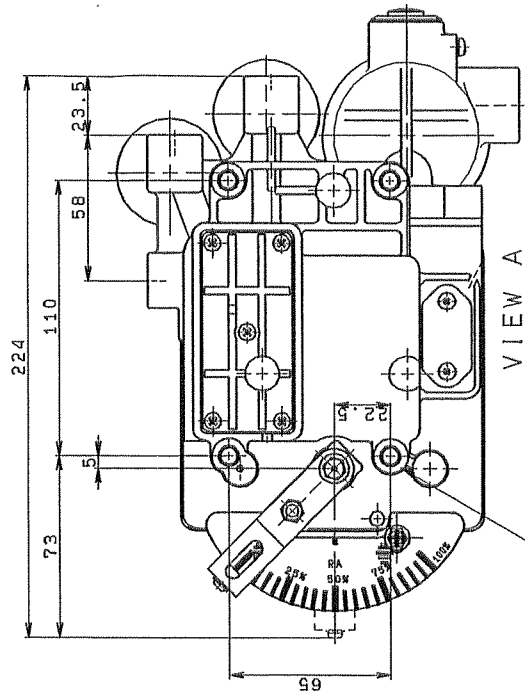
ROTARY TYPE  
(WITH TERMINAL BOX)

1P8100-0\*1-\*





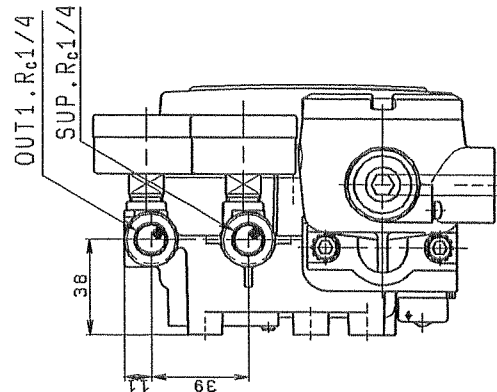
OUT2 . Rc1/4



VIEW A

4XM8X1.25 DEPTH12  
FEMALE THREAD FOR MOUNTING,  
BACKSIDE

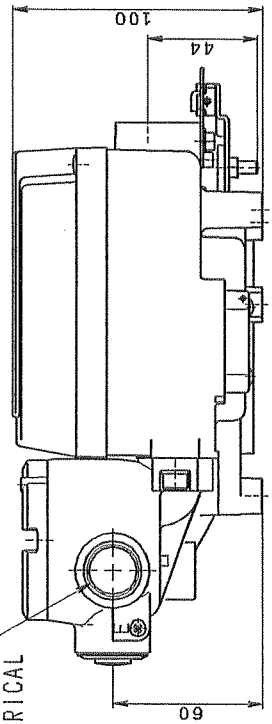
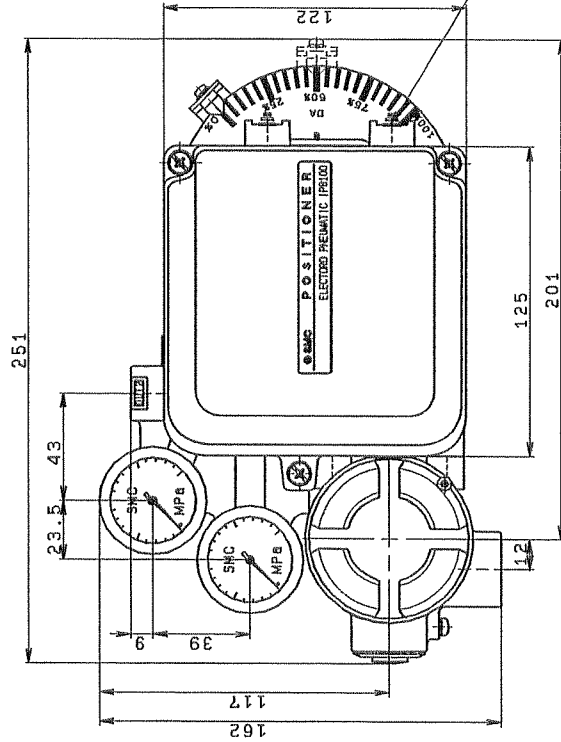
2XM8X1.25 DEPTH12  
FEMALE THREAD FOR MOUNTING,  
SIDE POSITION



OUT1 . Rc1/4  
SUP . Rc1/4

2XG1/2

PORTING FOR ELECTRICAL  
CONNECTIONS



ROTARY TYPE (WITH EXTERNAL SCALE PLATE UNIT) (WITH TERMINAL BOX)
IP8100-0*1-H