

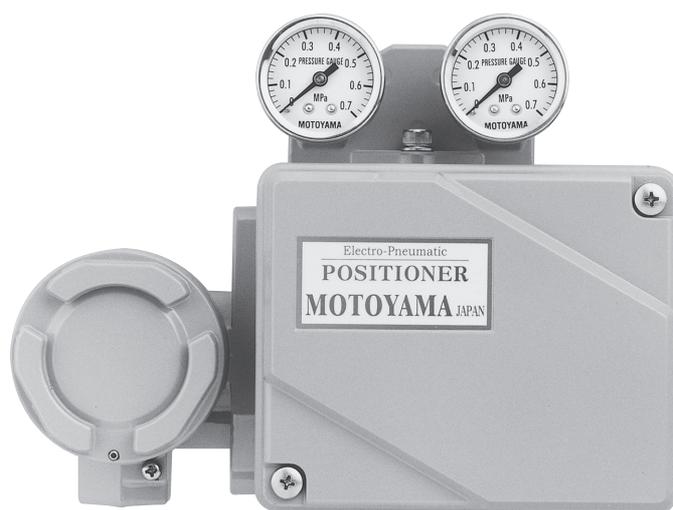
MOTOYAMA

INSTRUCTION MANUAL

ELECTRO-PNEUMATIC VALVE POSITIONERS

**Models EA91A Flameproof Type of
Explosion-protected Construction**

**Model EA90A Intrinsic Safety Type of
Explosion-protected Construction**



 **MOTOYAMA ENG. WORKS, LTD.**

FOREWORD

Thank you very much for purchasing our **Model EA91A/EA90A Electro-pneumatic Valve Positioner**. Take fully notice that the items described below to use this valve positioner safely and correctly.

1 General Information

- (1) This Instruction Manual describes the basic recommended procedures for operating the Model EA91A/EA90A Electro-pneumatic Valve Positioner. Thoroughly read and understand all descriptions in this manual before operation. This Instruction Manual should always be referred prior to any operations.
- (2) This product is mounted to a control valve as dedicated equipment. Read and follow all individual procedures in this instruction manual with the instruction manual of control valve when working and operating this product mounted to the control valve.
- (3) As the result of studying and improving this product without notice, the specifications, dimensions, adjustments, illustrations, and other items included in this manual might be different in details. For any questions about the delivered product or this instruction manual, contact MOTOYAMA sales office or sales agency for purchase before operation.

2 Safety Information

To handle this product safely, the symbol marks and signal words shown below are used in this instruction manual to alert risk as required. The contents of symbol mark and signal word are described below.

Symbol Mark & Signal Word	Description
 WARNING	This mark with this signal is used when the possibility of death or serious injury to user is assumed if handling this product incorrectly.
 CAUTION	This mark with this signal is used when the possibility of light injury or middle injury to user, or property damage is assumed if handling this product incorrectly.
 IMPORTANT	This mark and signal are used to comply the instructions to prevent damage of this product or malfunction.

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1 SAFETY INSTRUCTIONS

1.1 General Safety Instructions

1.1.1 Compliance with Safety Instructions

When handling and operating the electro-pneumatic valve positioner, all the safety instructions herein should be securely followed.

1.1.2 Conformance with Specifications

Both the Model EA91A Electro-pneumatic Valve Positioner (flameproof explosion-protected construction) and the Model EA90A Electro-pneumatic Valve Positioner (intrinsically safe explosion-protected construction) have been approved in accordance with the Labor Safety and Hygiene Law of "Technical Criteria of Electrical-mechanical Equipment Explosion-protected Construction"(hereafter referred to as "Technical Criteria"). The certified seal, and the nameplate or the cautionary label describing the specifications to be required protecting explosion are attached to each valve positioner in conformance with all specified requirements. Check the items described in the certified seal, and the nameplate or the cautionary label, and use this product.

Model No.	Explosion-protection Type	Applicable Explosive Gases	Installation Location
EA91A	Flameproof Type Technical Criteria, Ex sd IIC T6X	II C T6	All gases classified in Group I and Div.1 and 2 Hazardous Area. Non-Hazardous Area. (Locations specified in Technical Criteria and Division 1 and 2 Hazardous Area)
EA90A	Intrinsic Safety Type Technical Criteria, Ex ia IIC T5	II C T5	All gases classified in Group I and Div.0, 1 and 2 Hazardous Area. All Non-Hazardous Area. (Locations specified in Technical Criteria and Division 0,1, and 2 Hazardous Area)

1.1.3 Prohibition of Changing Specifications and Modifications

Do not change the specifications or modify the valve positioners by user.

1.2 Safety Instructions on Model EA91A Electro-pneumatic Valve Positioner

1.2.1 Limitation of Installation Locations

The EA91A Valve Positioner can be installed in the hazardous area according to the available explosive gas of the valve positioner.

However, do not install the EA91A Valve Positioner in the Class 0 hazardous area.

1.2.2 Maintenance during Operation

Do not perform maintenance of the EA91A valve positioner while the power is being turned ON. When performing maintenance by opening the terminal box with the valve positioner turned ON due to circumstances, carefully make sure before and during maintenance that the explosive gases are absent using gas detector.

When impossible to check whether the explosive gases are absent or not, maintenance must be limited to visual inspection and adjustment of movable parts not requiring the opening of the terminal box such as zero adjustment and stroke adjustment. Be careful not to generate impact sparks during this maintenance.

1.2.3 Repairs

- a) Turn OFF the power and move the EA91A Valve Positioner to safety place before repairing.
- b) Both mechanical and electric repairs are limited to restoring the valve positioner to its original condition in principle.
- c) The use is limited to the repairable degree only using general tools without soldering iron.

1.2.4 Protection against Conventional Short-circuit Current

The coil part filled with resin of the EA91A Valve Positioner is the special explosion-protected construction compliance with the Technical Criteria. This Technical Criteria requires the "protection against 4000A conventional short-circuit current for the electrical device or part with resin-filled construction to be connected to the external power supply". For the host device such as controller to be connected to the EA91A Valve Positioner, use fuse or breaker with breaking capacity 4000A or more.

"WARNING" seal is affixed on terminal box.

1.3 Safety Instructions on Model EA90A Electro-pneumatic Valve Positioner

The EA90A Electro-pneumatic Valve Positioner (intrinsically safe explosion-protected construction) consists of one intrinsic safety device (electro-pneumatic valve positioner) designed and produced following to the new Technical Criteria and one intrinsic safety related device (safety barrier).

Use the safety barrier individually passed the device test for combining with the EA90A Electro-pneumatic Valve Positioner. Select the safety barrier that complies with the combination conditions described in Item 2.6.2 "Model EA90A Electro-pneumatic Valve Positioner (Intrinsic Safety Type)" in this manual.

1.3.1 Limitation of Installation Location

The electrical device with the intrinsically safe explosion-protected construction consists of the combination of the intrinsic safety device (EA90A Electro-pneumatic Valve Positioner) to be installed in hazardous area and the safety barrier (intrinsic safety related device) to be installed in non-hazardous area.

The EA90A Valve Positioner can be installed in hazardous area according to the available explosive gas of the intrinsic safety device. However, do not install the safety barrier to be electrically connected to the EA90A Valve Positioner in hazardous area unless the safety barrier is used in combination with other explosion-protected construction (flameproof explosion-protected construction, etc.)

1.3.2 Combination with Safety Barrier

The safety barrier that does not individually pass the model test in compliance with the Technical Criteria should not be used by connecting to this electric-pneumatic valve positioner EA90A.

The explosion-protected device type of the safety barrier shall be "IIC" and the classification shall be "ia". Be sure to comply with the conditions since there are limitations of inductance and capacitance for safety rate and external wiring. (Refer to Item 2.6.2 "Model EA90A Electro-pneumatic Valve Positioner (Intrinsic Safety Type)" in this manual for maintenance of the EA90A Electro-pneumatic Valve Positioner.)

1.3.3 Maintenance

Consult with Motoyama for maintenance of the EA90A Electro-pneumatic Valve Positioner in principle.

If performing maintenance by user, read the following instructions herein and carefully follow the instructions described in Chapter 8 "MAINTENANCE" for specific procedures.

(1) Maintenance of EA90A Valve Positioner

When performing maintenance the EA90A Valve Positioner installed in hazardous area, carefully make sure before and during maintenance whether the explosive gases are absent or not by using gas detector.

(2) Maintenance during Operation

Do not perform maintenance of the EA90A Valve Positioner while the power is being turned ON.

When performing maintenance with the valve positioner turned ON due to circumstances, maintenance must be limited to visual inspection and adjustment of movable parts such as zero adjustment and stroke adjustment.

(3) Repairs

- a) Turn OFF the power, disconnect the external wiring, and then move the EA90A Valve Positioner to non-hazardous area.
- b) Both mechanical and electric repairs are restricted to only restoring the valve positioner to its original condition in principle.
- c) The repair by user shall be limited to repair using general tools without soldering iron.

(4) Verification of Intrinsic Safety

Check the following items in non-hazardous area when confirming intrinsic safety of the EA90A Valve Positioner at periodic maintenance of the EA90A Valve Positioner and at replacement of the parts for repairs.

Check the insulation performance by applying voltage with 500V for one minute to the plus (+) terminal or the minus (-) terminal, and the grounding terminal of the terminal block.

2 GENERAL INFORMATION

2.1 Purpose

The Model EA91A and EA90A Electro-pneumatic Valve Positioners are mounted to control valves. They convert electric signals from the controller into pneumatic pressure to control the opening of the control valve properly. The valve positioners are of explosion-protected construction, and are improved the positioning accuracy and response performance of process control valves installed in hazardous areas.

2.2 Applicable Regulation

The valve positioners delivered are passed the test in accordance with technical criteria of explosion-protected construction standard for electrical machine and equipment (issued by the Ministry of Labor in Japan, No. 556, 1996).

2.3 Standard Specifications

Type		Model EA91A	Model EA91AC	Model EA90A	Model 90AC
		Lever Type (Single Action)	Cam Type (Single Action)	Lever Type (Single Action)	Cam Type (Single Action)
Input Current		4 to 20mADC			
Input Resistance		250Ω			
Supply Air Pressure		Max. 500kPaG(5.0kgf/cm ² G)			
Structure	Explosion-protection	Flame-proof type (TIIS) Ex sd IIC T6X (NEPSI) Ex d mb IIC CT6 Gb (KOSHA) Ex d mb IIC T6		Intrinsic safety type (TIIS) Ex ia IIC T5 (NEPSI) Ex ia IIC T5 Ga	
	Protection Class	IEC IP65 (※IEC IP66)			
Connection	Air Piping Connection	Rc 1/4 (PT 1/4)			
	Conduit Connection	G 1/2			
Characteristics	Output Characteristics	Linear			
	Standard Stroke	10 to 65mm (※over 65 to 130mm)	60°(Linear) (※ 60°Eq% 90°Linear)	10 to 65mm (※over 65 to 130mm)	60°(Linear) (※ 60°Eq% 90°Linear)
	Linearity	≦ ±1.0%F.S	≦ ±2.0%F.S	≦ ±1.0%F.S	≦ ±2.0%F.S
	Hysteresis Error	≦ 1.0%F.S	≦ 1.5%F.S	≦ 1.0%F.S	≦ 1.5%F.S
	Dead band (substance alone)	≦ 0.1%F.S	≦ 0.3%F.S	≦ 0.1%F.S	≦ 0.3%F.S
	Repeatability	≦ ±0.3% F.S			
	Air Consumption	≦6.0 ℓ / min Nor (Sup. 140kPaG (1.4kgf/cm ² G), Signal 50%)			
	Maximum Supply and Exhaust of air	7.0 ℓ/min Nor (Sup. 140kPaG (1.4kgf/cm ² G), Signal 50%)			
	Insulation Resistance	≧100MΩ (with 500V DC Mega between terminal and case)			
	Ambient Temperature	-40°C to 100°C (-20°C to 60°C for explosion protection)		-20°C to 60°C	
Painting	Munsell 2.5PB 5/8 (Blue)				
Mass	Approx. 2.9kg				

[Notes] (1) ※Available as options on customer's request.
 (2) Model EA90A/EA90AC positioner is not available for reverse action type pilot.

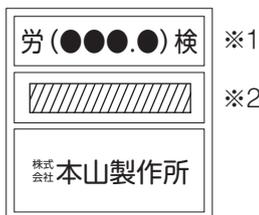
2.4 Model Numbering System

Specifications		Basic Model No.	Specification Code	
Structure	Flameproof Type	EA91A		
	Intrinsic safety Type	EA90A		
Displacement transfer Method	Lever Type		(Blank)	
	Cam Type		C	
Method of Leading External Cable	Conduit Type (standard)			(Blank)
	Explosion-proof connector with packing Type(option)			T

[Note] If method of leading external cable is explosion-proof connector(Spec. code:T), applicable standard is JIS, flame-proof. In case of NEPSI flame-proof type, flame-proof packing connector(cable glands), certified by NEPSI, shall be supplied by customer.

2.5 Nameplate Identification

(1) The safety certified seal nameplate (Official Certification Plate) is attached on the top of positioner case.



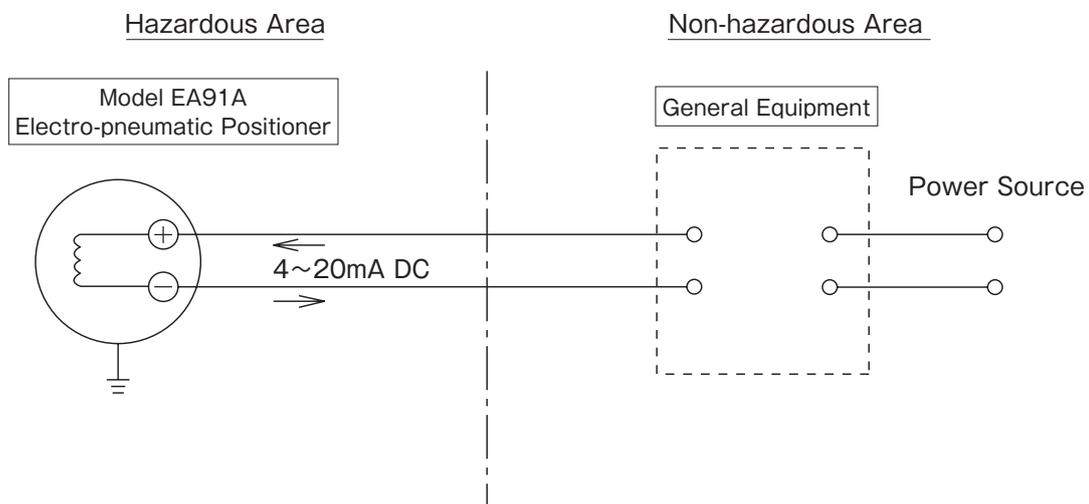
[Notes]

- ※1. Described date may be differed bytime of manufacture.
- ※2. To be described authorization Nos. in .

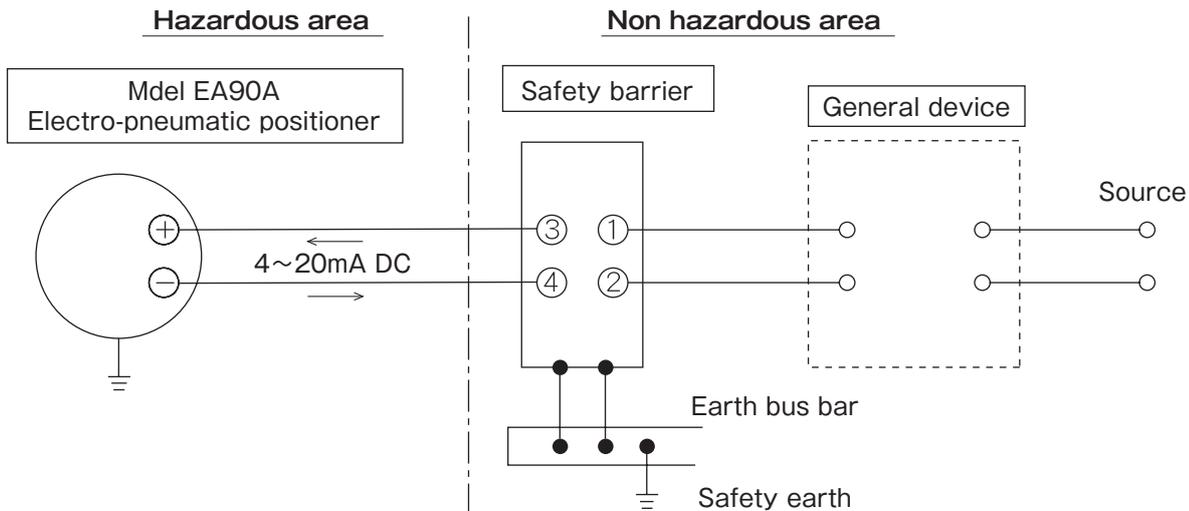
- (2) The explosion protection "WARNING" nameplate is attached on the upper part of terminal box. (EA91A and EA90A have different contents each other.)
- (3) The specification nameplate is attached on the right side of positioner case.
- (4) The orifice plate classification nameplate is attached on the pilot cover.

2.6 System Configuration

2.6.1 Model EA91A Electro-Pneumatic Positioner (Flameproof Type)



2.6.2 Model EA90A Electro-Pneumatic Positioner (Intrinsic Safety Type)



To combine with a safety barrier

The safety barrier which is used in combination with electro-pneumatic positioner EA90A must be *2TIIS certified type.
For the safety barrier selection, please refer to the following data for Intrinsically safe approval of model EA90A.

- ① Performance classification and Group
ia IIC
- ② Permissible maximum values
 $U_i = 30V$, $I_i = 100mA$, $P_i = 0.75W$
- ③ Parameters
 $C_i =$ negligibly small
 $L_i =$ negligibly small

*2 TIIS ; Technology Institution of Industrial Safety (JAPAN)

Caution

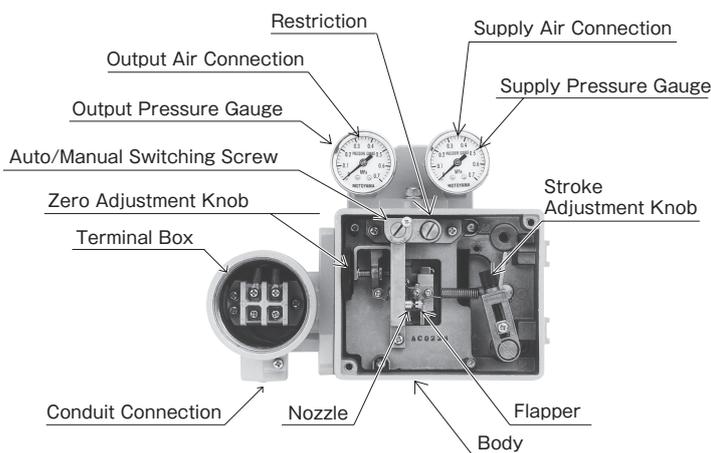
* Motoyama distribute recommended safety barriers. If you are interested or have any questions about the product, please contact our sales offices or sales agents.



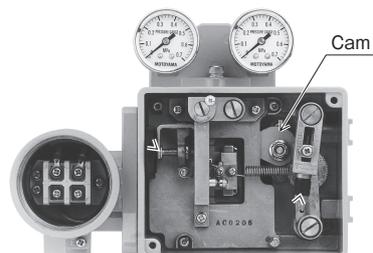
Do not connect a constant voltage power supply to the Electro-pneumatic positioner EA90A, which has an intrinsic safety type. Overcurrent may flow and damage the diode inside the positioner.

2.7 Construction

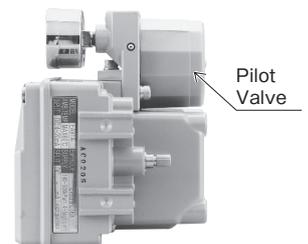
2.7.1 Lever Type



2.7.2 Built-in Cam Type



Right-hand lateral face



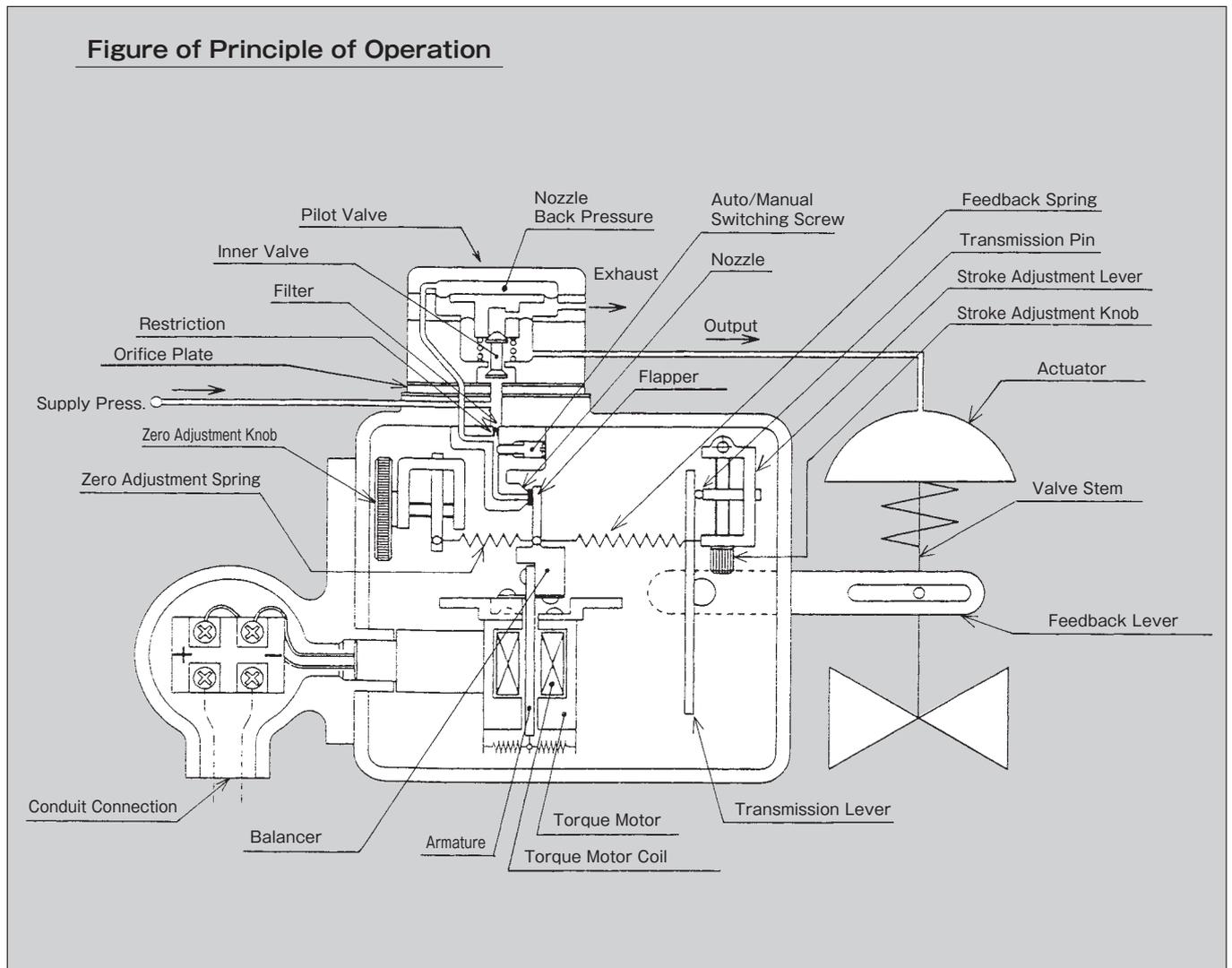
3 PRINCIPLE OF OPERATION

The Model EA91A and EA90A Electro-Pneumatic Positioner is used as accessory measuring instrument to pneumatic control valves. This converts electric signals from the controller into pneumatic pressure to position the opening of pneumatic control valve.

As the signal current from the controller or manual operator increases, the torque motor coil generates magnetic pole on the armature. The armature receives rotary torque in the counter-clockwise direction, and varies the distance between the nozzle and the flapper. As a result, the nozzle back pressure changes, and the pilot valve reacts accordingly.

The output air of pilot valve is supplied to the diaphragm motor, and moves the control valve. The valve stem movement is mechanically transmitted to the feedback spring through feedback lever, transmission lever, and stroke adjustment lever, and balances the valve movement at a position that is equal to the generated torque due to the signal current.

Figure of Principle of Operation

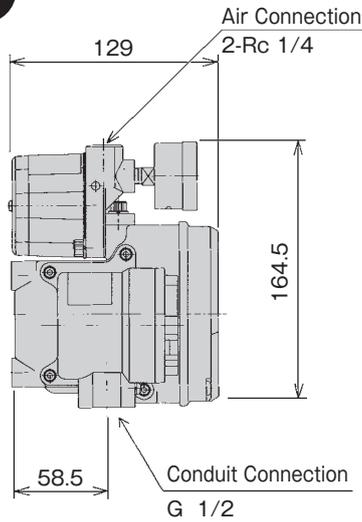


4 INSTALLATION

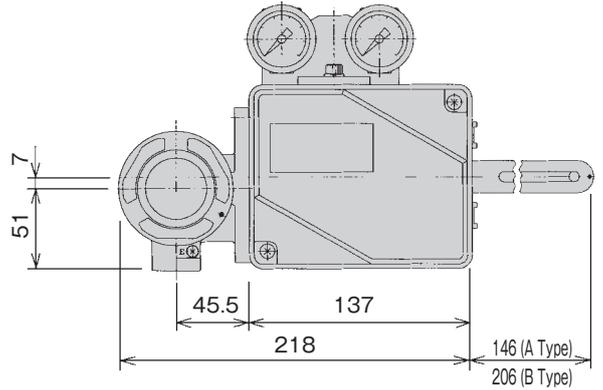
4.1 Dimensions Unit: mm

Lever Type

(Left Lateral View)

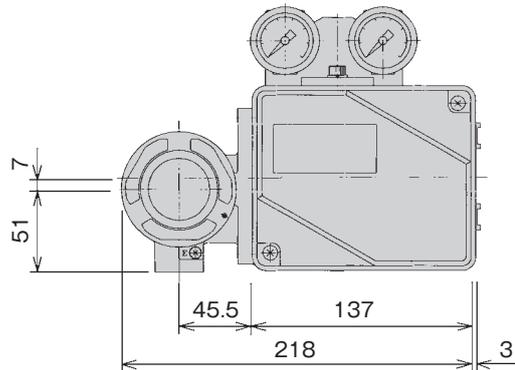


Type	Actuator Size(Outer Dia.)
A	φ 200 to φ 330
B	φ 400 to φ 650



Built-in Cam Type

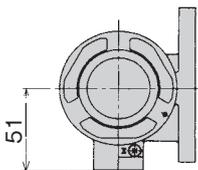
(See above as left lateral view)



Leading External Cable

◇Conduit Type

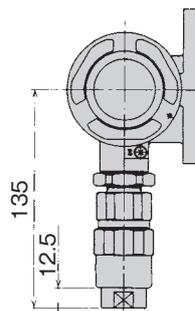
Model : EA91A(C), EA90A(C)



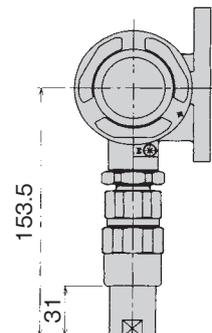
◇Flameproof Packing Type

(Additional Option):Applicable cable OD:φ9.1 to φ11
Model : EA91A(C)T

KXB-LO-16
(Standard)



KXB-LO-16F
(Special Option)



4.2 Installation Conditions

4.2.1 Locations for Installation

The models EA91A and EA90A electro-pneumatic positioner can be installed and used at the hazardous area in accordance with gases to be used.

4.2.2 Environmental Conditions

The applicable environmental conditions are shown in the right table.

Model Environmental Conditions	Model EA91A Flameproof Type	Model EA90A Intrinsic Safety Type
Ambient Temp.	-20°C to +60°C	-20°C to +60°C
Atmospheric Pressure	80 to 110 kPa, Absolute Press.	

※The ambient temperature in the non-explosion-protected environment is -40°C to +100°C

 CAUTION	<p>① If the equipment may cause to be exposed to the radiation from plant facilities and the ambient temperature may be abnormally high, take appropriate measures to insulate the heat.</p> <p>② If installing the equipment under the special conditions (vibration, corrosive atmosphere, always be exposed to drain), take appropriate measures to protect from such conditons.</p>
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※If the device is in conditions of ① or ②, contact our sales branch or sales agent.

4.3 Pre-Installation Check

(1) Nameplate Check (related to specifications and explosion-protected type)

Check the content of the nameplate attached to the main body of the positioner whether the ordered specification is conformed with.

(2) Appearance Check

Check the presence of damage on the device due to transport.

(3) Accessory Identification

Lever Type : Bracket, Stem Clamp (Connector Arm included), Feedback Lever, and Connector Pin

Buit-in Cam Type : Bracket, Connecting Shaft, Set Screw, Spacer Bolt, and Set Spring

Also, the relative bolts, nuts, vises, and washers, etc. are attached.

(4) Pressure Gauge Check

 IMPORTANT	<p>Be sure not to provide overpressure because the pressure gauge appropriate for supply air pressure is installed.</p>
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(5) Orifice Plate Check

Remove pilot cover, and check orifice plate appropriate for actuator capacity is installed and set.

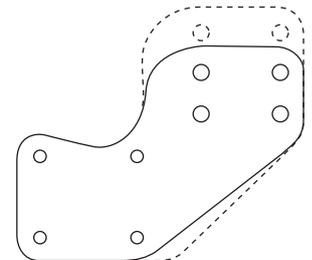
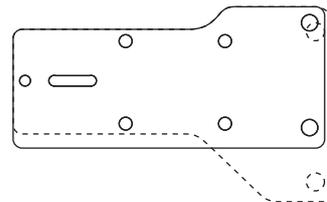
 IMPORTANT	<p>Although orifice plate that conforms to the order specifications is installed at factory shipment, check it again. (Refer to Item 4.6.1)</p>
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※Refer to Item 9.2 "Dimension of Mounting Hardware" for dimension of each part.

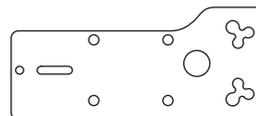
Bracket (Refer to Item 9.2)

For Model 2800

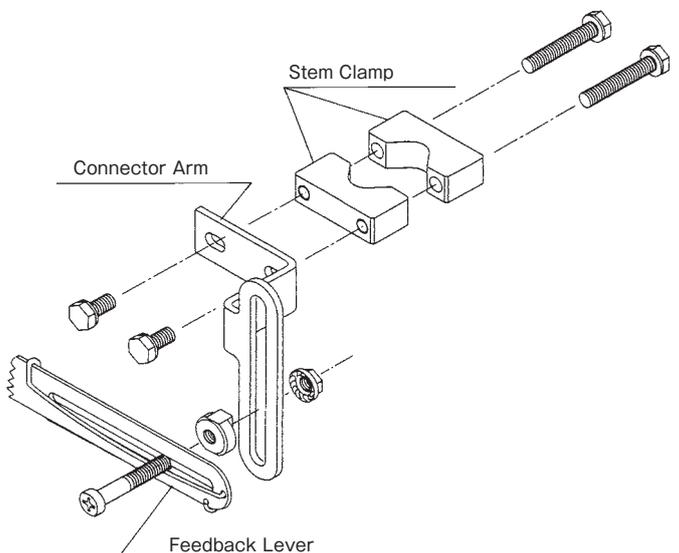
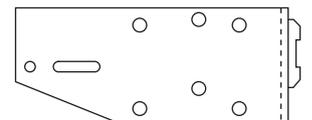
For Model 3800



For Model 2900



For Model 3300



Installation Drawing of Actuator for Model 3800

4.4 Installation to Linear Motion Actuator

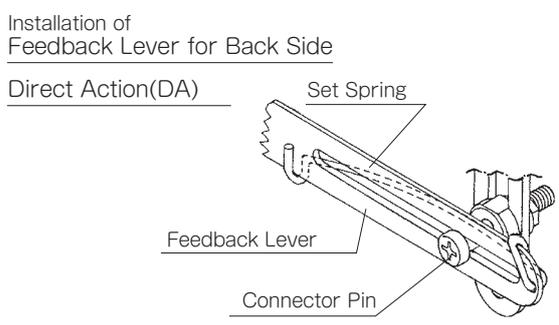
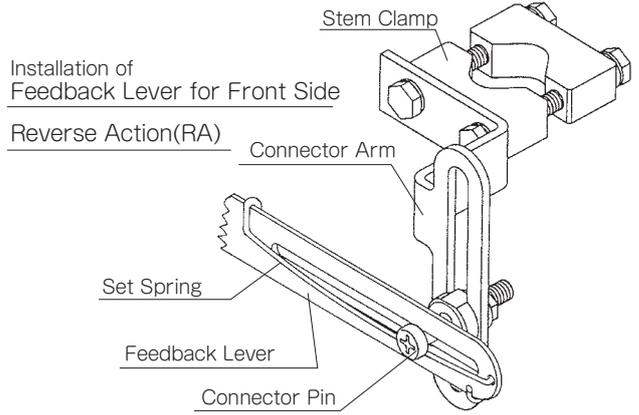
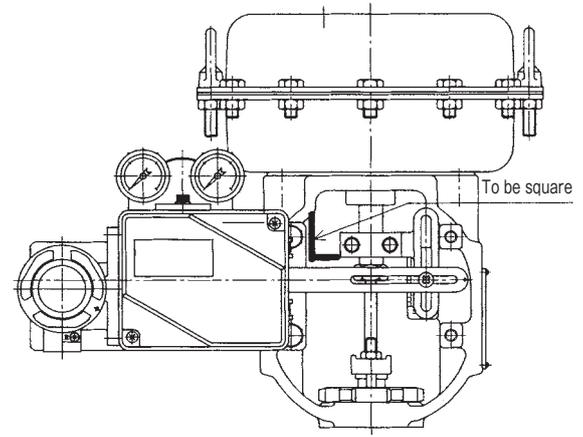
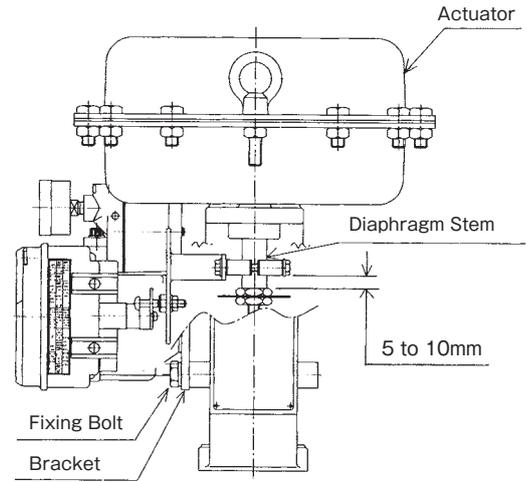
Use bracket suitable for actuator, and install the Positioner properly. When installing, use mounting threaded hole on the back of the Positioner and mounting threaded hole in the front of the actuator.

- (1) Connector arm should be attached to stem clamp and these assembled parts should be clamped to diaphragm stem.

 IMPORTANT	<p>At this point, attach the stem clamp upward approx. 5 to 10 mm from lock nut. Fix the connector arm so as to be parallel to the front surface of actuator.</p>
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- (2) Attach the bracket to actuator.
- (3) Install the Positioner to bracket.
- (4) Install air piping. (Refer to Item 5.2)
- (5) Change A/M Switch to M(Manual) and turn handle of air filter regulator to supply air pressure to actuator for letting the valve stroke come up to 50% position.
- (6) Fix the connector pin to feedback lever and connector arm.

 IMPORTANT	<ol style="list-style-type: none"> ① Fix the connector pin so that feedback the lever and connector arm are positioned in horizontal and parallel (square to positioner) at midpoint (50%) of the stroke. ② Assemble the connector pin between feed-back lever and set spring. ③ Check that the stroke adjustment lever in the Positioner is square.
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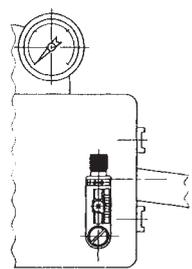
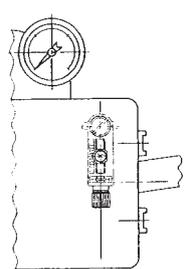


※Model 3800, Model 2800, and other linear motion actuator may be applied the same procedures as mentioned above.

Position of Stroke Adjustment Lever

Direct Action (DA)

Reverse Action (RA)



4.5 Installation to Rotary Motion Actuator

- (1) Attach the spacer bolt.
Tighten the spacer bolt to crank box. (Screw short side of spacer bolt threaded part.)
 - (2) Mount the connecting shaft.
Insert the lock nut, spring washer, and indicator to connecting shaft, and screw the connecting shaft to M8 screw of valve shaft.
 - (3) Fix the indicator.
Check that valve action is air failure-open or air-failure close. Then, fix the indicator to appropriate position, open or close, on indicator scale with lock nut.
- ※The hole position of set spring must be vertical to connecting shaft.

IMPORTANT Set the inserting hole on connecting shaft vertically and the set screw on connecting rod horizontally to proper position.

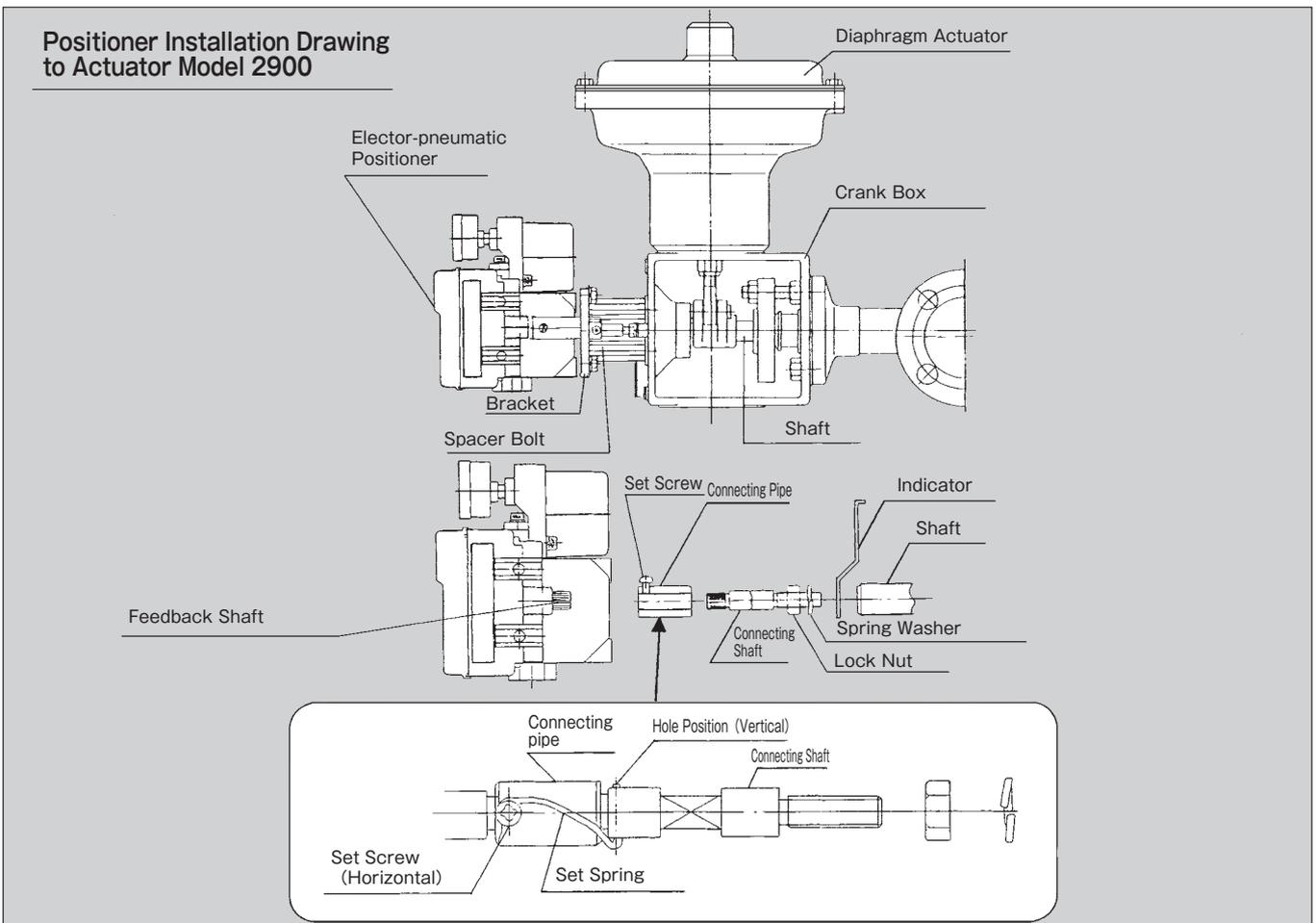
- (4) Attach the bracket.
Attach the bracket to the preinstalled spacer bolt.
 - (5) Attach the connecting pipe.
Attach the connecting pipe to the serrated portion of the feedback shaft at back side of the positioner with set screw.
- ※The position of the set screw must be horizontal.
- (6) Mount the positioner.
Insert the connecting shaft to the connecting pipe and mount the positioner to spacer bolt.

IMPORTANT Check the positioner and connecting shaft the connecting pipe and the feedback shaft are fixed in alignment, when the bracket is tighten.

- (7) Attach set spring.
Attach the set spring to the connecting pipe and connecting shaft.

IMPORTANT The set spring is the important part to absorb play between connecting shaft and set screw. Be sure to attach the set spring so that the function is served fully.

- (8) Install air piping. (Refer to Item 5.2)

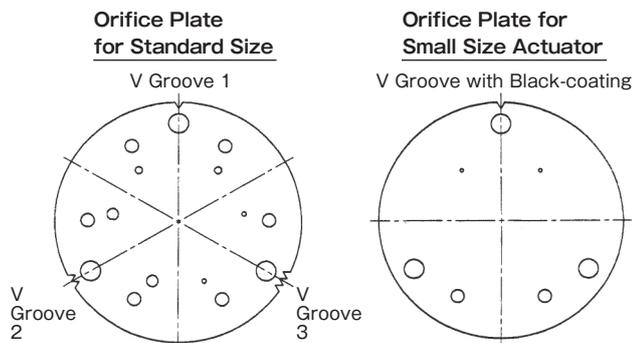


4.6 Conformity of Capacity and Characteristics

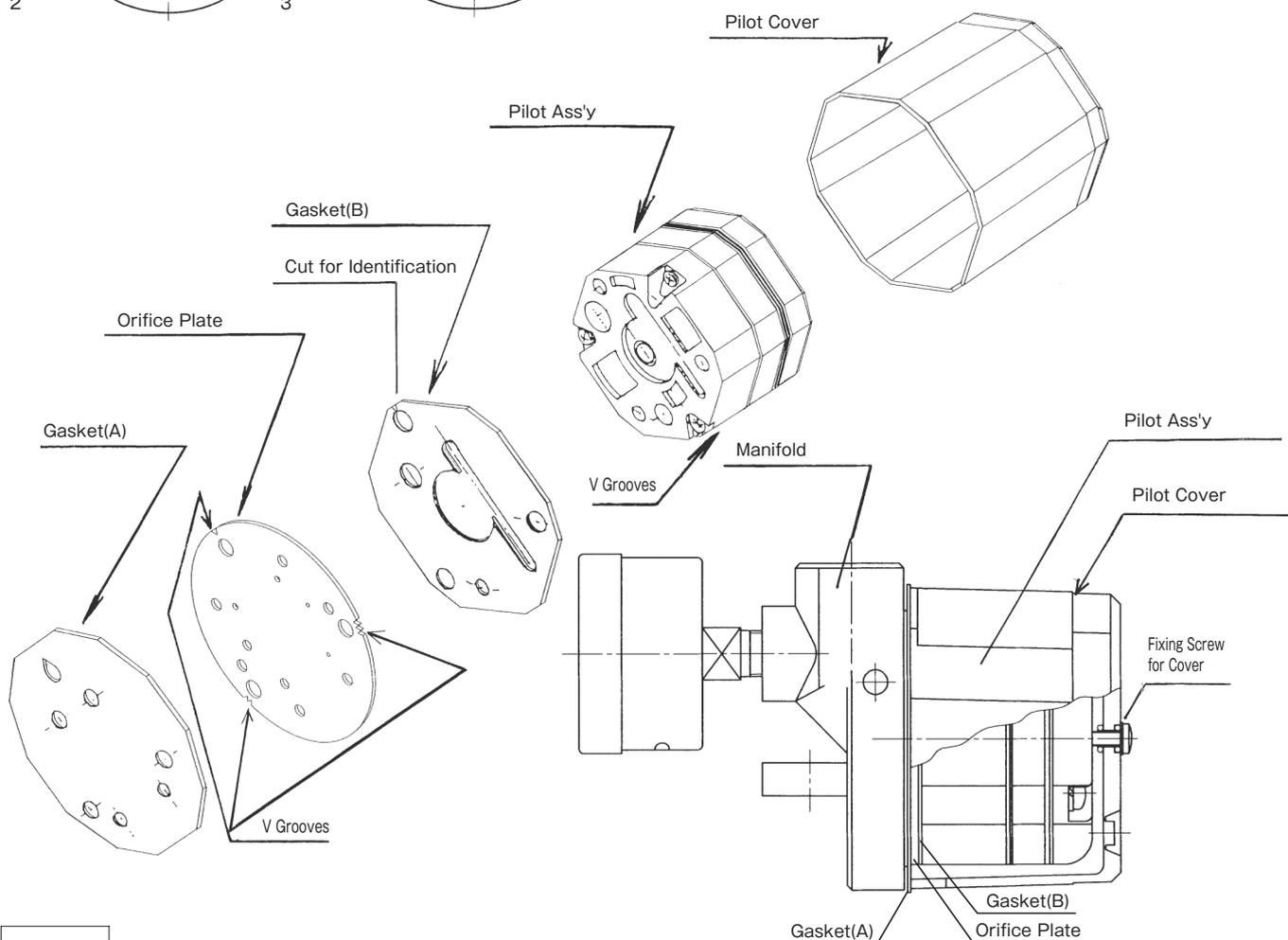
4.6.1 Selection of Orifice Plate for Actuator Capacity

For the purpose of obtaining stable actuation of positioner with small-capacity actuator to large-capacity actuator, the Models EA91A and EA90A Electro-pneumatic Positioner are equipped with appropriate orifice plate in accordance with actuator size.

- (1) The orifice plate has two types in accordance with the actuator size. One standard plate can be compatible with three kinds of size of actuator.
- (2) When using each size of orifice plate, align V groove position of orifice plate with cut position of gasket.
- (3) When replacing or changing the position of orifice plate, remove pilot cover, and loosen three screws fixing pilot assembly.
- (4) General classification for usage of orifice plate, see table below.
- (5) To install booster relay for actuator size $\varnothing 270$ and larger, use V groove 1 of orifice plate No.1.
- (6) Model 3800 actuator $\varnothing 280$ and larger with rated travel 15, 20, 25mm and spring range 20 to 100kPaG(0.2 to 1.0kgf/cm²), use V groove 3 of orifice plate No. 1.



No	Positioner Types	Actuator Size	No. of Groove for Identification
1	Linear, Built-in Cam	$\varnothing 270$ to $\varnothing 330$	V Groove 1
	Linear, Built-in Cam	$\varnothing 400$ to $\varnothing 650$	V Groove 2
	Linear, Built-in Cam	$\varnothing 240$	V Groove 3
2	Linear	$\varnothing 200$	V Groove with Black-coating



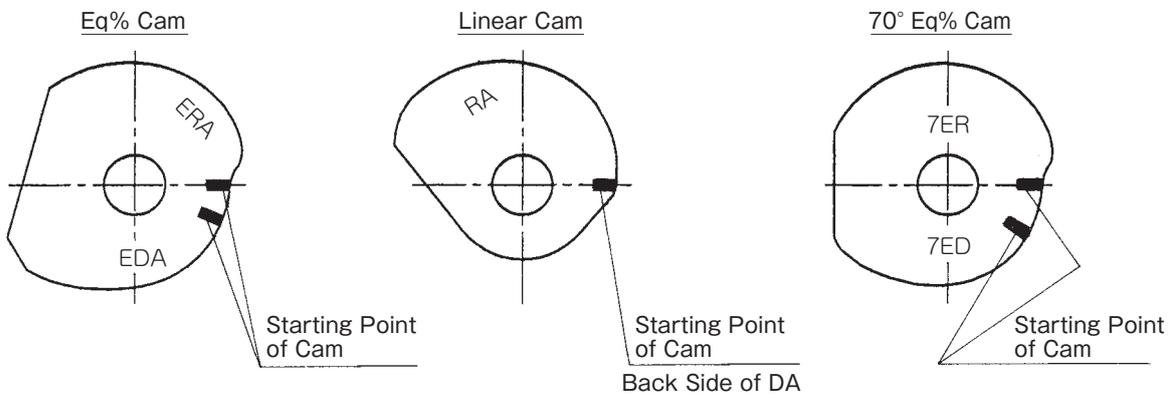
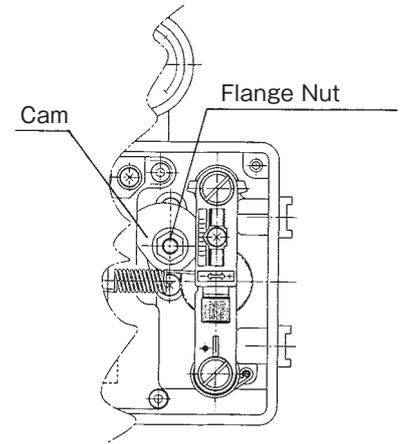
4.6.2 Selection of Built-in Cam

(1) The cam for linear motion has three types. The three types of cam are described in the table below.

Characteristics	Rotating Angle	Action
① Linear	60°, 90°	DA, RA
② Eq%	60°	DA, RA
③ Eq% (Available only for Model 2993)	70°	DA, RA

(2) The starting point for characteristics and identification of DA (start air supply) and RA (stop air supply) are stamped on the cam.

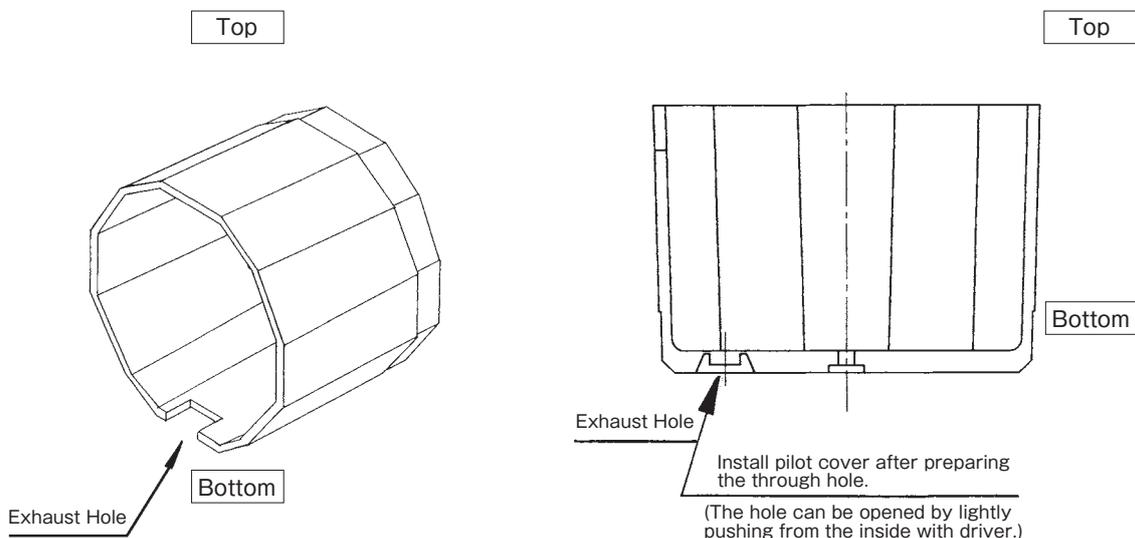
(3) Loosen flange nut to select cam or to adjust position of cam.



4.6.3 Selection of Pilot Cover

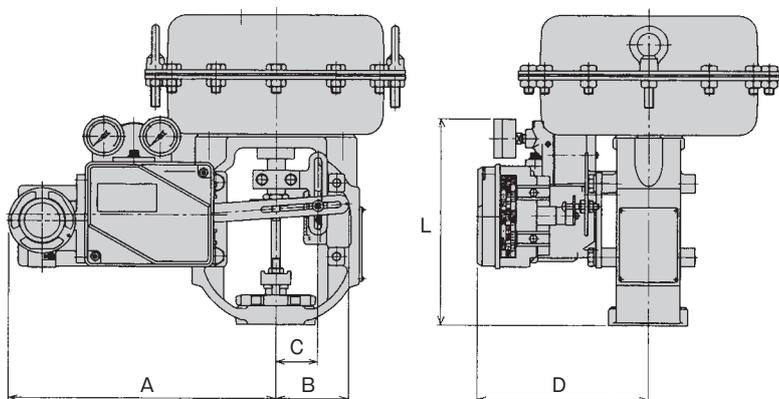
The exhaust hole of pilot cover changes due to installation position of the positioner. Refer to the figure below, and check the top and bottom of pilot cover.

※The pilot cover is machined to meet designated position if the installation position is specified. However, if changing the installation position in field, handle with extra attention.



4.7 Installation Dimensions

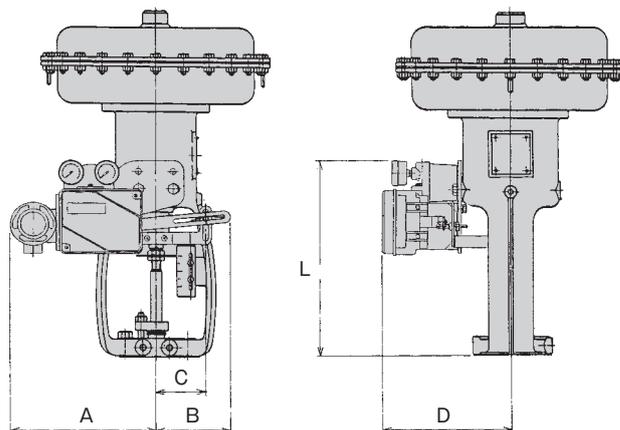
4.7.1 Model 3800 Actuator



Unit: mm

Actuator Size	A	B	C	D	L
N24	290	77	45	185	215
N28	290	77	45	185	225
N33S	290	77	45	185	233
N40	325	100	58	195	312

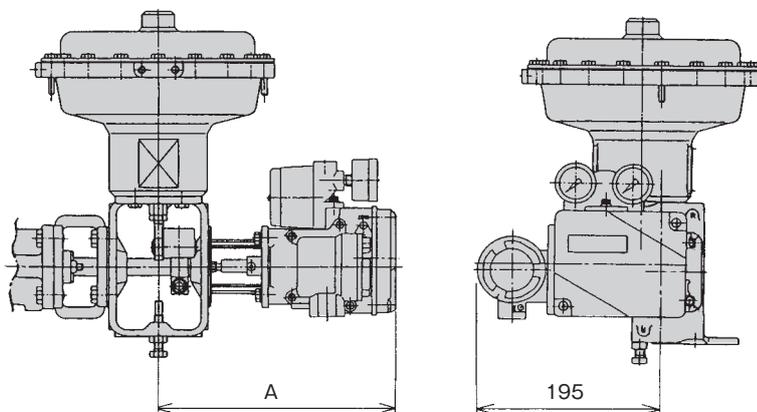
4.7.2 Model 2800 Actuator



Unit: mm

Actuator Size	A	B	C	D	L
240, 280	241	125	93	193	250
330	241	125	93	205	270
400, 500	241	185	143	223	305
650S	241	185	143	296	405

4.7.3 Model 2900 Actuator



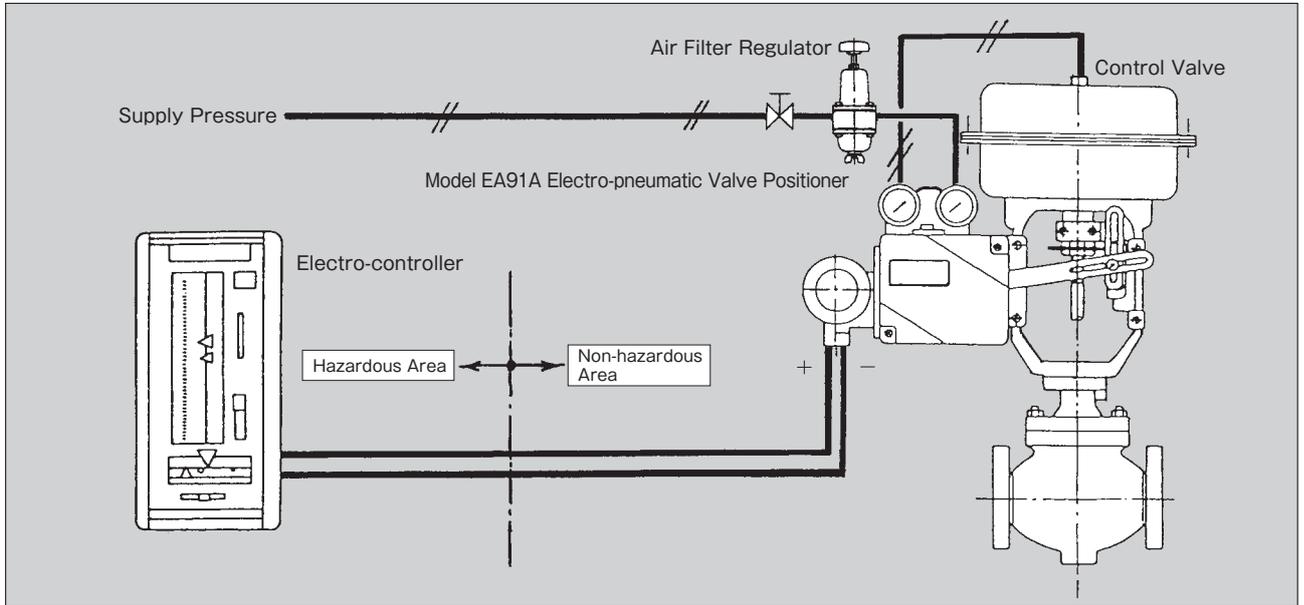
Unit: mm

Actuator Size	Dimension "A"	
	#2916B(V) #2911-1M	#2992(-A)
240H(P)	230	250
280H	240	250
330H(P)	240	250
400H(P)	270	265
500H(P)	270	295

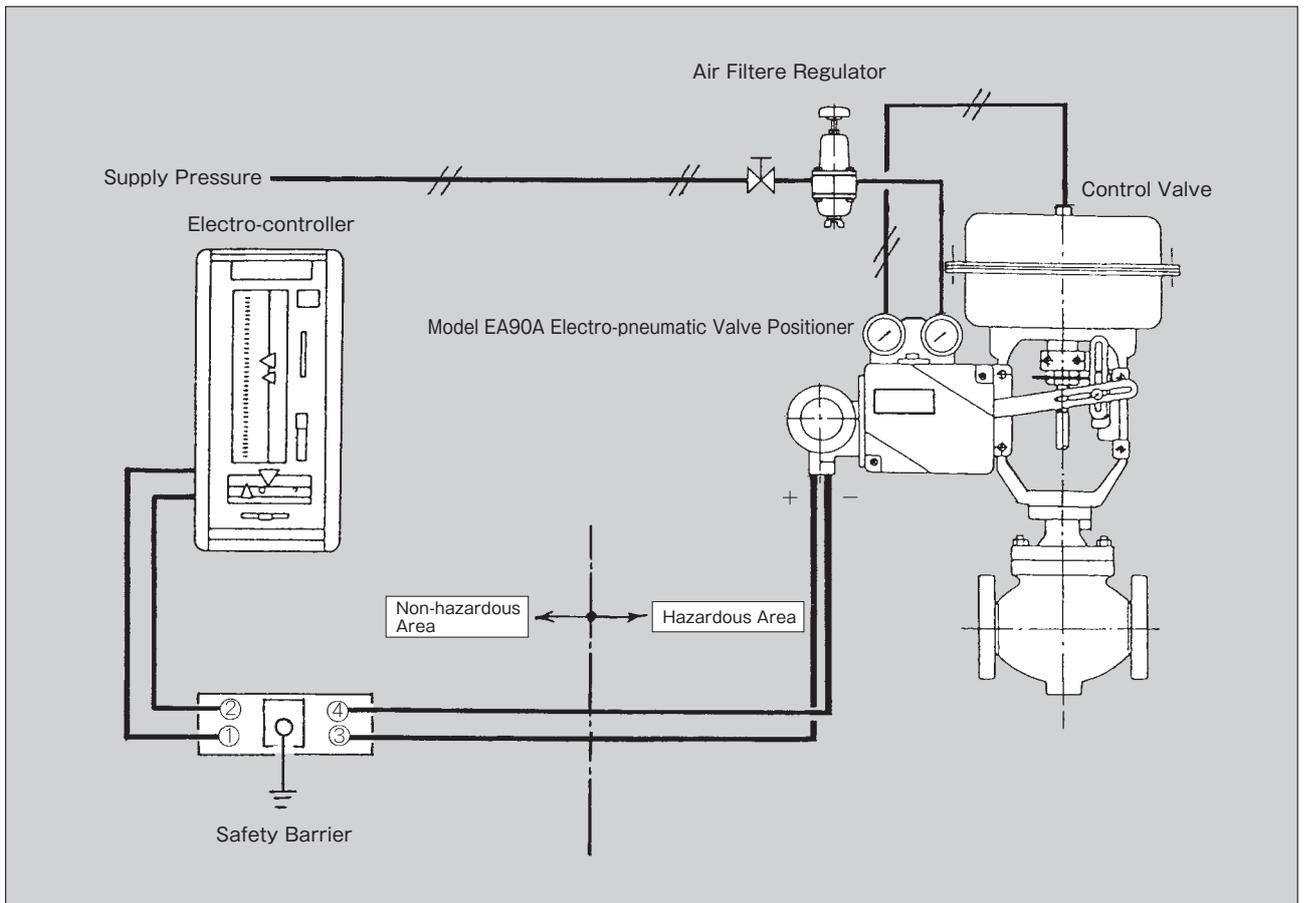
5 EXTERNAL CONNECTION

5.1 Piping and Wiring Systems

5.1.1 Model EA91A Electro-pneumatic Valve Positioner (Flameproof Explosion-protected Construction)



5.1.2 Model EA90A Electro-pneumatic Valve Positioner (Intrinsic Safety Construction)

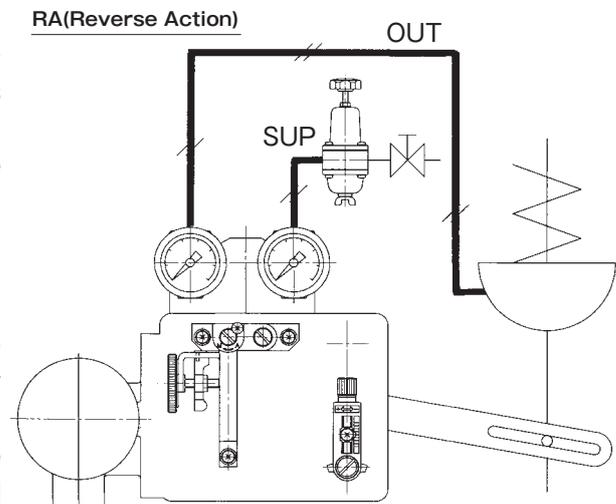
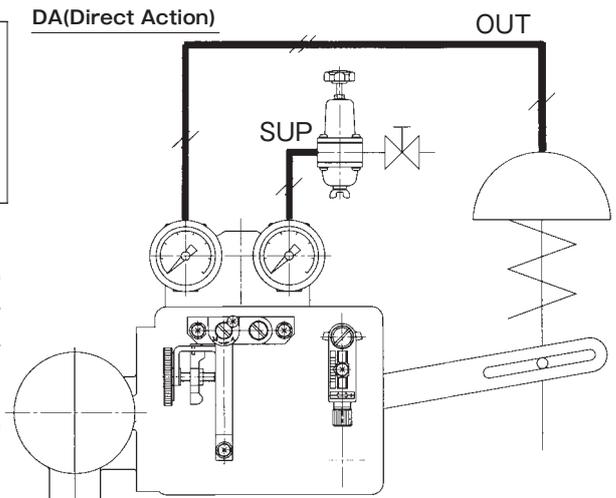


5.2 Pneumatic Piping

 IMPORTANT	<p>① Before piping, fully purge the air tube, and completely remove water, oil, rust, and other foreign matters.</p> <p>② Always use dry clean air for supply air.</p>
----------------------	--

5.2.1 Piping

- (1) The electro-pneumatic valve positioner has two connectors for supply air (SUP) and output air (OUT). The Rc1/4 screwed type is used for connector.
- (2) For supply air (SUP), perform piping from the air filter regulator.
- (3) For output air (OUT), perform piping to the actuator.
- (4) Use $\phi 6/4$ or $\phi 8/6$ of general type copper tube (MOTOYAMA adopts PVC coated copper tube as standard.)
- (5) After completing conduit piping, check for leakage from piping.



5.3 Electrical Wiring

※If there is a possibility of the influence on the positioner due to noise, use shielded cable for avoiding the noise.

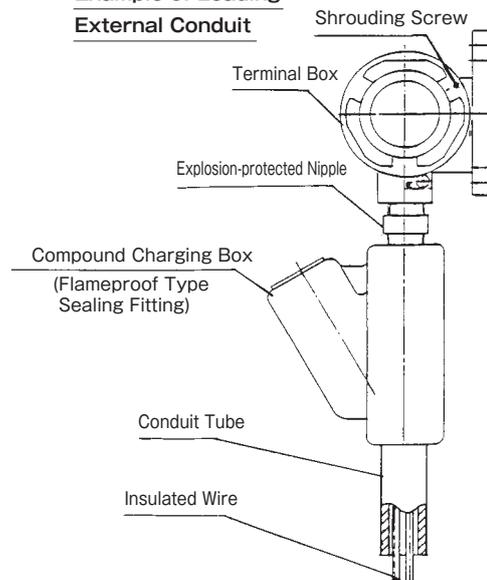
5.3.1 Model EA91A Electro-pneumatic Valve Positioner (Flameproof Explosion-protected Construction)

- (1) Connect wires in accordance with the wiring diagram in Item 5.1.1.
- (2) The parallel pipe female thread G1/2 female screw is used for conduit connection.
- (3) Perform wiring in accordance with leading procedure for external conduit referring to "New Recommended Practice for Explosion-protected Electrical Installations".

5.3.1.1 Leading Procedure for Flameproof Thread Connecting Type of Conduit Tube

- (1) Perform thread connection securely using steel plate conduit tube (JIS C8305) and lock nut (JIS C8330) for steel plate conduit tube.
- (2) Place sealing fitting near leading port of conduit tube, and make the leading opening airtight with compound.
- (3) For connection of EA91A Electro-pneumatic Valve Positioner with terminal box, accessories for wiring, conduit tube of sealing fitting, etc., fix with lock nut with more than 6 threads of effective thread connected. Also, make the port watertight at the same time.

Example of Leading External Conduit



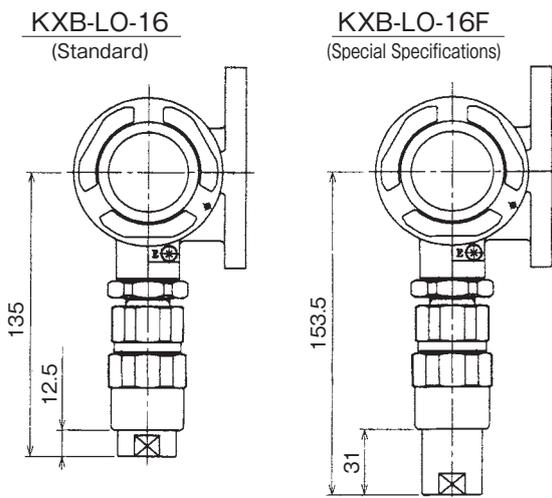
WARNING

5.3.1.2 Leading Procedure for Flameproof Packing Type (Optional Specifications)

For connector of flameproof packing type, use the following two connectors certified at the same time of EA91A and EA91AC.

- ① KXB-LO-16 (Standard)
- ② KXB-LO-16F (Specified, Special Specifications)

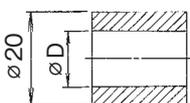
※Impossible to use connector other than two connectors described above.



※The cable to be connected shall be equal to or better than vinyl insulated vinyl sheath cable for control "CVV" (JIS C3401).

- (1) Process end of cable using crimp-style terminal. Refer to the table shown below for outside diameter of cable.
- (2) Screw-in connecting assembly to terminal box, and fix with lock nut.
- (3) Insert cable gland, union coupling, and union cover to the cable.
- (4) Then, insert washer and rubber packing to the cable, screw-in cable gland securely, and lock the hexagon socket head set screw to tighten clamp.
- (5) Two types of the rubber packing for cable are included.

Basic Shape of Rubber Packing



Unit : mm

Nominal Size of Packing	Inside Diameter of Packing ϕd	Outer Diameter of Cable
10	$\phi 10$	$\phi 9.1$ to $\phi 10$
11	$\phi 11$	$\phi 10.1$ to $\phi 11$

- (6) Tighten union coupling and union cover.

5.3.1.3 Connecting Procedure

- (1) Loosen the shrouding screw (M3 Hexagon Socket Set Screw), and remove terminal cover.
- (2) Connect cable to terminal block.

Terminal Screw Size : M4

Standard Wiring (Positioner Wiring)

Right Terminal (-) (Black Colored Lead Wire)

Left Terminal (+) (Red Colored Lead Wire)

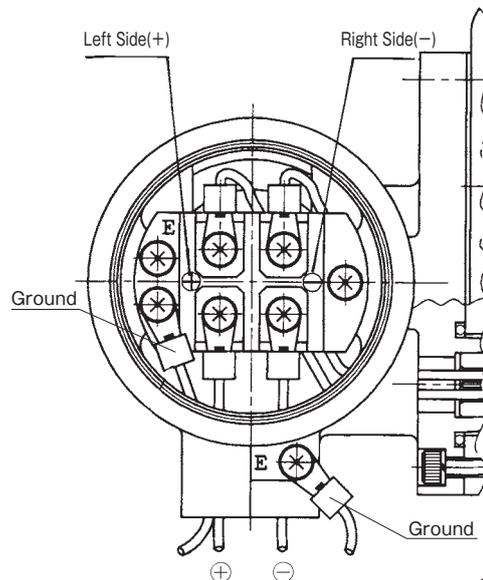
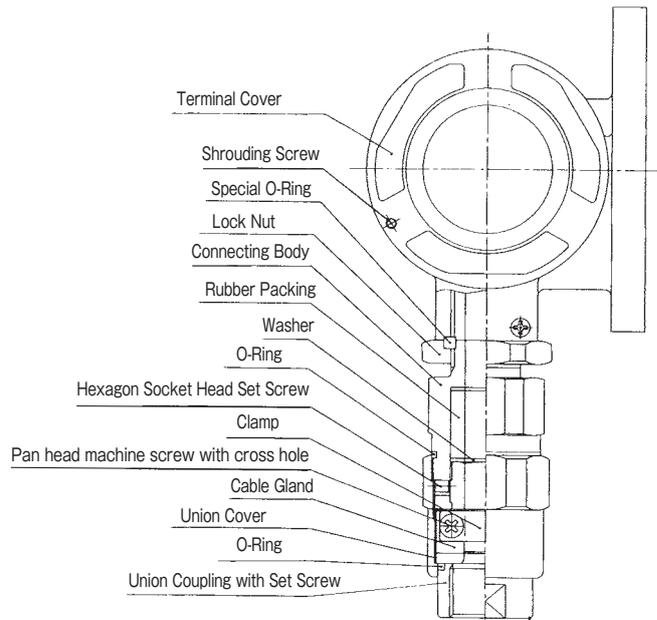
Reverse Positioner (Model EA90A is not applicable)

Right Terminal (Red Colored Lead Wire)

Left Terminal (Black Colored Lead Wire)

Even if connecting reverse positioner, perform wiring in accordance with the indication of terminal. (Wiring has been converted and adjusted to reverse positioner by MOTOYAMA.)

- (3) After completing connection, screw-in the shrouding screw to terminal cover, and lock the shrouding screw.



5.3.2 Model EA90A Electro-pneumatic Valve Positioner (Intrinsically Safe Explosion-protected Construction)

 **CAUTION**

The Model EA90A Electro-pneumatic Valve Positioner is designed to ensure intrinsically safe. However, electric or magnetic energy from other electric apparatuses and wires may cause adverse affections on the intrinsic safety system. To avoid these affections, perform external wiring in accordance with the instructions described below. For details, refer to "New Recommended Practice for Explosion-protected Electrical Installations".

- (1) Identify intrinsically safe circuits and un-intrinsically safe circuits, and separate intrinsically safe circuits from other electric circuits.
- (2) Take appropriate measures to prevent influences such as electrostatic induction and electromagnetic induction.
- (3) Minimize inductance and capacitance of the wires as much as possible, and always make them lower than maximum value if operating condition is specified.
- (4) Protect the wires against external damages.
- (5) Be sure to ground uncharged open metallic parts.

■Wiring Procedure

- (1) Connect wires in accordance with the wiring diagram shown in Item 5.1.2.
- (2) The parallel pipe female thread G1/2 female screw is used for conduit connection.
- (3) Condition for External Wiring of Intrinsically Safe Circuit :
Set the parameter of intrinsically safe circuit and the parameter of safety barrier so that the conditions described below are satisfied.
 $L_w \leq L_o$
 $C_w \leq C_o$
 L_w : Inductance of External Wiring of Intrinsically Safe Circuit
 L_o : Permissible Inductance of Intrinsically Safe Circuit
 C_w : Capacitance of External Wiring of Intrinsically Safe Circuit
 C_o : Permissible Capacitance of Intrinsically Safe Circuit
Effective internal inductance and effective internal capacitance of EA90A Electro-pneumatic Valve Positioner are negligibly small.
- (4) Use insulated wires or cables for Intrinsically Safe Explosion-protected Construction. Use metal tubes, metal conduits, or metal protective tubes as needed to mechanically protect external wiring and prevent induction.
- (5) Place the Model EA90A Electro-pneumatic Valve Positioner away from other electric apparatus as far as possible, and separate its wiring from the others.

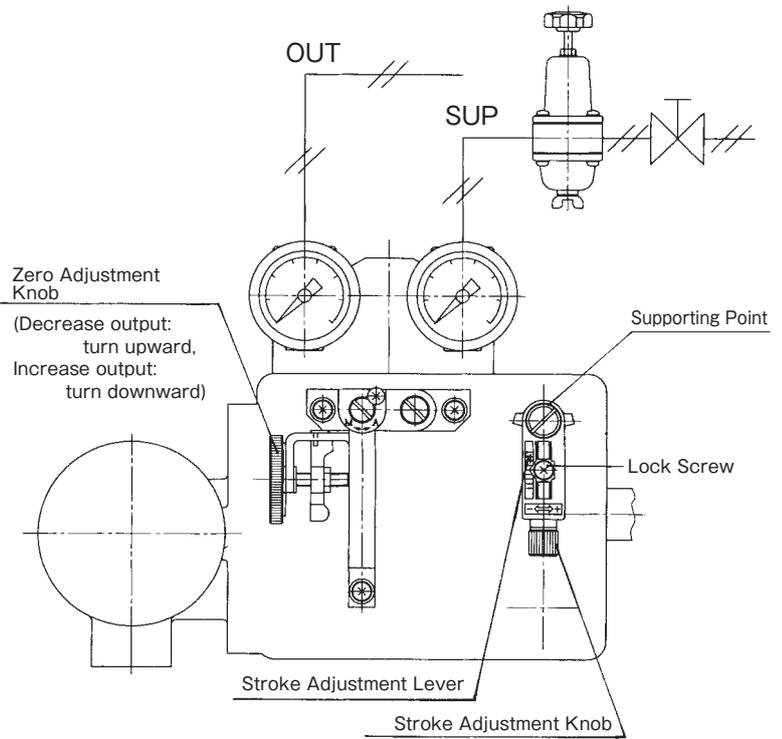
6 CALIBRATION

IMPORTANT

Each unit of the Positioner is completely calibrated and inspected before delivery. However, slight error may occur due to vibration and impact during transportation. Be sure to perform calibration and loop test of the Positioner before operation.

WARNING

Do not open the cover of the terminal box for using Flameproof Explosion-protected type (Model EA91A) during power-on. When circumstances require opening the cover during power-on, properly make sure that no explosive gases are present using gas detector before maintenance. In this connection, it is possible to inspect and adjust with the cover removed. However, be very careful not to generate impact sparks during maintenance.



6.1 Advance Check before Calibration

(1) Switching of Direct/Reverse Action for Linear Motion Actuator

Perform switching of direct/reverse action of the Positioner by changing the supporting point (minus groove of lever column) of stroke adjustment lever.

- Supporting Point of DA (Direct Action) : Upper Side
- Supporting Point of RA (Reverse Action) : Lower Side

(2) Switching of Direct/Reverse Action for Cam

It is possible to switch action by mounting the cam in accordance with inscription on cam. (Inscription : DA, RA)

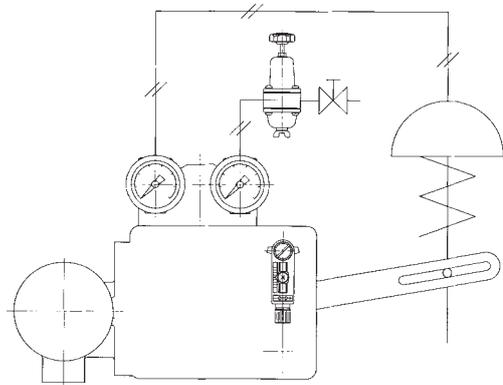
(3) Check of Stroke Adjustment Lever

Make sure that the stroke adjustment lever is placed vertically at the 50% point in rated stroke (or angle). Perform manual switching mechanism with "M" for manual operation. (Refer to Item 6.8 "Manual Switching Mechanism")

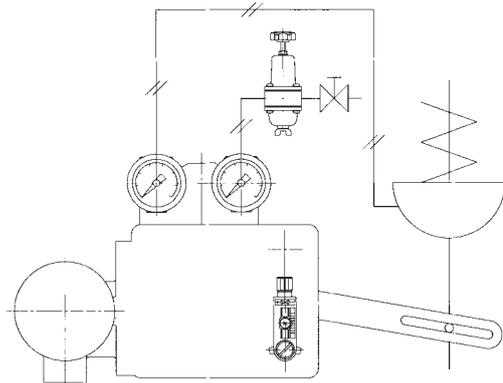
IMPORTANT

When the stroke adjustment lever leans with same angle in both right and left angle with reference to the leaning angle 50% as origin, the specifications of linearity will be satisfied.

Installing Position of Stroke Adjustment Lever for Direct Action



Installing Position of Stroke Adjustment Lever for Reverse Action



6.2 Adjusting Procedure

- (1) Set input signal to 50%. Then, adjust to 50% point of specified stroke with zero adjustment knob.
- (2) Move the input signal between 25% and 75%, and make sure that the stroke is set to 25% and 75% of specified stroke. If the stroke is not within tolerance, adjust input signal to specified stroke by repeating stroke adjustment and zero adjustment while checking plus or minus of the specified stroke. If specified stroke point is obtained with the adjustments, the input signal between 0% and 100% will approximately adjust reference stroke point.
- (3) If shut-off power of valve is considered as important, check as follows. For DA (Direct Action), make sure that the input signal is greater than the reference value and the needle of pressure gauge in OUT side indicates approx. supply pressure. For RA (Reverse Action), make sure that the input signal is less than the reference value and needle of pressure gauge in OUT side indicates approx. zero.

※For cam type, basically perform same procedures since the specified stroke is the specified angle. However, perform cam position adjustment described in Items 6.1 and 6.4.

6.3 Zero Adjustment (Common to Linear Type and Built-in Cam Type)

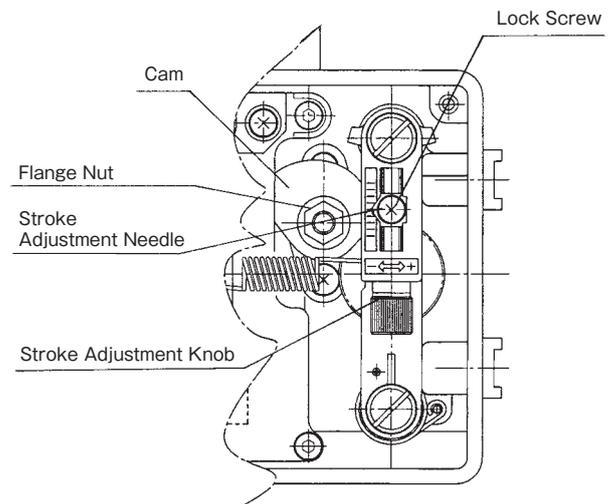
- (1) The output increases (start point rises) by turning the zero adjustment knob clockwise (downward).
- (2) The output decreases by turning the zero adjustment knob counterclockwise (upward).

6.4 Zero Adjustment for Cam

The zero origin position of proper part of cam is inscribed on cam surface. Check the opening of valve, loosen flange nut and adjust the position.

6.5 Stroke Adjustment (Common to Linear Type and Built-in Cam Type)

- (1) Loosen lock screw fixing stroke adjustment knob of the stroke adjustment lever.
- (2) If making the stroke (angle) wider, adjust by turning screw of stroke adjustment lever clockwise.
- (3) If making the stroke (angle) narrower, adjust by turning screw of stroke adjustment lever counterclockwise.
- (4) Performing these adjustments while watching the indication  on the stroke adjustment lever.
- (5) After setting is completed, be sure to tighten the lock screw securely.



6.6 Split Range Adjustment (Common to Linear Type and Built-in Cam Type)

- (1) The split range has four types such as 1/1.5, 1/2, 1/3, and 1/4 for both linear and built-in cam types.
- (2) For replacement parts of split range, use feedback spring and zero adjustment spring. The identification table is shown below.
- (3) Move the stroke adjustment knob of stroke adjustment lever to meet required stroke. Then, adjust the stroke in accordance with procedures from Items 6.2 to 6.5 while inputting the input signal as specified in the specification.

(4) Lever Type: Actuator Type #3800
(Size: N24 to N40), Stroke: 5 to 65mm

Kinds of Spring		Zero Adjustment		Feedback Spring					
Identification Color		None	Blue	None	Blue	Black	White	Red	Yellow
Split Range	Standard	●		●			☆ ^{Note.8}	☆ ^{Note.1}	
	1/1.5	●		●					
	1/2	●		●	☆ ^{Note.2}	☆ ^{Note.3}			
	1/3	●		☆ ^{Note.1}	●	☆ ^{Note.4}			
	1/4	●			●				☆ ^{Note.4}

(5) Lever Type: Actuator Type #2800
(Size: 500 to 600), Stroke: 5 to 130mm

Kinds of Spring		Zero Adjustment		Feedback Spring					
Identification Color		None	Blue	None	Blue	Black	White	Red	Yellow
Split Range	Standard	●		●	☆ ^{Note.5}		☆ ^{Note.8}	☆ ^{Note.1}	
	1/1.5	●		●					
	1/2	●		●	☆ ^{Note.6}	☆ ^{Note.5}			
	1/3	●		☆ ^{Note.1}	●	☆ ^{Note.7}			
	1/4	●			●				☆ ^{Note.4}

- Note 1. #3800 N24 to N33S: Stroke 5 to under 15mm
N40: Stroke 15mm
- #2800 ϕ 500 to 650: Stroke 15mm
- Note 2. #3800 N24 to N33S: Stroke 20mm or more
N40: Stroke 38 to under 65mm
- Note 3. #3800 N40: Stroke 65mm
- Note 4. #3800 N24 to N33S: Stroke 38mm
- Note 5. #2800 ϕ 650: Stroke 105mm or more
- Note 6. #2800 ϕ 500: Stroke 38mm or more
 ϕ 650: Stroke 38 to under 105mm
- Note 7. #2800 ϕ 500 to ϕ 650: Stroke 70mm or more
- Note 8. #3800 N40 #2800 ϕ 500 to ϕ 650: Stroke 65mm

(6) Lever Type: Actuator Type #3300,
Stroke: 12.7mm

Kinds of Spring		Zero Adjustment		Feedback Spring					
Identification Color		None	Blue	None	Blue	Black	White	Red	Yellow
Split Range	Standard	●		●					
	1/1.5	●		●					
	1/2	●		●					
	1/3	●		●					
	1/4	●			●				

(7) Built-in Cam Type: Linear Cam
(0° to 60° or 0° to 90°)

Kinds of Spring		Zero Adjustment		Feedback Spring					
Identification Color		None	Blue	None	Blue	Black	White	Red	Yellow
Split Range	Standard	●		●	☆ ^{Note.1}				
	1/1.5	●					●		
	1/2	●			●	☆ ^{Note.2}			
	1/3	●			●				
	1/4	●							●

- Note 1. 0° to 90° Cam Standard
- Note 2. 0° to 90° Cam Split Range 1/2

(8) Built-in Cam Type: Eq% Cam(0° to 60°)

Kinds of Spring		Zero Adjustment		Feedback Spring					
Identification Color		None	Blue	None	Blue	Black	White	Red	Yellow
Split Range	Standard	●		●					
	1/1.5	●					●		
	1/2	●			●				
	1/3	●				●			
	1/4	●							●

(9) Built-in Cam Type: Actuator Type #3900
(Standard Cam for Linear, Special Cam for Eq%)

Kinds of Spring		Zero Adjustment		Feedback Spring					
Identification Color		None	Blue	None	Blue	Black	White	Red	Yellow
Split Range	Linear	Standard	●				●		
		1/2	●			●			
	Eq%	Standard	●		●				
		1/2	●			●			

(10) Calculating Method for Lever Type Positioner(Example)

Rated Stroke	Split Range	Required Stroke	Calculation
15 mm	1/2	30 mm	$15 \times 2 = 30\text{mm}$
38 mm	1/2	72 mm	$38 \times 2 = 72\text{mm}$
38 mm	1/3	114 mm	$38 \times 3 = 114\text{mm}$

※Therefore, when the stroke is greater than 65mm, the feedback spring (or zero adjustment spring) will be special specification.

※For details except items described above, contact our sales office or sales agent in your region.

6.7 Reverse Positioner Adjustment (Common to Linear Type and Built-in Cam Type)

6.7.1 In case of Reverse Positioner Specifications (Adjusted at Our Factory)

- Connect wiring in accordance with indications (+) and (-) of terminal. (Reverse positioner wiring has already been performed and adjusted at our factory)
- Make sure that action of reverse positioner is properly performed by increasing/decreasing the input signal.
- Perform operating adjustment in accordance with the procedures from Items 6.2 to 6.5, and check with loop test.



IMPORTANT

If adjusted at our factory, nameplate of "Reverse Positioner" is stuck at the back of the terminal cover.

6.7.2 In case of Changing to Reverse Positioner Specifications at Site.

- Zero adjustment spring must be replaced with "blue" colored spring. For your inquiry of the spring, please contact us or our sales agent in your area.
- Connect wiring with (+) and (-) terminals in reverse of (Reverse positioner wiring is performed and adjusted)
- Make sure that adjustment for reverse positioner is performed by increasing/decreasing the input signal.
- Perform operating adjustment in accordance with the procedures from Items 6.2 to 6.5, and check with loop test.



IMPORTANT

The Models EA90A and EA90AC cannot be compatible with the reverse positioner. (The positioner does not work even if the wiring is connected in reverse since diode is mounted in torque motor.)

6.8 Manual Switching Mechanism -A/M Switching (Common to Lin-ear Type and Built-in Cam Type)

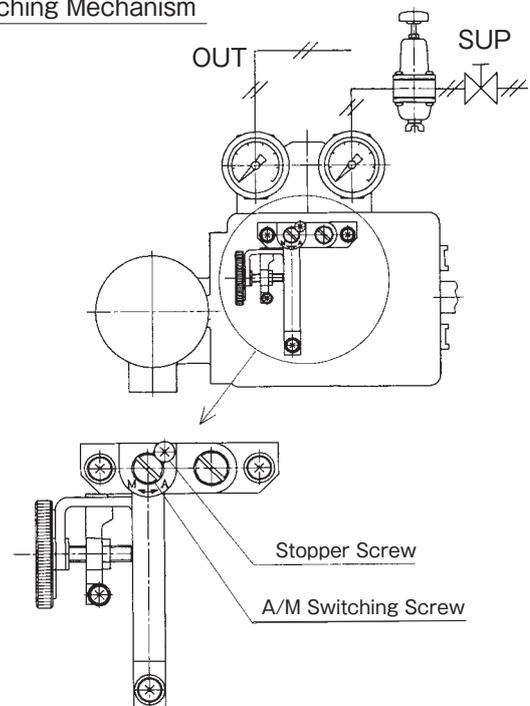
Before operating manual switching mechanism, make sure that the filtered regulator is placed at the line of supply side of the positioner. (Due to supply bypass method)



IMPORTANT

- If not venting through the filtered regulator, it might apply excessive pneumatic pressure to the positioner or the actuator.
- If not inputting through the filtered regulator, it might be in danger that the air pipe of the positioner is clogged up with foreign matter.

Manual Changeover Switching Mechanism



6.8.1 Switching Procedure

- Operate the filtered regulator, and set the supply pressure (SUP) to zero.
- Turn the A/M switching screw to manual "M" side (clockwise) with minus driver until it stops.
- The air is supplied through the air pipe to supply side (SUP).
- Operate the filtered regulator, and perform operation of control valve manually.
- Turn the A/M switching screw to auto "A" side until it contacts with the stopper screw.
- Operate the filtered regulator, and reset to original supply pressure.



IMPORTANT

Never remove the stopper screw.

7 MAINTENANCE

⚠ CAUTION

Be sure to move the Valve Positioner to non-hazardous area for repairing or maintaining incident to part replacement.

7.1 Periodic Maintenance

Periodic maintenance and check are important in preventing occurrence of non-conformance and extending service life of the positioner. A definite maintenance program should be established and followed using the Periodic Check List shown below as a guide.

Periodic Check List

※Before inspection of each part, check for damage of appearance, abnormal rust, air leakage, etc.

Check Item		Periodic Check Frequency (Yr.)		Remarks
		1.0	2.0	
Pneumatic Pressure	Pressure Gauge		○	Check for presence or absence of damage and for accuracy
	Restriction (Fixed Restriction)	○		Refer to Item 7.2.1
	Filter	○		Refer to Item 7.2.1
Pilot	Diaphragm	○		Check for wear and tear, Refer to Item 7.2.2
	Gasket Packing	○		Check for wear and tear, Refer to Item 7.2.2
	Nozzle, Flapper	○		Check for presence or absence of damage
	Supply Air Valve, Seat for Main Body		○	Check for presence or absence of damage
Sliding	Feedback Lever (Sliding Part of Connector Pin)		○	Check for presence or absence of wear and tear
	Connector Pin (Transmission Pin)		○	Check for presence or absence of wear and tear
	Set Spring (Linear Type)		○	Check for presence or absence of wear and tear
	Each Bearing (Linear, Cam Types)		○	Use Plasti-lube #00 when reassembling

※For filtered pressure reducing valve, periodically perform blowing of drain (Guide : approx. 6 months) and cleaning of filter (Guide : approx. 1 year)

[Note] Plasti-lube : Produced by SULFLO INC

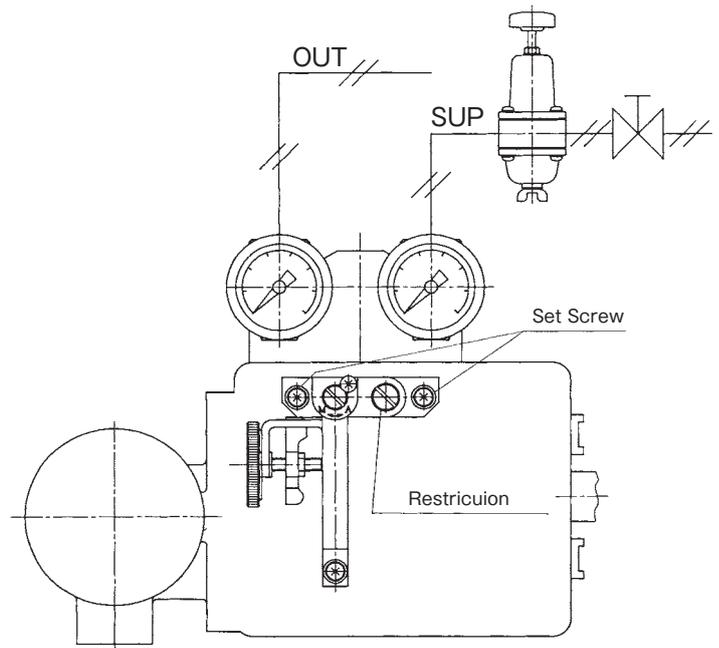
7.2 Maintenance Procedure

7.2.1 Restriction and Filter

The restriction of air pipe, clogging and dirt of filter in the positioner might cause failure. Clean the air pipe and the filter periodically.

- (1) Set supply air pressure at zero.
- (2) Loosen the drain cock of the filtered pressure reducing valve. Then, drain and purge properly.
- (3) Remove the restriction.
- (4) Clean overall restriction by inserting a $\varnothing 0.2$ mm wire into hole of restriction.
- (5) Remove the filter of nozzle base. Then, clean and purge properly.
- (6) Apply a coating of silicon grease thinly and uniformly when assembling.
- (7) Perform the reversed procedure for reassembling. At this point, check for leakage from restriction.

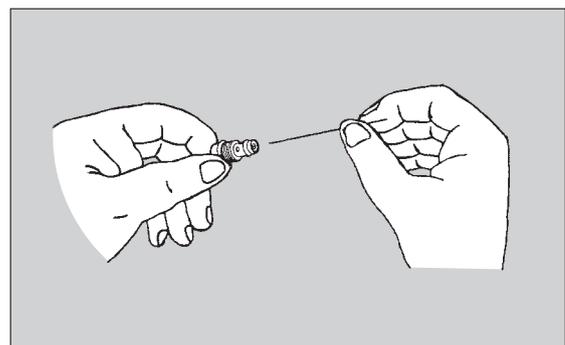
- (8) Reset the supply air pressure to original pressure. Then, check for leakage from the gasket and the pilot assembly.
- (9) Align the opening of the pilot cover with original position, and mount the pilot cover.



 IMPORTANT	<p>Never loosen the set screw on the nozzle base when performing the restriction check. (The gap between flapper and nozzle is adjusted precisely.)</p>
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7.2.2 Pilot

- (1) Follow the procedure described in Item 7.2.1 for operation of supply air pressure and filtered pressure reducing valve.
- (2) For pilot assembly, loosen three pan head screws, and remove the pilot from manifold after removing the pilot cover.
- (3) Disassemble the pilot. Check for wear and tear in upper and lower diaphragms, and for presence or absence of damage in supply air valve and seat of main body.
- (4) At the same time, check for wear and tear in gasket A and B.
- (5) Clean the parts described above and over-all pilot.
- (6) Reverse the procedures to reassemble the pilot. At this point, make sure that the orifice plate is placed at original position.
- (7) Reverse the procedures to mount the pilot assembly to manifold when removing the pilot assembly.



 IMPORTANT	<p>After checking each part, be sure to check by performing the operating test and the loop test.</p>
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8 TROUBLESHOOTING

Following problems and causes are non-conformances expected to encounter in routine operation. Take following remedy if the non-conformances are encountered.

Troubleshooting Chart

	Problem	Cause	Corrective Action	
Positioner does not work	Positioner does not work normally	Abnormal control valve	Turn manual switching mechanism to "M", adjust supply air pressure, and check whether control valve works normally or not. If abnormality is present, disassemble control valve.	
	Excessive vibration in control valve	Wear of contacting face between nozzle and flapper	Replace positioner.	
	Abnormal response speed, hunting	Incorrect selection of orifice plate, dislocation of assembling position	Check in accordance with nameplate stuck to pilot cover.	
	Supply air pressure is out of the standard	Supply air does not serve normally	Check supply air filter regulator, Check air pipe for leakage.	
	Output pressure does not increase	Leakage in output air pipe	Leakage in output air pipe	Check air pipe for leakage.
		Zero position is dislocated	Zero position is dislocated	Apply 50% input signal, and turn zero adjustment knob to check whether air is output.
		Manual switching screw is set to "M" side	Manual switching screw is set to "M" side	Change to "A" side.
		Electric wire is disconnected	Electric wire is disconnected	Check electric lines, and tighten each wire securely.
		Electric line is short-circuited	Electric line is short-circuited	Remove short-circuited part, and then change input signal from 50% to between 25% to 75% to ensure that short-circuiting is absent.
		Filter and/or restriction is clogged	Filter and/or restriction is clogged	Move flapper with finger, and check whether output increases or decreases. If output air pressure could not be obtained, clean filter and /or restriction to remove clogging.
Contacting face between nozzle and flapper is improper	Contacting face between nozzle and flapper is improper	Check for contact by inserting seal tape between nozzle and flapper. If not outputting, replace pilot.		
Positioner does not work normally	Valve opening changes wiggly.	Noise influences the signal. Signal itself changes wiggly.	Change the signal wiring to the shield one. Adjust the gain of the Electro-controller.	
	Poor repeatability	Zero position is dislocated	Check each part listed below for looseness, and tighten securely. <ul style="list-style-type: none"> ○ Looseness in stroke adjustment knob. ○ Prevention of backlash in zero adjustment screw. Looseness in screw. ○ Dislocation of cam. 	
	Large hysteresis error. Poor linearity	Mounted or tightened part is loosened and twisted	Retighten and adjust mounted or tight-ened part listed below. <ul style="list-style-type: none"> ○ Backlash and looseness in mounted part of back lever. ○ Looseness in armature of feedback spring and balance spring with tightened parts. ○ Looseness and twist in joint, fit, or connecting part to transmit force. 	
	Slow response speed	Filter and/or restriction is clogged, Air leakage from joint	Clean filter and/or restriction, or retighten joint part to stop air leakage. If response speed is still slow, replace pilot.	
	Hunting exists	Too small capacity of actuator (Be careful if capacity is less than 300cc)	Exchange, orifice plate to V-groove 3 of standard orifice plate or No. 2 of orifice plate.	

※Since the positioner is to be installed under several conditions, non-conformance that is difficult to predict might occur. If non-conformance occurs, contact our sales office or sales agency for purchase.

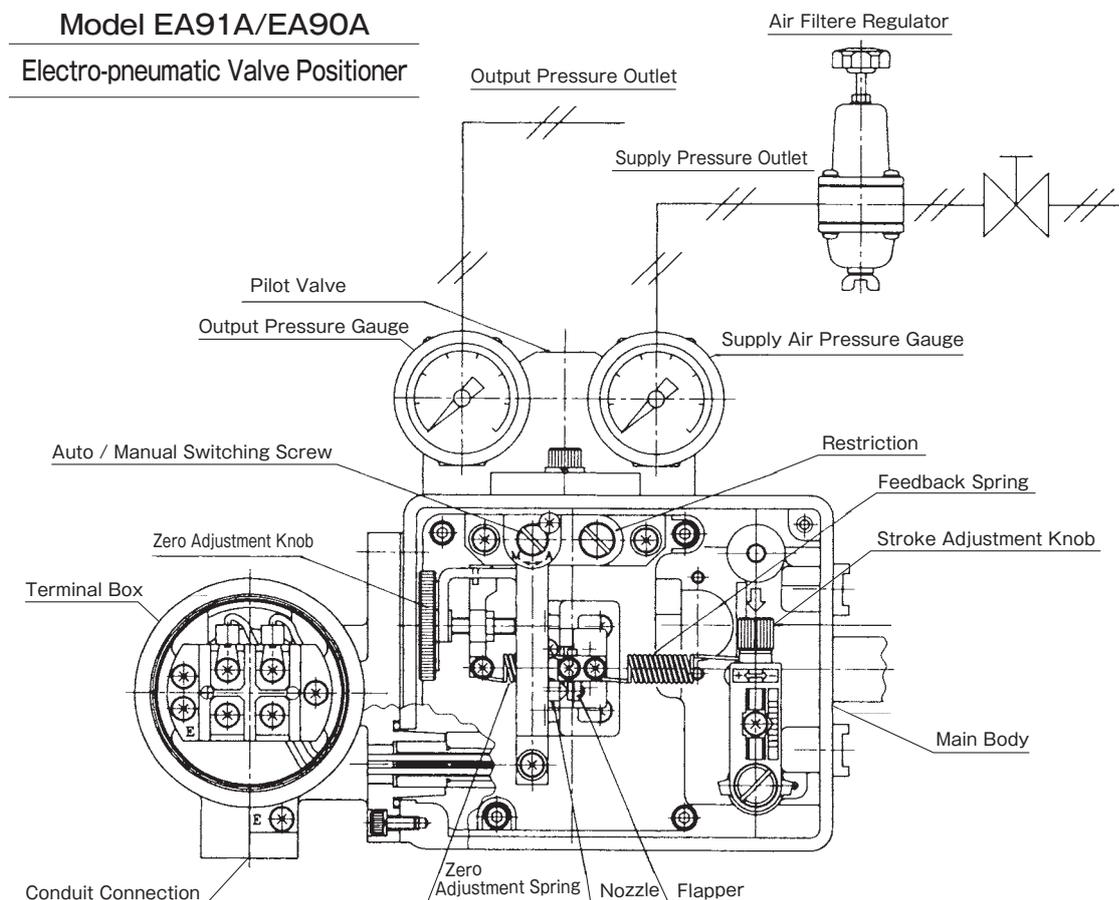
9 REFERENCE INFORMATION

9.1 Predicted Service Life

The predicted service life of each part used in Model EA91A/EA90A Electro-pneumatic Positioner is listed below. However, since this predicted values will differ depending on the operating temperature, operating pressure, operating frequency, and operating environment, use this list when performing periodic repair and periodic maintenance as the reference value.

Therefore, take note that the predicted service life listed below is not assured by MOTOYAMA. The product will be warranted for one year after delivering this product in principle.

Model : EA91A/EA90A (Predicted Service Life:10 Years)				
Main Part Name	Material	Predicted Service Life (Yr.)	Spare Parts	Remarks
Pressure Gauge	Stainless/C6872T	3	—	
Pilot Valve	Aluminum Alloy/Rubber with Cloth	5	Presence	Replace packing at replacement.
Restriction	Stainless	5	Presence	Replace O-Ring at replacement.
Manual Switching Screw	Stainless	5	—	
Nozzle	Stainless	5	—	
Flapper	Stainless	5	—	
Variety of Spring	Stainless-WP	10	—	
Cover Packing	NBR	3	—	
Filter	Sintered Metal	3	—	
Variety of O-Ring	NBR	5	Presence	

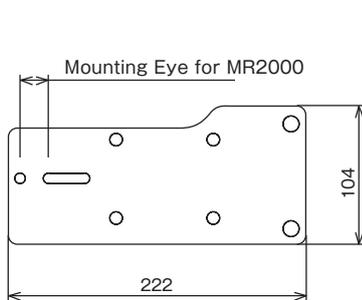


9.2. Dimension of Fitting

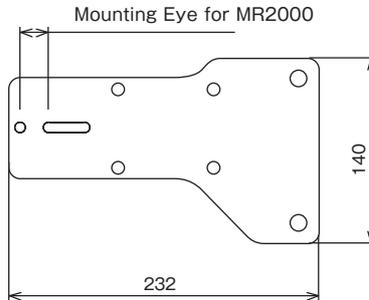
[Note]

- ※1. Actuator Type : The bracket for #3800 and #3300 can be attached to Model EA91A electro-pneumatic valve positioner and MR2000 air filter regulator.
- ※2. Actuator Type : When attaching the bracket for #2800 to MR2000 air filter regulator, special brackets shown below are required.

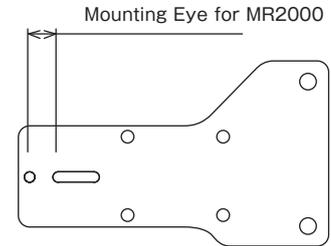
(1) Bracket Unit : mm



Actuator Type : #3800, Size:N24 to N33S
(W/Side Handle)

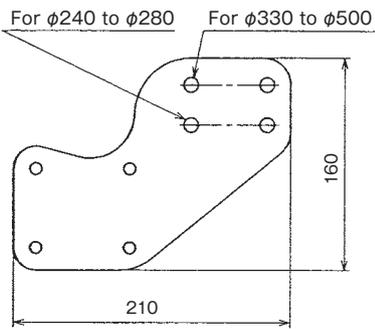


Actuator Type : #3800, Size:N40
(W/O Side Handle)

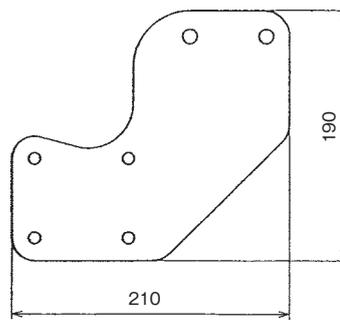


Use backside of left dwg.

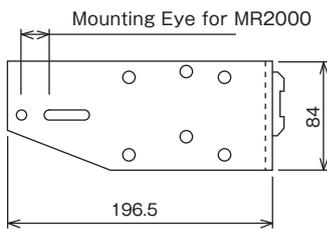
Actuator Type : #3800, Size:N40
(W/Side Handle : Common)



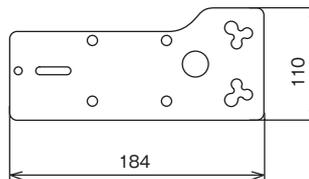
Actuator Type : #2800, Size : φ240 to φ500
(For φ240 to φ280, W/Side Handle : Common)



Actuator Type : #2800, Size : φ650
(For φ330 to φ500, W/Side Handle)

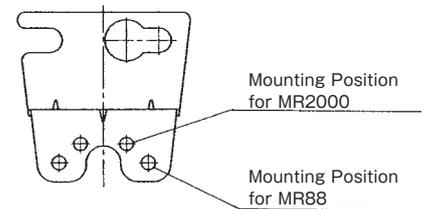


Actuator Type : #3300

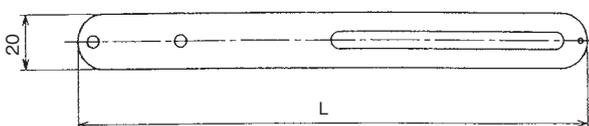


Actuator Type : #2900, and #3900

Bracket for Air Filter Regulator



(2) Feedback Lever

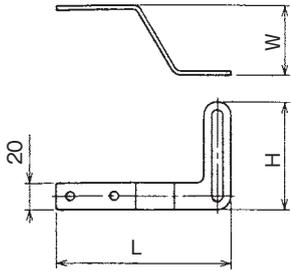


Unit : mm

Actuator Type	Actuator Size	Lifting Range	L
#2800	φ240 to φ330	15 to 38	187
#3800	N24 to N33S		
#2800	φ400 to φ650	15 to 65	247
#3800	N40		
#2800	φ400 to φ650	70 to 130	357
#2800	φ240 to φ330	5 to 10	165
#3800	N24 to N33S		
#3300	C20	12.7	

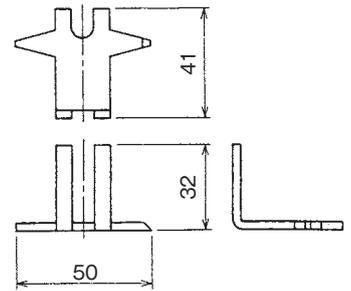
(3) Connector Arm Unit : mm

Actuator Type : #2800

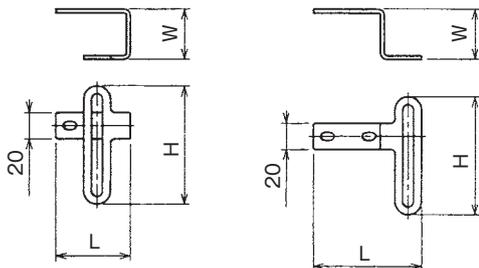


Actuator Size	Lifting Range	L	H	W
ø240 to ø330	5 to 10	90	80	52
ø240 to ø330	15 to 38	130	80	52
ø400 to ø500S	15 to 65	183	110	70
ø500	70 to 100	293	100	80
ø500SH-BL	15 to 65	183	110	110
ø500SH-BL	70 to 100	293	100	90
ø650	15 to 65	191	110	130
ø650	70 to 130	298	100	140

Actuator Type : #3300



Actuator Type : #3800

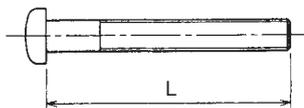


Actuator Size	Lifting Range	L	H	W
N24 to N33S	5 to 10	56	90	38
N24 to N33S	15 to 38	81	90	38
N33L to N40	15 to 65	96	90	45

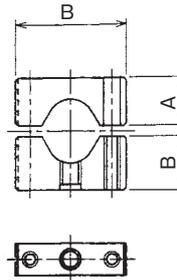
Lift 5 to 10mm

Lift 15 to 65mm

(4) Connector Pin



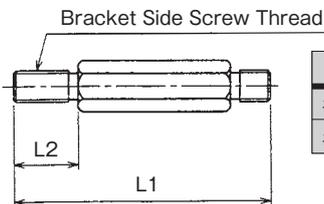
Actuator Type	Actuator Size	L
#2800	ø240 to ø280	40
#3800	N24 to øN40	
#3300	C20	
#2800	ø330 to ø650	55



(5) Stem Clamp

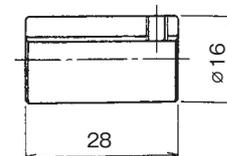
Actuator Type	Actuator Size	A	B
#2800	ø240 to ø330	20	42
#3800	N24 to N33S		
#2800	ø400 to ø500	23.5	54
#3800	N40		
#2800	ø650	28	65

(6) Spacer Bolt

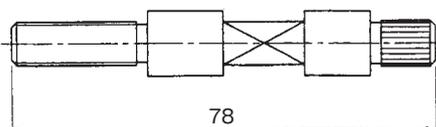


Applied Valve Type	L1	L2
#92(-A)	95	22
#16B(V), #11-1M	85	24

(7) Spacer



(8) Joint





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