

Model PM15E Electro-Pneumatic Valve Positioner Installation, Operation and Maintenance Instructions

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1. STORAGE INSTRUCTIONS

PM15E Positioner Storage and Handling Procedures

PM15E positioners are precision instruments which should be stored and handled accordingly to avoid problems or damage.

Electro-pneumatic positioners contain electronic components which can be damaged by exposure to excessive water. Appropriate precautions should be taken to protect units while in storage.

Warehouse Storage

Stored in original shipping containers, units should be stored in an environmentally controlled area, i.e., clean, cool (15–26°C, 60–80°F) and dry, out of direct sunlight or weather exposure.

Field Storage

NOTE: Once the air supply to the positioner is connected and turned on, internal air bleed will prevent the ingress of moisture and protect the unit from corrosion. It is recommended that the air supply be left on at all times.

- If units are installed immediately, turn, and leave on, the air supply.
- If positioners must be stored outdoors, tighten all covers which may have loosened in shipment, make sure all open enclosure points are sealed.

Positioners should be wrapped and sealed air and watertight with desiccant inside the plastic; units should be securely covered with an opaque cover and not exposed to direct sunlight, rain or snow.

Units should have all ports sealed and be protected from direct exposure to weather. For long term storage (>1 month) or overseas shipment units should be protected with plastic and desiccant.

Potential Damage to Mechanism

When units are stored in hot, humid climates, the daily heating/cooling cycle will cause air to expand/contract and be drawn in and out of the positioner housing. Dependent on the local

temperature variations, humidity and dew points and time in storage, condensation could occur and accumulate inside on the I/P converter causing erratic operation or failure due to water and corrosion. The potential for condensation damage is especially high in southern climates and aggravated if units are exposed to direct sunlight.

For further assistance, please contact your nearest Worcester distributor.

2. INSTALLATION

Before mounting the positioner, the relationship of the actuator to the valve must be determined. The actuator can be mounted in-line or cross-line to the valve. In addition, the actuator can be mounted right-side-up or inverted. If a spring-return actuator is used, the actuator can be set up to fail with the valve closed or with the valve open. This gives the end user a total of eight possible set-up configurations.

A. Mounting Guide

The following notes pertain to Positioner Mounting Guide below.

- 1) “Inverted” actuator position and “Cross-Line” actuator mounting applies to sizes 10–20 39 Series actuators only. On sizes 25 and larger, the output shaft is square, which allows for the coupling to be indexed 90° to the actuator shaft. Normal actuator position means that the actuator is mounted “right-side-up”.
- 2) For spring-return actuators only: “Fail-Open” actuators have a “9” in position 3 of the ordering code.
- 3) To change cam to reverse-acting, remove and reinstall upside down (see Section 9).
- 4) For double-acting actuators only: Normal hose positions refers to that described in Section 2.C, Connections.

Actuator

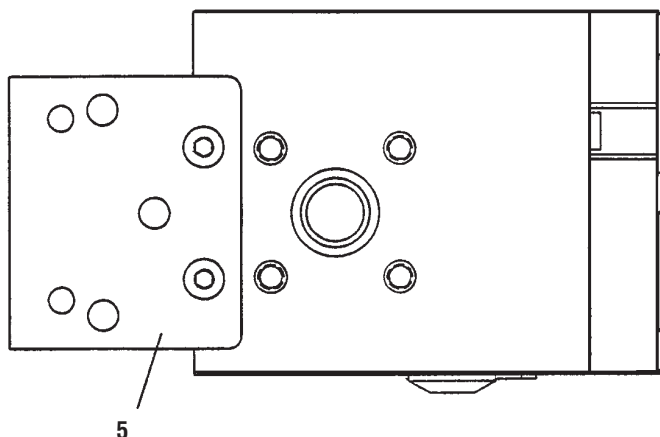
Positioner

Actuator Mounting (Note 1)	Failure Mode (Note 2)	Actuator Position (Note 1)	Rotation to Open	Positioner Operation	Cam (Note 3)	Cam Setting	Actuator Supply Hoses Note 4	Valve Position at Min. Signal
In-Line	Fail-Close	Normal	CCW	Direct-Acting	Direct-Acting	0° (Min. Signal) When Valve is Closed	Normal	Closed
In-Line	Fail-Close	Normal	CCW	Reverse-Acting	Reverse-Acting	90° (Max. Signal) When Valve is Closed	Reverse	Open
Cross-Line	Fail-Close	Inverted	CW	Direct-Acting	Reverse-Acting	0° (Min. Signal) When Valve is Closed	Reverse	Closed
Cross-Line	Fail-Close	Inverted	CW	Reverse-Acting	Direct-Acting	90° (Max. Signal) When Valve is Closed	Normal	Open
In-Line	Fail-Open	Inverted	CCW	Direct-Acting	Direct-Acting	90° (Max. Signal) When Valve is Open	Normal	Closed
In-Line	Fail-Open	Inverted	CCW	Reverse-Acting	Reverse-Acting	0° (Min. Signal) When Valve is Open	Reverse	Open
Cross-Line	Fail-Open	Normal	CW	Direct-Acting	Reverse-Acting	90° (Max. Signal) When Valve is Open	Reverse	Closed
Cross-Line	Fail-Open	Normal	CW	Reverse-Acting	Direct-Acting	0° (Min. Signal) When Valve is Open	Normal	Open

B. Mounting Instructions for a Direct-Acting PM15E to a Spring-Return or Double-Acting 39 Actuator:

The most common installation configuration is with the actuator mounted in-line, direct-acting, and with spring return set for fail-closed. Direct-acting means that as the signal increases, the valve travels in the open direction.

- 1) Close the valve/actuator assembly if it is not already closed (fully CW).
- 2) Remove the position indicator, if any, from the actuator shaft.
- 3) Attach the mounting bracket to the top of the actuator such that the indicating scale is upright and on the same side of the actuator as the actuator nameplate. Use four (4) screws and lockwashers supplied with mounting kit.
- 4) Place coupling on actuator shaft. DO NOT tighten set screws at this time.
- 5) Install the indicating arm and locknut on the coupling such that the end of the arm points downward.
- 6) Place the positioner on the bracket so that the actuator nameplate and the side of the positioner with the zero adjustment are on the same side. Positioner is mounted to bracket using mounting adapter and screws (5). See illustration below.
- 7) Align the mounting holes and then use the two (2) 5/16-18 socket head cap screws, lockwashers, hex nuts, and rubber washers (between bracket and positioner) supplied with the mounting kit to fasten the positioner to the bracket.
- 8) Tighten the set screw at the upper end of the coupling to the positioner shaft (seat the set screw in the positioner shaft groove). The other two set screws will be tightened after the actuator is cycled 90°. Proper alignment of the positioner spindle to the actuator shaft is very important since improper alignment can cause excessive wear and friction to the positioner.



C. Connections

Air connections are tapped for 1/4" NPT male connectors and are clearly marked. Gauge ports Ip, P, S, C1, C2 are 1/8" NPT. We recommend use of tape, Loctite® 577 or similar for sealing.

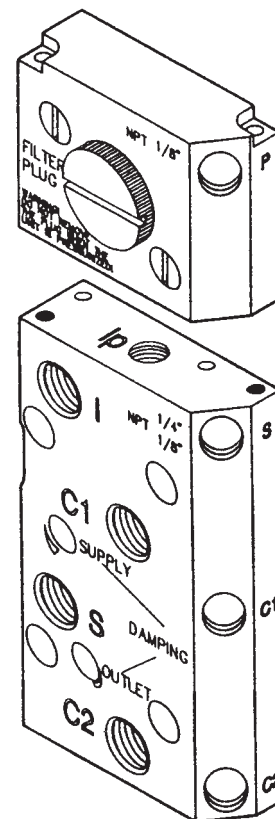
Electrical connection on I/P unit accepts 1/2" NPT cable gland.

- Port I** Not used and will be plugged.
- Port S** Supply air, maximum 0.9 MPa (125 psi), minimum 0.15 MPa (21 psi) for PM15E.
- Port C1, C2** Actuator connections (0.2-0.9 MPa). C2 opening port.
- OUT** Exhaust air port. Do Not Block!
- Port Ip** Used as air passage to I/P unit.
- Port IE** Input electric signal (4-20 mA) (on the I/P unit).
- Port P** Gauge port for I/P unit output pressure (on the I/P unit).

Ports P, S, C1 and C2 are sealed with plugs. To install gauges, unscrew plugs and replace with gauges. Gauges for these ports are supplied by customer.

We recommend use of tape, Loctite® 577 or similar for sealing.

Port OUT is for venting the unit. All air from the positioner, actuator and I/P unit is vented to atmosphere through this port. Do not block this port. If port is covered or plugged, remove



before pressurizing. A high flow silencer or an exhaust pipe can be connected to this port to prevent foreign objects from entering and blocking the unit's exhaust.

When using gases other than air for supply, please contact Worcester.

Connect the air supply line to port S.

For double-acting operation, connect the right-hand and the left-hand ports of the actuator end cap (right-hand end cap when facing actuator nameplate) to ports C2 and C1 respectively.

For single-acting operation, plug port C1 for increasing signal to open or close. Plug C2 for decreasing (reverse) signal to close.

The 4-20 mA signal wires will be connected to the terminal block by passing the wires through port I_E. Be certain that you observe proper polarity when making the connections. Remove cover (62) for access.

3. OPERATION

The PM15E operates on a force balance principal. Force is originated by the signal pressure transmitted through a diaphragm onto the balance arm. The opposing force is achieved through the feedback spring and is proportional to the position of the lower arm. The lower arm position is determined by the position of the cam which is secured to the spindle and connected to the actuator shaft, thus providing the feedback from the actuator/valve. When these two forces are equal, the balance arm and the spool in the pilot valve are in neutral position—the complete unit is in a balanced position. Air is supplied to the pilot valve through port S, and controls the air flow through ports C1 and C2.

Assume an equilibrium position.

An increased control pressure will deflect the diaphragm (1) down, compressing the feedback spring (3). The balance arm (2) moves the spool (7) in the pilot valve (8) furnishing supply air to the actuator, while at the same time air is exhausted from actuator and is vented to atmosphere through the pilot valve and the OUT port.

With the increased supply air, the actuator rotates (or moves linearly), moving the positioner spindle (6). The spindle and cam (5) rotate, forcing the lower arm (4) upwards, compressing the feedback spring (3). This motion will continue until two forces are equal and the unit is an equilibrium position.

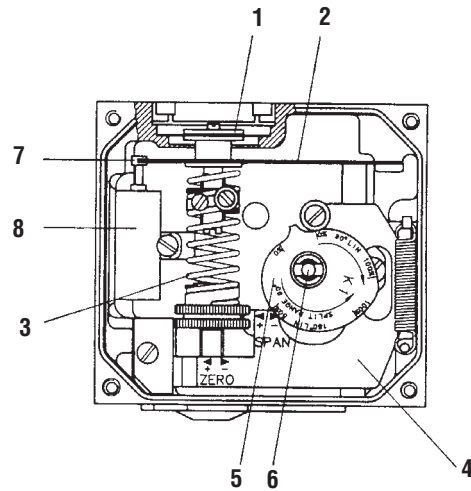
4. AIR REQUIREMENTS

Maximum supply pressure is 0.9 MPa (125 psi).

Supply air shall be clean, dry and free from oil, water, moisture, foreign parts and debris.

The air shall be freeze-dried or similar to a dew point of at least 10°C (18°F) below lowest expected ambient temperature.

A < 40 micron filter/regulator is recommended to be installed as close to PM15E as possible to ensure proper supply air quality.

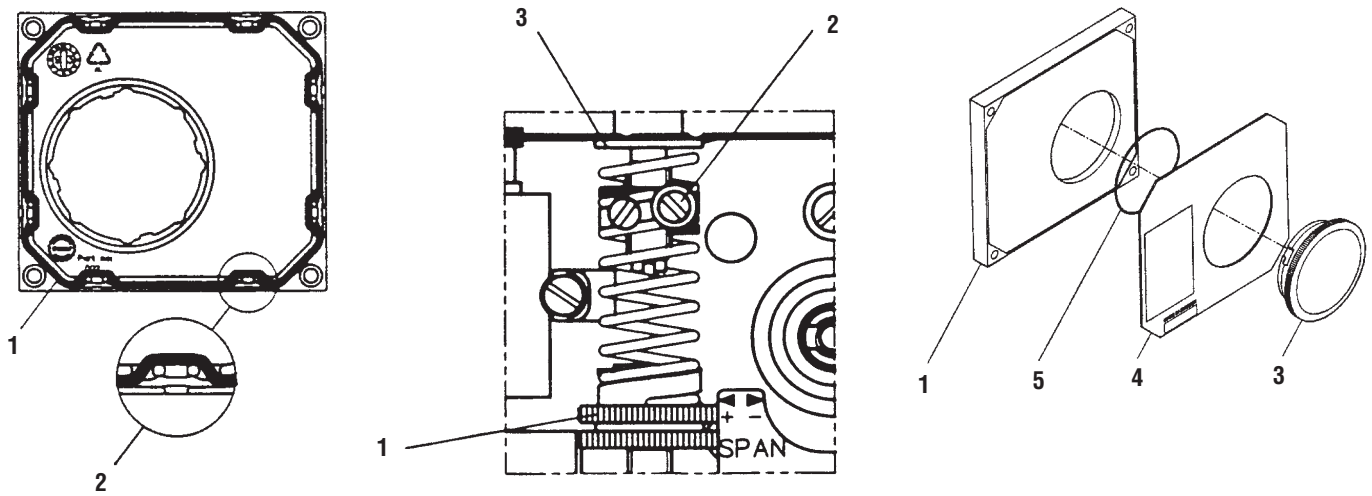


5. FRONT COVER AND INDICATOR COVER

The front cover of the PM15E is secured to the pneumatic unit with four captured screws and sealed with an O-ring (1). The O-ring can be looped over notches (2) in the front cover to allow for drainage. There are eight locations on the front cover where the O-ring can be looped. This O-ring system is common to the pneumatic unit and I/P unit in the PM15E. This unique sealing system allows for complete sealing or draining of the units by changing the position of the O-ring.

The indicator cover (3) is O-ring sealed and secured by a bayonet coupling. The indicator cover is also used to secure the identification cover (4).

To remove the indicator cover, turn it slightly counterclockwise until it loosens. Identification cover and O-ring (5) are now removable. When installing indicator cover and identification cover, make sure that the O-ring is properly engaged.



6. SPAN AND ZERO ADJUSTMENT

Span is adjusted with the brass-colored (upper) thumb wheel (1) located on the feedback spring.

To adjust the span, always return to minimum input signal first, then loosen the locking screw (2) and turn thumb wheel (1). Tighten screw (2) when span is set. Do not allow the top of the spring to contact the spring guide (3).

Always check zero after adjusting span.

Zero is adjusted by turning the silver (lower) thumb wheel (4) located on the lower arm (5), or externally with a screwdriver (7) through the zero adjustment opening. Remember to install cover (6) to ensure the unit seals.

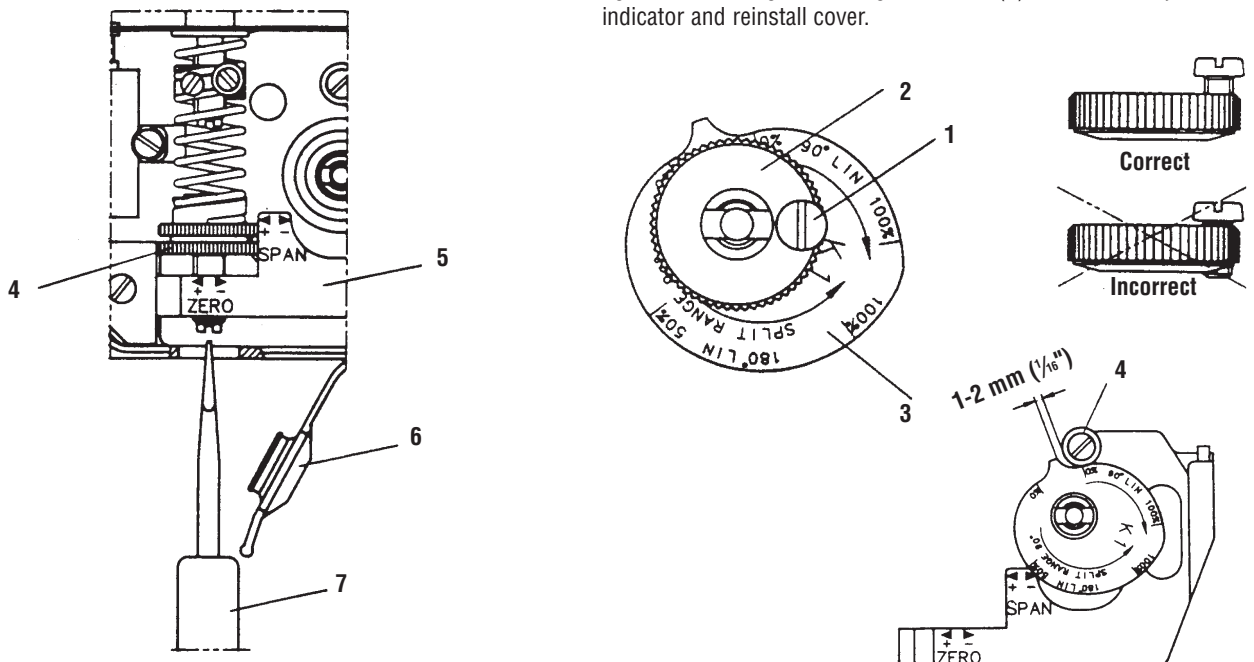
7. INDICATOR ADJUSTMENT

To adjust the indicator, take off front cover and pull the indicator upwards until it comes off the Allen screw.

Before installing the indicator make sure that the Allen screw is tightened. Press the indicator on the screw and adjust it by rotating clockwise to desired position.

8. CAM ADJUSTMENT

With the cover and indicator removed, loosen the screw (1) and turn the cam locking nut (2) counterclockwise until the cam loosens. Adjust the cam (3) as desired, making sure that the ball bearing (4) is always riding on an active lobe on the cam. To secure the cam, make sure that screw (1) is backed out from the locking nut (2), then finger-tighten the locking nut and tighten screw (1). Install and adjust the indicator and reinstall cover.



9. REVERSE-ACTING AND SPLIT-RANGE

Reverse-Acting

For reverse-action operation, invert cam. Also reverse connections C1 and C2. For single-acting actuators, move actuator connection from C2 to C1 and plug C1.

Split-Range

For split-range, reposition the cam, noting the markings on the cam: for 4-12 mA, use initial 50% zone; for 12-20 mA, use 51-100% zone.

Figure 1

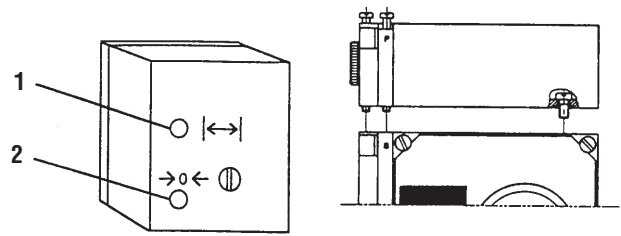


Figure 2



Figure 3

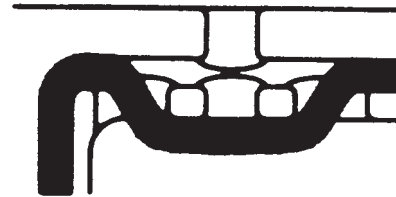
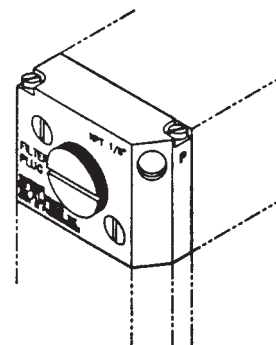


Figure 4



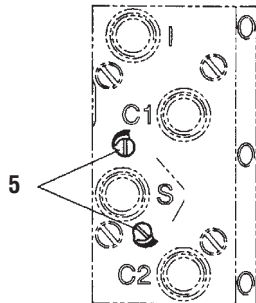
10. DAMPERS

The standard built-in dampers (5) located on the connecting block provide a simple means of adjusting the actuator travel speed.

For maximum actuator travel speed, dampers shall be adjusted to minimum damping position.

Double-Acting Actuators – Adjust only OUTLET damper; set SUPPLY damper in minimum damping position.

Single-Acting Actuators – Adjust both dampers for desired operation.



11. I/P UNIT, PM15E

I/P unit is mounted directly on top of the positioner unit. No external air supply is needed since the I/P unit is supplied with air from the positioner unit.

The I/P unit is equipped with a built-in 30 micron filter (Figure 4).

CAUTION: Do not operate the unit without filter and filter plug installed. Do not unscrew filter plug when the positioner is pressurized.

Span and zero for the I/P converter is factory set and should not require adjustment.

I/P Calibration

Check I/P output by connecting gauge to port P.

- Adjust Zero on screw 2.
- Adjust Span on screw 1.

12. REMOVING AND MOUNTING THE I/P UNIT TO THE POSITIONER UNIT

Switch off supply air and disconnect input signal (port I). Loosen screws (3) and remove connection block (1), the gauge or plug from port Ip, the fitting from port I and existing gasket (4). Carefully install gasket (6) supplied together with I/P unit. When correct, installed port I will be blocked by the gasket.

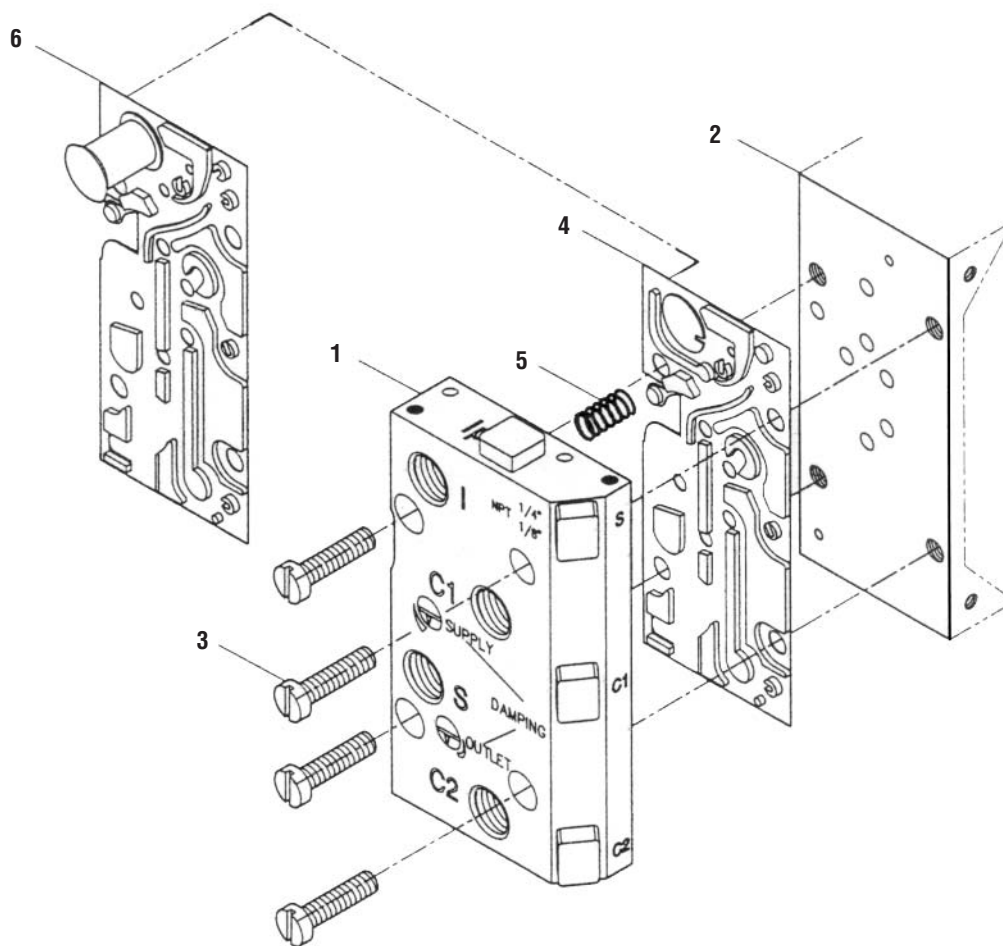
Make sure that relief valve spring (5) is installed properly. Install the connection block (1) to the positioner unit (2).

Remove cover on I/P unit.

Install the I/P unit to the top of the positioner unit, making sure that the four O-rings are present and properly seated. Tighten the unit with the three screws (see Figure 1 and Figure 2, page 6).

Connect input signal cable to port I_E and tighten the cable gland (see Figure 5 on Page 6). Adjust the O-ring on the I/P unit housing to desired position—sealed or drained (see Figure 3 on page 6 or Section 5 on page 4).

A gauge indicating output signal from the I/P converter can be installed in port P. Make sure that the filter plug is tightened before supply air is switched on (Figure 4 on page 6).



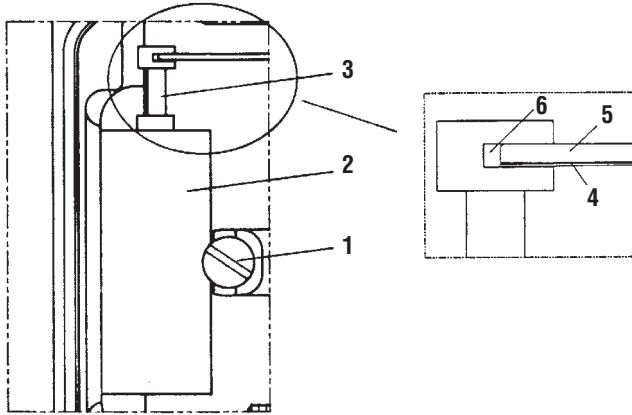
13. MAINTENANCE

A. Pilot Valve

To remove the pilot valve for cleaning or inspection, remove the screw (1) and carefully lift out the complete assembly (2). Gently remove the spool (3) from the block and clean the parts, using methylate cleaner or similar. Blow parts dry with compressed air.

Should the parts show signs of wear, a new assembly is recommended. Mixing spool valves and valve bodies may result in very high bleed rates and poor performance. Check the O-rings, then secure and install the pilot valve assembly to the positioner unit and secure it with the screw (1). Make sure that the leaf spring (4) on the balance arm (5) is properly fitted in the groove on spool (6). Check again to ensure smooth operation of the assembly.

To maintain original factory performance specifications, use only spool valve assemblies supplied by Flowserve.



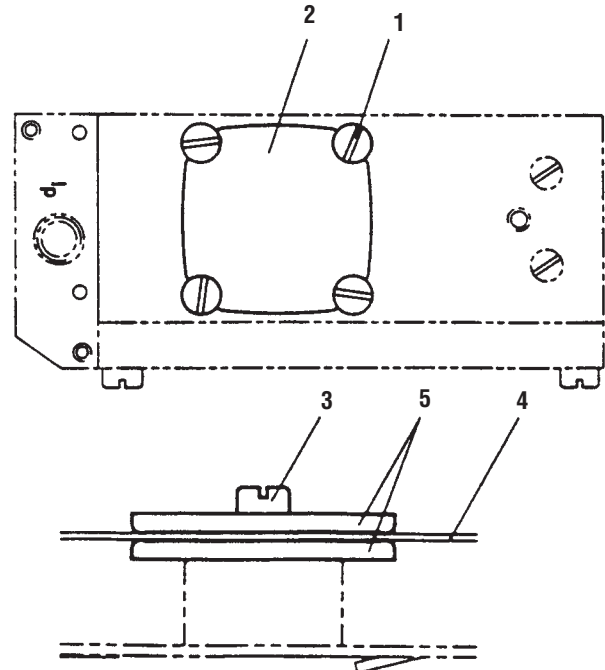
B. Diaphragm

The I/P unit must be removed to access the diaphragm. (See previous section.) Then loosen screws (1) and remove the diaphragm cover (2). Loosen screw (3); diaphragm (4) and washers (5) can be removed.

When installing the diaphragm, make sure to place one washer on each side of the diaphragm. Make sure that the raised circle on the washers is facing the diaphragm.

Install the screw (3) and tighten.

Check the O-ring on the diaphragm cover (2), then install and secure the cover with screws (1).

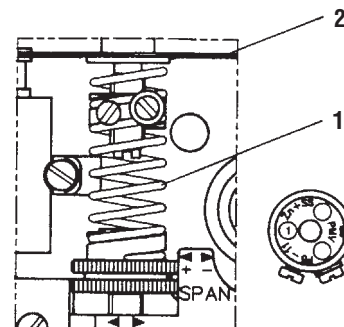


C. Feedback Spring

Once the front cover and indicator are removed, the feedback spring can be easily accessed.

Hold the spring (1) from the top, pull down and out.

When installing, hold the assembly at the top, guide the lower part to position on the zero screw, then press down until it fits easily under the balance arm (2). Make sure that the assembly is aligned properly against the lower arm and the notch is engaged in the tab on the balance arm (2).



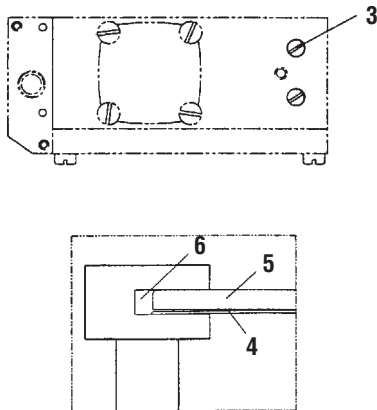
D. Balance Arm

The balance arm can only be removed after I/P unit, diaphragm and feedback spring have been removed. (See previous sections.)

Loosen the screws (3) and the balance arm can be removed.

When installing the balance arm make sure that the leaf spring (4) on the underside of the balance arm (5) is properly engaged into the groove (6) of the spool in the pilot valve.

Tighten the two screws (3) holding the balance arm to the positioner.

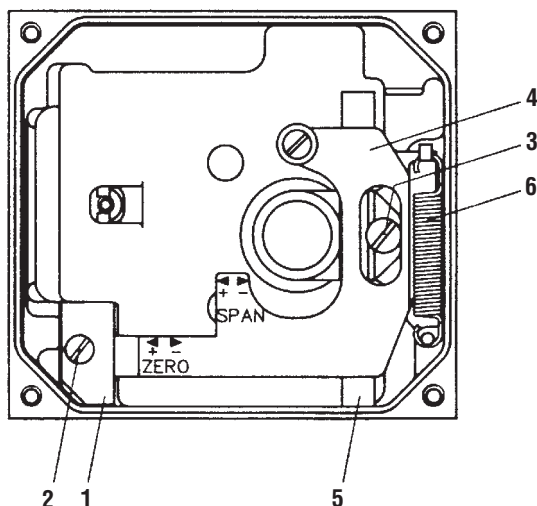


E. Lower Arm

Once the front cover is removed, the lower arm can be easily accessed. Remove the indicator, feedback spring and the cam. Loosen screw (2) and remove twist stop (1). Remove screw (3), lower arm (4), rod (5) and spring (6).

Check rod and lower arm for wear; replace if necessary. Clean the rod and install it in the lower arm. The lower arm should move easily and smoothly.

Install the lower arm and rod assembly into the positioner housing, making sure that the spring (6) is attached properly to the lower arm and positioner housing.



Secure the lower arm and rod assembly with the screw (3). Check again that the lower arm moves smoothly.

Apply a small amount of grease on the small tongue on the lower arm, then install and secure the twist stop.

Install cam, feedback spring, indicator and front cover.

F. O-Rings

With time and use, O-rings can become brittle. This can cause poor operation and even failure of the positioner.

Always check O-rings when performing any work on the positioner and replace bad O-rings.

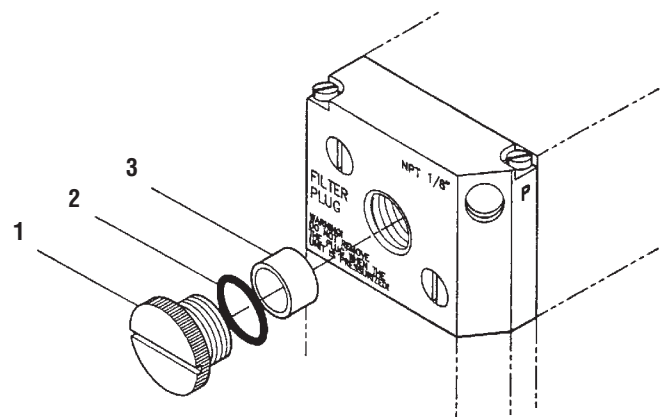
A thin layer of silicon grease applied on the Buna N (Black) O-rings prolongs their life. On Q (Red Silicon) O-rings, use a non-silicon based grease.

G. Filter Plug

CAUTION: Do not operate the unit without filter and filter plug installed. Do not attempt to unscrew filter plug while positioner is pressurized.

The PM15E is equipped with a built-in secondary filter located on the side of the I/P unit.

For replacement or inspection, make sure that positioner unit is not pressurized, then unscrew filter plug (1). Remove filter (3) and install a new one into the filter plug. Check condition of O-ring (2) and filter compartment. If moisture is found, check upstream filters/oil-water separators. Moisture can cause I/P failure. Reinstall filter plug.



14. TROUBLESHOOTING

NOTE: All PM15E positioners are serialized and date coded. Please note date, and provide the serial number when contacting the factory for troubleshooting or service.

Signal change results in actuator running to end positions:

- Check coupling between positioner and actuator.
- Check cam position and locking screw.
- Check input signal.

Signal change has no effect on the actuator position:

- Check indicator and screw.
- Check air supply to positioner and tubing to the actuator.
- Check input signal to positioner.
- Check diaphragm for damage or leakage.
- Check pilot valve function.
- Check cam for correct setting.
- Check I/P output.

Inaccurate positioning:

- Dirty or worn pilot valve.
- Defective or leaking diaphragm.
- Input signal fluctuates.
- Incorrect sizing of actuator.
- Valve/actuator "stiction".
- High valve/actuator breakaway torque.
- Loose cam.

15. TECHNICAL DATA

Input Signal	4-20 mA
Linearity	< 0.75%*
Hysteresis	< 1%*
Repeatability	< 0.5%*
80% Load (Supply Pressure 87 psi)	1,000 (kPa/kPa) (psi/psi)
50% Load (Supply Pressure 87 psi)	1,250 (kPa/kPa) (psi/psi)

Air Consumption at Supply Pressure

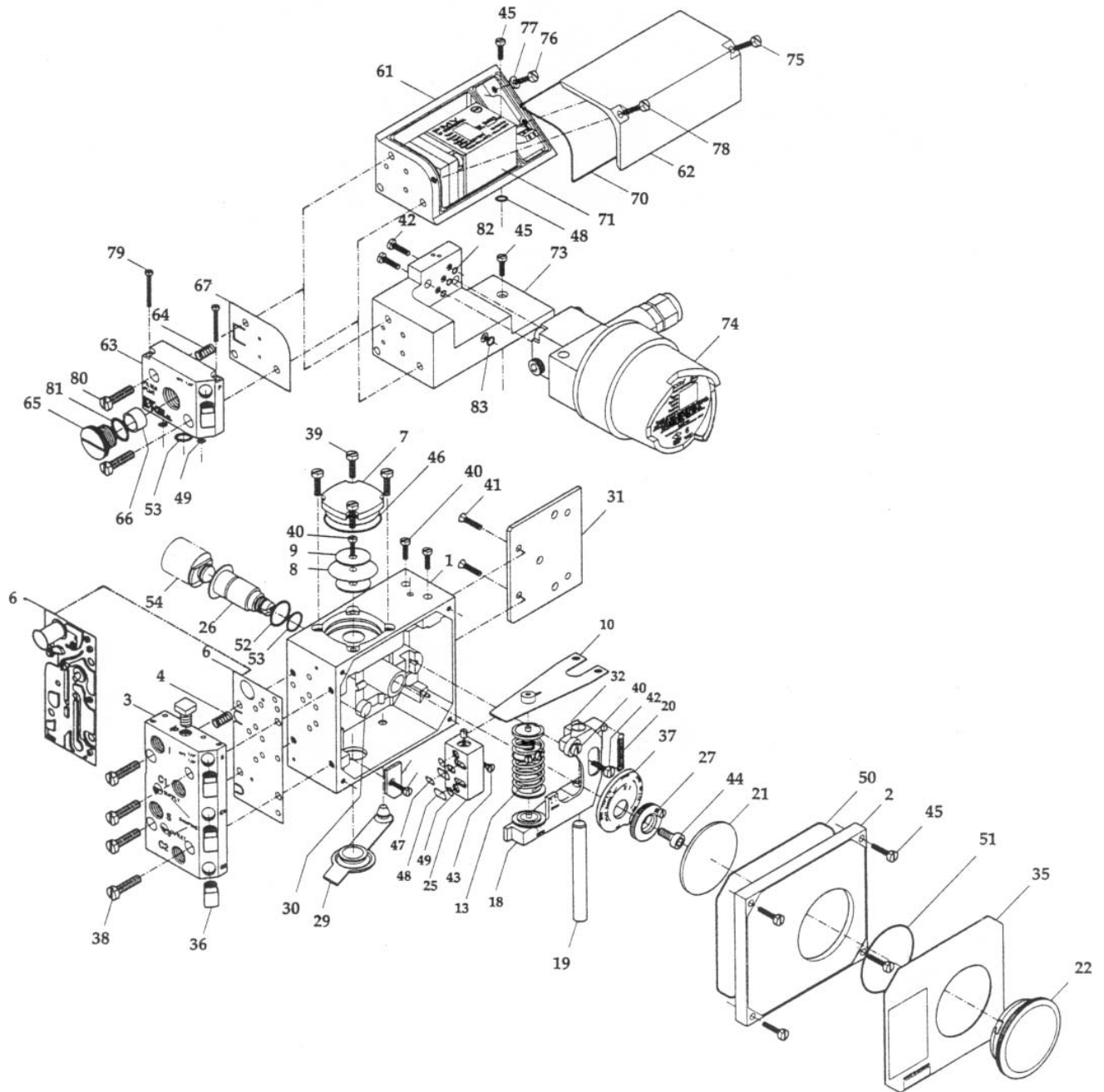
	± 20%
0.2 MPa/29 psi	6.1 nl/min 0.22 SCFM
0.4 MPa/58 psi	13.6 nl/min 0.48 SCFM
0.6 MPa/87 psi	22 nl/min 0.78 SCFM
0.8 MPa/116 psi	30.5 nl/min 1.08 SCFM
1 MPa/145 psi	39 nl/min 1.38 SCFM

Air Delivery at Supply Pressure

	± 20%
0.2 MPa/29 psi	200 nl/min 6.9 SCFM
0.4 MPa/58 psi	370 nl/min 12.8 SCFM
0.6 MPa/87 psi	540 nl/min 18.8 SCFM
0.8 MPa/116 psi	710 nl/min 24.7 SCFM
1 MPa/145 psi	880 nl/min 30.6 SCFM

Supply Pressure	0.15-0.9 MPa/21.8-125 psi
Temperature Range	-20°C to +85°C (-4°F to 185°F)
Connector Threads	¼" NPT
Gauge Threads	⅜" NPT
Weight Std.	1.5 kg/3.4 lbs.
Weight with Gauges	1.8 kg/3.9 lbs.
Ingress Protection	IP 66/NEMA Type 4

*Percent of full scale.



Spare Part List

Pos	Part No.	Qty	Description
1		1	Housing
2	P5-2	1	Front Cover Including O-Ring
3	P5-AS3N	1	Connecting Block NPT 1/4" Assembly
4	P5-4	1	Relief Valve Spring
6	P5-6EP	1	Gasket for EP5
7	P5-7	1	Diaphragm Cover Including O-Ring
8	P5-8	1	Diaphragm
9	P5-9	2	Diaphragm Washer
10	P5-10	1	Balance Arm
13	P5-AS13/315	1	Feedback Spring 3-15 PSI Assembly
18	P5-18	1	Lower Arm Assembly
19	P5-19	1	Rod
20	P5-20	1	Spring
21	P5-21A	1	Indicator Arrow
22	P5-22T	1	Indicator Cover Transparent Including O-Ring
24	P5-24	1	Twist Stop
25	P5-25	1	Pilot Valve Including O-Rings
26	P5-26	1	Shaft Including O-Rings, Screw
27	P5-27	1	Cam, Locking Nut Including Screw
29	P5-29	1	Zero Cover
30	P5-30	1	Cover
31	P5-31	1	Mounting Adapter Including Screws
32	P5-32	1	Ball Bearing

Pos	Part No.	Qty	Description
35	P5-xx/xx	1	Identification Cover
36	12047N	4	Plug NPT 1/8"
37	P5-K1	1	Cam
38-45	P5-Screws	1	Screw Set P5/EP5
75-80			
46-53	P5-Seal NBR	1	O-Ring Set P5/EP5
81-83, 6, 67, 70			Nitrile, NBR
46-53	P5-Seal Q	1	O-Ring Set P5/EP5
81, 83, 6, 67, 70			Silicone Q
54	P5-S3	1	Spindle Adaptor
I/P Unit Part List			
61		1	I/P Box
62	E5-2	1	I/P Cover Including Screws
63	E5-AS3N	1	I/P Nose NPT 1/4" Assembly
64	P5-4	1	Relief Valve Spring
65	P5-5	1	Filter Plug Including Filter 66, O-ring, 81
66	E5-6	1	Filters (5 per Package)
67	E5-7	1	Gasket I/P
71	E5-STD	1	I/P Converter
73	E5 N-AS 11	1	Mounting Bracket Round I/P Including Screws, O-Rings, I/P Nose
	E5 G-AS 11		
74	FU-STD	1	Enclosure Including I/P Converter Std.
74	E5-EX/US	1	Enclosure Including I/P Converter, Explosion-Proof FM, CSA

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