VALVE POSITIONER

100N, 101N, 102N

Instructions

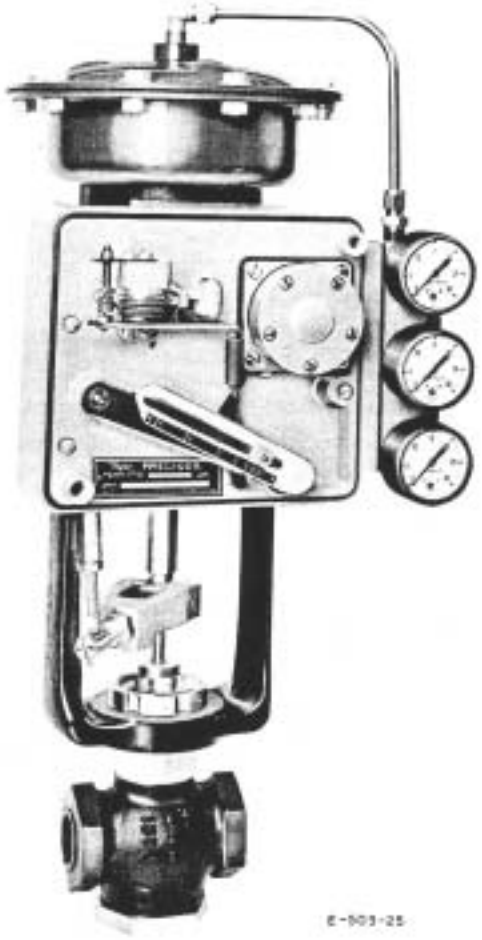

Fig. 1 - Precisor Pneumatic Valve Positioner, 100N

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Introduction

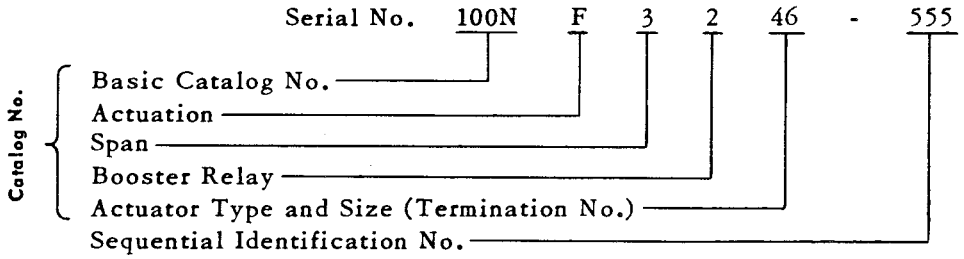
DESCRIPTION

The Pneumatic Valve Positioner is a force-balance instrument which is used as a position controller. Regulating action is obtained by balancing the pneumatic input from the controller and the motion feedback from the valve stem. These forces oppose each other across a flexure-pivoted baffle.

SERIAL and CATALOG NUMBERS

The serial number stamped on the data plate consists of the catalog number and a sequential identification number. The catalog number describes the construction of the valve positioner.

'X' before the serial number shows that the positioner has been built to meet a customer's particular requirement.



Basic Catalog No.

100N - Positioner with By-pass and Pressure Gages
101N - Positioner with Pressure Gages
102N - Positioner
103N - Positioner for use as a Fixed High Sensitivity Controller
104N - Positioner for use as a Position Transmitter

Actuation

F - Pressure

Span

0 - None - as the 103N
1 - 6 psi
2 - 8 psi
3 - 12 psi
4 - 16 psi

Booster Relay

1 - Without Booster Relay
2 - With Booster Relay

Actuator Type and Size

NOTE: THE TERMINATION NUMBER OF A TAYLOR ACTUATOR AND A TAYLOR POSITIONER ARE ALWAYS THE SAME.

TYPE OF ACTUATOR	AIR-TO-LOWER		AIR-TO-RAISE	
	Termination No.	Effective Diaphragm Area (sq. in.)	Termination No.	Effective Diaphragm Area (sq. in.)
Cast Iron Evenaction	01 02 03 04	12 26 50 72		
Motosteel Evenaction	05 06 07 08	16 36 60 125	09	16
Motosteel Lever Motors	15 16 17	16 36 60		
Lin-E-Aire for Valve with Screwed Packing Box	20 21 (Senior Top) 22 23 (Senior Top)	20 45 45 80	30 31 (Senior Top)	20 45
Lin-E-Aire for Valve with Bolted Packing Box	40 41 (Senior Top) 42 43 (Senior Top) 44 45 (Senior Top) 46	20 45 45 80 80 160 160	50 51 (Senior Top) 52	20 45 45
667			72 73 (Senior Top) 74 75 (Senior Top) 76 77	46 69 69 105 105 156

19 - Unmounted

29 - Competitive Actuators

Example: 100NF3246-555 identifies a pneumatic positioner with by-pass and pressure gages (100N) that is actuated by pressure (F) and has an input span of 12 psi (3). It has a booster relay (2) and an air-to-lower standard Lin-E-Aire actuator with an effective diaphragm area of 160 sq. in. (46). 555 is the sequential identification number.

SPECIFICATIONS

Hysteresis
0.3% of 12 psi span

Repeatability
0.1% of 12 psi span

Linearity
1.6% of span

Sensitivity
0.1% of 12 psi span

Relay Capacity
1.0 scfm - without booster
4.0 scfm - with booster and by-pass
5.0 scfm - with booster and without by-pass

Air Connections
1/4" Int. NPT

Air Consumption
0.45 scfm.

Supply Pressure
20 psi - recommended
10 psi - minimum
50 psi - maximum

Supply Pressure Effect
0.07 psi change in output per 1 psi change in air supply between 18 and 25 psi

Span
6, 8, 12, 16 psi

Stroke
Adjustable 1/4" to 3"

Output Range
From 0 psi up to within 0.3 psi of input supply

Ambient Temperature Limits
-40° F minimum, +180° F maximum

Ambient Temperature Effect
(Mounted on Valve Actuator)

Zero Adjustment
0.07 psi change in output per 100° F change in input between -40° F and +180° F with output at 9 psi

Span Adjustment
0.04 psi change in output per 100° F change in input between -40° F and +180° F with output at 9 psi

Vibration Effect
Will withstand 3g acceleration over 0 to 60 cps

Net Weight
7 lbs.

Shipping Weight
12 lbs.

INSTALLATION

AIR CONNECTIONS

The 100N positioner with the by-pass manifold has the air connections located at the top and bottom of the manifold.

All other models of the positioner have the air connections located at the side of the positioner.

After the valve actuator has been installed in the line, make the connections as listed below. All ports have 1/4" Int. NPT.

C - Input signal from the controller
S - Air Supply
M - Output signal to the actuator

PRE-START-UP CHECK

Before putting the valve positioner into operation, use the following check to assure optimum performance:

1. Make sure the valve stem is secured to the actuator, the connections are correctly made, and that the input will not exceed gage pressure or positioner specifications.

2. Turn on the air supply and check for leaks.

3. Make sure the motion lever arm is free of interference by stroking the valve through the full travel as follows:

   a. Set the input pressure 1 to 2 psi below the starting pressure and slowly increase it until the valve stem moves. Stem should move at starting pressure. If it does not, adjust the zero screw. Pg. 9

   b. Set the input pressure 1 to 2 psi above the top range level. The valve travel should be at the maximum position. If it is not, adjust the pivot point. Pg. 9

   The positioner is now ready for operation.

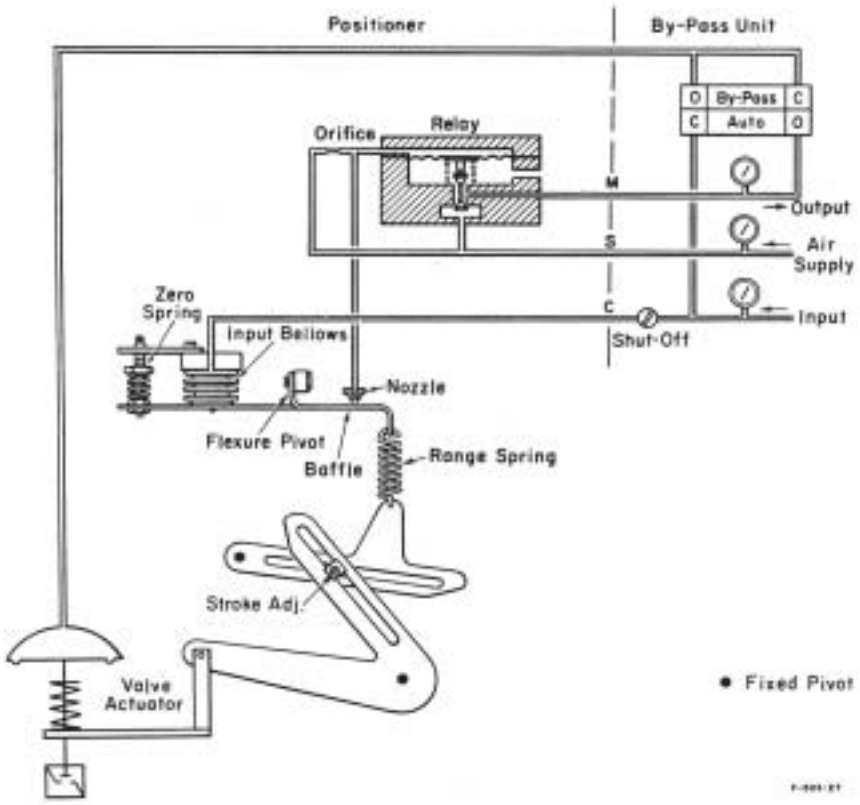


Fig. 2 - Schematic Diagram of Direct Acting Positioner without Booster

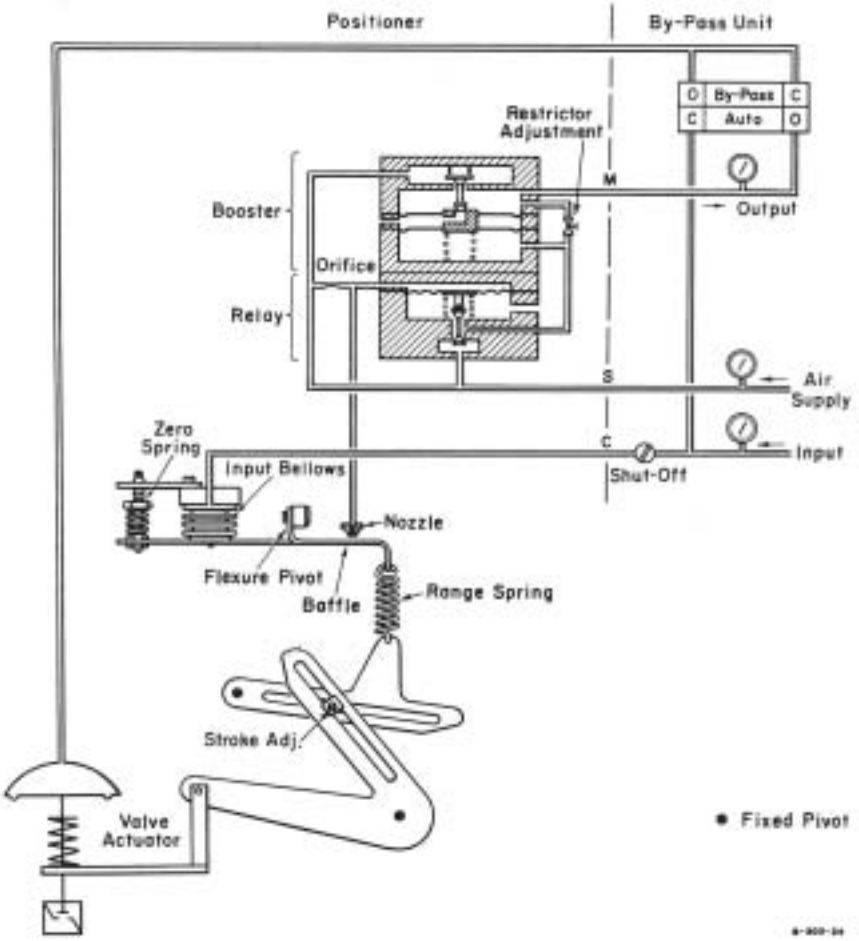


Fig. 3 - Schematic Diagram of Direct Acting Positioner with Booster

DESCRIPTION OF OPERATION

The valve positioner is a force-balance pneumatic type motion controller. Two forces, one pneumatic and the other developed as a result of motion, oppose each other across a flexure-pivoted baffle.

Direct Acting Positioner - Fig. 2

For a direct acting positioner mounted on an air-to-lower actuator, as the input pressure increases, the output pressure also increases.

An increase in pressure from the controller is fed through the input line to the bellows, causing the bellows to expand and push against the baffle. As the baffle moves toward the nozzle, the nozzle-baffle gap is diminished and nozzle back-pressure builds up in the orifice chamber of the relay. This pressure acts against the diaphragm of the direct-acting relay and opens the inner valve to allow the increased pressure to feed through the relay to the output port and the diaphragm of the valve actuator.

As the valve stem moves downward, the motion arm attached to it acts through the motion linkage to stretch the range spring. Extension of the spring pulls the baffle away from the nozzle and restores the force balance between the bellows and the spring.

A decrease in input causes the relay output to decrease and allows the valve actuator stem to move upward. This in turn decreases the tension on the spring to restore a force-balance position.

Booster-Relay - Fig. 3

The one-to-one booster relay is used to increase the positioner output air capacity. It can be mounted on the standard relay by removing the relay cover and replacing it with the booster assembly.

Assume a balanced position with a direct-acting positioner. As the positioner input increases, the output pressure also increases. The pressure in the lower booster chamber builds up at the same rate. The pressure in the upper booster chamber builds up at a slower rate because of the restrictor adjustment. This causes the double diaphragm to move upward, seating the exhaust valve and opening the booster supply to the upper chamber and the output line. Equilibrium is established when the pressure in the two chambers is equalized. The restrictor adjustment is used to match the booster capacity to the volume of any actuator.

By-Pass Manifold - Fig. 4

The by-pass manifold allows for positioner or controller operation of the valve actuator. A slide-valve is provided for Auto-Bypass switching. When on BY-PASS the positioner can be removed from the valve actuator and BYPASS assembly. Pg. 10

Reverse Acting Positioner - Fig. 4

For a reverse acting positioner, as the input pressure increases, the output pressure decreases. The bellows position is reversed to push against the baffle in the opposite direction and move the baffle away from the nozzle.

Split Range

Some applications use full valve travel for only a fraction of the controller output. This is called split range operation and can be done by matching the range spring rating to the required fraction of the controller output.

For example, if the application requires full valve travel for a 3 to 9 psi input, a 6 psi range spring is used. Calibration is the same as the example given in the calibration procedure except that the specific range is used.

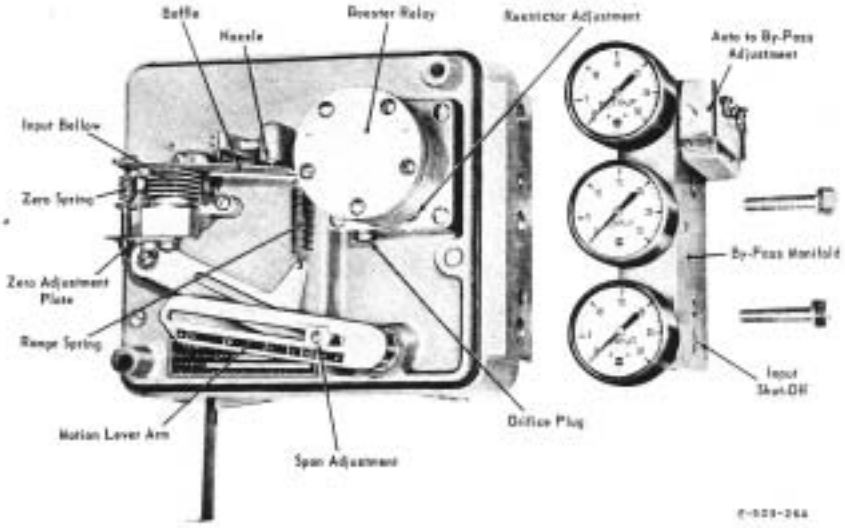


Fig. 4 - Positioner with By-Pass Manifold and Gages

PRE-CALIBRATION ALIGNMENT

Basic pre-calibration procedure for the positioner is described in this section. It is required only after changing the range, installing the positioner on an actuator, major maintenance, or reversing the action.

Note: For minor adjustments proceed to Calibration on page 9.

1. With the positioner mounted on the valve, set the travel adjustment on the positioner to agree with the travel of the valve as marked on the valve travel indicator plate.

2. Adjust the air supply to the correct pressure (normally 20 psi) and the input to mid-range.

3. Loosen the lock nut and adjust the hex stud of the ball joint connection until the valve moves to the center of its stroke. Tighten the locknut.

4. Positioner with Booster Relay - only

   a. Shut off the restrictor adjustment by turning it clockwise to the stop. Back it off one turn.

   b. Manually push the baffle against the nozzle and release it while watching the output. If the output oscillates, count the number of oscillations. If there are more than 4, turn the restrictor adjustment 1/6 turn counter-clockwise.

   c. Repeat Step b until there are less than 4 oscillations.

   Proceed to Calibration.

CALIBRATION

Note: After changing the range, installing the positioner, major maintenance, or reversing the action, first align the positioner as described under Pre-Calibration Alignment on page 8.

Zero Adjustment

1. Adjust the input to about 2 psi below the lower limit of the operating range and increase the input slowly.

   a. If the valve stem moves before the input pressure reaches the lower limit pressure, turn the zero spring adjustment nut to the right.

   b. If the valve stem moves after the input pressure reaches the lower limit pressure, turn the zero spring adjustment to the left.

   Note: If the positioner is equipped with gages, the OUTPUT gage will increase suddenly as the valve stem starts to move.

2. Repeat Step 1 until the zero spring is correctly set for the low limit starting pressure.

Note: If the positioner has a booster relay, repeat Step 4B at the low limit pressure.

Span Adjustment

1. Adjust the input to about 2 psi above the upper limit of the operating range and decrease the input slowly.

   a. If the valve stem moves before the input pressure reaches the upper limit pressure, move the span adjustment pivot slightly to a lower setting.

   b. If the valve stem moves after the input pressure reaches the upper limit pressure, move the span adjustment pivot slightly to a higher setting.

2. Repeat zero and span adjustments until the correct valve stroke is obtained for the required operating range.

Note: If the positioner has a booster relay, repeat Step 4B at the high limit pressure.

CHANGING THE ACTION

If the bellows assembly is pushing down on the baffle, the instrument is in direct action. Fig. 1

If the bellows assembly is pushing up on the baffle, the instrument is in reverse action. Fig. 4

To change the instrument action, use the following procedure:

1. With the air supply off, remove the 5/16" nut at the end of the zero spring.
2. On the threaded zero adjustment plate, remove the screw nearest the zero spring and loosen the other screw.
3. Remove the two screws which hold the bellows block to the case, and reverse the position of the assembly in respect to the baffle.
4. Match the block to the holes drilled in the positioner base plate and replace the screws.
5. Line up the zero spring with the baffle; replace and tighten the screws on the zero adjustment plate.
6. Replace and tighten the nut at the end of the zero spring.
7. Turn on the air supply and proceed to Calibration, Pg. 9.

REMOVING THE POSITIONER

The 100N positioner is equipped with a by-pass manifold to allow removal of the positioner for servicing while the actuator operates directly from the controller.

1. Loosen the lock screws and slide the switch plate from AUTO to BYPASS. Tighten the screws.
2. Turn the input shut-off screw clockwise to its stop.
3. Disconnect the motion lever arm from the valve stem.

PERIODIC SERVICING

If clean, dry air is a normal operating condition, the positioner should be serviced every six months. When the air supply is dirty or oily, more frequent servicing is required.

Turn off the air supply and give attention to the following parts:

1. Orifice

   a. Unscrew the orifice plug located on the base of the relay valve.

   b. Clean the orifice with a wire less than 0.0135" in diameter.

   Note: If the air relay valve is equipped with a push-to-clean orifice, push the plunger.

2. Nozzle

   a. Hold the baffle away from the nozzle and wipe the baffle with a soft, lint-free cloth.

   b. Clean the exterior of the nozzle thoroughly to remove any accumulated dirt and oil.

3. Screens

   a. Use a tweezers to remove the metal screens in the supply and output ports.

   b. Wash the screens in a grease solvent and replace in ports. Turn on the air supply.

TROUBLE SHOOTING

Problem	Possible Cause
1. Output pressure is low	1a. Supply is low
	1b. Leak in output line
	1c. Orifice is plugged
	1d. Motion linkage has slipped from calibrated position
2. Output pressure is high	2a. Supply is high
	2b. Nozzle is plugged
	2c. Motion linkage has slipped from calibrated position

Problem	Possible Cause
3. Positioner is unstable	3a. Restrictor adjustment on the booster relay is incorrectly set. Pg. 8
	3b. Motion linkage is blocked or hindered