

# POWERS

A WATTS INDUSTRIES CO.

## TECHNICAL INSTRUCTIONS SINGLE ACTING POSITIONING RELAY 147-3000

### FEATURES

- Compact design can be installed in any position
- Low maintenance epoxy coated aluminum manifold housing and stainless steel external parts resist corrosion
- Good dynamic response, adjustable combination of proportional band and air exhaust capacity
- Not sensitive to mechanical vibrations
- Rugged design, very easy to repair
- Only one moving valve part, therefore, less sensitive to clogging
- Usable as positioner or as motion transmitter
- Standard yoke mounting per IEC 534-6

### APPLICATIONS

The 147-3000 Pneumatic Positioner Relay improves control system performance by providing the following functions:

- .....Elimination of valve movement caused by line pressure variations
- .....Minimize effects of stick-slip (hysteresis)
- .....Faster valve movement
- .....Increased close-off rating when I/P's are used
- .....Split ranging

### OPERATION

The 147-3000 single acting positioner assures an exact relationship between actuator valve stem position and controller input signal. Operating on the time-proven force balance principle, valve stem motion is transferred through a feedback spring which opposes the force produced by the input signal diaphragm. Supply air is fed through a pneumatic three-way valve which has output pressure to the diaphragm actuator that is varied as a result of movement of the feedback arm. Any change in instrument signal pressure or external actuator force will either increase or exhaust positioner output pressure causing movement of the actuator stem until an equilibrium is reached. Stepless combination of gain adjustment and stroking speed control provides unusual capability of matching valve performance with process loop system dynamics..



### SPECIFICATIONS

#### OPERATING

<b>Ambient Temperature Range</b>	-10°F to 150°F (-23°C to 65°C)	
<b>Travel</b>	See Back Page	
<b>Signal Input</b>	3-15, 3-9, 9-15 psi	
<b>Maximum Open Loop Gain</b>	150:1	
<b>Minimum Open Loop Gain*</b>	50:1	
<b>Steady State Air Consumption</b>	9 psi signal / 20 psi supply	0.10 SCFM
<b>Linearity</b>	<±1.3% of span	
<b>Hysteresis</b>	<0.4% of span	
<b>Dead Band</b>	<0.2% of span	
<b>Threshold Sensitivity</b>	<0.07% of span	
<b>Supply Pressure Effect</b>	0.12% of span per psi	
<b>Ambient Temperature Effect</b>	0.1% per 2°F	
<b>Travel Time</b>	46 in2 Actuator @ 20 psi Supply	Air In* 1.8 sec. for 1/2" Air Out* 2.1 sec. for 1/2"
	75 in2 Actuator @ 20 psi Supply	Air In* 3.8 sec. for 3/4" Air Out* 2.3 sec. for 3/4"

#### PHYSICAL

<b>Air Connections</b>	1/4" NPT Instrument and Supply	
	1/8" NPT Output and Gauge	
<b>Body Materials</b>	Manifold Housing Material	Anodized Epoxy Coated Aluminum
	Upper Housing Material	High Strength Polyamide
	External Feedback Parts	Stainless Steel
<b>Shipping Weight</b>	1.2 lbs. (.544kg)	
<b>Dimensions</b>	2-1/4" x 3-1/16" x 4-1/4" (5.7 cm x 7.8 cm x 10.8 cm)	
<b>Supply Air Pressure</b>	Maximum of 50 PSI PSI with 46 Actuator	Maximum of 30 PSI With 75 Actuator

\*@ Maximum speed setting (gain screw flush).

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- .....Faster valve movement
- .....Increased close-off rating when I/P's are used
- .....Split ranging

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### SPECIFICATIONS

#### OPERATING

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<b>Travel</b>	See Back Page	
<b>Signal Input</b>	3-15, 3-9, 9-15 psi	
<b>Maximum Open Loop Gain</b>	150:1	
<b>Minimum Open Loop Gain*</b>	50:1	
<b>Steady State Air Consumption</b>	9 psi signal / 20 psi supply	0.10 SCFM
<b>Linearity</b>	<±1.3% of span	
<b>Hysteresis</b>	<0.4% of span	
<b>Dead Band</b>	<0.2% of span	
<b>Threshold Sensitivity</b>	<0.07% of span	
<b>Supply Pressure Effect</b>	0.12% of span per psi	
<b>Ambient Temperature Effect</b>	0.1% per 2°F	
<b>Travel Time</b>	46 in2 Actuator @ 20 psi Supply	Air In* 1.8 sec. for 1/2" Air Out* 2.1 sec. for 1/2"
	75 in2 Actuator @ 20 psi Supply	Air In* 3.8 sec. for 3/4" Air Out* 2.3 sec. for 3/4"

#### PHYSICAL

<b>Air Connections</b>	1/4" NPT Instrument and Supply	
	1/8" NPT Output and Gauge	
<b>Body Materials</b>	Manifold Housing Material	Anodized Epoxy Coated Aluminum
	Upper Housing Material	High Strength Polyamide
	External Feedback Parts	Stainless Steel
<b>Shipping Weight</b>	1.2 lbs. (.544kg)	
<b>Dimensions</b>	2-1/4" x 3-1/16" x 4-1/4" (5.7 cm x 7.8 cm x 10.8 cm)	
<b>Supply Air Pressure</b>	Maximum of 50 PSI PSI with 46 Actuator	Maximum of 30 PSI With 75 Actuator

\*@ Maximum speed setting (gain screw flush).

## INSTALLATION

Before starting, make sure the positioner stroke range is appropriate for your valve. See Table 3 on back page.

### Mounting

1. Attach positioner take-off plate (16) to valve stem and tighten stem lock nuts. Angle part of take-off plate should be pointing up for N.C. valves with 46 actuator and pointing down for N.O. valves with 46 actuator. For 75 in2 actuator the take off plate always faces down.
2. Orientate positioner for N.O. or N.C. action per Figure 1, 2, or 3. Loosely bolt positioner black slot to actuator mounting rib. Do Not Tighten.  
NOTE: Be sure take-off pin assembly (2, 3, 4) is resting on angle of take-off plate.
3. Use separate air source to stroke valve to mid-position.
4. Slide positioner up or down rib until feedback lever is level when valve is at midstroke.
5. Tighten mounting bolt.
6. Remove air from actuator.

### Air Piping

NOTE: Use only dry and filtered instrument air.

7. Pipe 1/8" NPT positioner output to actuator.
- 7a. Plug or install gauge in second 1/8 NPT port.
8. Connect control signal to 1/4" NPT "signal" port.
9. Connect instrument quality air supply to 1/4" NPT "supply" port. Do not exceed 50 PSI Supply with 46 actuator, 30 PSI with 75 actuator.

### Span Adjustment

10. Find the proper take-off pin setting in Table 3.
11. Move take-off pin assembly to proper setting.
  - a. Moving pin closer to housing narrows throttling span.
  - b. Moving pin away from housing increases throttling span.

### Zero Adjustment

11. Set signal input to positioner at 3 psi.
12. Adjust zero screw until output gauge reads zero.
13. Set signal input to positioner at 3.2 psi.
14. Readjust zero screw until valve begins to move. (A seat leak test is the most accurate way to determine valve starting point.)
15. Return signal to 3 psi. Valve should return to fully closed position. (Again, this is best determined by a seat leak test.)
16. Increase signal to 15 psi and adjust take off pin (22) to full open position as necessary.

## SPECIAL FUNCTIONS

### Split Range

Split range calibration is used to provide full valve stroke with a partial (3-9 or 9-15) control signal. Two valves are sequenced by using split ranging. Heating processes with large load changes benefit from split ranging two small valves instead of using one large valve.

Heat-cool processes can be controlled with one signal by split ranging the heating and cooling valves.

Select the appropriate split range positioner from Table 3.

Factory mounted and calibrated split range positioners can be specified by code "L" (3-9) or code "U" (9-15) in the Flowrite Order Code "Spring Range" field.

Note: The two unmarked 1/8" NPT ports are output to the actuator. Plug or install a gauge in the unused 1/8" NPT port. The 1/4" NPT port marked "signal" is the input signal to the positioner from an I/P or controller. The 1/4" NPT port marked "supply" is connected to instrument quality air supply (50 PSI max for 46 actuator, 30 PSI max for 75 actuator).

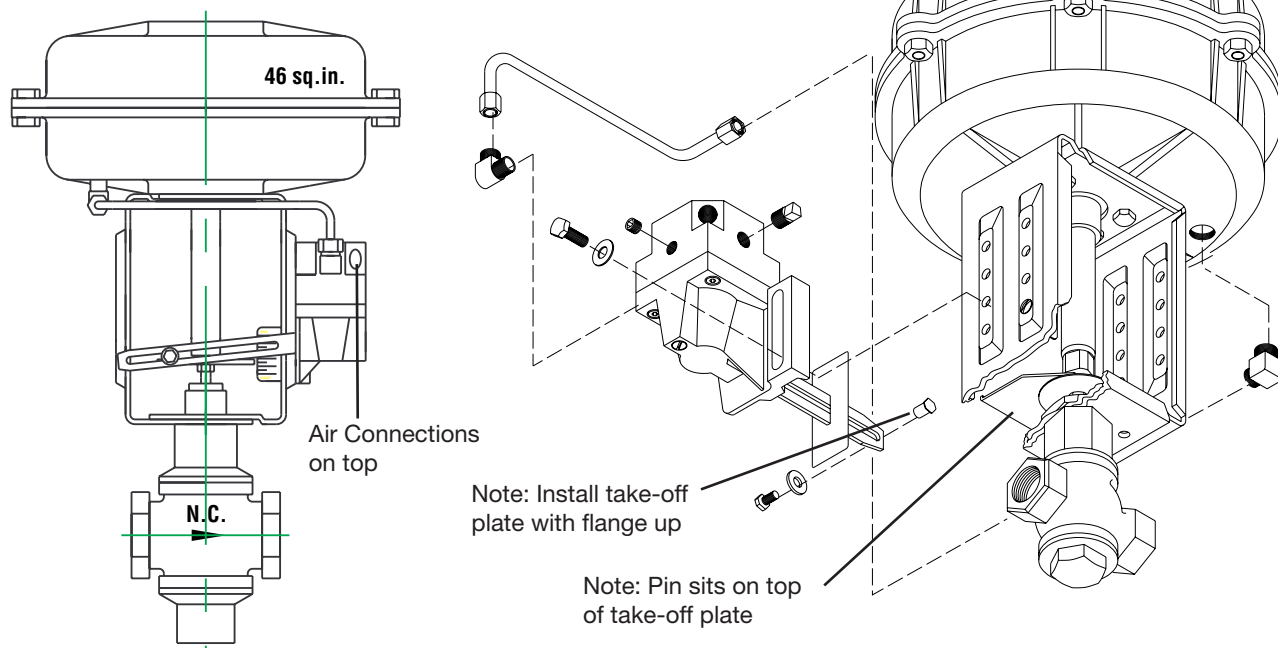
### CALIFORNIA PROPOSITION 65 WARNING

**WARNING:** This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. (Installer: California law requires that this warning be given to the consumer.)

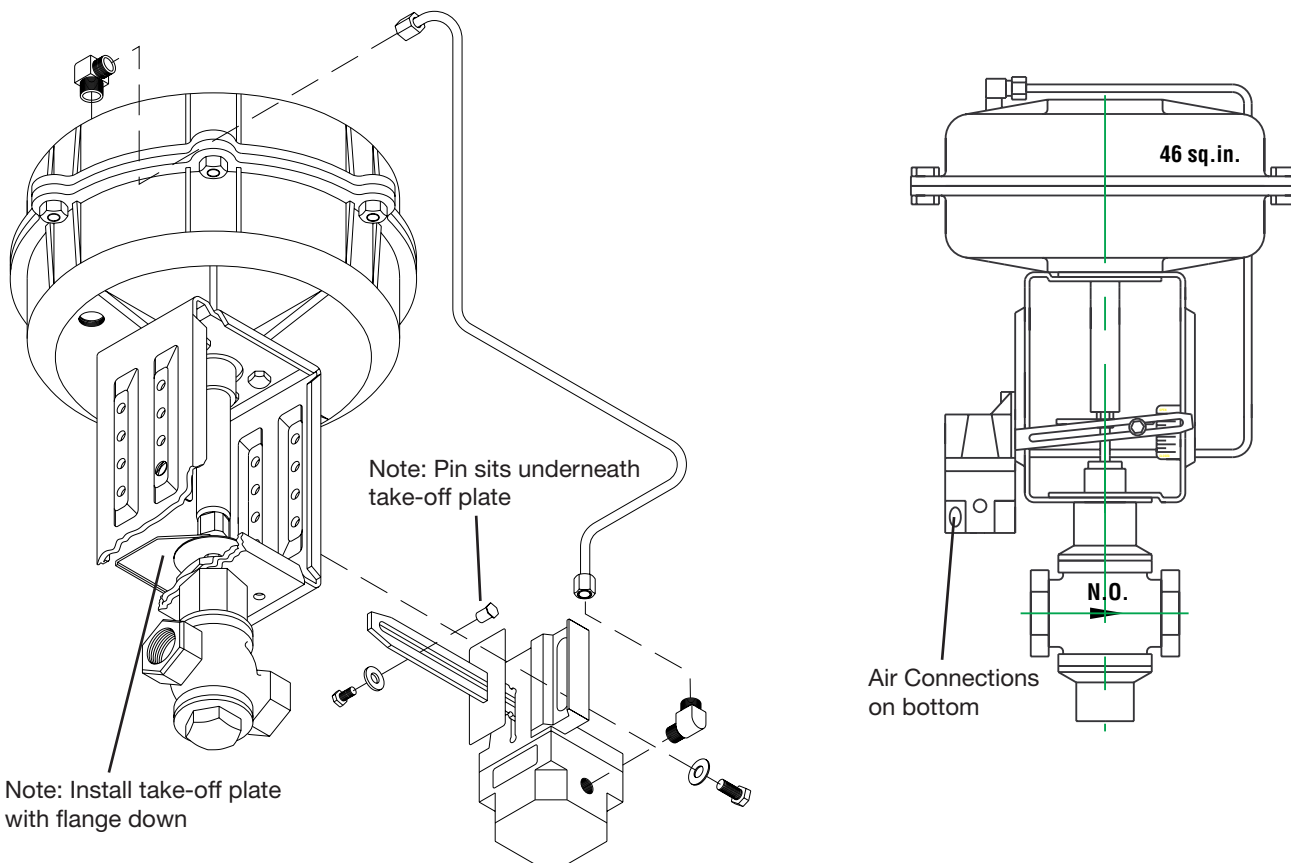
**For more information:** [www.wattsind.com/prop65](http://www.wattsind.com/prop65)

**PARTS AND ACCESSORIES LIST**

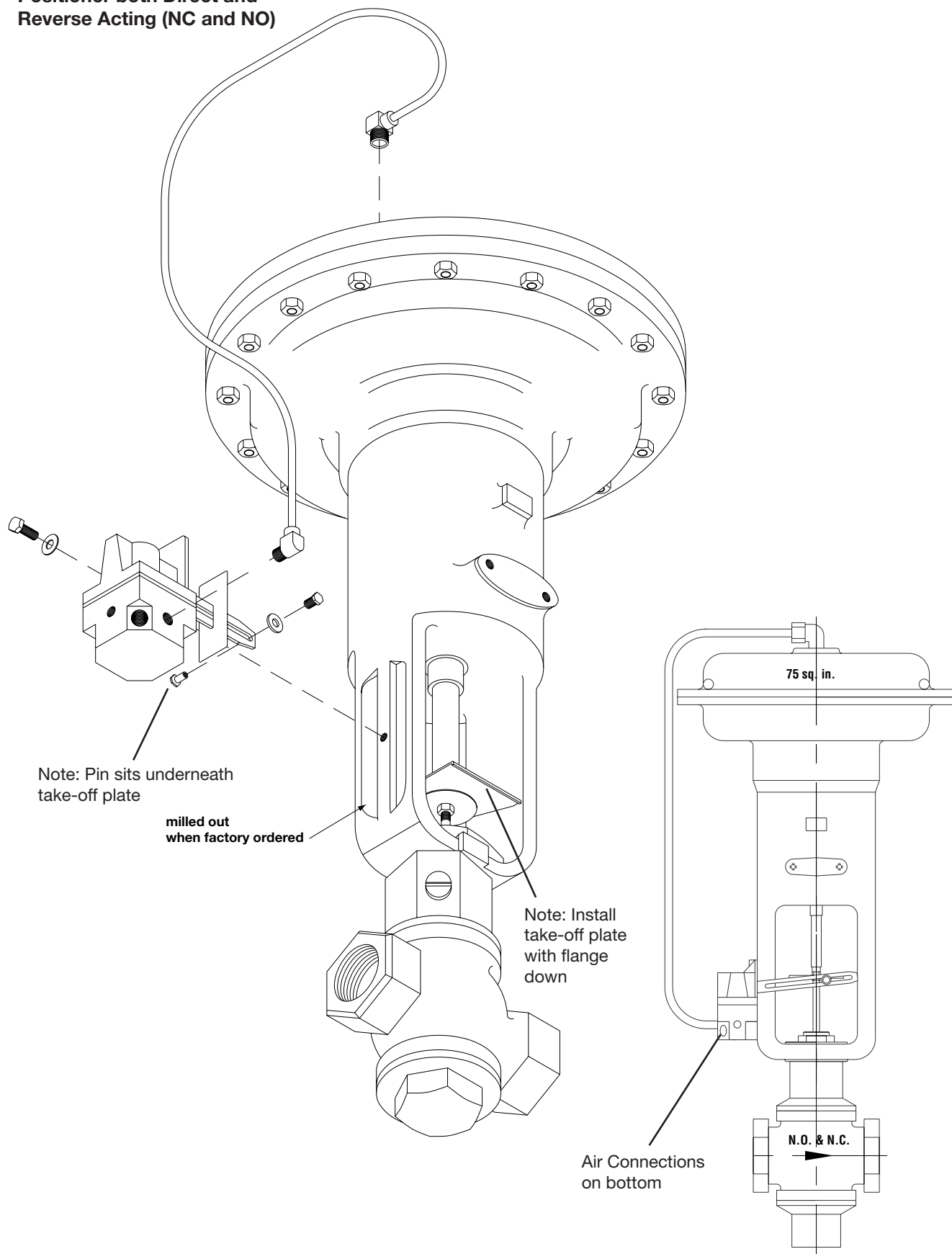
**Figure 1 - 46 Actuator N.C. Mounting**



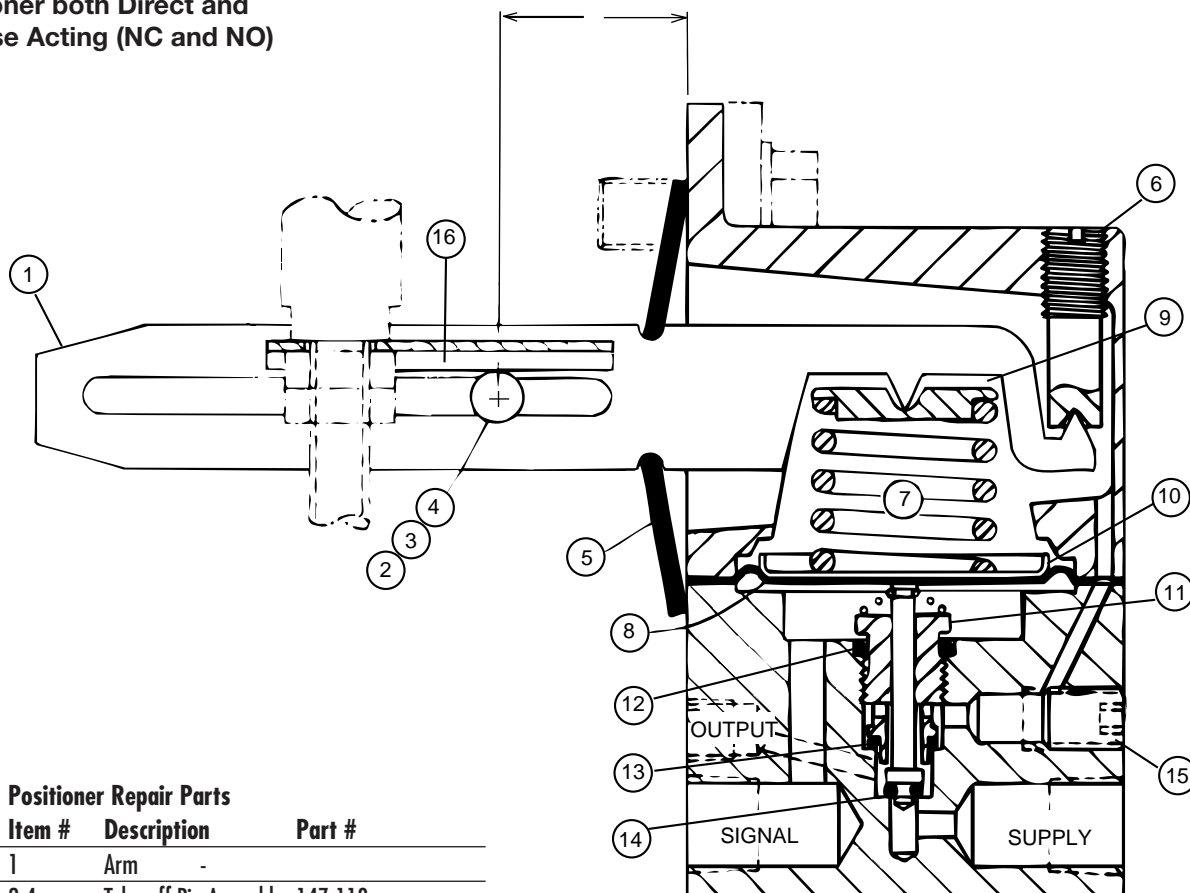
**Figure 2 - 46 Actuator N.O. Mounting**



**Figure 3 - 75 sq. in. Valve with Positioner both Direct and Reverse Acting (NC and NO)**



**Figure 4 - 75 sq. in. Valve with Positioner both Direct and Reverse Acting (NC and NO)**



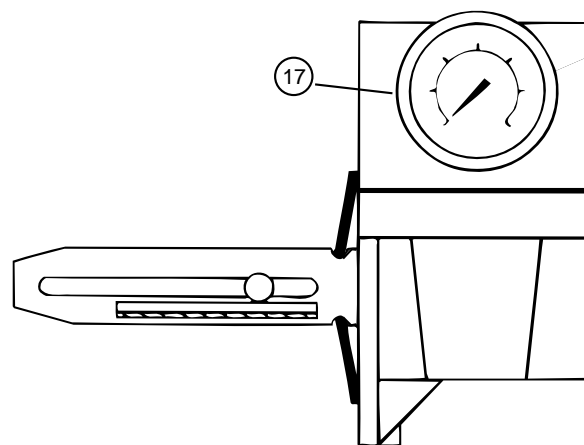
**Table 1. Positioner Repair Parts**

Item #	Description	Part #
1	Arm	-
2-4	Take-off Pin Assembly	147-119
5	Rain Seal	147-117
6	Zero Adjustment	-
7	Feedback Spring	See Table 3
8	Diaphragm	147-118
9	Spring Seat	-
10	Thrust Plate	-
11	Valve Plug Assy (DA)	147-123
12	Large O-Ring	inc. with Item 11
13	Medium O-Ring	inc. with Item 11
14	Small O-Ring	inc. with Item 11
15	Gain Adjustment	-

**Table 2. 46 Actuator Mounting Kits**

All mounting kits include take off plate, Dekoron 1300 composite wall air tubing, tube fittings and mounting bolt. Positioner mounting on 75 actuator is factory mounted only. No retrofit mounting kits are available for the 75 actuator.

	Kit for N.O. 1/4" stems	147-301E
	Kit for N.C. 1/4" stems	147-302E
	Kit for N.O. 3/8" stems	147-301F
	Kit for N.C. 3/8" stems	147-302F
16	Take off plate only, 1/4"	147-122
16	Take off plate only, 3/8"	147-122A
17	Output Pressure Gauge	142-0373



**Figure 5 - Positioner with Mounted Output Gauge**

**TABLE 3****Positioner Selection (Figure 4)**

<b>Operation</b>	<b>Stroke Range</b>	<b>Actual Stroke (in)</b>	<b>Take Off Pin Setting (in)</b>	<b>Complete Positioner</b>	<b>Sprin Kit Only</b>	<b>Color Wire (Dim in)</b>
<b>Full</b>	1/8" to 3/16"	1/8	1	<b>1473000D</b>	<b>147 130</b>	Black/White (0.125 x 0.165)
		3/16	3-1/4			
	1/4" to 3/8"	1/4	1-1/4	<b>1473000C</b>	<b>147 129</b>	Plated Silver w/Black (.125)
		3/8	3-1/2			
1/2" to 3/4"	1/2	1-1/2	<b>1473000</b>	<b>147 115</b>	Plated Silver (.125)	
	3/4	3-1/4				
1" to 1-1/2"	1	2	<b>1473000A</b>	<b>147 116</b>	Plated Silver w/Red (.105)	
	1-1/2	3				
<b>Split Range</b>	1/8" to 3/16"	1/8	2-1/2	<b>1473000C</b>	<b>147 129</b>	Plated Silver w/Black (.125)
		3/16	3-1/2			
3-9 PSI or 9-15 PSI	1/4" to 3/8"	1/4	1-1/2	<b>1473000</b>	<b>147 115</b>	Plated Silver (.125)
		3/8	3-1/4			
	1/2" to 1"	1/2	2-1/4	<b>1473000A</b>	<b>147 116</b>	Plated Silver w/Red (.105)
	3/4	2-3/4				
		1	3-7/8			

**TABLE 4****Powers Flowrite® Valve Strokes**

<b>SIZE</b>	<b>TYPE</b>								
	<b>DB</b>	<b>DI</b>	<b>MI</b>	<b>SB</b>	<b>SD</b>	<b>SI</b>	<b>SS</b>	<b>WM</b>	<b>VE</b>
1/2 (A, B, C, D)									1/4
1/2 (full port)				3/4			3/8	1/8	
3/4				3/4	3/4		3/4	3/16	
1	3/16			3/4	3/4		3/4	1/4	
1-1/4	1/4				1		1	5/16	
1-1/2	1/4			3/4	1		1	5/16	
2	3/8			3/4	1	3/4	1	5/16	
2-1/2		3/4	1			3/4			
3		3/4	1			1			
4		3/4	1			1-1/2			
5		1-1/4	1-3/8			1-1/2			
6		1-1/4	1-3/8						
8		1-1/2							





**WARRANTY INFORMATION**

Powers Process Controls warrants that the equipment manufactured by it is free from defects in material and workmanship and, without charge, equipment found to be defective in material and workmanship will be repaired, or at Seller's option, replaced F.O.B. original point of shipment, if written notice of failure is received by Seller within one (1) year after date of shipment, provided said equipment has been properly installed, operated in accordance with Seller's instructions, and provided such defects are not due to abuse or chemical decomposition by chemical or galvanic action. This express warranty is in lieu of and excludes all other warranties, guarantees, or representations, express or implied. There are no implied warranties for merchantability or of fitness for a particular purpose. The Seller assumes no responsibility for repairs made on Seller's equipment unless done by Seller's authorized personnel, or by written authority from the Seller. The Seller makes no guarantee with respect to material not manufactured by it.

**POWERS****A WATTS INDUSTRIES CO.**

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## INSTALLATION

Before starting, make sure the positioner stroke range is appropriate for your valve. See Table 3 on back page.

### Mounting

1. Attach positioner take-off plate (16) to valve stem and tighten stem lock nuts. Angle part of take-off plate should be pointing up for N.C. valves with 46 actuator and pointing down for N.O. valves with 46 actuator. For 75 in2 actuator the take off plate always faces down.
2. Orientate positioner for N.O. or N.C. action per Figure 1, 2, or 3. Loosely bolt positioner black slot to actuator mounting rib. Do Not Tighten.  
NOTE: Be sure take-off pin assembly (2, 3, 4) is resting on angle of take-off plate.
3. Use separate air source to stroke valve to mid-position.
4. Slide positioner up or down rib until feedback lever is level when valve is at midstroke.
5. Tighten mounting bolt.
6. Remove air from actuator.

### Air Piping

NOTE: Use only dry and filtered instrument air.

7. Pipe 1/8" NPT positioner output to actuator.
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## SPECIAL FUNCTIONS

### Split Range

Split range calibration is used to provide full valve stroke with a partial (3-9 or 9-15) control signal. Two valves are sequenced by using split ranging. Heating processes with large load changes benefit from split ranging two small valves instead of using one large valve.

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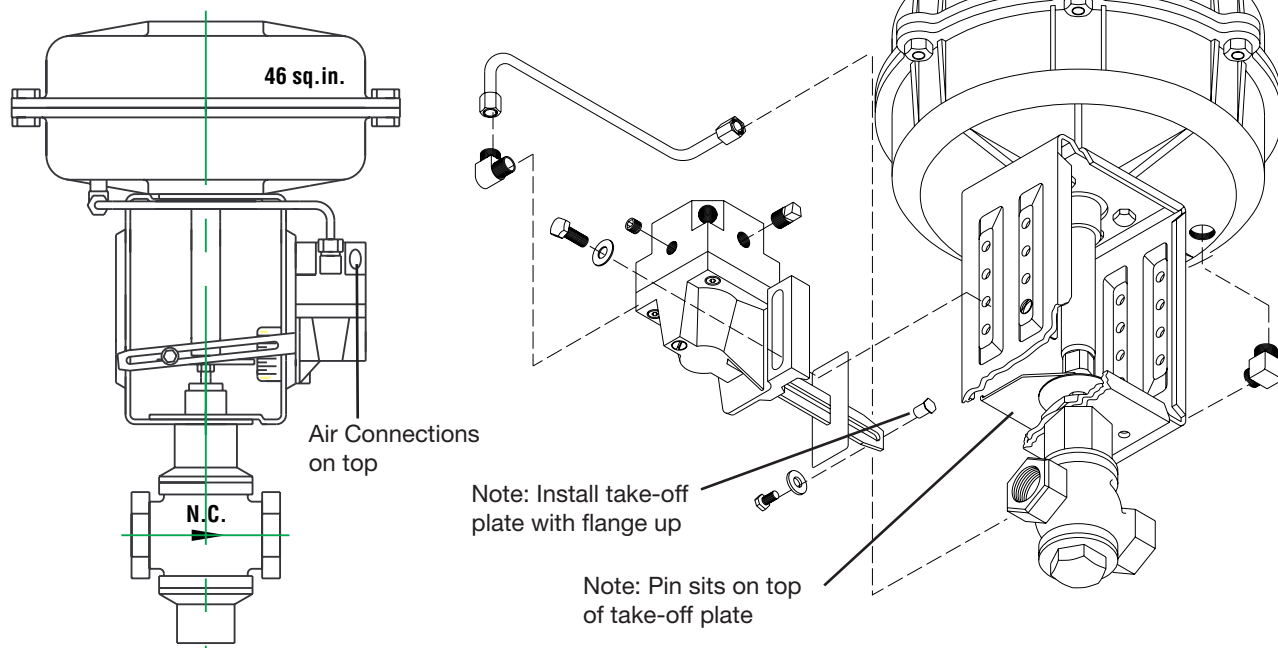
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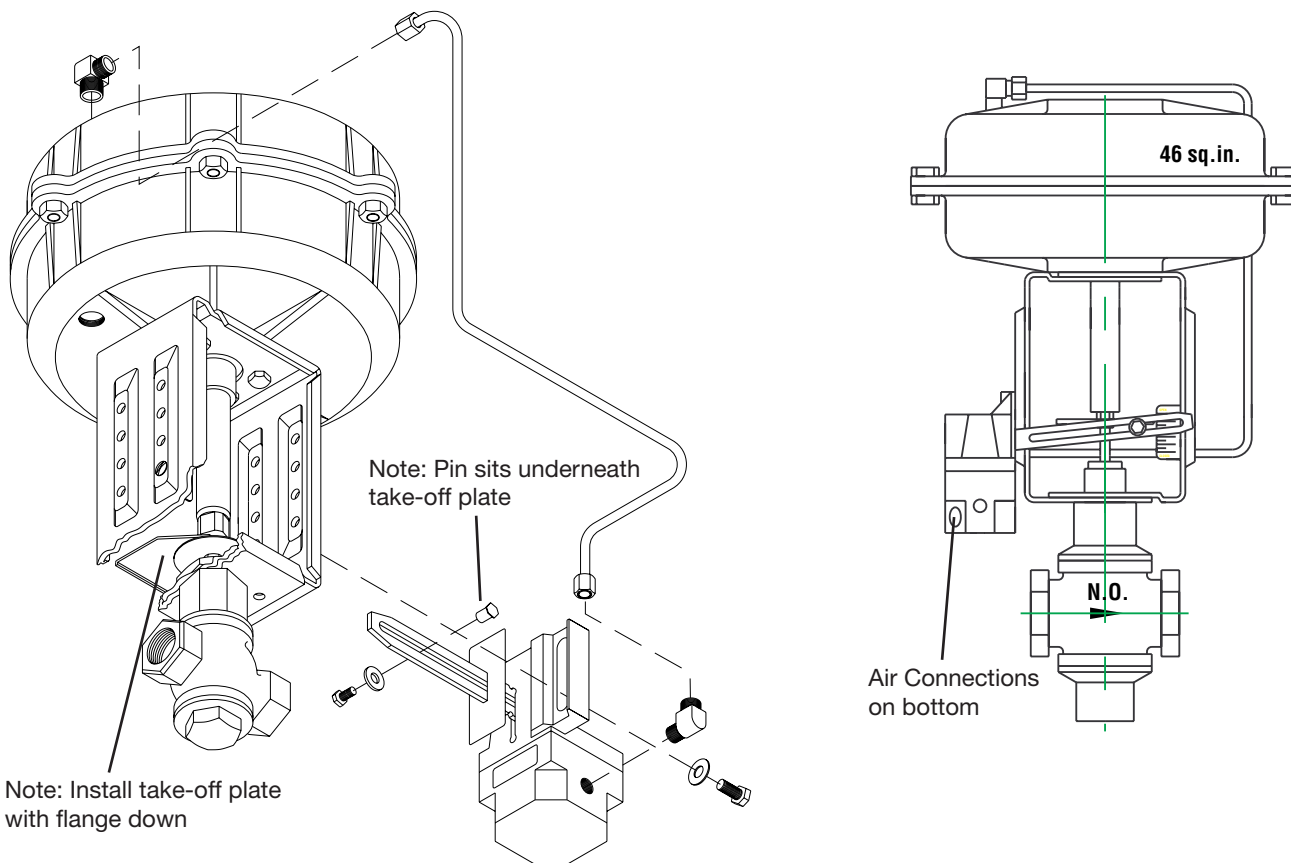
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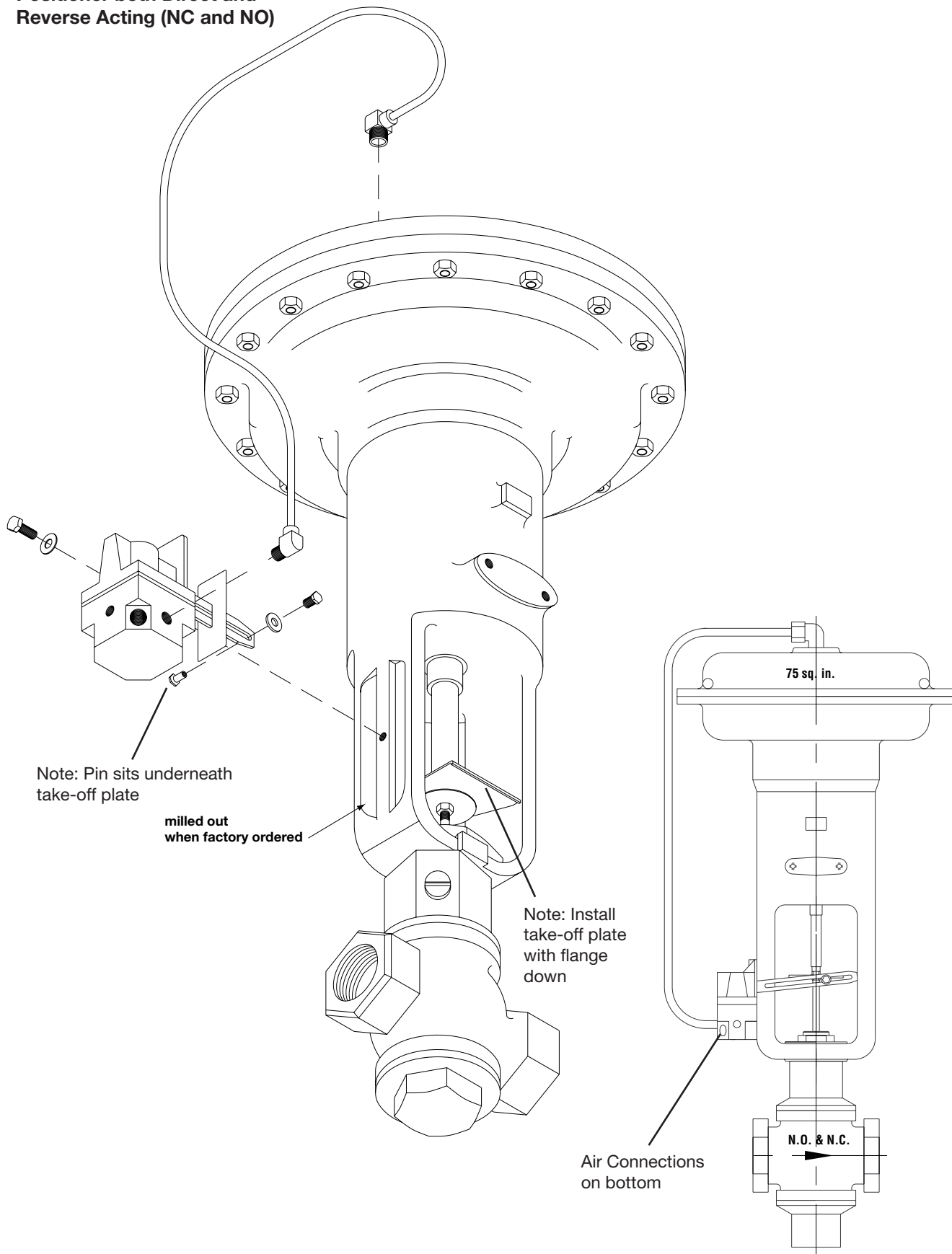
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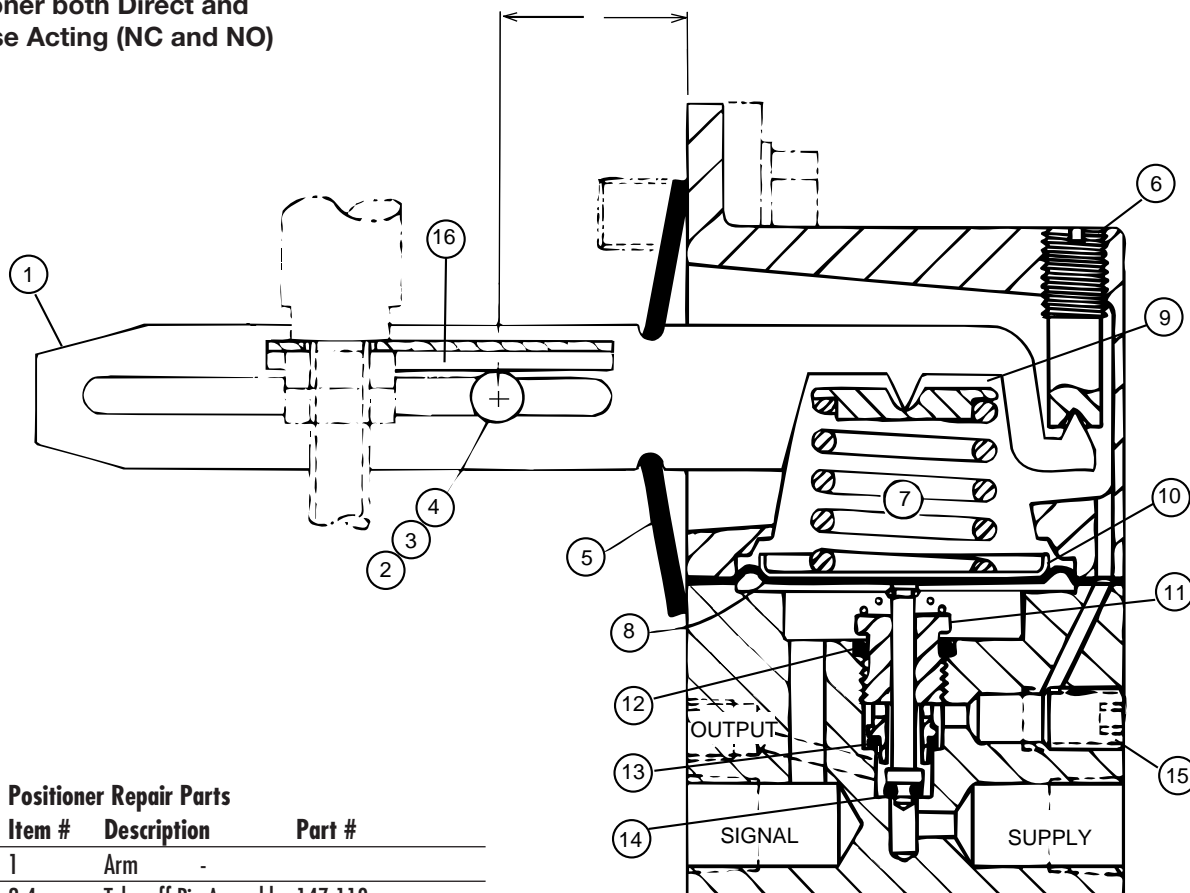
**Figure 2 - 46 Actuator N.O. Mounting**



**Figure 3 - 75 sq. in. Valve with Positioner both Direct and Reverse Acting (NC and NO)**



**Figure 4 - 75 sq. in. Valve with Positioner both Direct and Reverse Acting (NC and NO)**



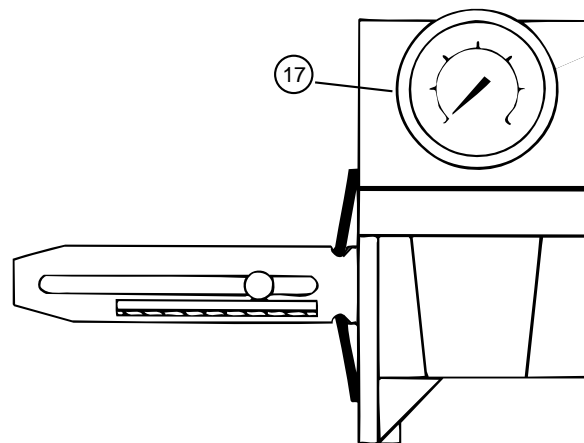
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7	Feedback Spring	See Table 3
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9	Spring Seat	-
10	Thrust Plate	-
11	Valve Plug Assy (DA)	147-123
12	Large O-Ring	inc. with Item 11
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15	Gain Adjustment	-

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17	Output Pressure Gauge	142-0373



**Figure 5 - Positioner with Mounted Output Gauge**

**TABLE 3****Positioner Selection (Figure 4)**

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<b>Full</b>	1/8" to 3/16"	1/8	1	<b>1473000D</b>	<b>147 130</b>	Black/White (0.125 x 0.165)
		3/16	3-1/4			
	1/4" to 3/8"	1/4	1-1/4	<b>1473000C</b>	<b>147 129</b>	Plated Silver w/Black (.125)
		3/8	3-1/2			
1/2" to 3/4"	1/2	1-1/2	<b>1473000</b>	<b>147 115</b>	Plated Silver (.125)	
	3/4	3-1/4				
1" to 1-1/2"	1	2	<b>1473000A</b>	<b>147 116</b>	Plated Silver w/Red (.105)	
		3				
	1-1/2					
<b>Split Range</b>	1/8" to 3/16"	1/8	2-1/2	<b>1473000C</b>	<b>147 129</b>	Plated Silver w/Black (.125)
		3/16	3-1/2			
3-9 PSI or 9-15 PSI	1/4" to 3/8"	1/4	1-1/2	<b>1473000</b>	<b>147 115</b>	Plated Silver (.125)
		3/8	3-1/4			
	1/2" to 1"	1/2	2-1/4	<b>1473000A</b>	<b>147 116</b>	Plated Silver w/Red (.105)
		3/4	2-3/4			
1	3-7/8					

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<b>SIZE</b>	<b>TYPE</b>								
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1/2 (A, B, C, D)									1/4
1/2 (full port)				3/4			3/8	1/8	
3/4				3/4	3/4		3/4	3/16	
1	3/16			3/4	3/4		3/4	1/4	
1-1/4	1/4				1		1	5/16	
1-1/2	1/4			3/4	1		1	5/16	
2	3/8			3/4	1	3/4	1	5/16	
2-1/2		3/4	1			3/4			
3		3/4	1			1			
4		3/4	1			1-1/2			
5		1-1/4	1-3/8			1-1/2			
6		1-1/4	1-3/8						
8		1-1/2							



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**POWERS**  
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