

## Powers™ Controls

### RL 243 A Analog Relay



#### Description

The RL 243A Analog Relay is a pneumatic auxiliary device designed to assist the engineer in obtaining specialized control action within a pneumatic control system. Applications include amplifying, summing, differential pressure, ratio control, higher pressure, and signal characterization control. (See Figures 2 through 15.)

The relay operates on a force balance principle and is provided with a Powers' two-valve design to assure stability and prevent unnecessary air consumption. Internal relief assembly prevents signal lock-up and assures fail-safe operation.

This relay does not require any adjustment or calibration and can be mounted in any position.

#### Product Number

243-0011

#### Operation

The relay output pressure at Port R is dependent on the interaction of pneumatic signals at Ports T, TR and TD, and on the availability of a supply source at Port S. See Figure 1.

The basic relay formula can be expressed as follows:

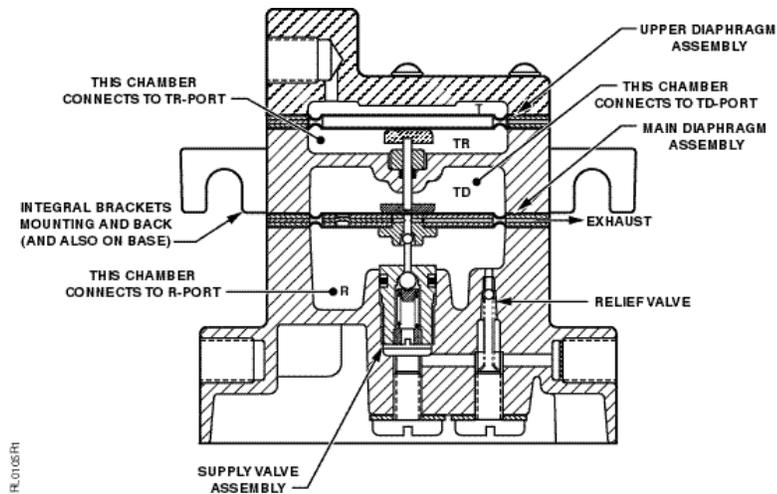
$$R = [TD + (T - TR)] \leq S$$

**NOTE:** (T - TR) cannot be less than zero.

Ports T and TD are direct acting, and increasing the input signal pressure will increase the output pressure. Port TR is reverse acting, and increasing the input pressure will reduce any direct acting force available at T port. The supply and exhaust valve assemblies will automatically increase or decrease the output pressure at R port to bring the main relay diaphragm into balance. This can only be accomplished when the output pressure equals the total net force available from T, TR and TD ports.

## Warning/Caution Notations

<b>WARNING:</b>		Personal injury/loss of life may occur if you do not perform a procedure as specified.
<b>CAUTION:</b>		Equipment damage, or loss of data may occur if you do not perform a procedure as specified.



**Figure 1. Operation.**

<b>Specifications</b>	Instrument Air Supply	
	Normal	0-25 psi (0-172 kPa)
	Maximum	30 psi (207 kPa)
	Ambient Temperature Range	
	Operating	40 to 120°F (4.4 to 49°C)
	Storage	-20 to 120°F (-28.9 to 49°C)
	Adjustments	None Required
	Hysteresis	Within 0.25 psi (1.7 kPa)
	Relief Valve Differential	Within 1.0 psi (6.89 kPa)
	Air Connections	1/8-inch NPT
Mounting	Integral brackets for wall or panel	
Dimensions	See Figure 17	

## Application

The analog relay can provide a number of pneumatic control functions to meet the requirements of an automatic control system. Applications are almost unlimited, depending upon how it is piped and applied with other devices in a single system. Typical applications where this relay can be utilized include:

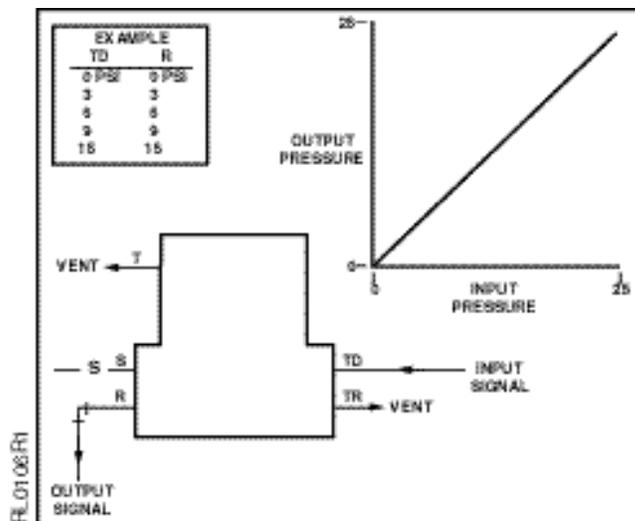
- Direct acting amplifying relay (1/1 ratio). See Figure 2.
- Higher pressure amplifying relay. Also minimum pressure relay with remote adjustment of minimum. See Figure 3.
- Lower pressure transfer relay. See Figure 4.

**Application,  
 Continued**

- Summing relay (sum of two inputs) or advancing relay with remote adjustment of advance. See Figure 5.
- Direct acting differential pressure relay. See Figure 6.
- Reverse acting amplifying relay. See Figure 7.
- Direct acting amplifying relay (1/2 ratio). See Figure 8.
- Direct acting amplifying relay (2/1 ratio). See Figure 9.
- Minimum pressure relay (2/1 ratio), with remote adjustment of minimum pressure. See Figure 10.
- Minimum pressure relay with characterized pressure output and with remote adjustment of minimum pressure. See Figure 11.
- Signal retard relay with remote adjustment of retard. See Figure 12.
- Signal inverting relay. See Figure 13.
- Averaging of high and low signals. See Figure 14.
- Direct acting amplifying relay (1/1 ratio) with optional override for positive positioning of actuated device. See Figure 15.

**Direct Acting (D.A.) Amplifying Relay, 1/1 Ratio.**

Normally used to duplicate pressure signal with a greater air capacity or to utilize another control air source. Relay is fail-safe and air output cannot exceed available source at S port.



**Figure 2.**

**Application,  
 Continued**

**Higher Pressure Amplifying Relay or Minimum Pressure Relay With Remote Adjustment of Minimum.**

The output signal will always be the higher of the two inputs. Signals are interchangeable for adjusted minimum or controller and can be connected to either input as shown. Relay is fail-safe and air output cannot exceed available source at S port.

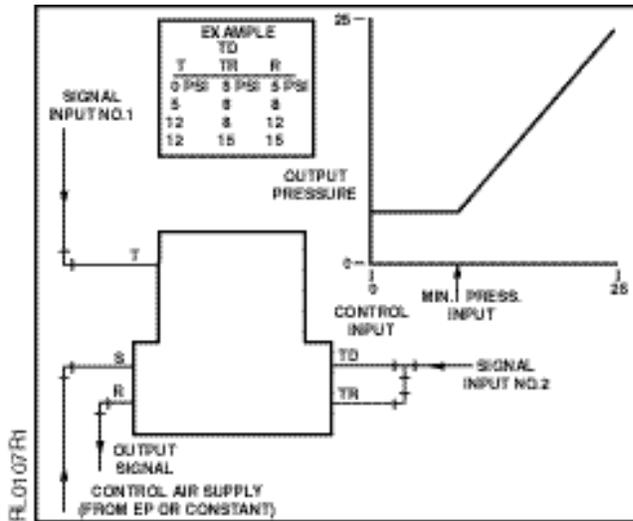


Figure 3.

**Lower Pressure Transfer Relay.**

Relay output pressure will always equal the lower of two input signals.

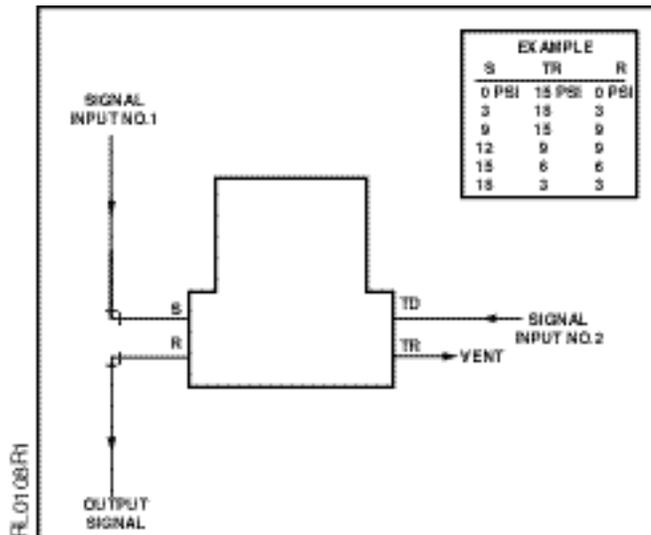


Figure 4.

**Application,  
 Continued**

**Summing Relay or Advancing With Remote Adjustment of Advance.**

Output pressure is equal to total of both inputs. Maximum output is limited by available control air supply at S port. Input signals are interchangeable and can be piped to either input port as shown.

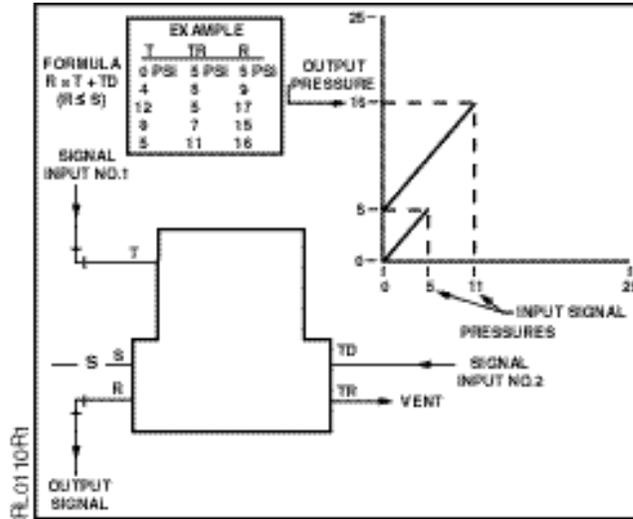


Figure 5.

**Direct Acting Differential Pressure Relay.**

Output pressure is equal to pressure at T port less pressure at TR port.

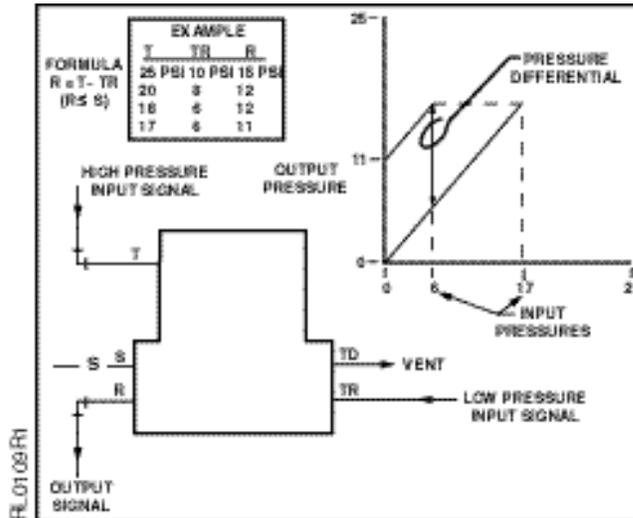


Figure 6.

**Application,  
 Continued**

**Reverse Acting Amplifying Relay.**

Output signal will decrease when input signal increases. This relay will always operate over the full span of available air supply. Primary application is for cylinder actuators. Not recommended for applications where an input pressure must produce a specific output pressure, regardless of variations in supply pressure.

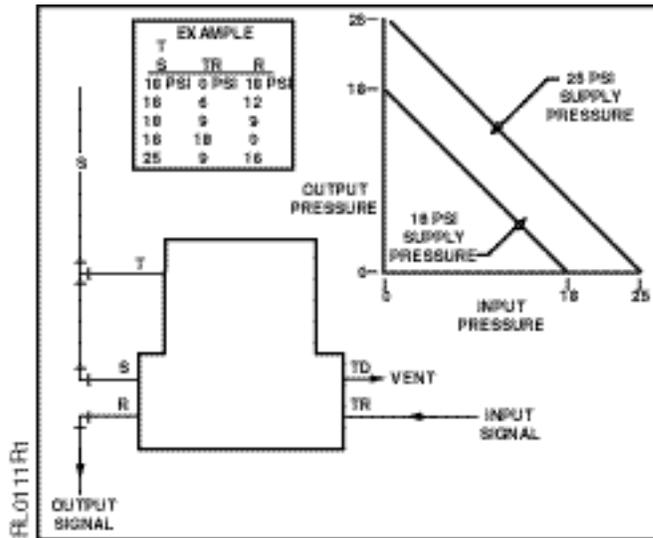


Figure 7.

**Direct Acting (D.A.) 1/2 Ratio Amplifying Relay.**

Output signal will equal input signal x 2.

**NOTE:** Relay is fail-safe and cannot generate an output signal without a source of air at S port.

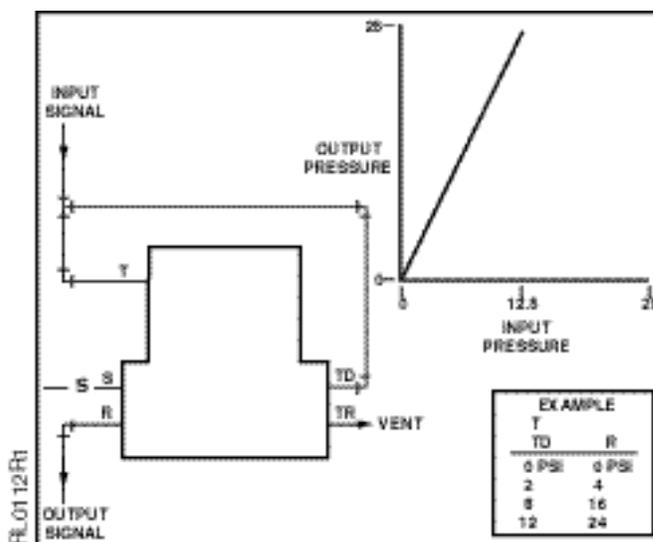


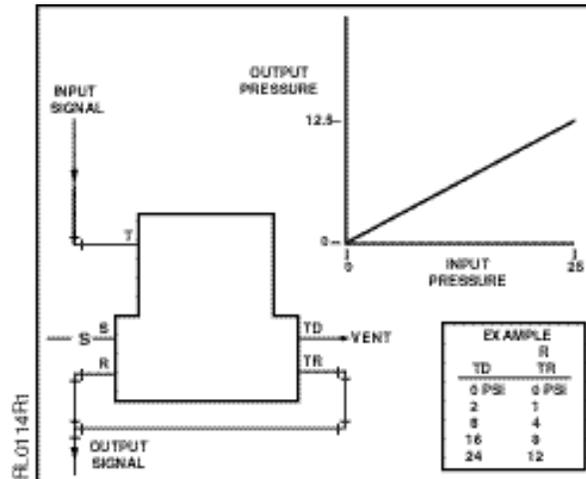
Figure 8.

**Application,  
 Continued**

**Direct Acting (D.A.) 2/1 Ratio Amplifying Relay.**

Output signal will equal 1/2 input signal.

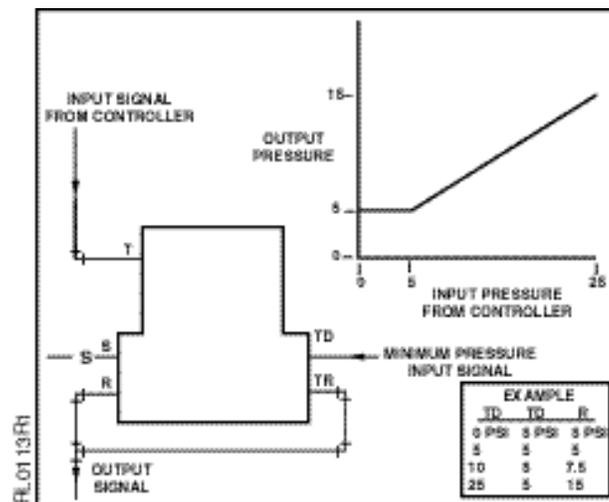
**NOTE:** Relay is fail-safe and cannot generate an output signal without a source of air at S port. A separate supply can be omitted by connecting the input signal to T port and S port.



**Figure 9.**

**Minimum Pressure Relay.**

Minimum pressure relay with 2/1 ratio on increase above minimum and with remote adjustment of minimum pressure.



**Figure 10.**

**Application,  
 Continued**

**Minimum Pressure Relay With Characterized Pressure Output and Remote Adjustment of Minimum.**

Initial pressure increase above minimum will follow a 2/1 fixed ratio until controller input equals twice the initial minimum value. A continued rise in controller input will provide a direct 1/1 ratio rise in output.

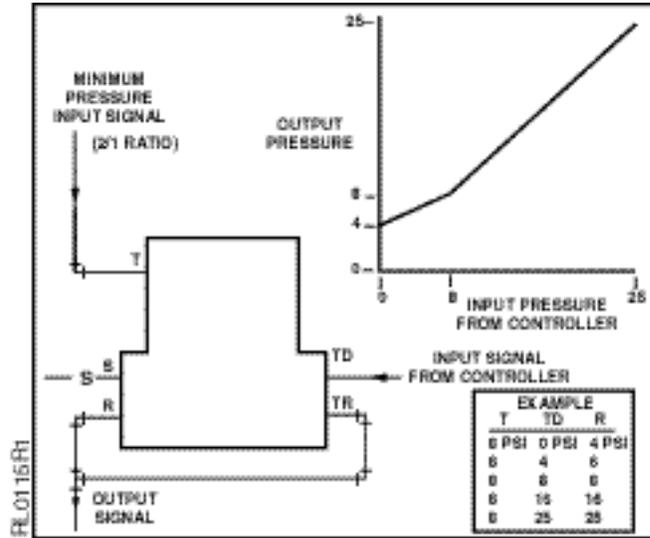


Figure 11.

**Signal Retard Relay With Remote Adjustment Of Retard.**

Relay output signal will equal input pressure less retard adjustment.

**NOTE:** Relay is fail-safe and cannot generate an output signal without a source of air at S port. A separate supply can be omitted by connecting the controller input to T and S ports.

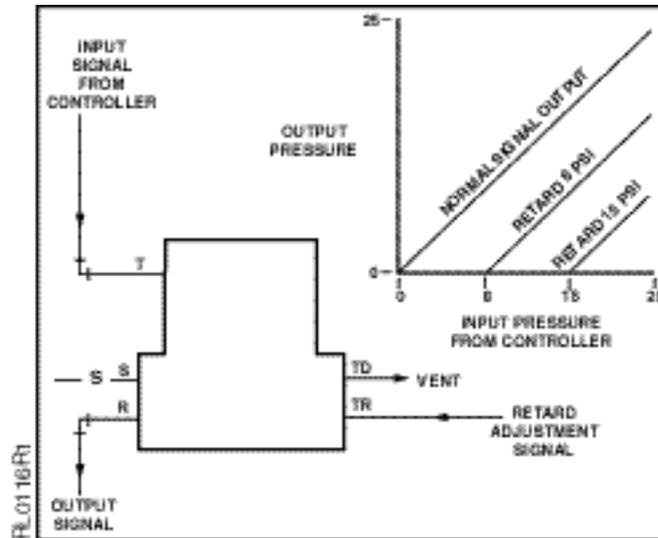


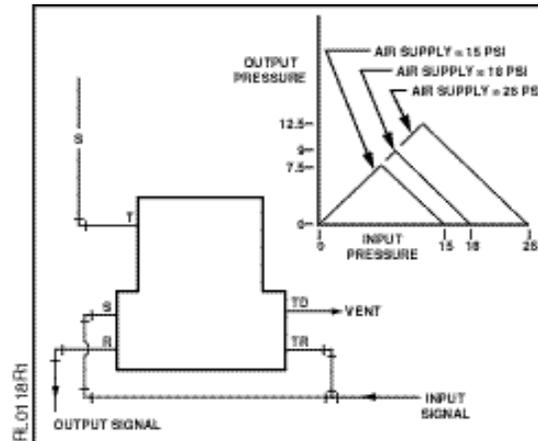
Figure 12.

**Application,  
 Continued**

**Signal Inverting Relay.**

D.A. output until input pressure reaches 1/2 of available supply at port T. Additional increase in input pressure will reduce output by equal amount.

**NOTE:** Output will peak at 1/2 of pressure at T port and is sensitive to variations in supply pressure.



**Figure 13.**

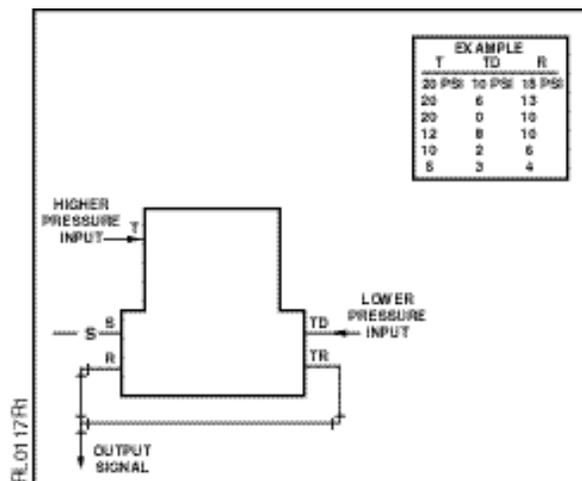
**Averaging of High and Low Inputs.**

Relay output will equal the mathematical average of a high and low input signal.



**CAUTION:**

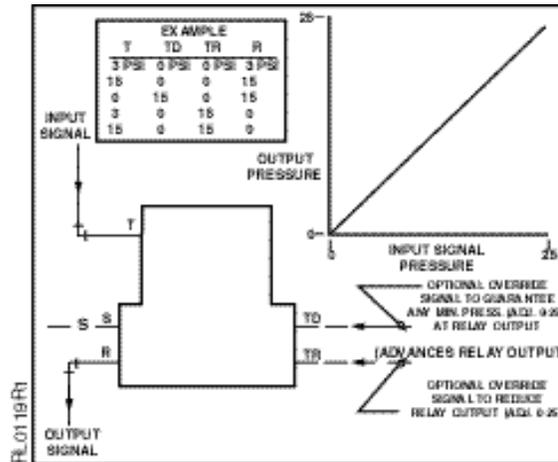
Pressure at T port must be higher of the two input signals to obtain averaging output. Use with two input signal selector relay for applications where either input can be the higher pressure.



**Figure 14.**

**Application,  
 Continued**

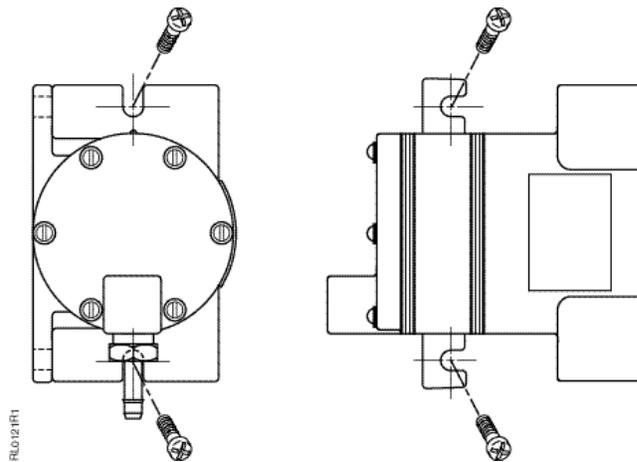
**Direct Acting (D.A.) Amplifying Relay with Optional Override for Positive Positioning of Actuated Device.**



**Figure 15.**

**Installation**

The analog relay can be installed within control panels, unit ventilators, other packaged units, or on any other surface such as walls, partitions and ducts.



**Figure 16.**

1. Slotted base accommodates screws or bolts for direct horizontal mounting within panel or on a flat wall surface.
2. Integral bracket allows vertical mounting within panel or on a flat wall surface.

### Construction Analog Relay

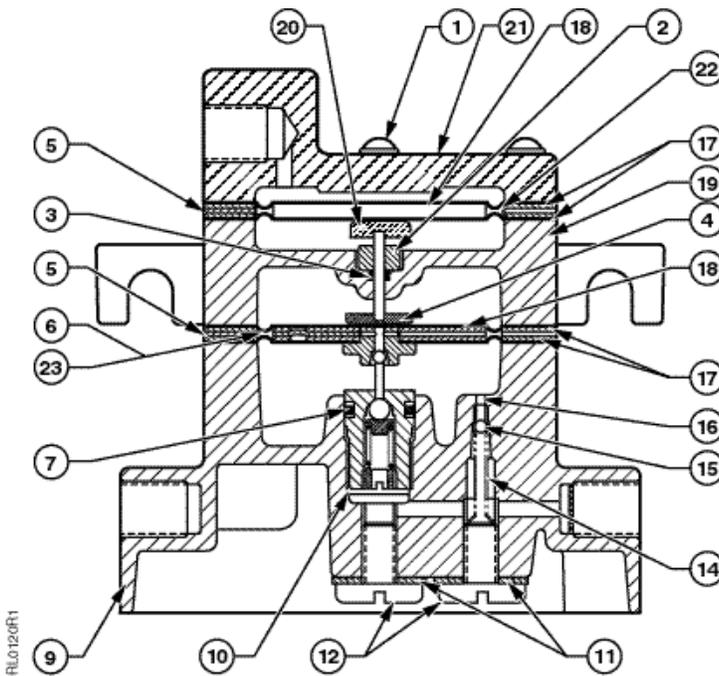


Figure 17.

Table 1.

Item	Service Part No.*	Part Name	No. Req'd	Material
1		Round Head Sems Screw	6	Steel
2		Upper Seal Retainer	1	Brass
3		"O" Ring	1	Buna N
4		Stern & Diaph. Seat Ass'y	1	-
5		Vent Ring	2	Steel
6		Exhaust Valve & Diaph. Ass'y	1	-
7		"O" Ring	1	Buna N
9		Lower Body	1	Zinc Alloy
10		Supply Valve Assembly	1	-
11	243-092	Washer	2	Fiber
12	034-072K	Pan Head Steel Screw	2	Steel
14	243-094	Spring	1	Stn. Steel
15	045-324	Ball	1	Buna N
16		Seat Insert	1	Brass
17		Ring	4	Steel
18		Diaphragm	2	Neoprene
19		Main Body	1	Zinc Alloy
20		Diaphragm Seat	1	Aluminum
21		Cover	1	Zinc Alloy
22		Diaphragm & Disc. Assembly	1	
23		Seal Washer	2	Buna N

\*Items without part numbers are not recommended for field replacement.

### Dimensions

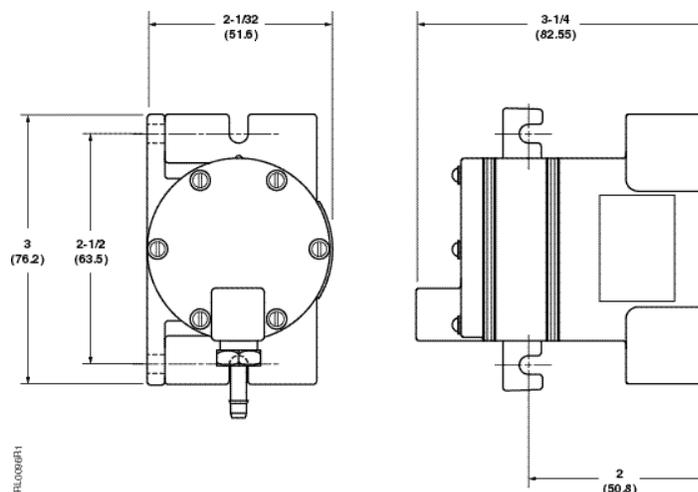


Figure 17. Dimensions in Inches (Millimeters).

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