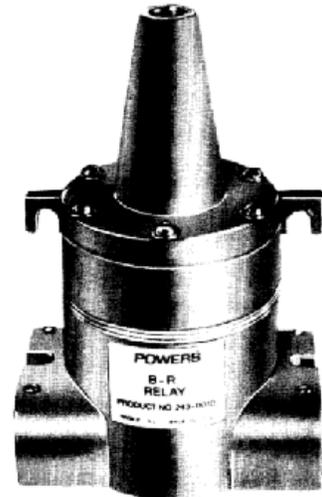


# Powers™ Controls

## RL 243 MP Multi-Purpose Relay



### Description

The Powers RL 243 MP Multi-Purpose Relay is a pneumatic auxiliary device designed to provide a variety of pneumatic control functions for the typical control system. Applications include direct and reverse acting amplifying, signal advancing, minimum pressure relay, and lower pressure transfer. (See Figures 2 through 10.)

The relay operates on a force balance principal 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. The relay housing is provided with integral brackets to facilitate installation without a separate bracket.

A single spring adjustment is provided to allow setting the relay for desired operation. The relay is adaptable for flush panel mounting to facilitate manual readjustment if desired.

### Product Number

243-0009

### Operation

The relay output pressure at port R is dependent upon the adjustable setting of spring S<sub>1</sub>, the interaction of pneumatic signals at ports TD and TR, and the availability of a supply source at port S. The basic relay formula can be expressed as follows:

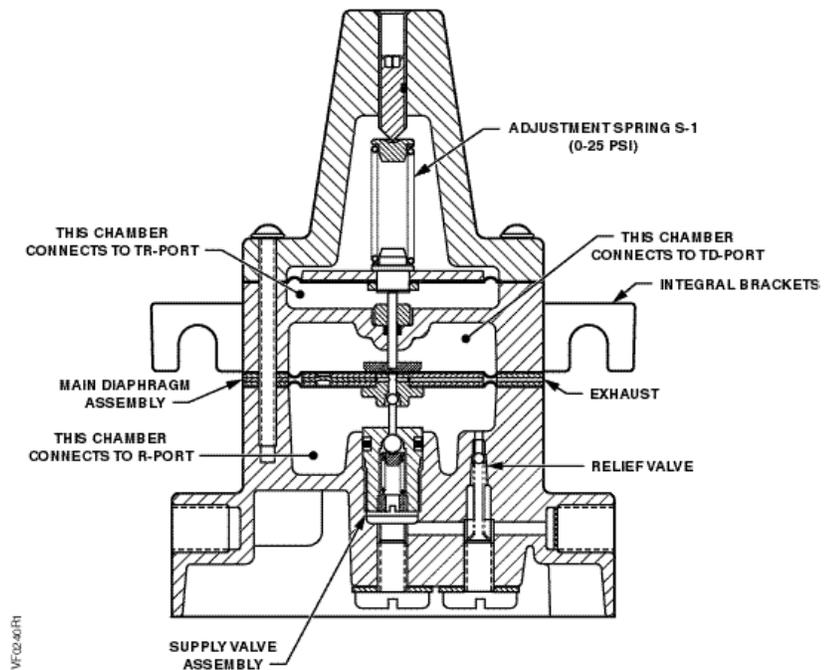
$$R = (TD + (S_1 - TR)) \leq S$$

**NOTE:** (S<sub>1</sub> - TR) cannot be less than zero,

*Where:*

- R is the output pressure
- TD is a direct acting input variable
- S<sub>1</sub> is the setting of the adjustment spring
- TR is a reverse acting input variable (opposing S<sub>1</sub>)

**Operation,  
 continued**



**Figure 1.**

The return line pressure R depends on the force exerted by adjustment spring  $S_1$  and air pressures at TD and TR. TR pressure is exerted against the bottom of the upper diaphragm, opposing  $S_1$ . However, if  $S_1$  is greater than force TR, this difference ( $S_1$  minus TR) is transmitted by the stem to the main diaphragm below. The other force acting downward on the main diaphragm is caused by the air pressure at TD. These downward forces are balanced by air pressure R pushing up on the main diaphragm. Spring force  $S_1$  is adjustable up to an equivalent pressure of 25 psi.

**Specifications**

Instrument air supply	
Normal	0-2.5 psi (0 to 172 kPa)
Maximum	30 psi (207 kPa)
Temperature limits	
Ambient	40 to 120°F (4.4 to 49°C)
Storage	-20 to 120°F (-29 to 49°C)
Adjustments	
Spring $S_1$	0 to 25 psi (0 to 172 kPa)
Hysteresis	Within 0.25 psi (1.7 kPa)
Relief valve differential	Within 1.0 psi (6.89 kPa)
Accessories	
Panel mounting	For flush mounting, with adjustable knob, dial plate and mounting bracket
Surface bracket	For exposed surface mounting (Use with Panel Mounting Kit above)

### Application

The multi-purpose relay is factory calibrated with a 15 psi spring adjustment for reverse acting service. However, the multi-purpose relay provides a number of specific control actions which are frequently utilized in control systems. Some of the typical applications where this relay can be applied are as follows. Additional applications can be obtained depending upon how it is piped and applied with other devices in a single system.

- Direct acting amplifying (See Figure 2).
- Reverse acting amplifying (See Figure 3).
- Lower pressure transfer relay (See Figure 4).
- Signal advancing relay (See Figure 5).
- Minimum pressure relay (See Figure 6).
- DA or RA limit control (See Figure 7 and 8).
- Signal inverting relay (See Figure 9).
- Characterized minimum pressure relay (See Figure 10).

### Direct Acting (DA) Amplifying Relay

Output pressure will vary directly with input pressure. Relay is failsafe and cannot generate an output signal unless a source of air is available at S-port (Figure 2).

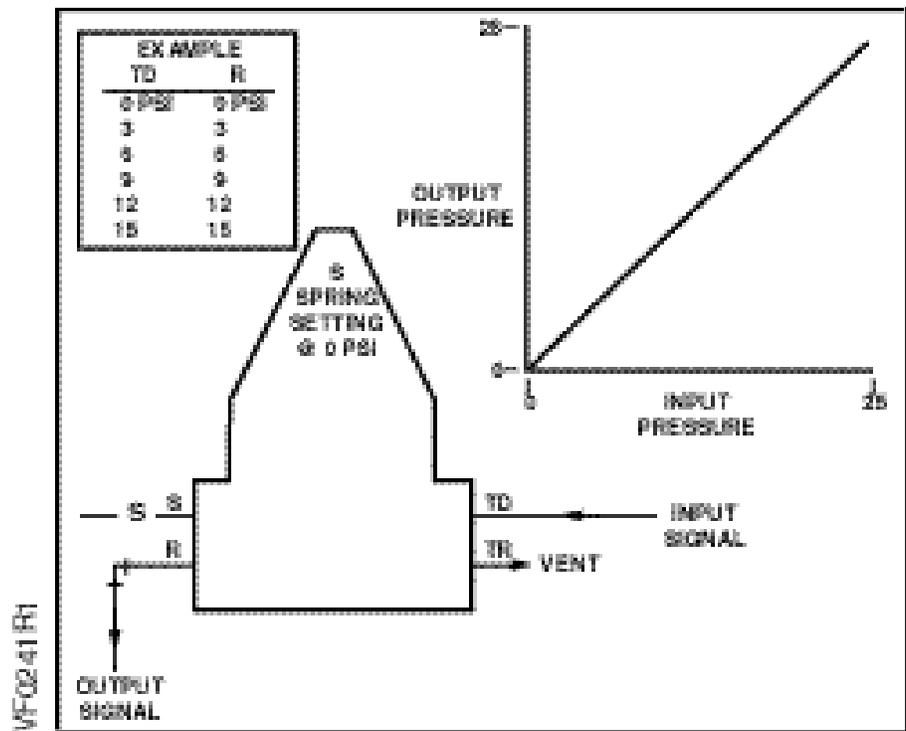
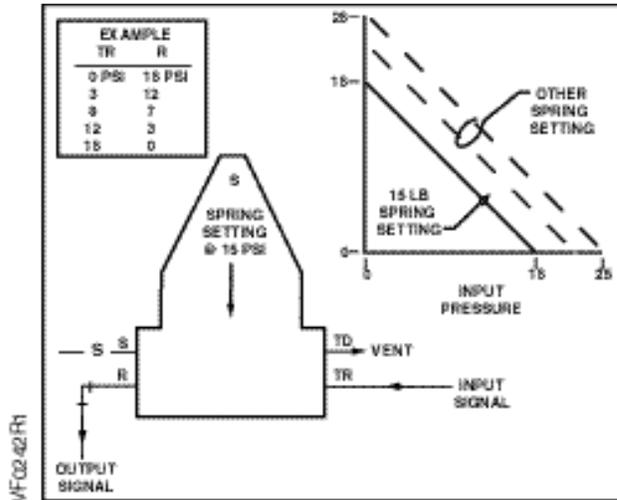


Figure 2. Direct Acting (DA) Amplifying Relay.

**Reverse Acting (RA) Amplifying Relay**

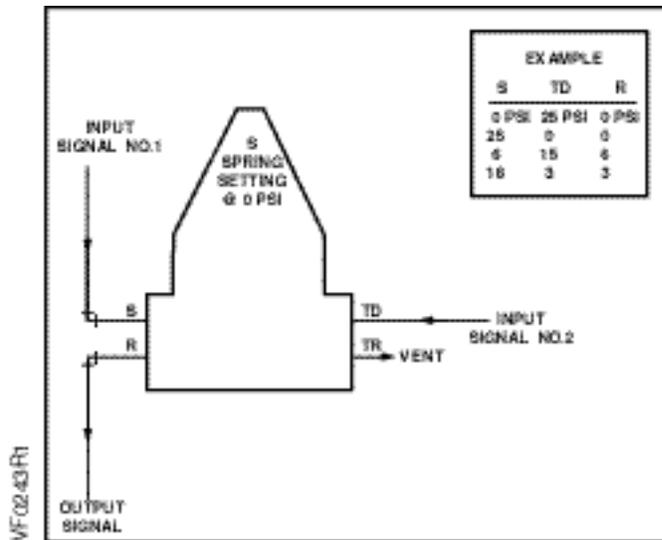
A rise in input pressure will cause an equivalent fall in output pressure. Initial maximum relay output is adjusted with spring setting. Relay is fail-safe and cannot generate an output signal unless a source of air is available at S-port (Figure 3).



**Figure 3. Reverse Acting (RA) Amplifying Relay.**

**Lower Pressure Transfer Relay**

Output pressure will equal the lower of the two input signals. Internal relief valve prevents signal lock up when pressure at S-port drops below relay output pressure (maximum differential within 1.0 psi) (Figure 4).



**Figure 4. Lower Pressure Transfer Relay.**

**Signal Advancing Relay** Output pressure will exceed input pressure by a constant value (as adjusted with spring S-1) except as limited by available air supply at S-port (Figure 5).

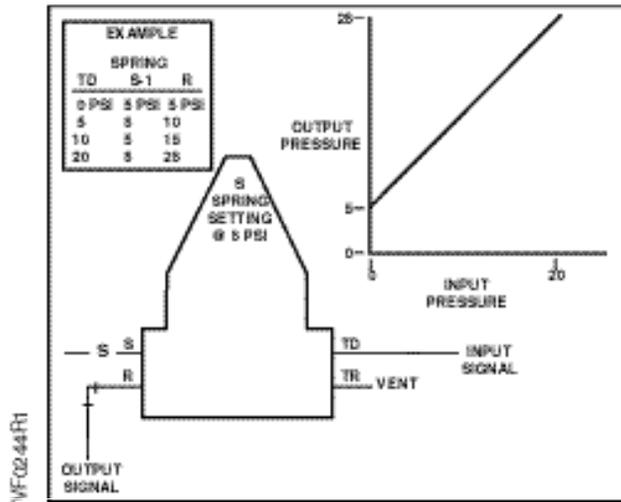


Figure 5. Signal Advancing Relay.

**Minimum Pressure Relay**

Relay output will always provide a minimum pressure as adjusted with spring S-1. Variations in input signal below this minimum will not affect output pressure. Output pressure will equal input pressure for any value over the minimum setting. Air supply to S-port can be from EP valve or equivalent to provide interlock with system operation (Figure 6).

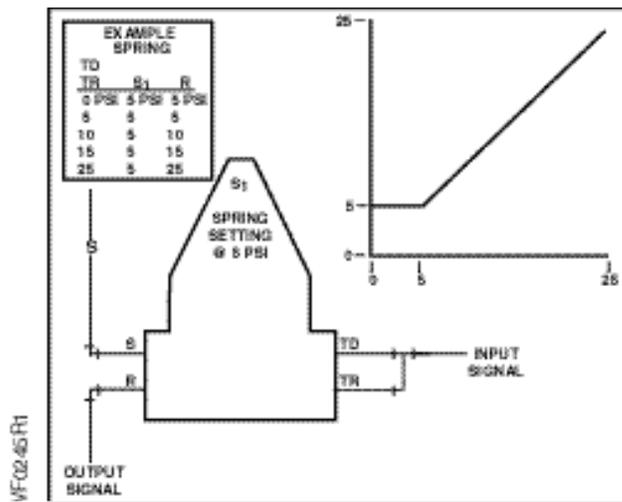
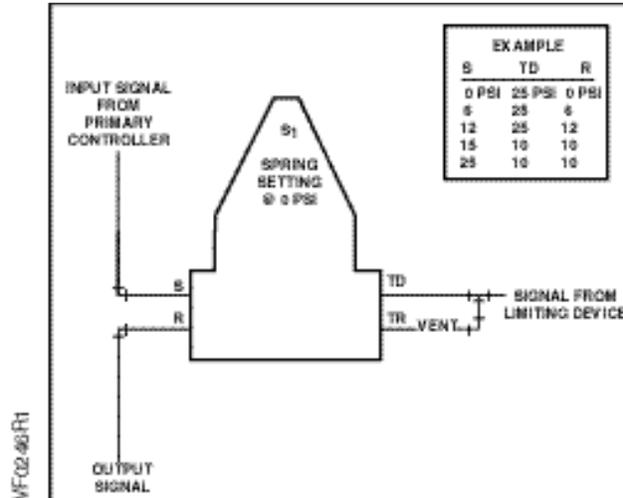


Figure 6. Minimum Pressure Relay.

**Direct Acting (DA) Limit Control**

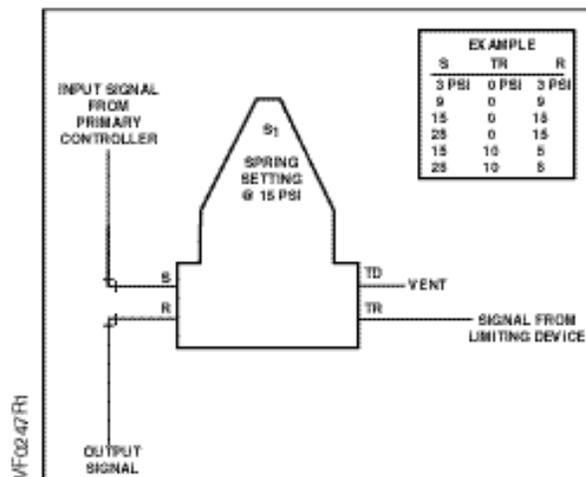
Variable pressure signal from primary controller will pass directly to relay output as long as an equal or higher pressure is available from the limit control. Spring S-1 can be adjusted to allow a minimum output which will not be under control of the limiting device (Figure 7).



**Figure 7. Direct Acting (DA) Limit Control.**

**Reverse Acting (RA) Limit Control**

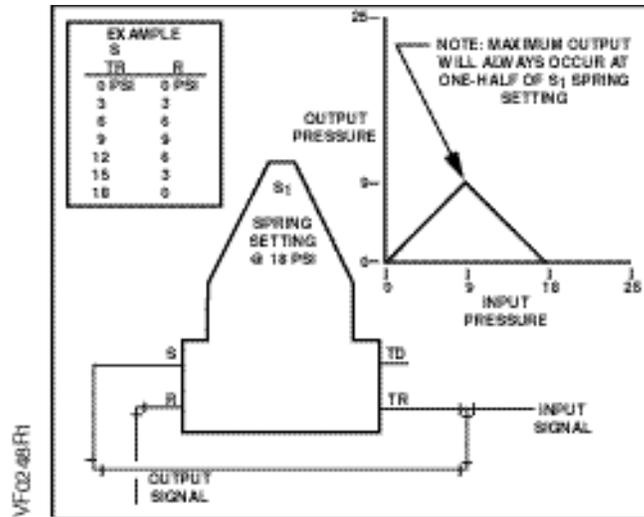
Variable pressure signal from primary controller will pass directly to relay output. Maximum relay output can be adjusted with spring S-1. An air pressure signal from the limiting device will reduce the possible output pressure an equal amount below the maximum setting (Figure 8).



**Figure 8. Reverse Acting (RA) Limit Control.**

**Signal Inverting Relay**

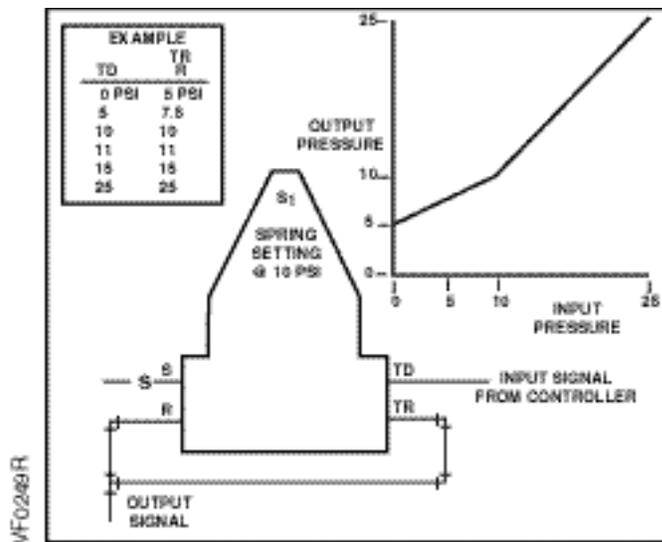
Input signal will pass directly to relay output until maximum output pressure is reached (1/2 of spring setting). A further rise in input pressure will reduce output by an equal amount (Figure 9).



**Figure 9. Signal Inverting Relay.**

**Characterized Min. Pressure Relay**

Initial input from controller will increase relay output above minimum at a 2/1 ratio until relay output is twice the minimum value. A further increase in input pressure will increase the output an equal amount (1/1 ratio) (Figure 10).



**Figure 10. Characterized Min. Pressure Relay.**

## Installation

Multi-Purpose Relay with integral bracket can be installed on panels, ducts, unit ventilators, or any other vertical or horizontal surface. Relay also can be panel mounted to facilitate manual adjustment. Technical Bulletin 155-246 (TB 148) shows panel mounting arrangement.

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

## Dimensions

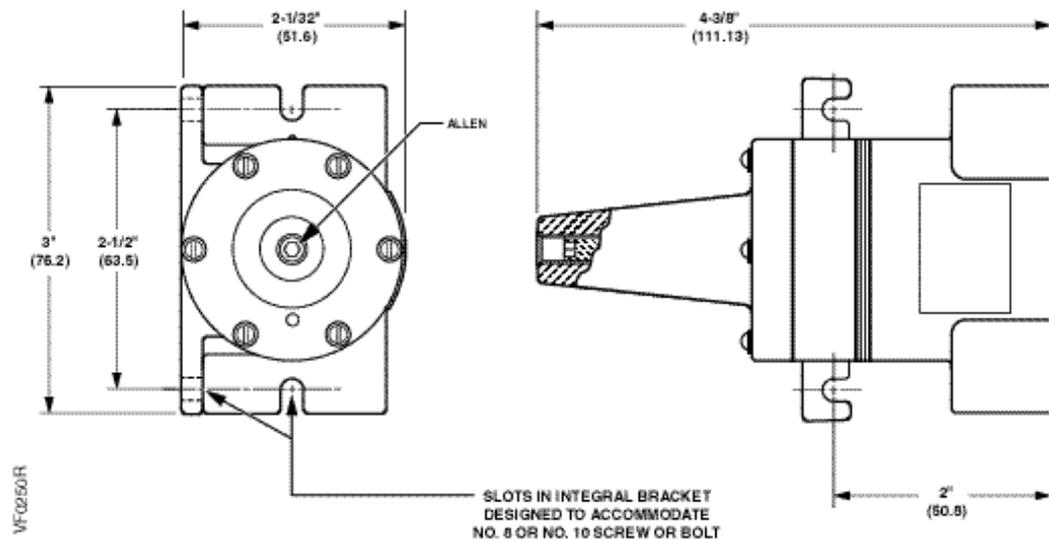


Figure 11. Dimensions in Inches (Millimeters).

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