

**D**

**SECTION D**



# ***PNEUMATIC RELAYS***

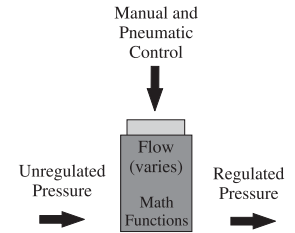
# Pneumatic Relays






Pneumatic relays perform mathematical functions on one or more input signals that result in a single regulated pneumatic output including:







- Average
- Sum

Fairchild pneumatic relays meet all the requirements of a precision device including:

- Accuracy
- Sensitivity
- Fast response



	 <b>14</b> Positive/Negative Bias Relay	 <b>15</b> Positive Bias Relay	 <b>21</b> Adjustable Ratio Relay	 <b>22</b> Pneumatic Computing Relay	 <b>24</b> Snap Acting Relay
<b>Flow Capacity: SCFM (m<sup>3</sup>/HR)</b>	40 (68)	40 (68)	40 (68)	2 (3.4)	14 (23.8)
<b>Exhaust Capacity: SCFM (m<sup>3</sup>/HR)</b>	5.5 (9.4)	5.5 (9.4)	5.5 (9.4)	Note 1	14 (23.8)
<b>Sensitivity: Inch/WC (cm)</b>	0.5 (1.27)	0.25 (0.64)	0.5 (1.27)	Note 1	0.2" WC to 0.5 psig Depending on model
<b>Supply Pressure Max: PSIG (kPa)</b>	250 (1700)	250 (1700)	250 (1700)	150 (1000)	120 (800)
<b>Signal Pressure Max: PSIG (kPa)</b>	150 (1000)	150 (1000)	150 (1000)	50 (350)	120 (800)
<b>Output Pressure Max: PSIG (kPa)</b>	150 (1000)	150 (1000)	150 (1000)	50 (350)	120 (800)
<b>Dimensions (Approx): Inches (mm)</b>	Dia. 3 H 8 (Dia. 76 H 203)	Dia. 3 H 7 (Dia. 76 H 177)	9 7/8 x 3 5/8 4 7/8 (251 x 92 x 124)	Dia. 3 H 9 (Dia. 76 H 229)	Dia. 3 H 8 1/2 (Dia. 76 H 216)

	 <b>25</b> Reversing Relay	 <b>85D</b> Two-Stage Biasing Relay	 <b>1500A</b> High Flow Positive Bias Relay	 <b>2500A</b> High Flow Reversing Relay	 <b>90</b> Low Pressure Selector Relay	 <b>91</b> High Pressure Selector Relay
<b>Flow Capacity: SCFM (m<sup>3</sup>/HR)</b>	40 (68)	14 (23.8)	150 (255)	150 (255)	Note 2	Note 2
<b>Exhaust Capacity: SCFM (m<sup>3</sup>/HR)</b>	11 (18.7)	2.5 (4.25)	40 (68)	40 (68)	Note 2	Note 2
<b>Sensitivity: Inch/WC (cm)</b>	.13 (.32)	N/A	1.0 (2.54)	1.0 (2.54)	Note 2	Note 2
<b>Supply Pressure Max: PSIG (kPa)</b>	250 (1700)	250 (1700)	250 (1700)	250 (1700)	Note 2	Note 2
<b>Signal Pressure Max: PSIG (kPa)</b>	150 (1000)	150 (1000)	150 (1000)	150 (1000)	200 (1400)	200 (1400)
<b>Output Pressure Max: PSIG (kPa)</b>	150 (1000)	150 (1000)	150 (1000)	150 (1000)	200 (1400)	200 (1400)
<b>Dimensions (Approx): Inches (mm)</b>	Dia. 3 H 7 1/2 (Dia. 76 H 191)	1 3/4 x 1 3/4 x 5 (44 x 44 x 127)	Dia. 4 1/2 x 8 1/2 (Dia. 114 H 216)	Dia. 4 1/2 x 8 1/2 (Dia. 114 H 216)	Dia. 3 H 1 3/4 (Dia. 76 H 44)	Dia. 3 H 1 3/4 (Dia. 76 H 44)

Note 1: Multiple configurations allowing up to 4 inputs plus positive and negative biasing over a broad range, designed for multiple functions such as Averaging, Differential, Inverting, Totalizing and On/Off.

Note 2: Switching Differential: +0.1 PSID (<0.7); max.differential between signals: 100PSID (700)

# Model 14 Positive and Negative Bias Relay



## Features

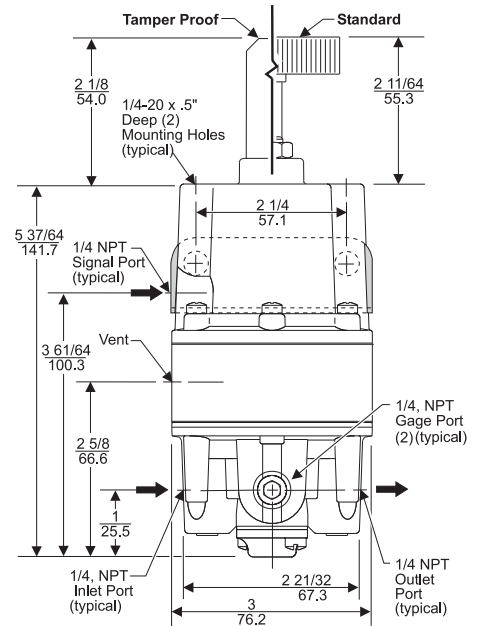
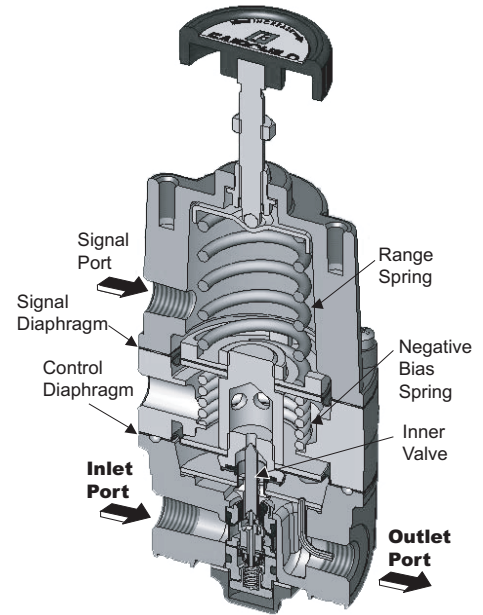
- Control sensitivity of 1/2" water column allows use in precision applications.
- A balanced Supply Valve minimizes the effects of supply pressure variation.
- An Aspirator Tube minimizes downstream pressure droop under flow conditions.
- A separate Control Chamber isolates the diaphragm from the main flow to eliminate hunting and buzzing.
- Mounting Bracket is available
- Canadian Registration Number (CRN) certification for all territories and provinces.

## Operating Principles

The output of the relay is the sum of the spring bias, set with the Range Screw, plus a pneumatic input signal. ( $P_o = P_s \pm K$ ); where  $P_o$  is output pressure,  $P_s$  is signal pressure, and  $K$  is the combined spring constant. The signal pressure exerts a force against the top of the Signal Diaphragm that creates a downward force on the Diaphragm Assembly and opens the Supply Valve. Output pressure flows through the Outlet Port and the Aspirator Tube to the Control Chamber where it creates an upward force on the bottom of the Control Diaphragm.

When the setpoint is reached, the force that acts on the bottom of the Control Diaphragm balances with the force that acts on the top and bottom of the Signal Diaphragm.

When the output pressure increases above the setpoint, the increase is transmitted through the Aspirator Tube to the Control Diaphragm. The increased pressure that acts on the Control Diaphragm moves the Diaphragm Assembly upward to seat the Supply Valve, move the Relief Seat away from the Relief Valve, and let downstream air exhaust through the port in the Ring Spacer.

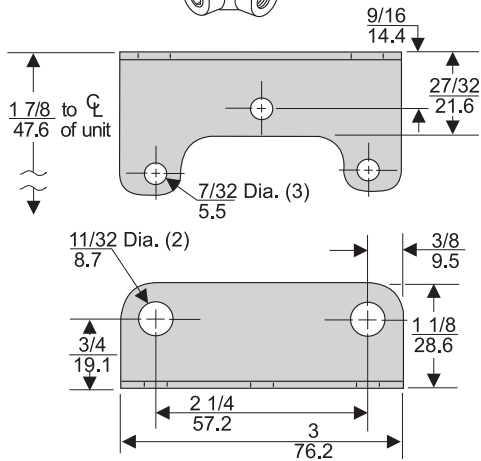
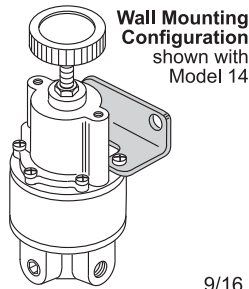
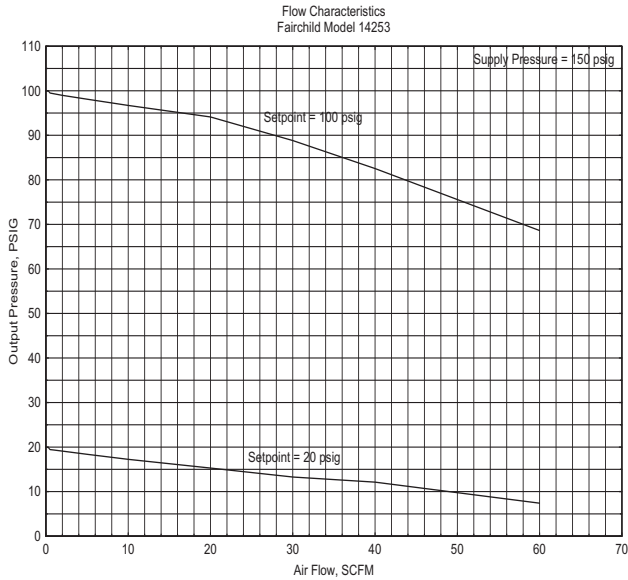


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**Model 14**

The Model 14 Positive and Negative Bias Relay is designed for applications that require an output pressure that is the sum of a controlled input signal plus or minus a fixed bias.

## Technical Information



Mounting Bracket: 09921

## Model 14 Relay Kits & Accessories

Mounting Bracket Kit.....09921 (sold separately)

## Service Kit

A Service Kit is available for the Model 14, refer to the *Fairchild Model 14 Positive / Negative Bias Relay Instruction, Operation and Maintenance Instructions, IS-30000014*.

## Catalog Information

Catalog Number

1 4 2

Pressure Range

psig	[BAR]	(kPa)
-18 to 2	[-1.2 to .15]	(-120 to 15)
-18 to 10	[-1.2 to .7]	(-120 to 70)
-18 to 30	[-1.2 to 2]	(-120 to 200)
-18 to 100	[-1.2 to 7]	(-120 to 700)

Pipe Size

1/4" NPT	2
3/8" NPT	3
1/2" NPT	4

Options

Silicone Elastomers <sup>1</sup>	A
Tapped Exhaust	E
Fluorocarbon Elastomers	J
Non-Relieving	N
Tamper Proof	T
BSPT (Tapered)	U

<sup>1</sup> Maximum Supply Pressure 75 psig, [5.0 BAR], (500 kPa)

## Specifications

**Supply Pressure**

250 psig, [17.0 BAR], (1700 kPa) Maximum

**Flow Capacity (SCFM)**

40 SCFM (68 m<sup>3</sup>/HR) @ 100 psig, [7.0 BAR], (700 kPa) supply and 20 psig, [1.5 BAR], (150 kPa) setpoint

**Exhaust Capacity (SCFM)**

5.5 SCFM (9.35 m<sup>3</sup>/HR) where downstream pressure is 5 psig, [.35 BAR], (35 kPa) above 20 psig, [1.5 BAR], (150 kPa) setpoint

**Signal or Output Pressure**

150 psig, [10.0 BAR], (1000 kPa) Maximum

**Supply Pressure Effect**

Less than 0.1 psig, [.007 BAR], (.7 kPa) for 100 psig, [7.0 BAR], (700 kPa) change in supply pressure

**Sensitivity**

Less than 1/2" (1.27 cm) Water Column

**Ambient Temperature**

-40°F to +200°F, (-40°C to 93.3°C)

**Hazardous Locations**

Acceptable for use in Zones 1 and 2 for gas atmosphere; Groups IIA and IIB and Zones 21 and 22 for dust atmospheres.

**Materials of Construction**

Body and Housing .....Aluminum  
Trim .....Stainless Steel, Brass, Zinc Plated Steel  
Diaphragms.....Nitrite on Dacron

# Model 15 Positive Relay



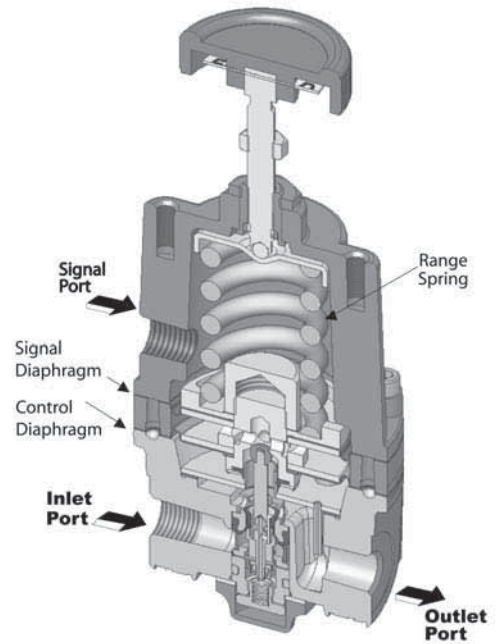
## Features

- The Model 15 is sensitive to 1/4" Water Column variation which permits use in precision applications.
- A Balanced Supply Valve minimizes the effects of supply pressure variation.
- Aspirator Tube minimizes downstream pressure droop under flow conditions.
- Flow of up to 40 SCFM with 100 psig Supply at 20 psig Setpoint allows use in applications requiring high flow capacity.
- A Separate Control Chamber isolates the diaphragm from the main flow, eliminating hunting and buzzing.
- Mounting Bracket available

## Operating Principles

The Model 15 Positive Bias Relay provides an output pressure that represents the input signal pressure plus a preset bias. Mathematically  $P_o = P_s + K$  where  $P_o$  is output pressure,  $P_s$  is signal pressure and  $K$  is the spring constant. This unit, available in several bias range configurations to meet a variety of output requirements, offers excellent sensitivity and high flow capacity in a small volume.

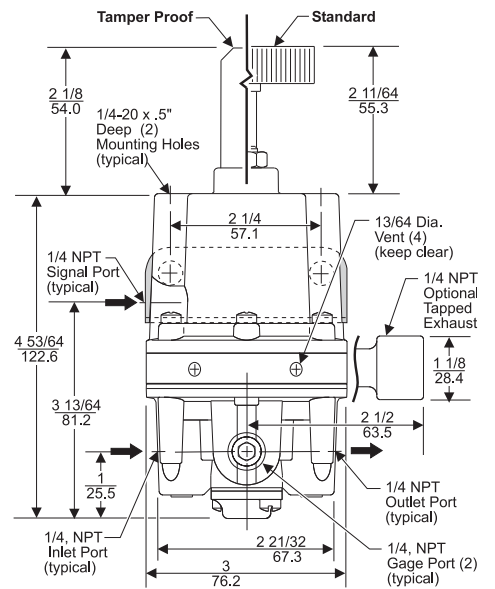
The unit is well suited to a variety of control applications, including range shifting, and tension control, and pressure control from a remote location.



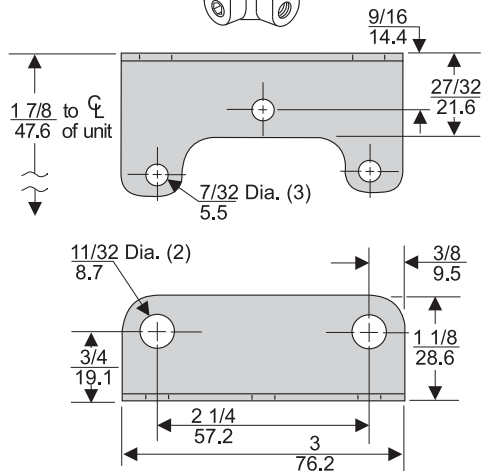
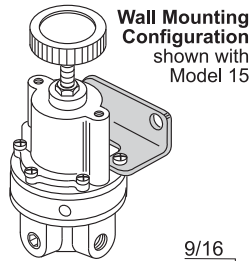
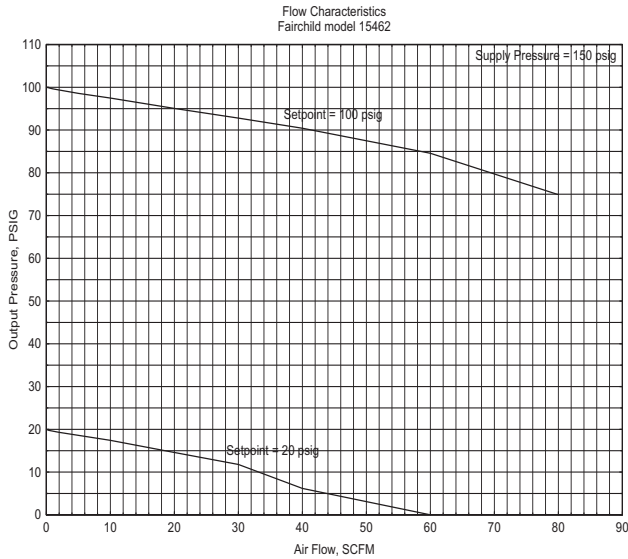
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**Model 15**

The Model 15 Positive Bias Relay is designed for applications that require an output pressure that is the sum of a controlled input signal plus a fixed bias.



**Technical Information**



Mounting Bracket: 09921

**Model 15 Relay Kits & Accessories**

Mounting Bracket Kit.....09921 (sold separately)

**Service Kit**

A Service Kit is available for the Model 15, refer to the corresponding *Fairchild Model 15 Positive Bias Relay, Instruction, Operation and Maintenance Instructions*, IS-300000015.

**Catalog Information**

Catalog Number

1 5 4

Pressure Range

psig	[BAR]	(kPa)
0-10	[0-0.7]	(0-70)
0.5-30	[0.03-2]	(3-200)
1-60	[0.1-4]	(10-400)
2-150	[0.15-10]	(15-1000)

2  
 3  
 4  
 6

Pipe Size

1/4" NPT	.....	2
3/8" NPT	.....	3
1/2" NPT	.....	4

2  
 3  
 4

Options

- Silicone Elastomers <sup>1</sup> .....
- Tapped Exhaust .....
- Viton (Fluorocarbon) Elastomers .....
- BSPP (Parallel) <sup>2</sup> .....
- Tamper Proof .....
- BSPT (Tapered) .....

A  
 E  
 J  
 H  
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 U



<sup>1</sup> Maximum Supply Pressure -75 psig, [5.0 BAR], (500 kPa)

<sup>2</sup> BSPP Threads in Inlet & Outlet Ports Only. Others BSPT.

**Specifications**

**Supply Pressure**

250 psig, [17.0 BAR], (1700 kPa) Maximum

**Flow Capacity (SCFM)**

40 SCFM (68 m<sup>3</sup>/HR) @ 100 psig, [7.0 BAR], (700 kPa) supply and 20 psig, [1.5 BAR], (150 kPa) setpoint

**Exhaust Capacity (SCFM)**

5-1/2 SCFM (9.4 m<sup>3</sup>/HR) where downstream pressure is 5 psig, [.35 BAR], (35 kPa) above 20 psig, [1.5 BAR], (150 kPa) setpoint

**Signal or Output Pressure**

150 psig, [10.0 BAR], (1000 kPa) Maximum

**Supply Pressure Effect**

Less than 0.1 psig, [.007 BAR], (.7 kPa) for 100 psig, [7.0 BAR], (700 kPa) change in supply pressure

**Sensitivity**

Less than 1/4" (.64 cm) Water Column

**Mounting**

Pipe or Panel

**Ambient Temperature**

-40°F to +200°F, (-40°C to 93.3°C)

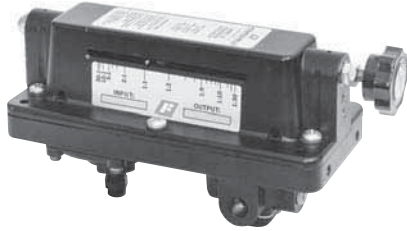
**Hazardous Locations**

Acceptable for use in Zones 1 and 2 for gas atmosphere; Groups IIA and IIB and Zones 21 and 22 for dust atmospheres

**Materials of Construction**

Body and Housing .....Aluminum Alloy  
Trim .....Stainless Steel, Brass, Zinc Plated Steel  
Diaphragms.....Buna A and Dacron

# Model 21 Relay



## Features

- Venturi aspiration compensates for downstream pressure losses
- Optional input and output biasing allows versatility in applications
- Adjustable from 30:1 dividing ratio to 1:30 multiplying ratio assures infinite pressure adjustments
- Floating seal ring isolates control chamber which increases stability by reducing effect of high flows.
- Panel or Line Mounting

## Operating Principles

The Model 21 consists of a signal chamber lever arm, a Model 20 output valve body, and pivot assembly for lever arm adjustment. The ratio of output pressure to signal pressure is infinitely adjustable. The adjustment range permits signal amplification of 1:30 or signal reduction of 30:1 by rotation of the ratio adjustment knob.

The signal pressure acting on the signal chamber diaphragm transmits a force through a lever to the control diaphragm, thus setting output pressure. The lever fulcrum is adjustable.

Output pressure is a function of signal pressure times the ratio of lever arm lengths on either side of the fulcrum. A bias may be introduced by means of the set screws.

The Model 21D is available with both input and output adjustable bias. Maximum input bias is 3 psig, with a maximum output bias of 9 psig. The basic mathematical expression for the bias in this relay is:

$$P_o = (P_s - K_1) R + K_2, \text{ where}$$

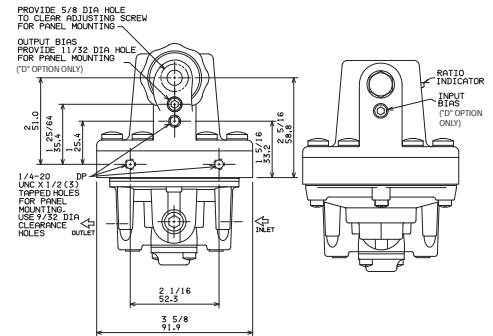
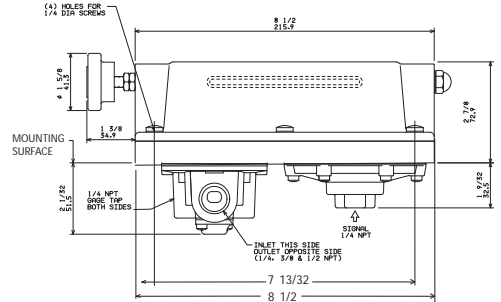
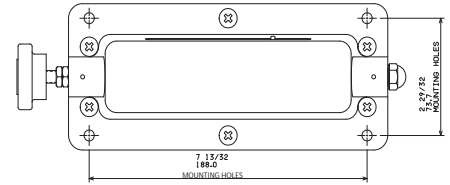
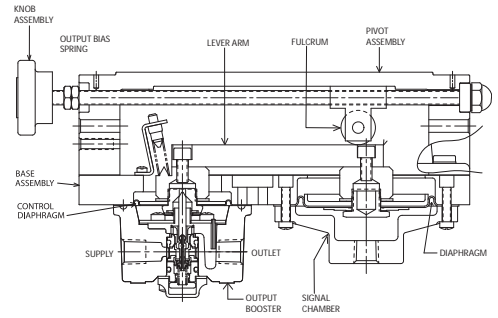
$P_o$  = Output pressure

$P_s$  = Input signal

$R$  = Ratio of setting

$K_1$  = Input bias, (-) only

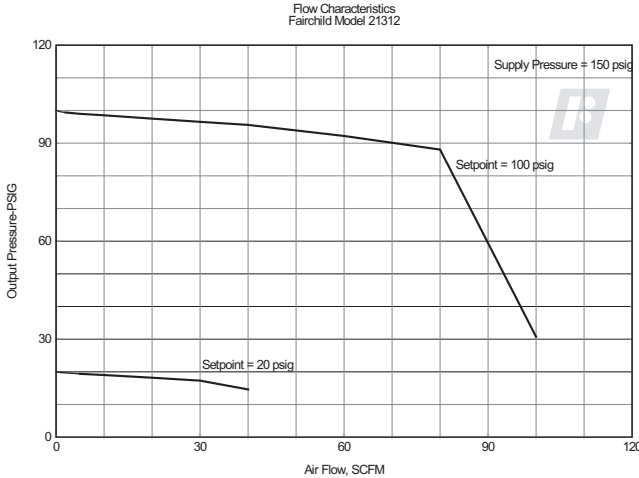
$K_2$  = Output bias, (+) only



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**Model 21**

Technical Information



Specifications

Flow Capacity

40 SCFM (68 m<sup>3</sup>/HR) 100 psig, [7.0 BAR], (700 kPa)  
supply, 20 psig, [1.5 BAR], (150 kPa)

Exhaust Capacity

5.5 SCFM (9.4 m<sup>3</sup>/HR) (downstream pressure 5 psig, [.35 BAR], (35 kPa) above set pressure)

Supply Pressure

250 psig, [1.7 BAR], (1700 kPa) Maximum

Supply Pressure Effect

Less than .1 psig, [.007 BAR], (.7 kPa) for 100 psig, [7.0 BAR], (700 kPa) change

Signal or Output Pressure

150 psig, [1.0 BAR], (1000 kPa) Maximum

Ratio Range

30:1 through 1:30 (signal pressure: output pressure)

Operating Pressure (minimum)

0.5 psig, [0.03 BAR], (3.5 kPa)

Sensitivity

0.5" (1.27 cm) Water Column

Ambient Temperature Limits

-40°F to +200°F, (-40°C to +93.3°C)

Materials of Construction

Body and Housing.....Aluminum  
Trim.....Stainless Steel, Brass, and Zinc Plated Steel  
Diaphragms.....Buna N and Dacron  
Lever and Fulcrum.....Hardened Steel

Catalog Information

Catalog Number

2 1 3 1

□ □

Pipe Size

1/4" NPT .....  
3/8" NPT .....

2  
3

Options

Bias<sup>1</sup> .....  
Fluorcarbon Elastomers .....  
Tamper Proof .....  
BSPT (Tapered) .....

D  
J  
T  
U

<sup>1</sup> Maximum Input Bias: -3 psig, [-0.2 BAR], (-20 kPa),  
Maximum Output Bias: 9.0 psig, [0.6 BAR], (60 kPa)

Installation

A service kit is available for the Model 21. Refer to the Fairchild Model 21 Relay Installation, Operation and Maintenance Instructions, IS-10000021.





# Model 22 Computing Relay



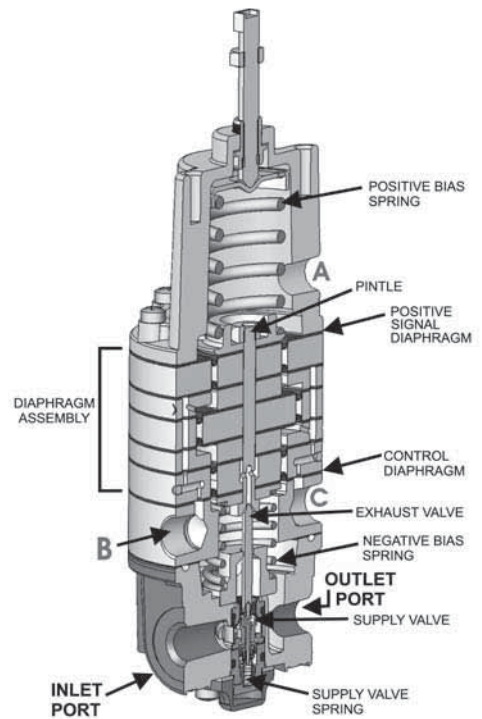
## Features

- Small bleed across relief seat assures fast response to small signals
- Multiple inputs allow versatility in process control
- Adjustable Bias Range from -18 to +15 psig permits variation in output
- Two gauge ports located 90° from supply and outlet ports, allows versatility in installation
- Line or Panel Mounting

## Operating Principles

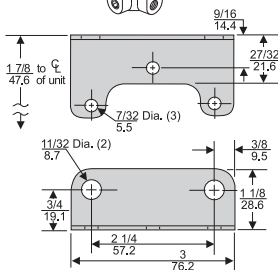
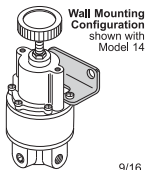
The Model 22 Pneumatic Computing Relay is a highly versatile control valve designed to perform a number of specialized functions, including averaging, differential, inverting, and totalizing. This high quality unit, which offers up to four inputs as well as positive and negative biasing over a broad range, is available in several configurations to meet most application requirements.

The combination of multiple configuration options and accurate response characteristics make the Model 22 the ideal choice in a variety of applications with specific input/output requirements such as override or multi-element control, or as an ON-OFF valve.

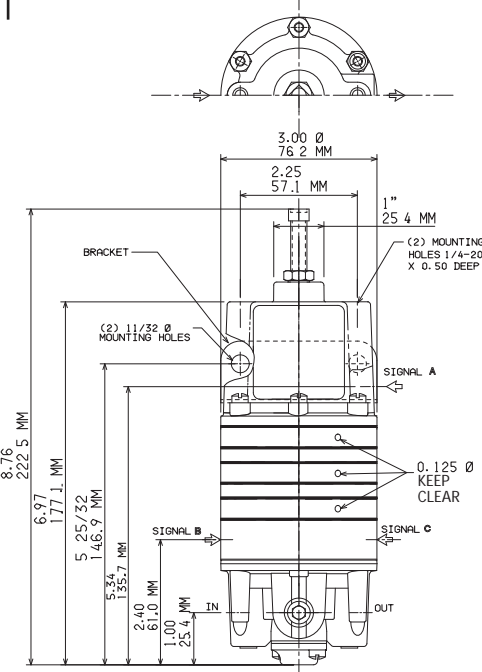


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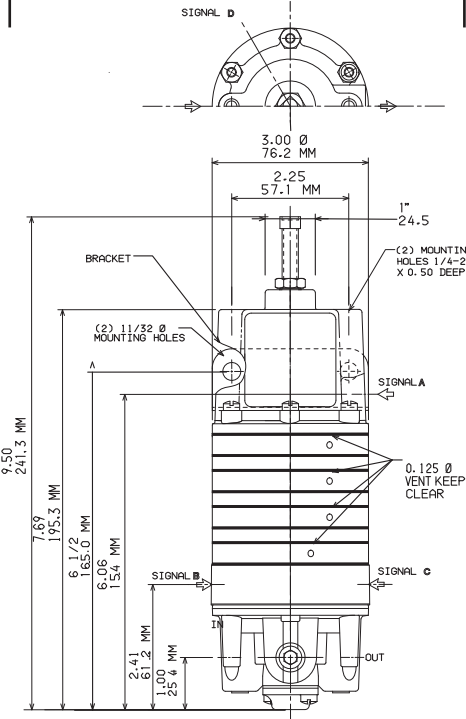
Model 22



For Models: 22112, 22113, 22212, 22213, 22222, 22223, 22312



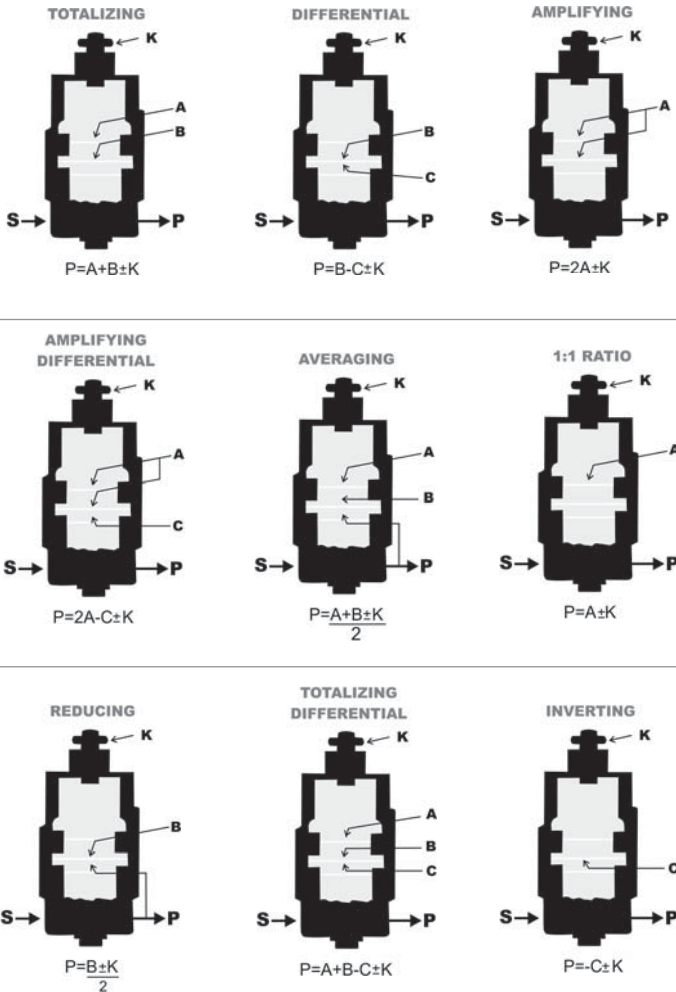
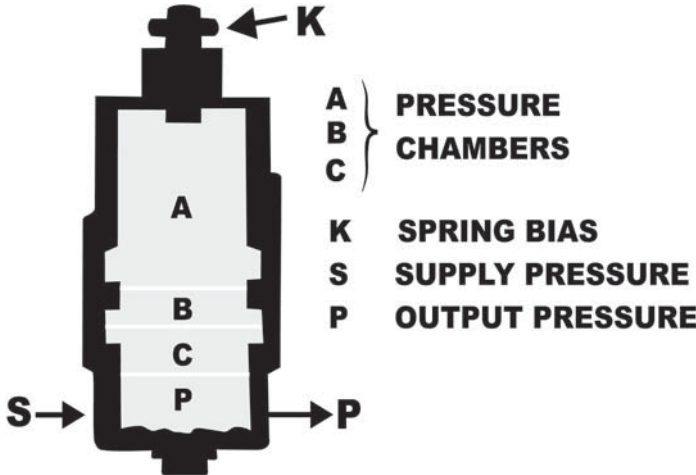
For Models: 22142 & 22422



**Model 22 Mounting Bracket Kit**  
P/N 09921 - zinc plated steel  
(sold separately)

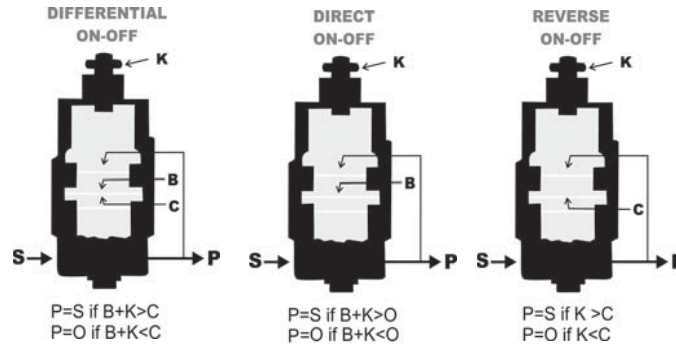
Cross Section

The diagrams show some typical functions and modes of operation for the Model 22. In the equation associated with the diaphragms, P=Output Pressure and A, B, and C=Signal Pressures. K, the constant, is provided by the biasing springs, and is adjustable over a range of -18 psig to +30 psig. S=Supply Pressure



When used as an ON-OFF valve, the Model 22 may open or close a pneumatic circuit, moving rapidly to a full open or a full closed position when signal pressures deviate from set point. In the full open position, the valve passes full supply pressure without modulation or regulation. The function is achieved by connecting output pressure to signal chamber A. This connection forms a feedback loop so that, once flow is started, the valve is driven wide open. The relay always goes full open or full closed when conditions are as shown in the diagrams.

**NOTE:**  
Relays reflecting functions identified with prefix numbers 223, 224, 225 and 226 are not shown in this catalog sheet. These units are equipped with additional diaphragms to enable the handling of added signal inputs.

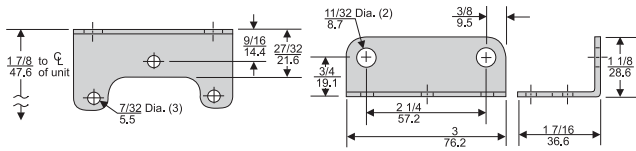
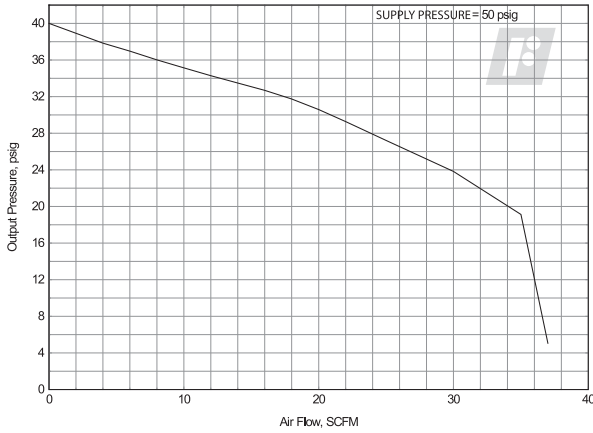


$P=A+B+C+D \pm K$  (not shown)  
 $P=A+B-C+D \pm K$  (not shown)

# Model 22 Computing Relay

## Technical Information

Fairchild Model 22112



## Model 22 Relay Kits & Accessories

Mounting Bracket Kit.....09921 (sold separately)

**Model 22**

### Specifications

#### Input and Output Pressure

3-15 psig, [.2-1.0 BAR], (20-100 kPa)

#### Normal Supply

20 psig, [1.5 Bar], (150 kPa)

#### Maximum Operating Pressure

**Signal and Output:** 50 psig, [3.5 BAR], (350 kPa)

**Supply:** 150 psig, [10.0 BAR], (1000 kPa)

#### Maximum Over Pressure

**Any Connection:** 100 psig, [7.0 BAR], (700 kPa)

**Supply Connection Only:** 250 psig, [17.0 BAR], (1700 kPa)

#### Minimum Output Pressure

0 psig at any supply pressure

#### Linearity of Output Pressure

Within 0.4% of full range

#### Supply Pressure Effect

A supply pressure change of 5 psig [.35 BAR], (35 kPa) will not change output pressure

#### Air Consumption (in balance of dead end service)

0.06 SCFM (.102 m<sup>3</sup>/HR) maximum at 15 psig, [1.0 BAR], (100 kPa) output

#### Repeatability

For unbalances within the normal pressure range, output pressure will repeat its previous value within 0.5% of full range

#### Output Flow Capacity (Midscale Output)

20 psig, [1.5 BAR], (150 kPa) supply. A forward flow of 2 SCFM (3.4 m<sup>3</sup>/HR) will not cause a drop in output of more than 3% of full range

#### Ambient Temperature Limits

-40°F to 200°F, (-40°C to 93.3°C)

#### Materials of Construction

Valve & Bonnet ..... Die Cast Aluminum  
Diaphragm ..... Buna A  
Range Screws & Fastners ..... Zinc Plated Steel

## Catalog Information

### Catalog Number

2 2

### Function

Totalizing (P = A+B±K)  
Differential (P = B-C±K)  
Amplifying (P = 2A±K)  
Inverting (P = -C±K)  
Totalizing Differential (P = A+B-C±K)  
Amplifying Differential (P = 2A-C±K)  
1:1 Ratio (P = A±K)

Differential On-Off (P = S if B±K>C) or (P = O if B±K<C)

Reverse On-Off (P = S if K>C) or (P = O if K<C)

Direct On-Off (P = S if B+K>O) or (P = O if B+K<O)

Reducing (P =  $\frac{B±K}{2}$ )

Averaging (P =  $\frac{A+B±K}{2}$ )

Totalizing (P = A+B+C±K)

Totalizing (P = A+B+C+D±K)

Totalizing Differential (P = A+B-C+D±K)

11			
21			
22			
31 <sup>1</sup>			
41 <sup>1</sup>			
42 <sup>1</sup>			

### Pipe Size

1/4" NPT .....

3/8" NPT .....

<sup>1</sup> 1/4" NPT Pipe Size Only

2  
3

### Options

Fluorocarbon Elastomers .....

J

### SYMBOL KEY

A, B, C, D ..... Signal Pressure  
K ..... ± Spring Bias  
P ..... Output Pressure  
S ..... Supply Pressure

### Service Information

Repair parts are available for servicing the Model 22. Please refer to the *Fairchild Model 22 Installation, Operation and Maintenance Instructions*, IS-30000022.



## Features

- Near Zero Throttling and Pilot Staging result in true snap-action.
- 14 SCFM Flow rate meets requirements for high forward and exhaust capacity applications.
- Pneumatic and mechanical set point allows operation from a remote location.
- Available with Normally Open or Normally Closed Valve Options to meet requirements.

## Operating Principles

The Model 24 Snap Acting Relay is a highly accurate differential relay with snap-acting switching. The output of the unit will go to supply pressure when the signal is equal to or greater than the setpoint. The signal pressure must fall below the setpoint to return the output to zero.

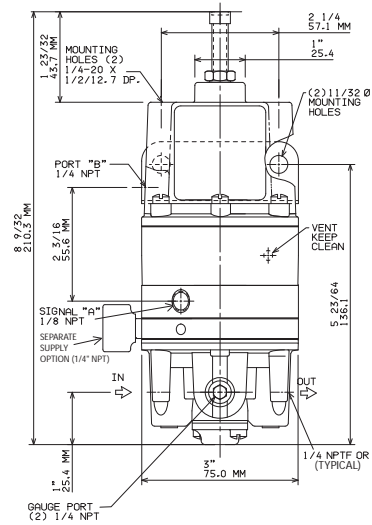


Chart 1

RANGE			CHANGE IN SIGNAL TO OPERATE		
psig	[BAR]	(kPa)	psig	[BAR]	(kPa)
2" W.C. - 10	[2" W.C. - 0.7]	(2" W.C. - 70)	0.2" W. C.		
0.5-30	[.03-2.0]	(3-200)	0.1	[.007]	(.7)
1.0-60	[0.1-4.0]	(10-400)	0.2	[.014]	(1.4)
2.0-120	[.15-8.0]	(15-800)	0.5	[.03]	(3)

**D**

Model 24

Figure 1

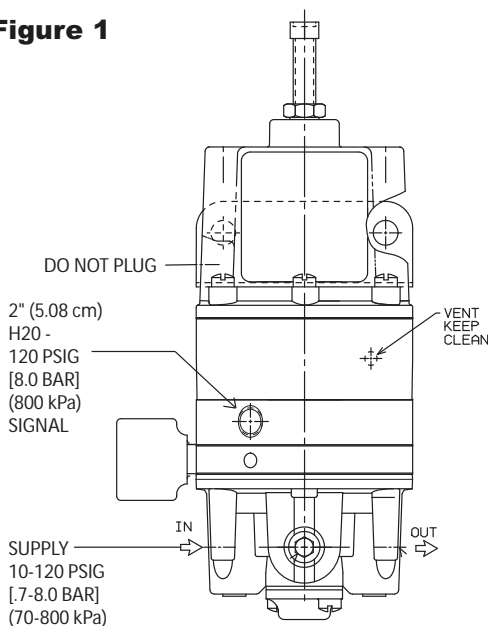
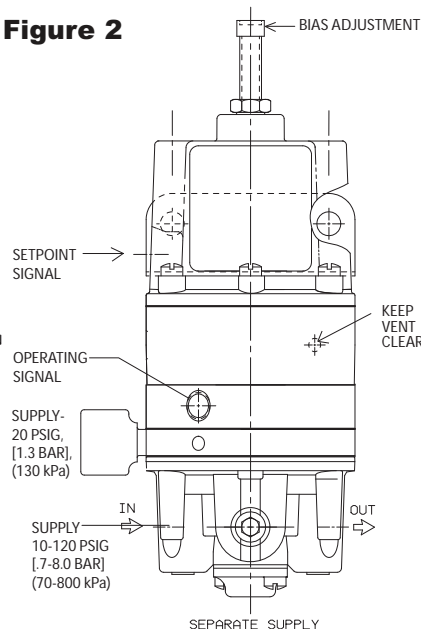


Figure 2

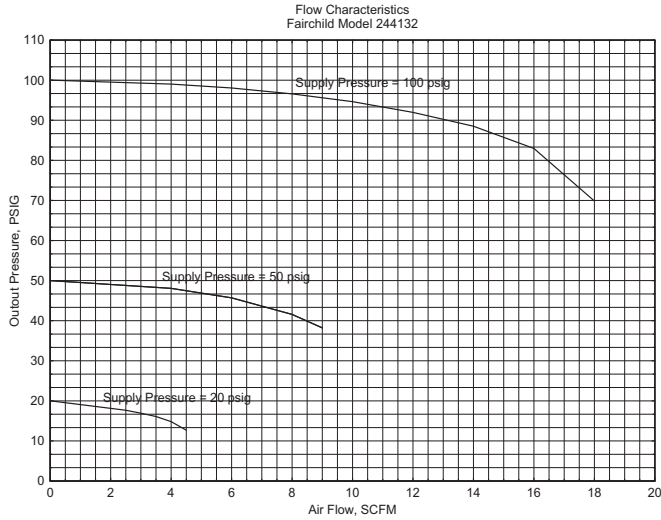


**Figure 1** illustrates a configuration which uses a pneumatic signal for set point which may or may not be biased by the adjusting screw. In this case, the adjustment adds to the pneumatic signal. Should the set point and the operating signal be switched, the bias adjustment would subtract from the set point signal. To determine whether a Normally Open or Normally Closed valve is required, note that when "B" plus spring bias is greater than signal at "A" port, a Normally Open unit has an output, while a Normally Closed unit does not.

In **Figure 2** the unit is shown with a separate supply option (SS) to indicate use of the unit when the supply is a control signal such as 3-15 psig or any pressure less than 10 psig.

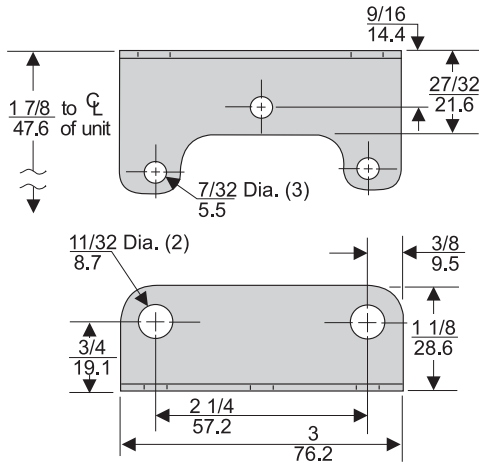
# Model 24 Snap Acting Relay

## Technical Information



**D**

**Model 24**



Mounting Bracket: 09921

## Model 24 Relay Kits & Accessories

Mounting Bracket Kit.....09921 (sold separately)

## Catalog Information

Catalog Number 2 4 4

### Switch Position

Normally Open ..... 1  
Normally Closed ..... 2

### Pressure Range

psig	[BAR]	(kPa)	
2" W.C. -10	[0.006-0.7]	(0.63-70)	2
0.5-30	[0.03-2]	(3-200)	3
1-60	[0.1-4]	(10-400)	4
2-120	[0.15-8]	(15-800)	6

### Pipe Size

1/4" NPT ..... 2  
3/8" NPT ..... 3  
1/2" NPT ..... 4

### Options

Tapped Exhaust	E
Fluorocarbon Elastomers	J
Knob Adjustment	K
Tamper Proof	T
BSPT (Tapered)	U
Separate Supply to Pilot	SS

## Specifications

### Maximum Supply Pressure

120 psig, [8.0 BAR], (800 kPa)

### Minimum Supply Pressure

10 psig, [0.7 BAR], (70 kPa) (use separate supply option if inlet pressure is less than 10 psig, [0.7 BAR], (70 kPa))

### Flow Capacity (SCFM)

14 SCFM (23.8 m<sup>3</sup>/HR) @ 100 psig, [7.0 BAR], (700 kPa) supply

### Exhaust Capacity (SCFM)

14 SCFM (23.8 m<sup>3</sup>/HR) @ 100 psig, [7.0 BAR], (700 kPa) drop

### Signal Range

2" (5 cm) W.C. to 120 psig, [8.0 BAR], (800 kPa)

### Change in Signal to Operate

See Chart 1.

### Repeatability

0.2" (.5 cm) Water Column

### CV Rating

0.23

### Mounting

Pipe or Panel

### Air Consumption

Less than 0.015 SCFM (.03 m<sup>3</sup>/HR) for 100 psig, [7.0 BAR], (700 kPa) inlet

### Ambient Temperature

-40°F to +200°F, (-40°C to 93.3°C)

### Materials of Construction

Body and Housing .....Aluminum Casting  
Trim .....Stainless Steel, Zinc Plated Steel  
Diaphragms .....Buna N and Dacron



The Model 25 Reversing Relay provides an output which will decrease in direct proportion to an increase in input pressure.

## Features

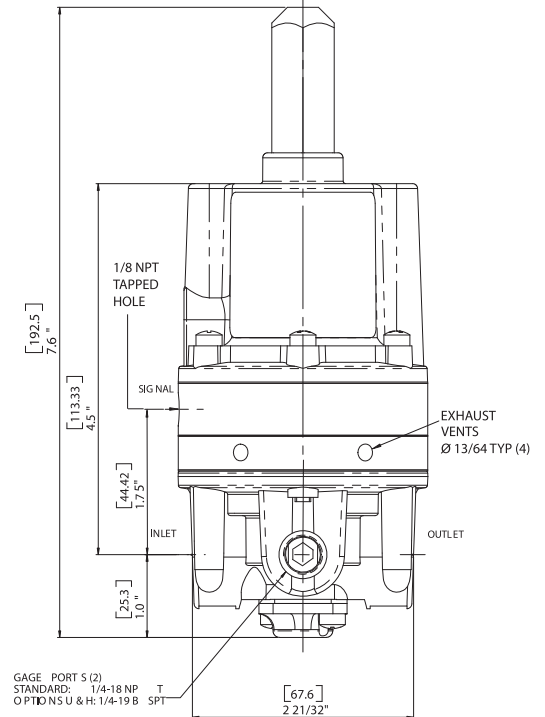
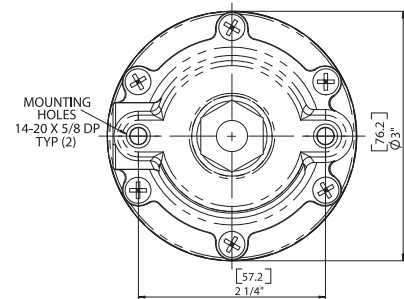
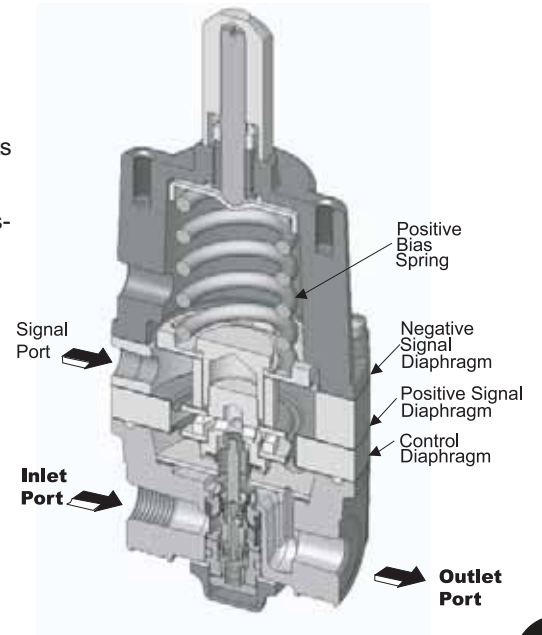
- Control Sensitivity of 1/8" water column for use in precision applications.
- Balanced supply valve minimizes the effects of supply pressure variation.
- Aspirator tube compensates for output pressure droop under flow conditions.
- Separate control chamber isolates the diaphragm from the main flow to eliminate hunting and buzzing.
- Unit construction allows servicing without removal from air line.

## Operating Principles

The Model 25 Reversing Relay is designed for applications requiring an output that equals a manually preset spring load minus a variable signal pressure. This high quality unit combines excellent sensitivity with unusually high flow capacity.

The Model 25 is ideally suited for a variety of precision control applications, including converting direct acting valves to reverse action, controlling opposite acting valves from a single transmitter, and cushioning cylinder loads.

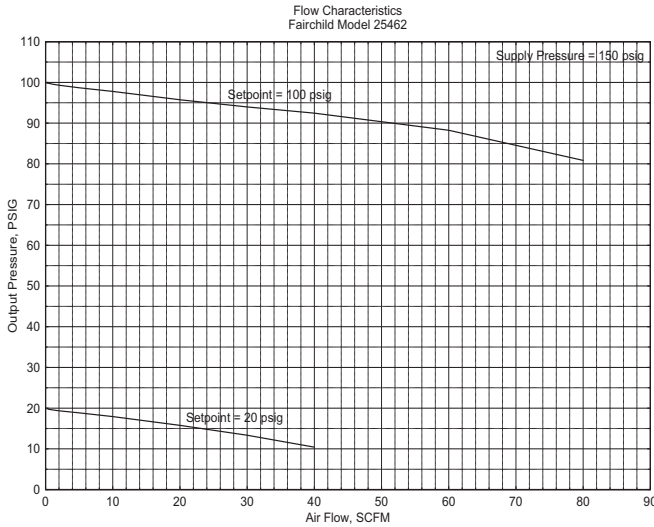
The basic mathematical expression for the Model 25 is  $PO = K - PS$  where PO is output pressure, PS is signal pressure and K is the spring constant.



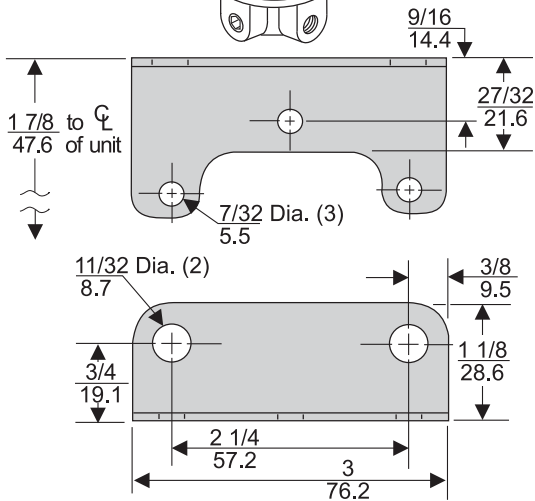
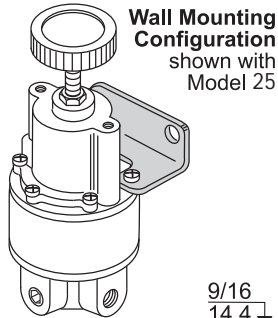
**D**  
Model 25

# Model 25 Reversing Relay

## Technical Information



**D**  
Model 25



Mounting Bracket: 09921

## Model 25 Relay Kits & Accessories

Mounting Bracket Kit.....09921 (sold separately)

## Catalog Information

Catalog Number 2 5 4

### Pressure Range

psig	[BAR]	(kPa)	
0-10	[0-0.7]	(0-70)	2
0.5-30	[0.03-2]	(3-200)	3
1-60	[0.1-4]	(10-400)	4
2-150	[0.15-10]	(15-1000)	6

### Pipe Size

1/4" NPT	2
3/8" NPT	3
1/2" NPT	4

### Options

Tapped Exhaust	E
BSPB (Parallel) <sup>1</sup>	H
Fluorocarbon Elastomers	J
BSPT (Tapered)	U

<sup>1</sup> BSPB Threads in Inlet & Outlet Ports Only. Others BSPT.

### Service Kit

A Service Kit is available for the Model 25 Reversing Relay, refer to the *Fairchild Installation, Operation and Maintenance Instructions*, IS-30000025.

### Specifications

#### Maximum Supply Pressure

250 psig, [17.5 BAR], (1750 kPa)

#### Flow Capacity

40 SCFM (68 m<sup>3</sup>/HR) @ 100 psig, [7.0 BAR], (700 kPa) supply, 20 psig, [1.5 BAR], (150 kPa) setpoint

#### Exhaust Capacity

11 SCFM (18.7 m<sup>3</sup>/HR) where downstream pressure is 5 psig, [.35 BAR], (35 kPa) above setpoint

#### Signal or Output Pressure

150 psig, [10 BAR], (1000 kPa) maximum

#### Supply Pressure Effect

Less than 0.1 psig, [.007 BAR], (.7 kPa) for 100 psig, [7.0 BAR], (700 kPa) change in supply pressure

#### Sensitivity

Less than 1/8" (.32 cm) Water Column

#### Mounting

Pipe or Panel

#### Ambient Temperature Limits

-40°F to +200°F, (-40°C to 93.3°C)

#### Materials of Construction

Body .....Aluminum  
Trim .....Aluminum, Stainless Steel, Brass  
Diaphragms .....Buna N and Dacron



## Features

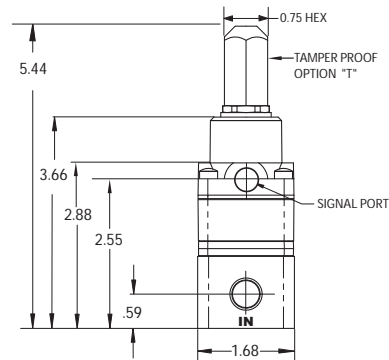
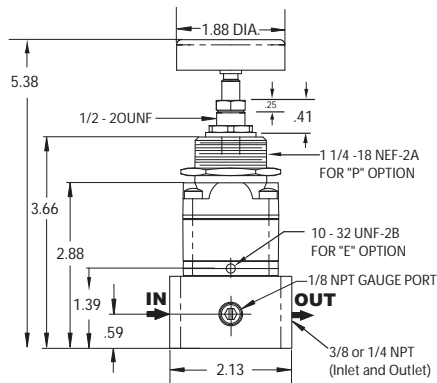
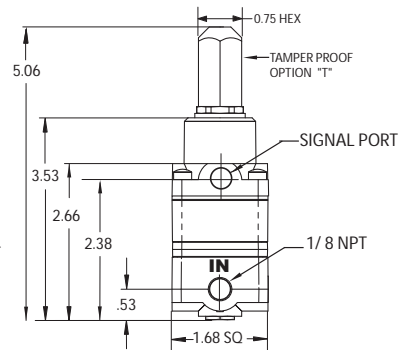
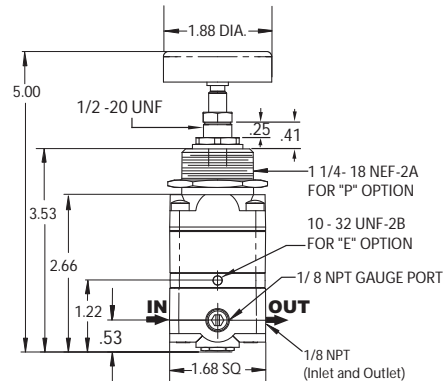
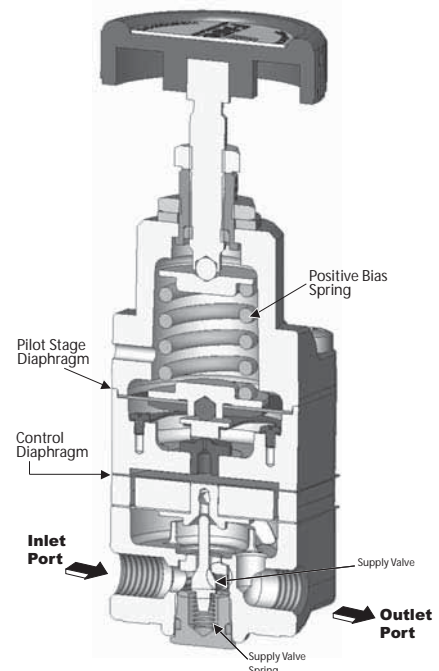
- 2 Stage Pilot Operation allows precise control of set points.
- 14 SCFM flow capacity in a small size unit.
- Low air consumption preserves air and other costly gases.
- Compact size permits installation where space is limited.
- Available in 1/8", 1/4" and 3/8" port sizes.

## Operating Principles

The Model 85D Multi-Stage Biasing Relay is a precision control combining the sensitivity of a precision pressure regulator with positive biasing capability. This compact, pilot-operated device offers unusually high output capacity with minimal air consumption, while providing excellent protection against supply or output pressure variations.

The versatile Model 85D is recommended for use in systems requiring precision pressure maintenance and instrument biasing, in dead end service and instrument panel supply applications.

The basic mathematical expression for the Model 85D is  $PO = PS + K$  where PO is output pressure, PS is signal pressure and K is the spring constant.





# Model 85D Multi-Stage Biasing Relay

## Specifications

### Maximum Supply Pressure

250 psig, [17.5 BAR], (1750 kPa)

### Recommended Operating Supply Pressure

150 psig, [10 BAR], (1000 kPa)

### Maximum Signal or Output Pressure

150 psig, [10 BAR], (1000 kPa)

### Flow Capacity

14 SCFM (23.8 m<sup>3</sup>/HR) @ 100 psig, [7.0 BAR], (700 kPa) supply, 20 psig, [1.5 BAR], (150 kPa) setpoint

### Exhaust Capacity

2.5 SCFM (4.25 m<sup>3</sup>/HR) where downstream pressure is 5 psig, [.35 BAR], (35 kPa) above setpoint

### Supply Pressure Effect

Less than 0.2 psig, [.014 BAR], (1.4 kPa) for 100 psig, [7.0 BAR], (700 kPa) change in supply pressure

### Pressure Change Under Flow Conditions

Less than 0.1 psig, [.007 BAR], (.7 kPa) from dead end service to 10 SCFM (17 m<sup>3</sup>/HR)

(Set pressure 10 psig, [.7 BAR], (70 kPa), supply pressure 100 psig, [7.0 BAR], (700 kPa)

### Air Consumption

Less than .1 SCFM (.17 m<sup>3</sup>/HR)

### Ambient Temperature Limits

-40°F to +200°F, (-40°C to 93.3°C)

### Materials of Construction

Body .....Aluminum  
 Trim .....Aluminum, Stainless Steel, Brass  
 Diaphragms .....Buna N and Dacron

## Catalog Information

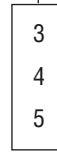
### Catalog Number

8 5 6



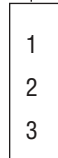
### Pressure Range

psig	[BAR]	(kPa)	
0-20	[0-1.5]	(0-150)	3
1-60	[0.07-4]	(7-400)	4
1-100	[0.07-7]	(7-700)	5



### Pipe Size

1/8" NPT	1
1/4" NPT	2
3/8" NPT	3



### Options

Tapped Exhaust	E
Bonnet Mounting	P
Tamper Proof	T
BSPT (Tapered)	U



## Service Kit

A Service Kit is available for the Model 85D Multi-Stage Biasing Relay, refer to the *Installation, Operation and Maintenance Instructions*, IS-3000085D.

**D**

Model  
85D

# Models 90 and 91 Low / High Pressure Selector Relay



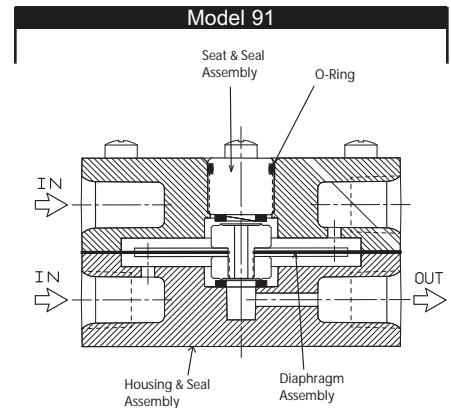
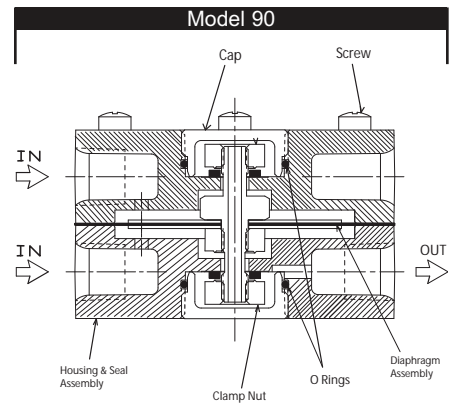
## Features

- Small, rugged design suitable for installation where space is limited.
- Soft seat construction to assure positive shutoff.
- Low selection differential to allow precise control of switching.
- Fast response that is suitable for control in critical loops.
- Automatic switching that eliminates manual monitoring of signal pressure.

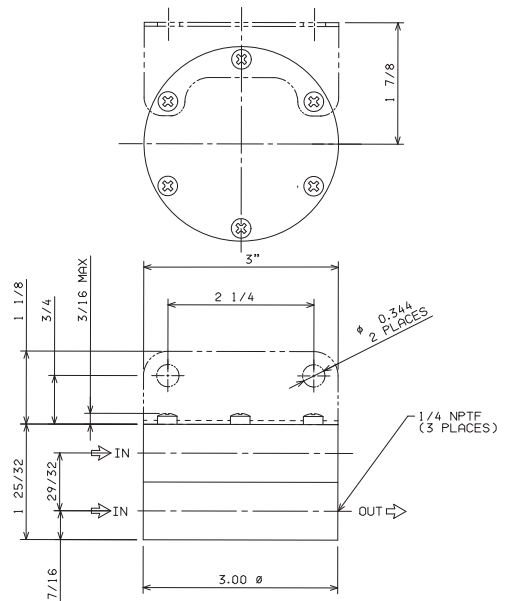
## Operating Principles

The Model 90 Low Pressure Selector Relay is designed to select the lower of two signal pressures to provide a continuous output pressure to a control device. The Model 90 is recommended for dead end or low flow service in critical applications such as control loops requiring precise, automatic monitoring of signal pressures.

The Model 91 High Pressure Selector Relay is designed to select the higher of two signal pressures, and to provide a continuous output pressure (or pressure range) to a controller. The ability to precisely control switching and pressure monitoring make the Model 91 the logical choice in dead end or low flow applications such as precision control loops.

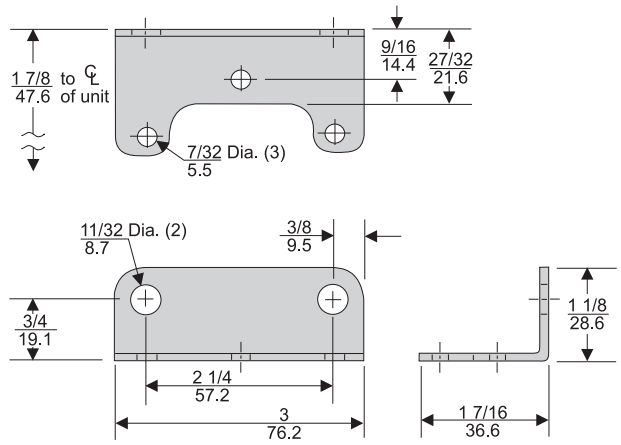
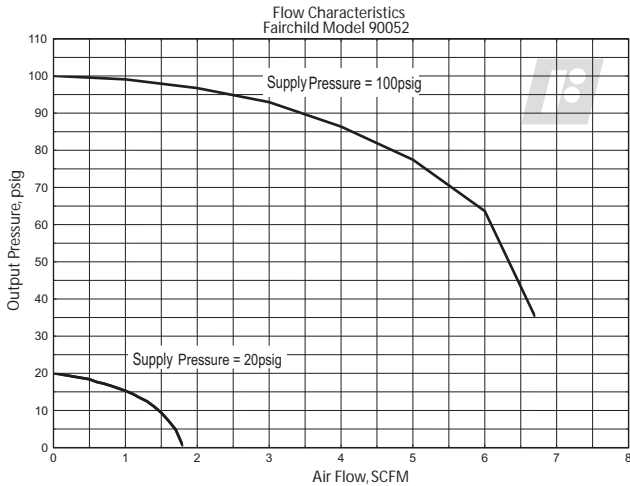


**D**  
Models 90 & 91



# Models 90 and 91 Low / High Pressure Selector Relay

## Technical Information



**D**

**Models 90 & 91**

Mounting Bracket: 09921

## Model 90/91 Relay Kits & Accessories

Mounting Bracket Kit.....09921 (sold separately)

## Specifications

**Maximum Signal Pressure**  
200 psig, [14.0 BAR], (1400 kPa)

**Minimum Switching Differential**  
Less than .1 psig, [.007 BAR], (.7 kPa)

**Maximum Differential between Signals**  
100 psig, [7.0 BAR], (700 kPa)

**Ambient Temperature Range**  
-40°F to +200°F, (-40°C to +93.3°C)

**Materials of Construction**  
Body..... Aluminum Alloy  
Diaphragm ..... Dupont Fairprene-coated fabric  
Trim ..... Brass

## Catalog Information

**Catalog Number** 9  05

**Models**  
90 Low Pressure Selector ..... 0   
91 High Pressure Selector ..... 1

**Pipe Size**  
1/4" NPT ..... 2

**Options**  
Fluorocarbon Elastomers ..... J   
BSPT (Tapered) ..... U

## Installation

Service Kits are available for the Model 90 and Model 91. Refer to the *Fairchild Model 90 and Model 91 Installation, Operation and Maintenance Instructions*, IS-30009091.



## Features

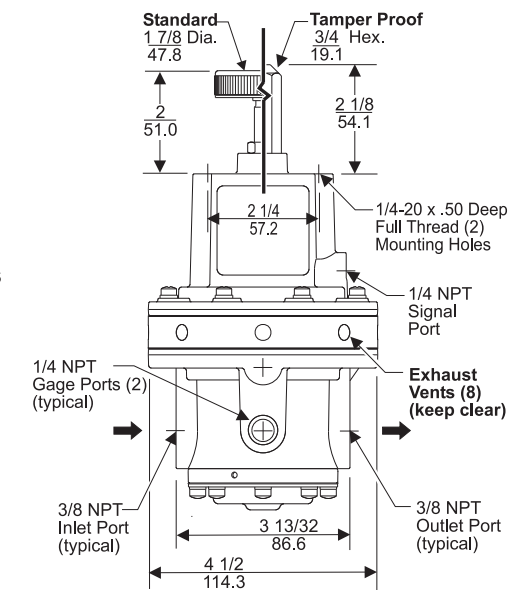
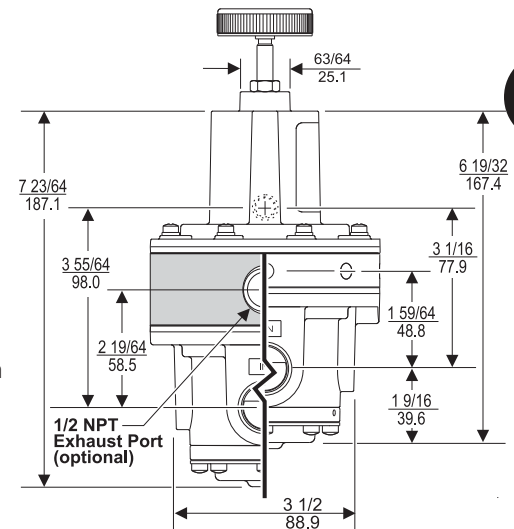
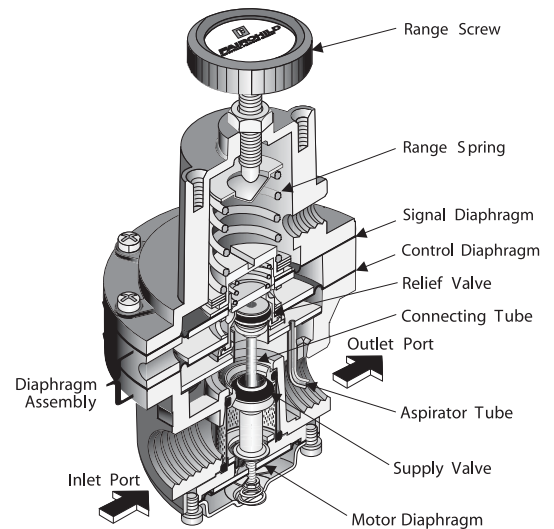
- Control sensitivity of 1" water column allows use in precision applications.
- Large Supply and Exhaust Valves provide high forward and exhaust flows.
- Soft Supply and Exhaust Valve seats minimize air consumption.
- A balanced Supply Valve minimizes the effect of supply pressure variation.
- An Aspirator Tube compensates downstream pressure drop under flow conditions.
- A separate Control Chamber isolates the diaphragm from the main flow to eliminate hunting and buzzing.
- Unit construction lets you service the Model 1500A without removing it from the line.

## Operating Principles

The output of the relay is the sum of the spring bias, set with the Range Screw, plus a pneumatic input signal. ( $P_o = P_s + K$ ); where  $P_o$  is output pressure,  $P_s$  is signal pressure, and  $K$  is the spring constant set by the Range Screw. The signal pressure exerts a force against the top of the Signal Diaphragm that creates a downward force on the Diaphragm Assembly and opens the Supply Valve. Output pressure flows through the Outlet Port and the Aspirator Tube to the Control Chamber where it creates an upward force on the bottom of the Control Diaphragm.

When the setpoint is reached, the forces of the signal pressure and the Range Spring that act on the top of the Signal Diaphragm, balance with the force of the output pressure that acts on the bottom of the Control Diaphragm to close the Supply Valve.

When the output pressure increases above the setpoint, the Diaphragm Assembly moves upward to close the Supply Valve and open the Exhaust Valve. Because the Poppet Valve is closed, pressure flows down the Control Tube to the bottom of the Motor Diaphragm. This pressure keeps the Supply Valve tightly closed while in the exhaust mode. The Poppet Valve opens and excess output pressure exhausts through the Vent in the side of the unit until it reaches the setpoint.

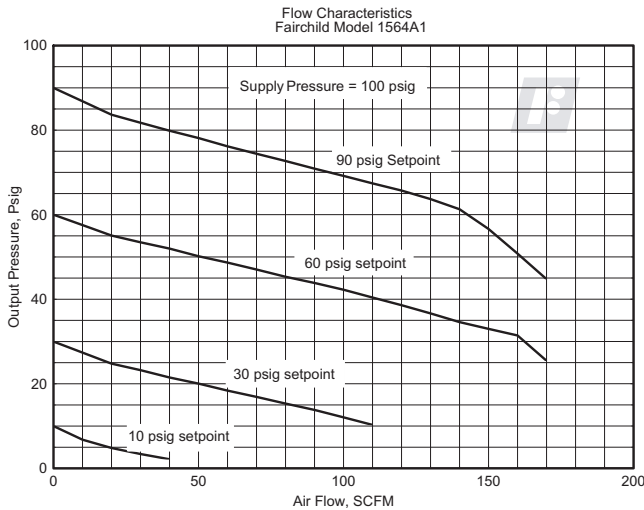


**D**

**Model 1500A**

# Model 1500A Positive Bias Relay

## Technical Information



## Specifications

### Supply Pressure

250 psig, [17.0 BAR], (1700 kPa) Maximum

### Flow Capacity (SCFM)

150 (255 m<sup>3</sup>/HR) @ 100 psig, [7.0 BAR], (700 kPa) supply & 20 psig, [1.5 BAR], (150 kPa) setpoint

### Exhaust Capacity (SCFM)

40 (68 m<sup>3</sup>/HR) where downstream pressure is 5 psig, [.35 BAR], (35 kPa) above 20 psig, [1.5 BAR], (150 kPa) setpoint

### Signal or Output Pressure

150 psig, [10.0 BAR], (1000 kPa) Maximum

### Supply Pressure Effect

Less than 0.1 psig, [.007 BAR], (.7 kPa) for 100 psig, [7.0 BAR], (700 kPa) change in supply pressure

### Sensitivity

1" (2.54 cm) Water Column

### Ambient Temperature

-40° F to +200° F, (-40° C to +93° C)

### Materials of Construction

Body and Housing ..... Aluminum  
 Diaphragms ..... Nitrile on Dacron  
 Trim ..... Zinc Plated Steel, Brass

## Catalog Information

### Catalog Number

1 5 [ ] [ ] A [ ]

### Pressure Range

psig	[BAR]	(kPa)	
0-10	[0-0.7]	(0-70)	2
0.5-30	[0.03-2]	(3-200)	3
1-60	[1-4.0]	(10-400)	4
2-150	[0.15-10]	(15-1000)	6

### Pipe Size

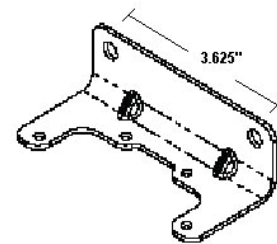
3/8" NPT	3
1/2" NPT	4
3/4" NPT	6

### Options

Tapped Exhaust	E
Tamper Proof	T
BSPT (Tapered)	U

## Installation

For installation instructions, refer to the *Fairchild Model 1500A Positive Bias Relay Installation, Operation and Maintenance Instructions*, IS-3001500A.



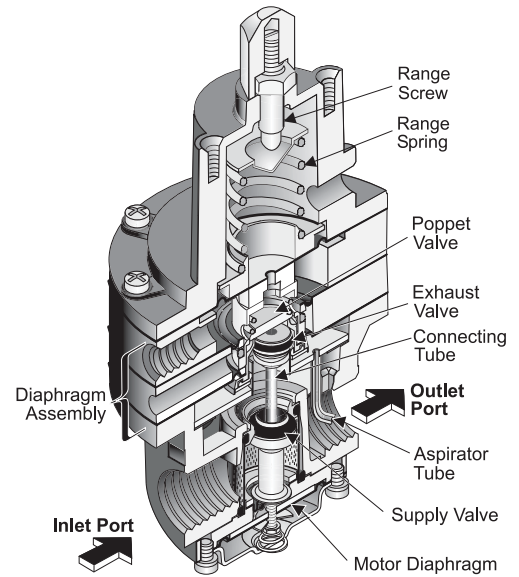
**Model 1500A Mounting Bracket Kit**  
 P/N 20555-1 zinc plated (sold separately)



The Model 2500A Bias Reversing Relay provides an outlet pressure that decreases in direct proportion to increases in input signal.

## Features

- Control sensitivity of 1" water column allows use in precision applications
- Large Supply and Exhaust Valves provide high forward and exhaust flows
- Soft Supply and Exhaust Valve seats minimize air consumption
- A balanced Supply Valve minimizes the effect of supply pressure variation
- An Aspirator Tube compensates downstream pressure droop under flow conditions
- A separate Control Chamber isolates the diaphragm from the main flow to eliminate hunting and buzzing
- Unit construction lets you service the Model 2500A without removing it from the line

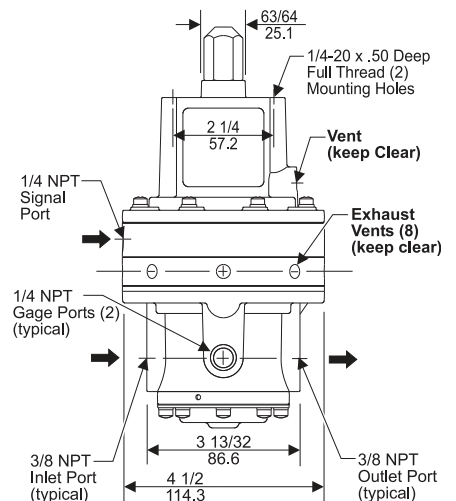
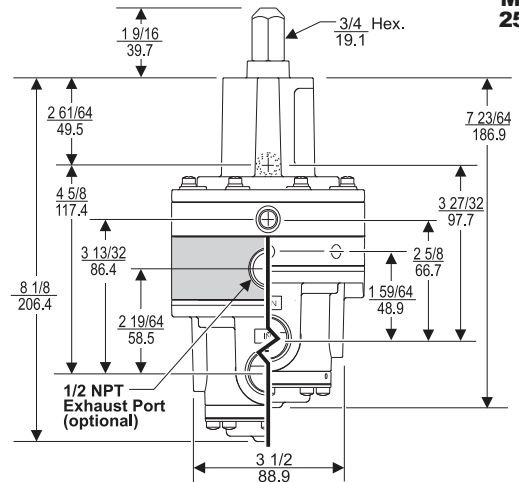


## Operating Principles

When you adjust the Range Screw to a specific setpoint, the Range Spring exerts a force against the top of the Diaphragm Assembly. The increasing input signal that acts on the Diaphragm Assembly opposes the Range Spring force and closes the Supply Valve to decrease output pressure. ( $P_o = K - P_s$ ); where  $P_o$  is output pressure,  $K$  is the spring constant, set by the screw, and  $P_s$  is signal pressure. The output pressure flows through the Outlet Port and the Aspirator Tube to the Control Chamber to create an upward force on the bottom of the Control Diaphragm.

When the setpoint is reached, the net downward force of the Diaphragm Assembly balances with the upward force of the output pressure that acts on the bottom of the Control Diaphragm to close the Supply Valve.

When the output pressure increases above the setpoint, the Diaphragm Assembly moves upward to close the Supply Valve and open the Exhaust Valve. When the Poppet Valve is closed, pressure flows down the Control Tube to the bottom of the Motor Diaphragm. This pressure keeps the Supply Valve tightly closed while in the exhaust mode. The Poppet Valve opens and excess output pressure exhausts through the Vent in the side of the unit until it reaches the setpoint.

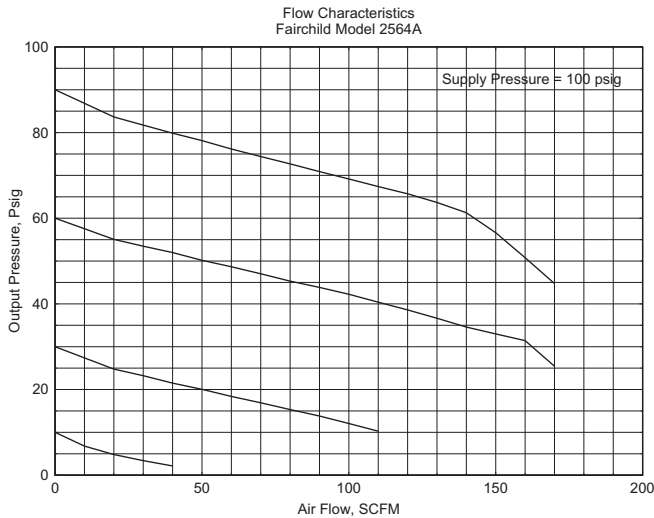


**D**

**Model 2500A**

# Model 2500A Biasing Reversing Relay

## Technical Information



## Specifications

### Maximum Supply Pressure

250 psig, [17.0 BAR], (1700 kPa)

### Maximum Signal or Output Pressure

150 psig, [10 BAR], (1000 kPa)

### Flow Capacity

150 SCFM (255 m<sup>3</sup>/HR) @ 100 psig, [7.0 BAR], (700 kPa) supply, 20 psig, [1.5 BAR], (150 kPa) setpoint

### Exhaust Capacity (SCFM)

40 SCFM (68 m<sup>3</sup>/HR) where downstream pressure is 5 psig, [.35 BAR], (35 kPa) above 20 psig, [1.5 BAR], (150 kPa) setpoint

### Supply Pressure Effect

Less than 0.1 psig, [.007 BAR], (0.7 kPa) for 100 psig, [7.0 BAR], (700 kPa) change in supply pressure

### Sensitivity

1" (2.54 cm) Water Column

### Ambient Temperature

-40°F to +200°F, (-40°C to 93.3°C)

### Materials of Construction

Body and Housing ..... Aluminum  
Trim ..... Zinc Plated Steel, Brass  
Diaphragms ..... Nitrile on Dacron

## Catalog Information

### Catalog Number

2 5   A

### Pressure Range

psig	[BAR]	(kPa)	
0.5-10	[0.03-0.7]	(3-0.7) .....	2
0.5-30	[0.03-2]	(3-200) .....	3
1-60	[0.1-4]	(10-400) .....	4
2-150	[0.15-10]	(15-1000) .....	6

### Pipe Size

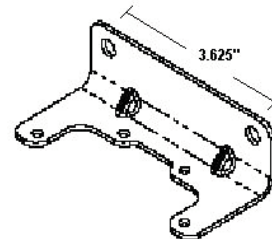
3/8" NPT .....	3
1/2" NPT .....	4
3/4" NPT .....	6

### Options

Tapped Exhaust ..... E

## Installation

For installation instructions, refer to the *Fairchild Model 2500A Multi-Stage Relay Installation, Operation, and Maintenance Instructions*, IS-3002500A.



20555-1

**Model 2500A Mounting Bracket Kit P/N**  
20555-1 zinc plated (sold separately)