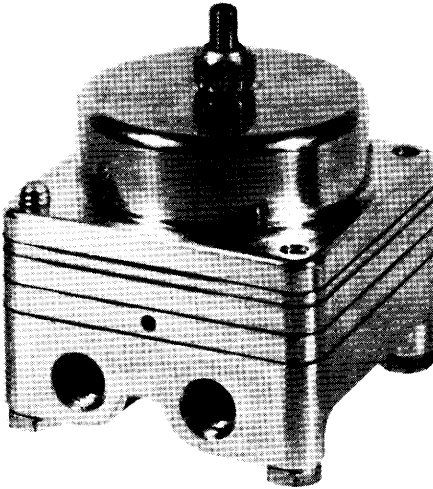


# INSTRUCTIONS

FOR

## INSTALLATION AND OPERATION



# Model No. CR102 REVERSING RELAY

## SECTION I — GENERAL INFORMATION

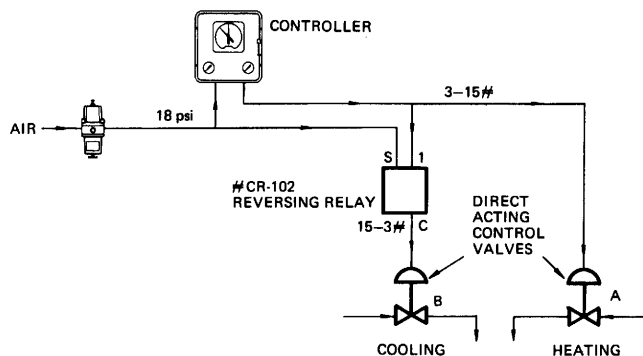
### A. Description

The CR-102 Reversing Relay is a proportional unit designed for use in industrial pneumatic control systems where the application requires delivery of a control (output) pressure which decreases in direct proportion to an increase in signal (input) pressure. In the region where "P<sub>1</sub>" varies between zero and "K", operation is described by the equation:

$$P_c = K - P_1 \text{ where } K = \text{Bias}$$

### B. Typical Application

Valve A closes and Valve B opens on rising signal from controller.



### C. Specifications

#### Design Data

**FUNCTION:** Delivers a decreasing control output with increasing signal input.

**OUTPUT PRESSURE RANGE:** 0–30 psig.

**SUPPLY PRESSURE:** Minimum: 10 psig above maximum output pressure.  
Maximum : 60 psig.

**OVERLOAD PROTECTION:** 100 psig will not damage unit.

**INPUT-OUTPUT RATIO:** 1:1 ± 3% of full range.

**AMBIENT TEMPERATURE LIMITS:** –40° F. to 180° F.

**CONNECTIONS:** 1/4" female NPT.

**WEIGHT:** 1.3 pounds.

(Specifications continued on Page Two)

*Robertshaw*

Industrial Products Division  
1602 Mustang Drive  
Maryville, Tennessee 37801  
Phone: (865) 981-3100 Fax: (865) 981-3168

INSTRUCTION MANUAL NUMBER

P-2170

## Performance Data

ULTIMATE SENSITIVITY: 0.1% of full range.  
REPEATABILITY: 0.25% of full range.  
LINEARITY: 0.5% of full range.  
HYSTERESIS: 0.5% of full range.  
MAXIMUM AIR CONSUMPTION: 3.0 SCFH.

AMBIENT TEMPERATURE EFFECT: Change in output for a 5 psig change in supply pressure – 0.5% of full range.

SUPPLY PRESSURE EFFECT: Change in output for a 5 psig change in supply pressure – 0.5% of full range.

## SECTION II – INSTALLATION

### A. General

Be sure that all pipe fittings used are clean, free of chips, dirt and moisture. If pipe compound or shellac is used, apply a small amount above the second or third male thread only. DO NOT GET PIPE COMPOUND OR SHELLAC INSIDE RELAY.

### B. Mounting

When installing the relay, do not remove the plastic plugs from the connections until ready to install fittings. Do not remove any metal pipe plugs!

The relay may be mounted in any position. Due to its size and weight, it may be supported

by the air lines. If more secure mounting is desired, use the mounting bracket furnished as shown in Figure 1. Use two 1/4" bolts, toggle bolts, or wood screws as required by the installation.

### C. Connections

All port openings are 1/4" female NPT. Make the air connections to the proper ports as shown in Figure 1 and the operational description.

NOTE: The supply pressure must be at least 10 psi more than the maximum desired control pressure.

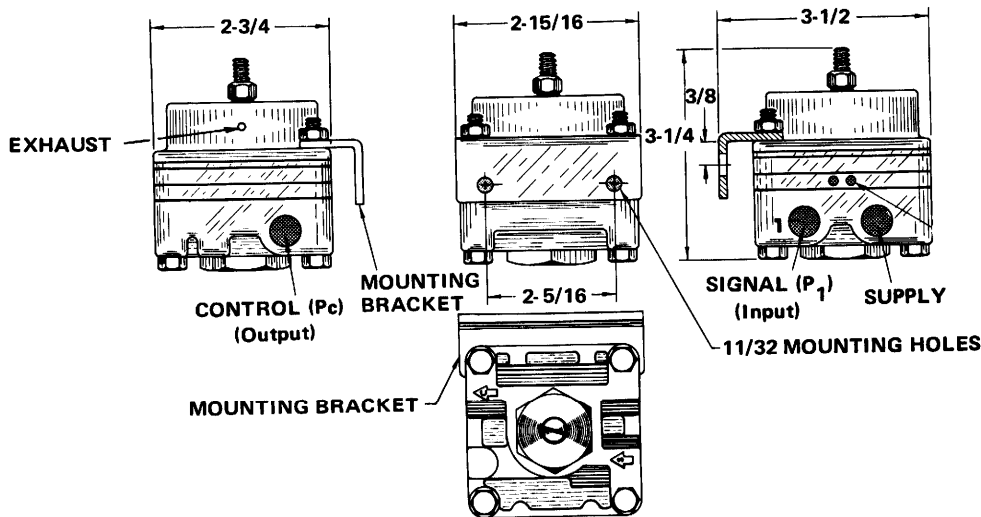


Figure 1

## SECTION III – OPERATION

Adjustment of the set-point spring determines the output of the control with zero signal pressure. The effective areas of the diaphragms are such that the pressures against the lower two cancel each other, and the effective area of the upper diaphragm is such as to give an upward force of one unit per unit of signal pressure.

For example (with a supply pressure of 40 psig and zero signal pressure), if the adjusting screw is turned clockwise, it compresses the spring, creating a downward force on the center

assembly and thereby on the valve. This downward pressure upon the valve opens the lower surface of the valve, admitting supply air into the control chamber. Assume that the spring was compressed until the control pressure was 30 psig. At this point, the upward force of the control pressure against the bottom diaphragm balances the spring force. This balancing force will return the center assembly to its original position, permitting the valve to close. The unit is now delivering 30 psig control pressure with zero signal pressure.

An increase of signal pressure to 10 psig acting on the effective areas of the diaphragms, will create an upward force. As a result, the center assembly will move upward, opening the upper surface of the valve and exhausting the control pressure until the upward force of the signal pressure (10) plus the upward force of the new control pressure (20) equals the downward force of the spring (30). The decrease in the control pressure will return the unit to balance, closing the exhaust portion of the valve. Further increase in the signal pressure will cause further decrease in the control pressure until, when the signal pressure is 30 psig, the control pressure will be zero.

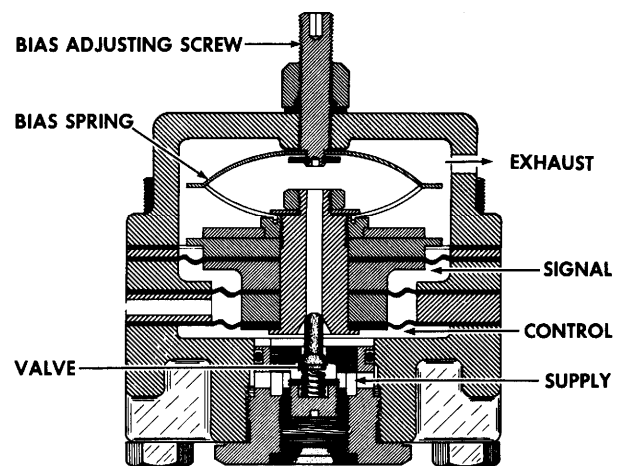


Figure 2

## SECTION IV — ADJUSTMENTS

1. VALVE SPRING (Refer to Figures 2 and 3)  
With Adjustable Seat (17) assembled into Cover (12), insert Valve (10) and Valve Spring (16) into Adjustable Seat (17). Turn Spring Retainer (15) into internal threads of Seat (17) until outer surface of Spring Retainer is approximately 1/16" below edge of Seat (17). Spring should just hold Valve (10) against seating surface "A" in Adjustable Seat (17). Seal Spring Retainer (15) to Adjustable Seat (17) with "Locktite."
2. RATIO OF SIGNAL TO CONTROL PRESSURE  
A. With the supply pressure at 40 psig and a sig-

nal pressure of 1 psig, adjust the Bias Adjusting Screw to obtain a control pressure of 29 psig. Increase signal pressure to 25 psig and check control pressure, which should be 5 psig  $\pm$  .9 psig.

- B. If necessary, remove Cap (13) and adjust Valve Seat (17) to correct the ratio.
- C. Repeat steps (A) & (B) until the correct ratio is obtained. The unit may be adjusted while operating with the Cap (13) removed, but the final setting must be checked after the Cap (13) has been replaced.

## SECTION V — MAINTENANCE

The simplified design of the relay makes routine maintenance unnecessary. However, should the air or the air lines be dirty, it may be necessary to clean the surfaces of the valve and the valve seats. If continued difficulty is experienced from dirt, moisture, oil, etc., suitable filters should be provided in the supply lines.

If the control pressure does not reduce properly, or if the exhaust appears to be leaking:  
See Figure 3

1. Remove the Cover by unscrewing from the Relay Base.
2. Disassemble the cover assembly as shown in Figure 3.
3. Using a CLEAN soft brush, cloth, or paper, wipe off Valve Seats A and B.
4. Inspect both hemispherical surfaces of Valve for dirt, chips, etc. If any scars or imperfections are apparent, the Valve should be replaced.
5. Reassemble the cover assembly as shown in Figure 3. Be sure the Valve Cover is tight. Following the procedure outlined in Section IV, adjust the Valve Seat, replace the Cap and check the Cap and Cover for leakage.

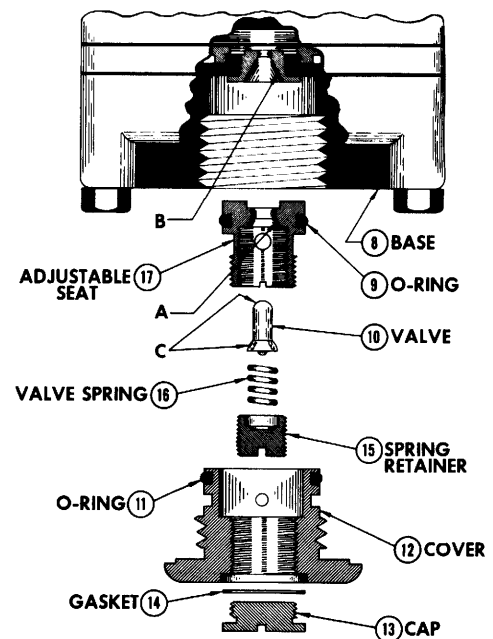


Figure 3

DO NOT USE ANY GASKET SHELLAC, PIPE COMPOUND OR OTHER SEALANT.

## SECTION VI – REPAIR

If the procedure outlined in Section V fails to restore proper operation, disassemble the relay as shown in Figure 4.

1. Inspect the air passages for dirt.
2. Inspect the Valve surfaces for bumps, scars or other irregularities. The hemispherical surfaces must be smooth and regular.
3. Inspect the valve seats (A and B in Figure 3). These surfaces must be clean and smooth with no scars or surface irregularities.
4. Inspect diaphragms for holes or worn spots which might permit air leakage.
5. Install the complete Cover assembly in the Base and make sure that the valve spring is seating the valve properly.
6. Replace any worn or defective parts and reassemble the relay. **DO NOT USE ANY GASKET SHELLAC, PIPE COMPOUND OR OTHER SEALANT!**
7. With Supply and Signal air pressures connected, check the unit for external leakage.

**CAUTION:** If cleaning is required, do not subject the diaphragms to cleaning fluids or solvents.

### Ordering Information

Order replacement parts by name and number from:

Your local branch office or  
 Fulton Sylphon Division  
 Robertshaw Controls Company  
 P. O. Box 400  
 Knoxville, Tennessee 37901

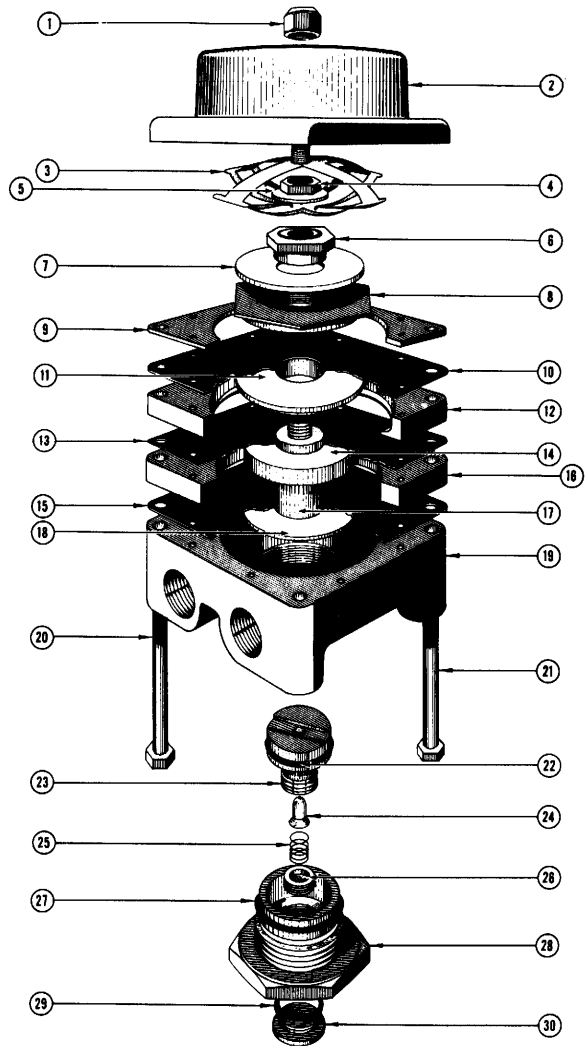


Figure 4

### Repair Parts

DETAIL	NAME	DETAIL	NAME	DETAIL	NAME
1	Lock Nut	11	Upper Diaphragm Ring	21	Screw
2	Cover	12	Pressure Plate	22	O-Ring
3	Spring Assembly	13	Diaphragm	23	Adjustable Seat
4	Hex Nut	14	Bottom Diaphragm Ring	24	Valve
5	Washer	15	Diaphragm	25	Valve Spring
6	Nut	16	Vented Plate	26	Spring Retainer
7	Washer	17	Exhaust Seat	27	O-Ring
8	Washer (Hex)	18	Support Ring	28	Cover
9	Spacer Plate	19	Base	29	Gasket
10	Diaphragm	20	Screw	30	Cap