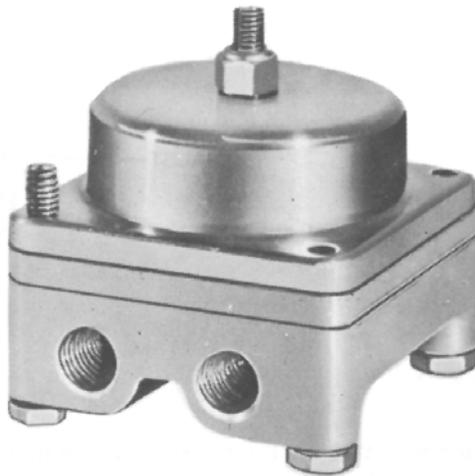


# INSTRUCTION MANUAL

## FOR

### Adjustable Bias Volume Booster Relay

# CR-101-A1



**Note to installer:** Before installing, read instructions carefully and record model number. After installing, give this manual to operating personnel or see that it is filed for future reference.

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INSTRUCTION MANUAL NUMBER

**P-2167**

Rev. A

**NOTES:**

# SECTION I - GENERAL INFORMATION

## A. DESCRIPTION:

The Model CR101-A1 Volume Booster Relay is a proportioning unit designed for use in pneumatic control systems where the application requires amplifying the volume of control air or biasing the control air pressure.

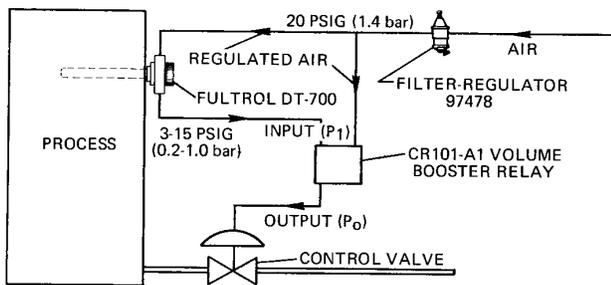
Equation:  $P_O = P_I \pm F_S$

Where  $P_O$  is the output pressure,  $P_I$  is the input pressure and  $F_S$  is the bias.

The relay components are made of steel and aluminum, and the diaphragms are Buna-N on nylon.

## B. TYPICAL APPLICATION:

Improves the response time of a control circuit by boosting the air volume from a simple "non-relay" controller to a control valve, and to shift ("bias") the signal range so as to get the best control valve action under the conditions of pressure and pressure drop within the valve.



## C. SPECIFICATIONS:

### DESIGN DATA

#### INPUT PRESSURE RANGE ( $P_I$ ):

0 to 20 psig (0 to 1.4 bar) nominal  
50 psig (3.5 bar) maximum

**SUPPLY PRESSURE** ..... 30 psig (2.1 bar) nominal  
60 psig (4.2 bar) Maximum  
(Should always be at least 10 psig (0.7 bar) greater than output pressure.)

**BIAS ADJUSTMENT ( $F_S$ )** .....  $\pm 18$  psig (1.2 bar)

**OVERLOAD PROTECTION** ..... 100 psig (7 bar) will not damage unit

**AMBIENT TEMPERATURE LIMITS** ..... -40° F to 180° F  
(-40° C to 82° C)

**CONNECTIONS** ..... 1/4" female NPT for input, output and supply, 1/16" NPT for exhaust

**WEIGHT** ..... 1.2 lb (0.54 kg)

### PERFORMANCE DATA

**ULTIMATE SENSITIVITY** ..... 0.1% of full range

**LINEARITY** ..... 1% of full range

**HYSTERESIS** .....  $\pm 0.3\%$  of full range

**REPEATABILITY** ..... 0.5% of full range

#### SUPPLY PRESSURE EFFECT:

Change in output pressure for 5 psig (0.35 bar) supply pressure change, less than 1% of full range

#### AMBIENT TEMPERATURE EFFECT:

Change in output for a 75° F (24° C) ambient temperature change, 0.5% of full range

**AIR CONSUMPTION** ..... 3.0 SCFH maximum

#### FOR MAXIMUM FLOW:

*Supply Output Capacity* ..... 3.0 SCFM nominal  
*Exhaust Output Capacity* ..... 5.0 SCFM nominal

**LOAD EFFECT (CONTROL AIR TO CAUSE 1 PSIG (0.07 BAR) PRESSURE DROP:** ..... 1.0 SCFM

**MINIMUM OUTPUT PRESSURE ( $P_O$ )** ..... 0 to 0.5 psig  
(0 to 0.03 bar)

## SECTION II - INSTALLATION

### A. GENERAL:

Be sure that all pipes and 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 "Caplugs" (plastic plugs) from the connections until ready to install fittings.

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. Bracket may be removed or inverted by removing lock nuts.

### C. CONNECTIONS:

The input, supply and output ports are 1/4" female NPT. The exhaust port is 1/16" NPT. Make the air connections to the proper ports as shown in Figure 1. The air supply must be clean, dry and regulated (use filter - regulator #97478) and must not exceed 60 psig (4.2 bar).

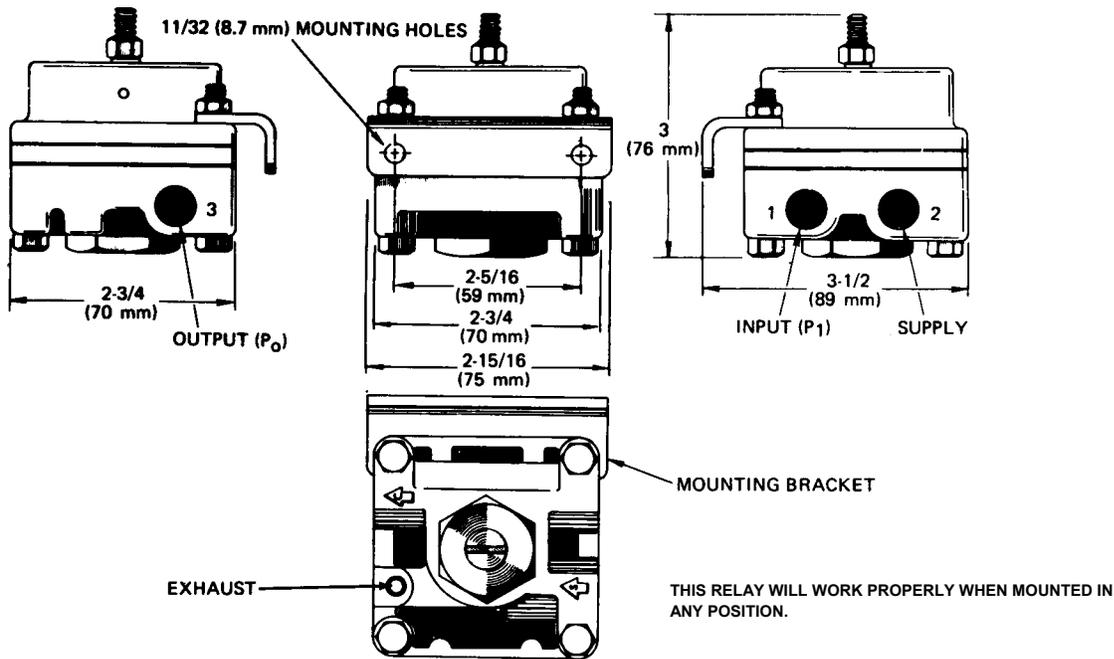


Figure 1

## SECTION III - OPERATION

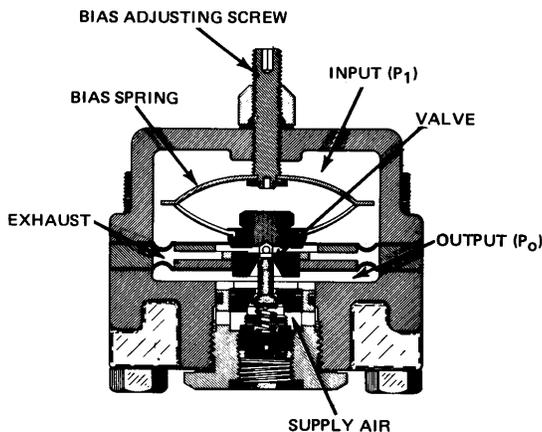


Figure 2

Air pressure in the input chamber exerts a downward force on the input diaphragm. This force moves the center assembly down, closing the exhaust valve. Further movement opens the lower portion of the valve allowing the supply air pressure to enter the output chamber. This air acts on the control diaphragm and also passes out through the output port. As the increasing output pressure approaches the input pressure, the center assembly will begin to rise, permitting the valve to close, throttling the flow of supply air. When the output pressure equals the input pressure, both surfaces of the valve will be closed and the relay will be in balance.

A further increase in the signal pressure will cause the lower portion of the valve to open until the output pressure again

equals the input pressure. A decrease in the input pressure will allow the output pressure to force the center assembly upward, opening the exhaust valve until the output pressure is equal to the input pressure.

To adjust the bias for an advanced or retarded output, turn the adjusting screw clockwise or counterclockwise respectively, to change the force exerted by the biasing spring.

## SECTION IV - ADJUSTMENTS

### A. BIAS ADJUSTMENT:

With normal supply pressure and input (signal) pressure applied, the Bias Adjusting Screw (Figure 2) may be turned clockwise to increase the output (control) pressure or counterclockwise to decrease output pressure.

### B. RATIO ADJUSTMENT:

The ratio of input to output pressure may be adjusted by adjusting Valve Seat (17) as follows (see Figure 3 except

where noted):

1. With a supply pressure of 30 psig and an input pressure of 3 psig, turn Bias Adjusting Screw (Figure 2) until output pressure is 3 psig. Increase input pressure to 15 psig and check output pressure, which should be  $15 \pm 0.2$  psig.
2. If necessary, remove Cap (24) and adjust Valve Seat (17) until the correct output pressure is obtained.
3. Repeat steps 1 and 2 until the correct ratio is obtained. This unit may be adjusted while operating with Cap (24) removed, but the final setting must be checked after the Cap (24) has been replaced.

## SECTION V - MAINTENANCE

The simplified design of this relay makes routine maintenance unnecessary. However, should the air or air lines be dirty, it may be necessary to clean the surfaces of the Valve (18) and the Valve Seats (A) and (B). 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 go below 0.5 psi with the Bias Spring (Figure 2) in the null position, or if the exhaust appears to be leaking (refer to Figure 3 except as noted) and follow the instructions below:

1. Remove the Cap (24) and Spring Retainer (20) by unscrewing from the Cover (22). Note position of Spring Retainer (20) before removing so that it can be replaced in approximately the same position. The Valve (18), Valve Spring (19) and Gasket (23) are now free to fall out. Be careful not to drop the parts.
2. Using a CLEAN, soft brush, cloth or paper, wipe off the Valve Seats (A) and (B).
3. Inspect both Hemispherical Surfaces (C) of the Valve (18) for dirt, chips, etc. If any scars or imperfections are apparent, the Valve (18) should be replaced.
4. Replace the Valve (18), Valve Spring (19), Spring Retainer (20), Gasket (23) and Cap (24). Be sure that the Spring Retainer (20) is in the same position as it was in before disassembly, approximately one turn below being flush with end of Adjustable Seat (17) and that the Cap (24) is tight. Check Cap (24) for external leakage.
5. Adjust per Section IV if needed.

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

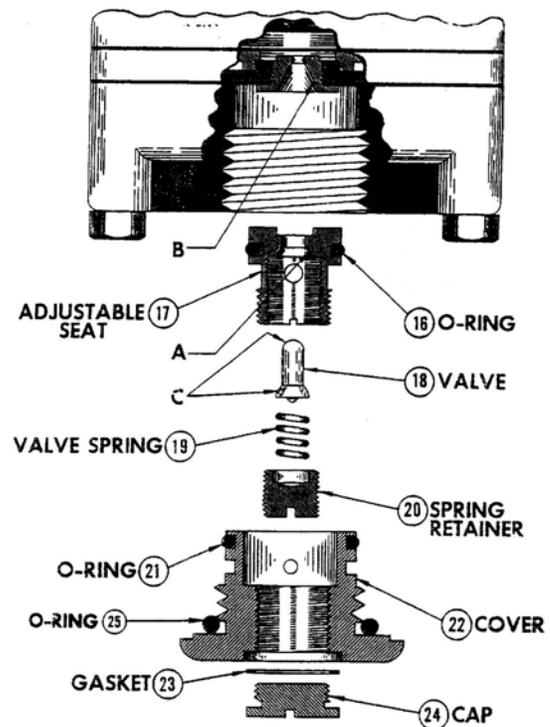


Figure 3

## SECTION VI - REPAIR

If the procedure outlined in Section V (MAINTENANCE) fails to restore proper operation, disassemble the relay as shown in Figure 4 (except as noted) and follow the instructions below:

1. Inspect air passages for dirt.
2. Inspect the Valve (18) surfaces for bumps, scars or other irregularities. The Hemispherical Surfaces (C in Figure 3) must be smooth and regular.
3. Inspect the Valve Seats (A and B in Figure 3) in the Base (15) and Exhaust Valve Plate (14). The surfaces must be clean and smooth with no scars or surface irregularities.
4. Inspect Diaphragms (6) and (13) for holes or worn spots which might permit air leakage.
5. Install the Valve (18), Valve Spring (19) and Spring Retainer (20) and make sure that the Valve Spring (19) is seating the Valve (18) 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 Input air pressure connected, check the unit for external leakage.
8. Follow procedure in Section IV (ADJUSTMENTS).

**CAUTION:** If cleaning is required, do not subject the Diaphragms (6) and (13) to cleaning fluids or solvents.

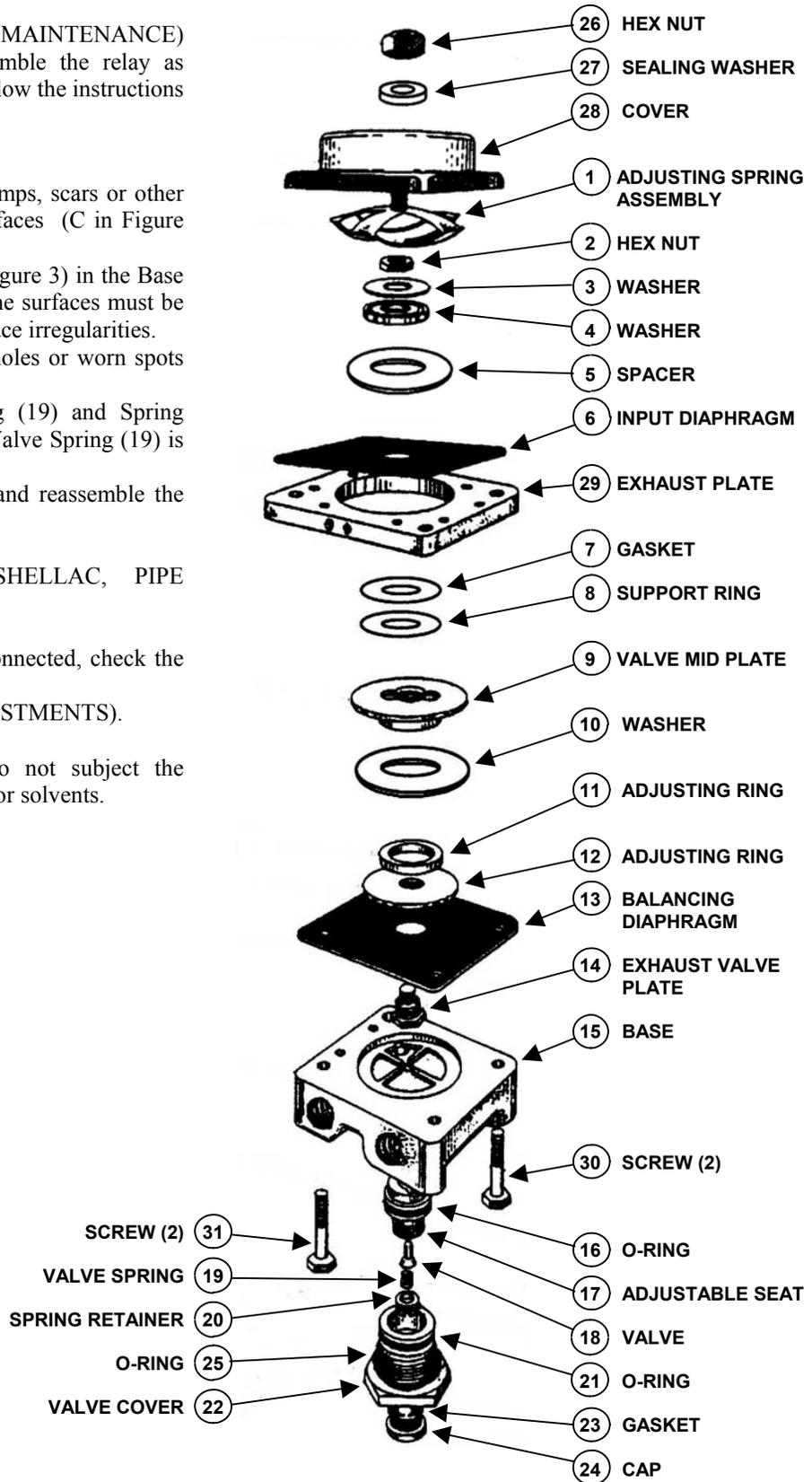


Figure 4

REPAIR PARTS			
ITEM	DESCRIPTION	PART NUMBER	QUANTITY
*	EXHAUST SEAT ASSEMBLY (contains items 1 thru 14)	081033F0001	1
1	ADJUSTING SPRING ASSEMBLY	081249A0001	1
2	HEX NUT, 1/4-20	027939A0001	1
3	WASHER	027947A0001	1
4	WASHER	027946A0001	1
5	SPACER	029533A0001	1
6	INPUT DIAPHRAGM	027932B0001	1
7	GASKET	027944A0001	1
8	SUPPORT RING	027943A0001	1
9	VALVE MID PLATE	027600C0001	1
10	WASHER	029360A0001	1
11	ADJUSTING RING	029185A0001	1
12	ADJUSTING RING	027677A0001	1
13	BALANCING DIAPHRAGM	027588B0001	1
14	EXHAUST VALVE PLATE	027935A0001	1
15	BASE	027668C0001	1
*	VALVE ASSEMBLY (contains items 16 thru 22)	081650A0001	1
16	O-RING	036240N0014	1
17	ADJUSTABLE SEAT	029352A0001	1
18	VALVE	026059C0001	1
19	VALVE SPRING	029359A0001	1
20	SPRING RETAINER	029354A0001	1
21	O-RING	036240N0018	1
22	VALVE COVER	029353A0001	1
*23	GASKET	029356A0001	1
*24	CAP	029355A0001	1
*25	O-RING	036240N0119	1
*26	HEX NUT, 1/4-28	036602A1800	1
*27	SEALING WASHER	037723A0001	1
28	COVER	027930A0001	1
29	EXHAUST PLATE	028571B0008	1
30	CAP SCREW, 1/4-20 X 1-1/2	036617E2600	2
31	CAP SCREW, 1/4-20 X 1-3/4	036617E2800	2
32	MOUNTING BRACKET (not shown)	029139A0001	1
33	HEX NUT, KEPS, 1/4-20 (not shown)	036603A0019	2

Note: A Repair kit, part number 083405A0001, is available for rebuilding relay.  
The Repair kit contains parts marked thus \*.



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