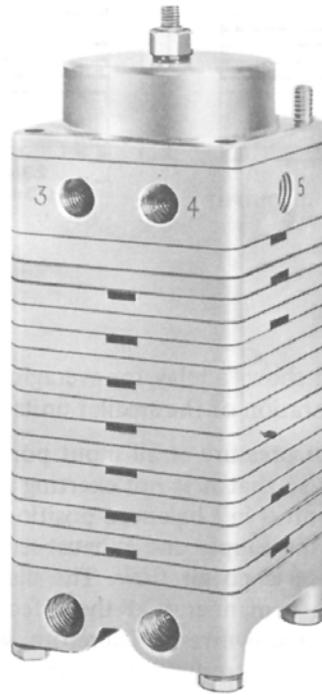


INSTRUCTION MANUAL

FOR

Averaging Relay

CR-103-A



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-2172

Rev. A

NOTES:

SECTION I - GENERAL INFORMATION

A. DESCRIPTION:

The Model CR-103 Averaging Relays are proportioning units designed for use in industrial pneumatic control systems where the application requires averaging 2, 3, 4, 5, 6 or 7 input pressure signals to obtain one output pressure signal.

For example: Where two or more transmitters (or controllers) are measuring a common variable, the output pressures of the transmitters (or controllers) can be averaged according to the equation:

$$\text{Output pressure of Averaging Relay} = \frac{\text{Sum of input pressure signals} \pm \text{spring bias}}{\text{Number of input pressure signals}}$$

Unused ports must be left open to atmospheric pressure.

B. DESIGN DATA:

INPUT PRESSURE RANGE:

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

OUTPUT PRESSURE RANGE:

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: ± 18 psig (1.2 bar) divided by the number of input signals

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

WEIGHT:

2 input signals 2 lb. (0.91 kg)
7 input signals 3.5 lb. (1.59 kg)

C. PERFORMANCE DATA

ULTIMATE SENSITIVITY: 0.1% of full range

LINEARITY: 1% of full range

HYSTERESIS: Less than 1% 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: 6.0 SCFH maximum

FOR MAXIMUM FLOW:

Supply Output Capacity 3.0 SCFM nominal
Exhaust Output Capacity 3.0 SCFM nominal

D. MODEL NUMBER DESCRIPTION:

MODEL NUMBER	INPUT
CR103-A2	2 Signals
CR103-A3	3 Signals
CR103-A4	4 Signals
CR103-A5	5 Signals
CR103-A6	6 Signals
CR103-A7	7 Signals

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

C. CONNECTIONS:

The input, supply and output ports are 1/4" female 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).

DIMENSIONS

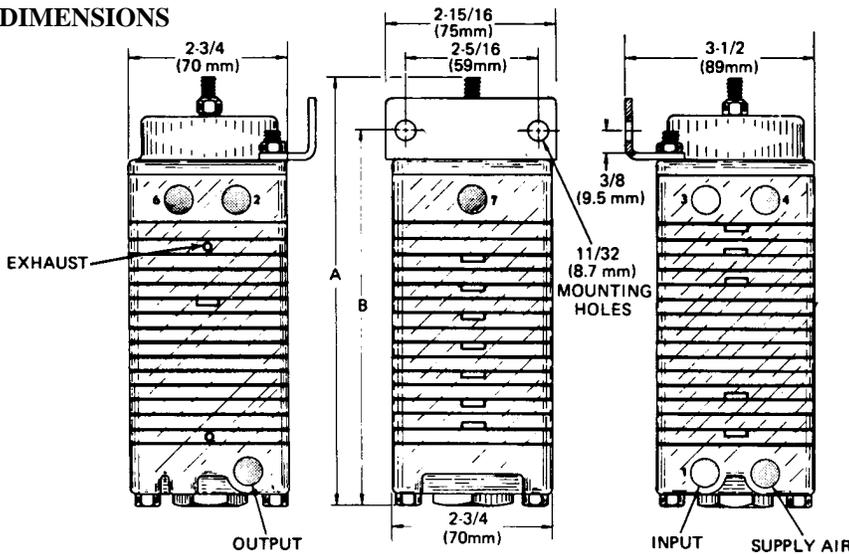


Figure 1

NUMBERED PORTS ARE INPUT SIGNAL CONNECTIONS

DIMENSIONS

MODEL NO.	A	B
CR103-A2	4-7/8" (124 mm)	4" (102 mm)
CR103-A3	5-3/8" (137 mm)	4-1/2" (114 mm)
CR103-A4	5-7/8" (149 mm)	5" (127 mm)
CR103-A5	6-3/8" (162 mm)	5-1/2" (140 mm)
CR103-A6	6-7/8" (175 mm)	6" (152 mm)
CR103-A7	7-3/8" (187 mm)	6-1/2" (165 mm)

SIGNAL PORT 5 IS ON THE FACE OPPOSITE PORT 7

SECTION III - OPERATION

OPERATION:

The illustration (Figure 2) shows a relay for averaging 7 input pressure signals. The operation of the smaller units is similar.

With zero input pressure at all input ports and the biasing spring adjusted so that it is not exerting any force in either direction, the unit is in a balanced position. In this balanced position, both the supply and exhaust seats of the valve are closed and there is no air flow. The diaphragm areas are related in such a manner that the effected force of any input pressure is downward. Therefore, with the unit in a balanced position, introduction of any input pressure will create a downward force which will move the center assembly down, opening the supply seat of the valve and permitting supply air pressure to flow into the output chamber. This output pressure is channeled into all of the balancing chambers. The diaphragms of the balancing chambers are related so that this output air pressure creates an upward force. As the output pressure approaches the average input pressure, the center

assembly will be returned to the balanced position, permitting the supply seat of the valve to close, throttling the flow of supply air.

Should any or all of the input pressure decrease, the upward force of the output pressure would be greater than the downward force of the input pressures. Then the center assembly would move upward, opening the exhaust seat and thereby exhausting the output air until the decreased output pressure again balances the input pressures.

The spring assembly permits biasing the output pressure to a maximum of ± 18 psig (1.2 bar) divided by the number of inputs. In the 6 input signal relay, this means that the output pressure may be biased ± 3 psig (0.21 bar). In the 2 input signal relay, it may be biased ± 9 psig (0.62 bar). This is accomplished by turning the adjusting screw in the top of the assembly to either extend or compress the spring.

SECTION IV - ADJUSTMENTS

A. BIAS ADJUSTMENT:

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

B. RATIO ADJUSTMENT:

This is not a normal operating adjustment. However, when necessary, 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 (2.1 bar) and an input pressure of 3 psig (0.21 bar) on each input port, turn Bias Adjusting Screw (Figure 2) until output pressure is 3 psig (0.21 bar). Increase all input pressures to 15 psig (1.03 bar) and check output pressure, which should be 15 ± 0.2 psig (1.03 ± 0.01 bar).
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.

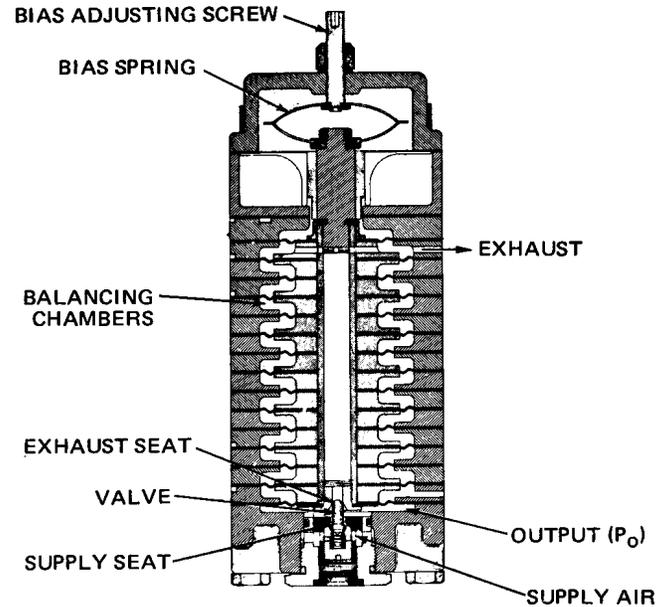


Figure 2

SECTION V - MAINTENANCE

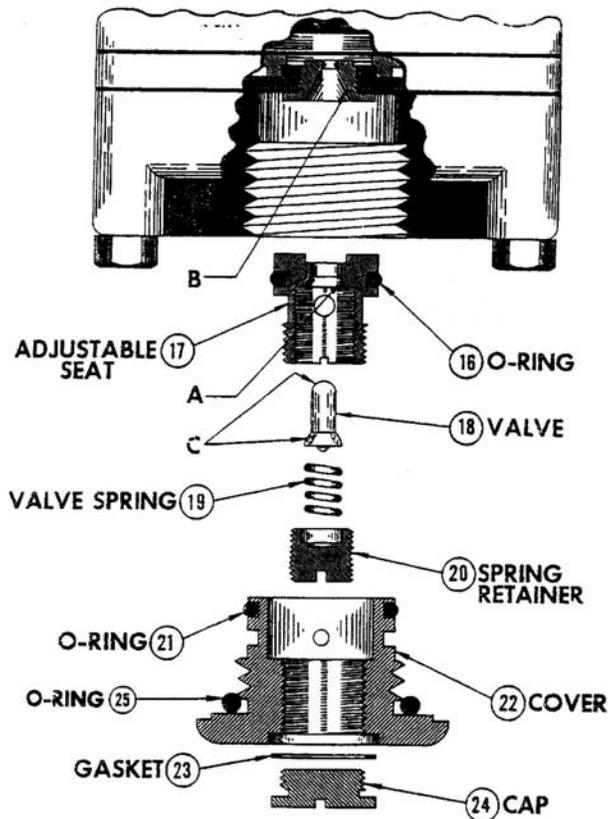


Figure 3

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 to minimum output pressure or zero, or if the exhaust appears to be leaking, follow the instructions below (refer to Figure 3 except as noted):

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.

SECTION VI - REPAIR

If the procedure outlined in Section V (MAINTENANCE) fails to restore proper operation, it is recommended that the relay be returned to the factory for repair due to the critical orientation of the components. Contact the factory or a factory representative for instructions on returning the relay.

If the relay is to be repaired in the field the order in which the plates and gaskets were assembled, and the orientation of those parts, must be noted so that they may be reassembled correctly. Repair kits are available as specified below.

To repair the relay, 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). The surfaces must be clean and smooth with no scars or surface irregularities.
4. Inspect Diaphragms (29 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 pressures connected, check the unit for external leakage.
8. Follow procedure in Section IV (ADJUSTMENTS).

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

REPAIR KITS	
RELAY MODEL NO.	REPAIR KIT PART NUMBER
CR-103-A2	083405B0006
CR-103-A3	083405B0005
CR-103-A4	083405B0004
CR-103-A5	083405B0003
CR-103-A6	083405B0002
CR-103-A7	083405B0001

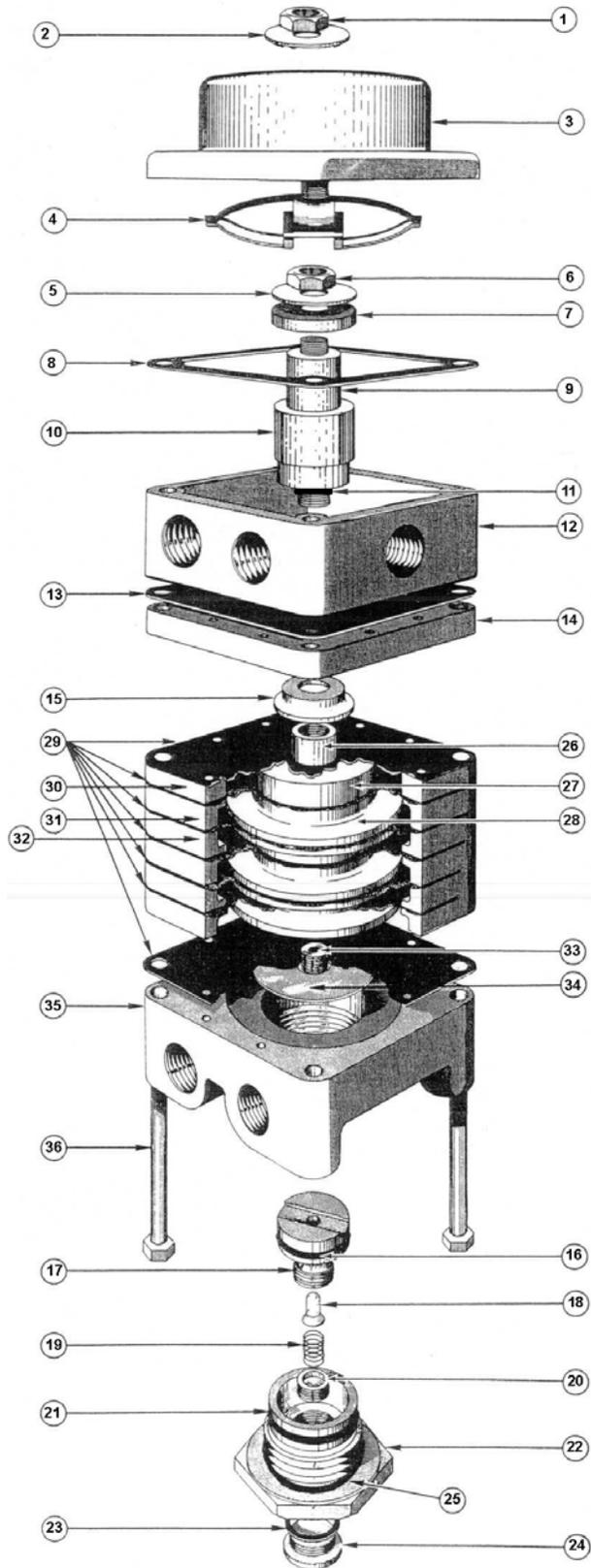


Figure 4

REPAIR PARTS			
ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1*	HEX NUT, 1/4-28	036602A1800	1
2*	SEALING WASHER	037723A0001	1
3	COVER	027930B0001	1
4	ADJUSTING SPRING ASSEMBLY	081249A0001	1
5	WASHER	027947A0001	1
6	HEX NUT, 1/4-20	027939A0001	1
7	WASHER	027946A0001	1
8*	GASKET	028566A0001	1
9	STEM	028559A0001	1
10	SPACER	029707B0001	1
11*	O-RING	036240N0010	1
12	MULTIPLE INPUT CASE	028562A0001	1
13*	GASKET	028567A0001	1
14	TRANSFER PLATE	029716A0001	1
15	TOP SPACER	028555A0001	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	TUBE	SEE TAB	1
27	EXHAUST RING	029715A0001	1
28	DIAPHRAGM RING	031766A0001	SEE TAB
29*	BALANCING DIAPHRAGM	028561A0001	SEE TAB
30	EXHAUST PLATE	027929A0002	2
31	PRESSURE PLATE	028571A0001	SEE TAB
32	PRESSURE PLATE	028569A0001	SEE TAB
33*	EXHAUST SEAT	028557A0001	1
34	SUPPORT RING	028565A0001	1
35	BASE	027668C0001	1
36	SCREW	SEE TAB	4
37	HEX NUT, KEPS, 1/4-20 (not shown)	036603A0019	2
38	MOUNTING BRACKET (not shown)	029139A0001	1
39	PIPE PLUG, 1/4 NPT (not shown)	028564A0001	SEE TAB
40	PIPE PLUG, 1/16 NPT (not shown)	525GD001	1

Note: Repair kits are available for rebuilding relay.
Repair kits contain parts marked thus *.

TABULATION							
MODEL	DETAIL						
	26	28	29	31	32	36	39
CR-103-A2	028556A0006	3 reqd	5 reqd	2 reqd		036617E3600	5 reqd
CR-103-A3	028556A0005	5 reqd	7 reqd	4 reqd		036617E3800	4 reqd
CR-103-A4	028556A0004	7 reqd	9 reqd	5 reqd	1 reqd	036617E3900	3 reqd
CR-103-A5	028556A0003	9 reqd	11 reqd	7 reqd	1 reqd	036617E4000	2 reqd
CR-103-A6	028556A0002	11 reqd	13 reqd	8 reqd	2 reqd	036617E4100	1 reqd
CR-103-A7	028556A0001	13 reqd	15 reqd	9 reqd	3 reqd	036617E4200	



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