1-1 Instruction
The W.E. Anderson electro-pneumatic positioner is adaptable for most any environment and can be used in conjunction with the full range of W.E. Anderson pneumatic actuators. The electro-pneumatic positioner is designed to receive an electronic signal and provide an output for a specific angle of rotation.

2-1 Storage
If the positioner is to be stored for an extended period of time before use it is essential that the positioner be stored in a location subject to moderate temperatures and free of moisture.

3-1 Positioner Mechanical Operation

![Figure 1]

Positioner Operation Diagram

The 200E positioner consists of (see figure 1) a nitrile rubber diaphragm (24) exposed to the internal 3-15 psi pneumatic signal supplied by the internal I/P transducer, the mechanical action of a feedback spring (37) and a double acting spool valve (34) connected to the diaphragm by the lever (32) and rod (35) assembly. When the current signal sent to the I/P transducer is increased the air pressure in the diaphragm chamber (39) is increased by a proportionate amount. Conversely a decrease in input current will result in a lowering of pressure in the diaphragm chamber (39). As the diaphragm (24) moves back and forth there is a resultant force exerted on the rod (35) and lever (32) assembly. The output shaft is linked to the cam which rotates causing the hinge (33), lever (32), and feedback spring (37) assembly to increase the opposing force on the diaphragm (24). When the two forces are equal (ie: the actuator has rotated to the angle which corresponds to the pneumatic input) the actuator will come to rest. The actuator stem therefore will remain in a stable position only as long as the feedback spring's (37) force is equal to the air signal force on the
diaphragm (34). This action moves the spool valve (34) into the neutral position maintaining the existing pressure in the actuator chambers.

3-2 Positioner I/P Operation

The I/P transducer mechanism creates a pneumatic signal using a flapper/nozzle system. The input current flowing through the coil (51) magnetizes the soft iron yoke (52) forming lines of flux in between the iron yoke gap (53) which applies a proportional force on the permanent magnet (54). As the input current goes up so does the magnetic force generated by the soft iron yoke (52). This force variation causes the up and down motion of the flapper/nozzle assembly.

The key component in this system is the flapper/nozzle assembly. The flapper consists of a rectangular shaft (55) and a permanent magnet (54) connected to one end of the shaft. The shaft (55) is affixed to the fulcrum (which allows for free rotation) in the center to allow for a force balance to be created between the magnetic field and the air pressure coming from the nozzle (56). Note: as the magnetic force increases the flapper becomes increasingly stiff tightening the air restriction at the nozzle.

The air enters the I/P transducer through the air restriction port (50) pressurizing the I/P diaphragm chamber (49). The opposite side of the diaphragm is exposed to the pressure generated by the flapper/nozzle system and the force generated by the calibration spring (59). (Which is designed to oppose the input air pressure.)

Air will be flowing from the nozzle (56) and pushing against the flapper (55). As the input current increases the flapper will be held tightly against the lip of the nozzle limiting the amount of air that may flow from the nozzle. When the flow is limited the pressure will increase in the nozzle area. As the pressure increases (in the nozzle area) the pressure on the I/P diaphragm (58) will also increase. Conversely if the input current decreases the effective pressure on the I/P diaphragm (58) will decrease. This diaphragm (58) motion controls the pressure sent to the positioner diaphragm (24). The pressure the I/P mechanism supplies to the positioner diaphragm (24) will be between 3 and 15 psi. (Based on the 4-20 mA user supplied input.) This output pressure will allow the positioner to operate as a standard pneumatic positioner.

The I/P mechanism has been calibrated to generate a linear output signal so that there is a linear relationship between the I/P output and the rotations of the actuator. (eg. If the actuator is open to 45° the I/P input will be 12 mA, at the mid point of the range.)

4-1 Installation

1. Place the bracket on top of the actuator making sure that the long axis of the bracket is parallel with the long axis of the actuator. Insert 4 mounting screws and hand tighten.
2. Place positioner on top of bracket and insert positioner shaft into actuator output shaft. Note: if you are using a coupling install coupling prior to shaft insertion. Remove polycarbonate cover and insert and hand tighten all 4 fasteners. Align positioner and
actuator and tighten mounting hardware. Note: The W.E. Anderson actuator has a NAMUR shaft eliminating the need for coupling.

![Figure 3](image)

**Figure 3**
Gauge & Supply Manifold

3. Hose Connections: Connect Output port 1 (on the positioner see figure 3) to port B (on the actuator see figure 4.a & 4.b) and Output port 2 to port A. Note: Use hoses and fittings that are rated for at least 170 psi.

4. Connect air supply to positioner.

| Caution: | The supply air to the positioner must have Filter and Regulator set with at least a 5 Micron filtering capability. We recommend our Part Number F221 or F451 Air Filters. |

5. Place gauges on the gauge ports. Gauge ports 1 and 2 should have a gauge with a pressure range of 0-160 psi and gauge 3 (Note: this gauge will be located on the I/P transducer case) should have a pressure range of 0-30 psi. If gauges are not available or are not desired it is possible to place 1/8” NPT plugs on the gauge ports. Note: Use brass or stainless steel plugs whenever possible.

6. Remove I/P Cover. Connect 1/2” conduit connector to I/P housing. Conduit must contain 2 wires for I/P signal. Attach signal wires to appropriate terminal block. Note: terminal blocks designate correct locations for positive and neutral wires see figure 5. Replace I/P cover.

![Figure 5](image)

**Figure 5**
I/P Transducer Terminal Blocks

4-2 Positioner Calibration:
The W.E. Anderson positioners come pre-calibrated and should not require any adjustment.

1. Turn on air to Positioner. Note: Only one air supply is required to operate the actuator and I/P transducer.

2. Set signal (to I/P transducer) at 4.5 mA (or minimum input signal +3%). The actuator should move to approximately 3° of rotation. (Even if the actuator has not rotated to the appropriate rotation continue to step 3 to adjust the range.)

3. Increase the input signal to 20 mA (or maximum input signal) and observe the amount of rotation. If the actuator has moved the valve to 90° the range is set correctly (if a rotation other than 90° is obtained proceed to step 4). If the range is now correctly set you may proceed to step 5.

4. When a rotation other than 90° is obtained it is necessary to adjust the range. The range is adjusted by changing the number of spring turns in the feedback spring and is accomplished by the following method:

   a. This range adjustment has a high degree of variation (approximately 40% of the total range). Rotating the nut (36) (see figure 1) will change the total number of usable spring turns (see figure 1) thereby increasing or decreasing the set point of the total spring force exerted on the system. If the range needs to be increased (ie: the rotation of the valve does not reach 90°) then the nut (36) will be rotated in the counter clockwise direction. To decrease the range (ie: the rotation of the valve is greater than 90°) rotate the nut (36) clockwise. When you have determined the type of adjustment needed rotate the nut (36) until the valve has rotated to exactly 90°. After correctly setting the range proceed to step 5 to recheck the zero position.
5. When the range has been set correctly it is necessary to recheck to zero position. The zero set point of the positioner is adjusted by one of the following two methods:
   a. Adjustment of the zero position nut (38).
   b. Changing the position of the runner (30) on the hinge lever teeth.

Set the signal to 4.5 mA (or the minimum input signal plus 3%). The valve should now be approximately 3° open. (Note: the signal is set to 4.5 mA instead of 4.0 mA to avoid an improper calibration due to frictional effects.) If this rotation is not 3° (±0.5°) then it is necessary to adjust the zero position. Loosen the lock nut (78) and rotate the zero setting nut (38). (Note: if the necessary adjustment is small, within 1°, you may use the runner (30) (see figure 1) teeth.) Clockwise rotation will increase the pretension of the spring (ie: the valve has not reached 3° of rotation) raising the zero setting. Counter clockwise rotation (ie: the valve has rotated more than 3°) will lower the zero setting. When you have successfully set the zero position be sure to return to step 3 to verify that all calibration is still correct.

6. After the range and zero have been set it is necessary to check the linearity of the system. Set the signal to 12 mA (or the mid point of your particular range) and view the amount of rotation of the actuator. The actuator should be at the mid point of the travel. (45° for standard operation.) If the actuator is not correctly positioned recheck the preset zero and range to be sure they are set correctly.

5-1 Reverse Rotation:
The 200E positioner can be used with both fail clockwise and fail counter clockwise actuators. This convertibility will allow an increased signal to lead to counter clockwise rotation or clockwise rotation depending on the cam orientation. When a fail counter clockwise actuator is to be used it is necessary to make some minor alterations to the positioner.

1. Remove red indicator. Note: The positioner indicator is press fitted.
2. Remove locking screw (44) and locking plate (43). (see figure 5)
3. Remove the cam (41). Remove 3 cam set screws (42). Turn cam over. Note: The standard side of the cam will have the letter D in the corner designating direct action. The reverse side of cam will have a the letter R in the corner designating reverse action. Reinstall cam set screws (42) in new orientation.
4. Place cam (41) on top of shaft assembly in desired orientation. Replace locking screw (41) and locking plate (43). Note: Be sure that the NAMUR shaft is rotated to the proper position.
5. Recalibrate positioner according to section 4-2.

6-1 Cam Description:
The W.E. Anderson positioner cam is designed to be used for two different types of applications.

<table>
<thead>
<tr>
<th>Shape</th>
<th>Working Angle</th>
<th>Signal range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0° - 90°</td>
<td>4-20 mA</td>
</tr>
<tr>
<td>2</td>
<td>0° - 65°</td>
<td>4-20 mA</td>
</tr>
</tbody>
</table>

This third shape of the cam can be used if a current input signal of 4-12 mA or 12-20 mA is available. This input signal would yield a pressure range of 3-9 psi or 9-15 psi.

7-1 Maintenance
The W.E. Anderson positioner is designed to require very little maintenance. In the event that the positioner is not functioning properly it may be necessary to perform minor repairs. The unit can be returned to the factory for warranty repair if the warranty period has not expired. Repairs for the 200E in or out of warranty are done on a repair/exchange basis. All units returned for repair are to be shipped freight prepaid to:

Dwyer Instruments, Inc.
102 Hwy 212
Michigan City, IN 46361
Attention Repair Department

7-2 Spool Valve Repair
1. Disconnect the feedback spring (37) (see figure 1) from the lever (32).
2. Remove the spring retaining screw (66) and retaining spring (63) from lever (32) and spool slot.
3. Loosen (do not remove) magnet set screw (67). Separate the magnet (61) and the spool (34) and extract the spool (34) out of the left side of the Spool valve housing (62).
4. The spool (34) may be cleaned with a soft cloth or paper towel.

   Caution: Do not use abrasive material to clean the spool. Damage to the spool can result in air leakage.

5. If the spool valve body (10) appears to contain debris it may be removed using the following procedure. If the spool valve body (10) appears to be reasonably clean proceed to step 6.
   a. Remove the manifold screws (25) from the manifold block (11). (see section 10-1 for parts list). Note: Be sure to disassemble the magnet (61) and spool (34) assembly before the manifold block (11) is extracted. Extract the manifold block (11) and spool valve housing (62) (Note: these 2 pieces are 1 casting) through the top of the positioner.
b. Remove the spool valve body (10) retaining screw from the spool valve housing (62). Slide the body out the left side of the housing. Use a soft cloth to clean the interior of the body. Do not use any abrasive instruments to clean the spool valve body (10).

c. Slide spool valve body (10) back into housing. Be sure to orient the body correctly during insertion. Replace the retaining screws. Insert Manifold block (11) into top of positioner. Install the manifold screws (25).

6. Insert spool (34) into spool valve body (10) (note: make sure that the spool is oriented correctly) and replace retaining spring (63) and retaining spring screw (66). Note: be sure not to overtighten the retaining spring screw. Tighten magnet set screw (67).

![Figure 7: Spool Valve Disassembly Diagram]

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8-1 Trouble Shooting

No matter how well the equipment is designed and manufactured, there may be times when servicing will be required due to normal wear, the need for adjustment, or various external causes. Whenever equipment needs attention, the operator or repairman should be able to locate the cause and correct the trouble quickly. The trouble shooting chart below is provided to assist the mechanic in those respects.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The actuator does not respond to</td>
<td>1. Excessive friction in actuator or positioner coupling assembly.</td>
<td>1. Recheck coupling arrangement for possible binding points.</td>
</tr>
<tr>
<td>moderate signal variations</td>
<td>2. Blockage in spool valve body or spool.</td>
<td>2. Check air filter (5 micron) for anomalies. Note: If air appears to be clean check for cleanliness of spool by the procedure outlined in section 5-1.</td>
</tr>
<tr>
<td></td>
<td>3. Air leakage in control signal or diaphragm seal.</td>
<td>3. Check air connections and diaphragm assembly as described in section 6-1.</td>
</tr>
<tr>
<td>Instability or oscillation of the</td>
<td>1. Undersized actuator</td>
<td>1. Increase actuator size</td>
</tr>
<tr>
<td>actuator connected to the positioner</td>
<td>2. High moment of inertia of valve.</td>
<td>2. Place flow control device between the positioner and the air supply.</td>
</tr>
<tr>
<td>Delayed Response Time</td>
<td>1. Undersized spool valve</td>
<td>1. Use High Flow spool valve</td>
</tr>
<tr>
<td></td>
<td>2. Undersized hoses</td>
<td>2. Use Hoses and fittings with an internal diameter of at least 1/4&quot;</td>
</tr>
<tr>
<td>Difficulty in attaining proper</td>
<td>1. Loose Hardware</td>
<td>1. Check all mounting hardware</td>
</tr>
<tr>
<td>calibration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>