Valtek XL Series High-Performance Positioner

GENERAL INFORMATION

This bulletin is designed to assist in installing, calibrating, troubleshooting and performing maintenance as required for the Valtek® XL Series high-performance positioner.

Product users and maintenance personnel should thoroughly read and strictly follow the instructions contained in this bulletin prior to operating the positioner. Any questions concerning this product should be directed to a Flowserve representative.

To avoid possible injury to personnel or damage to valve parts, WARNING and CAUTION notes must be strictly followed. Modifying this product, substituting non-factory parts or using maintenance procedures other than outlined could drastically affect performance and be hazardous to personnel and equipment.

The XL high-performance positioner is a two-stage device and is designed for use in control loops where fast response is required. The XL positioner is designed to be modular and use the P/P module for 3-15 psi input signal or the NT 3000 Series Transducer Module for 4-20 mA input signal.

The XL high-performance positioner is designed as a four-way device, but can easily be converted to a three-way device by plugging one of the output ports.

NOTE: The XL high-performance positioner must use the I/P NT 3000 Transducer. The I/P 2000 Transducer is not acceptable for use with the XL Series Positioner.

The XL positioner can handle supply pressures up to 150 psi; thus, a supply regulator is usually not required. However, *a five micron air filter is required for pneumatic positioners and a coalescing filter is required for I/P positioners.*

NOTE: The air supply should conform to ISA Standard S7.3 (a dew point at least 18° F / -8° C below ambient temperature, particle size below 5 microns, oil content not to exceed one part per million).

The XL Series positioner features an adjustable gain of 400-1100:1. The medium gain setting is standard on size 25 actuators, while the high gain setting is standard on size 50 and larger actuators (refer to 'Gain Adjustment Procedure' section for further details.)

All positioners come with one of two types of cams: a linear characteristic cam for use on linear actuators or a combination linear / modified equal percentage characteristic cam for rotary actuators. Refer to the 'Rotary Actuator Cam Characteristic' chart on page 4 for specific installed characteristics.

POSITIONER OPERATION

The positioner schematic (Figure 1) shows an XL Series positioner connected for double-acting service on a linear actuator. Tension on the feedback spring provides feedback to the positioner, which varies as the stem position changes. The spring-loading force is applied through the feedback linkage and cam to the positioner's input capsule.

Instrument signal pressure is applied between the diaphragms in the input capsule. Therefore, the input capsule serves as a force-balance member, matching the valve stem position (as measured by tension on the feedback spring) to the instrument signal.

When the opposing forces balance exactly, the system will be in equilibrium and the stem will be in the exact position called for by the instrument signal. If the opposing forces are not in balance, the input capsule will move up or down and, by means of the pilot-valves, will

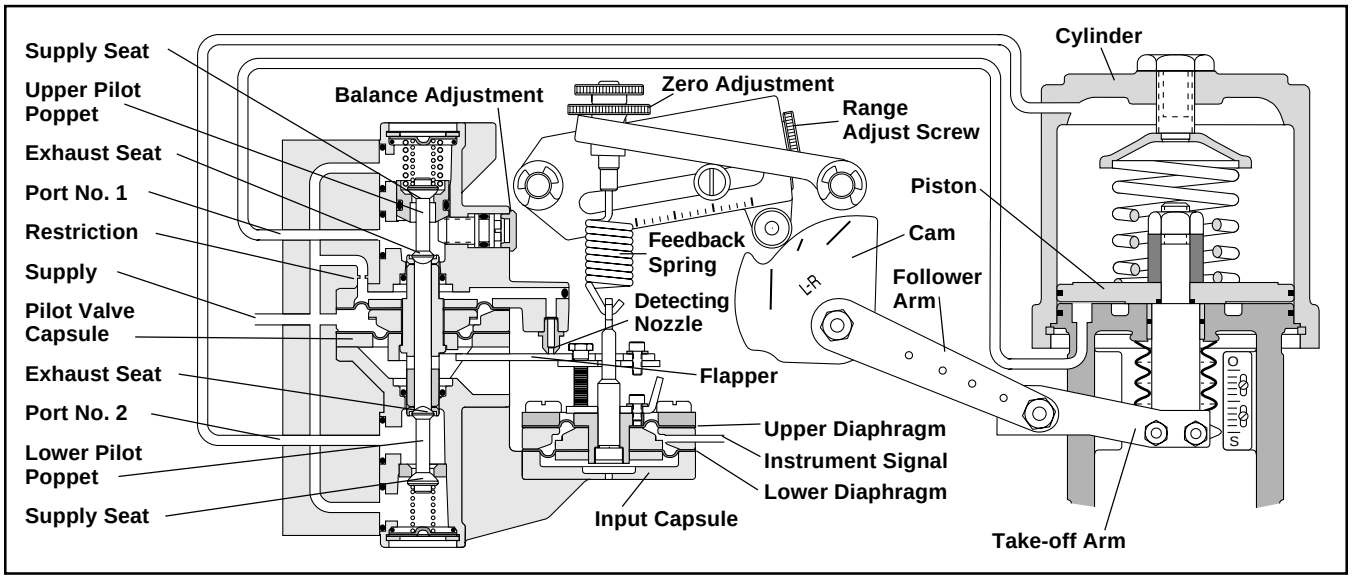

Figure 1: XL Positioner Schematic for Air-to-Open

change the output pressures, moving the stem until the tension on the feedback spring opposes exactly the instrument signal pressure.

The sequence of operation is as follows: An increase in instrument signal pressure forces the input capsule downward. Displacement of the capsule in turn moves the flapper away from the detecting nozzle. This allows a larger flow rate through the nozzle, decreasing the pressure exerted on the top of the pilot valve capsule.

Supply air biases the pilot-valve in an upward direction. As the capsule moves up, it will close the exhaust seat of the upper pilot poppet and open the supply seat, which applies increased air pressure to the bottom cylinder port. At the same time, the pilot-valve capsule will open the exhaust seat for the lower pilot poppet; thus, decreasing pressure to the top cylinder port.

This difference in pressure will drive the piston upward, which stretches the feedback spring until the spring tension exactly opposes the force resulting from the instrument signal pressure. At this point, the flapper will be moved toward the detecting nozzle to restore the pressure above the pilot-valve capsule to its equilibrium value. As a force-balanced condition is approached, the pilot-valve capsule will be forced back to a neutral position where the pilots are neither supplying air to, nor exhausting air from, their respective sides of the piston.

A decrease in instrument signal pressure reverses the described actions and causes a proportional downward movement of actuator piston and stem.

Installation of XL Series Positioner on Double-Acting, Linear-Cylinder Actuators

When installing or retrofitting the XL Series positioner on all sizes of linear actuators, proceed as follows:

NOTE: For retrofitting to an actuator equipped with a Beta or 80R positioner, the same bracket, follower arm and take-off arm can be used (begin with step 4).

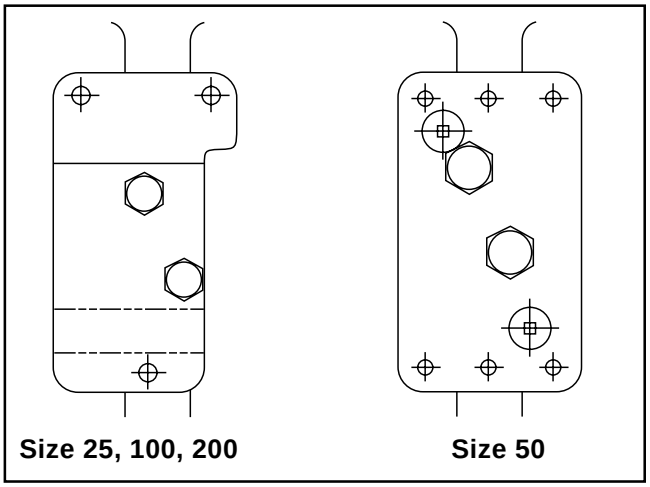

Figure 2: Positioner Mounting Bracket

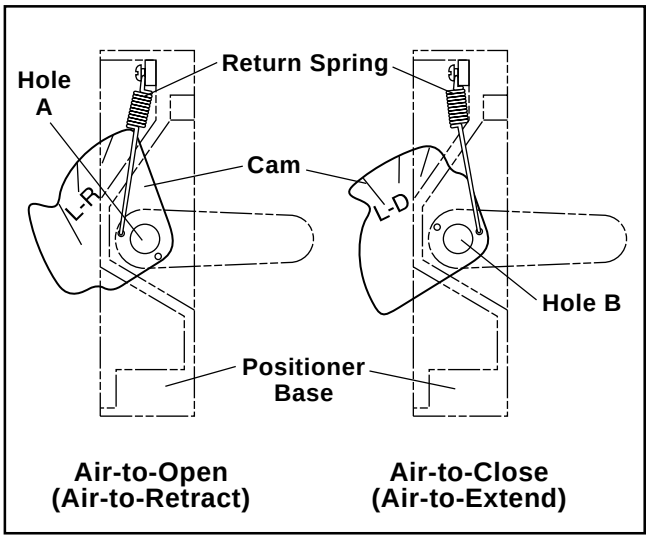

Figure 3: Return Spring / Cam Mounting
(viewed from positioner's right side)

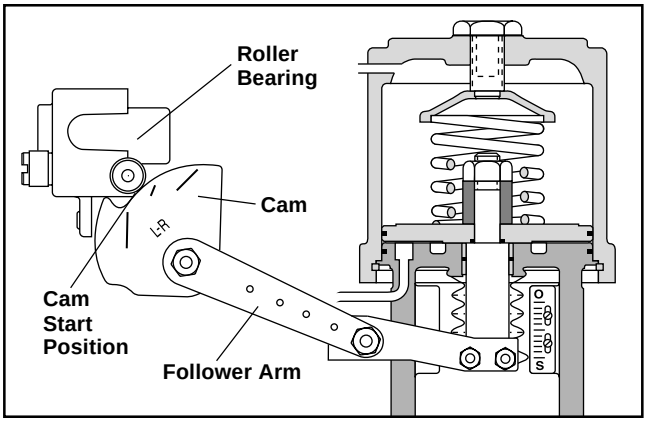

Figure 4: Cam Alignment

NOTE: When retrofitting the XL positioner to an actuator equipped with other positioners, remove the existing positioner, tubing and associated bolting. **See tubing instructions in Step 10.**

1. Place the stem clamp onto the actuator stem with the boss on the right side as illustrated in Figure 1.
2. Mount positioner bracket to the yoke leg which has the stroke indicator plate attached. (See Figure 2.)
3. Mount the take-off arm on the stem clamp so the slots in the end of the arm step upward toward the cylinder. The holes in the follower arm should line up with the slots in the take-off arm.
4. For air-to-retract action, install the cam in the positioner, with L-R facing outward. For air-to-extend action, L-D side of the cam should face outward. When installing the cam, position it so the center mark on the cam lines up through the center of the cam roller-bearing on the cam follower arm with the follower arm perpendicular to the base of the positioner. (See Figures 3 and 4.) Apply a small amount of grease to the bent end of the return spring and feed it through the hole in the cam. Loop the other end of the return spring over the screw and screw it into the positioner base.

   NOTE: Screw head will not bottom out.
5. Feed the appropriate follower arm onto the cam shaft boss with the hole markings facing outward. Secure with the lockwasher and nut. (See Figure 7.)
6. Fasten the follower pin into the correct hole in the follower arm for the desired stroke length of the trim. (Stroke lengths are stamped on the follower arm.)
7. Feed the follower pin into the appropriate slot in the take-off arm. (See Figure 4.) Tighten the nut on the pin and grease the slot where the pin rides.

   NOTE: A light industrial grease is recommended. Failure to lubricate the pin can cause premature wear.
8. Using three screws, mount the positioner to the brackets as shown in Figure 2.
9. If necessary, adjust the height of the stem clamp so the first line of the cam aligns with the center of the cam roller-bearing when the valve is seated. (See Figure 4.) Tighten the stem clamp.
10. For air-to-open action, tube 'output 2' to the top of cylinder and 'output 1' to the bottom of cylinder. For air-to-close action, tube 'output 1' to top of cylinder and 'output 2' to the bottom of the cylinder.

    NOTE: For three-way diaphragm actuators plug output 2, tube output 1 to desired side of diaphragm.
11. Attach supply air and instrument tubing or wiring.

    CAUTION: Signal air pressure higher than 30 psi may damage the module gauge and instrument signal capsule; a 3-15 psi instrument signal is recommended on the pneumatic module.

Reversing Air Action of XL Series Positioners on Linear Actuators

Reversing the air-action of the positioner is simple. No additional parts are required, although the tubing will need to be rerouted on the linear actuator.

To reverse the air-action of XL series positioners on all sizes of linear actuators, proceed as follows:

1. Using the 'Spring Cylinder Linear Actuators' Installation, Operation, Maintenance Instructions, reverse the air-action of the actuator.
2. Disengage the return spring from the cam and remove the cam from the cam shaft.
3. Reverse the cam, return spring and tubing for the desired air-action by referring to Steps 4-8 in the 'Installation of XL Series Positioner on Linear Actuators' section of these instructions.

Installing XL Series Positioner on Rotary Actuators

Proceed as follows when installing the XL Series positioner on all sizes of rotary actuators if the cam and follower arm are not already installed, otherwise refer directly to step 7.

1. With the desired cam and its identification letter facing toward the cam shaft, slide the cam onto the end of the cam shaft with the shorter shoulder. (Refer to Table I to determine desired cam characteristic.) Fasten with the star lock washer and nut.
2. Insert the follower arm into the back recess of the

Table I: Rotary Actuator Cam Characteristic Chart

Valve Style	Characteristic	Air To	
SST/VLD	Modified Equal Percentage	Open	Close
		B	C
SST/VLD	Linear	C	B
MaxFlo	Modified Equal Percentage	CAM1	CAM2
	Linear	CAM1	CAM2

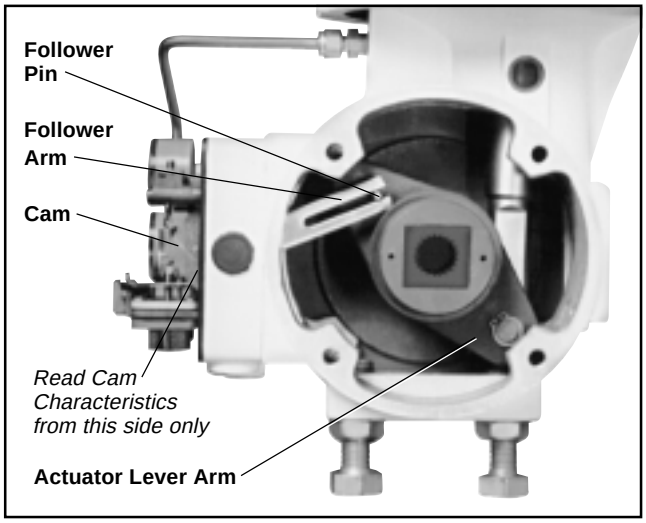

Figure 5: XL Series Positioner Installation on Valtek Rotary Actuator

positioner with part identification number facing out to the right side. Slide the cam shaft through the inner bearing and then slip flatted hole of the follower arm over the longer stepped shoulder of the cam shaft.

3. Place a small amount of thread-locking compound (Loctite No. 222 or equivalent) to the threaded portion of cam shaft nut. Slide the cam shaft nut through outer bearing and screw it onto the cam shaft. Tighten the cam shaft together firmly so that the follower arm is securely clamped. Also, make sure the cam is tightly secured to cam shaft. Check to be sure there is no slippage. Apply a small amount of grease to the bent end of the return spring and feed it through the hole in the cam. Loop the other end of the return spring over the screw and screw it into the positioner base.

   NOTE: Screw head will not bottom out.

4. Rotate the zero adjustment arm back into place and reinstall the feedback spring.
5. If the follower pin is present, insert it into the hole in the actuator lever arm and drive it firmly into place with a hammer. (See Figure 5.)
6. Apply grease to the sliding surfaces of the follower arm before mounting the positioner to the transfer case. When mounting the positioner to the transfer case, make sure to guide the follower arm so the pin slides in the slot on the follower arm. (See Figure 5.) Fasten the positioner to the transfer case with the three mounting screws. Push up on the cam to verify the pin is riding in the follower arm slot or remove transfer case cover plate to inspect.

   CAUTION: Failure to replace the cover plate before pressurizing or operating the actuator will cause damage to the shaft since the cover plate houses a shaft-support bearing.

   Depending on the positioner cam side selected, the valve flow characteristic may be linear or equal percent when compared to the instrument signal to the positioner. Figures 11 through 16 show the shaft rotation versus instrument signal of a valve (Valdisk, ShearStream or MaxFlo). These graphs should be used when visually checking the valve shaft rotation versus positioner signal relationship.

Reversing Air-Action of XL Series Positioners on Rotary Actuators

Reversing the action on rotary actuators is achieved by mounting the yoke to the opposite side of the transfer case. Refer to maintenance instructions 'Spring Cylinder Rotary Actuators' for details.

Note: When reversing action on rotary actuators, also change cam. (See Table I.)

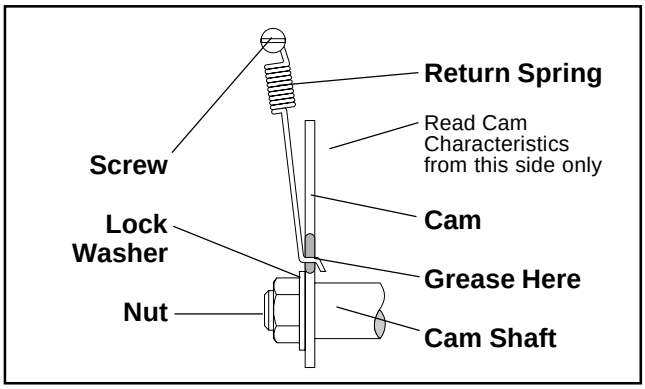

Figure 6: Cam Return Spring Installation

POSITIONER CALIBRATION

Introduction

Valtek positioners are calibrated at the factory; however, due to shipping and handling, it may be necessary to check the calibration before operating the valve. The XL positioner, for strokes 3/4-inch and above, can be calibrated to a range of 3-15; two-way split range, 3-9, or 9-15; and three-way split ranging, 3-7, 7-11, 11-15 psi using the standard feedback spring. An alternate red colored feedback spring on linear actuators is used for strokes less than 3/4-inch.

WARNING: When stroking the actuator during calibration, keep hands, hair and clothing away from moving parts. Failure to do so may cause serious personal injury.

Note: Positioners and I/Ps are calibrated at the factory. Use mechanical adjustments in positioner for calibration. Zero and span on the I/P should not be used to calibrate valve.

For calibration, proceed as follows:

1. For 3-15 or 3-9 psi range, loosen by hand the zero adjustment locking knob and adjust the zero adjustment knob until the valve begins to stroke with more than 3 psi signal (for 9-15 psi range adjust to 9 psi).
2. Loosen the range adjustment locking screw no more than 1/8 turn.

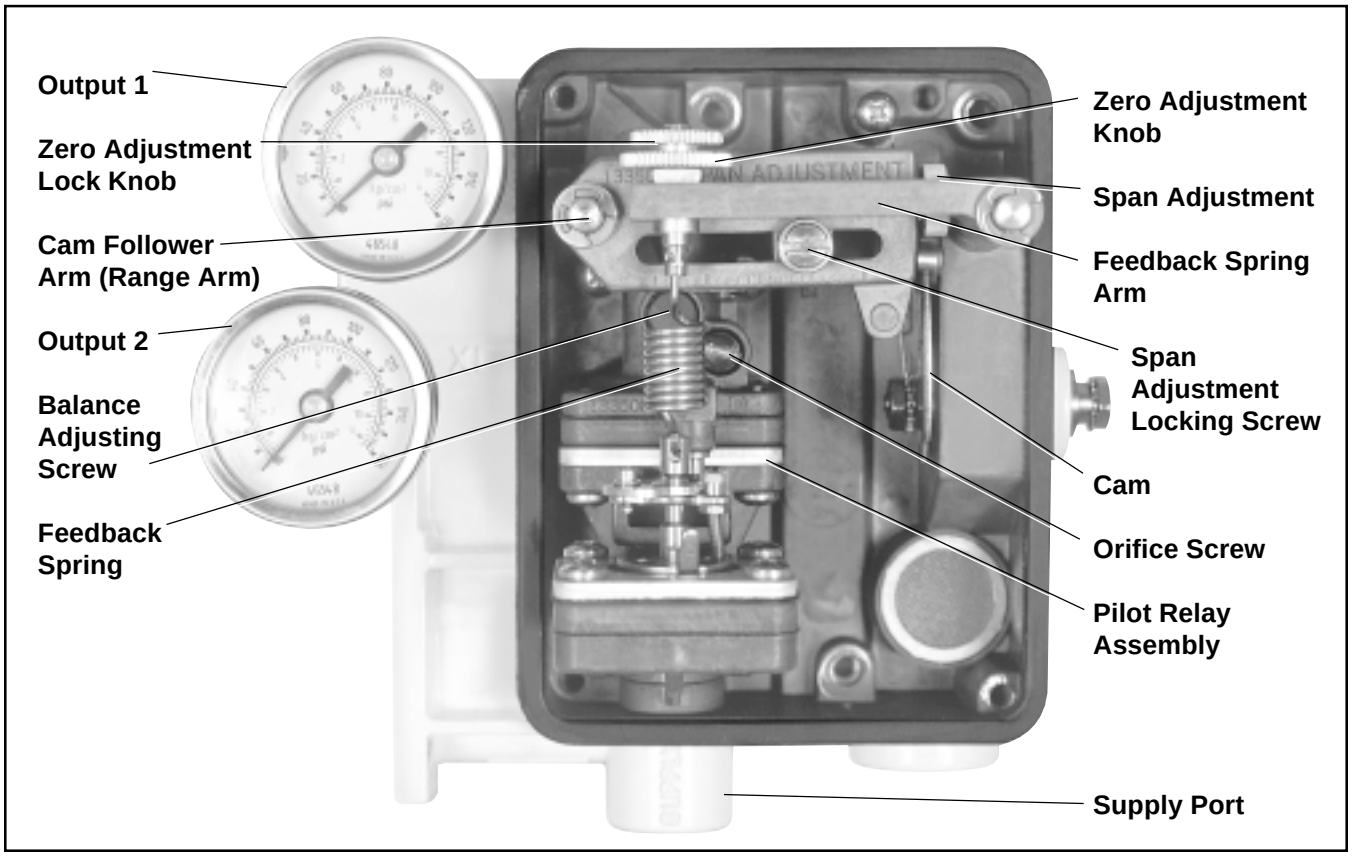

Figure 7: Positioner Adjustments

3. With a Phillips screwdriver adjust span adjustment so valve is at full stroke with more than 15 psi for 3-15 or 9-15 psi range (adjust to 9 psi for 3-9 psi range).
4. Return to 3 psi (or 9 psi for 9-15 psi range) and check the zero. Repeat steps 1-4 if necessary.
5. Tighten the zero adjustment lock knob and span adjustment lock knob.
6. Use the same procedure for three-way split range.

Positioner Balance Adjustment

CAUTION: Balance is preset at the factory. If balance adjustment becomes necessary, make changes carefully and slowly, allowing the positioner to respond before continuing adjustments. Check balance pressure frequently to ensure correct values.

Balance adjustment is set at the factory and normally should not need adjustment. Balance adjustment (output pressure level) permits the equilibrium pressure in both sides of the actuator piston to be raised or lowered. The actuator pressure level of output 1 and 2 should be approximately 75 to 80 percent of the supply pressure. When actuator springs are used there will be a pressure difference between output 1 and 2; the average pressure of both ports should be 75 to 80 percent of the supply pressure. The minimum recommended supply pressure is 60 psig. *For example, if 100 psig supply pressure was used on a fail closed actuator, the balance pressure should be adjusted so that output 1 reads approximately 85 psig and output pressure 2 reads approximately 70 psig. The average of these two pressures is 77.5 percent of the supply pressure.*

If necessary, adjust the output pressure level using the following the procedure:

1. If output pressure level is low, before adjusting, check for leaks in tubing connections between the positioner and actuator and check supply pressure.
2. Make certain there is no process force or pressure in the valve (The valve should be removed or isolated from the process.)
3. On positioners without gauges, connect gauges to ‘output 1’ and ‘output 2’ lines.
4. Remove rubber cap over balance adjustment. (See Figure 7.)
5. Apply full actuator operating pressure to the positioner supply port.
6. Set input signal to midscale (9 psi for 3-15 psi span). Output pressure level cannot be adjusted with actuator against valve seat or travel stops. Allow actuator pressure to stabilize.
7. Observe the pressure gauges. If reading is not correct, turn balance adjustment screw about $^{1}/_{8}$ turn at a time and wait about 20-30 seconds for pressure to stabilize (counterclockwise to increase pressure). Continue until output pressure level of the higher pressure gauge is approximately 80 percent of supply.
8. Replace rubber cap over balance adjustment screw.

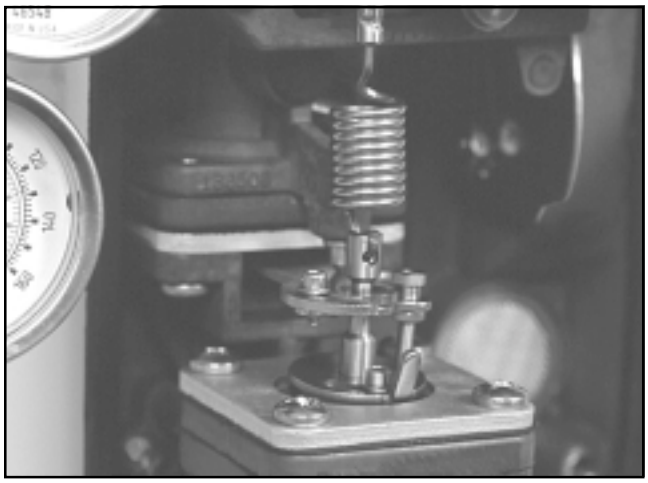

Figure 8: Close-up of Gain Adjustment

Gain Adjustment Procedure

The unique gain adjustment on the XL positioner provides a means to increase or decrease the responsiveness of the valve / actuator / positioner system. Increasing the gain makes the valve more responsive and faster, while decreasing the gain makes the system less sensitive and slower to respond (with increased damping).

The gain is infinitely adjustable between its highest and lowest settings. For convenience, three marks indicate high (H), medium (M) and low (L) gain. Most sizes of actuators will respond well to a medium (M) gain setting. All XL positioners are factory-set on the medium (M) gain setting. Unique actuator / valve configurations may require a gain adjustment at the factory or in the field.

1. Before adjusting the gain, place the controller on manual and isolate the valve from the process.
2. Turn off the supply air to the control valve actuator.
3. Using a $^{5}/_{64}$-inch Allen wrench, *loosen both the upper and lower lock screws* about one half turn. Do not loosen the spacer nut. (See Figure 9.)
4. By grasping the adjust lever, carefully rotate the gain adjust assembly to the desired position.

   CAUTION: To avoid damaging the gain adjust connecting spring mechanism. Make sure both the upper and lower gain adjust plates rotate together. When they are rotated to the new position, the connecting spring should be perpendicular to the plates.
5. When the gain is set to the desired position, firmly tighten both lock-down screws.
6. Turn on the supply pressure. Check the actuator responsiveness by providing a step signal to the positioner. When the gain is set as desired, check the valve zero and span calibration and re-calibrate if needed.
7. Return the valve to service.

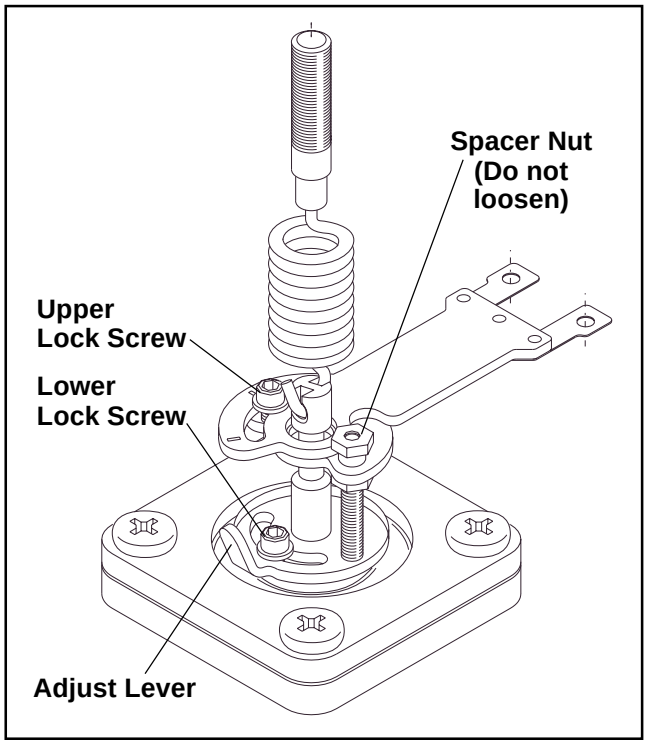

Figure 9: Gain Adjustment

Calibrating I/P Module Zero and Span Settings

NOTE: Although calibration can be accomplished using the output pressure gauge on the I/P module, its accuracy is ±3 percent. The standard gauge should be removed only for calibration and more accurate calibration equipment of ±0.1 percent of span should be used. The pressure gauge port is $^{1}/_{8}$-inch NPT. Calibration manifolds are available from the factory (Part No. 97370).

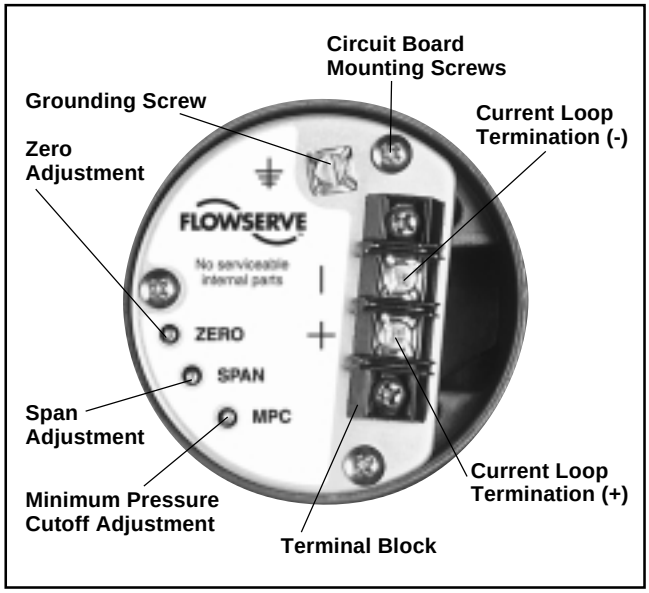

Figure 10: NT 3000 Module Circuit Board
(housing cover removed)

1. Connect the I/P module to a supply pressure between 30 to 150 psi.
2. Remove I/P module housing cover. (See Figure 10.)

   WARNING: Be certain power to the I/P module is disconnected before removing the housing cover in explosive atmospheres; otherwise personal injury may occur.
3. Before adjusting the zero and span, be certain the MPC feature is disabled. Refer to Step 7 in the 'Adjusting the Minimum Pressure Cutoff Feature' section.
4. Connect a current source to the terminal block on the circuit board.

   NOTE: The zero and span adjustments are multi-turn potentiometers (pots) that have no stops on the ends of their travel; however, they have a slip clutch to prevent damage from over-adjustment. The pots also make a clicking noise when they have reached the limits of their adjustment.
5. Apply a 4.0 mA signal to the input. Locate and adjust the zero trim pot to achieve a 3.0 psi output. Output will increase with clockwise rotation of zero trim pot. If calibrating an I/P module with a 10-50 mA input signal, apply a 10.0 mA signal to the input.
6. Increase the input signal to 20.0 mA (50 mA for 10-50 mA units). Locate and adjust the span trim pot to achieve a 15.0 psi output. The output will increase with clockwise rotation of the span.
7. Recheck the zero setting by repeating Step 5. The span adjustment may affect the zero setting.
8. Repeat Steps 5, 6 and 7 until the proper adjustments are obtained.

Adjusting the Minimum Pressure Cutoff Feature

The XL positioner with I/P Transducer has a 'Minimum Pressure Cutoff' (MPC) feature, which allows the user to set the positioner so when the input signal falls below a user-adjustable current the pressure output falls rapidly to approximately 1.7 psi, causing the valve to move to the failure position. This feature is generally used when the service requires a tight shut off or to prevent throttling near the valve seat. To adjust this feature, refer to Figure 10 and perform the following steps:

NOTE: The following procedure applies only if the minimum pressure cutoff feature will be used.

NOTE: The zero and span settings of both the positioner and I/P transducer should be verified as accurate before the minimum pressure cutoff feature is enabled and adjusted.

1. Connect the I/P module to a 30 to 150 psi air supply pressure.
2. Remove the I/P module housing cover.

   WARNING: Be certain power to the I/P module is disconnected before removing the housing cover in explosive atmospheres; otherwise personal injury may occur.
3. Connect an adjustable current source to the terminal block on the circuit board. Apply the desired input signal to the positioner at which the output pressure is to fall to approximately 1.7 psi. This signal can range from factory setting of 3.7 to 8 mA.
4. Turn the minimum pressure cutoff pot clockwise until the output pressure drops off.
5. Fine-tune the pressure drop-off point by increasing the input signal and then decreasing it through the desired shut-off signal. Observe the signal value at which the pressure drops off. If the pressure drops off at a lower mA signal than desired, turn the MPC pot slightly counterclockwise. If the pressure drops off at a higher signal than desired, turn the tight shut-off screw slightly clockwise.
6. Repeat Step 5 until the pressure drops off at the desired input signal.
7. To disable the MPC feature turn the minimum pressure cutoff pot (marked 'MPC') 20 turns counterclockwise or until it makes a clicking noise.

Positioner Maintenance

NOTE: Refer to NT 3000 IOM for I/P module maintenance instructions.

For proper maintenance, proceed as follows:

1. Maintain a clean air supply, free of dust, oil and water. A coalescing air filter for I/P is required to ensure a clean air supply. Check and maintain filter regularly.
2. Make sure all arms and levers move freely.
3. Check for any loose parts.
4. Be sure there are no leaks in the air supply tubing fittings or connections.
5. Refer to the troubleshooting chart on page 12 in case of problems.

   NOTE: The two Phillips screws on the back of the positioner base are for factory assembly only and should not be removed.

Pilot Relay Disassembly and Reassembly

The pilot relay is available as a complete unit and can be easily replaced. (See Steps 2 and 18.) Before attempting to correct any problem with the pilot relay assembly, obtain a positioner repair kit that contains the soft goods most commonly required.

NOTE: Numbers in parentheses correspond to the numbers in Figure 17.

1. Remove the feedback spring (47) and rotate the span and zero arms (40, 46) out of the way.
2. Remove four screws (33) holding the pilot relay to positioner base (1). Remove relay from positioner.
3. Remove the nut (25) connecting the flapper assembly (21) to the signal capsule.
4. Remove four screws (32) holding the two halves of the pilot relay assembly together. Carefully pull the relay assembly halves apart, making sure the flapper assembly (21) slides off the flapper adjustment screw (19) without damaging the signal diaphragm assembly (16). Pull the relay diaphragm assembly (13) out of the other half of the relay body (9).
5. With relay assembly in two sections, remove two screws (22) holding flapper assembly (21) to the relay diaphragm assembly (13). Remove the flapper.
6. Remove diaphragm retaining plate (15) from the relay diaphragm assembly (13) and relay plate (14).
7. Replace relay diaphragm assembly (13) with one from positioner repair kit. Place relay plate (14) between the new diaphragms making sure the $^1/_{16}$-inch diameter holes between the relay plate (14) and diaphragm line up. Position diaphragm retaining plate (15) on the relay diaphragm assembly with rounded inner diameter edge against the diaphragm.
8. Attach the flapper assembly (21) onto the relay diaphragm assembly (13) using two screws (22) with a locking adhesive on the threads. The flapper assembly should extend away from the $^1/_{16}$-inch diameter hole through the relay plate. Make sure the lettering on the flapper assembly is facing away from the diaphragm.
9. With the relay halves still apart, remove relay tube O-rings (8) from the upper and lower bodies (9, 7) and replace them with new O-rings (found in the positioner O-ring repair kit).
10. Remove the rubber cap (35) and the balance adjust screw cap (36) from the upper relay body (9). Remove the O-ring (38) from the balance adjust screw and install new O-ring.
11. To remove and clean the poppets (28), remove the retaining rings (31), poppet covers (27), O-rings (30), and poppet springs (29) found at the end of each housing. After removing the poppets, inspect them for dirt buildup or damage to seating surfaces.
12. The upper relay body (9) has a movable seat ring (34) which is adjusted with the balance adjust screw (36). This seat is removed by pushing it out with a soft instrument such as a wooden dowel. Be careful not to damage the seating surface. Remove the O-ring (37) from the seat ring.
13. Lubricate and replace the O-ring (37) on the movable seat ring (34). Carefully reinstall the seat ring into the upper relay body (9), being careful not to damage the seating surface or O-rings.
14. Reinstall the poppets (28), poppet springs (29), Seat Spring O-rings (30), and poppet covers (27) before installing retaining rings (31).
15. If the signal diaphragm assembly (16) is damaged, proceed as follows: With the relay halves still apart, remove the four screws (32) holding the signal diaphragm assembly (16) to the pilot relay assembly. Remove the locking screw (23), washer (24), adjustable gain lower plate (26), and diaphragm plate. Remove the signal diaphragm assembly (15) and remove the relay plate (14) from between the diaphragms. Place the relay plate (14) between the diaphragms on the new assembly *taking care to align the $^1/_{16}$-inch diameter holes between the diaphragms and the relay plate* (14). Replace the diaphragm plate (15), the adjustable gain lower plate (26), the washer (24), and the locking screw, but do not tighten. Replace the four screws (32) that hold the signal diaphragm assembly together.
16. With O-ring grease, pack grease into the O-ring groove and lightly lubricate the outside of the relay tube on the diaphragm relay assembly (13) making sure the small holes in the side of the tube on the ends do not get plugged with grease. Insert the relay diaphragm assembly (13) as assembled in steps 7 and 8 into the lower relay half. Carefully align the flapper over the adjustable gain screw (19) and replace and tighten the nut (25).
17. Fasten the two halves of the relay together using the four long screws (32). *Make sure the $^1/_{16}$-inch diameter holes in the relay diaphragm assembly* (13) *and the upper relay body* (9) *line up.* Set the gain to the desired setting and tighten the locking screws (23, 25). See gain adjustment procedure.
18. *Replace the screen* (110) *and the O-rings* (8,12) found on the back of the pilot relay before reinstalling the pilot relay on the base of the positioner with four screws (33). Clean out any debris lodged in the screen or replace with a new one.
19. Replace the span arm and zero arm (40, 46) and the feedback spring (47).

Orifice Screw

The orifice screw enhances positioner stability. If the positioner overshoots excessively or remains in the full-signal position regardless of the signal, the orifice may be partially or full plugged.

When checking the orifice screw, care should be taken to retain the O-ring and orifice filtering screen located on the end of the screw. The screen is secured by the O-ring. Do not overtighten when replacing the orifice screw.

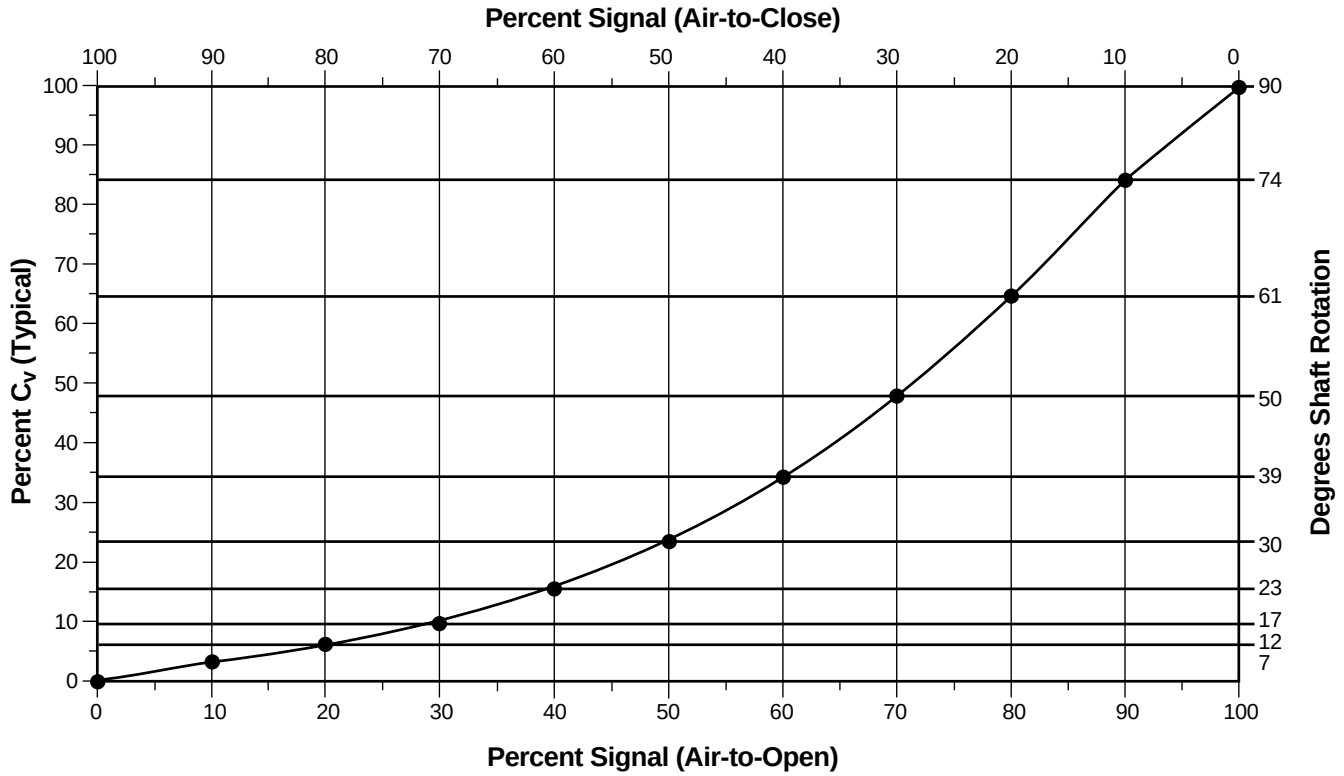

Figure 11: Valdisk – Equal Percent Flow Characteristic (Shaft Rotation vs. Instrument Signal)

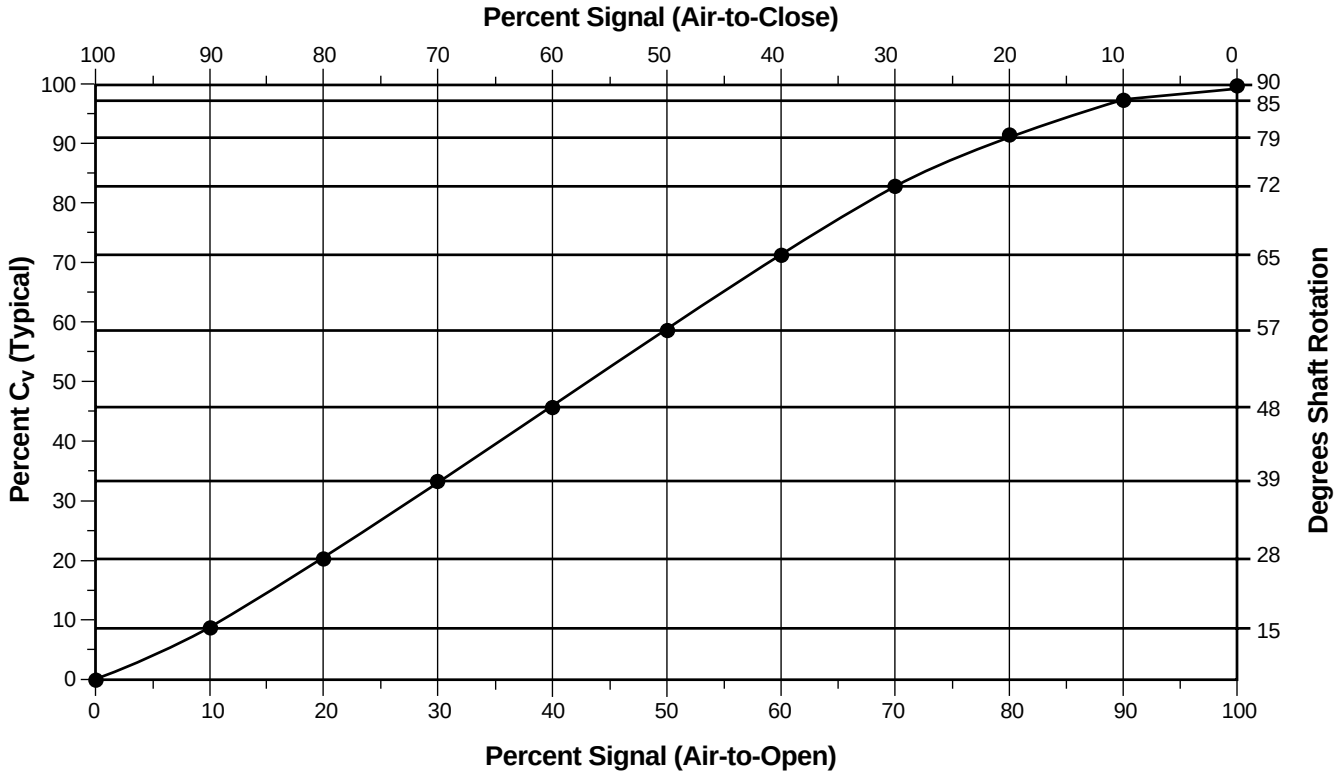

Figure 12: Valdisk – Linear Flow Characteristic (Shaft Rotation vs. Instrument Signal)

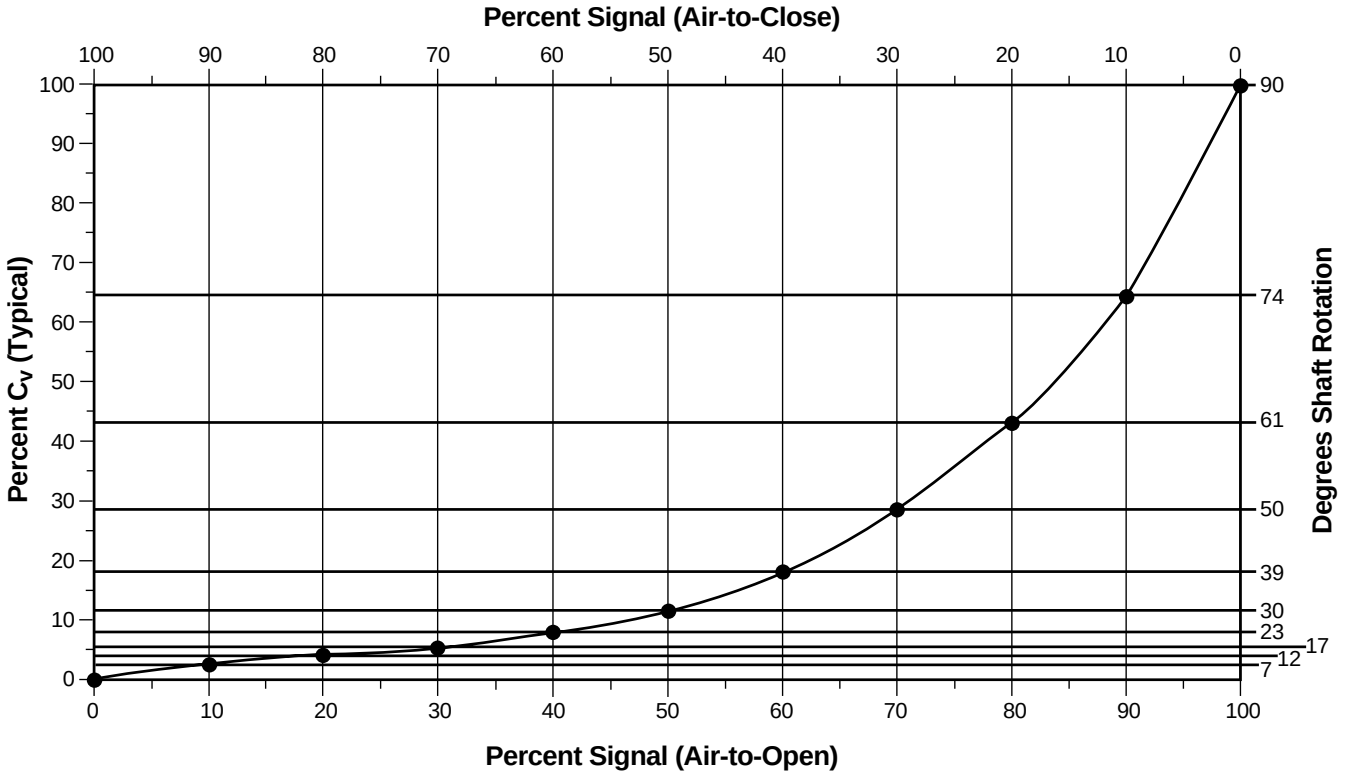

Figure 13: ShearStream – Equal Percent Flow Characteristic (Shaft Rotation vs. Instrument Signal)

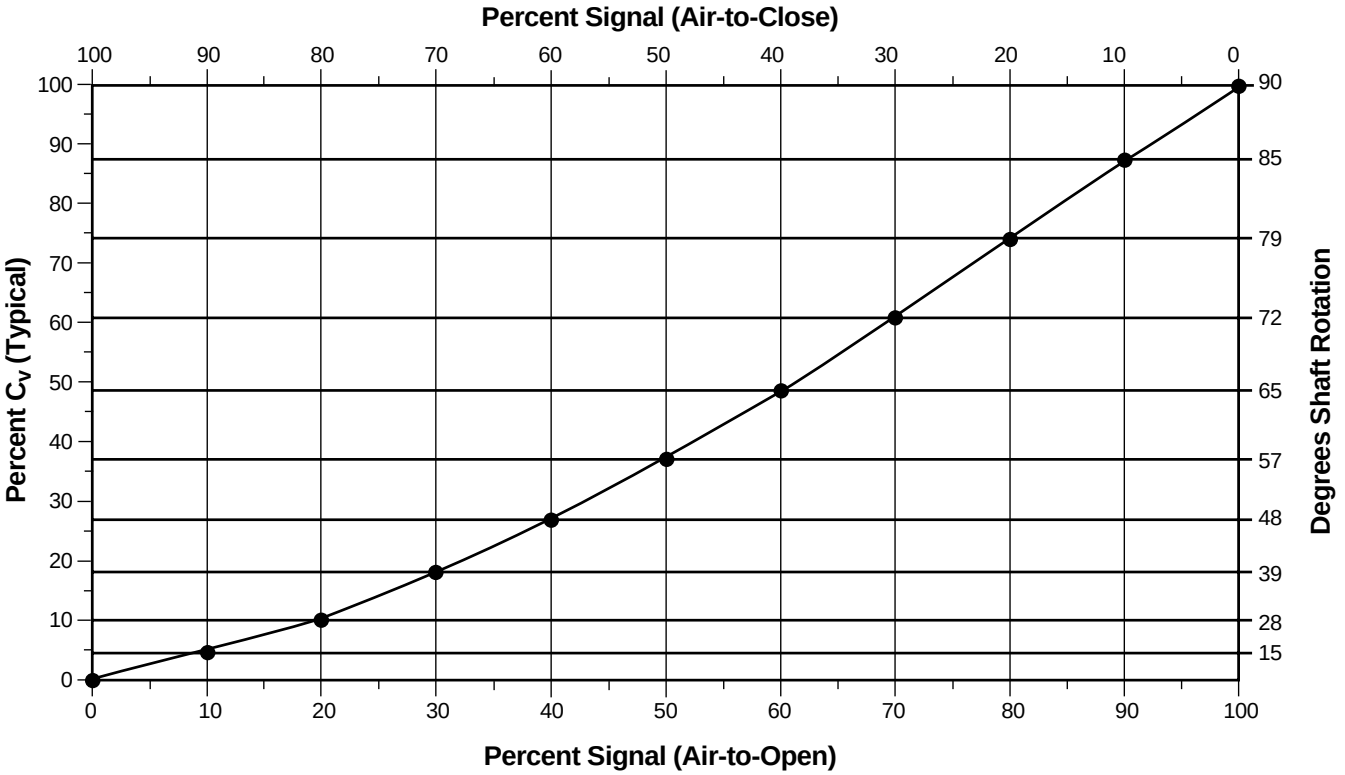

Figure 14: ShearStream – Linear Flow Characteristic (Shaft Rotation vs. Instrument Signal)

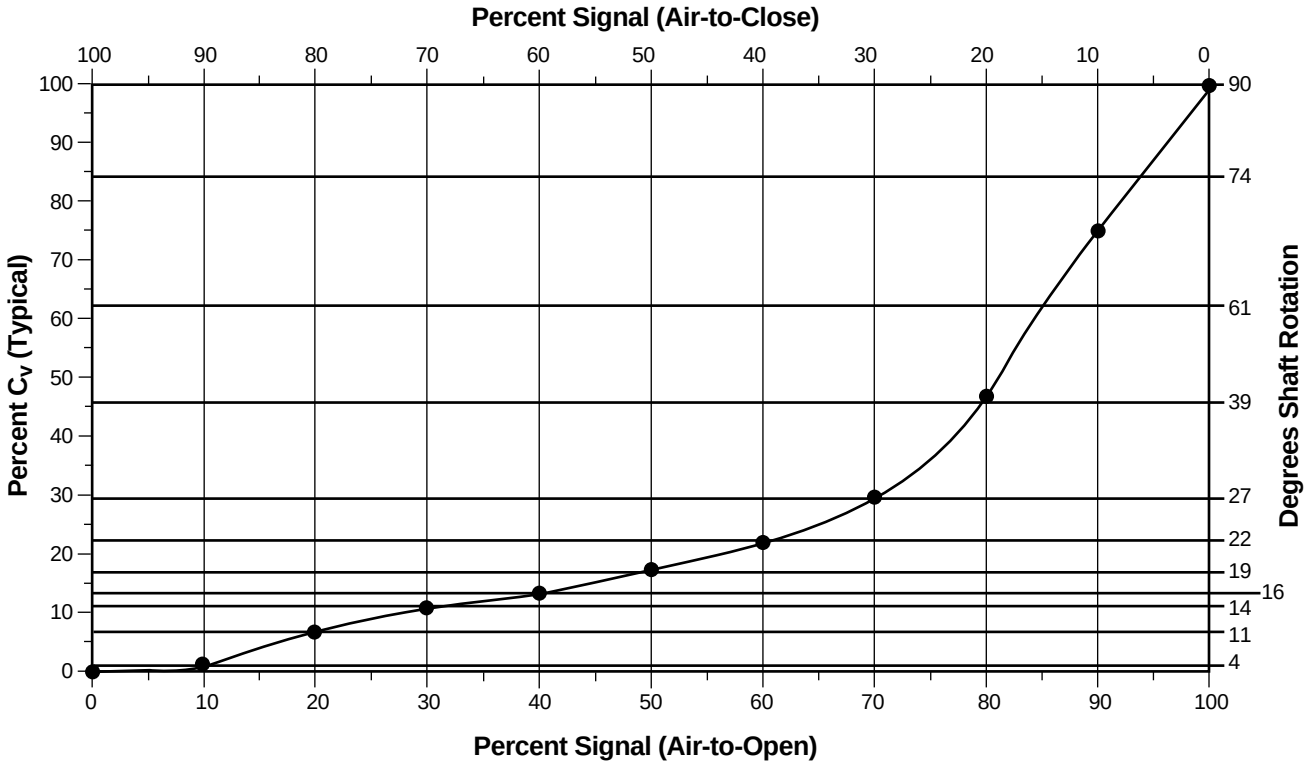

Figure 15: MaxFlo – Equal Percent Flow Characteristic (Shaft Rotation vs. Instrument Signal)

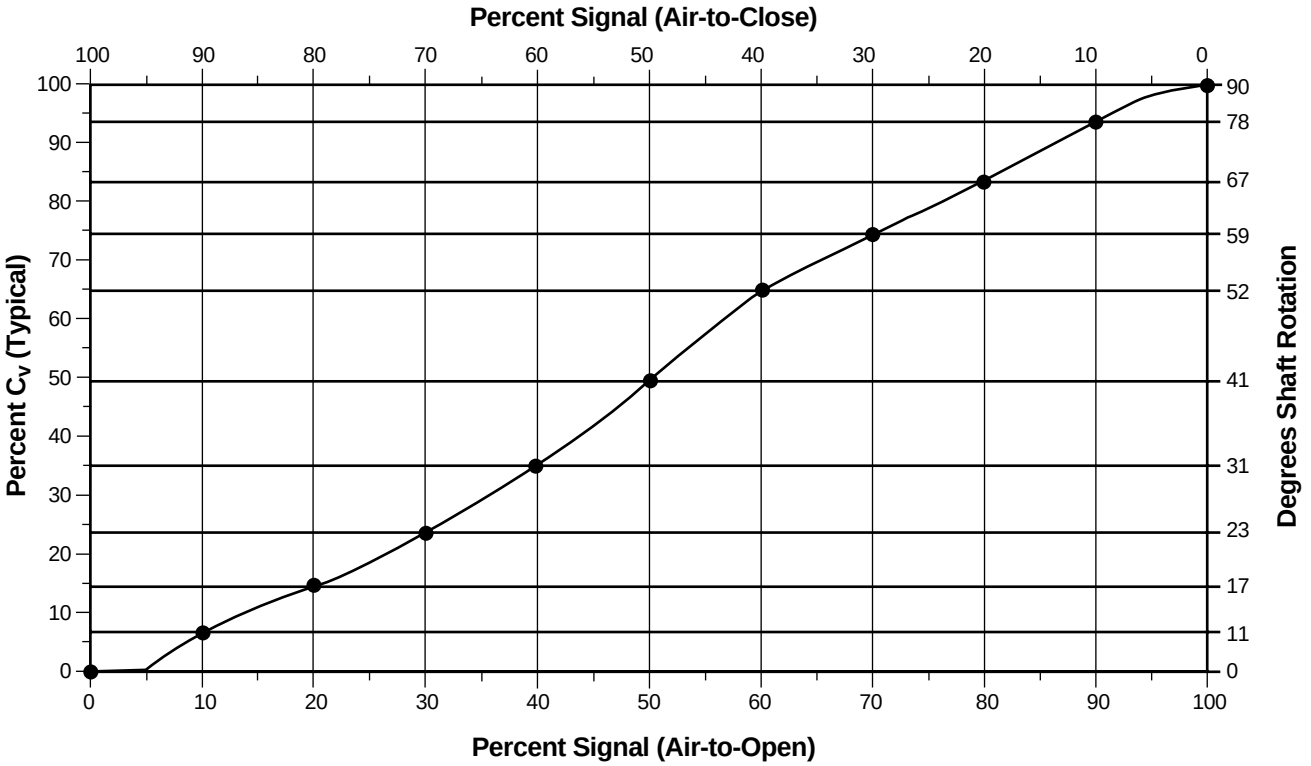

Figure 16: MaxFlo – Linear Flow Characteristic (Shaft Rotation vs. Instrument Signal)

Troubleshooting XL Positioners

Failure	Probable Cause	Corrective Action
Valve won't stroke, no excessive air is exhausting from positioner	1. Tubing to wrong ports 2. Cam action reversed 3. Lever is stuck 4. Low air supply 5. Relay tube stuck 6. Balance adjust screw not adjusted correctly 7. I/P module filter plugged 8. I/P module failure 9. I/P mounting bolts loose 10. I/P pressure signal blocked	1. Re-tube to correct ports. (See 'Installation' section) 2. Refer to 'Installation' section and reverse cam 3. Work with lever arm until it turns freely 4. Increase air supply to recommended value 5. Disassemble relay assembly and work relay tube free. Lightly lubricate if necessary 6. Adjust balance pressure with adjusting screw 7. Remove I/P module and replace filter 8. Replace I/P module 9. Tighten mounting bolts 10. Remove I/P module and clear passageway; replace O-ring if necessary
Valve won't stroke, excessive air exhausting from positioner	1. A diaphragm in relay assembly burst 2. One of the poppets is stuck 3. Internal control valve problem 4. Damaged relay O-rings on relay tube 5. Blocked passageways in relay	1. Replace relay assembly or replace diaphragms 2. Remove relay assembly/poppet cover; free stuck poppet 3. Refer to instructions or check for actuator tubing leaks 4. Disassemble relay and replace O-rings 5. Disassemble relay and check small holes under diaphragms; clean if clogged
Actuator goes to full signal position regardless of signal	1. Broken feedback spring 2. Linkage is disconnected or stuck 3. Orifice is clogged by water, oil or dust in air supply 4. Bent flapper, damaged nozzle 5. I/P module failure 6. Clogged orifice screen	1. Replace feedback spring 2. Check and tighten bolts/nuts in linkage. Make sure linkage does not hang up; grease pin that rides in follower arm slot 3. Remove orifice screw and carefully clean orifice hole 4. Straighten flapper or replace damaged parts 5. Replace I/P module 6. Remove relay and clean or replace orifice screen
Calibration shifts	1. Loose positioner mounting 2. Loose linkage 3. Loose zero adjustment locking knobs 4. Wear of arms or pins 5. I/P mounting bolts loose 6. Stroke has changed in valve	1. Remove cover and check three screws holding positioner to bracket; check two bolts holding bracket to yoke 2. Tighten nuts and bolts on linkage and stem clamp 3. Tighten zero adjustment locking knob; re-calibrate if necessary 4. Replace worn arms, pins; grease appropriately 5. Tighten I/P mounting bolts 6. Refer to valve maintenance instructions
Excessive air consumption (other than normal exhaust)	1. Air leakage from manifold rings between relay and base 2. Air leakage from tubing 3. Leaky cylinder piston O-rings 4. Air leakage from relay	1. Tighten screws holding relay assembly together and/or replace O-rings 2. Tighten or replace tubing fittings 3. Replace O-rings in cylinder 4. Disassemble relay and check and replace dynamic O-rings next to tube if necessary
Actuator strokes very slowly in one direction only	1. Connection between signal capsule and flapper misadjusted 2. Tubing to cylinder is restricted 3. Balance pressure low	1. Adjust gain according to Figure 8 or until actuator strokes approximately equal speed in both directions. Verify alignment of upper and lower gain plates. Make sure spacer nut is tightened 2. Inspect tubing/fittings for restrictions and replace if necessary 3. Adjust balance pressure according to page 5
Erratic operation	1. Dirt buildup on relay poppets or seats 2. Dirt buildup on relay tube 3. Clogged ports / passageways in relay 4. Faulty I/P module 5. Clogged orifice screw 6. Mechanical binding in linkage or internal galling in valve 7. Clogged orifice screen	1. Disassemble; clean poppets and seats; add air or change filter 2. Disassemble; clean relay and lightly lubricate; replace O-rings if necessary; add air filter or change filter 3. Disassemble, inspect and clean all ports and passageways 4. Replace the I/P module 5. Remove orifice screw and carefully clean orifice 6. Tighten linkage or refer to valve maintenance instructions 7. Remove relay and clean or replace orifice screen
Excessive overshoot	1. Restricted air flow to positioner 2. Balance pressure not set correctly 3. Gain is set too high	1. Adjust air supply as needed 2. Adjust balance pressure according to page 5. 3. Lower gain mechanism until overshoot is minimized

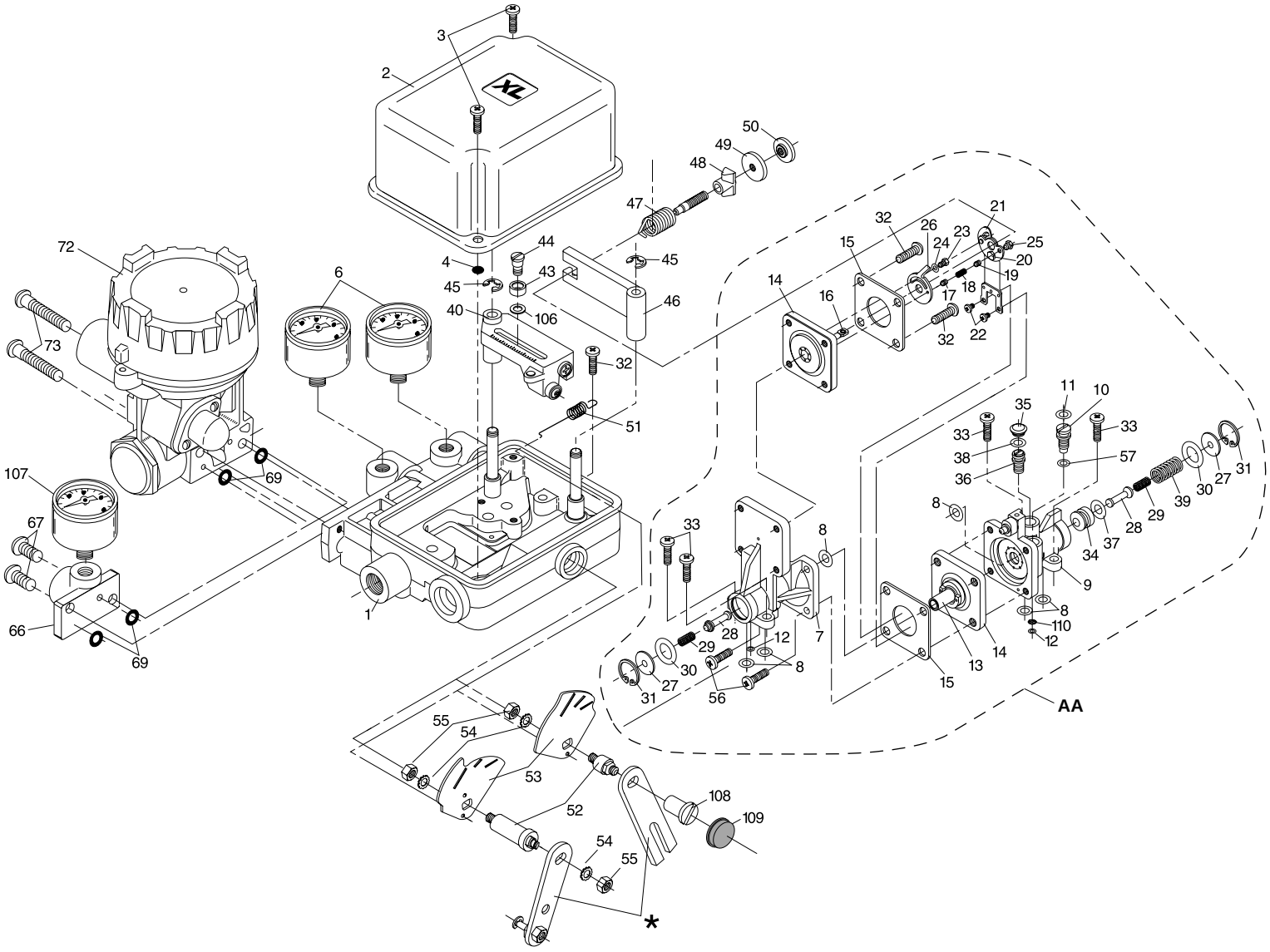

Figure 17: Positioner--Exploded View

AA Pilot relay assembly
1 Base assembly
2 Cover
3 Screw
4 O-ring
6 Pressure gauge 0-160 psi
7 Bottom relay assembly
8 O-ring
9 Upper relay assembly
10 Orifice screw
11 O-ring
12 O-ring
13 Relay diaphragm assembly
14 Relay plate
15 Diaphragm retaining plate
16 Signal diaphragm assembly
17 Set screw
18 Spring
19 Set screw
20 Nut
21 Adjustable gain upper plate
22 Pan head screw
23 Socket screw
24 Washer
25 Spacer nut
26 Adjustable gain lower plate
27 Poppet cover
28 Poppet
29 Poppet spring
30 O-ring
31 Retaining ring
32 Screw
33 Screw
34 Adjustable seat
35 Rubber cap
36 Balance adjust screw
37 O-ring
38 O-ring
39 Adjustable seat spring
40 Span arm
43 Pivot bushing
44 Pivot screw
45 Snap ring
46 Zero arm
47 Feedback spring
48 Pivot block
49 Adjust zero knob
50 Zero locking knob
51 Return spring
52 Cam shaft
53 Cam
54 Lock washer
55 Nut
56 Screw
57 O-ring
66 Pneumatic adapter
67 Screw
69 O-ring
72 I/P module
73 Screws
106 Washer
107 Signal gauge
108 Cam shaft nut
109 Cap
110 Orifice Screen

*All of the above parts are in stock, and can be purchased in any one of 14 spare parts kits. For selecting and ordering the appropriate kit or a new positioner, contact your Valtek representative or the factory. * See follower arm kits.*

Ordering Information

The following information is provided to order a XL positioner or to adapt an existing positioner from one application to another.

Linear Actuators

When ordering a positioner for a linear actuator, select two part numbers; one each from Tables II and III.

Table II: Positioner Model with 3-15 psi or 4-20 mA span for Linear Actuators(1)

	Air Action	P/P Module	NT 3000-10 I/P Module
Std. Stroke	Air-to-Open	10076820	10122958
	Air-to-Close	10076821	10122959

(1) The cam can be turned over in the field for opposite air action.

Table III: Linear Actuator Follower Arms

Actuator Size	Stroke (inch)	Spud (inch)	Follower Arm Kit
25	1/4**	2.00	10043879*
	3/8**	2.00	10043879*
	1/2**	2.00	10037613*
50	1/4 - 1 1/2**	2.00	10037613
	3/4 - 1 1/2**	2.00	10037613
	3/4 - 2 1/2**	2.62	10044111
	3**	2.62	10037614
100 / 200	3/4 - 3**	2.62 - 2.88	10037614
	3/4 - 4**	3.38 - 4.75	10037615
	5 - 8**	3.38 - 4.75	10037616

*Requires the use of stem clamp number 55679

** Use short stroke positioner

Rotary Actuators

When ordering a positioner for a rotary actuator, select two part numbers; one from Table IV and one from Table V which includes part numbers for follower arm.

Table IV: Positioner Model with 3-15 psi or 4-20 mA span for for Valdisk, Valdisk 150, and ShearStream Rotary Actuators.

Actuator Size	Installed Cam(2)	Pneumatic Module	NT 3000-10 I/P Module
25	B	10075141	10121777
50			
100	C	10075142	10121780

(2) The cam can be turned over in the field to the opposite side 'B' or 'C'. To select the correct positioner model choose either 'B' or 'C' from Table I

Table V: Follower Arms for Rotary Actuators

Actuator Size (Square-inches)	Follower Arm Part Number
25	10034715
50	10034714
100 / 200	10033767

When installed on a rotary valve, the signal vs. C_V relationship can be equal percentage or linear, based on air action as well as cam characteristics. (See Table I.)

Spare Part Kits

Cover Kit – Part No. 10094522

Item No.	Description	Quantity
2	Cover	1
3	Screw	2
4	O-ring	2
5	Sticker	1

Gauge Kit – Part No. 10129690

Item No.	Description	Quantity
6	Pressure gauge 0-160 psi	2

Span & Zero Arm Kit – Part No. 10094523

Item No.	Description	Quantity
40	Range arm assembly	1
43	Pivot bushing	1
44	Pivot Screw	1
45	Snap Ring	2
46	Zero Adjust arm	1
106	Washer	1

Feedback Spring Kit – Part No. 10094524

Item No.	Description	Quantity
47	Feedback Spring assembly (Includes item no. 103, 104)	1
48	Pivot block	1
49	Adjustment knob	1
50	Lock knob	1

Base Kit – Part No. 10094525

Item No.	Description	Quantity
58	Base	1
63	Screen	1
64	Screen retainer	1
65	Bearing	2
66	Post	2
67	Gasket	1

Standard O-ring Kit – Part No. 10094526

Item No.	Description	Quantity
8	Relay/ base O-ring and relay tube O-ring	6
11	Orifice screw O-ring	1
12	Relay/ base O-ring	2
30	Relay retainer O-ring	2
37	Adjustable seat O-ring	1
38	Adjustable screw O-ring	1
57	Orifice face O-ring	1
69	Input signal O-ring	2

Ext. Temp. O-ring Kit – Part No. 10094527

Item No.	Description	Quantity
8	Relay/base O-ring and relay tube O-ring	6
11	Orifice screw O-ring	1
12	Relay/base O-ring	2
30	Relay retainer O-ring	2
37	Adjustable seat O-ring	1
38	Adjustable screw O-ring	1
57	Orifice face O-ring	1
69	Input signal O-ring	2

Standard Dia. Kit – Part No. 10094528

Item No.	Description	Quantity
13	Relay diaphragm	1
16	Signal diaphragm assembly	1

Ext. Temp. Dia. Kit – Part No. 10094529

Item No.	Description	Quantity
13	Relay diaphragm	1
16	Signal diaphragm assembly	1

Standard Relay Kit – Part No. 10094530

Item No.	Description	Quantity
AA	Pilot Relay assembly (Includes item no. 7-39, 56, 57, 110)	1

Ext. Temp. Relay Kit – Part No. 10094531

Item No.	Description	Quantity
AA	Pilot Relay assembly (Includes item no. 7-39, 56, 57, 110)	1

Std. Linear Cam Kit – Part No. 10094532

Item No.	Description	Quantity
32	Pan head screw	1
51	Return spring	1
52	Cam shaft	1
53	Cam	1
54	Lock washer	2
55	Nut	2

Std. Rotary Cam Kit – Part No. 10094533

Item No.	Description	Quantity
32	Pan head screw	1
51	Return spring	1
52	Cam shaft	1
53	Cam	1
54	Lock Washer	1
55	Nut	1
108	Cam shaft nut	1
109	Cap	1

Rotary MaxFlo Cam Kit – Part No. 10094534

Item No.	Description	Quantity
32	Pan head screw	1
51	Return spring	1
52	Cam shaft	1
53	Cam	1
54	Lock washer	1
55	Nut	1
108	Cam shaft nut	1
109	Cap	1

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