Valtek Beta Positioners for Control Valves

General Information

This bulletin contains instructions for installing, calibrating, troubleshooting, and performing maintenance as required for the Valtek® Beta Positioner mounted on control valves.

Instructions for maintaining and calibrating the NT 3000 I/P module are contained in Installation, Operation, Maintenance Instructions 47, NT 3000 Series Electro-pneumatic Transducer Module. For calibration and maintaining the remote I/P see Installation, Operation, and Maintenance Instructions 30, Electro-pneumatic Transducer.

Product users and maintenance personnel should read thoroughly and follow exactly the instructions contained in this bulletin prior to operation of the positioner. If there is any question concerning this bulletin, call your Valtek representative.

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

NOTE: *Numbers in parenthesis correspond to the part item numbers in Figure 17.*

Beta Positioner Overview

The Valtek Beta Positioner is available with either a pneumatic (P/P) module for air control signals or an electro-pneumatic (I/P) module for milliampere electrical control signals. It is double-acting, capable of supplying air to either side of the actuator piston while exhausting the other side to the atmosphere.

The Valtek Beta positioner can be interchanged with the 80R and XL positioners without changing the brackets or takeoff arms.

The Beta Positioner with I/P module is intrinsically safe for FM/CSA class 1, division I, groups A, B, C, and D; class II, groups E, F, and G, and CENELEC EEx ia IIc, when installed with the appropriate energy limiting safety barriers (See Figure 1). It is also explosion proof for FM/CSA class II, groups E, F, and G, and CENELEC EEX d IIb + H_2. Since the positioner is insensitive to supply pressure changes and can handle supply pressures from 30 to 150 psi a supply regulator is usually not required; however, an air filter is highly recommended.

NOTE: *The air supply should conform to ISA Standard S7.3 (a dew point at least 18°F below ambient temperature, particle size below 5 microns, oil content not to exceed 1 part per million).*

Positioner Operation

The Beta Positioner is a force-balanced instrument. Figure 2 shows a Beta Positioner, with either a pneumatic or electro-pneumatic (I/P) module, installed on a double-acting actuator for air-to-open action. Positioning is based on a balance of two forces; one proportional to the instrument signal and the other proportional to the stem position.

With the I/P model, the current signal is first converted to a 3-15 psi air signal. For the pneumatic model, the 3-15 psi signal is passed directly into the positioner. The pressure signal acts upon the diaphragms in the instrument signal capsule creating a downward force. The motion of the actuator stem is transmitted to the top end of the feedback spring through the follower arm and cams. As a result, tension in the feedback spring will vary as the stem position changes.

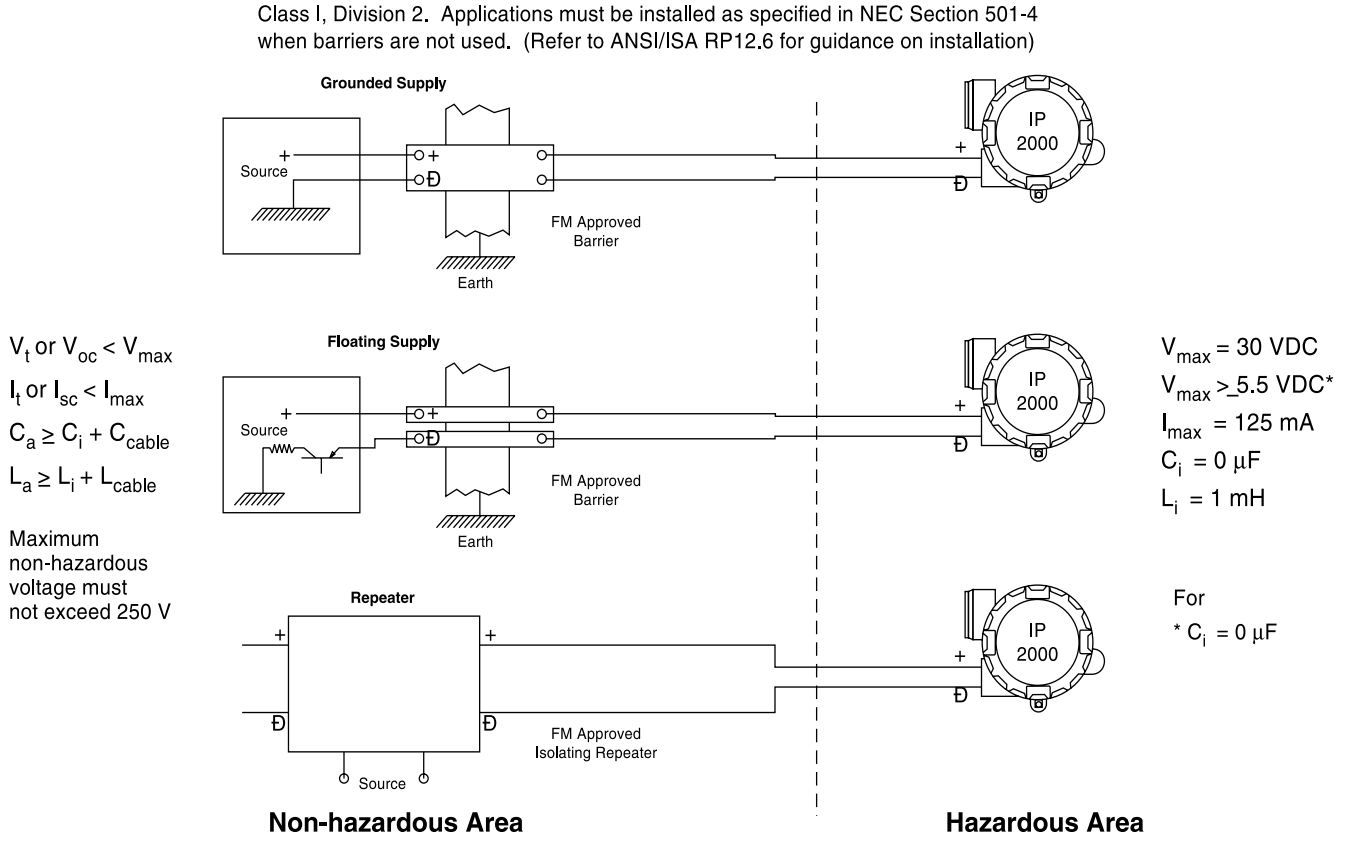


Figure 1: Intrinsically Safe Installation Schematic

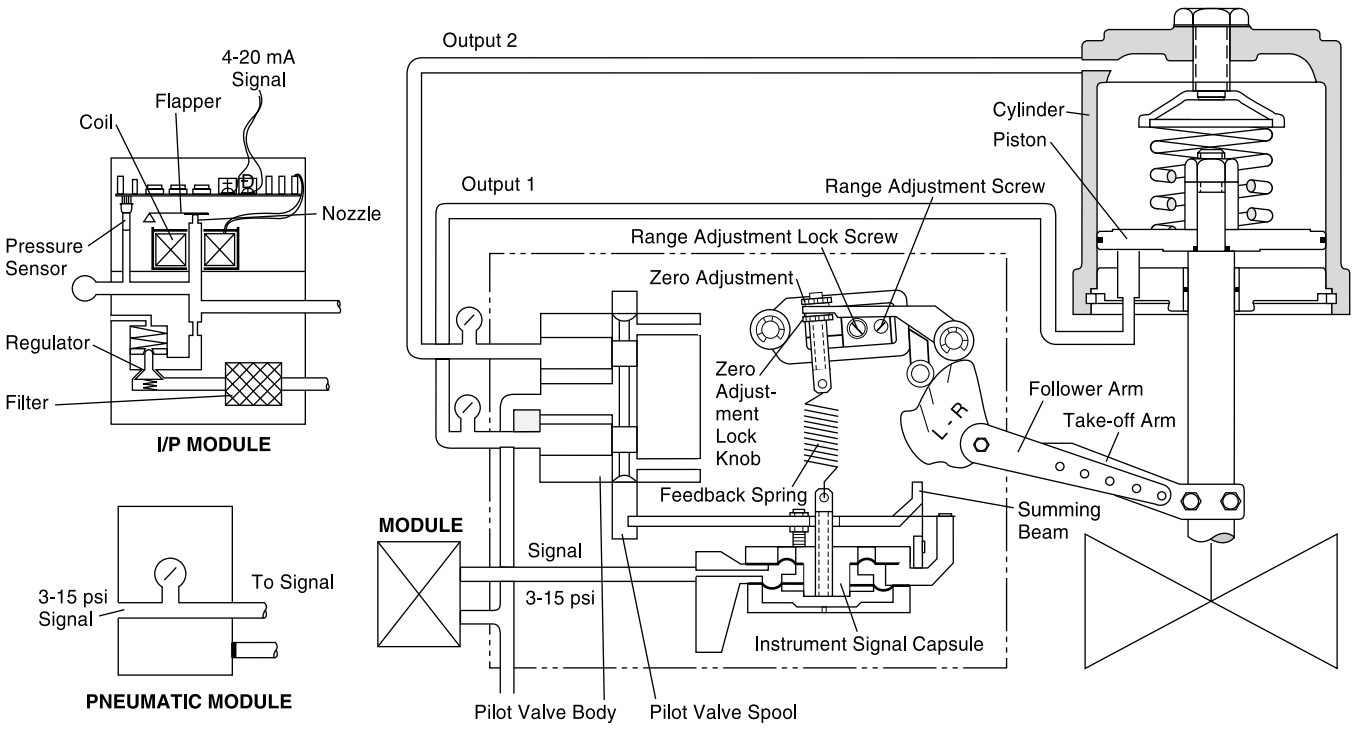


Figure 2: Positioner Schematic for Air-to-Open (Retract)

When these opposing forces balance exactly, the system will be in equilibrium and the stem will be in the position called for by the instrument signal. If these opposing forces are not in balance, the summing beam will move up (or down) and, by means of the spool valve, will change the output pressures and flow rate. This will cause the piston to move until tension on the feedback spring equalizes with the instrument signal pressure.

The detailed sequence of positioner operations are as follows: An increase in the instrument signal forces the instrument signal capsule and summing beam downward. This motion of the summing beam also pulls the pilot valve spool downward from its equilibrium position. This opens the pilot valve ports, supplying air to port 1 and exhausting air from port 2. This causes the actuator piston to move upward.

This upward motion of the piston is transmitted back to the positioner through the feedback linkage and cam resulting in the spring being stretched proportionally to the valve position. The piston continues to stroke upward until the force in the feedback spring increases sufficiently to counter the force generated by the instrument signal capsule. At this point, the summing beam and spool begin to return to their equilibrium position. As the valve spool ports start to close, the air flow rate to the actuator is decreased.

After the piston has reached the required position, the feedback spring tension force will equal the force generated in the instrument signal capsule. The summing beam and instrument signal capsule will remain in their equilibrium positions with no air flowing to the actuator until a change in the instrument signal is made.

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

The spool has a close tolerance to the block and a small amount of air, 0.3 SCFM, will exhaust at the null, or equilibrium, position. This air consumption is normal.

I/P Module Operation

The I/P module receives a 30-150 psi air supply pressure from the Beta positioner and converts it to a 3-15 psi output signal. This signal is proportional to a 4-20 mA input signal or a 10-50 mA input signal depending on the model used.

The supply pressure from the Beta Positioner is filtered as it passes through a field-replaceable, coalescing filter element in the module. Next it passes through an internal pressure regulator that regulates it to approximately 22 psi. The air then goes through an orifice that restricts the flow and air consumption.

The air is further controlled to 3-15 psi using a spring-diaphragm flapper that is attracted by an electromagnet to a nozzle. A temperature compensated piezoresistive pressure sensor mounted on a circuit board senses the I/P output pressure. The pressure sensor and circuitry create a feedback loop, which determines how much current to send to the electromagnet for a desired pressure output. The electromagnet in the feedback loop varies the nozzle-flapper spacing, which regulates the I/P output pressure to 3-15 psi proportional to the 4-20 (or 10-50 mA) input signal.

Figure 3: Positioner Mounted on Mark One with Linear Actuator

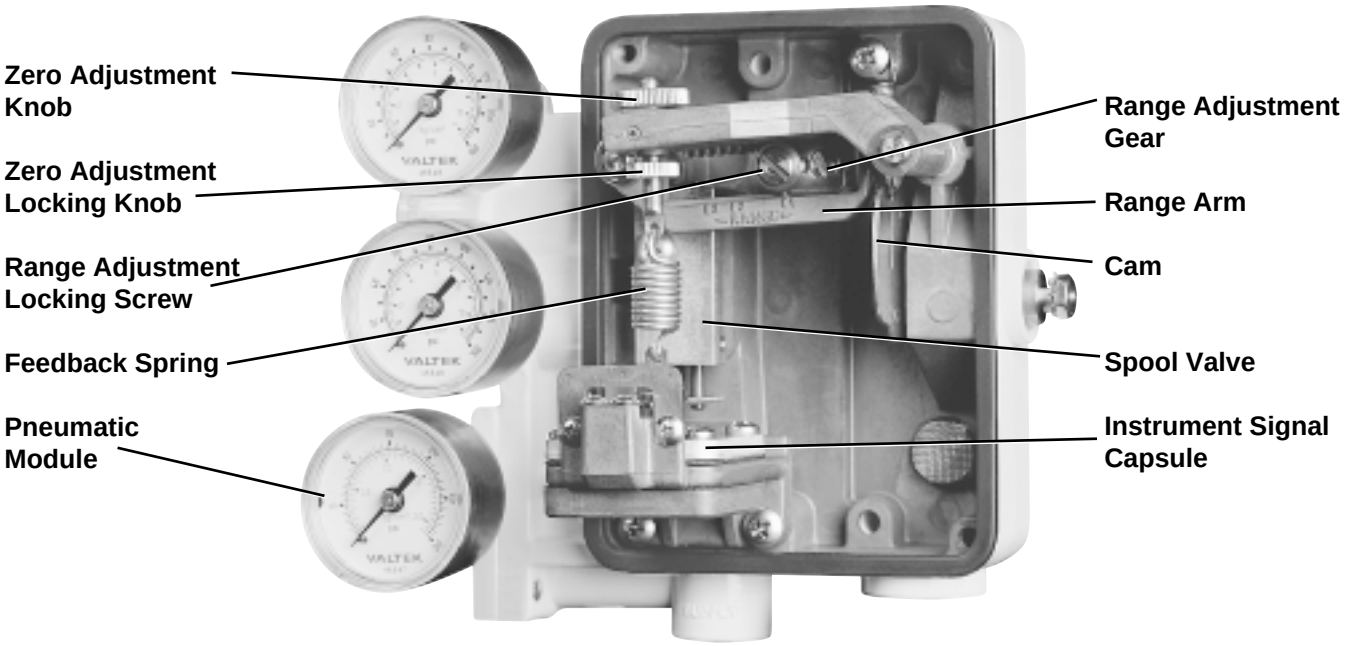


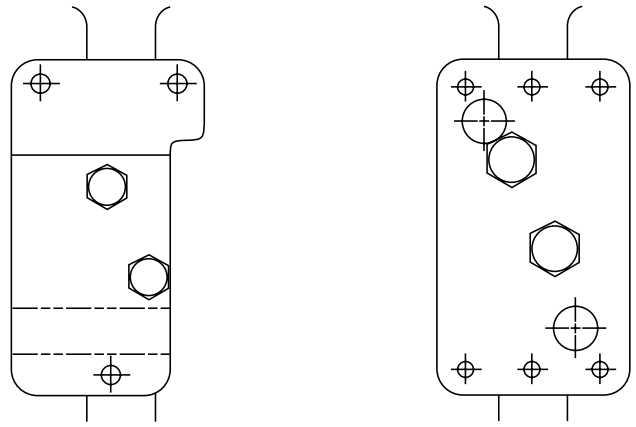
Figure 4: Beta Positioner with Pneumatic Module

Installation

The installation section of this bulletin details how to install the positioner on linear and rotary actuators. Reversing the air action on linear and rotary actuators is also covered along with an explanation of how to convert the positioner from an I/P to pneumatic or pneumatic to I/P control signal.

Installing Positioner on Linear Actuators

Information for installing or retrofitting the Beta Positioner on all sizes of linear actuators follows:



Size 25, 100, 200 **Size 50**

Figure 5: Mounting Bracket

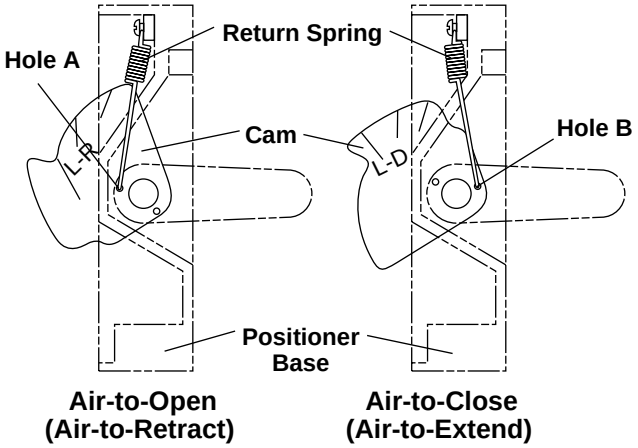


Figure 6: Return Spring / Cam Mounting

(viewed from positioner's right side)

NOTE: *When retrofitting the Beta Positioner to an actuator equipped with a Moore or comparable positioner, remove the existing positioner, bracket, stem clamp, and associated bolting. If retrofitting to an actuator equipped with a Valtek Beta pneumatic, system 80, or XL positioner, the same bracket, stem clamp, and bolting can be used.*

1. Place the new stem clamp (if applicable) onto the actuator stem with the boss on the right side as illustrated in Figure 3.
2. Mount the positioner bracket to the yoke leg which has the stroke indicator plate attached to it and in the correct position as shown in Figure 5.

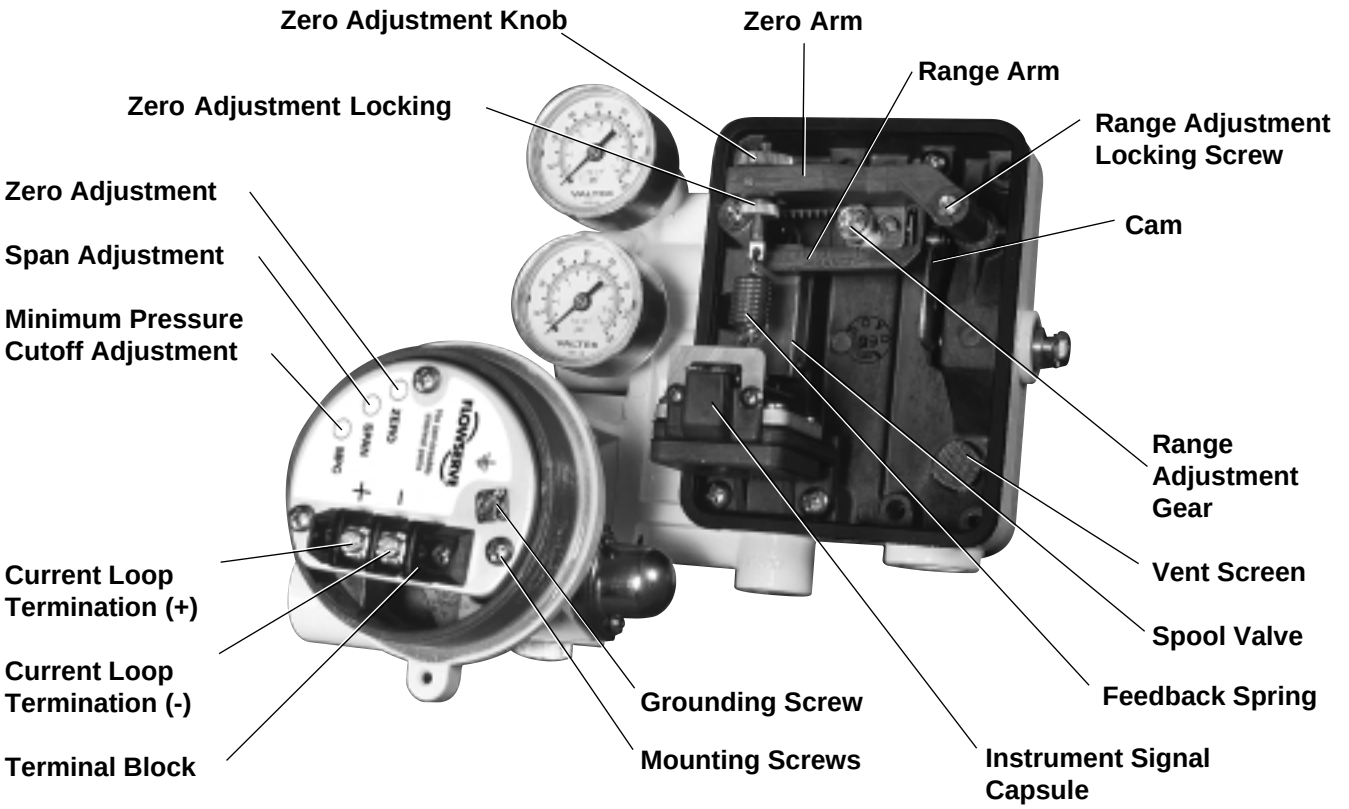


Figure 7: Beta Positioner with NT 3000 Transducer

3. If not welded to the stem clamp, bolt the take-off arm to the stem clamp so that the arm curves upward (toward the cylinder). The holes in the follower arm (31) should line up with the slots in the take-off arm (again refer to Figure 3).
4. Referring to Figure 6, install the cam (27), cam shaft (29) and follower arm (31) for the proper air action. For air-to-open action, the cam should be installed with the letters L-R facing toward the cam shaft and the return spring should be fed into hole "A." For air-to-close action, the L-D side of the cam should face toward the cam shaft and the return spring should be fed into hole "B."
5. Feed the appropriate stroke follower arm (31) onto the cam shaft boss (29) with the hole markings facing outward. Fasten securely with the lock washer (32) and nut (33).
6. Mount positioner on the bracket. Connect the follower arm (31) and take-off arm together with follower pin (62). Connection must allow free movement of follower arm.

   CAUTION: Be certain to lubricate the follower pin and take-off arm where contact is made to prevent premature wear. A light industrial grease is recommended. Failure to do so can cause premature wear, resulting in equipment failure and possible personal injury.
7. For air-to-open (air-to-retract) air action, tube "output 1" to the bottom and "output 2" to the top of the cylinder. For air-to-close (air-to-extend) action, tube "output 2" to the bottom and "output 1" to the top of the cylinder.
8. Attach air supply and instrument tubing, using $^{1}/_{4}$-inch NPT tubing connections.

   CAUTION: A 3-15 psi instrument signal is recommended on the pneumatic module. High air pressure may damage the module; the module is limited to 30 psi.

Reversing Air Action 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 on all sizes of Valtek linear actuators:

1. Using Installation, Operation, Maintenance Instructions 2, 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 "Installing Positioner on Linear Actuators" section of this bulletin.

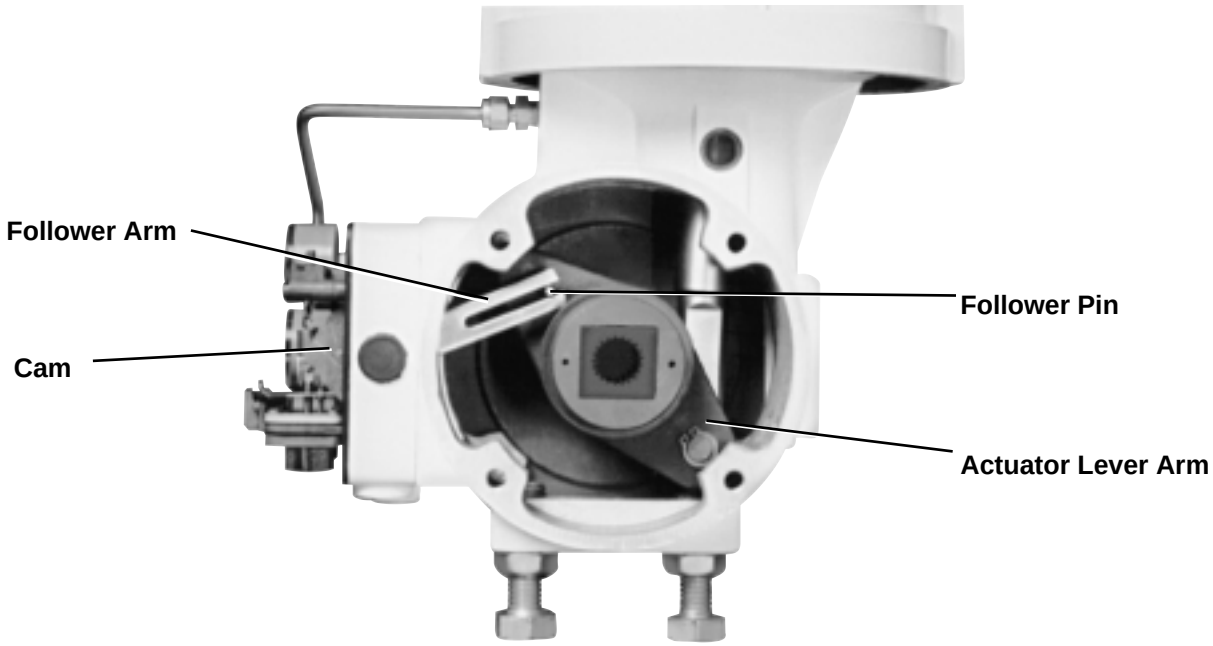


Figure 8: Beta Positioner Installation on Rotary Actuator

Installing Positioner on Rotary Actuators

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

1. Remove the feedback spring (34) and rotate the zero adjustment arm (22) out of the way. Remove the snap ring (8) from the range adjustment arm post and remove the range adjustment arm (13).

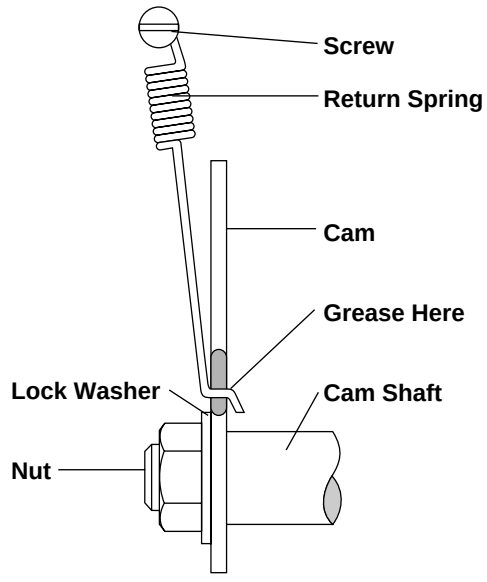


Figure 9: Installation for Cam Return Spring

Table I: Rotary Actuator Cam Characteristic Chart

Cam No.	Fail Action	Characteristic (1)	
		Equal Percent	Linear
Valdisk and ShearStream			
046467.999.000	Air-to-Open	B	C
046467.999.000	Air-to-Close	C	B
MaxFlo			
121579.999.000	Air-to-Open	B	C
160825.999.000	Air-to-Close	B	C

(1) Letters are the markings stamped on either side of the cam.

2. With the desired cam (see Table 1) and its identification letter facing towards the cam shaft, slide the cam (56) onto the end of the cam shaft having the shorter shoulder (57). (Refer to Table 1 to determine desired cam characteristic). Fasten with the star lock washer (32) and nut (33).
3. Insert the follower arm (58) into the back recess of the positioner with part identification number facing out. Slide the cam shaft (57) through the inner bearing and then slip the flatted hole of the follower arm (58) over the longer stepped shoulder of the cam shaft (57).
4. Place a small amount of threadlocking compound (Loctite #222 or equivalent) to the threaded portion

of the cam shaft nut (59). Slide the cam shaft nut (59) through the outer bearing and screw it onto the cam shaft (57). Tighten the cam shaft together firmly so that the follower arm (58) is securely clamped. Also, make sure the cam (56) is tightly secured to the cam shaft. Check to be sure there is no slippage. Apply a small amount of grease to the bent end of the return spring (18) and feed it through the hole in the cam (56). Loop the other end of the return spring over the screw (19) and screw it into the positioner base.

NOTE: *Screw head will not bottom out.*

5. Replace the range adjustment arm (13) and its snap ring (8).
6. Rotate the zero adjustment arm (22) back into place and reinstall the feedback spring (34).
7. Insert the follower pin (62) into the hole in the actuator lever arm and drive it firmly into place with a hammer (see Figure 8).
8. Apply grease to the sliding surfaces of the follower arm (58) before mounting the positioner to the transfer case. When mounting the positioner to the transfer case, make sure to guide the follower arm (58) so the pin slides in the slot on the follower arm (see Figure 8). Fasten the positioner to the transfer case with the three mounting screws. Push up on cam to verify that the pin is riding in the follower arm slot or remove the transfer case cover plate to inspect.

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

   Depending on the positioner cam side selected, the rotation of the valve shaft may be linear or equal percent when compared to the instrument signal to the positioner. Figures 13 through 16 show the shaft rotation versus instrument signal of a valve (Valdisk, MaxFlo or ShearStream). These graphs should be used when visually checking the valve shaft rotation versus positioner signal relationship.

Reversing Air-Action 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 Installation, Operation, Maintenance Instructions 10, Valdisk Control Valves; Installation, Operation, Maintenance Instructions 27, ShearStream Control Valves; Installation, Operation, Maintenance Instructions 31, Rotary Actuators; or Installation, Operation, Maintenance Instructions 39, MaxFlo Control Valves.

Converting Positioner Input Signal

Converting a Beta positioner's input signal from an I/P to pneumatic or pneumatic to I/P control signal is accomplished by unbolting the existing input signal module and replacing it with the other (either an I/P module or a pneumatic module). The part numbers for these modules are found in the "Ordering Information" section of this bulletin.

Calibration

Procedures for calibrating both rotary and linear actuators are the same.

Valtek positioners mounted on valves are calibrated at the factory; however, due to shipping and handling, it may be necessary to check the calibration before operating the valve. There are three feedback springs (34) available for use in the Beta Positioner, depending on the valve stroke and split range required. The silver spring (standard) is used with standard stroke actuators. A red spring is used with short stroke actuators ($^1/_2$-inch on 25 or 50 square-inch actuators, $^3/_4$ and 1-inch strokes on 100 square-inch actuators). A green spring provides two, three or four-way split ranges on standard stroke actuators. The silver spring also provides two or three-way split ranges on short stroke actuators

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

Calibrating Positioner Zero and Span

For Calibration, see Figure 7 and proceed as follows:

1. For standard ranges (3-15 psi, 4-20 mA), loosen the zero adjustment locking knob (23) and adjust the zero adjustment knob (20) until the valve begins to stroke at just over the desired zero point (usually 3 psi pneumatic, 4 mA electrical).
2. Loosen range adjustment locking screw (9) about $^1/_8$ turn.
3. With a screwdriver, turn the range adjustment gear (12) so that the valve is at full stroke at just under the desired maximum range point (usually 15 psi pneumatic, 20 mA electrical).
4. Return to minimum signal (usually 3 psi pneumatic, 4 mA electrical) and check the zero. Repeat steps 1 - 4 if necessary.
5. Tighten the range adjustment locking screw (9).
6. Tighten the zero adjustment locking screw (23).

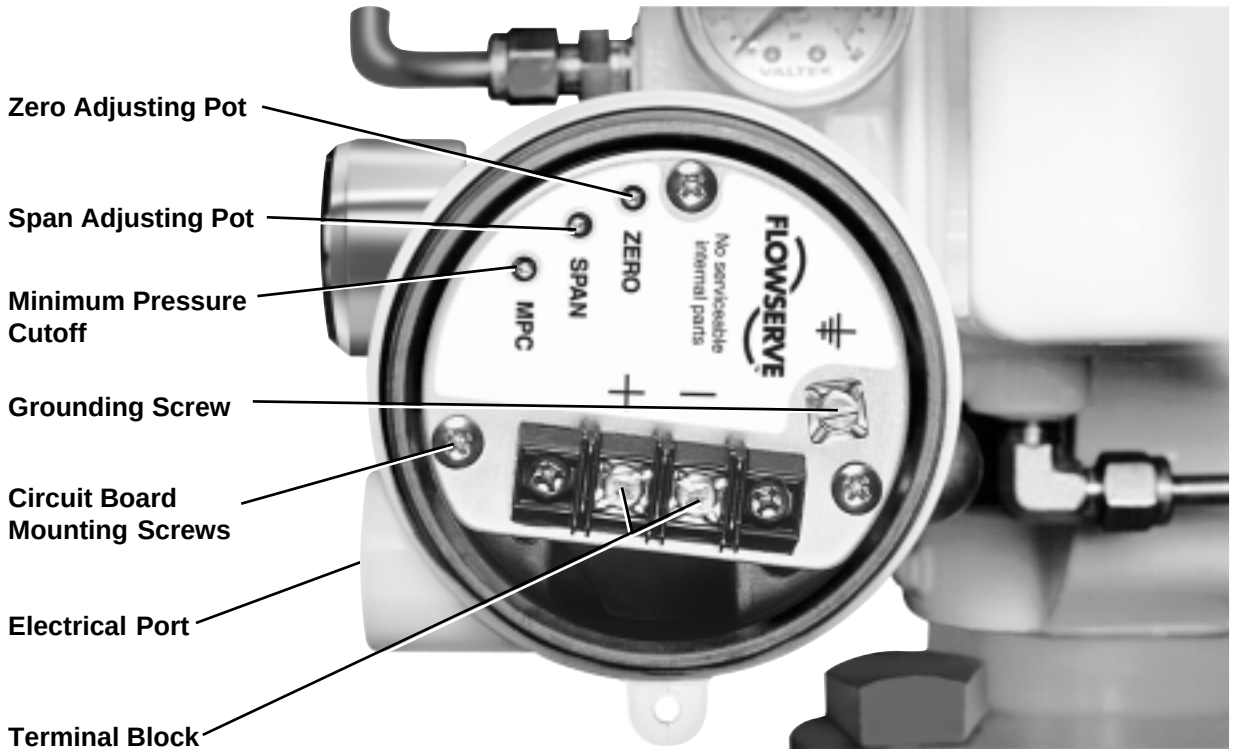


Figure 10: I/P Module Circuit Board (housing cover removed)

Adjusting Minimum Pressure Cutoff; I/P Module Pressure Regulator or Module Output; Calibrating and Adjusting the NT 3000 I/P

Refer to Installation, Operation, Maintenance Instructions 47, NT 3000 Series Electro-pneumatic Transducer Module, for instructions on adjusting the MPC feature, adjusting the I/P module pressure regulator output, adjusting I/P module pressure modulator or calibration of the I/P module zero and span settings.

MAINTENANCE

Beta Positioner Maintenance

General maintenance procedures for the Beta positioner on both rotary and linear actuators are the same. At least once every six months, check positioner for proper operation by following the steps outlined below.

1. Maintain a clean air supply, free of dust, oil, and water. It is recommended that an air filter be used to ensure a clean air supply to positioner. Check and maintain air filter at least every six months.

   NOTE: *The air supply should conform to ISA Standard S7.3 (a dew point at least 18^{o} F below ambient temperature, particle size below 5 microns, oil content not to exceed 1 part per million).*

2. Make sure all arms and levers move freely.
3. Check for and tighten any loose parts.
4. Be sure there are no leaks in the air supply.
5. Check and maintain the coalescing filter element in the I/P module every six months.
6. Refer to the “Troubleshooting” section of this bulletin in case of problems.

Removal and Repair of Pilot Valve

To remove or repair the positioner pilot valve, refer to Figure 17 and proceed as follows.

1. Loosen the zero adjustment locking knob (23) and zero adjusting knob (20). Disconnect the feedback spring (34) from the zero adjusting screw (24). Remove the feedback spring (34) from the positioner assembly. Rotate the zero arm (22) out of the way before removing the snap ring (8) holding the range adjustment arm (13) to the base (7). Remove the range adjustment arm (13).
2. Remove the two screws (53) holding the pilot valve assembly (40, 52) to the base (7). Remove the pilot valve assembly (40, 52) from the positioner, being careful not to damage the spool valve or summing beam assembly (41). Slide the spool (40) from the spool valve body (52) and check it for dirt build-up

or sticking. To operate properly, the spool (40) should slide freely and fall through the spool valve body (52) by its own weight when held vertically. Clean both the pilot valve spool (40) and body (52) with a degreasing solvent. When clean, insert the spool (40) back into the body (52) and move it back and forth to ensure that it slides freely for proper operation. If the spool (40) doesn't slide freely, reclean or replace it.

CAUTION: Do not apply oil or grease to the spool. It will adversely affect the performance of the positioner.

Removal and Repair of Instrument Capsule Assembly

To remove and repair the instrument capsule assembly, refer to Figure 4 or 17, and proceed as follows.

NOTE: *If the instrument capsule assembly is damaged, the entire instrument capsule assembly with the summing beam is available as a spare part and can be replaced as a unit. It can also be disassembled and only the soft goods replaced.*

1. To replace the entire instrument capsule assembly, first remove the pilot valve assembly (40, 52) as described in steps 1 and 2 in the preceding section. Then remove the two screws (35) fastening it to the base. Make sure the new instrument capsule O-ring (48) is installed in the base of the instrument capsule assembly. Install the two mounting screws (35) and tighten. Reinstall the pilot valve assembly (40, 52) as described in step 7.
2. If you wish to disassemble the instrument capsule and replace diaphragms, then proceed as follows: Remove the pilot valve assembly (40, 52) as described in steps 1 and 2 of the preceding section. Remove the instrument capsule assembly from the positioner base by removing two screws (35). Remove the nut (38) from the top of the summing beam assembly (41). Remove the four screws (36) that attach the summing beam assembly (41) to the assembly of the instrument capsule body (43), then remove the summing beam assembly (41).
3. Remove the four screws (39) holding the upper diaphragm retaining plate (42) to the instrument capsule assembly. Remove the upper diaphragm retaining plate (42) and the lower diaphragm retaining plate (50) from the assembly. Carefully push the diaphragm assembly (49) through the hole and out the bottom of the instrument capsule base. Examine the instrument diaphragm assembly (49) for wear or failure and replace if necessary. When replacing the diaphragm assembly (49), remove and save the feedback screw from this assembly.
4. Reattach the feedback screw to the new instrument diaphragm assembly (49) by applying a small amount of threadlocking compound (Loctite #222 or equivalent) to the threads. Twist the feedback screw into the instrument diaphragm assembly (49) until it is approximately flush with the bottom of the diaphragm assembly (49). However, make sure it doesn't protrude through.
5. Carefully fold up the corners of the smaller diaphragm on the diaphragm assembly (49) and carefully work it through the hole in the instrument capsule base (43). Rotate the diaphragm assembly so the small tapped hole in the diaphragm assembly (49) hub is oriented downward closest to the mounting base. Install the lower diaphragm retaining plate (50) and the upper diaphragm retaining plate (42) over the diaphragm assembly (49) making sure that all the diaphragm corners are lying flat. Install and securely tighten the four screws (39). Apply a small amount of Loctite #222 to the shorter threaded portion of the spring and stud assembly (45, 46, 47) and screw it into the diaphragm center hub until the spring coil (46) bottoms out against the center hub. Thread nut (38) onto the longer portion of the stud assembly until it bottoms out against the top of the coil spring (46).
6. Reinstall the summing beam assembly (41) with four screws (36) with a small amount of Loctite #222 or equivalent applied to each screw. Be careful not to bend the thin flexures on the summing beam. With the bottom nut (38) threaded down against the top of the spring coil (46), install the top nut (38) and tighten it firmly, attaching the summing beam assembly (41) to the diaphragm assembly. Install a new O-ring (48) in the instrument capsule base. Install the two mounting screws (35) and fasten the assembly securely to positioner base (7).
7. To reinstall the pilot valve assembly (40, 52), replace the three pilot valve O-rings (54). Compress the leaf spring on the end of the summing beam assembly (41) and carefully engage the notched end of pilot valve assembly (40, 52) with the beam spring. Slide the pilot valve assembly (40, 52) carefully until it is aligned with its mounting holes and fasten securely with two screws (53).
8. Return range arm (13) to the base (7) and secure with snap ring (8). Reinstall the feedback spring (34) with one end engaging the feedback screw on the instrument diaphragm assembly (49) and the other end engaging the zero screw (24). Then calibrate positioner according to "Calibration" section of this document.

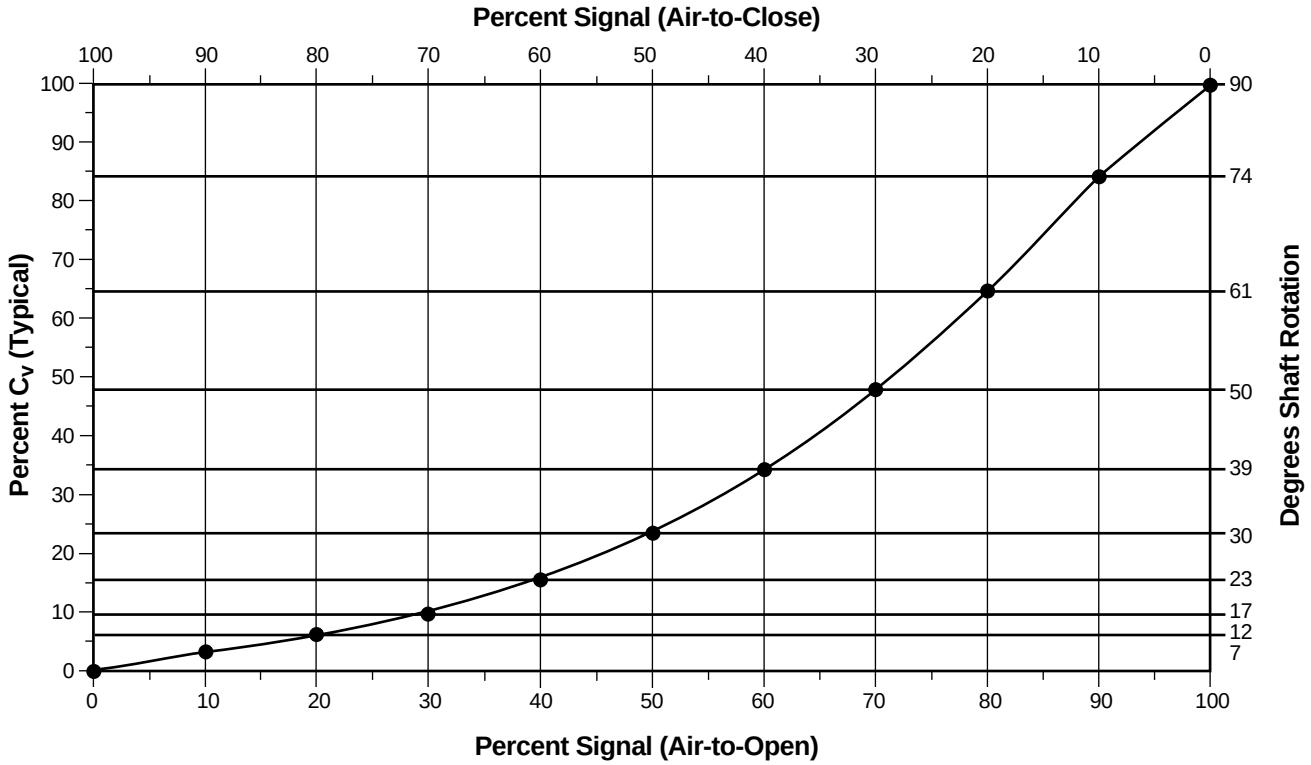


Figure 11: Valdisk – Equal Percent Flow Characteristic (Shaft Rotation vs. Instrument Signal)

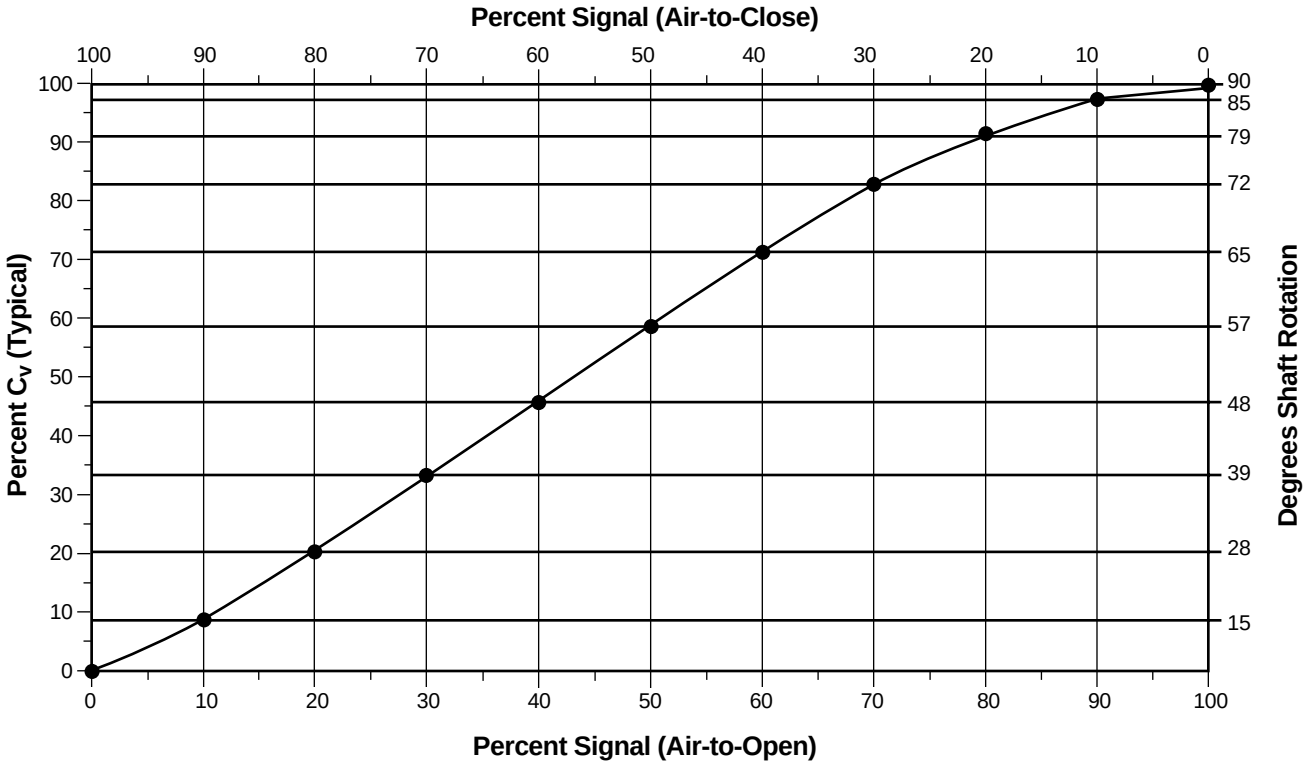


Figure 12: Valdisk – Linear Flow Characteristic (Shaft Rotation vs. Instrument Signal)

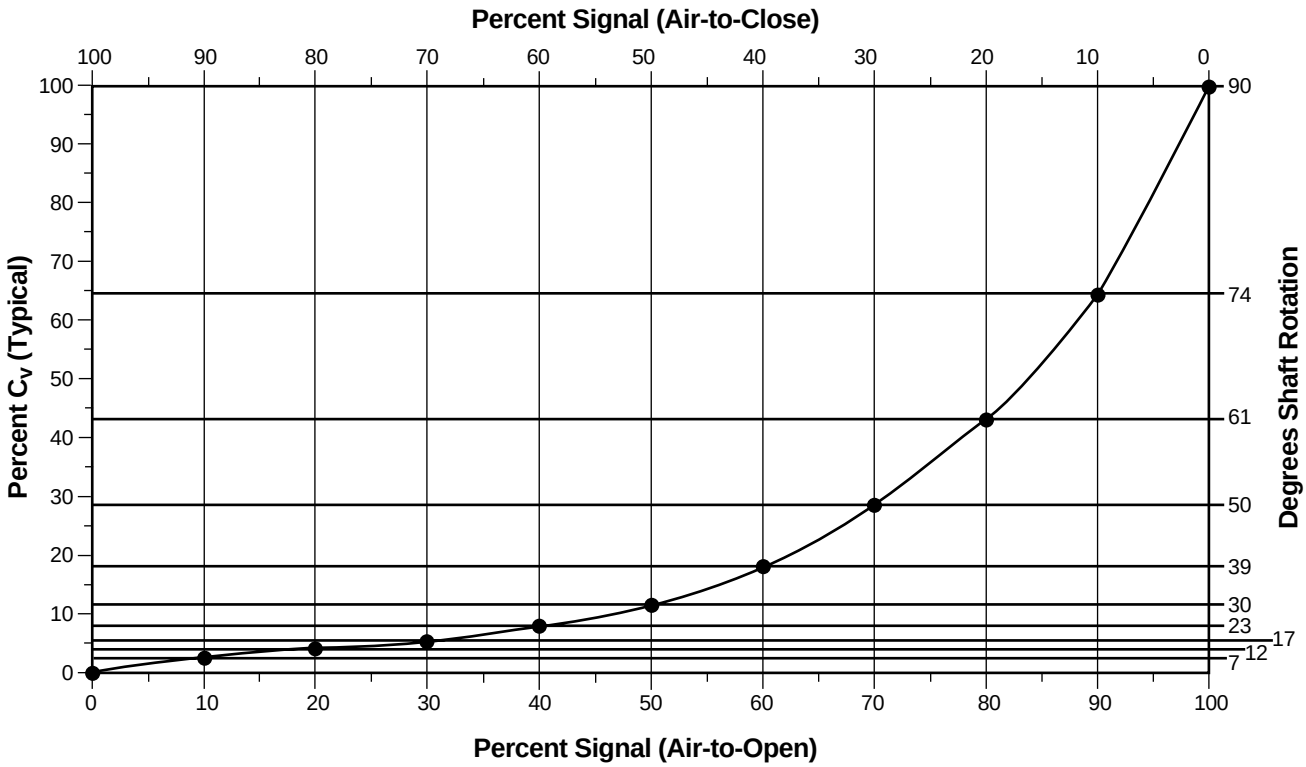


Figure 13: ShearStream – Equal Percent Flow Characteristic (Shaft Rotation vs. Instrument Signal)

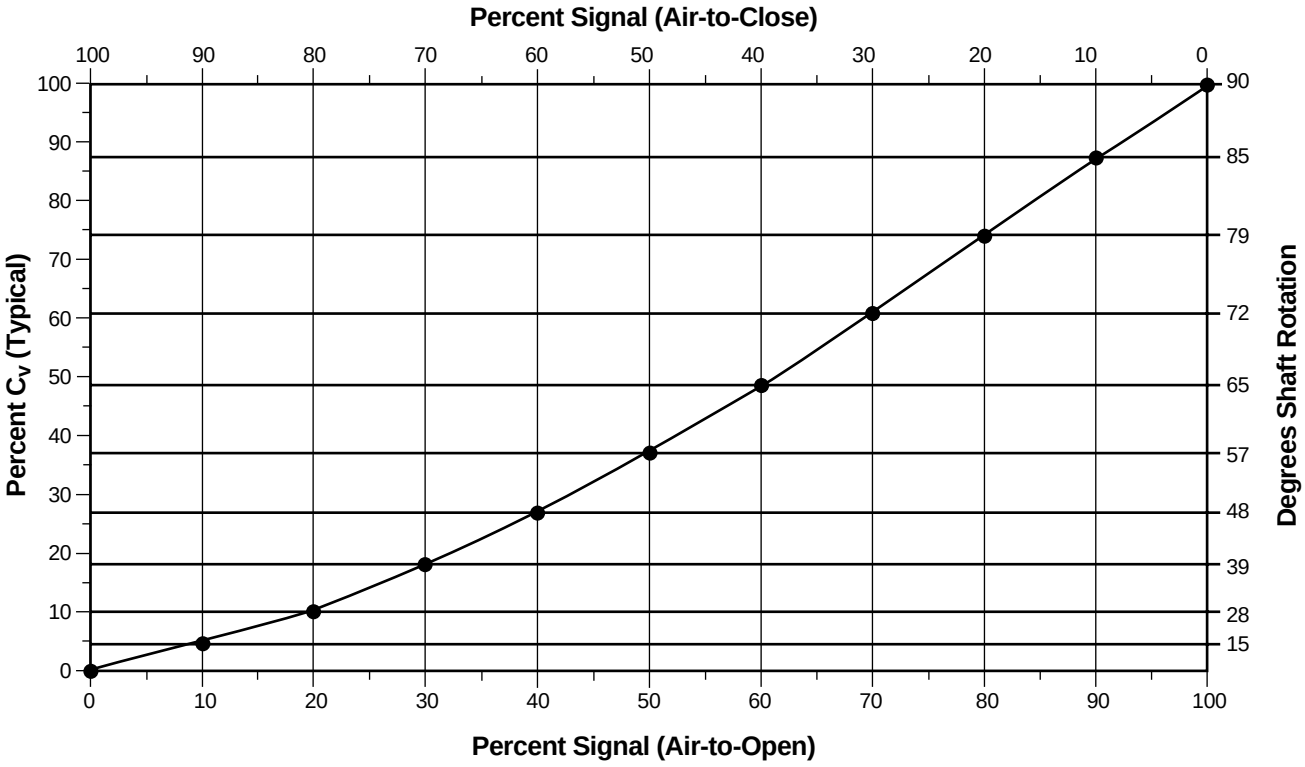


Figure 14: ShearStream – Linear Flow Characteristic (Shaft Rotation vs. Instrument Signal)

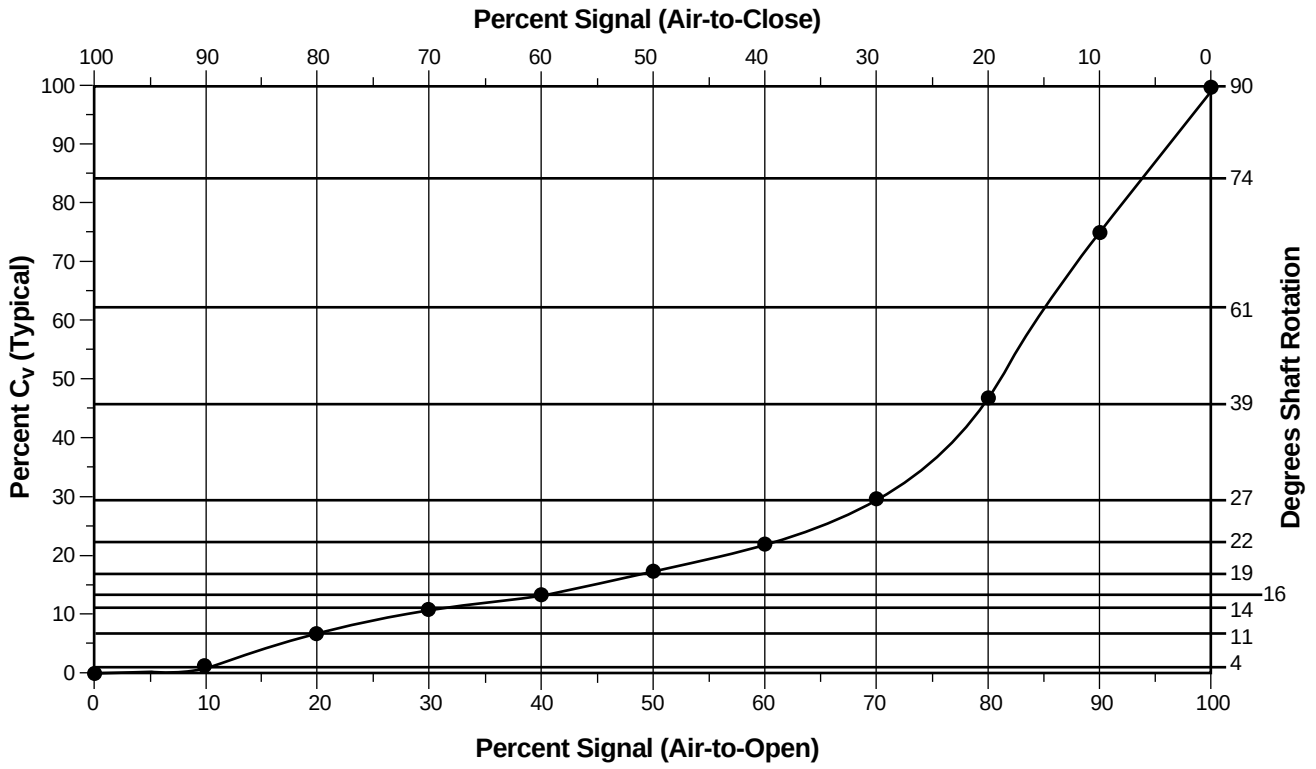


Figure 15: MaxFlo – Equal Percent Flow Characteristic (Shaft Rotation vs. Instrument Signal)

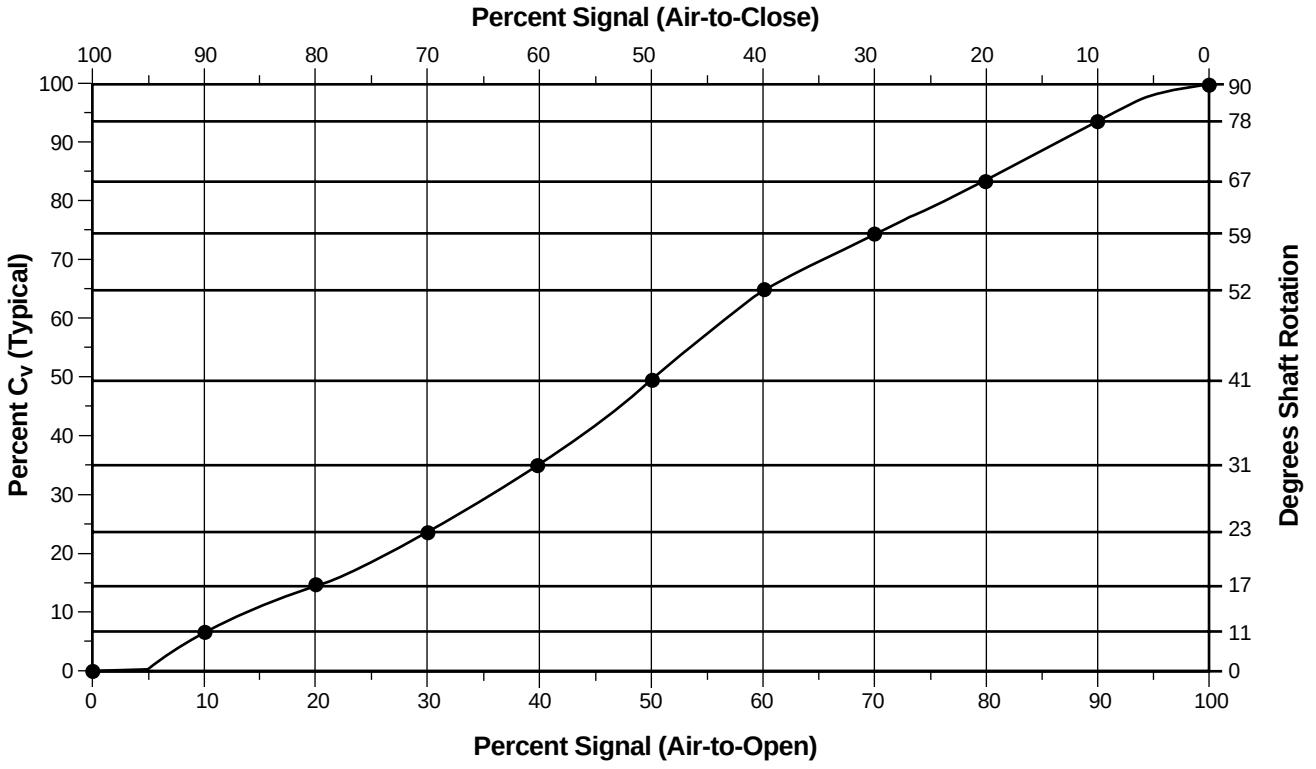


Figure 16: MaxFlo – Linear Flow Characteristic (Shaft Rotation vs. Instrument Signal)

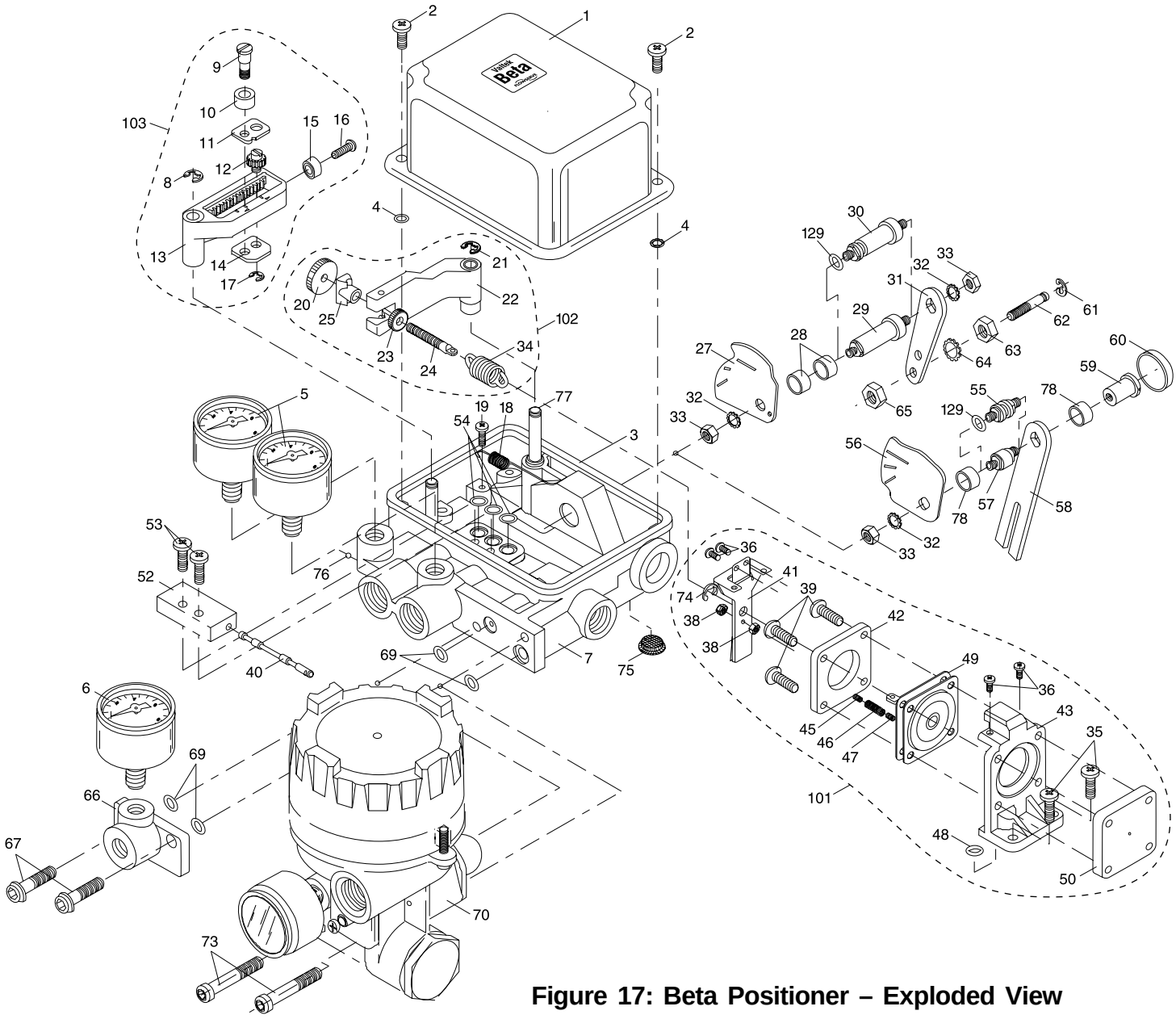


Figure 17: Beta Positioner – Exploded View

Positioner Parts List*

1. Cover
2. Screw
3. Gasket
4. O-ring
5. Pressure gauge 0-150 psi
6. Pressure gauge 0-30 psi
7. Base
8. Snap ring
9. Pivot screw
10. Pivot bushing
11. Front range plate
12. Range adjustment gear
13. Range adjustment arm
14. Rear range plate
15. Bearing
16. Screw
17. Snap ring
18. Return spring
19. Screw
20. Zero adjustment knob
21. Snap ring
22. Zero arm
23. Zero adjustment lock knob
24. Zero adjusting screw
25. Pivot
26. Lock washer
27. Cam, linear
28. Bushing, linear
29. Cam shaft, linear
30. Cam shaft, linear, vented
31. Follower arm
32. Lock washer
33. Nut
34. Feedback spring
35. Screw
36. Screw
38. Nut
39. Screw
40. Spool
41. Summing beam assembly
42. Upper diaphragm retaining plate
43. Diaphragm base
45. Stud
46. Spring
47. Stud
48. Instrument capsule O-ring
49. Instrument diaphragm assembly
50. Lower diaphragm retaining plate
52. Spool valve body
53. Screw
54. Spool valve O-rings
55. Cam shaft, rotary, vented
56. Cam, rotary
57. Cam shaft, rotary
58. Follower arm, rotary
59. Cam shaft nut, rotary
60. Cap, rotary
61. Snap rings
62. Follower pin
63. Nut
64. Lock washer
65. Nut
66. Pneumatic adapter
67. Bolt, socket head
69. O-ring
70. I/P module assembly
73. Bolt, socket head
74. Snap ring
75. Vent screen
76. Ball
77. Post
78. Bushing, rotary
101. Instrument diaphragm assembly
102. Zero adjusting arm assembly
103. Range arm assembly
129. O-ring, vented

** All of the above parts are in stock, and can be purchased in any one of 34 spare parts kits. For selecting and ordering the appropriate kit or a new positioner, contact your Valtek representative or the factory.*

Ordering Information

The following information is provided to order a new Beta 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 2 and 3.

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

Stroke	Air Action	P/P Module	NT 3000 I/P Module
Stand.	Air-to-Open(2)	130122.999.000	167981.999.000
	Air-to-Close	130157.999.000	167982.999.000
Short	Air-to-Open(2)	130158.999.000	167983.999.000
	Air-to-Close	130159.999.000	171787.999.000

(1) Can be split ranged 2:1 or 3:1 without additional parts. Also available are positioner models with 6-30 psi or 10-50 mA span and the same split ranges.
(2) 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	055895.999.000*(3)
25	3/8	2.00	055895.999.000*(3)
25	1/2	2.00	048624.999.000
25	3/4 - 1 1/2	2.00	048624.999.000
50	1/4	2.00	080647.999.000(3)
50	3/4 - 1 1/2	2.00	048624.999.000
50	3/4 - 1 1/2	2.62	056098.999.000
50	3	2.62	048625.999.000
100 / 200	3/4 - 3	2.62 - 2.88	048625.999.000
100 / 200	3/4 - 4	3.38 - 4.75	048626.999.000
100 / 200	5 - 8	3.38 - 4.75	048627.999.000

* Requires the use of stem clamp number 055679.164.000
(3) Use short-stroke positioners with: 25 sq. in. actuator, 1/4, 3/8 with stroke; 50 sq. in. actuator, 1/4-inch stroke.

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 the follower arm.

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

Valve Type	Installed Cam(4)	P/P Module	NT 3000 I/P Module(5)
Valdisk or Shear Stream			
	B(4)	130326.999.000	167985.999.000
	C(4)	130327.999.000	167986.999.000
MaxFlo			
Air-to-Open	B (eq. per.)	130975.999.000	167989.999.000
Air-to-Close	B (eq. per.)	161127.999.000	171236.999.000
Air-to-Open	C (Linear)	130978.999.000	171235.999.000
Air-to-Close	C (Linear)	161154.999.000	171269.999.000

(1) Can be split ranged 2:1 or 3:1 without additional parts. Also available are positioner models with 6-30 psi or 10-50 mA span and the same split ranges.
(4) 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 the “Cam Characteristic” chart in Table I.
(5) FM/CSA Explosion Proof and Intrinsically Safe rating.

Table V: Follower Arms - Rotary Actuators

Actuator Size (Square-inches)	Follower Arm Part Number
25	042817.999.000
50	042816.999.000
100 / 200	041418.999.000

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 1.

Several kits are available to convert the Beta positioner control signal from either pneumatic to I/P, or from I/P to pneumatic.

Table VI: Conversion Kits(1)

Module	Number
I/P to Pneumatic	041694.999.000
Pneumatic to I/P	
(FM/CSA Exp. Proof. I.S.)	164672.999.000
(Cenelec I.S. w/M20 connection)	167926.999.000
(Cenelec I.S. w/1/2" NPT connection)	171586.999.000
(Cenelec Exp. Proof w/M20 connection)	171971.999.000
(Cenelec Exp. Proof w/1/2" NPT connection)	173444.999.000

(1) Conversion kits include I/P or pneumatic module, two screws (item 67 or 73), two O-rings (item 69), and a standard gauge (item 6). See Figure 17 for reference to item numbers.

SPARE PART KITS

BETA POSITIONER *(see Figure 17)*

Kit 1 - Standard
Part No. 043984.999.000

Item No.	Description	Quantity
40, 52	Pilot valve assembly	1
53	Screw	2
54	Spool valve O-rings	3

Kit 2 - Standard w/EPDM O-rings
Part No. 063528.999.000

Item No.	Description	Quantity
40, 52	Pilot valve assembly	1
53	Screw	2
54	Spool valve O-rings	3

Kit 3 - Standard w/Viton O-rings
Part No. 033451.999.000

Item No.	Description	Quantity
40, 52	Pilot valve assembly	1
53	Screw	2
54	Spool valve O-rings	3

Kit 4 - Standard w/extended temperature O-rings
Part No. 046710.999.000

Item No.	Description	Quantity
40, 52	Pilot valve assembly	1
53	Screw	2
54	Spool valve O-rings	3

Kit 5 - High flow w/Buna-N O-rings
Part No. 075171.999.000

Item No.	Description	Quantity
40, 52	Pilot valve assembly	1
53	Screw	2
54	Spool valve O-rings	3

Kit 6 - High flow w/extended temperature O-rings
Part No. 081575.999.000

Item No.	Description	Quantity
40, 52	Pilot valve assembly	1
53	Screw	2
54	Spool valve O-rings	3

ZERO ARM KITS

Kit 7 - No split range (Standard Stroke) 2, 3-way split range (Short Stroke) Part No. 125250.999.000

Item No.	Description	Quantity
21	Snap ring	1
34	Feedback spring	1
102	Zero adjustment arm assembly (includes item No. 20, 22, 23, 24, 25)	1

Kit 8 - 2, 3, 4-way split range (Standard Stroke)
Part No. 130165.999.000

Item No.	Description	Quantity
21	Snap ring	1
34	Feedback spring	1
102	Zero adjustment arm assembly (includes item No. 20, 22, 23, 24, 25)	1

Kit 9 - 1/2-inch stroke No Split Range
Part No. 130164.999.000

Item No.	Description	Quantity
21	Snap ring	1
34	Feedback spring	1
102	Zero adjustment arm assembly (includes item No. 20, 22, 23, 24, 25)	1

CAM KITS (Linear Valves)

Kit 10 - Standard cam
Part No. 044186.999.000

Item No.	Description	Quantity
18	Return spring	1
19	Screw	1
27	Cam (linear)	1
29	Cam shaft (linear)	1
32	Lock washer	2
33	Nut	2

Kit 11 - Standard cam, cam shaft with O-ring groove for vented positioner
Part No. 054394.999.000

Item No.	Description	Quantity
18	Return spring	1
19	Screw	1
27	Cam (linear)	1
30	Cam shaft (linear, vented)	1
32	Lock washer	2
33	Nut	2
129	O-ring (vented)	1

Kit 12 - Standard cam, cam shaft, with O-ring groove for vented positioner, extended temperature
Part No. 051362.999.000

Item No.	Description	Quantity
18	Return spring	1
19	Screw	1
27	Cam (linear)	1
30	Cam shaft (linear, vented)	1
32	Lock washer	2
33	Nut	2
129	O-ring (vented positioner)	1

Kit 13 - Equal percentage cam
Part No. 076490.999.000

Item No.	Description	Quantity
18	Return spring	1
19	Screw	1
27	Cam (linear)	1
29	Cam shaft (linear)	1
32	Lock washer	2
33	Nut	2

CAM KITS (Rotary Valves)

Kit 14 - Standard Part
No. 048444.999.000

Item No.	Description	Quantity
18	Return spring	1
19	Screw	1
33	Nut	1
32	Lock washer	1
56	Cam (rotary)	1
57	Cam shaft (rotary)	1
59	Cam shaft nut (rotary)	1
60	Cap (rotary)	1

Kit 15 - Standard w/O-ring groove for vented positioner
Part No. 074910.999.000

Item No.	Description	Quantity
18	Return spring	1
19	Screw	1
33	Nut	1
32	Lock washer	1
55	Cam shaft (rotary, vented)	1
56	Cam (rotary)	1
59	Cam shaft nut (rotary)	1
60	Cap (rotary)	1
129	O-ring (vented)	1

Kit 16 - Reversible rotary cam, linear shaft rotation vs. signal change
Part No. 041610.999.000

Item No.	Description	Quantity
18	Return spring	1
19	Screw	1
33	Nut	1
32	Lock washer	1
56	Cam (rotary)	1
57	Cam shaft (rotary)	1
59	Cam shaft nut (rotary)	1
60	Cap (rotary)	1

INSTRUMENT CAPSULE KITS

Kit 17 - Standard input capsule, 3-15 psi
Part No. 120079.999.000

Item No.	Description	Quantity
35	Screw	2
48	Instrument capsule O-ring	1
101	Instrument capsule assembly (includes item No. 36, 38, 39, 41, 42 43, 45, 46, 47, 49, 50, 74)	1

Kit 18 - EPDM diaphragms, 3-15 psi
Part No. 130491.999.000

Item No.	Description	Quantity
35	Screw	2
48	Instrument capsule O-ring	1
101	Instrument capsule assembly (includes item No. 36, 38, 39, 41, 42 43, 45, 46, 47, 49, 50, 74)	1

Kit 19 - Fluorisilicon diaphragms, 6-30 psi, extended temperature
Part No. 130175.999.000

Item No.	Description	Quantity
35	Screw	2
48	Instrument capsule O-ring	1
101	Instrument capsule assembly (includes item No. 36, 38, 39, 41, 42 43, 45, 46, 47, 49, 50, 74)	1

Kit 20 - 6-30 psi, standard temperature
Part No. 130168.999.000

Item No.	Description	Quantity
35	Screw	2
48	Instrument capsule O-ring	1
101	Instrument capsule assembly (includes item No. 36, 38, 39, 41, 42 43, 45, 46, 47, 49, 50, 74)	1

Kit 21 - Fluorosilicon diaphragms, 3-15 psi, extended temperature
Part No. 130166.999.000

Item No.	Description	Quantity
35	Screw	2
48	Instrument capsule O-ring	1
101	Instrument capsule assembly (includes item No. 36, 38, 39, 41, 42 43, 45, 46, 47, 49, 50, 74)	1

Kit 22 - Viton diaphragms, 3-15 psi
Part No. 130486.999.000

Item No.	Description	Quantity
35	Screw	2
48	Instrument capsule O-ring	1
101	Instrument capsule assembly (includes item No. 36, 38, 39, 41, 42 43, 45, 46, 47, 49, 50, 74)	1

ADAPTER MANIFOLD KITS

Kit 23 - Standard adapter manifold w/gauge (item 6); item No. 67 bolts replaces No. 73
Part No. 041694.999.000

Item No.	Description	Quantity
66	Pneumatic adapter	1
67	Socket head bolt	2
69	O-ring	2
6	Gauge, 0-30 psi	1

Kit 24 - Standard without gauge
Part No. 095704.999.000

Item No.	Description	Quantity
66	Pneumatic adapter	1
73	Socket head bolt	2
69	O-ring	2

Kit 25 - Extended temperature kit (Fluorisilicon O-rings) without gauges
Part No. 095705.999.000

Item No.	Description	Quantity
66	Pneumatic adapter	1
73	Socket head bolt	2
69	O-ring	2

Kit 26 - Adapter w/Viton O-rings without gauges
Part No. 095706.999.000

Item No.	Description	Quantity
66	Pneumatic adapter	1
73	Socket head bolt	2
69	O-ring	2

POSITIONER BASE KITS

Kit 27 - Standard base w/o O-rings
Part No. 063458.999.000

Item No.	Description	Quantity
3, 7, 28, 77	Base assembly (includes posts, bushings, gasket)	1

Kit 28 - Standard base w/EPDM O-rings for manifold
Part No. 082908.999.000

Item No.	Description	Quantity
3, 7, 28, 77	Base assembly (includes posts, bushings, gasket)	1
69	EPDM O-ring	2

Kit 29 - Stainless steel base
Part No. 087627.999.000

Item No.	Description	Quantity
3, 7, 28, 77	Base assembly (includes posts, bushings, gasket)	1
175	Set screw	1
75	Vent screen	1

Kit 30 - Standard base w/Viton O-ring
Part No. 033450.999.000

Item No.	Description	Quantity
3, 7, 28, 77	Base assembly (includes posts, bushings, gasket)	1
69	Viton O-ring	2

Kit 31 - Standard base w/Buna-N O-rings
Part No. 062159.999.000

Item No.	Description	Quantity
3, 7, 28, 77	Base assembly (includes posts, bushings, gasket)	1
69	Buna-N O-ring	2

Kit 32 - Scout valve base
Part No. 076973.999.000

Item No.	Description	Quantity
3, 7, 28, 77	Base assembly (includes posts, bushings, gasket)	1

Kit 33 - Positioner Cover Kit
Part No. 043981.999.000

Item No.	Description	Quantity
1	Cover with sticker	1
2	Screw	2
4	O-ring	2

Kit 34 - Range Arm Kit
Part No. 125252.999.000

Item No.	Description	Quantity
8	Snap ring	1
103	Range arm assembly (includes item No. 9, 10, 11, 12, 13, 14, 15, 16, 17)	1

Beta Positioner Troubleshooting

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 arm stuck 4. Pilot spool stuck 5. I/P module filter plugged 6. I/P module failure 7. I/P mounting bolts loose	1. Retube to correct ports (see "Installation" section) 2. Refer to installation section and reverse cam 3. Work with stuck arm until it freely turns 4. Work spool by hand until it freely moves, or remove spool and spool valve body and clean thoroughly; replace if necessary 5. Remove I/P module and replace filter 6. Replace I/P module 7. Tighten mounting bolts
Actuator goes to full signal position, regardless of signal	1. Broken feedback spring 2. Linkage is disconnected, stuck or missing parts 3. Pilot spool stuck 4. I/P module orifice plugged	1. Replace feedback spring 2. Check and tighten all bolts and nuts in linkage, make sure linkage doesn't stick. 3. Work spool by hand until it freely moves, or remove spool and spool valve body and clean thoroughly; replace if necessary. Do not apply grease to spool valve. 4. Return I/P module to factory for service
Calibration shifts	1. Loose positioner mounting 2. Loose linkage 3. Loose zero adjustment locking knob 4. Worn arms or pins 5. I/P mounting bolts loose	1. Remove cover and check three screws holding positioner to bracket, check two bolts holding bracket to yoke 2. Tighten all nuts and bolts on linkage 3. Tighten zero adjustment locking knob or range adjustment locking knob adjustment after calibrating knob 4. Replace arms or pins, and apply grease 5. Tighten mounting bolts
Excessive air consumption (other than normal exhaust)	1. Air leakage from O-rings 2. Air leakage from tubing 3. Leaky cylinder piston O-rings	1. Remove spool valve; Check O-rings and replace if necessary 2. Tighten or replace tubing fittings 3. Replace O-rings in cylinder
Actuator strokes very slowly in one direction only	1. Connection between capsule and beam improperly adjusted 2. Tubing to cylinder is restricted 3. I/P module filter plugged	1. Retighten summing beam to diaphragm assembly with nut bottomed out against coil of spring (See step 6 in "Removal & Repair of Instrument Capsule Assembly") 2. Locate faulty tube and replace it 3. Remove I/P module and replace filter
Erratic operation	1. Dirt build-up inside spool valve 2. Bent spool 3. Broken linkage or positioner parts	1. Disassemble; clean spool and body; add air filter to air supply; if air filter exists, replace cartridge 2. Replace spool and valve block 3. Replace broken parts

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