V-9000 Series Rotary Motion Rack and Pinion Pneumatic Actuators for Butterfly Valves

Product Bulletin

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The V-9000 Series Pneumatic Rack and Pinion Actuators are designed for direct mounting on Johnson Controls® VF Series Butterfly Valves. The actuators are available in eight sizes with torque output capacities capable of automating VF Series Butterfly Valves up to 20 inches in size.

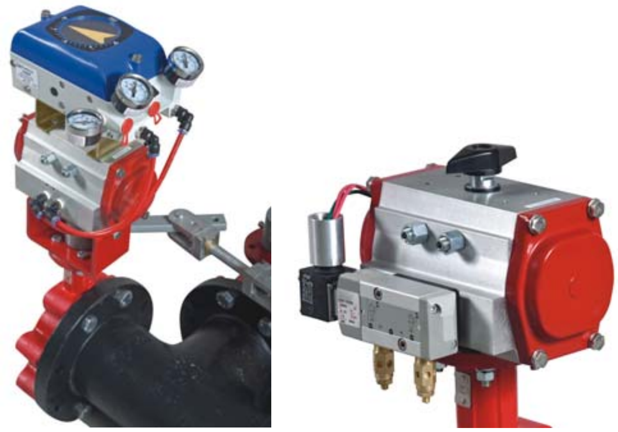


Figure 1: V-9000 Series Pneumatic Actuators Installed on VF Series Butterfly Valves

Table 1: Features and Benefits

Features	Benefits
Compact Modular Design	Provides direct mounting to VF Series Butterfly Valves.
Low Friction Piston Guides and Rings	Provide maximum efficiency and long life.
Built-in Shaft Position Indicator and Travel Stops	Mean that no add-on visual indicators or travel stops are required.
Full Range of Modular Add-on Control Accessories	Allows versatility in meeting system design requirements.

Applications

The V-909x Series Actuators are double-acting (air-to-open/air-to-close), whereas the V-919x Series Actuators incorporate spring-return action. The unique modular design allows the same basic actuator body to be used for both spring-return or double-acting service requirements.

For two-position operation, either style of actuator is furnished with the appropriate factory-mounted 120 VAC solenoid air valve. For modulating control applications, the solenoid air valve is replaced with a V-9000-500 Positioner.

Clean (filtered), dry air at 40 to 120 psig (280 to 840 kPa) is recommended. Pressures well below and slightly higher than this range may be allowed under certain conditions. Consult a Johnson Controls representative for application recommendations.

The recommended operating temperature range is -13 to 200°F (-25 to 95°C). Below 32°F (0°C), take care to protect the supply air lines from freezing should condensed moisture collect in them.

Features

The V-9000 Series Pneumatic Actuator is a space-saving modular product line that is completely enclosed and self-contained (see Figure 2).

The acetal guide ring and bearing pad have a very low coefficient of friction and absorb the side thrusts of the pistons. In addition, the piston cylinder walls in the body are honed to a very fine finish thus reducing the overall coefficient of friction.

The output shaft bearings on the top and bottom of the pinion are made of low-friction acetal. The output shaft and pinion gear are one piece, manufactured from hardened alloy steel, and zinc-plated for corrosion protection.

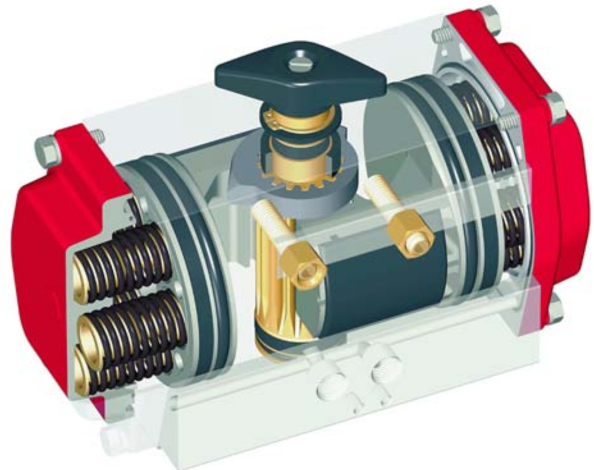


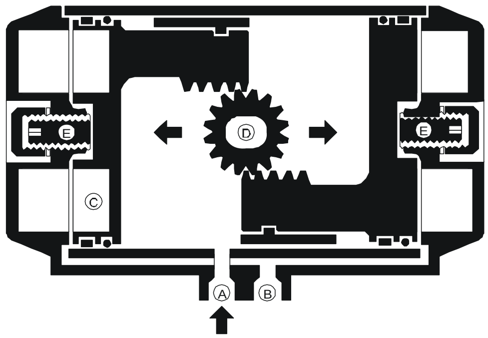
Figure 2: V-9000 Cutaway View

The shaft position indicator clearly shows the open or closed position and can easily be removed when field mounting a positioner or travel switch.

The body is extruded aluminum with an anodized corrosion protective surface. The end caps have a thermoplastic epoxy coat for chemical resistance.

The travel stop adjusting screws limit the travel of the actuator to specific degrees of rotation. The pistons are die cast aluminum.

Operation.

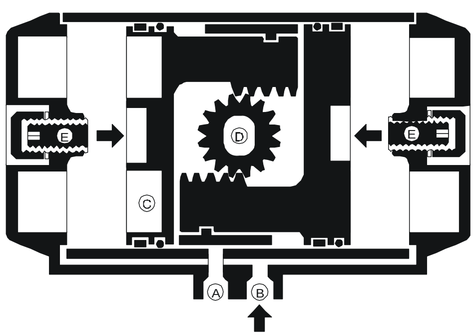


Drive Stroke

Figure 3: Sectional View from Top
V-909x Series Double Acting Actuators

As illustrated in Figure 3, the air pressure is applied to the inner chamber through Port A and exhausted from the outer chamber through the exhaust Port B. The outward generated force causes the pistons (C) to move outward, which in turn causes the output shaft (D) to rotate counterclockwise (when viewed from the top).

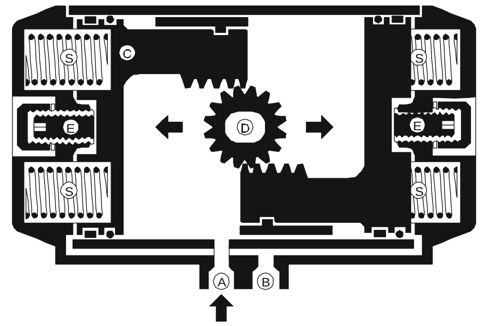
This movement continues until the pistons come into contact with the mechanical end stroke adjustment screws (E), which are factory set for 90° rotation. The screws can be adjusted to precisely regulate the rotation of the pistons and output shaft to the correct amount of travel.



Return Stroke

Figure 4: Sectional View from Top
V-909x Series Double Acting Actuators

As illustrated in Figure 4, with air pressure applied to the outer chamber from the supply through Port B and exhausted from the inner chamber through Port A, the inward generated force causes the pistons (C) to move inward, which in turn causes the output shaft (D) to rotate clockwise (when viewed from the top).

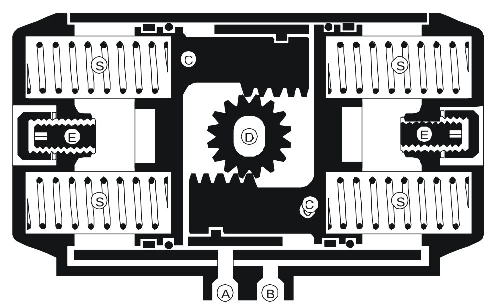


Air Stroke

Figure 5: Sectional View from Top
V-919x Series Spring Return Actuators

As illustrated in Figure 5, the air pressure is applied to the inner chamber through Port A and exhausted from the outer chamber through the exhaust Port B. The outward generated force causes the pistons (C) to move outward, which in turn causes the output shaft (D) to rotate counterclockwise (when viewed from the top) and the return springs (S) to compress.

This movement continues until the pistons come into contact with the mechanical end stroke adjustment screws (E), which are factory set for 90° rotation. The screws can be adjusted to precisely regulate the rotation of the pistons and output shaft to the correct amount of travel.



Spring Stroke

Figure 6: Sectional View from Top
V-919x Series Spring Return Actuators

As illustrated in Figure 6, with air pressure exhausted through Port A, the inward force generated by the return springs (S) causes the pistons (C) to move inward, which in turn causes the output shaft (D) to rotate clockwise (when viewed from the top).

Actuator Sizing

The V-9000 Series Rack and Pinion Actuators are presized for all styles of Johnson Controls VF Series Butterfly Valves; refer to the ordering data templates in *VF Series Standard-Pressure, Standard-Temperature Butterfly Valves Product Bulletin (LIT-977205P)* and *VF Series High-Pressure, High-Temperature Butterfly Valves Product Bulletin (LIT-977208)* for full code numbers for sizing recommendations. The actuators are sized for the maximum expected seating/unseating torque requirements of the valve at the minimum available air supply pressure to the actuator. Actuator sizing recommendations on VF Series Butterfly Valves are based on a 25% safety factor on 2 through 12 in. valves and a 10% safety factor on 14 through 20 in. valves.

See Table 2 for torque and ordering data for V-909x Series Actuators. Example 1 and Example 2 use information provided in Table 2.

- **Example 1**: A valve with 80 psig available air pressure requires 695 lb·in of torque. Use a V-9093-1 with 721 lb·in torque available.
- **Example 2**: A valve with 60 psig available air pressure requires 1,235 lb·in of torque. Use a V-9094-2 with 1,615 lb·in torque available.

Sizing for the V-919x Series Spring Return Actuators is dependent on the return to normal position of the valve.

See Table 2 for sizing information for normally open, normally closed, and three-way valves. Example 3, Example 4, and Example 5 use information provided in Table 2.

- **Example 3**: A normally closed valve with 80 psig available air pressure requires 465 lb·in of torque. Use a V-9194-14 with 522 lb·in spring start and 491 lb·in air end torque.
- **Example 4**: A normally closed valve with 60 psig available air pressure requires 705 lb·in of torque. Use a V-9194-24 with 732 lb·in spring end and 883 lb·in air start torque.
- **Example 5**: A three-way valve with 80 psig available air pressure requires 846 lb·in of torque. Use a V-9196-12 with 1,679 lb·in spring start; 978 lb·in spring end; 4,764 lb·in and air start; and 4,063 lb·in air end torque.

Note: One valve in the three-way assembly is normally open and one valve is normally closed; therefore, all four values must exceed the torque requirements for the valve assembly.

Table 2: V-909x Series Actuator Torque Data (lb·in)[1] and Ordering Data (Double Acting)

Code Number	Supply Pressure psig (kPa)					VF Series Code Number[2]	Actuator Air Volume (in^3)	Shipping Weight lb[3]
	40 (280)	60 (420)	80 (560)	100 (700)	120 (840)			
V-9092-1	145	221	297	373	449	-020	9.35	3.4
V-9093-1	351	536	721	906	1,091	-030	20.5	6.3
V-9094-1	493	753	1,013	1,272	1,532	-040	28.9	8.5
V-9094-2	1,058	1,615	2,171	2,728	3,285	-042	62.0	16.9
V-9096-1	2,797	4,270	5,742	7,214	8,687	-060	140.6	38.8
V-9097-1	5,783	8,826	11,870	14,914	17,957	-070	309.5	77.8
V-9098-1	14,211	21,691	29,171	36,650	44,130	-080	734.1	167.0

1. lb·in x 113 = N·m
2. Refer to the ordering data templates in *VF Series Standard-Pressure, Standard-Temperature Butterfly Valves Product Bulletin (LIT-977205P)* and *VF Series High-Pressure, High-Temperature Butterfly Valves Product Bulletin (LIT-977208)*.
3. lb x 0.454 = kg

Table 3: V-919x Series Actuator Torque Data (in·lb)[1] and Ordering Data (Spring Return)

Code Number	Suffix	Air Stroke Supply Pressure psig (kPa)										Spring Stroke		Weight (lb)[2]
		40 (280)		60 (420)		80 (560)		100 (700)		120 (840)				
		NC[3] Start	NO[3] End	NC Start	NO End	NC Start	NO End	NC Start	NO End	NC Start	NO End	NO Start	NC End	
V-9193	-12	210	167	395	352	580	537	765	722	950	907	184	141	6.0
	-13	156	76	341	261	526	446	711	631	896	816	275	195	6.3
	-14	--	--	281	176	466	361	651	546	836	731	360	255	6.6
	-15	--	--	220	97	405	282	590	467	775	652	439	316	6.8
	-16	--	--	--	--	369	185	554	370	739	555	536	352	7.1
V-9194	-12	310	232	570	492	830	752	1089	1011	1349	1271	261	183	8.0
	-13	218	101	478	361	738	621	997	880	1257	1140	392	275	8.4
	-14	--	--	386	231	646	491	905	750	1165	1010	522	367	8.8
	-15	--	--	294	94	554	354	813	613	1073	873	659	459	9.1
	-16	--	--	--	--	462	229	721	488	981	748	784	551	9.5
V-9194	-22	692	469	1249	1026	1805	1582	2362	2139	2919	2696	589	366	18.1
	-23	509	174	1066	731	1622	1287	2179	1844	2736	2401	884	549	18.8
	-24	--	--	883	437	1439	993	1996	1550	2553	2107	1178	732	19.5
	-25	--	--	700	142	1256	698	1813	1255	2370	1812	1473	915	20.3
	-26	--	--	--	--	1073	404	1630	961	2187	1518	1767	1098	21.0
V-9195	-13	--	--	1357	733	2099	1475	2841	2217	3583	2959	1419	795	22.1
	-15	--	--	--	--	1568	529	2310	1271	3052	2013	2365	1326	24.2
V-9196	-12	1819	1118	3292	2591	4764	4063	6236	5535	7709	7008	1679	978	39.7
	-13	1399	349	2872	1822	4344	3294	5816	4766	7289	6239	2448	1398	42.1
	-14	--	--	2452	1123	3924	2595	5396	4067	6869	5540	3147	1818	44.5
	-15	--	--	2030	353	3502	1825	4974	3297	6447	4770	3917	2240	46.8
	-16	--	--	--	--	3154	1196	4626	2668	6099	4141	4546	2588	49.2
V-9197	-12	3833	2508	6876	5551	9920	8595	12964	11639	16007	14682	3275	1950	75.1
	-13	2859	868	5902	3911	8946	6955	11990	9999	15033	13042	4915	2924	80.2
	-14	--	--	4930	2275	7974	5319	11018	8363	14061	11406	6551	3896	85.2
	-15	--	--	3949	638	6993	3682	10037	6726	13080	9769	8188	4877	90.3
	-16	--	--	--	--	6022	2031	9066	5075	12109	8118	9839	5848	95.3
V-9198	-12	9487	6747	16967	14227	24447	21707	31926	29186	39406	36666	7464	4724	160.2
	-13	7125	3015	14605	10495	22085	17975	29564	25454	37044	32934	11196	7086	168.3
	-14	--	--	12243	6762	19723	14242	27202	21721	34682	29201	14929	9448	176.4
	-15	--	--	9880	3030	17360	10510	24839	17989	32319	25469	18661	11811	184.5
	-16	--	--	--	--	14998	6778	22477	14257	29957	21737	22393	14173	192.6

1. in·lb x 113 = N·m
2. lb x 0.454 = kg
3. N.C. is the abbreviation for Normally Closed; N.O. is the abbreviation for Normally Open.

Table 4: V-919x Series Ordering Data

Code Number	Suffix	VF Series Code Number[1]	Total Actuator Air Volume Required for 90° Rotation (cubic inches)	Total Number of Springs in Actuator[2]
V-9193	-12	-320	32.6	4
	-13	-330		6
	-14	-340		8
	-16	-360		12
V-9194	-12	-420	45.9	4
	-13	-430		6
	-14	-440		8
	-15	-450		10
	-16	-460		12
V-9194	-22	-422	95.5	4
	-23	-432		6
	-24	-442		8
V-9195	-13	-530	130.8	6
	-15	-550		10
V-9196	-12	-620	259.6	4
	-13	-630		6
	-14	-640		8
	-15	-650		10
	-16	-660		12
V-9197	-12	-720	450	4
	-13	-730		6
	-14	-740		8
	-15	-750		10
	-16	-760		12
V-9198	-12	-820	900	4
	-13	-830		6
	-14	-840		8
	-15	-850		10
	-16	-860		12

1. Refer to the ordering data templates in *VF Series Standard-Pressure, Standard-Temperature Butterfly Valves Product Bulletin (LIT-977205P)* and *VF Series High-Pressure, High-Temperature Butterfly Valves Product Bulletin (LIT-977208)*.
2. The numbers listed are the total number of springs in the actuator; the last digit of the code number suffix indicates the number of springs per piston. There are two pistons per actuator.

Dimensions

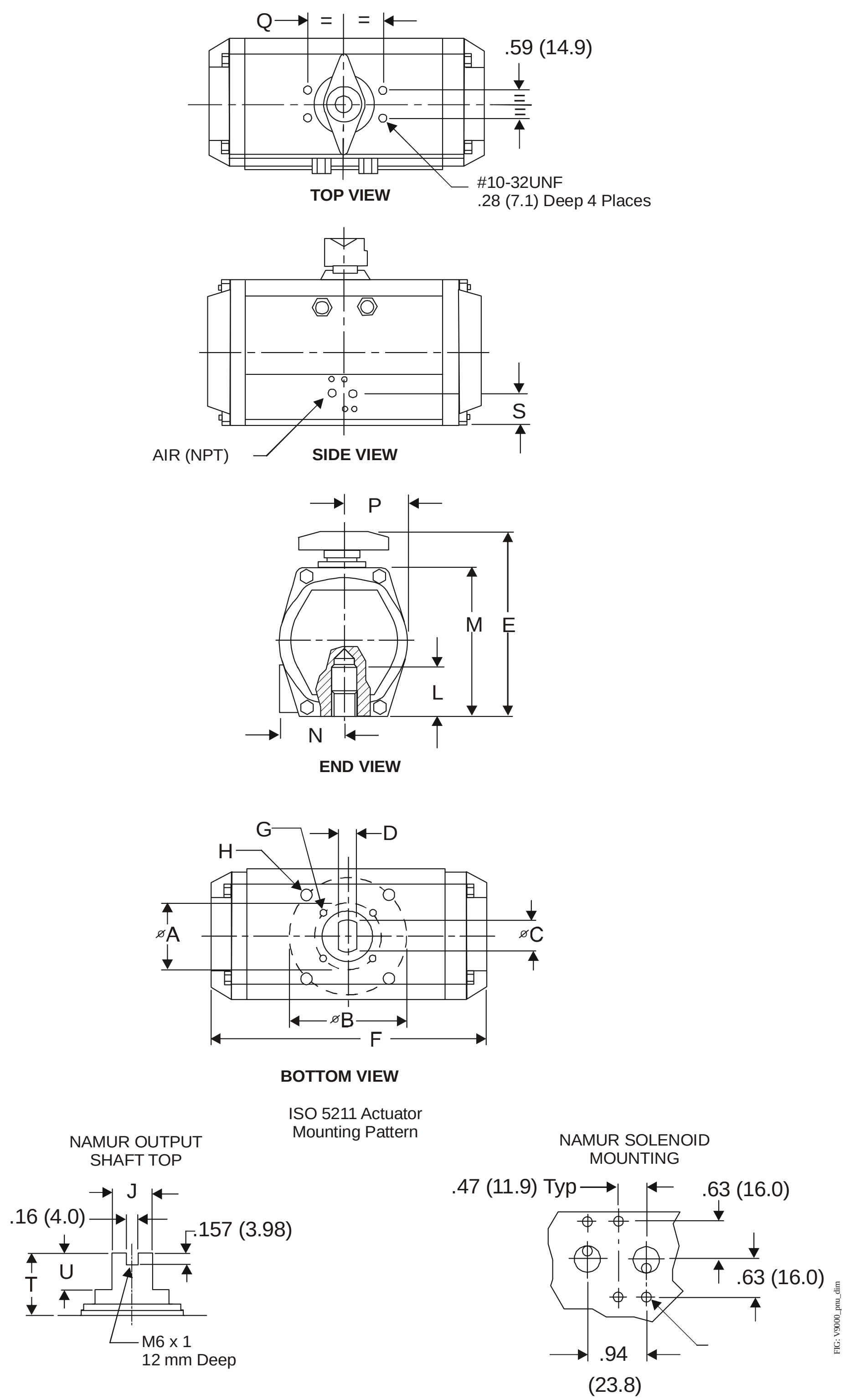


Figure 7: V-9000 Series Pneumatic Actuator Dimensions in. (mm)
(See Table 5 for Dimensions Matrix)

Table 5: V-9000 Series Actuator Dimensions Matrix in. (mm)

Dimension	V-9x92	V-9x93	V-9x94-1x	V-9x94-2x	V-9x95	V-9x96	V-9x97	V-9x98
Air (NPT)	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
A	1.97 F05	1.97 F05	1.97 F05	4.92 F12	4.92 F12	--	4.92 F12	6.50 F16
B	2.76 F07	2.76 F07	2.76 F07	4.92 F12	4.92 F12	4.92 F12	6.50 F16	7.87 x4.72 Rect.
C	.55 (14.0)	.75 (19.1)	.75 (19.1)	1.18 (30.0)	1.18 (30.0)	1.18 (30.0)	1.97 (50.0)	2.50 (63.5)
D	.40 (10.2)	.51 (13.0)	.51 (13.0)	.87 (22.1)	.87 (22.1)	.87 (22.1)	.47 (11.9)	.62 (15.7)
E	4.53 (115)	5.43 (138)	5.78 (147)	7.28 (185)	8.09 (206)	9.36 (238)	11.62 (295)	13.49 (343)
F	5.58 (142)	7.40 (188)	8.59 (218)	11.90 (302)	12.31 (313)	15.54 (395)	19.57 (497)	28.78 (731)
G (UNC)	1/4-20 x .32	1/4-20 x .32	1/4-20 x .32	5/16-18 x .46	5/16-18 x .46	--	1/2-13 x .78	M16x2 x 28 mm
H (UNC)	5/16-18 x .40	5/16-18 x .40	5/16-18 x .40	1/2-13 x .60	1/2-13 x .60	1/2-13 x .60	5/8-11 x 1.11	M16x2 x 28 mm
J	.38 (9.7)	.50 (12.7)	.50 (12.7)	1.12 (28.4)	1.12 (28.4)	1.12 (28.4)	1.12 (28.4)	1.12 (28.4)
L	1.38 (35.1)	1.46 (37.1)	1.46 (37.1)	2.20 (55.9)	2.20 (55.9)	2.20 (55.9)	4.72 (120)	6.50 (165)
M	3.46 (87.9)	4.27 (109)	4.61 (117)	5.52 (140)	6.32 (161)	7.80 (198)	10.16 (258)	12.06 (306)
N	1.72 (43.7)	2.28 (57.9)	2.47 (62.7)	2.78 (70.6)	2.88 (73.2)	3.78 (96.0)	4.56 (116)	5.40 (137)
P	1.38 (35.1)	1.79 (45.5)	1.97 (50.0)	2.37 (60.2)	2.70 (68.6)	3.39 (86.1)	4.41 (112)	5.39 (137)
Q	1.58 (40.1)	1.58 (40.1)	1.58 (40.1)	1.58 (40.1)	1.58 (40.1)	2.56 65.0)	2.56 (65.0)	2.56 (65.0)
S	.89 (22.6)	1.26 (32.0)	1.32 (33.5)	1.64 (41.7)	1.64 (41.7)	2.26 (57.4)	2.45 (62.2)	2.48 (63.0)
T	.79 (20.1)	.79 (20.1)	.79 (20.1)	.79 (20.1)	.79 (20.1)	1.18 (30.0)	1.18 (30.0)	1.18 (30.0)
U	.47 (11.9)	.47 (11.9)	.47 (11.9)	.47 (11.9)	.47 (11.9)	.75 (19.1)	.75 (19.1)	.75 (19.1)

Actuator Accessories

Positioner

Figure 8: V-9000-500 Positioner Mounted on a Three-Way Butterfly Valve Assembly

Use the V-9000-500 Positioner for modulating control of both double-acting and spring-return actuators.

When the V-9000 Series Rack and Pinion Actuator is ordered as a factory-mounted component of a complete VF Series Butterfly Valve assembly, the positioner can be ordered as a factory-installed option.

The positioner is designed for the proportional operation of quarter turn rotary actuators. It is generally coupled axially to the shaft of the actuator. The transparent cover and a pointer mark the position of the final control element. The positioner operates on a force-balance principle and allows for precise positioning over the entire range of the actuator stroke.

The positioner includes non-interactive zero and span adjustments, as well as field-selectable direct or reverse action.

The positioner is furnished with supply, input, and output gauges, as well as a position indicator visible through the clear polycarbonate cover of the unit.

Installation for Double Acting Actuation

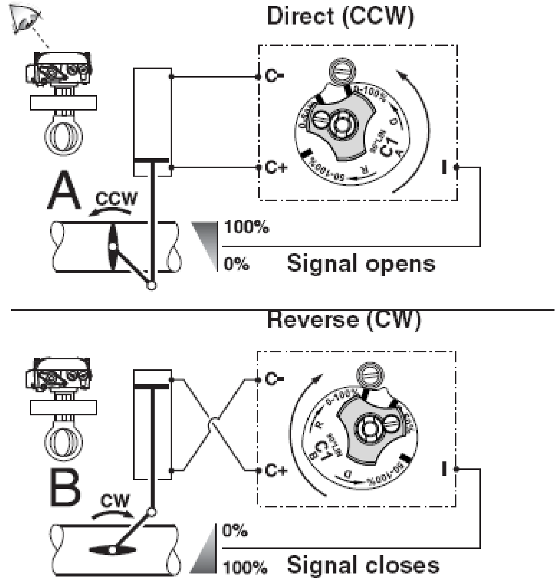


Figure 9: V-9000-500 Positioner Installation for Double Acting Actuation

Installation for Single Acting Actuation

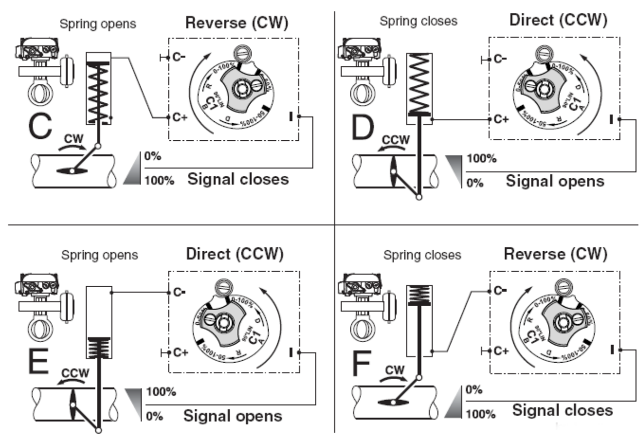


Figure 10: V-9000-500 Positioner Installation for Single Acting Actuation

To reverse the single action, turn the cam over and reverse the air connections to the cylinder (see Figure 10).

Positioner Calibration

Note: The V-9000-500 positioner is factory calibrated to 0-100% ±1%.

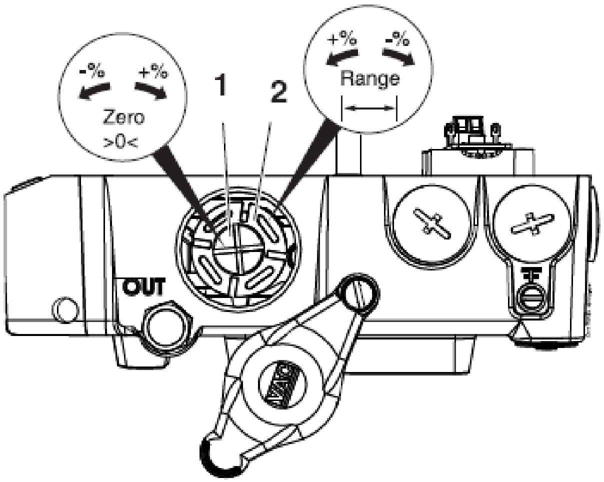


Figure 11: Zero and Range (Span) Adjustment Locations

Zero Position

Note: Always set zero first.

1. Set 0% input signal.
2. Wait until the valve/actuator responds.
3. Turn the zero screw (1) with a screwdriver to adjust the zero position.

Range (Span)

1. Increase to 100% input signal.
2. Wait until the valve/actuator responds.
3. Turn the range wheel (2) to adjust the range (span).

> **IMPORTANT:** Verify the zero position. Make fine adjustments if necessary. When split ranging, where zero can be a signal other than 0%, you must repeat these positioner calibration procedures until you reach the desired setting.

Solenoid Air Valves

For two-position operation of double-acting actuators, a V-9000-140 Series Four-Way Solenoid Air Valve must be used. The four-way solenoid air valve exhausts one chamber of the actuator while the other chamber is pressurized. For two-position operation of spring return actuators, a V-9000-140 Series Four-Way Solenoid Air Valve is also used.

The V-9000-140 is furnished with a manual override switch and is housed in a sturdy National Electrical Manufacturers' Association (NEMA) 4 enclosure.

Note: When a V-9000 Series Rack and Pinion Actuator is ordered as a factory-mounted component of a complete VF Series Butterfly Valve assembly, the appropriate solenoid air valve is automatically furnished with the actuator (unless a V-9000-500 Positioner is specified).

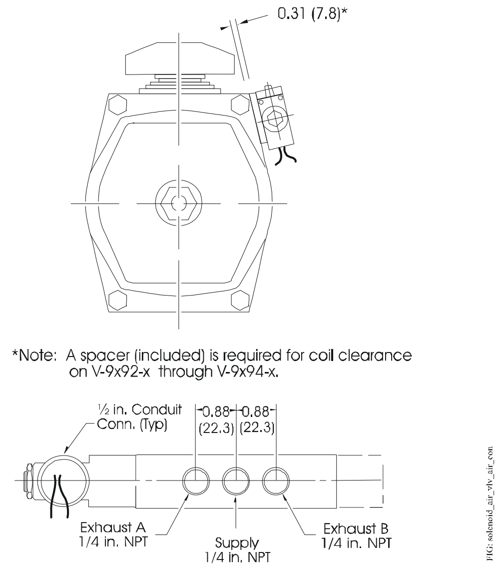


Figure 12: Solenoid Air Valve Dimensions in. (mm) and Air Connections

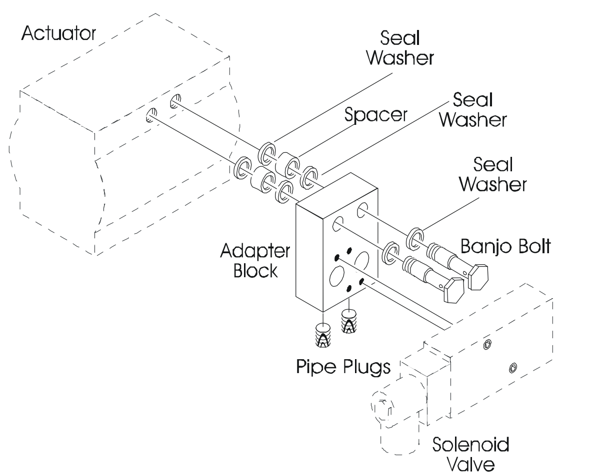


Figure 13: Adapter Block

When replacing a solenoid air valve on the rack and pinion actuators manufactured prior to April 1992, an adapter block is required to mount the replacement solenoid valve to the actuator (see Figure 13). The replacement solenoid air valve kit for the old-style actuators includes the solenoid valve and mounting screws.

The existing banjo bolts from the old solenoid valve are used to mount the adapter block to the old-style actuator. The adapter block has two bottom ports that need to be plugged, in order for the solenoid valve to operate correctly once assembled.

1. Using a 3/16-inch hex key, screw the two pipe plugs into the bottom ports.
2. Place a seal washer over each of the banjo bolts before inserting the bolts through the adapter block.
3. Place an additional seal washer on the banjo bolts and slide the washer next to the adapter block. Follow the seal washer with a spacer, and then a final washer.
4. The adapter block assembly is now mounted to the actuator by screwing the banjo bolts into the two air ports on the side of the actuator.
5. The solenoid valve is now attached to the adapter block with the two mounting screws provided with the solenoid valve.

There are two different size adapter blocks to mount to the V-9000 Series actuators. The V-9092-1 to V-9094-1 actuators have 1/8 in. air connections, and the V-9094-2 to V-9098-1 have 1/4 in. air connections.

Travel Switch.

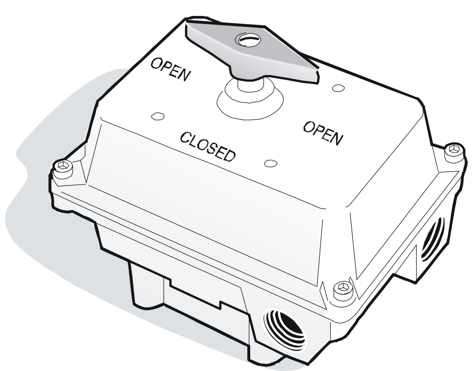


Figure 14: Travel Switch

For remote binary valve position indication, a V-9000-4xx Travel Switch is mounted to the actuator. The travel switch and appropriate mounting kit are ordered separately (see Table 10).

Note: The travel switch cannot be used on V-9000 Series Actuators equipped with a V-9000-500 Positioner.

The travel switch signals the actuator and valve position to local and remote stations. The compact monitor mounts directly to the top of the actuator.

Features include finger-touch control cams, captive cover bolts, local position indicator, and two conduit entries for easy wiring (see Figure 15).

Rated for 5 A at 125/250 VAC; 5 A at 24 VDC, the internal switches are prewired to a terminal block. Standard switches are two Single-Pole, Double-Throw (SPDT) micro switches.

The die cast aluminum housing meets NEMA 4, 4x Standards.

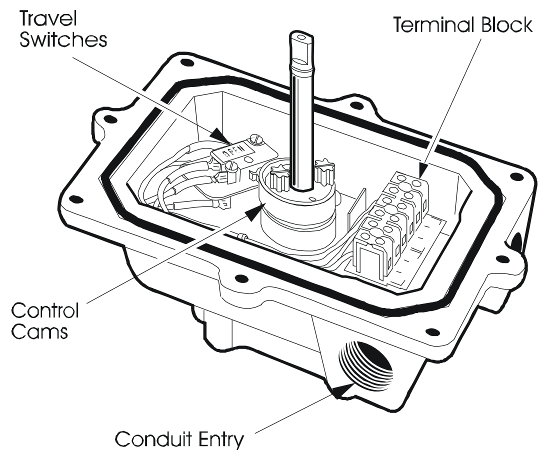


Figure 15: Travel Switch Components

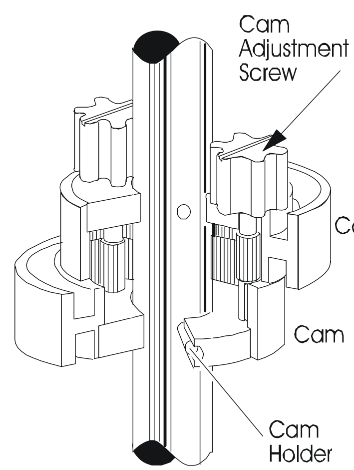


Figure 16: Cams

The uniquely designed cams are easily adjustable from the top by finger touch or a flathead screwdriver; no special tools are required (see Figure 16).

The cams do not slip out of adjustment from line vibration. A cam for each switch is mounted directly to the output shaft and each cam is independently micro-adjustable. Each cam is color coded; the red adjustment screw matches the red cam, and the green adjustment screw matches the green cam.

A cam holder remains fixed to the output shaft. The adjustment screws rotate the eccentric shaped cams. Standard factory cam settings are to the open and closed positions for 90° travel.

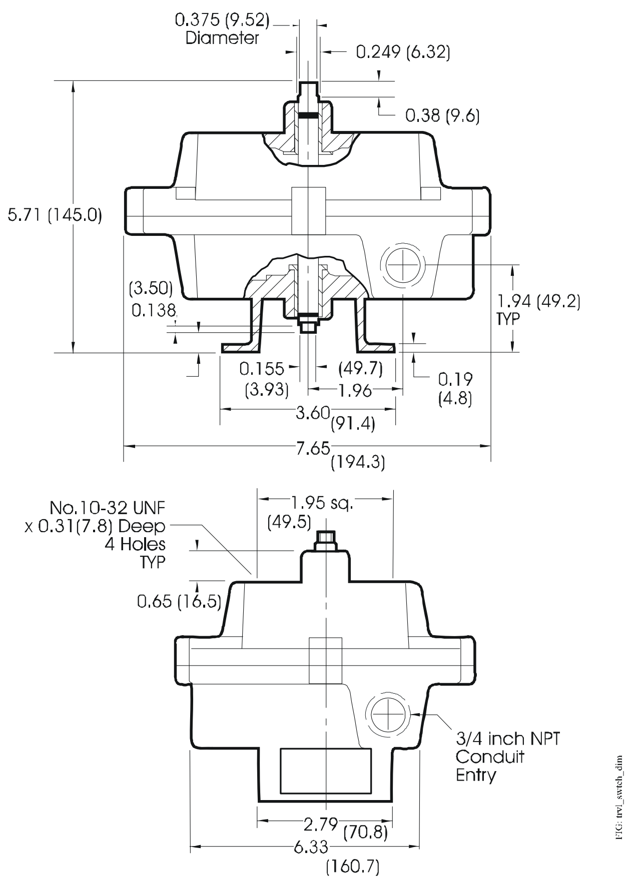


Figure 17: Travel Switch Dimensions in. (mm)

Speed Controls

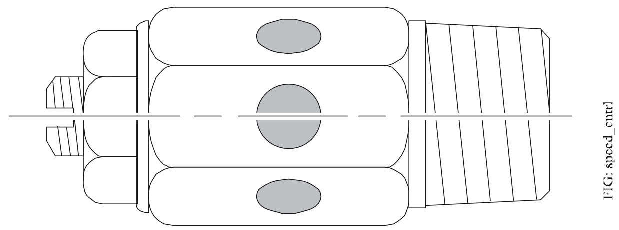


Figure 18: Speed Controls

Use the V-9000-300 Series Speed Control Kits to regulate the speed at which the two-position actuators stroke. Use the speed control option in applications where fast changes in valve disc position may result in objectionable pressure surges and/or water hammer throughout the water distribution system. The speed control kits consist of two adjustable orifices, which are screwed directly into the exhaust ports of the solenoid air valve.

Accessory Specifications

Table 6: Solenoid Including Mounting Hardware (Order Separately)

Solenoid Valve Model Number and Features		Description
V-9000-146		120 VAC Solenoid Air Valve, Four-Way, for New Style[1] V-9092 to V-9094-1 and V-9193 to V-9194-1 Series Actuators
V-9000-147		120 VAC Solenoid Air Valve, Four-Way, for New Style[1] V-9094-2 to V-9098 and V-9194-2 to V-9198 Series Actuators
Features	**Voltage Requirements**	120 VAC
	Power Consumption	AC: 5.6 VA; DC: 7.2 watts
	Maximum Pressure	140 psig (980 kPa)
	Ambient Temperature Limits	0 to 180°F (-18 to 82°C)
	Air Connections	1/4 in. National Pipe Thread (NPT) (Internal)
	Electrical Connections	18 AWG Leads, 24 in. (61 cm) Long
	Enclosure Materials	Die Cast Aluminum Body with NEMA 4 Coil Housing

1. For actuators manufactured after April 1, 1992.

Table 7: Speed Controls (Order Separately)

Speed Control Model Number	Description
V-9000-311	Brass Speed Controls (Two) for New Style[1] V-9192 to V-9194-2 Series Actuators
V-9000-312	Brass Speed Controls (Two) for New Style[1] V-9194-2 to V-9198 Series Actuators

1. For actuators manufactured after April 1, 1992.

Table 8: Plastic Position Indicators (Order Separately)

Actuator Series	Code Number[1]
V-9x92	V-9092-611
V-9x93	V-9093-611
V-9x94-1x	V-9094-6111
V-9x94-2x	V-9094-6112
V-9x95	V-9095-611
V-9x96	V-9096-611
V-9x97	V-9097-611
V-9x98	V-9098-611

1. For actuators manufactured after April 1, 1992.

Table 9: Positioners (Order Separately)

Positioner Model Numbers and Specifications		Description
Models		V-9000-500 Pneumatic Positioner for All Old and New Style V-9000 Series Actuators (Includes Three Gauges)
Mounting Kits (Order Separately)	**V-9000-511**[1]	Positioner Mounting Kit for New Style V-9x92 to V-9x94-1 Series Actuators
	V-9000-512[1]	Positioner Mounting Kit for New Style V-9x94-2 and V-9x95 Series Actuators
	V-9000-513[1]	Positioner Mounting Kit for New Style V-9x96 to V-9x98 Series Actuators
Air Specifications	**Supply Pressure**	40 to 140 psig (280 to 980 kPa) Air supply must be clean (filtered), dry, and oil free.
	Output Flow Capacity	2000 scim (546 mL/s) at 60 psig (420 kPa)
	Air Consumption	1200 scim (328 mL/s) at 60 psig (420 kPa)
	Control Action	Direct or Reverse; Field Selectable
	Operating Range	Factory Set at 3 to 15 psig (21 to 105 kPa) for 90° Rotation; Field Selectable at 3 to 15 psig for 65° Rotation or 3 to 9 psig (21 to 63 kPa) or 9 to 15 psig (63 to 105 kPa) for 65° Rotation
	Starting Point	Factory Set at Approximately 3 psig (21 kPa)
	Ambient Temperature Limits	-5 to 160°F (-21 to 71°C)
Air Connections	**Supply**	1/4 in. NPT (Internal)
	Control Input	1/8 in. NPT (Internal)
	Outputs	1/8 in. NPT (Internal)
Materials	**Body**	Aluminum, Anodized
	Diaphragm	Buna-N Rubber
	Spool	Stainless Steel
	Cover	Polycarbonate

1. For actuators manufactured after April 1, 1992.

Table 10: Travel Switches (Order Separately)

Travel Switch Model Numbers and Specifications		Description
Travel Limit Switch Models		V-9000-400[1] for All V-9000 Series Actuators
Mounting Kits	**V-9000-401**[1]	For V-9x92 and V-9x93 Series Actuators
	V-9000-402[1]	For V-9x94 and V-9x95 Series Actuators
	V-9000-403[1]	For V-9x96 and V-9x97 Series Actuators
	V-9000-404[2]	For V-9x96, V-9x97, and V-9x98 Series Actuators[3]
Features	**Switches**	Two Single-Pole, Double-Throw (SPDT)
	Electrical Rating	5 A at 120/250 VAC; 5 A at 24 VDC
	Body Materials	Die Cast Aluminum, NEMA 4, 4x Housing

1. For actuators manufactured before April 1, 1992.
2. For actuators manufactured after April 1, 1992.
3. Mounting kits are not required for smaller size actuators (V-9x92 through V-9x95).

Table 11: Pneumatic Rack and Pinion Actuator Adapter Sleeves[1] (Order Separately)

Valve Size	V-9x92	V-9x93	V-9x94-1x	V-9x94-2x	V-9x95	V-9x96	V-9x97	V-9x98
2	None Required.	V-9094-300	V-9094-300	V-9095-300	V-9095-300	--	--	--
2-1/2	None Required.	V-9094-300	V-9094-300	V-9095-300	V-9095-300	--	--	--
3	None Required.	V-9094-300	V-9094-300	V-9095-300	V-9095-300	--	--	--
4	--	V-9094-400	V-9094-400	V-9095-400	V-9095-400	--	--	--
5	--	None Required.	None Required.	V-9095-600	V-9095-600	V-9096-600	--	--
6	--	None Required.	None Required.	V-9095-600	V-9095-600	V-9096-600	--	--
8	--	--	--	V-9095-800	V-9095-800	V-9096-800	V-9097-800	--
10	--	--	--	None Required.	None Required.	None Required.	V-9097-120	--
12	--	--	--	None Required.	None Required.	None Required.	V-9097-120	--
14	--	--	--	--	--	--	V-9097-160	V-9098-100
16	--	--	--	--	--	--	V-9097-160	V-9098-100
18	--	--	--	--	--	--	None Required.	V-9098-200
20	--	--	--	--	--	--	None Required.	V-9098-200

1. Adapter sleeves are required to field mount rack and pinion actuators to VFM valves.

Table 12: Technical Specifications

Models	**V-909x Series**	Rack and Pinion Double Acting Actuators; see Table 2 for full code numbers.
	V-919x Series	Rack and Pinion Spring Return Actuators; see Table 3 for full code numbers.
Output Torque	**V-909x Series**	See Table 2.
	V-919x Series	See Table 3.
Supply Pressure		Nominal 60 to 80 psig (420 to 560 kPa); Minimum 40 psi (280 kPa), Maximum 140 psi (980 kPa). Air supply must be clean (filtered), dry, and oil free.
Ambient Temperature Limits		-13 to 200°F (-25 to 93°C)
Materials	**Body**	Extruded Aluminum, Anodized
	End Caps	Die Cast Aluminum, Polyester Coated
	Pistons	Die Cast Aluminum
	Output Shaft	Carbon Steel, Zinc Plated
	Piston Guides	Acetal
	Spring Cartridges	Coated Spring Steel, Zinc Plated Hardware
	O-ring Seals	Buna-N Rubber
Accessories (Order Separately)		See Table 6 through Table 10.

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

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