

KEYSTONE

A comprehensive range of pneumatic actuators, providing compact, reliable and economical powered operation for all types of quarter-turn valves.

Features

- Direct mounting to all Keystone Butterfly Valves.
- Double Rack & Pinion design nullifies side loads on the pinion shaft, minimizing bearing wear and extending life.
- Double Acting or Spring Return models utilize the same compact body design.
- Aluminum body, hard anodized externally and internally, for corrosion and wear resistance.
- Electrostatic powder coating (ESPC) finish, external on body, internal and external on end caps, protects against corrosive environments.
- Adjustable travel stops.
- Safe end cover bolting requiring no special tools.
- Anti-blowout drive pinion.
- Over travel adjustment (at each end) +5°.
- Under travel adjustment (at each end) -10°.
- Easy field conversion between DA and SR models.



Technical Specifications

Torque output range:
 Double Acting 238 - 18180 lbs in
 Spring Return 132 - 12515 lbs in

Operating medium:
 Air (dry or lubricated)

Travel adjustment:
 Over travel (at each end) +5°.
 Under travel (at each end) -10°.
 Increased under travel is available, on request.

Temperature range: -20°F to 210°F
 Air supply pressure: 120 psi maximum

Mounting Specifications

Actuator to valve:
 Keystone standard

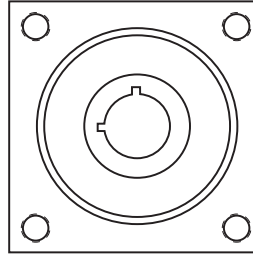
Accessories
 NAMUR VDI/VDE 3845 or Keystone standard

Operation

Double and Single Acting Actuators

Both the double acting and spring return MRP actuators feature a compact design with the same envelope dimensions. This flexible unit can be converted from double acting to single acting in the field without special charts to decipher color codes on which springs to use. The spring return actuator is available with spring sets from 40 pounds to 100 pounds in 10 pound increments. The springs are manufactured from heavy gauge wire to assure long life and corrosion resistance.

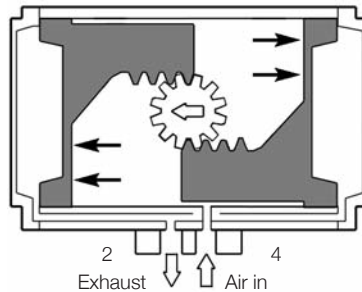
Actuator Mounting pad of the Keystone MRP: The dual-keyed input shaft allows parallel or perpendicular mounting to the valve flow.



Standard Double Acting

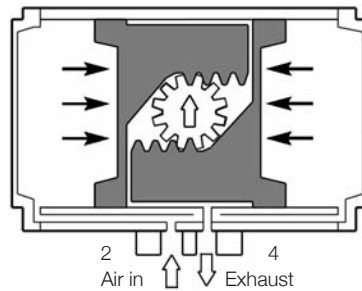
To OPEN Valve

In a double acting application, air pressure is introduced to Port 4, pressurizing the space between the pistons and driving the pistons out towards the actuator ends. The volume of air above the piston heads is exhausted to atmosphere. This causes the piston racks to drive the pinion in a counterclockwise direction, resulting in a quarter-turn rotation. This rotation is transferred to the valve shaft, opening the valve.



To CLOSE Valve

Air pressure introduced to Port 2, pressurizing the spaces above each piston head and driving the pistons inward. The volume of air between the pistons is exhausted to atmosphere. This causes the piston racks to drive the pinion in a clockwise direction, resulting in a quarter-turn rotation. This rotation is transferred to the valve shaft, closing the valve.

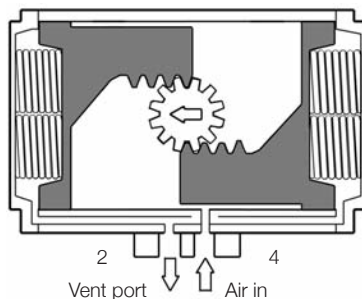


Spring Return

To OPEN Valve

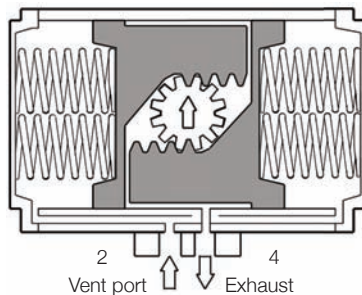
In a single acting application, air pressure is introduced to Port 4, pressurizing the space between the pistons and driving the pistons out towards the actuator ends while at the same time compressing the springs.

This causes the piston racks to drive the pinion in a counterclockwise direction, resulting in a quarter-turn rotation. This rotation is transferred to the valve shaft, opening the valve.



To CLOSE Valve

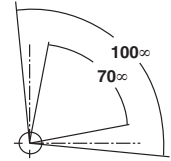
When the air pressure is relieved, the spring tension moves the pistons inward and exhausts the air through Port 4. This causes the piston racks to drive the pinion in a clockwise direction, resulting in a quarter-turn rotation. This rotation is transferred to the valve shaft, closing the valve.



Travel Adjustments

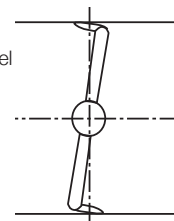
Within the mechanical connections of the drive between the valve and the MRP actuator there are several points of manufacturing tolerance, including valve disc or ball to stem, stem to adapter and adapter to actuator that must be compensated for in the operation of the assembly. Therefore, adjustment is necessary to ensure that valve operation is as precise as required. With the MRP, Dual travel stops allow adjustment at both ends of the stroke. Maximum adjustment range of 70° to 100° rotation, including an over travel of 5° and an under travel of 10°.

The standard travel stops also provide the desired adjustment necessary for proper operation of various valve types, as detailed.



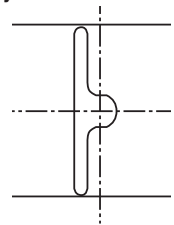
Resilient seated butterfly valves

Shut-off occurs before the disc has rotated a full 90° from the open position. Travel adjustment is therefore desirable to prevent over travel, which would result in unnecessary operating torque and premature deterioration of seat life. In the open position, adjustment is necessary to ensure maximum flow through the valve and minimum dynamic forces acting on the disc.



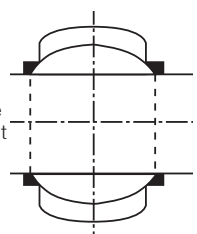
High performance butterfly valves

The double offset design of high performance butterfly valves results in the disc moving into the seat with a camming action. It is important that the disc does not travel beyond the seat position, otherwise damage to the seat will occur.



Ball and Plug valves

The ball or plug must be precisely in line with the valve port to prevent damage to the seat in the open position. Adjustment at the closed position is necessary to ensure that complete shut-off is achieved.



MRA Rack & Pinion Actuator



The MRA version of the popular Keystone MRP rack & pinion actuator offers increased resistance to caustic wash down utilized in many food and beverage applications. This version has all of the features enjoyed by users of the MRP – a hard anodized body that enhances outside environmental protection plus provides a hard, corrosion resistant internal surface for the bearings and pistons. This results in a longer life span with less downtime.

The end caps are coated with chromate plus ESPC inside and out, thus keeping this rack & pinion working long and hard for the customer. The E.S.P.C. treatment for the body and end caps plus SNP* protection for the pinion offers that next step required for harsh indoor environments such as caustic wash down areas.

* Special Nickel Protection

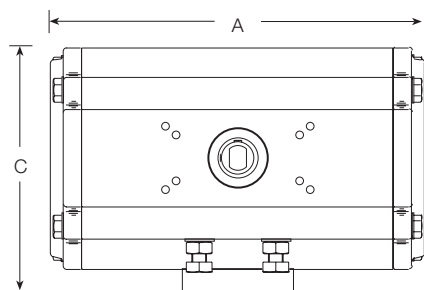
Ordering Guide

example	MRP	-	004	U	-	K	-	D	000	-	_____
Actuator Coating											
P – Black Powder Coat											
A – Grey Epoxy Coating											
Actuator Size											
004 009											
014 025											
037 045											
070 088											
180* 181*											
Mounting Base Threads											
U – UNC											
Mounting Base Drilling											
K – Keystone Direct Mount											
Actuator Configuration											
D – Double Acting											
S – Spring Return											
Spring Range											
000 – None											
040 – 40 psi											
060 – 60 psi											
080 – 80 psi											
100 – 100 psi											
Seal Options											
Blank – Std Nitrile											
VT – Viton®											
LT – Low Temp											

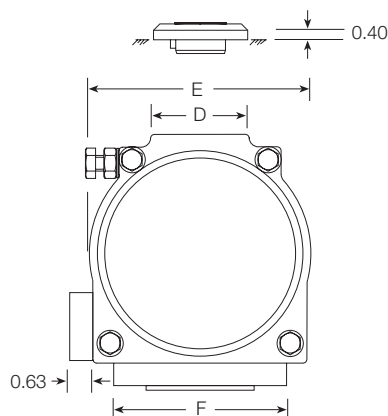
* Models 180 and 181 only available as MRP

Dimensions (inches)

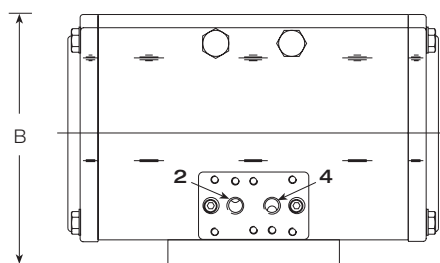
Top view



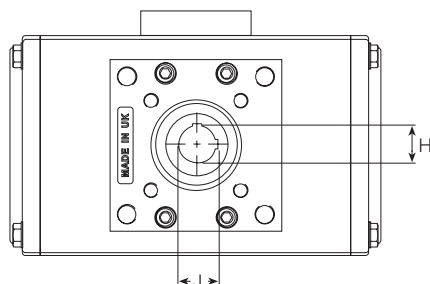
Front View



Side View



Bottom view



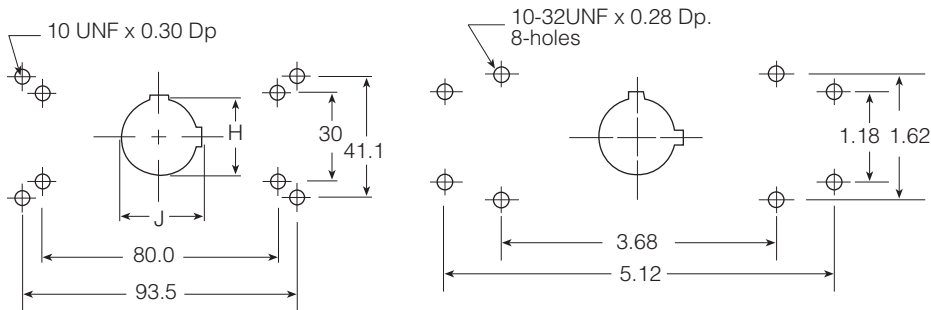
Note

- For size 180 only, spring return model has an extended body, due to the addition of spring packs. Dimension 'A' is then 27.32 inches.

Actuator dimensions (inches)

Size	A	B	C	D	E	F	Bottom of Shaft			Top of Shaft			Mounting Holes	
							H	J	Key	H	J	Key	No x Size	PCD
004	6.77	3.66	3.66	2.5	3.03	2.95	0.81	0.85	0.19	0.81	0.85	0.19	4 x 1/4-20UNC x 0.38 Dp	1.75
													4 x 3/8-16UNC x 0.56 Dp	3.25
009	7.67	4.8	4.8	2.5	4.17	3.15	1	1.06	0.25	1	1.06	0.25	4 x 3/8-16UNC x 0.56 Dp	3.25
014	8.11	5.43	5.22	2.5	4.59	3.15	1	1.06	0.25	1	1.06	0.25	4 x 3/8-16UNC x 0.56 Dp	3.25
025	9.53	6.42	6.1	2.5	5.64	4.4	1.12	1.25	0.25	1.12	1.25	0.25	4 x 3/8-16UNC x 0.56 Dp	3.25
													4 x 1/2-13UNC x 0.63 Dp	5
037	11.22	7.26	6.59	2.85	6.44	4.57	1.12	1.25	0.25	1.12	1.25	0.25	4 x 3/8-16UNC x 0.56 Dp	3.25
													4 x 1/2-13UNC x 0.63 Dp	5
045	13.13	7.87	7.12	2.95	6.87	4.57	1.12	1.25	0.25	1.12	1.25	0.25	4 x 3/8-16UNC x 0.56 Dp	3.25
													4 x 1/2-13UNC x 0.63 Dp	5
070	15.51	9.05	8.35	3.5	8.07	5	1.62	1.81	0.37	1.12	1.25	0.25	4 x 1/2-13UNC x 0.63 Dp	5
088	16.44	10	9.13	3.86	8.72	5.9	1.88	2.06	0.5	1.12	1.25	0.25	4 x 1/2-13UNC x 0.63 Dp	5
													4 x 3/4-10UNC x 0.63 Dp	6.5
180	18.93 ⁽¹⁾	11.10	10.47	5.12	9.84	7.48	1.88	2.06	0.5	1.12	1.25	0.25	4 x 3/4-10UNC x 1.0 Dp	6.5
181	18.93	11.10	10.47	5.12	9.84	7.48	2.25	2.43	0.5	1.12	1.25	0.25	4 x 3/4-10UNC x 1.0 Dp	6.5

Top Mount Drilling (Note 1) inches

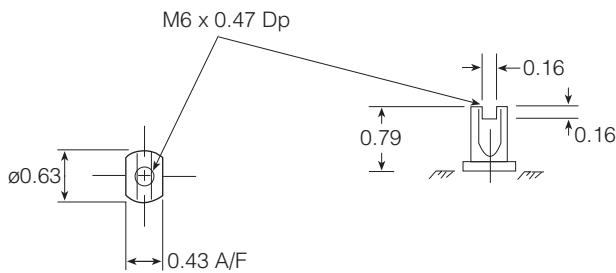


Top mounting drilling sizes 065 to 181

Note

1. 8 x 10 UNF x 0.30 Dp
Size 002 provides mounting holes at 3 x 1/4" [80 x 30 mm] only.

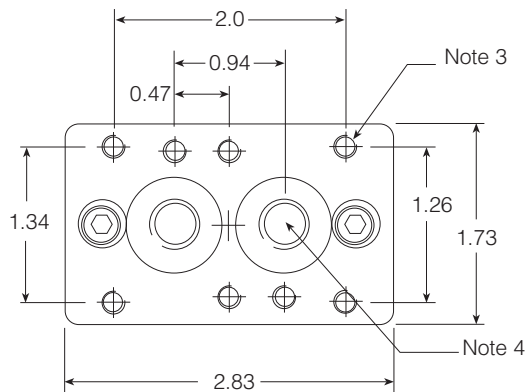
VDI/VDE 3845 Mounting (Note 2) inches



Note

2. Full compliance to this specification is achieved with the addition of an optional male insert fitted to the top drive.

Air Connection (Solenoid) Plate ins



Notes

3. 8 x 10 UNF x 0.30 Dp
4. 2 x 1/4" NPT x 0.45 Dp

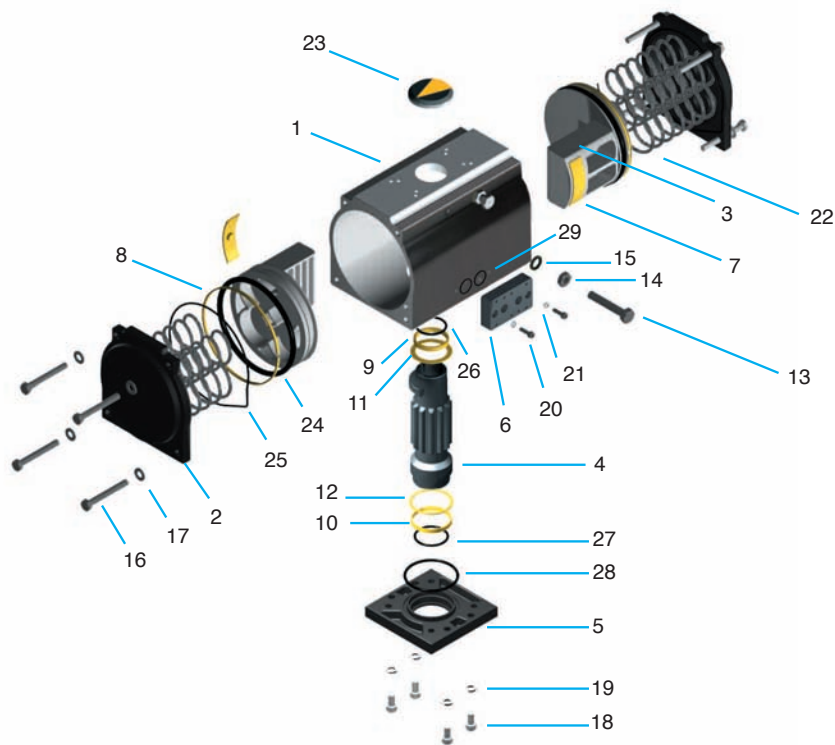
Air Consumption Volumes (at specified pressure)

Actuator Size	On opening		On closing (Double Acting models)	
	cu. in.	litres	cu. in.	litres
004	15.1	0.25	9.4	0.15
009	31.9	0.52	21.2	0.35
014	45.5	0.75	31	0.51
025	78.5	1.29	55	0.9
037	115.6	1.9	79.9	1.31
045	156.1	2.56	105.8	1.74
070	245.2	4.02	165.9	2.72
088	292.5	4.8	196.7	3.23
180/181	590.7	9.7	408	6.7

Weight lbs

Actuator Size	Double Acting	Spring Return
004	4.2	4.4
009	7.5	8.4
014	9.7	10.8
025	16.0	18.0
037	23.3	25.3
045	33.0	35.2
070	42.0	48.0
088	77.0	88.0
180/181	99.0	158.4

Materials of Construction



Notes

* ESPC = Electrostatic Powder Coating

** Nitrotech™ = Proprietary corrosion resistant finish

1. Devlon-V™ is a trademark of Devol Engineering.

2. Nitrotech™ is a trademark of Nitrotech Inc.

Materials of Construction

No.	Item	Material	US Material Std.	DIN/BS Material Std.	Finish
1	Body	Extruded aluminum	ASTM B221	BS 1474 6000 T5/6	Hard Anodize + ESPC*
2	End Cap	Die cast aluminum	ASTM B85	DIN 1725-231	Chromate + ESPC*
3	Piston	Die cast aluminum	ASTM B85	DIN 1725-231	Anodize
4	Pinion shaft	Carbon steel	ASTM A108	BS 970: 1983 212A42	Nitrotech™**
5	Base plate	Die cast aluminum	ASTM B85	DIN 1725-231	Chromate + ESPC*
6	Air connection plate	Die cast aluminum	ASTM B85	DIN 1725-231	Chromate + ESPC*
7	Piston backing pad	Devlon-V™			Natural
8	Piston support ring	Devlon-V™			Natural
9	Top bearing	Devlon-V™			Natural
10	Bottom bearing	Devlon-V™			Natural
11	Top spacer	Devlon-V™			Natural
12	Bottom spacer	Devlon-V™			Natural
13	Stop bolt	304 Stainless steel	ASTM A193	BS 3692-A2-304	Natural
14	Lock nut	304 Stainless steel	ASTM A193	BS 3692-A2-304	Natural
15	Sealing washer	304 Stainless steel	ASTM A193	BS 4320-A2-304	Natural
16	End cap bolt	304 Stainless steel	ASTM A193	BS 3692-A2-304	Natural
17	End cap washer	304 Stainless steel	ASTM A193	BS 4320-A2-304	Natural
18	Base plate bolt	304 Stainless steel	ASTM A193	BS 3692-A2-304	Natural
19	Base plate washer	304 Stainless steel	ASTM A193	BS 4320-A2-304	Natural
20	Air connection plate bolt	304 Stainless steel	ASTM A193	BS 3692-A2-304	Natural
21	Air connection plate washer	304 Stainless steel	ASTM A193	BS 4320-A2-304	Natural
22	Spring	Spring steel	ASTM A877	BS 2806 685 A55 HDR3	Oil Dip
23	Indicator	ABS			Natural
24	Piston O-ring	Rubber-NBR or FPM			Natural
25	End cap O-ring	Rubber-NBR or FPM			Natural
26	Shaft top O-ring	Rubber-NBR or FPM			Natural
27	Shaft bottom O-ring	Rubber-NBR or FPM			Natural
28	Base plate O-ring	Rubber-NBR or FPM			Natural
29	Air connection plate O-ring	Rubber-NBR or FPM			Natural

Specifications

Notes

Double Acting Models

Using the chart opposite, select the actuator, which will provide the nearest torque output above the anticipated torque of the valve (+ safety factor).

Spring Return Models

Determine the desired 'failure mode' (fail open or fail closed), then determine the critical torque points for the subject valve using the table below. Using the chart opposite, select the appropriate Spring Rating (far right columns), according to the air supply pressure. Select the actuator which will provide the nearest torque output (both 'start' and 'end of spring') above the anticipated valve torque (+ safety factor).

Critical torque points

Butterfly Valves 'Fail Closed'

Start of Air Torque

End of Spring Torque

Butterfly Valves 'Fail Open'

Start of Spring Torque

End of Air Torque

Ball Valves 'Fail Closed'

Start of Air (unseating) Torque

End of Air (full open) Torque

Start of Spring (breakout from open) Torque

End of Spring (re-seating) Torque

Ball Valves 'Fail Open'

Start of Spring (unseating) Torque

End of Spring (full open) Torque

Start of Air (breakout from open) Torque

End of Air (re-seating) Torque

Torque Output (lbs. Ins) - Double Acting Models

Actuator Size	Air Pressure (psi)						
	40	50	60	70	80	90	100
004	204	260	315	370	425	481	536
009	460	584	709	833	957	1082	1206
014	674	856	1038	1221	1403	1585	1767
025	1196	1519	1842	2166	2489	2812	3135
037	1737	2206	2676	3145	3615	4084	4554
045	2301	2922	3544	4166	4788	5409	6031
070	3606	4581	5556	6531	7505	8480	9055
088	4277	5432	6588	7744	8900	10056	11211
180/181	8736	11097	13458	15818	18180	22902	27624

Torque output (lbs.Ins) - Spring Return Models

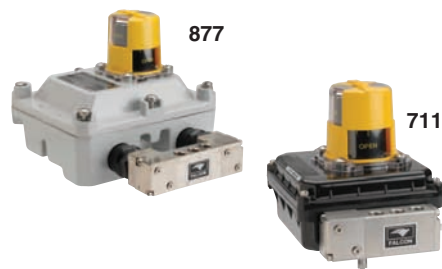
Actuator Size	Air Pressure (psi)								Spring Rating
	40 Start - End Air	50 Start - End Air	60 Start - End Air	70 Start - End Air	80 Start - End Air	90 Start - End Air	100 Start - End Air	Start - End Spring	
004	119 - 71	174 - 126	229 - 182	285 - 237	340 - 292	395 - 347	450 - 403	117 - 69	40
	98 - 38	153 - 93	208 - 148	263 - 203	319 - 259	374 - 314	429 - 369	150 - 90	50
		131 - 60	187 - 115	242 - 170	297 - 225	352 - 281	408 - 336	183 - 112	60
			165 - 82	221 - 137	276 - 192	331 - 247	386 - 303	217 - 133	70
			144 - 48	199 - 103	254 - 159	310 - 214	365 - 269	250 - 154	80
009	267 - 154	391 - 278	515 - 402	640 - 527	764 - 651	888 - 775	1013 - 900	269 - 156	40
	218 - 77	343 - 201	467 - 326	591 - 450	716 - 574	840 - 699	964 - 823	346 - 204	50
		294 - 125	419 - 249	543 - 373	667 - 498	792 - 622	916 - 746	422 - 253	60
		246 - 48	370 - 172	495 - 297	619 - 421	743 - 545	868 - 670	499 - 301	70
			322 - 96	446 - 220	571 - 344	695 - 469	819 - 593	576 - 349	80
014	386 - 237	568 - 419	750 - 601	933 - 783	1115 - 965	1297 - 1148	1479 - 1330	383 - 233	40
	314 - 127	496 - 309	678 - 492	861 - 674	1043 - 856	1225 - 1038	1407 - 1220	492 - 305	50
		424 - 200	606 - 382	789 - 564	971 - 747	1153 - 929	1335 - 1111	602 - 377	60
		352 - 91	534 - 273	717 - 455	899 - 637	1081 - 819	1263 - 1002	711 - 449	70
			463 - 163	645 - 346	827 - 528	1009 - 710	1191 - 892	820 - 521	80
025	712 - 386	1035 - 709	1358 - 1032	1681 - 1356	2005 - 1679	2328 - 2002	2651 - 2325	713 - 387	40
	591 - 183	914 - 507	1237 - 830	1560 - 1153	1884 - 1476	2207 - 1799	2530 - 2123	916 - 508	50
		793 - 304	1116 - 627	1439 - 951	1763 - 1274	2086 - 1597	2409 - 1920	1118 - 629	60
		672 - 102	995 - 425	1318 - 748	1642 - 1071	1965 - 1394	2288 - 1718	1321 - 750	70
			1842 - 874	1197 - 546	1521 - 869	1844 - 1192	2167 - 1515	1523 - 871	80
037	1030 - 577	1500 - 1046	1969 - 1516	2430 - 1985	2908 - 2455	3378 - 2924	3847 - 3394	1019 - 566	40
	854 - 287	1323 - 756	1793 - 1226	2262 - 1695	2731 - 2165	3201 - 2634	3670 - 3104	1309 - 742	50
		1146 - 466	1616 - 936	2085 - 1405	2555 - 1875	3024 - 2344	3494 - 2814	1599 - 919	60
		970 - 176	1439 - 646	1909 - 1115	2378 - 1585	2848 - 2054	3317 - 2524	1889 - 1096	70
			1263 - 356	1732 - 825	2201 - 1295	2671 - 1764	3140 - 2234	2179 - 1272	80
045	1338 - 815	1960 - 1437	2582 - 2059	3204 - 2680	3825 - 3302	4447 - 3924	5069 - 4546	1299 - 776	40
	1098 - 444	1720 - 1066	2341 - 1687	2963 - 2309	3585 - 2931	4207 - 3553	4828 - 4174	1670 - 1016	50
	857 - 72	1479 - 694	2101 - 1316	2723 - 1938	3344 - 2559	3966 - 3181	4588 - 3803	2042 - 1257	60
		1239 - 323	1860 - 945	2482 - 1566	3104 - 2188	3726 - 2810	4347 - 3422	2413 - 1497	70
			1620 - 573	2242 - 1195	2863 - 1817	3485 - 2439	4107 - 3060	2784 - 1738	80
070	2078 - 1293	3052 - 2268	4027 - 3242	5002 - 4217	5977 - 5192	6951 - 6167	7926 - 7141	2021 - 1236	40
	1696 - 715	2670 - 1689	3645 - 2664	4620 - 3639	5594 - 4613	6569 - 5588	7544 - 6563	2599 - 1618	50
	1313 - 136	2288 - 1111	3263 - 2086	4238 - 3060	5212 - 4035	6187 - 5010	7162 - 5985	3178 - 2001	60
		1906 - 533	2881 - 1507	3855 - 2482	4830 - 3457	5805 - 4431	6780 - 5406	3756 - 2383	70
			2499 - 929	3473 - 1904	4448 - 2878	5423 - 3853	6397 - 4828	4334 - 2765	80
088	2473 - 1460	3629 - 2616	4784 - 3772	5940 - 4928	7096 - 6083	8252 - 7239	9408 - 8395	2470 - 1457	40
	2022 - 756	3178 - 1912	4334 - 3068	5489 - 4224	6645 - 5379	7801 - 6535	8957 - 7691	3174 - 1908	50
	1571 - 52	2727 - 1208	3883 - 2364	5038 - 3519	6194 - 4675	7350 - 5831	8506 - 6987	3878 - 2359	60
		2276 - 504	3432 - 1660	4587 - 2815	5743 - 3971	6899 - 5127	8055 - 6283	4582 - 2810	70
			2981 - 956	4137 - 2111	5292 - 3267	6448 - 4423	7604 - 5579	5286 - 3261	80
180/181	4389 - 2122	6750 - 4482	9111 - 6843	11472 - 9204	13833 - 11565	16193 - 13926	18554 - 16286	5905 - 3637	40
		5664 - 2829	8025 - 5190	10385 - 7551	12746 - 9911	15107 - 12272	17468 - 14633	7558 - 4724	50
			6938 - 3537	9398 - 5897	11660 - 8258	14021 - 10619	16381 - 12980	9212 - 5810	60
				8213 - 4244	10573 - 6805	12934 - 8966	15295 - 11326	10865 - 6896	70
					9487 - 4952	11848 - 7312	14209 - 9673	12518 - 7983	80
					10762 - 5659	13122 - 8020	14171 - 9069	90	
						12036 - 6367	15825 - 10155	100	

Westlock Controls - Accessories

Quantum Rotary Control Monitors*

764/784/864, Weathertight
765/789/865, Non-incendive
711/722/811, Intrinsically Safe
777/877/360, Explosionproof

Quantum products offer a fully integrated solution for the monitoring and control of process valves. Combining sensors, Falcon low-powered solenoids, junction housings and a local visual position indicator in one compact unit suitable for weatherproof and hazardous location service, Westlock offers an extremely efficient and cost effective method for the monitoring and controlling of rotary valves.



AccuTrak™ Rotary Position Monitors*

1040/2004 and 9358/9044, Rotary Position Monitors, Weathertight
K-Switch, 9468, Rotary Position Monitor, Non-incendive
5004/5044 and 5050, Rotary Position Monitors, Intrinsically Safe
360, 2007 and 9479, Rotary Position Monitors, Explosionproof

The AccuTrak™ family of products offers an integrated solution for the monitoring of process valves. By combining sensors, junction housings and local visual position indication in one compact unit suitable for weatherproof and hazardous location service, Westlock offers an extremely efficient and cost effective method of both monitoring and controlling linear and rotary valves.



Positioners*

ICoT 5200/5300, Intelligent SmartCal Positioners
ICoT 5400, FOUNDATION Fieldbus™ Positioner
EaziCal, Electro-Pneumatic Positioner
793, Pneumatic Positioners

Westlock Controls offers a variety of solutions for the precise positioning of rotary and linear pneumatic actuators. These positioners are suitable for use with either double acting or spring return actuators. Mounting options include the ModMount®, NAMUR standards (VDI/VDE 3845) or actuator special kits. These units also provide the simplest form of installation and calibration as standard, without the requirement for additional equipment. Positioners are available with both HART® and Foundation Fieldbus™ digital communication protocols.



Network Solutions*

Intellis Network Solutions, Control Monitors; Network Accessories

Intellis is a family of industrial control field Network Control Monitors which use embedded control systems to automate valves and link field I/O to the host PLC or DCS. Each monitor is assigned a unique address and accepts input/output signals from valve position sensors, solenoids and external alarm and control devices. Hall effect sensors are utilized for valve position monitoring. Low-power Falcon solenoid valve provide integrated actuation control. Network interface modules Pacts allow communication via a protocol of choice. Westlock Intellis Network Control Monitors are available for linear or rotary applications in all area classifications.



Intellis Control Monitor

ModMount Mounting Kit (not pictured)

Mounting system designed to allow direct mounting of many Westlock Controls products to MRP and MRA actuators. The system allows for a low profile and strong mounting using the NAMUR mounting feature available on most Westlock models. ModMount system available on most Monitors and positioners.

* **AccuTrak, Quantum, Intellis Network Solutions and Positioners** - please consult the factory for the availability of global certifications such as ATEX, IEC, GOST, CSA and InMetro for specific configurations in these product lines, as approvals may vary.

Notes

1. AS-interface® is a registered trademark of AS-International.
2. DeviceNet™ is a trademark of Open DeviceNet Vendor Association, Inc.
3. Foundation™ fieldbus is a registered trademark of the Fieldbus Foundation.
4. HART® is a registered trademark of the HART Communication Foundation.
5. PROFIBUS® is a registered trademark of PROFIBUS International.