

# Fisher® 1035/El-O-Matic Rack-and-Pinion Rotary Actuator

Fisher 1035/El-O-Matic double-acting and spring-return rotary valve actuators are compact, simply-designed control devices quality-engineered to provide high torque outputs to 5700 N•m (50,000 lbf•in) and a high cycle life.

A compact, dual-opposed rack and pinion design and guide band suspension system combine to produce a symmetrically balanced, center-mount actuator with a short powerful stroke and rapid response. A fully concentric operating load capability provides optimum performance.

## Features

- **Three Point Suspension System**—Three carbon-filled PTFE guide bands provide a low friction bearing surface for piston alignment and rack support. Elimination of metal-to-metal contact between pistons and cylinder wall reduces friction for outstanding cycle life, smooth piston travel, and maximum power.
- **Balanced Piston Design**—As part of the design, three equally spaced bearing surfaces are cast into each piston. The rack and pinion construction results in even distribution of bearing loads, optimum gear engagement, and reduced piston tilt. Equal spring force applied to each piston enhances actuator life.
- **Multiple Constructions**—Conversion from double acting to spring return, or vice versa, is simple and safe, thus reducing spare part requirements. Valve/actuator action is also field reversible.
- **Dual Stop Adjustment**— This adjustment is standard on all E Series actuators. The P Series actuators are supplied with a limit plate adjustment feature.
- **Dual Piston Design**—Air pressure applies a balanced force across the common pinion gear (see figure 1). Symmetrically balanced center mount construction eliminates undue stress on the valve stem, bearings, and disc.



W9255  
1035/El-O-Matic Actuator with Fisher A41 Valve



**Specifications**

**1035 Actuator**

Double Acting	Spring Return
EDA 25	ESA 25
EDA 40	ESA 40
EDA 65	ESA 65
EDA 100	ESA 100
EDA 200	ESA 200
EDA 350	ESA 350
EDA 600	ESA 600
EDA 950	ESA 950
EDA 1600	ESA 1600
PDA 2500	PSA 2505
PDA 4000	PSA 4005

**Output Shaft:** ■ Double D insert for A41 valves  
 ■ Optional ISO 5211 square insert (see figure 1),  
 ■ Recessed ISO 5211 square drive for P Series actuators

**Dual Stop Adjustment:** ■ E Series actuators are furnished with dual stop adjustments (DSA) as a standard feature (see figure 5). ■ P Series actuators provide dual stops with the use of the “Limit Stop Plate” (LSP) option. The LSP is mounted between the actuator and yoke (see figure 6).

**Supply Pressure or Operating Pressure<sup>(1)</sup>**

2.8 to 6.9 bar (40 to 100 psig)

**Maximum Casing Pressure**

8.3 bar (120 psig)

**Temperature Range<sup>(1)</sup>**

**Standard:** -20 to 79°C (-4 to 175°F) with Nitrile O-rings

**Optional:**

■ High temperature -20 to 121°C (-4 to 250°F) with fluorocarbon O-rings (denoted by “V” in model no.), or

■ Low temperature -40 to 79°C (-40 to 175°F) with EPDM and special lubricant (denoted by a “LT” in model no.)

**Torque Output**

See Catalog 14

**Performance Characteristics**

See table 1

**Construction Materials**

See table 3

**Media**

Dry or lubricated air, or a noncorrosive gas

**Rotation (Standard Configurations)**

Rotation is counterclockwise with port A pressurized. Spring return actuators fail clockwise (see figures 2 and 3) with ■ fail-open or ■ fail-closed action.

**Stroking Time**

If stroking time is critical to your application, contact your Emerson Process Management sales office

**Lubrication**

Factory lubricated for the normal life of the actuator

**Coating**

All units feature a two component polyurethane coating system as standard with a primer coat of epoxy

**Approximate Weight**

See table 2

**Dimensions**

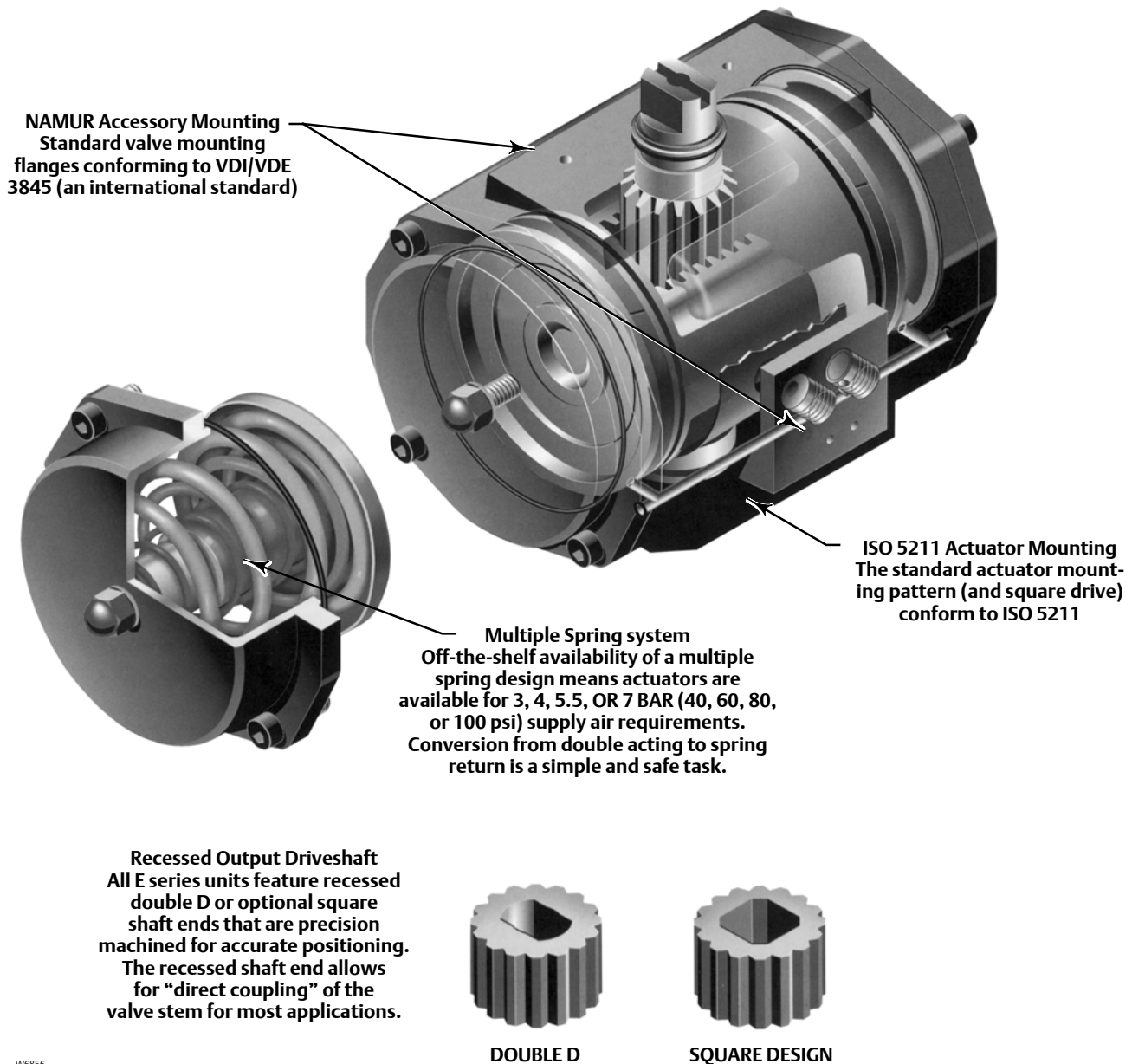
See figures 4, 5 and 6 and tables 4 and 5

**Options**

■ Repair kits, ■ Field reversible, ■ O-ring kits

1. The pressure/temperature limits in this bulletin and any applicable standard or code limitation for the actuator should not be exceeded.

Figure 1. Actuator Construction



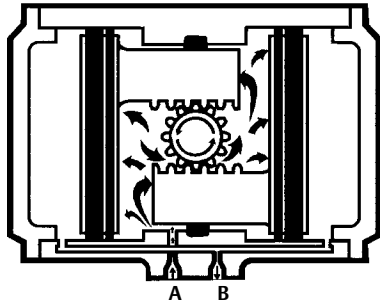
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## Installation

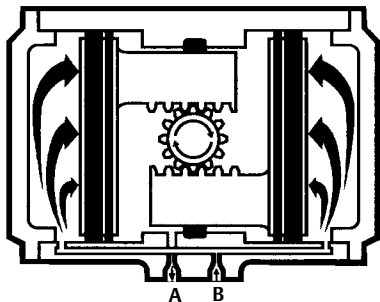
**Output Shaft**—E Series actuators feature a double D or square recessed actuator insert in the end of the output shaft (see figure 1). The double D connection allows direct coupling to A41 valve drive shafts, or it allows use of a coupling between the valve and actuator. The P Series actuators have a recessed square connection machined into the end of the

output shaft. The recessed square connection meets ISO 5211 standards. It allows the use of a coupler between the actuator (square) and valve (double D) connection. Refer to figures 4, 5 and 6 and tables 4 and 5 for actuator dimensions.

**Figure 2. Double-Acting Actuator (Standard Construction)**



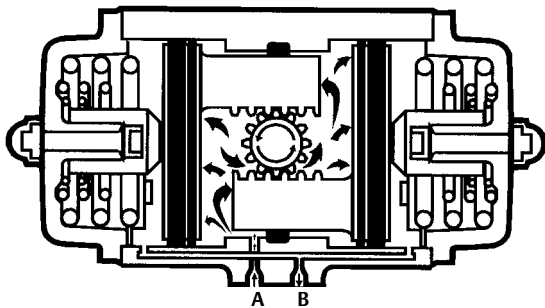
AIR AT `A' ROTATES SHAFT COUNTERCLOCKWISE



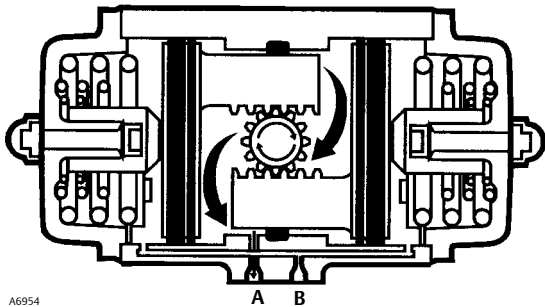
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AIR AT `B' ROTATES SHAFT CLOCKWISE

**Figure 3. E Series Spring Return Actuator (Standard Construction)**



AIR AT `A' ROTATES SHAFT COUNTERCLOCKWISE



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EXHAUST AT `A' ROTATES SHAFT CLOCKWISE

## Operation

1035 rack-and-pinion actuators are manufactured with an integral air manifold and with internal porting. The air manifold is designed to NAMUR standards for direct mounting of a device. This eliminates the need for external tubing and simplifies installation. For applications not requiring an air manifold, the inlet ports are marked A and B.

## Air-to-Air (Double Acting)

### Air to Port A

Pressure is applied to the central chamber driving the dual pistons outward. Linear piston force is transferred via gear racks producing counterclockwise rotation of the gear (see figure 2).

### Air to Port B

Pressure is applied to the outside chambers through the internal port driving the pistons inward to produce rotary (clockwise) motion.

## Spring Return (Single Acting)

### Air to Port A

Pressure is applied to the center chamber driving the pistons outward. This compresses the springs in the outside chambers and produces rotary (counterclockwise) motion (see figure 3).

### Loss of Pressure

Upon loss of pressure the stored energy from the compressed springs drives the pistons inward producing rotary motion depending on the actuator set-up. This fail safe position is held by spring compression until air pressure is re-applied to port A.

Table 1. Performance Characteristics

E SERIES ACTUATOR SIZE	BORE		STROKE		AVERAGE STROKE TIME (SEC) <sup>(1)</sup>	FREE AIR VOLUME <sup>(2)</sup>			
	(mm)	(In.)	(mm)	(In.)		Port "A" (liter)	Port "A" (in <sup>3</sup> )	Port "B" (liter)	Port "B" (in <sup>3</sup> )
E25	56	2.2	15.7	0.62	0.5	0.1	6.1	0.11	6.7
E40	70	2.8	18.8	0.74	0.7	0.16	9.8	0.22	13.4
E85	80	3.1	22.0	0.87	1.1	0.33	20.1	0.36	22.0
E100	91	3.6	25.1	0.99	1.2	0.35	21.4	0.49	29.9
E200	110	4.3	37.7	1.48	2.2	0.8	48.8	1.0	61.0
E350	145	5.7	37.7	1.48	3.7	1.8	110	1.9	116
E600	175	6.9	44.0	1.73	3.3	2.9	177	3.1	189
E950	200	7.9	50.3	1.98	5.4	4.7	287	4.9	299
E1600	230	9.1	62.8	2.47	5.8	7.3	445	8.0	488
P2500/P2505	300	11.8	56.5	2.22	6.7	8.0	488	9.3	567
P4000/P4005	325	12.8	81.7	3.22	12.4	13.5	824	17.5	1068

1. These times assume smaller solenoids for smaller actuators and larger solenoids for larger actuators with varying C<sub>v</sub>'s, but a constant air supply pressure of 5.51 bar (80 psi). E25 to E350 assume a 0.09 C<sub>v</sub> (0.08 K<sub>v</sub>); E600 and E9500 a 0.26 C<sub>v</sub> (0.22 K<sub>v</sub>); E1600, P2500(5) and P4000(5) a 0.51 C<sub>v</sub> (0.44 K<sub>v</sub>).  
2. To calculate air consumption per stroke multiply free air volume X air supply pressure (absolute).

Table 2. Approximate Weights

ACTUATOR SIZE	kg		lbs	
	EDA	ESA	EDA	ESA
E25	1.3	1.7	2.7	3.7
E40	1.8	2.4	4.0	5.3
E65	2.4	3.6	5.3	7.9
E100	3.1	4.6	6.1	10.1
E200	5.8	9.1	12.8	20.1
E350	10.4	16.9	22.9	37.3
E600	19.4	27.6	42.8	60.8
E950	26.4	38.6	58.2	85.0
E1600	42.7	65.8	94.1	145
P2500/P2505	56.8	88.2	125	194
P4000/P4005	86.6	131.8	190	291

the pistons as they move towards the center of the actuator. The Outer Travel Stop (stop 2 in figure 5) acts against the pistons and stops their motion as they move out towards the end caps. The Inner Travel Stop is not available when the outward motion of the pistons causes the cam to rotate clockwise.

### Limit Stop Plate (P Series only)

The Limit Stop Plate (LSP) allows the customer to limit the actuator motion regardless of the rotation direction of the actuator cam. One stop will limit the open position, and the other will limit the closed position. The particular stop (right or left), which limits a specific travel direction, depends on the cam rotation direction and whether the device is clockwise-to-close or counter-clockwise-to-close. The bolts attaching the LSP to the actuator must be properly torqued. See the instruction manual.

### Dual Stop Adjustment (E Series only)

The Inner Travel Stop (stop 1 in figure 5) acts against the stroke adjustment cam and limits the motion of

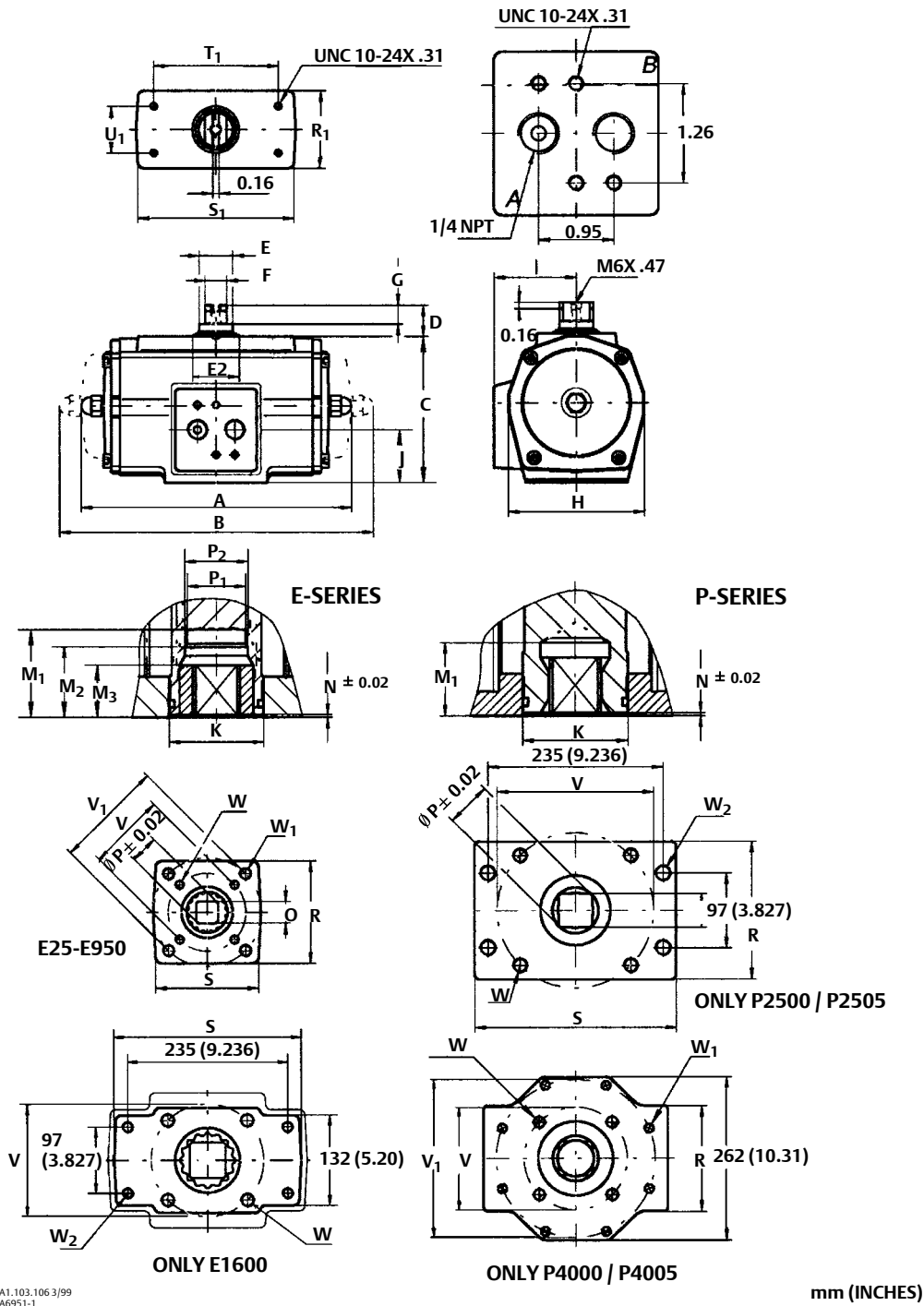
**Table 3. Construction Materials**

<b>Component Description</b>	<b>Material</b>
<b>E Series Actuators</b>	
Body, End Caps, and Pistons with Gear Rack	Aluminum alloy
Drive Shaft/Gear	Aluminum alloy (High strength)
O-Rings	Nitrile (Standard), Fluorocarbon (Optional high temp), and EPDM (Optional low temp)
Spring Clip, and Spring	Carbon Spring Steel
Spring Holder	Steel
Nuts, End Cap Bolt, and Travel Stop Bolt	Stainless Steel
Washer (end cap)	Nylon
Top Guide Bushing (shaft)	POM (polyoxymethylene)
Bottom Guide Bushing (shaft)	Nylon
Guide Band, Piston	Carbon Filled PTFE
Guide Band, Body	Nylon
Nut Cover	Polyethylene
<b>P Series Actuators</b>	
Body and End Caps	Aluminum alloy
Piston Gear Rack	Steel
Drive Shaft/gear	Aluminum alloy (High strength)
Pinion Gear	Steel
O-Rings	Nitrile (Standard), Fluorocarbon (Optional high temp), and EPDM (Optional low temp)
Spring Clip and Spring	Carbon Spring Steel
End Cap Bolt and Travel Stop Bolt	Alloy Steel
Washer	POM (polyoxymethylene)
Top Guide Bushing	POM (polyoxymethylene)
Bottom Guide Bushing	Nylon
Guide Band, Piston and Body	Carbon Filled PTFE

Table 5. Dimensions (Inches)

DIMENSION	E SERIES ACTUATORS									P SERIES ACTUATORS	
	E25	E40	E65	E100	E200	E350	E600	E950	E1600	P2500/ P2505	P4000/ P4005
A ED	6.26	7.09	7.83	8.70	11.14	12.01	15.24	16.69	20.31	14.88	19.76
B ES	6.77	8.03	9.80	10.51	14.17	15.24	18.78	20.35	25.08	22.44	32.83
C	3.15	3.66	4.13	4.65	5.63	7.13	8.66	10.20	11.69	14.02	14.96
D	0.79	0.79	0.79	0.79	0.79	0.79	1.18	1.18	1.18	1.18	1.18
E	0.63	0.87	0.87	0.87	1.42	1.42	2.17	2.17	2.52	2.17	2.52
E2	0.91	1.18	1.18	1.18	1.77	1.77	2.56	2.56	2.95	2.56	3.15
F	0.39	0.55	0.55	0.55	0.75	0.75	1.42	1.42	1.42	1.42	1.42
G	0.47	0.47	0.47	0.47	0.47	0.47	0.39	0.39	0.39	0.39	0.39
H	2.91	3.39	3.86	4.25	5.04	6.81	8.15	9.09	10.43	13.78	14.96
I	1.81	2.09	2.26	2.48	2.87	3.71	4.45	4.96	5.59	7.28	7.87
J	1.26	1.32	1.54	1.59	1.99	2.85	3.33	4.15	4.74	7.01	7.48
J1	0.88	1.24	1.41	1.54	1.90	2.56	3.50	4.03	4.50	---	---
K	0.94	1.30	1.30	1.50	2.17	2.17	2.68	2.95	3.74	3.35	4.72
L	0.45	0.61	0.61	0.73	0.97	0.97	1.63	1.63	1.87	---	---
M1	1.36	1.36	1.36	1.36	1.97	1.97	2.05	2.52	3.23	2.60	3.03
M2	---	---	---	1.06	1.46	1.46	---	---	---	---	---
M3	0.669	0.669	0.669	0.787	1.161	1.161	1.161	1.949	2.303	---	---
N	0.04	0.04	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.12	0.06
O max	0.437	0.556	0.556	0.753	0.871	1.068	1.068	1.424	1.817	1.817	2.173
O min	0.433	0.551	0.551	0.748	0.866	1.063	1.063	1.417	1.811	1.811	2.165
P	0.555	0.713	0.713	0.992	1.110	1.425	1.425	1.898	2.370	2.370	2.843
P1	0.555	0.713	0.831	0.909	1.303	1.303	1.437	1.909	2.382	---	---
P2	---	---	---	0.988	1.264	1.264	---	---	---	---	---
R	2.05	2.56	2.76	2.76	3.54	4.49	4.88	5.12	6.06	6.69	6.69
R1	1.97	1.97	1.97	2.36	2.36	2.36	3.54	3.54	4.92	6.30	6.30
S	2.05	2.56	2.76	2.76	3.54	4.49	4.88	5.59	11.02	11.42	11.42
S1	3.94	3.94	3.94	3.94	3.94	3.94	6.69	6.69	8.27	9.65	9.65
T1	3.150	3.150	3.150	3.150	3.150	3.150	5.118	5.118	5.118	5.118	5.118
U	---	---	---	---	---	---	---	---	3.827	3.827	---
U1	1.181	1.181	1.181	1.181	1.181	1.181	1.181	1.181	1.181	1.181	1.181
V	---	1.969	1.969	1.969	2.756	2.756	4.016	4.016	6.496	6.496	6.496
V1	1.969	2.756	2.756	2.756	4.016	4.016	4.921	5.512	---	---	10.000
W	---	1/4" - 20 x 0.39	1/4" - 20 x 0.39	1/4" - 20 x 0.39	5/16" - 18 x 0.39	5/16" - 18 x 0.39	3/8" - 16 x 0.63	3/8" - 16 x 0.63	3/4" - 10 x 1.14	3/4" - 10 x 1.14	3/4" - 10 x 1.14
W1	1/4" - 20 x 0.39	5/16" - 18 x 0.39	5/16" - 18 x 0.39	5/16" - 18 x 0.39	3/8" - 16 x 0.63	3/8" - 16 x 0.63	1/2" - 13 x 0.79	5/8" - 11 x 0.98	5/8" - 11 x 0.98	5/8" - 11 x 0.98	5/8" - 11 x 0.98
X	1.42	1.63	1.63	1.99	2.46	2.85	1.42	1.63	1.63	---	---
X max	1.63	1.91	1.91	2.3	2.91	3.31	1.63	1.91	1.91	---	---
Y	M6	M8	M10	M12	M12	M12	M16	M16	M20	---	---

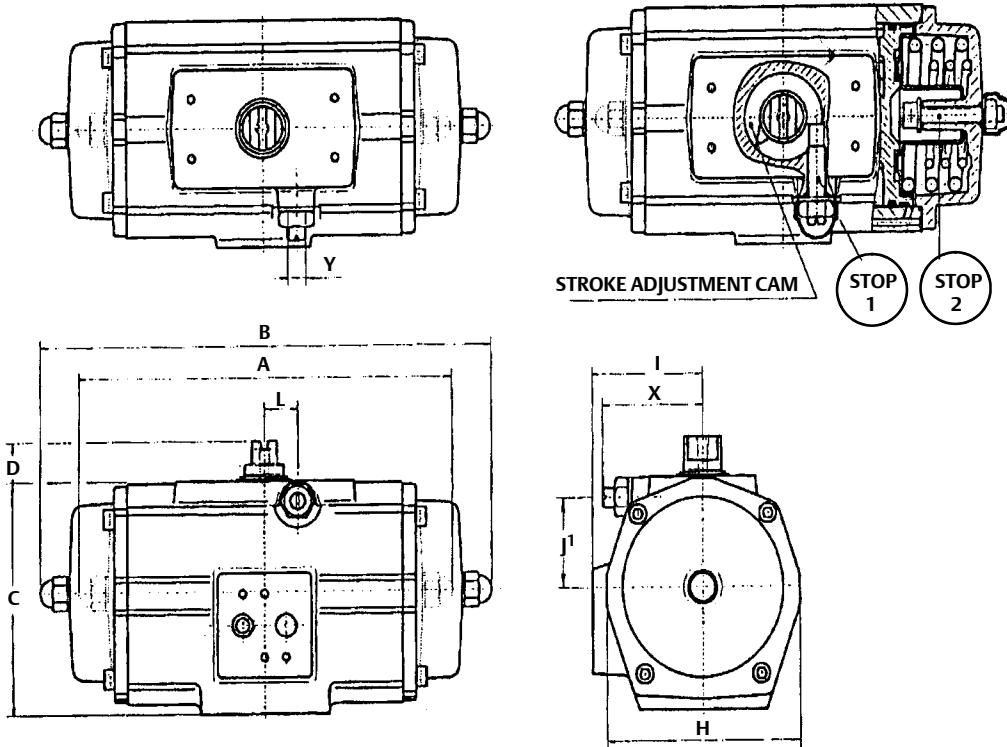
Figure 4. Dimensions (also see tables 4 and 5)



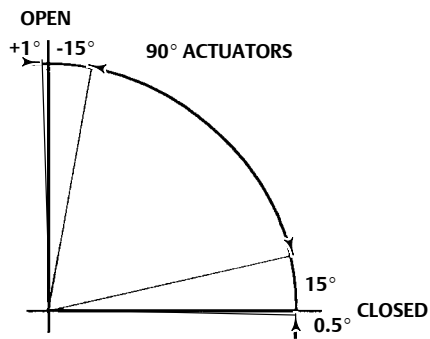
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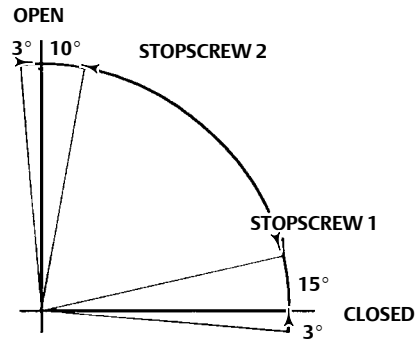
Figure 5. Dimensions (also see tables 4 and 5)



**E SERIES DUAL STOP DETAIL**



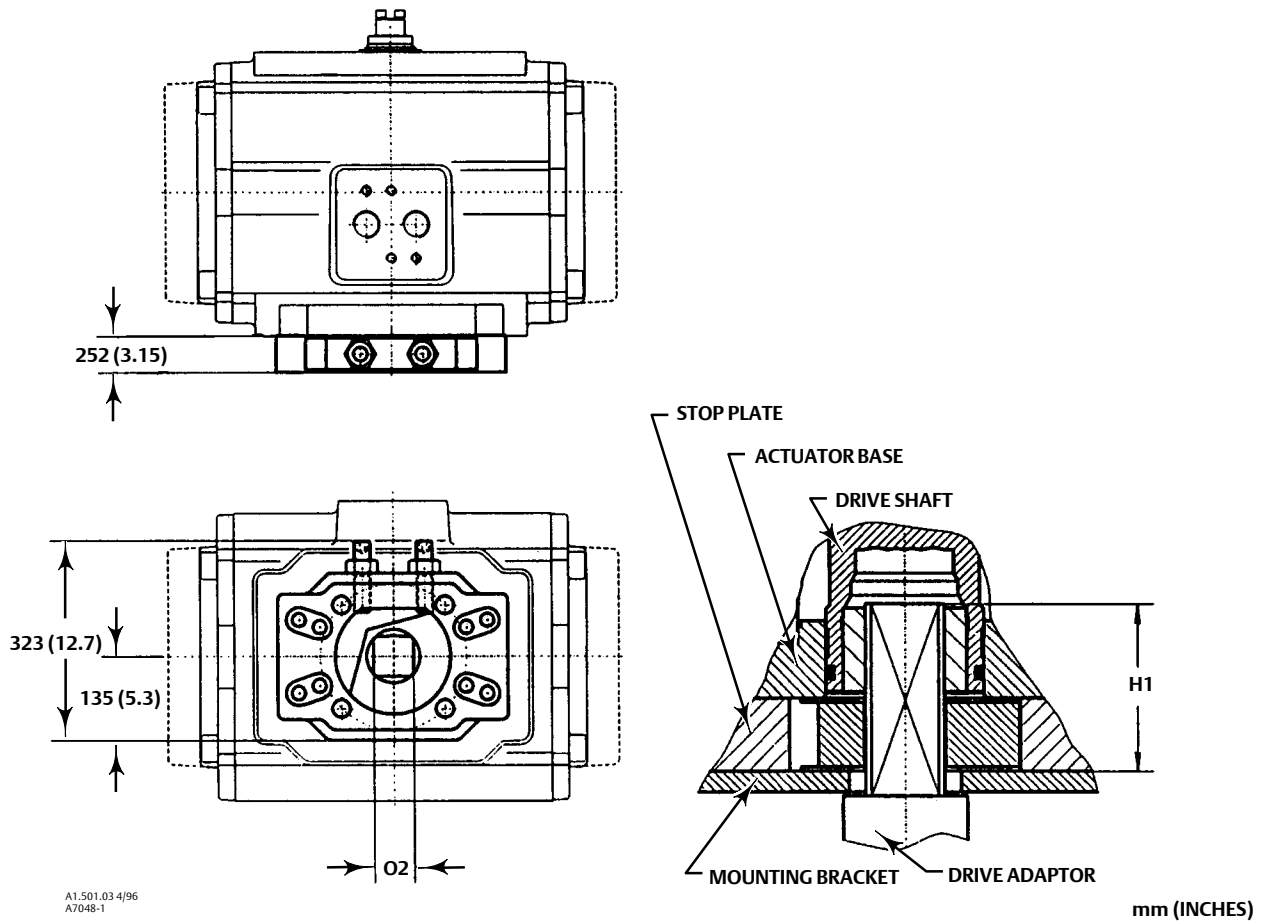
**P SERIES ADJUSTABLE RANGE**



**E SERIES ADJUSTABLE RANGE**

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Figure 6. Dimensions (also see tables 4 and 5)



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