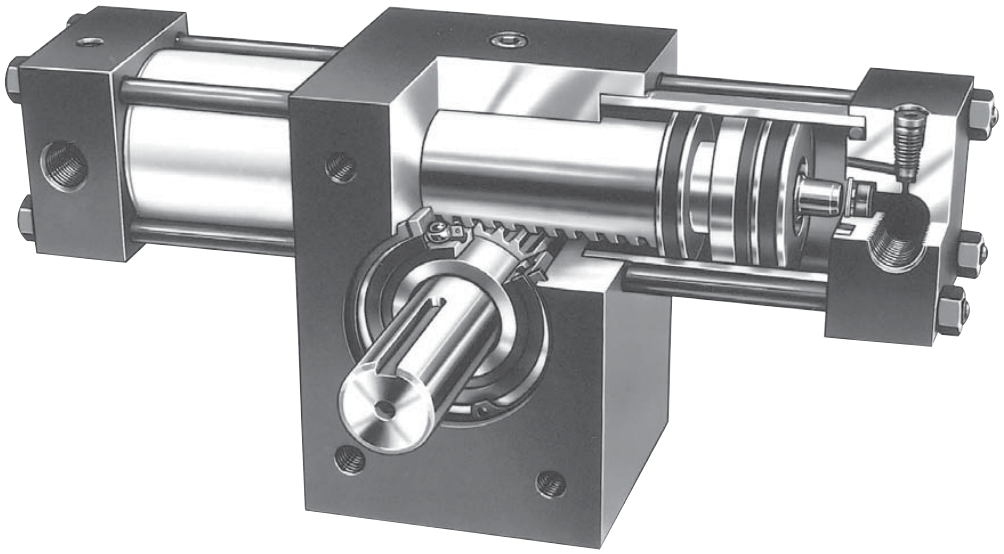
PTR Series

Pneumatic Rack & Pinion Rotary Actuator



Contents

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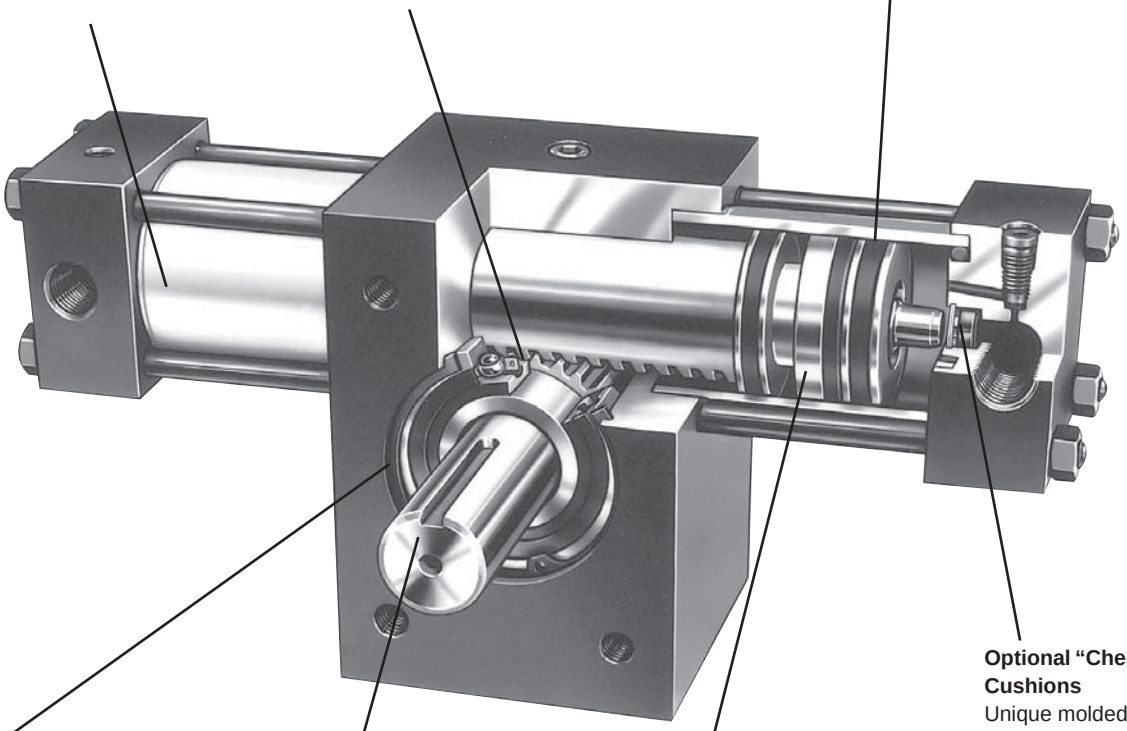
Piston Seals
Unique geometry of lipseal provides low breakaway pressure and long life. The specially formulated Nitroxile ELF compound incorporates a unique internal lubricant to provide the lowest breakaway and running friction, while maintaining the best wear resistance available. Can be operated with no added lubrication.

Rack & Pinion
Heavy duty gear design is made from through hardened chrome alloy steel for maximum strength and shock resistance. The gear chamber is prelubricated to provide millions of trouble-free cycles.

Tubing & Body
Aluminum is hard-coat anodized and permanently sealed for maximum wear resistance and long life.



Sealed Ball Bearings
Reduce friction and breakaway pressure while providing substantial pinion and shaft support. This ensures a rigid and long lasting assembly, even for high cycle applications.

Standard Male Keyed Shaft
Is as large as possible to ensure superior strength; pinion and output shaft are one- piece to provide long life. A female shaft is available.

Pistons
Floating Wear-Tech® aluminum pistons are supported at both ends by rugged filled PTFE wear bands which prevent cylinder scoring, galling, and binding. A magnet groove is standard on all pistons, allowing field conversion to position sensors.

Optional "Check Seal" Cushions
Unique molded flow passages combine the benefits of floating cushions with check valve action, providing effective cushioning and quick stroke reversal for higher cycle and production rates. This proven design eliminates failure-prone springs and ensures minimum wear. An adjustable needle valve and springless check valve allow exact "tailoring" of the cushion to match the application.

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Model Code and Ordering Information
Example: PTR251 - 0903FP - AB21MV - C

PTR	25	1	–	090	3	F	P	–	A	B	2	1	M	V	–	C	

Model [1]

10	1" Bore
15	1-1/2" Bore
20	2" Bore
25	2-1/2" Bore
32	3-1/4" Bore

Configuration

1	Single Rack
2	Double Rack
3	Three Position Actuator
6	Air/Oil Operation
7	Antibacklash

Rotation [2]

090	90°
180	180°
270	270°
360	360°

Or specify any other rotation.

Cushion / Bumpers

Omit	None
1	Cushioned CW Rotation [3]
2	Cushioned CCW Rotation [3]
3	Cushioned Both Rotations
4	Four Cushions [4]
5	Bumper CW Rotation [3]
6	Bumper CCW Rotation [3]
7	Bumper Both Rotations
9	Special

Stroke Adjusters

Omit	None
D	0-30° CW rotation [3, 5]
E	0-30° CCW Rotation [3, 5]
F	0-30° Both Rotations [5]
H	Shock/Stroke Adj. CW Rotation [3, 7]
K	Shock/Stroke Adj. CCW Rotation [3, 7]
L	Shock/Stroke Adj. Both Rotations [7]
X	Special

Port Flow Controls

Omit	None
P	Flow Control Both Rotations
R	Flow Control CW Rotation [3]
S	Flow Control CCW Rotation [3]

Mounting

A	Face/Base (STD)
F	Front Flange
G	Foot Flange
P	Pilot Ring
R	Rear Flange
X	Special

Shaft

A	Female Keyed
B	Single Male Keyed (STD)
C	Double Male Keyed
R	Preload Keyway
X	Special

Port Type

1	SAE Straight Thread
2	NPTF
4	BSPP (ISO 1179-1 with ISO 228-1 threads)
9	Special

Port Location

1	Position 1 (STD)
2	Position 2
3	Position 3
4	Position 4 [8]
5	Position 5 [6]
9	Special

Standard Options

Omit	None
M	Magnetic Piston Ring
S	Shaft Seal Cover
Q	Prepped for External Air/Oil Tank
L	Air/Oil Cushion & Flow Control Adj. at Location 1 (opposite standard)

Seals

Omit	Nitrile
V	Fluorocarbon
X	Special

Design Series

C	Current

Special Options

Omit STD

(Two-digit code assigned by factory and applies when any "X" or "9" appears in the model number or when special options or features are required.)

Other Options

Detail in clear text:
- Proximity Sensors
- Feedback Potentiometer

Order solid state (Hall effect) and reed sensors separately. See Electronic Sensors section for part numbers and specifications.

NOTES:

1 Cylinder bore size. See appropriate tables for torque output.

2 For 3-position units, specify middle and total rotation separated by a "/", ie 090/180. To obtain equal rotation both sides of midstroke (theoretical 12:00), order unit with 5° longer rotation than standard with stroke adjusters.

3 Viewed from shaft end.

4 Double rack models only.

5 Reduces to 10° with cushions.

6 Not available with cushions or stroke adjusters.

7 Refer to page H45 for option configuration compatibility.

8 Not available on double rack models.

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Specifications

- Maximum operating pressure: 250 PSI
- Output torque @ 100 psi: 39 lb-in to 2281 lb-in
- Standard rotations: 90°, 180°, 270°, 360°, 450°
- Maximum breakaway pressure: 5 PSI
- Zero internal and external leakage
- Mounting orientation: unrestricted
- Timing: keyway located at 12:00 position at midstroke of actuator
- Operating temperature range:
  - Standard seals 0 to 180°F
  - Fluorocarbon seals 0 to 250°F
- Filtration requirement: 40 micron filtered, dry air

Unit Weights (lb)

Model	Rotation			
	90°	180°	270°	360°
PTR101	2-1/4	2-1/2	2-3/4	3
PTR102	3-1/2	3-7/8	4-1/4	4-5/8
PTR151	8-1/4	8-3/4	9-1/4	9-3/4
PTR152	11-3/8	12-3/8	13-3/8	14-3/8
PTR201	13-5/8	14-5/8	15-5/8	16-3/4
PTR202	19-3/4	21-7/8	24	26-1/8
PTR251	21-1/8	22-3/4	24-3/8	26
PTR252	30-3/4	34	37-1/4	40-1/2
PTR321	44-1/4	46-5/8	49	51-3/8
PTR322	61-7/8	66-5/8	71-3/8	76-1/8

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Quick Reference Data

Model		Typ. Actual Output Torque @ 100 psi (lb-in)	Theoretical Output Torque* (lb-in) versus Input Pressure (psi)				Displacement per Degree Rotation (in^3/°)	Maximum Angular Backlash (minutes)	Tolerance (degrees)
Single Rack	Double Rack		50	75	100	250			
101		35	19	29	39	98	0.007	60	-0, +5
	102	70	39	59	79	197	0.014	60	-0, +5
151		100	59	88	118	294	0.021	45	-0, +4
	152	200	118	177	236	590	0.042	45	-0, +4
201		250	141	212	282	705	0.049	35	-0, +3
251		375	215	322	430	1074	0.075	35	-0, +3
	202	500	282	423	565	1410	0.099	35	-0, +3
	252	750	430	644	859	2148	0.150	35	-0, +3
321		1000	570	856	1141	2852	0.199	25	-0, +2
	322	2000	1141	1711	2281	5703	0.398	25	-0, +2

* Allow 10% for friction loss. Allow 20% on air/oil units. Use the single rack torque values for all air/oil, three position, and anti-backlash actuators.

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Bearing Load Capacities and Kinetic Energy Ratings

Model	Bearing Load Capacities* (lb)		Distance Between Bearings	Maximum Kinetic Energy absorption Rating for Models Based on Configuration (lb-in)			
	Radial	Thrust		Standard or Stroke Adjusters	Bumper	Cushion**	Shock Absorbers (per Cycle/per Hour)
10	100	50	1.40	0.5	0.75	5.00	15/150,000
15	250	125	2.15	1.50	2.25	15.00	35/200,000
20	500	250	2.15	3.00	4.50	35.00	140/350,000
25	750	375	2.50	5.50	8.25	55.00	140/300,000
32	1000	500	3.75	12.00	18.00	155.00	N/A

* Bearing capacities only. Check Kinetic Energy ratings to determine if actuator will stop load.
** Assuming positive back pressure provided by meter-out flow control.

Kinetic Energy Calculations

In many cases, the size and life of a rotary actuator is determined not by its torque output, but rather by its energy dissipation capability. This is based on the assumption that if the actuator is capable of stopping the load, it is certainly capable of starting the load.

Both torque output and kinetic energy absorption must be considered if the actuator physically stops the load.

To calculate Kinetic Energy, the following variables are required:

1. Rotational Mass Moment of Inertia (J_m) - See next page.
2. Total Rotation (Degrees)
3. Rotation Time (Seconds)

KINETIC ENERGY BASIC FORMULA

$$KE = 1/2\ J_m\omega^2$$

$$\omega = 0.035 \times \frac{\text{Angle Traveled (deg.)}}{\text{Rotation Time (sec.)}}$$

where

KE = Kinetic Energy (in-lb)

J_m = Rotational Mass Moment of Inertia (in-lb-sec^2)
See next page for formulas.

ω = Peak Velocity (rad/sec)
(Assuming twice average velocity)

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Kinetic Energy Basic Formula

$KE = 1/2\ Jm\omega^2$

$$\omega = 0.035 \times \frac{\text{Angle Traveled (Deg.)}}{\text{Rotation Time (Sec.)}}$$

where

KE = Kinetic Energy (in-lb)

Jm = Rotational mass moment of inertia (in-lb-sec^2)
(Dependent on physical size of object and weight)

ω = Peak Velocity (rad/sec) (Assuming twice average velocity)

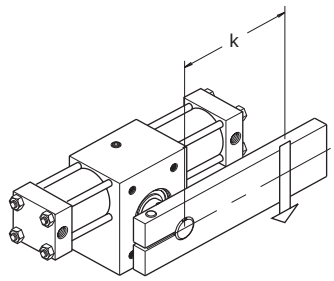
W = Weight of load (lb)

g = Gravitational constant = 386.4 in/sec^2

k = Radius of gyration (in)

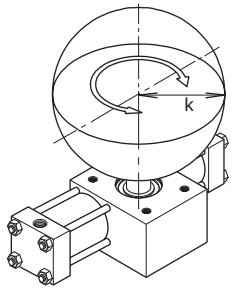
Moments of Inertia

POINT LOAD



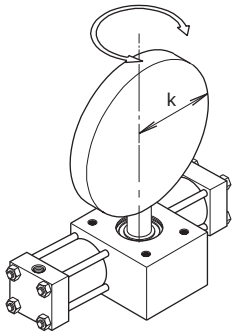
$$Jm = \frac{W}{g} \times k^2$$

SOLID SPHERE -
Mounted on center



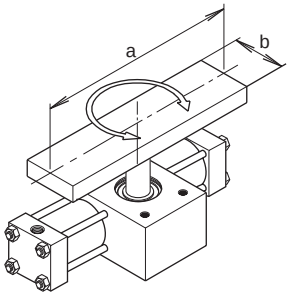
$$Jm = \frac{2}{5} \times \frac{W}{g} \times k^2$$

THIN DISK-
End mounted on center



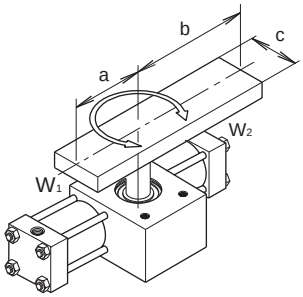
$$Jm = \frac{W}{g} \times \frac{k^2}{4}$$

THIN RECTANGULAR PLATE -
Mounted on center



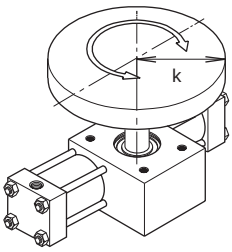
$$Jm = \frac{W}{g} \times \frac{a^2 + b^2}{12}$$

THIN RECTANGULAR PLATE -
Mounted off center



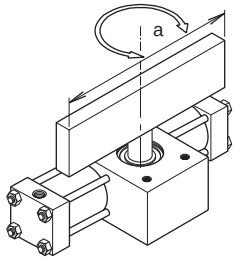
$$Jm = \frac{W_1}{g} \times \frac{4a^2 + c^2}{12} + \frac{W_2}{g} \times \frac{4b^2 + c^2}{12}$$

THIN DISK-
Mounted on center



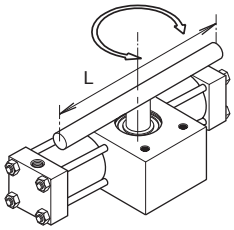
$$Jm = \frac{W}{g} \times \frac{k^2}{2}$$

THIN RECTANGULAR PLATE-
End mounted on center



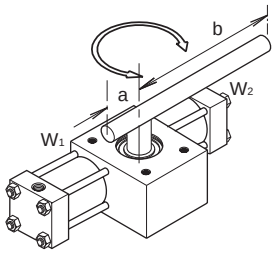
$$Jm = \frac{W}{g} \times \frac{a^2}{12}$$

SLENDER ROD-
Mounted on center



$$Jm = \frac{W}{g} \times \frac{L^2}{12}$$

SLENDER ROD -
Mounted off center



$$Jm = \frac{W_1}{g} \times \frac{a^2}{3} + \frac{W_2}{g} \times \frac{b^2}{3}$$

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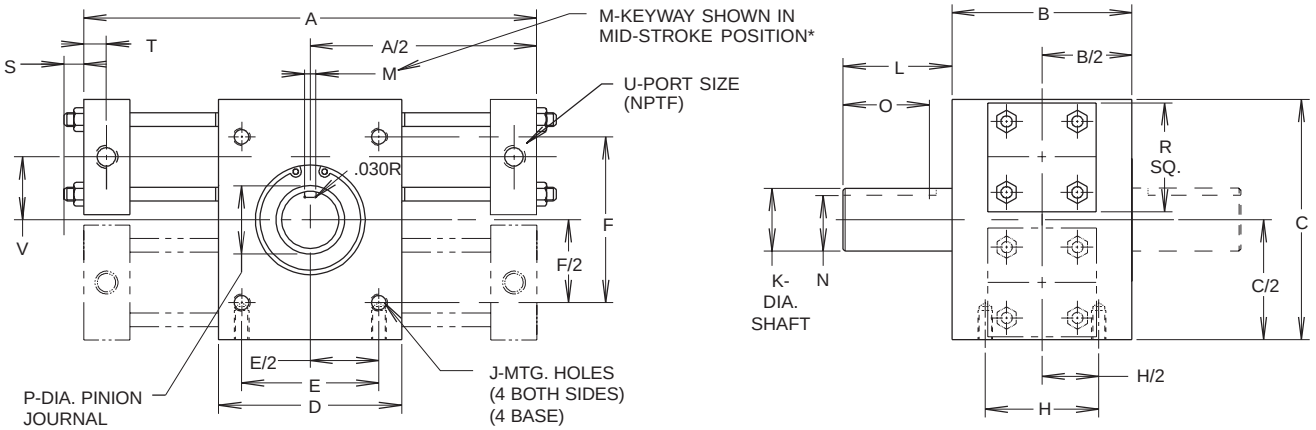
Standard Face Base Mount (A) and Male Keyed Shaft (B)

Double Male Keyed Shaft (C) shown in phantom



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Model	Rotation Degrees	A	B	C	D	E	F	H	J	K	L	M	N
10	90 180 360	6-11/16 8-1/4 11-7/16	2	3	2	1.500	2.000	1.500	1/4-20 x 3/8 DP	0.500 0.499	7/8	0.125 0.127	0.430 0.425
15	90 180 360	9-1/8 11-3/16 15-3/8	3	4-1/4	3	2.000	3.000	2.000	5/16-18 x 1/2 DP	0.875 0.874	1-7/8	0.188 0.190	0.771 0.761
20	90 180 360	11-3/16 14-1/16 19-11/16	3	5	4	2.500	3.500	2.000	3/8-16 x 1/2 DP	1.125 1.124	1-7/8	0.250 0.252	0.986
25	90 180 360	12-9/16 15-1/2 20-5/8	3-1/2	6	4	2.500	4.500	2.000	1/2-13 x 3/4 DP	1.375 1.374	2-1/4	0.313 0.315	1.201 1.191
32	90 180 360	16-5/8 21-1/8 29-3/8	5	8	5	3.000	5.000	2. 500	3/4-10 x 1 DP	1.750 1.749	3-1/2	0.375 0.377	1.542 1.532

Model	O	P	R	S	T	U	V
10	5/8	0.59	1-1/2	1/4	0.31	1/8	3/4
15	1-1/2	0.98	2	5/16	0.41	1/4	1-1/16
20	1-1/2	1.18	2-1/2	3/8	0.41	1/4	1-1/4
25	1-3/4	1.38	3	3/8	0.41	1/4	1-1/2
32	3	1.77	3-3/4	7/16	0.56	3/8	1-15/16

*To obtain equal rotation both sides of midstroke (theoretical 12:00), order 5° longer rotation than standard with stroke adjusters.

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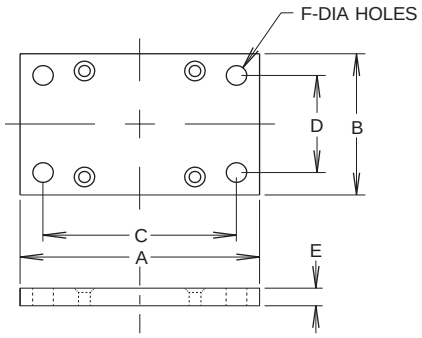
Mounting Options (F, G, P, R)

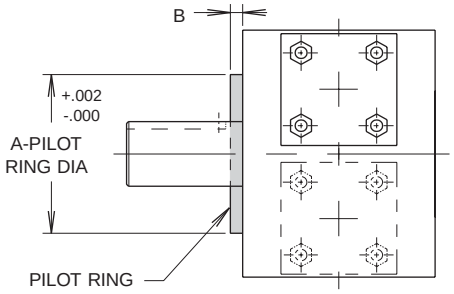
Foot Flange (G)



Model	A	B	C	D	E	F
10	3.25	2.00	2.625	1.375	0.250	0.281
15	4.50	3.00	3.875	2.125	0.438	0.406
20	4.50	4.00	3.875	3.375	0.438	0.406
25	5.50	4.00	4.500	3.000	0.438	0.531
32	8.00	5.00	6.500	3.500	0.750	0.781

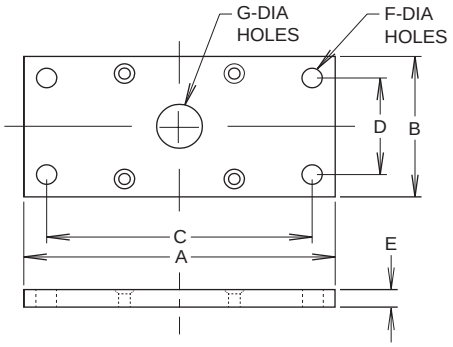
Note: Actuators are shipped with mounting flange installed unless otherwise noted.

Pilot Ring (P)



Model	A	B
10	1.124	0.125
15	2.000	0.25
20	2.167	0.25
25	2.679	0.25
32	3.348	0.25

Front Flange (F)
Rear Flange (R)



Model	A	B	C	D	E	F	G
10	4.25	2.00	3.625	1.375	0.250	0.281	0.625
15	5.75	3.00	5.125	2.125	0.438	0.406	1.000
20	6.50	4.00	5.875	3.375	0.438	0.406	1.250
25	8.25	4.00	7.250	3.000	0.438	0.531	1.625
32	12.00	5.00	10.000	3.000	0.750	0.781	2.000

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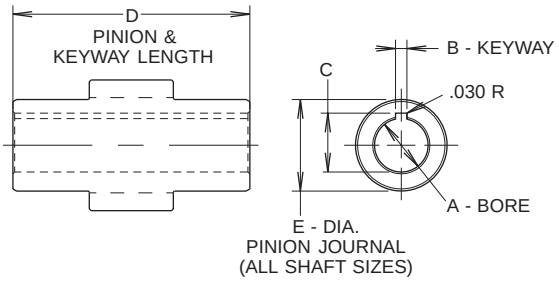
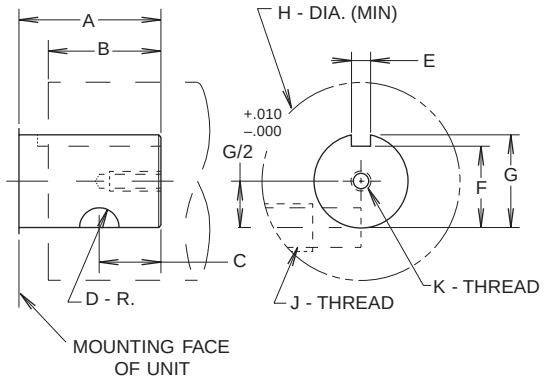
Shaft Options (C, A, R)

Units are equipped standard with single male keyed shaft (B).
Double male keyed (C) also available as shown on page H37.
Also available in female keyed and preload keyway options.





Note: Female keyed pinion designed primarily for pneumatic service. Review shaft stresses before applying on hydraulic service.

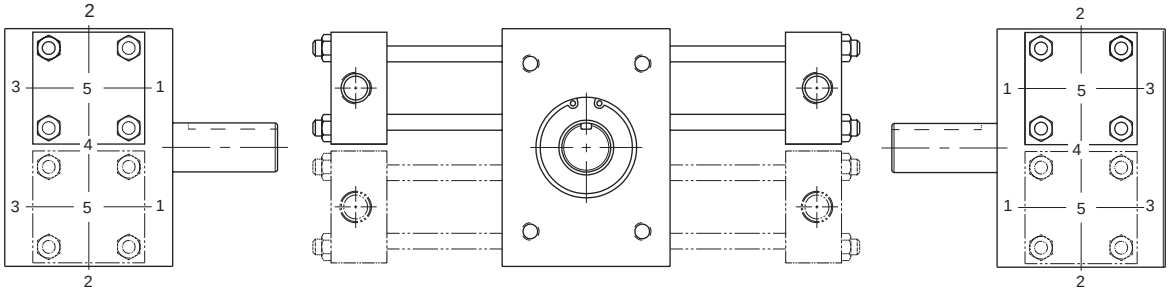
Female Keyed (A)

Model	A	B	C	D	E
10	0.375 0.377	0.093 0.095	0.417 0.422	1-13/32	0.59
15	0.500 0.502	0.125 0.127	0.560 0.565	2-11/16	0.98
20	0.750 0.752	0.187 0.189	0.837 0.847	2-23/32	1.18
25	1.000 1.002	0.250 0.252	1.083 1.093	3-1/8	1.38
32	1.250 1.252	0.250 0.252	1.367 1.377	4-9/16	1.77

PRELOAD KEY (R)

Model	A	B	C	D	E	F	G	H	J	K
10	7/8	5/8	0.375	0.156	0.125 0.127	0.430 0.425	0.500 0.499	1-1/2	3/8-24	10-32 x 3/8 DP
15	1-7/8	1-1/2	0.812	0.219	0.188 0.190	0.771 0.761	0.875 0.874	2	1/2-20	5/16-24 x 1/2 DP
20	1-7/8	1-1/2	0.812	0.250	0.250 0.252	0.986 0.976	1.125 1.124	3	5/8-11	3/8-24 x 9/16 DP
25	2-1/4	1-3/4	1.000	0.250	0.313 0.315	1.201 1.191	1.375 1.374	3-1/2	3/4-10	3/8-24 x 9/16 DP
32	3-1/2	3	1.500	0.437	0.375 0.377	1.542 1.532	1.750 1.749	4	1-8	1/2-20 x 3/4 DP

Port Size and Location (1, 2, 3, 4)



Notes:
1. Port position 1 is standard.
2. Port positions 2, 3 and 4 are standard options available at no additional cost.
3. Port position 4 is for single rack only.
4, Port position 5 is not available with cushions or stroke adjusters.

Model	Optional SAE Straight Thread (1)	Standard NPT (2)
10	7/16 - 20 (SAE 4)	1/8
15	7/16 - 20 (SAE 4)	1/4
20	9/16 - 18 (SAE 6)	1/4
25	9/16 - 18 (SAE 6)	1/4
32	3/4 - 16 (SAE 8)	3/8

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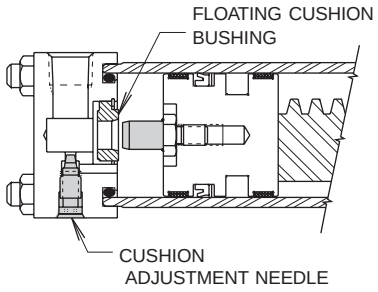
Cushions (1, 2, 3, 4)

The standard cushions operate over the last 30° of rotation in either or both directions. A floating bushing ensures no binding of the cushion spear. For severe operating conditions, four cushions can be fitted on double rack units. All cushions are fully adjustable. On double rack units, cushions will be located on the upper cylinder.



Standard Cushion Needle Locations

(Reference diagram on previous page)

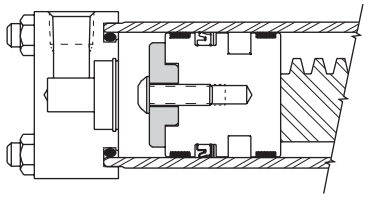
Port Position	Cushion Position
1	2
2	3
3	2
4*	3
5	N/A

*Single Rack only

H

Bumpers (5, 6, 7)

Built-in polyurethane bumper pads absorb shock and noise, thus permitting faster cycle times and increased production rates. Bumpers are available for pneumatic service only.



Notes: 1. Available with or without stroke adjusters
2. Not available with cushions

Bumper Thickness

Add the bumper thickness to overall unit length "A" for each bumper specified.

Model	Bumper Only	Bumper with Stroke Adjuster
10	0.13	0.44
15	0.19	0.63
20	0.25	0.75
25	0.25	0.75
32	0.25	1.00

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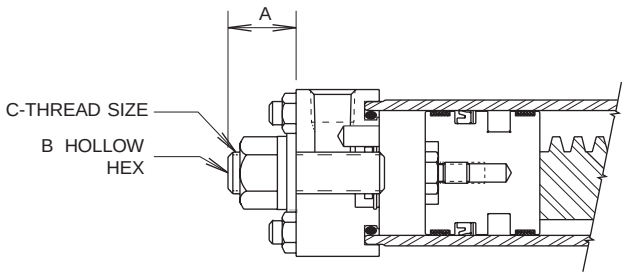
Stroke Adjusters (D, E, F) 30°

Stroke adjusters will reduce angle of rotation by 30° in either or both directions. Typical applications are for initial set-up purposes where exact rotation cannot be pre-determined or when rotation requirements may change between various operations. Not available with port position 5.



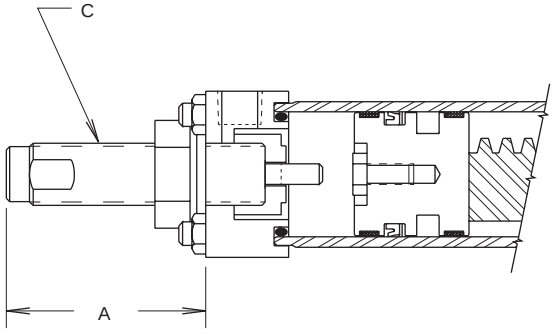
Notes:

1. Standard cushions operate over the last 30° of rotation. Stroke adjusters will decrease the effective cushion length by the same amount. For example, reducing the rotation by 5° yields a 25° cushion length. For effective cushions it is recommended that stroke adjustment not exceed 10° when used in conjunction with cushions.
2. Maximum unit rotation is equal to rotation specified in model code. Adjusters allow rotational positioning equal to or less than the maximum rotation.
3. 30° Stroke Adjusters are available with or without cushions. Double rack units will have cushions on upper rack and adjusters on lower rack. Single rack units with cushions (and double rack units with four cushions) and stroke adjusters will require additional "A" length.
4. Antibacklash can be achieved on double rack units with stroke adjusters as long as extra rotation is ordered.
5. When ordering cushions and stroke adjusters, the maximum adjustment is 10° per side.

Model	(1) Turn Adj.	30° Adjustment w/o Cushioned End Cap, A (Max)	10° Adjustment w/Cushioned End Cap, A (Max)	B	C
10	4.0°	0.63	0.38	1/8	1/4-28 UNF
15	4.6°	0.88	1.13	1/4	1/2-20 UNF
20	3.2°	1.13	1.13	1/4	1/2-20 UNF
25	3.2°	1.13	1.18	1/4	1/2-20 UNF
32	2.4°	1.50	2.13	3/8	3/4-16 UNF

Shock / Stroke Adjusters (H, K, L)

Hydraulic shock absorbers reduce noise and allow increased operating speeds and loads while also providing adjustability for end of rotation position. Shocks are fixed orifice self-compensating type and will provide constant deceleration despite changing energy conditions.



Notes:

1. Not available on Model 32 or with port position 5.
2. When specified with **DOUBLE RACK UNITS**: As a result of high energy levels and driving forces obtained with double rack units, all double rack actuators will contain four shock absorbers.
3. This option is not available in combination with the following options:
   a. Air/Oil (6)
   b. External Air/Oil (Q)
   c. Bumpers (5, 6, 7)
   d. Cushions (1, 2, 3, 4)
   e. Port Flow Controls (P, R, S)
   f. End Cap Mounted Proximity Sensors

   (Tie rod mounted reed and Hall effect sensors can be specified.)

Model	(1) Turn Adjustment	A (Max)	Max. Adjustment	C Thread Size
10	6°	2.20	110°	9/16 - 18 UNF
15	5°	2.40	80°	3/4 - 16 UNF
20	5°	3.66	130°	1 - 12 UNF
25	5°	3.66	130°	1 - 12 UNF

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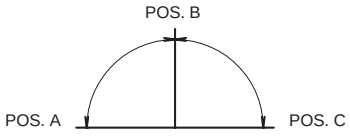
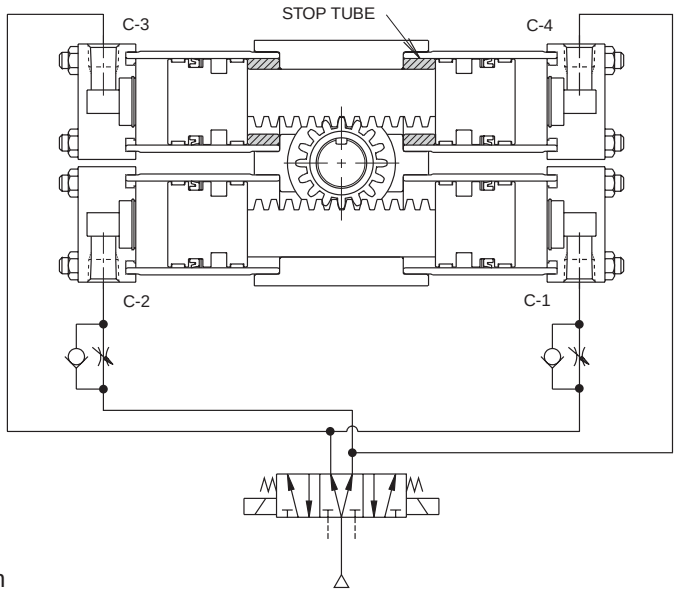
Three Position Actuator (3)

In addition to the standard two position actuators, three position units are also available. All standard options are also available.





Operation:

A standard double rack unit is fitted with stop tubes on the upper rack. Pressurizing port C-2 (with ports C-1, C-3 exhausted) causes counter-clockwise pinion rotation to angular position A. Alternately applying pressure to C-1 (with C-2, and C-4 exhausted) will cause clockwise rotation to angular position C. Both positions A and C are at end of stroke, thus typical end cap options such as cushions, bumpers, and stroke adjusters will operate at these positions only.

Position B is obtained by pressurizing all ports. Pressure applied to the upper floating pistons centers the rack between the stop tubes, rotating the pinion to position B. The lower rack is free floating as the forces are equal on both ends.

Dimensional Data:

Three position actuator dimensions are identical to the standard double rack units. If stroke adjusters are specified they will be fitted to the upper rack, flow controls and cushions will be on the lower rack. Rotational tolerances are given in the chart at the right.

Output Torque:

Output torque of the multiple position actuator is equivalent to the torque output of the same size single rack unit. The chart to the right gives selected torque values for specified pressures.

Ordering Information:

Three position actuators can be ordered by inserting a 3 into the "configuration" space in the model code. The desired middle and total rotation should be stated in the model code separated by a "/". The beginning position, 0°, need not be specified.

For example: **PTR153-045/180F-AB21-C** is a standard pneumatic actuator, three position, with an output torque of 118 lb-in at 100 psi. Position A is 0°, position B is 45°, and position C is 180°. Both positions A and C are adjustable by 30°, as the stroke adjuster option "F" was ordered.

Rotational Tolerances

Model	Total Rotation, Degrees	Between Positions, Degrees[1]	Backlash, Minutes[2]
103	-0, +5	±1	50
153	-0, +4	±1/2	40
203	-0, +3	±1/2	30
253	-0, +2	±1/2	30
323	-0, +2	±1/4	15

1. Measured from centers of backlash.
2. Zero backlash can be achieved at positions A and C by using optional stroke adjusters.

Theoretical Output Torque (lb-in) at Specified Pressure

Model	50 psi	100 psi	250 psi
103	19	39	98
153	59	118	294
203	141	282	705
253	215	430	1074
323	570	1141	2852

Note: When magnetic piston ring option "M" is ordered, all pistons will be so equipped.

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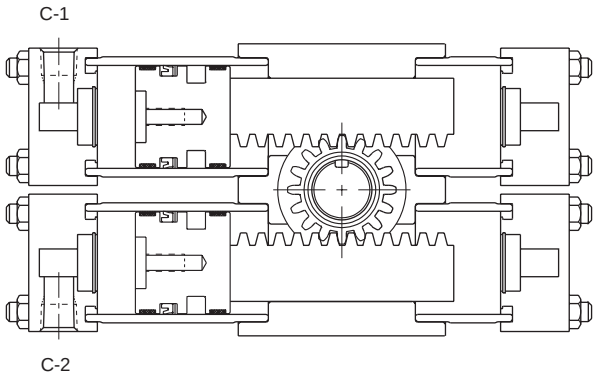
Antibacklash Actuator (7)

An antibacklash actuator is used to obtain precision positioning at the end of rotation. The backlash normally associated with rack and pinion actuators is eliminated by this unique configuration.



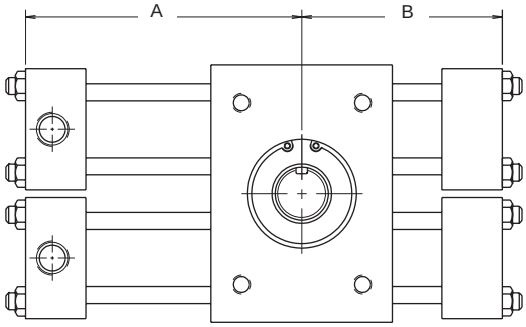
Operation:

A double rack unit is modified for actuation on one end only.

Alternately pressurizing C-1 or C-2 causes clockwise and counter-clockwise rotation, respectively. Backlash in the rack & pinion is eliminated as the pinion is tightly "trapped" between both racks at the end of stroke, preventing any further motion.

Dimensional Data:

Antibacklash actuators are similar in size and configuration to standard double rack units with one set of shorter cylinders. The table to the right shows dimensions for this shorter side. If cushions, stroke adjusters or port flow controls are ordered, they will be fitted to the powered rack side.



Output Torque:

Output torque of the antibacklash actuator is equivalent to the torque output of the same size single rack unit. The chart to the right gives selected torque valves for specified pressures.

Theoretical Output Torque, lb-in, at Specified Pressure

Model	50 psi	100 psi	250 psi
107	19	39	98
157	59	118	294
207	141	282	705
257	215	430	1074
327	570	1141	2852

Dimensions

Model	Rotation	A	B
107	90°	3-3/4	2-3/4
	180°	4-1/8	3-3/4
	360°	5-3/4	5
157	90°	4-9/16	3-5/16
	180°	5-5/8	4-9/16
	360°	7-11/16	6-5/8
207	90°	5-5/8	4-1/8
	180°	7-1/16	5-5/8
	360°	9-7/8	8-1/2
257	90°	6-5/16	4-3/8
	180°	7-3/4	6-5/16
	360°	10-5/16	8-13/16
327	90°	8-5/16	5-13/16
	180°	10-9/16	8-5/16
	360°	14-11/16	12-7/16

Ordering Information:

Antibacklash actuators can be ordered by inserting a "7" into the "configuration" space in the model code. For example: **PTR157-180F-AR21-C** is a pneumatic antibacklash actuator with a theoretical output torque of 118 lb-in at 100 psi.

The optional stroke adjusters make the rotation variable between 120° and 180°. The preload key option on the shaft is also specified to eliminate any backlash in the key and coupling interface.

Note:

Antibacklash can also be obtained on double rack actuators by implementing stroke adjusters at end of stroke. This will enable you to maintain double rack output torque.

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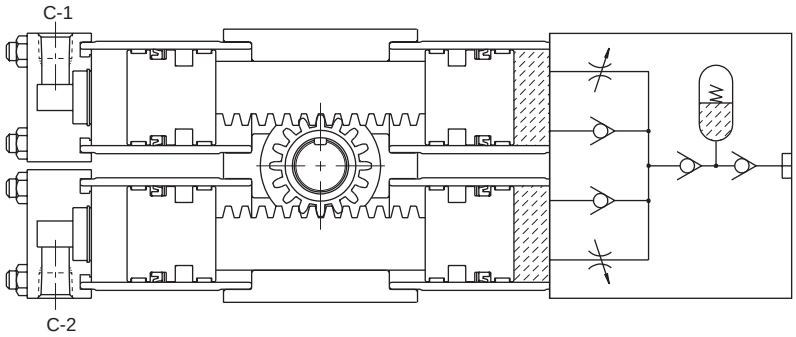
Self-Contained Tandem Air / Oil Operation (6)

The Air-Oil Tandem actuator allows precise speed and motion control using standard pneumatic controls. This is possible through the use of a completely sealed oil system which effectively meters and controls actuator movement with no slipping, jerking, or bouncing.



Operation:

A standard double rack unit is equipped with a built in hydraulic reservoir and flow controls. Air pressure is alternately applied to ports C-2 and C-1 to cause rotation in either direction. As oil is displaced from the opposite end of the drive rack it is metered precisely by the needle valve. A check valve allows free flow in the opposite direction so that independent speeds for rotation can be set.

The reservoir is directly attached to the actuator, eliminating plumbing and leakage paths. It is spring loaded to compensate for oil volume changes due to temperature variations and has built in fill port.

Dimensional Data:

Air / Oil Actuators are identical in size and configuration to standard double rack units, with the addition of the integral reservoir as shown.

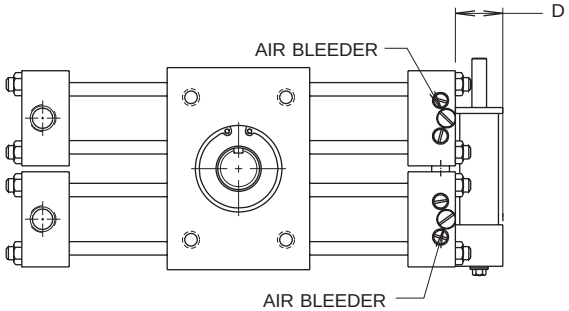
Output Torque:

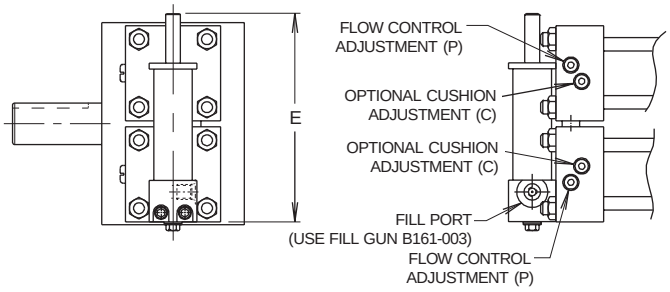
Theoretical output torques are shown in the table below. For design and sizing purposes an actuator should be selected with 20%-50% reserve capacity.

For maximum speed of the Air/Oil actuators please consult the factory or local representative.

Ordering Information:

Air / Oil Tandem actuators can be ordered by placing a "6" into the "configuration" space in the model code. All Air / Oil Tandem actuators include as standard port flow controls and Quad-ring piston seals (oil side only), thus it is not necessary to include a "P" and/or "Q" in the model code. Other options, such as cushions, stroke adjusters and magnetic piston ring are also available. For example: **PTR206-180F-AB21-C** is a standard Air/Oil actuator, with a theoretical output torque of 282 lb-in at 100 psi. Rotation of the unit is 180°, with optional cushions and stroke adjusters.





Dimensions

Model	D	E
106	1.00	3.63
156	1.00	4.38
206	1.25	4.91
256	1.25	4.91
326	1.25	6.29

Note: When magnetic piston ring option "M" is ordered, only the pneumatic pistons will be so equipped.

Theoretical Output Torque, lb-in, at Specified Pressure

Model	50 psi	100 psi	250 psi
106	19	39	98
156	59	118	294
206	141	282	705
256	215	430	1074
326	570	1141	2852

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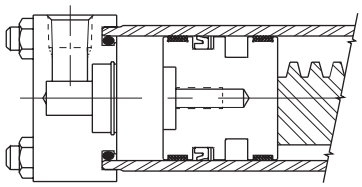
External Air / Oil Operation (Q)

The External Air/Oil actuator allows for connection to a separate air over oil control system. It can also be used for low pressure (less than 150 psi) non-shock hydraulic systems.

Operation:
A standard pneumatic rotary actuator is equipped with special piston seals for all pistons to ensure low breakaway pressure and no leakage. This allows smooth, jerk-free operation, even at very low pressures.

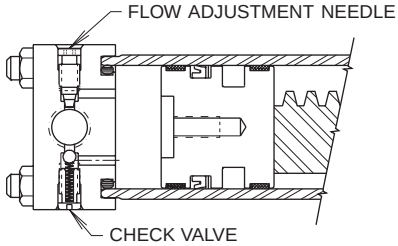
Output Torque:
Theoretical output torques are identical to the ones given at the beginning of the PTR section. For design and sizing purposes, an actuator should be selected with 20% - 50% reserve capacity.



NOTE: When cushions are specified, the actuator will be equipped with bronze cushion bushings in place of the standard nitrile cushion bushings.

Port Flow Controls (P, R, S)

Built in meter-out flow controls provide precise adjustment of actuator speed and eliminate the cost and space of externally plumbed components. A separate ball check is used to provide free flow in the opposite direction. Flow controls may be ordered in conjunction with cushions, bumpers, or stroke adjusters.



Standard Adjustment Needle Locations

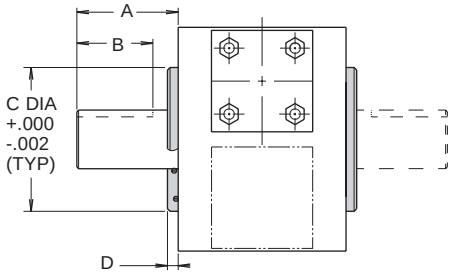
Port Position	Needle Position
1	2
2	3
3	2
4*	3

*Single rack only

Note: When both cushions and port flow controls are specified they will be stamped "C" and "P" respectively.

Shaft Seal Covers (S)

Shaft seal covers are designed to prolong bearing life by isolating them from external contamination and pressure. They are designed for use with standard male shafts only (not hollow shafts).



Specifications
Max. Pressure Differential: 500 psi
Material: Anodized Aluminum
Shaft Seal: Double Lip Wiper
Body Seal: O-Ring

Dimensions

Model	A	B	C	D
10	7/8	1/2	1.875	0.25
15	1-7/8	1-5/16	3.000	0.38
20	1-7/8	1-5/16	3.250	0.38
25	2-1/4	1-5/8	3.625	0.38
32	3-1/2	2-7/8	4.480	0.38

Fluorocarbon Seals (V)

Fluorocarbon seals are recommended for high temperature applications up to 250°F. Standard abrasion resistant nitrile seals should be used for general purpose applications with temperatures of 0 to 180°F.

Option	Temperature Range (°F)
Shock Absorbers	32 - 150
Bumpers	0 - 200
Piston Magnets	0 - 165
Proximity Sensors	-4 - 150
Reed/Hall Effect Sensors	14 - 140

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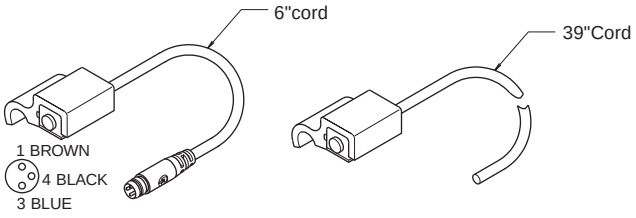
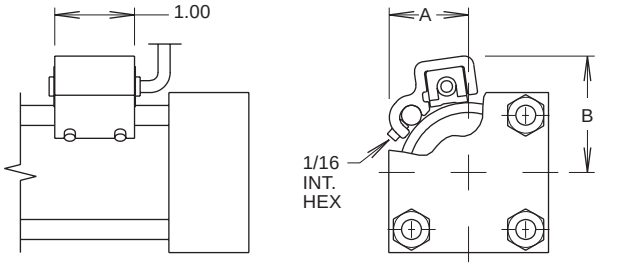
Magnetic Piston (M)

This option prepares the actuator for use with reed and Hall effect sensors. The "M" option should be specified to provide a magnet on the cylinder piston. Order sensors separately from the Electronic Sensors section.





Model	A	B
10	0.84	1.22
15	0.99	1.46
20	1.27	1.68
25	1.45	1.89
32	1.71	2.20

Proximity Sensors

(Namco Cylindicators or Balluff Cylinder Indicator Sensor)

The inductive type proximity sensor provides end of rotation indication. The non-contact probe senses the presence of the ferrous cushion spear and has no springs, plungers, cams or dynamic seals that can wear out or go out of adjustment. The sensor is solid state and meets NEMA 1, 12 & 13 specifications. For ease of wiring the connector housing is rotatable through 360°. To rotate, lift the cover latch, position and release.

The sensor make/break activation point may occur at 0.125" to ±0.125" from the end of stroke. Depending on the actuator size, this distance may cause activation at 2° to 15° from end of stroke.

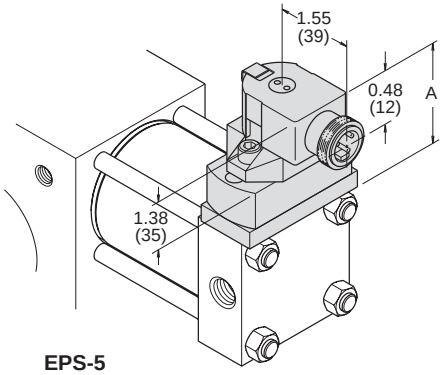
The standard proximity sensor controls 50-230 VAC/DC loads from 5 to 500 mA. The low 1.7 mA off-state leakage current can allow use for direct PLC input. The standard short circuit protection (SCP) protects the sensor from a short in the load or line upon sensing such a condition (5 amp or greater current) by assuming a non-conductive mode. The fault condition must be corrected and the power removed to reset the sensor preventing automatic restarts.

The low voltage DC sensor is also available for use with 10-30 VDC. The sensor is in a non-rotatable housing, but does incorporates the short circuit protection.

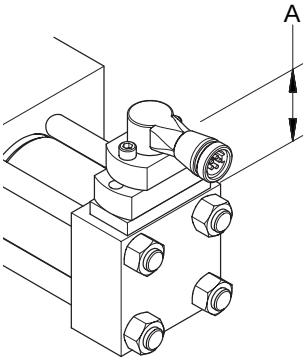
Both sensors are equipped with two LEDs, "Ready" and "Target". The "Ready" LED is lit when power is applied and the cushion spear is not present. The "Target" LED will light and the "Ready" LED will go out when the sensor is closed, indicating the presence of the cushion spear. Both LEDs flashing indicates a short circuit condition.

NOTES:

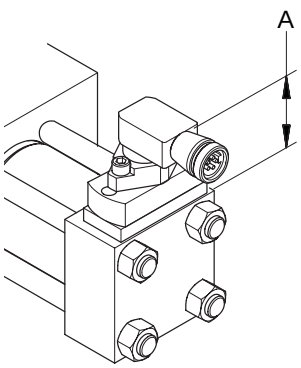
1. Available with or without cushions.
2. Not available with stroke adjusters.
3. Pressure rating: 3000 psi
4. Operating temperature: -4°F to 158°F
5. Specify sensor type, orientation and voltage when ordering.
6. The low voltage DC sensor is available in non-rotatable style only; consult factory for further information.



EPS-5



EPS-6



EPS-7

Model	A	
	EPS-5	**EPS-6 & 7**
15	1.88	2.17
20	2.44	2.75
25	2.16	2.48
32	1.94	2.25

Order proximity sensors separately. See Electronic Sensors section for specifications and ordering information.

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Seal Kit Ordering Information

- Standard units are equipped with Nitrile seals.
- Optional seal compounds are available.
- See parts list for items contained in seal kit.
- Seal kit part numbers as shown:

PSK	—	PTR322	V
Parker Seal Kit		Base Model	Omit - Standard V = Fluorocarbon Q = Quad Ring Piston Seals W = Carboxilated Nitrile Piston Seals

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