



# Position Feedback Cylinders

The Position Feedback Cylinder (PFC) provides continuous position sensing in a lightweight, small bore air cylinder. It can be used for measuring and gauging, positioning, and “on-the-fly” applications. It is available with or without a rod lock. Combine the PFC with the Bimba Pneumatic Control System (PCS), Digital Panel Meter (DPM), or the Electronic Controller to maximize performance.



# Contents

---

**461** Position Feedback Cylinders  
(PFC Models)

461 – Features and Benefits

462 – How It Works

463 – Engineering Specifications

464 – Mount Dimensions

465 – Dimensions

466 – 3-Pin Connector

467 – PFCL Models

468 – Dimensions (PFCL Models)

469 – How to Accessorize

472 – How to Order

---

**474** PFCN Cylinder Models

474 – Features and Benefits

475 – Mount Dimensions

476 – Specifications (PFCN Models)

477 – Dimensions (PFCNL Models)

478 – Accessories (PFCN Models)

479 – How to Order

---

---

**481** Pneu-Turn Position Feedback Rotary  
Actuator (PTF Models)

482 – Engineering Specifications

483 – Dimensions

485 – Options

486 – Option Dimensions

487 – How to Order

488 – Repair Parts

488 – Repair Kits

---

**489** SPCS-2 Servo Pneumatic Control  
System with Software Setup

490 – Application Sizing

491 – How to Order

492 – Dimensions

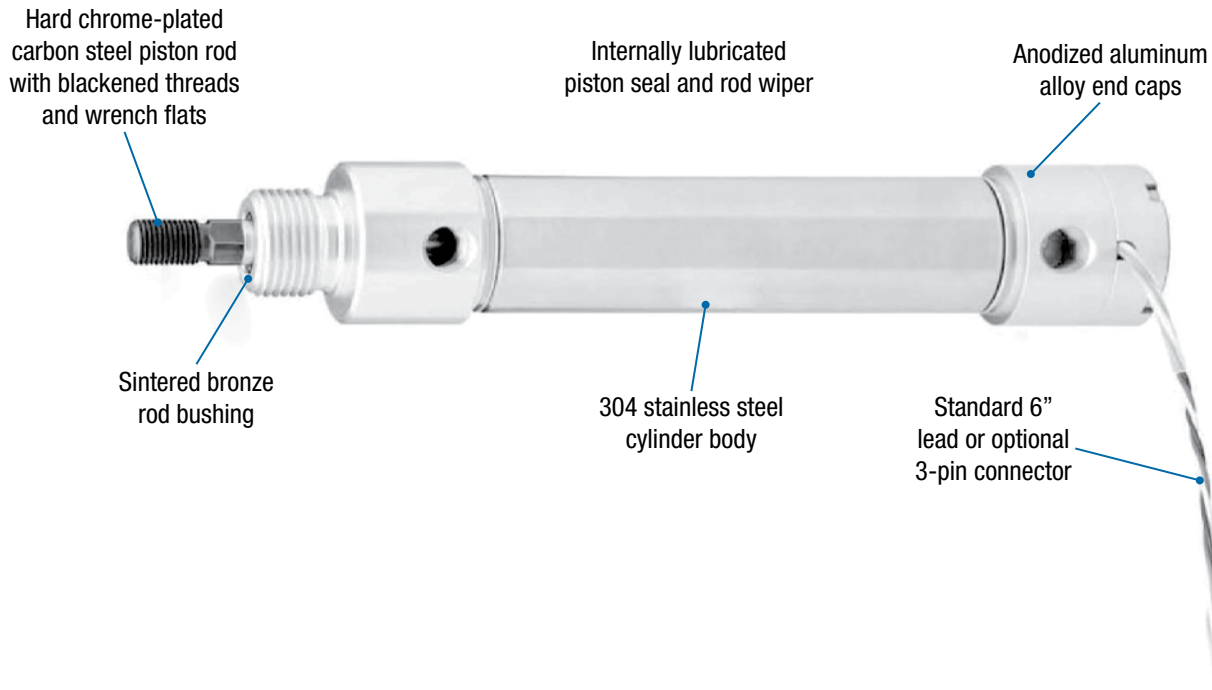
(Quick Connect Cables)

492 – Pneumatic Control

System Options

---

## Position Feedback Cylinders (PFC Models)



The Position Feedback Cylinder (Model PFC) is a linear pneumatic actuator that contains an internal LRT (Linear Resistive Transducer). The PFC can be used for measuring and gauging, positioning, and “on-the-fly” applications. It is available with or without a rod lock. Combine the PFC with the Bimba Servo Pneumatic Control Systems, model SPCS-2, to maximize performance.

## Features and Benefits

- > Higher loads and velocities than multiple position actuators, at a lower price point than electric actuators
- > Programmability with electronic controls leads to quicker changeovers and less overall downtime
- > Accurate to 0.010", comparable to electric motion
- > Closed loop control for precision upstream/downstream communication
- > Easy to set up and install

# How it Works

## Position Feedback Cylinders (PFC)

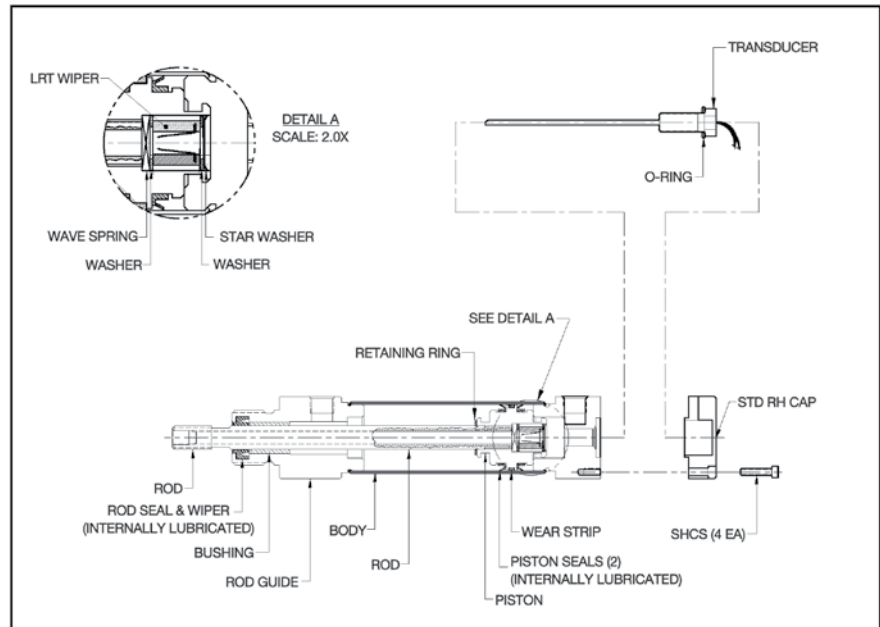
The Bimba Position Feedback Cylinder contains a Linear Resistive Transducer (LRT) or potentiometer mounted in the cylinder rear head. The LRT probe, which has a resistive element on one side and a collector strip on the other, is inside the cylinder rod. A wiper assembly is installed in the piston. As the piston moves, an electrical circuit is created between the resistive element and collector strip. A variable resistance (approximately 1KΩ per inch of stroke) proportional to piston position in the cylinder is produced by the cylinder. The cylinder can be easily setup to produce an analog signal compatible with 0-10 VDC PLC analog inputs.

The accuracy of an LRT is determined by three factors: resolution, linearity and repeatability.

Resolution refers to the smallest change that can be detected on the LRT. The Bimba LRT has infinite resolution, and can be divided into as many parts as the electronics allow. For example, with a 12-bit, 4096-part

controller, the stroke could be divided into 4096 parts. When 10 VDC are placed on a 10" cylinder, the smallest detectable increment would be  $10 \text{ VDC} \div 4096 = 2.4 \text{ millivolts}$  or  $0.0024"$ . Resolution is stroke sensitive—the longer the stroke, the less the resolution.

Linearity refers to the maximum deviation of the output voltage to a straight line. The Bimba LRT's linearity is  $\pm 1$  percent of stroke. Repeatability is the ability of the LRT to provide the same output voltage relative to a unique cylinder position each time the cylinder is cycled. Mechanical repeatability of the Bimba Position Feedback Cylinder is  $\pm 0.001"$ .



## Engineering Specifications (PFC)

<b>Repeatability:</b>	±0.001" Cylinder Only.
Refer to specifications in the following sections for positioning or measuring repeatability. Power supply ripple and A/D error may reduce repeatability when PFC is utilized with industrial control systems.	
<b>Nonlinearity:</b>	± 1 percent of full stroke
<b>Resolution:</b>	Infinite
<b>Signal Input:</b>	10 VDC typical
<b>Input Impedance Required:</b>	1 MOhm
<b>Signal Output:</b>	> 0 to slightly less than FS signal input
(The internal electrical stroke is slightly larger than the mechanical stroke of cylinder)	
<b>Maximum Speed:</b>	25 in./sec.
<b>Rated Life of LRT Wiper:</b>	1,0001 miles of travel
<b>Rated Life of Probe:</b>	10 million cycles <sup>1</sup>
<b>Air Requirements:</b>	Filtered to 5 micron with 0° dewpoint recommended. Moisture inside cylinder will cause output signal fluctuation.
<b>Pressure Rating:</b>	150 PSI
<b>Temperature Rating:</b>	0° to 200° F <sup>2</sup>
<b>Interface:</b>	6" standard leads or optional 8mm DIN connector
<b>Cylinder Body:</b>	304 stainless steel
<b>Piston Rod:</b>	Hard chrome plated carbon steel with blackened threads and wrench flats
<b>Rod Bushing:</b>	Sintered bronze
<b>End Caps:</b>	Anodized aluminum alloy
<b>Piston Seal:</b>	Internally lubricated urethane (standard) Internally lubricated Buna (L option)
<b>Rod Wiper:</b>	Internally lubricated Buna N (omitted on L option)
<b>Rod Seal:</b>	Internally lubricated Buna N (N/A on standard model)

<sup>1</sup> Higher velocities increase wear rate.

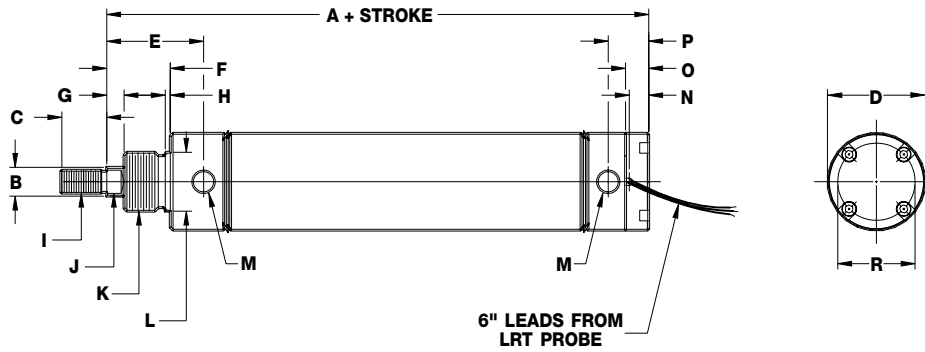
<sup>2</sup> Special low temperature lubrication is required for positioning applications using option L seals below 35° F.

	Estimated Cylinder Weights (lbs)				
	1-1/16"	1-1/2"	2	2-1/2"	3
PFC-	0.44	0.88	2.02	2.78	3.62
PFC-X	0.49	0.96	2.14	2.96	3.85
PFC-BF	0.54	1.07	2.28	3.02	4.08
ADDER WT/IN	0.06	0.10	0.15	0.20	0.29

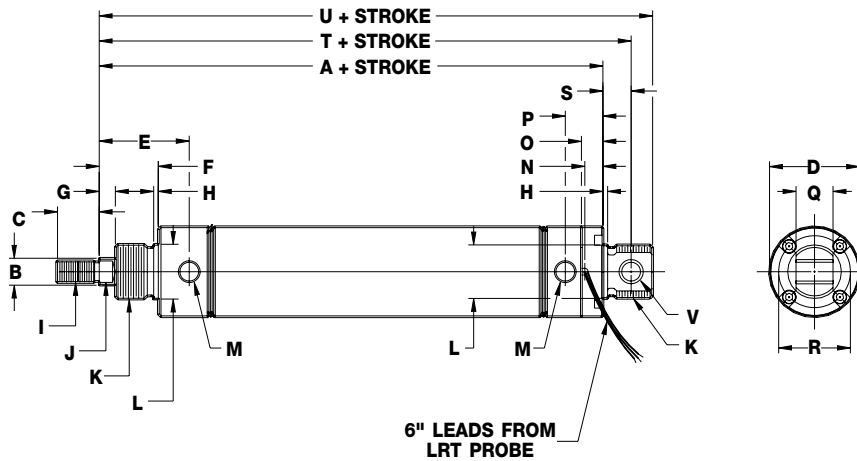
# How to Specify

## Mount Dimensions (PFC Models)

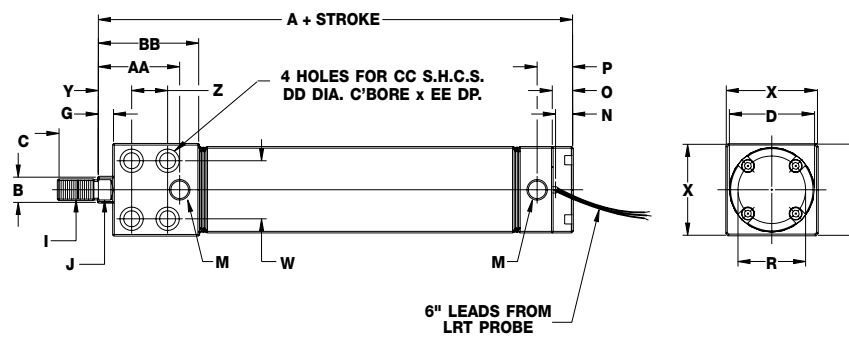
### Nose Mount



### Universal Mount for stud or pivot (includes bushing)

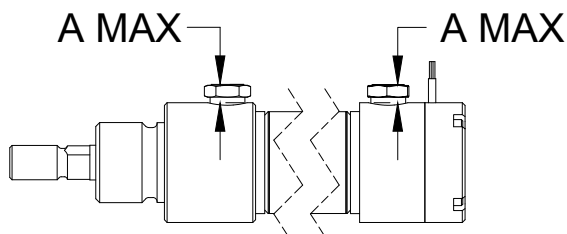


### Block Mount



NOTE: Mounting holes farthest from rod end are omitted for -L option for 11/16" bore.

### Option FT



Bore	A
1-1/16" (09)	0.35
1-1/2" (17)	0.41
2" (31)	0.41
2-1/2" (50)	0.52
3" (70)	0.52

## Dimensions

	1-1/16" Bore (09)		1-1/2" Bore (17)	2" Bore (31)	2-1/2" Bore (50)	3" Bore (70)
A	4.59		4.88	5.72	6.41	6.78
B	Ø 0.38		Ø 0.50	Ø 0.63	Ø 0.75	Ø 0.75
C	0.63		0.88	1.00	1.25	1.25
D	Ø 1.31		Ø 1.58	Ø 2.09	Ø 2.58	Ø 3.13
E	1.75	Option L 1.52	1.72	2.10	2.28	2.53
F	1.06		1.13	1.38	1.50	1.69
G	0.31		0.31	0.38	0.44	0.44
H	0.08		0.09	0.11	0.13	0.13
I	3/8-24 UNF		7/16-20 UNF	1/2-20 UNF	5/8-18 UNF	5/8-18 UNF
J	0.31		0.44	0.50	0.63	0.63
K	7/8-14 UNF		1-1/8-12 UNF	1-1/4-12 UNF	1-3/8-12 UNF	1-1/2-12 UNF
L	Ø 0.87		Ø 1.12	Ø 1.25	Ø 1.37	Ø 1.62
M	1/8 NPT		1/4 NPT	1/4 NPT	3/8 NPT	3/8 NPT
N	0.36		0.36	0.42	0.48	0.55
O	0.44		0.44	0.50	0.56	0.63
P	0.84		0.81	0.88	1.12	1.88
Q	0.62		0.74	0.86	0.99	0.99
R	Ø 1.09		Ø 1.36	Ø 1.67	Ø 2.06	Ø 2.44
S	0.47		0.56	0.66	0.75	0.81
T	5.06		5.44	6.38	7.16	7.60
U	5.44		5.91	6.88	7.78	8.22
V	Ø 0.31		Ø 0.38	Ø 0.44	Ø 0.50	Ø 0.50
W	0.88		1.25	1.44	1.88	2.25
X	1.38		1.75	2.25	2.75	3.25
Y	0.75		0.69	0.75	0.88	0.94
Z	0.88		0.75	1.00	1.25	1.38
AA	1.63	Option L 1.52	1.68	1.75	2.13	2.31
BB	2.03		2.00	2.41	2.72	2.91
CC	#10		1/4	3/8	7/16	1/2
DD	Ø 0.33		Ø 0.41	Ø 0.58	Ø 0.67	Ø 0.77
EE	0.20		0.25	0.39	0.45	0.52

Bumper Length Adder: 0.25"

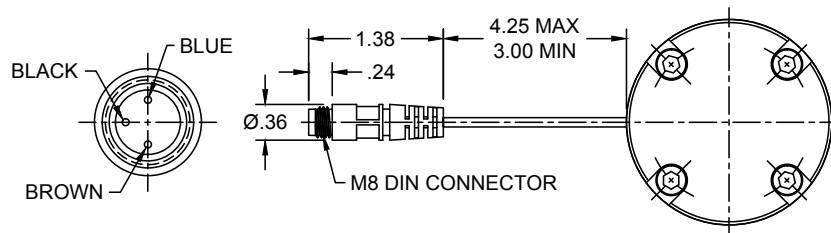
# How to Accessorize

## 3-Pin Connector

### Wire Colors

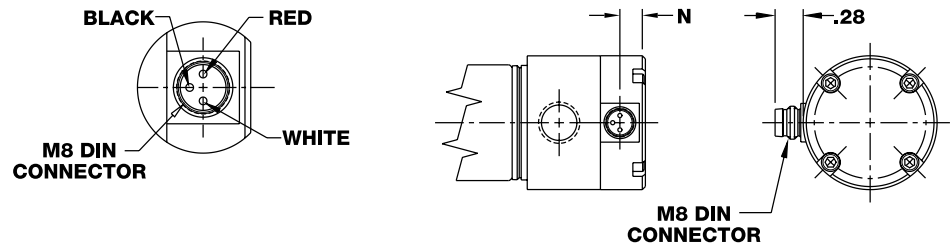
Wires	6" Leads and PA Option	P Option
Input	Red	Blue
Ground	Black	Black
Output	White	Brown

### P Option

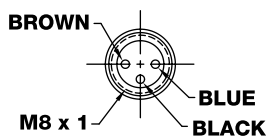
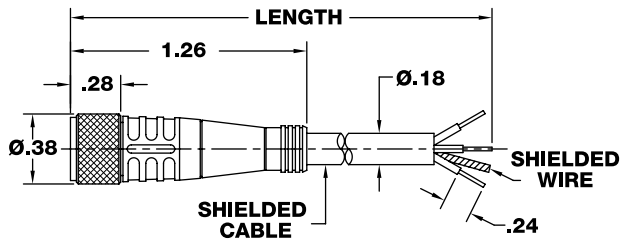


### PA Option

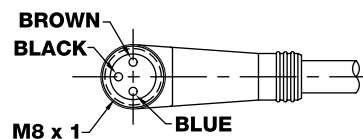
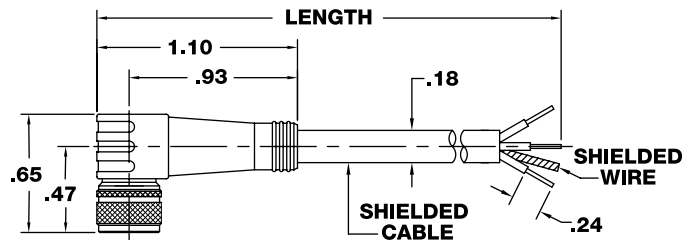
Bore	N (in)
09	0.25
17	0.25
31	0.31
50	0.38
70	0.44



### Straight-Models C4-S (2m), C4X-S (5m)



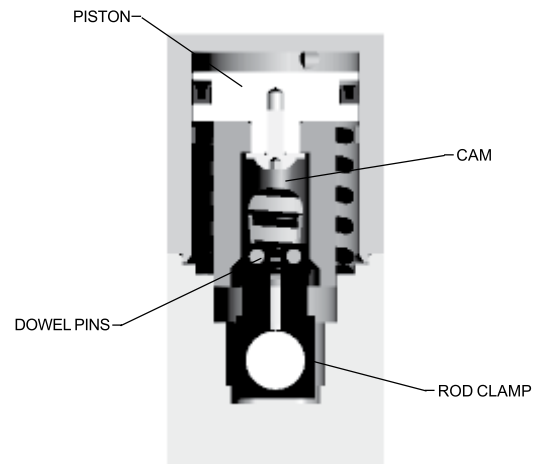
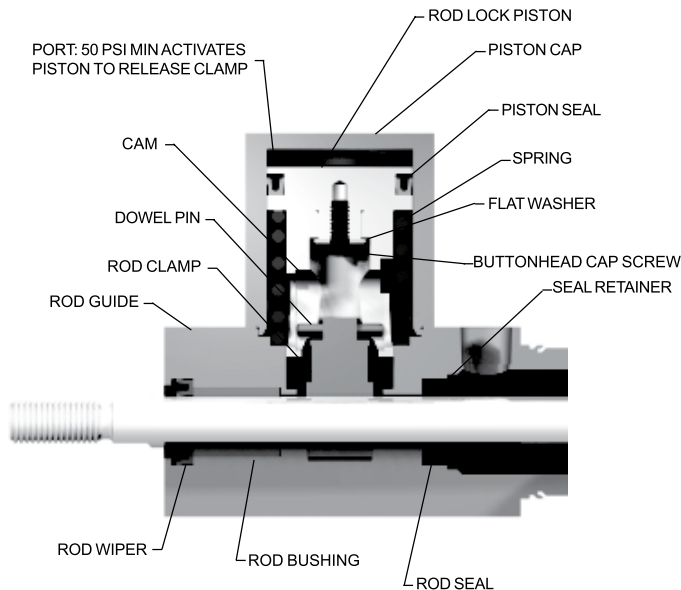
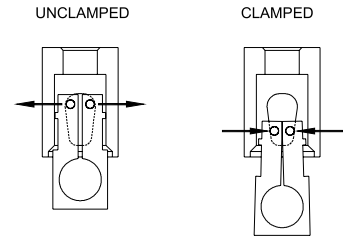
### Right Angle-Models C5 (2m), C5X (5m)





## PFCL Models

- > Dowel pins ride in the cam groove.
- > When air pressure is present, piston actuates and dowel pins follow cam to open position, allowing piston rod to travel freely through clamp.
- > In absence of pressure, the spring actuates piston and dowels follow to closed position, activating the rod clamp.



## Engineering Specifications

<b>Operating Medium:</b>	Air
<b>Operating Pressure:</b>	50 PSI minimum (to actuate lock piston) 125 PSI maximum
<b>Temperature Range:</b>	-20° to 200° F
<b>Lubrication:</b>	HT-99
<b>Cylinder Body:</b>	304 stainless steel
<b>Rod Guide:</b>	Aluminum
<b>Cap:</b>	Anodized aluminum
<b>Piston and Rod Seal:</b>	Buna-N
<b>Rod and Pivot Bushing:</b>	Sintered bronze
<b>Piston Rod:</b>	Hard chrome plated carbon steel
<b>Expected Service Life:</b>	5 million cylinder actuations 1 million lock actuations

\*PFC specifications are on pages 464-465.

## Rod Lock Holding Forces

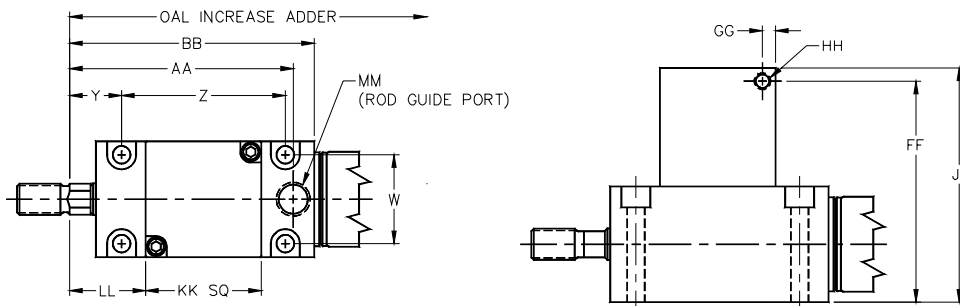
Bore	Holding Force (lbs)
3/4" (04)	40
1-1/16" (09)	90
1-1/2" (17)	170
2" (31)	310
2-1/2" (50)	500
3" (70)	700

## Operating Guidelines/Product Precautions

- > The Rod Lock is not a safety device.
- > Do not use for intermediate stopping; the cylinder is designed to prevent drift from a stationary position.
- > Load weight must not exceed the stated holding force for the cylinder.
- > Do not release rod lock if full pressure is present on either extend or retract. Uncontrolled motion will result that could damage internal components or cause personal harm.

# How to Specify

## Dimensions (PFCL Models)

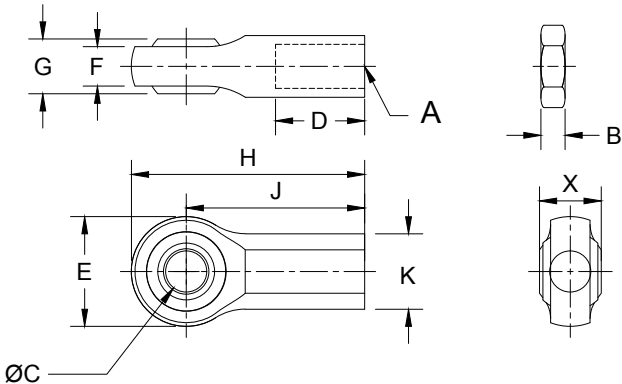


Bore	W	Y	Z	AA	BB	FF	GG	HH	JJ	KK	LL	MM	OAL Increase Adder
1-1/16" (09)	1.06	.62	1.95	2.66	2.91	2.62	.16	#10-32	2.78	1.38	0.90	1/8 NPT	1.08
1-1/2" (17)	1.25	.64	2.75	3.36	3.68	3.13	.25	1/8 NPT	3.38	1.75	1.14	1/4 NPT	1.68
2" (31)	1.62	.82	3.13	3.97	4.34	4.20	.38	1/8 NPT	4.45	2.25	1.26	1/4 NPT	1.94
2-1/2" (50)	1.88	.87	3.62	4.62	5.05	5.34	.33	1/4 NPT	5.67	2.75	1.31	3/8 NPT	2.33
3" (70)	2.25	.90	4.17	5.17	5.59	5.86	.50	1/4 NPT	6.28	3.25	1.35	3/8 NPT	2.69

\*All other dimensions are same as the non-contact PFC cylinders.

## Accessories (PFC/PFCN)

### Rod Eye for Option FT



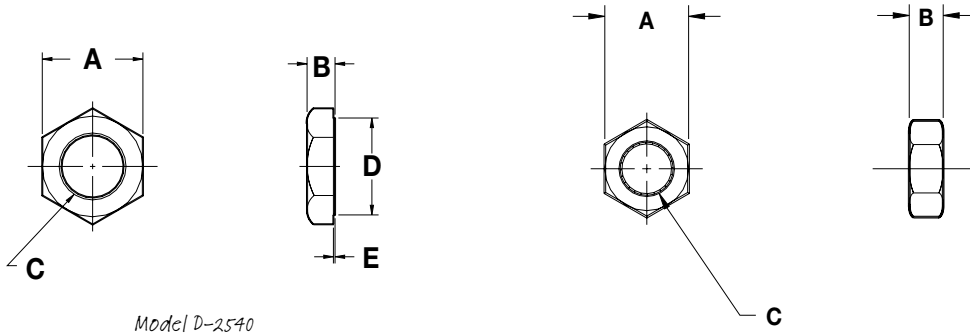
Bore	Model	A	B	C	D	E	F	G	H	J	K	X
1-1/16" (09)	D-117351-A	3/8"-24 THD	0.22	0.375	0.81	1.00	0.36	0.50	2.13	1.63	0.69	0.56
1-1/2" (17)	D-117352-A	7/16"-20 THD	0.25	0.438	0.94	1.13	0.41	0.56	2.38	1.81	0.75	0.63
2" (31)	D-117353-A	1/2"-20 THD	0.31	0.500	1.06	1.31	0.45	0.63	2.78	2.13	0.88	0.75
2-1/2" (50)	D-117354-A	5/8"-18 THD	0.38	0.625	1.38	1.50	0.48	0.75	3.25	2.50	1.00	0.75
3" (70)	D-117354-A	5/8"-18 THD	0.38	0.625	1.38	1.50	0.48	0.75	3.25	2.50	1.00	0.88

### Control Units

> SPCS-2 Servo Pneumatic Control Units are described on pages 489-492. Please use the table on page 490 to select the right SPCS products for your applications.

# How to Accessorize

## Mounting Nuts

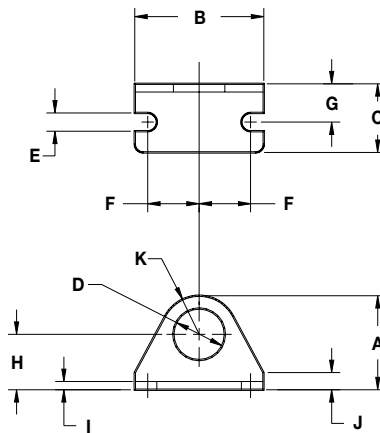


Model D-2540

Models D-2545  
D-8484  
D-508  
D-5379

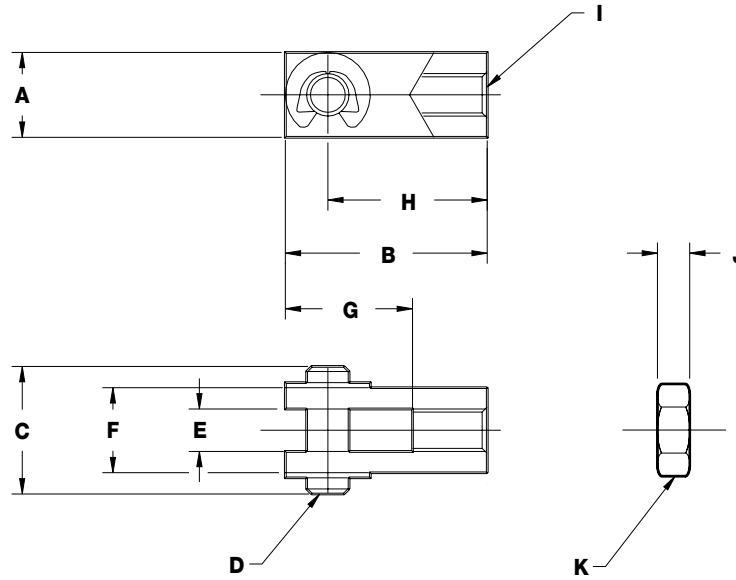
Bore	Model	A	B	C	D	E
1-1/16" (09)	D-2545	1.31	0.48	7/8-14 UNF-2B	N/A	N/A
1-1/2" (17)	D-8484	1.69	0.61	1-1/8-12 UNF-2B	N/A	N/A
2" (31)	D-508	1.88	0.50	1-1/4-12 UNF-2B	1.81	0.03
2-1/2" (50)	D-2540	1.88	0.50	1-3/8-12 UNF-2B	1.81	0.03
3" (70)	D-5379	2.25	0.50	1-1/2-12 UNF-2B	2.25	0.02

## Mounting Bracket



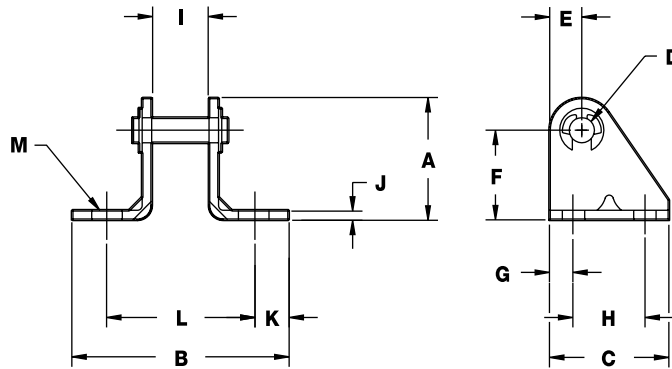
Bore	Model	A	B	C	D	E	F	G	H	I	J
1-1/16" (09)	D-8316	1.75	2.12	1.16	0.875	0.28	0.78	0.66	1.00	0.16	0.32
1-1/2" (17)	D-8318	2.19	2.75	1.44	1.125	0.34	1.06	0.81	1.25	0.19	0.38
2" (31)	D-8319	2.44	3.00	1.59	1.25	0.34	1.19	0.91	1.38	0.22	0.44
2-1/2" (50)	D-8320	2.81	3.75	1.88	1.312	0.41	1.50	1.06	1.62	0.25	0.50
3" (70)	D-19127	3.14	4.38	1.62	1.625	0.34	1.75	1.00	1.89	0.25	0.89

## Rod Clevis



Bore	Model	A	B	C	D	E	F	G	H	I	J	K
1-1/16" (09)	D-8310-A	0.62	1.69	0.88	0.312	0.31	0.62	0.94	1.38	3/8-24 THD	0.22	3/8-24 HEX NUT
1-1/2" (17)	D-8311-A	0.75	2.00	1.03	0.375	0.38	0.75	1.12	1.62	7/16-20 THD	0.25	7/16-20 HEX NUT
2" (31)	D-8313-A	0.88	2.31	1.14	0.438	0.44	0.88	1.31	1.88	1/2-20 THD	0.31	1/2-20 HEX NUT
2-1/2" (50) 3" (70)	D-8314-A	1.00	2.75	1.38	0.50	0.50	1.00	1.50	2.25	5/8-18 THD	0.38	5/8-18 HEX NUT

## Pivot Bracket



Bore	Model	A	B	C	D	E	F	G	H	I	J	K	L	M
1-1/16" (09)	D-8322-A	1.31	2.38	1.31	0.312	0.31	1.00	0.25	0.81	0.62	0.16	0.31	1.75	0.28
1-1/2" (17)	D-8324-A	1.62	3.00	1.62	0.375	0.38	1.25	0.31	1.00	0.75	0.19	0.44	2.13	0.34
2" (31)	D-8325-A	1.81	3.25	1.81	0.438	0.44	1.38	0.31	1.19	0.88	0.25	0.44	2.38	0.34
2-1/2" (50) 3" (70)	D-8326-A	2.12	4.00	2.12	0.50	0.50	1.62	0.38	1.38	1.00	0.25	0.62	2.75	0.41

# How to Order

The model number of Position Feedback cylinders consists of an alphanumeric cluster designating product type, bore size, stroke length, mounting style, and other optional components that together make up the complete part number to use in ordering. Use the ordering information below to build a valid part number.

An example of a basic Position Feedback unit with 1-1/16" bore, 12" stroke, block front mount, and additional options is shown below.

## PFC - 09 12 - BF L

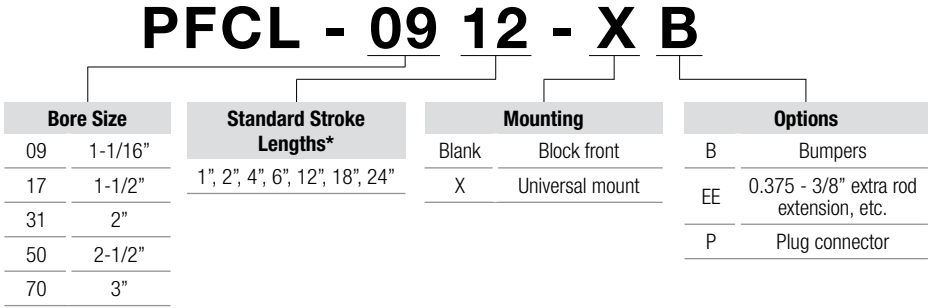
Bore Size		Standard Stroke Lengths	Mounting		Options	
09	1-1/16"		1", 2", 4", 6", 8", 12", 18", 24"	Blank	Front nose	B
17	1-1/2"	BF		Block front	EE	0.375 - 3/8" extra rod extension, etc.
31	2"	X		Universal mount	FT	Non-pneumatic feedback transducer <sup>2</sup>
50	2-1/2"				L	Low friction <sup>3</sup>
70	3"				P	M8 corded connector
					PA	Plug connector

<sup>1</sup> 10" is the maximum rod extension.  
<sup>2</sup> Piston seal removed; breather plugs inserted in the ports. Not compatible with option L, Y, YN, or YQ.  
<sup>3</sup> Low friction option includes special seals and lubrication. Rod wiper is omitted.

# How to Order

The model number of Position Feedback Rod Lock cylinders consists of an alphanumeric cluster designating product type, bore size, stroke length, and other optional components that together make up the complete part number to use in ordering. Use the ordering information below to build a valid part number.

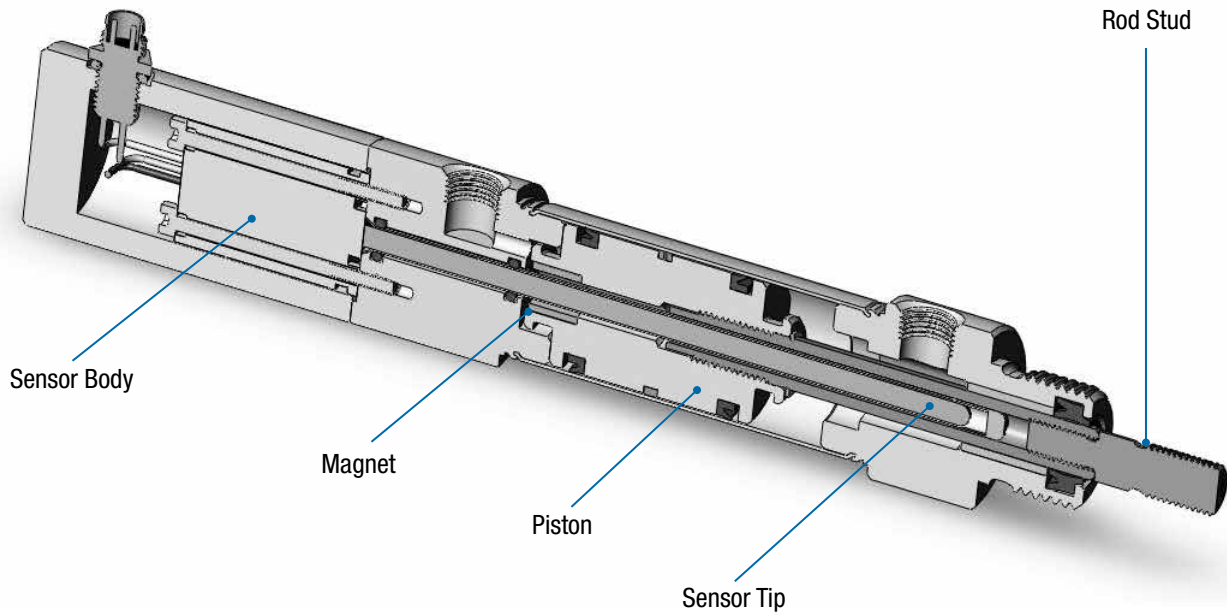
An example of a basic Position Feedback Rod Lock unit with 1-1/16" bore, 12" stroke, and additional options is shown below.



NOTES: Low friction seals on the piston are standard on the PFCL. Rod wiper is included on PFCL to keep out contaminants. Only available in Block Front Mounting on the Rod Guide.

# Product Features

## Position Feedback Cylinders (PFCN Models)



The Position Feedback Cylinders Non-Contact (Model PFCN) is similar to the original Model PFC, except it employs a magnetostrictive sensor instead of a LRT. The new technology is ideal for applications that involve dirty or moist environments, rapid oscillation over a small increment of stroke, and vibration. In addition, it is relatively immune to air line contamination. It is calibrated to produce exactly 0 volts fully retracted and 10 volts fully extended. Like our original PFC, it is available with or without a rod lock.

Bimba's Non-Contact Position Feedback Cylinders employ a new magnetostrictive sensor. The sensor tip, fixed inside the cylinder, senses position as a magnet mounted to the piston moves back and forth across the sensor tip's length. This provides many important advantages, and makes the Non-Contact Position Feedback Cylinder the preferred solution for closed-loop pneumatic positioning applications.

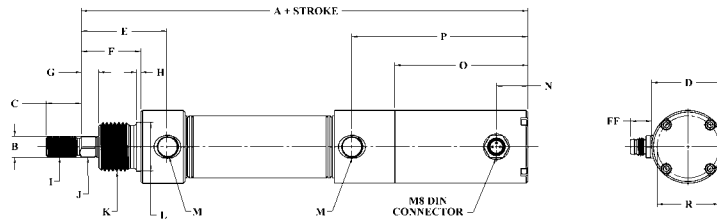
## Features and Benefits

- > The PFCN is immune to many of the conditions that deteriorate older technology PFC's, such as the presence of moisture, dirt, dirty air lines, and debris generated as pneumatic products wear, especially at high speeds.
- > The PFCN is immune to wear from oscillation back and forth over a narrow range of stroke.
- > The PFCN is calibrated for 0 volts fully retracted and 10 volts fully extended for all stroke lengths. Both offset and scale factor are user adjustable. This simplifies installation of multiple cylinders in an application and recalibration of replacement cylinders.
- > The PFCN connector is sealed to IP68.
- > Avoid applications that subject the non-contact PFC to:
  - » Side loads (Guiding is required. For detail on acceptable side loads contact Bimba Technical Support.)
  - » High speeds above 10 in/sec with no means to control impact energy at end of stroke
  - » High temperatures 200°F
  - » Low temperatures below - 20°F
  - » High electric or magnetic fields

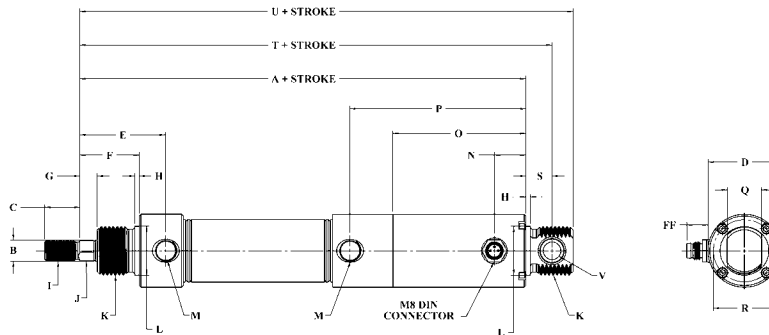


## Mount Dimensions (PFCN Models)

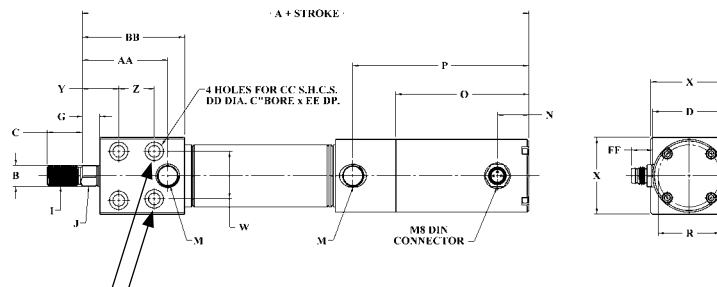
### Nose Mount



### Universal Mount for stud or pivot (includes bushing)



### Block Mount



These two holes are not present on 09 bore only.

Bore	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1-1/16" (09)	7.47	0.38	0.63	1.31	1.54/Option L 1.52	1.06	0.31	0.08	3/8-24 UNF	0.31	7/8-14 UNF	0.87	1/8 NPT	0.56
1-1/2" (17)	7.80	0.50	0.88	1.58	1.72	1.13	0.31	0.09	7/16-20 UNF	0.44	1-1/8-12 UNF	1.12	1/4 NPT	0.56
2" (31)	7.75	0.63	1.00	2.09	2.10	1.38	0.38	0.11	1/2-20 UNF	0.50	1-1/4-12 UNF	1.25	1/4 NPT	0.40
2-1/2" (50)	8.31	0.75	1.25	2.58	2.28	1.50	0.44	0.13	5/8-18 UNF	0.63	1-3/8-12 UNF	1.37	3/8 NPT	0.40
3" (70)	8.62	0.75	1.25	3.13	2.53	1.69	0.44	0.13	5/8-18 UNF	0.63	1-1/2-12 UNF	1.62	3/8 NPT	0.40

Bore	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF
1-1/16" (09)	2.38	3.14	0.62	1.11	0.47	7.94	8.31	0.31	0.88	1.38	0.75	N/A	1.52	1.82	#10	0.33	0.20	0.38
1-1/2" (17)	2.38	3.25	0.74	1.33	0.56	8.36	8.83	0.38	1.25	1.75	0.69	0.75	1.68	2.00	1/4	0.41	0.25	0.38
2" (31)	2.03	2.91	0.86	1.63	0.63	8.38	8.88	0.44	1.44	2.25	0.75	1.00	1.75	2.41	3/8	0.58	0.39	0.38
2-1/2" (50)	2.00	3.03	0.99	2.06	0.75	9.06	9.69	0.50	1.88	2.75	0.88	1.25	2.13	2.72	7/16	0.67	0.45	0.38
3" (70)	2.00	3.03	0.99	2.44	0.81	9.43	10.06	0.50	2.25	3.25	0.94	1.38	2.31	2.91	1/2	0.77	0.52	0.38

Bumper length adder 0.25"

# How to Specify

## Specifications (PFCN Non-Contact Models)

Positioning error due to temperature		
Microns/°C	Inches/°C	Inches/°F
20	0.000787	0.000437

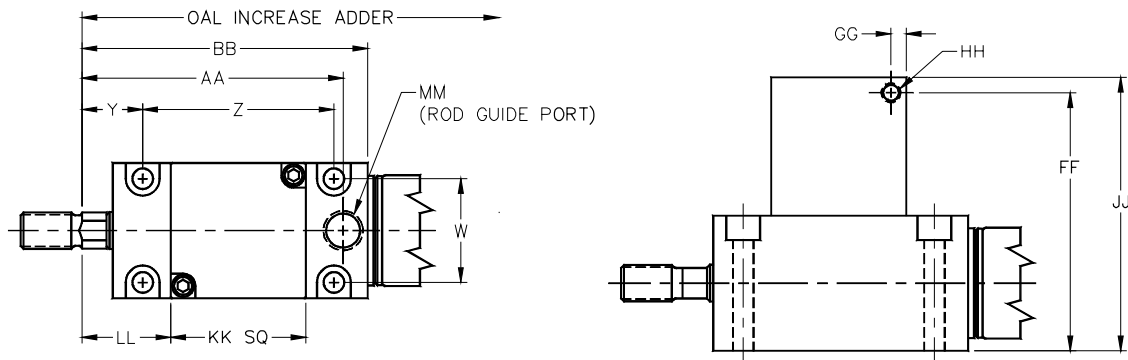
- > Operating temperature: -20° to 200° F (-28° to 93° C)
- > Accuracy: ± 0.016 inch maximum anywhere along the stroke (calculated value combining Non-Linearity, Repeatability, Hysteresis effects at a constant temperature)
- > Non-Linearity: ± 0.011 inch
- > Repeatability: ± 0.006 inch
- > Signal output: 0 V DC ± 6 mV retracted and 10 V DC ± 6 mV extended, all stroke lengths (into 100 kOhms minimum and 300 pF maximum)
- > Excitation (Supply) Voltage: 24 ± 10% V DC (50mA maximum current)
- > Maximum end of stroke impact speed: 10 in/sec.
- > Rated Life of the Cylinder: 1400 linear miles (at 10 inches/sec, no load, room temperature dry, 5 micron filtered air, continuous cycling)
- > Over voltage and reverse polarity protection
- > Cylinder RoHs compliant
- > IP-68 rated connector standard

NOTE: The device that digitizes the PFCN feedback output must have an input impedance of at least 100 kOhms.

### Estimated Cylinder Weights (lbs)

	1-1/16"	1-1/2"	2"	2-1/2"	3"
PFCN	0.81	1.35	2.48	3.93	5.68
PFCN-X	0.82	1.43	2.59	4.10	5.87
PFCN-BF	0.95	1.57	2.90	4.64	6.79
Adder WT/IN	0.05	0.08	0.14	0.18	0.24

## Dimensions (PFCNL Models)



Bore	W	Y	Z	AA	BB	FF	GG	HH	JJ	KK	LL	MM	OAL Increase Adder
1-1/16" (09)	1.06	0.62	1.95	2.66	2.91	2.62	0.16	#10-32	2.78	1.38	0.90	1/8 NPT	1.08
1-1/2" (17)	1.25	0.64	2.75	3.36	3.68	3.13	0.25	1/8 NPT	3.38	1.75	1.14	1/4 NPT	1.68
2" (31)	1.62	0.82	3.13	3.97	4.34	4.20	0.38	1/8 NPT	4.45	2.25	1.26	1/4 NPT	1.94
2-1/2" (50)	1.88	0.87	3.62	4.62	5.05	5.34	0.33	1/4 NPT	5.67	2.75	1.31	3/8 NPT	2.33
3" (70)	2.25	0.90	4.17	5.17	5.59	5.86	0.50	1/4 NPT	6.28	3.25	1.35	3/8 NPT	2.69

NOTE: All other dimensions are same as the non-contact PFCN cylinders.

# How to Accessorize

## Accessories (PFCN Models)

Bore	Mounting Nut	Mounting Bracket	Rod Clevis	Pivot Bracket
1-1/16" (09)	D-2545	D-8316	D-8310-A	D-8322-A
1-1/2" (17)	D-8484	D-8318	D-8311-A	D-8324-A
2" (31)	D-508	D-8319	D-8313-A	D-8325-A
2-1/2" (50)	D-2540	D-8320	D-8314-A	D-8326-A
3" (70)	D-5379	D-19127	D-8314-A	D-8326-A

## Controllers

- > SPCS-2 Servo Pneumatic Control Units are described on pages 489-492. Please use the table on page 490 to select the right SPCS products for your applications.

## Cables (for connection to standard plug connector)

Model	Description
C4-S	Straight Female Shielded Cord Set IP67, 2m
C4X-S	Straight Female Shielded Cord Set IP67, 5m
C5-S	Right Angle Female Shielded Cord Set IP67, 2m
C5X-S	Right Angle Female Shielded Cord Set IP67, 5m
SPCS-CBL-PWR-CMD	SPCS Quick Connect, Female/Strip Wire, 2m
SPCS-CBL-FBK	SPCS Female Connector, Both Ends, 2m
SPCS-USB-CBL	SPCS USB Setup Cable, 2m

The model number of Non-Contact Position Feedback cylinders consists of an alphanumeric cluster designating product type, bore size, stroke length, mounting style, and other optional components that together make up the complete part number to use in ordering. Use the ordering information below to build a valid part number.

An example of a basic Non-Contact Position Feedback unit with 2" bore, 6" stroke, universal mount, and additional options is shown below.

## PFCN - 31 6 - X L

Bore Size		Standard Stroke Lengths*	Mounting		Options	
09	1-1/16"		1", 2", 3", 4", 5", 6", 7", 8", 9", etc. * 0.5" increments, 1" minimum.	Blank	Front nose	B
17	1-1/2"	BF		Block front	EE	0.375 - 3/8" extra rod extension, etc.
31	2"	X		Universal mount	L	Low friction <sup>2</sup>
50	2-1/2"					
70	3"					

<sup>1</sup> Bumpers (used to control end of stroke impact) will lengthen the time required for the piston to settle into position at end of stroke as they slowly compress.  
<sup>2</sup> Low friction option includes special seals and lubrication.

### Approximate Power Factors

1-1/16"	=	0.9
1-1/2"	=	1.7
2"	=	3.1
2-1/2"	=	5.0
3"	=	7.0

For example, a PFCN-096-BF will exert a force of 0.9 times the air lines pressure; a PFCN-506-XB will exert a force of 5.0 times the air line pressure.

# How to Order

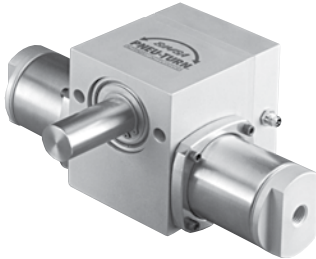
The model number of Non-Contact Position Feedback Rod Lock cylinders consists of an alphanumeric cluster designating product type, bore size, stroke length, mounting styles, and other optional components that together make up the complete part number to use in ordering. Use the ordering information below to build a valid part number.

An example of a basic Non-Contact PFC Rod Lock unit with 3" bore, 3" stroke, universal mount, and additional options is shown below.

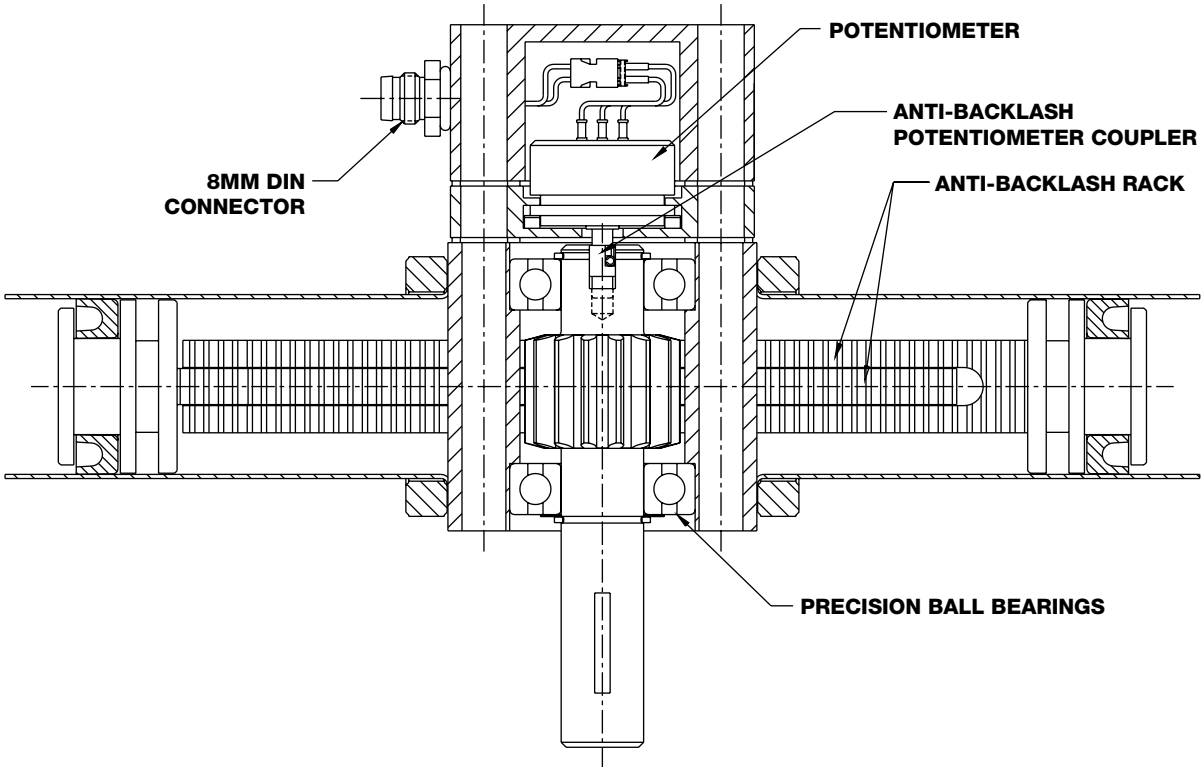
## PFCNL - 70 3 - X B

Bore Size		Standard Stroke Lengths*	Mounting		Options	
09	1-1/16"		1", 2", 3", 4", 5", 6", 7", 8", 9", etc. <small>* 0.5" increments, 0.5" minimum.</small>	Blank	Block front	B
17	1-1/2"	X		Universal mount	EE	0.375 - 3/8" extra rod extension, etc.
31	2"					
50	2-1/2"					
70	3"					

## Pneu-Turn® Position Feedback Rotary Actuator (PTF Models)



The Bimba Pneu-Turn® position feedback rotary actuator ( PTF ) provides continuous shaft position sensing. Standard features include shaft ball bearings and the elimination of mid-rotational backlash. Use the Bimba PTF in conjunction with Bimba's Pneumatic Control System ( PCS ) to achieve rotary shaft positioning accuracy within  $\pm 0.5^\circ$ .



# How it Works

## Engineering Specifications (PTF Models)

<b>Repeatability:</b>	± 0.01° (of potentiometer itself)
<b>Nonlinearity:</b>	± 88° (± 0.25% of 340±4°)
<b>Resolution:</b>	Infinite
<b>Signal Input:</b>	10 VDC typical
<b>Input Impedance Required:</b>	100 Kohm
<b>Signal Output:</b>	0 to 10 VDC FS (depends on FS mechanical rotation)
<b>Rated Life of Potentiometer:</b>	10 million cycles
<b>Temperature Coefficient:</b>	± 600 ppm/°C
<b>Electrical Rotation:</b>	340° ±4°

### General Specifications

Rotary action of the Pneu-Turn rotary actuator is achieved through the use of a rack and pinion assembly. Just as with any hydraulic or pneumatic cylinder, the speed of rotation may be controlled through the use of flow controls. The PTF may also be controlled with Bimba's Pneumatic Control System, Model PCS.

Care should be taken to insure that the inertial force does not exceed the published torque capacity.

### Port Positioning

Ports on the PTF may be repositioned to accommodate any air line configuration by loosening the three body retainer screws. Once desired port positions are obtained, screws must be tightened to specified torque values in the table below.

### Lubrication

The PTF is prelubricated at the factory for extensive, maintenance free operation. The life of the rotary actuator can be lengthened by providing additional lubrication with an air line mist lubricator or direct introduction of the oil to the actuator every 500 hours of operation. Recommended oils for Buna N seals are medium to heavy inhibited hydraulic or general purpose oil.

The rack and pinion gear and ball bearings are prelubricated at the factory for extensive maintenance free operation. If additional lubrication is required, use a high grade bearing grease.

### Woodruff Key Location

The standard position of the woodruff key is 12 o'clock at the center of rotation.

### Ratings

Pressure Rating: 150 psi air or oil with S Option

Rotation Tolerance: 1-1/16" - 2" bore is -0° to +10°. The Angle Adjustment Option allows 45° of adjustability. If cushions are ordered in conjunction with the angle adjustment option, adjustability will be 10°.

Temperature Range: Standard Seals: -20° to 200° F; V Option High Temp seals: 0° to 250°. NOTE: If used for positioning applications, it is recommended to use low temperature lubricant for temperatures less than 35° F.

Backlash: Both single and double rack models have zero mid-rotational and end of rotation backlash.

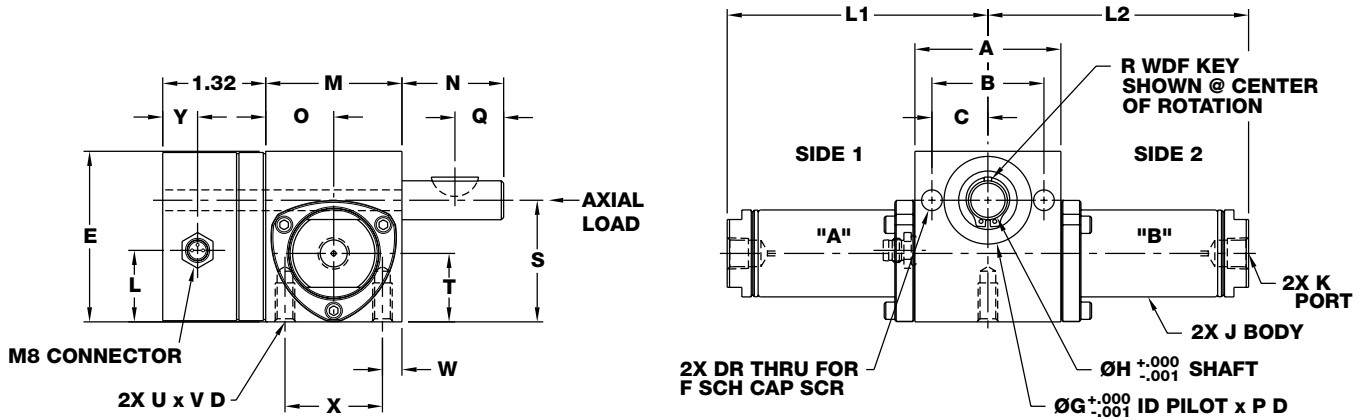
Breakaway: Less than 3 PSI.

Series	1-1/2"		2"	
	(098)	(196)	(247)	(494)
Theoretical Torque Capacity (in-lbs/PSI)	0.982	1.963	2.468	4.935
Bearing Load (Axial lbs)	110	110	130	130
Bearing Load (Radial lbs)	425	425	740	740
Distance between bearing midpoints (in)	1.71	1.71	1.82	1.82
Maximum rate of rotation ( @ 100 PSI with no load)	1500 deg/sec	1500 deg/sec	1000 deg/sec	1000 deg/sec
Weight (approximate oz)	47	88	103	150
Body Retainer cap screw recommended tightening torque (in-lbs)	20	20	20	20

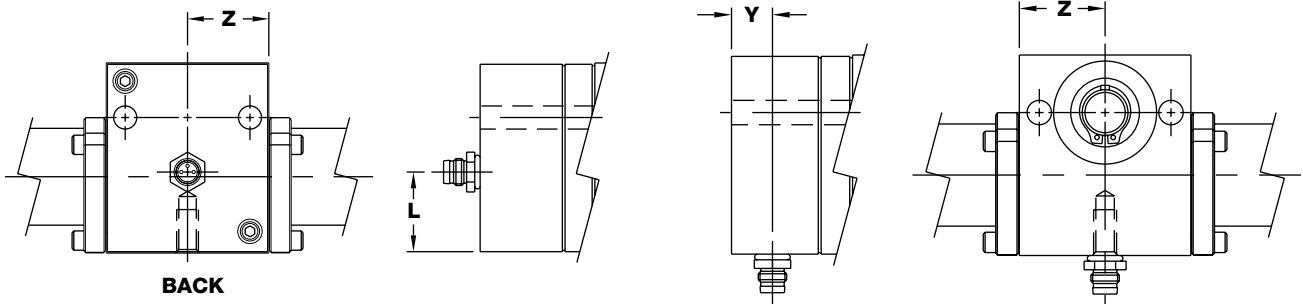


## Dimensions (PTF Models)

### Single Rack Models (in)



Plug connector shown in standard position. The H1 option dimensionally positions the connector on the clockwise rotation side.



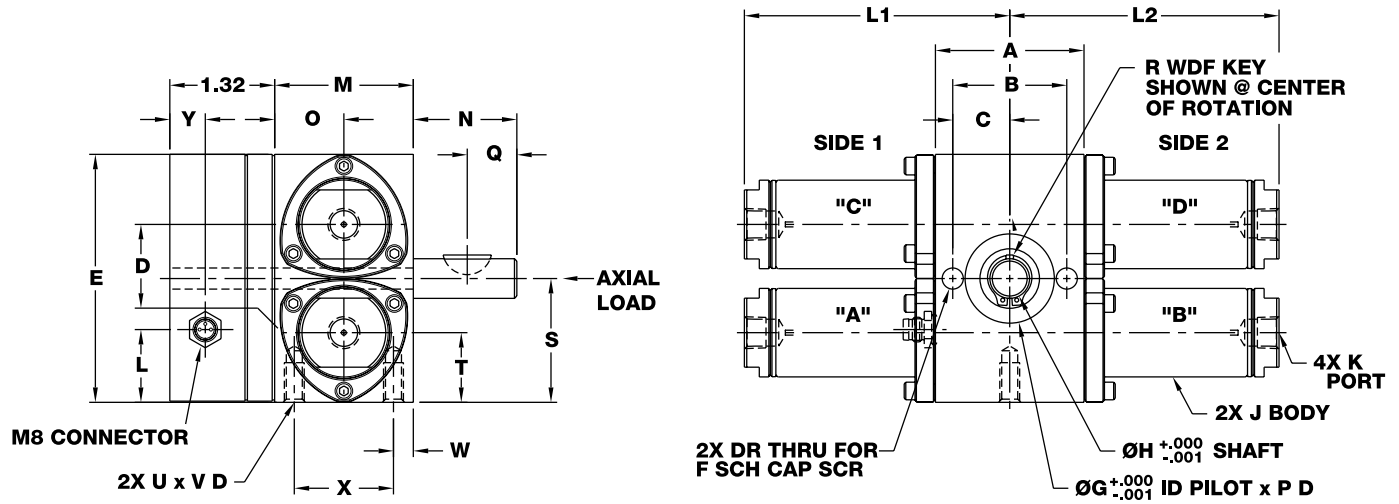
Bore	A	B	C	E	F	G (Ball Bearing I.D. Pilot)	H	J	K	L	M
1-1/2" (098)	2.38	1.81	0.90	2.84	5/16" S.H.C.S.	1.375	0.625	1.56	1/8 NPT	1.449	2.25
2" (247)	3.00	2.38	1.19	3.75	5/16" S.H.C.S.	1.875	0.875	2.08	1/4 NPT	1.918	2.56

Bore	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1-1/2" (098)	1.38	1.12	0.09	0.62	#405	2.09	1.15	5/16-18	0.62	0.31	1.62	0.45	1.19
2" (247)	2.00	1.28	0.10	0.75	#606	2.56	1.28	5/16-18	0.62	0.28	2.00	0.45	1.50

# How to Specify

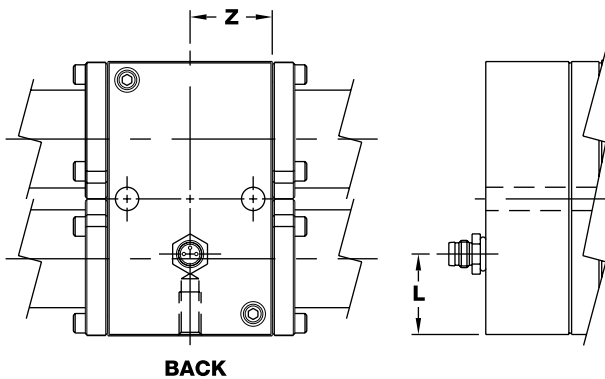
## Dimensions (PTF Models)

### Double Rack Models (in)

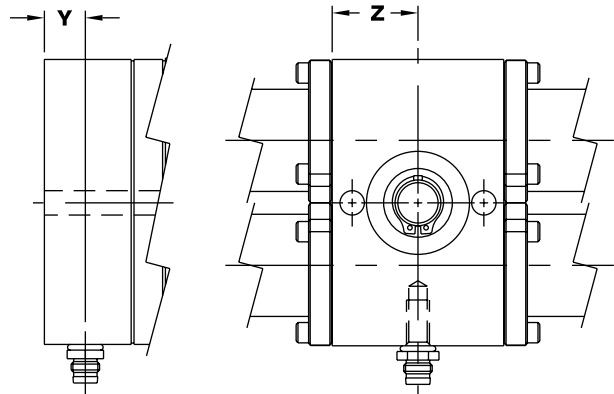


Plug connector shown in standard position. The H1 option dimensionally positions the connector on the clockwise rotation side.

### H2 Option



### H3 Option

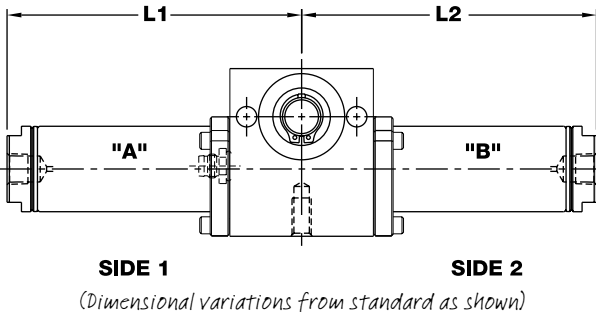


Bore	A	B	C	D	E	F	G (Ball Bearing I.D. Pilot)	H	J	K	L	M
1-1/2" (196)	2.38	1.81	0.90	1.88	4.19	5/16" S.H.C.S.	1.375	0.625	1.56	1/8 NPT	1.449	2.25
2" (494)	3.00	2.38	1.19	2.56	5.13	5/16" S.H.C.S.	1.875	0.875	2.08	1/4 NPT	1.918	2.56

Bore	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1-1/2" (196)	1.38	1.12	0.09	0.62	#405	2.09	1.15	5/16-18	0.62	0.31	1.62	0.45	1.19
2" (494)	2.00	1.28	0.10	0.75	#606	2.56	1.28	5/16-18	0.62	0.28	2.00	0.45	1.50

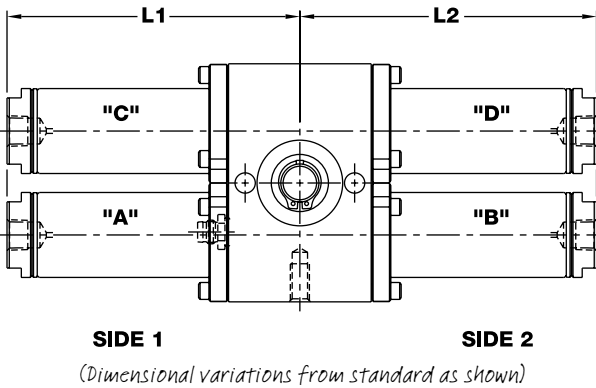
## Position Feedback Pneu-Turn Options

### Single Rack Options (in)



	1-1/2" (098)		2" (247)	
	L1	L2	L1	L2
Adder per Degree of Rotation	0.0097	0.0097	0.0137	0.0137
Base Unit (No Options)	2.34	2.34	2.84	2.84
Bumper Both Sides (B1)	2.49	2.49	3.04	3.04
Bumper CCW Side (B2)	2.34	2.49	2.84	3.04
Bumper CW Side (B3)	2.49	2.34	3.04	2.84
Cushion Both Sides (C1)	2.98	2.98	3.65	3.65
Cushion CCW Side (C2)	2.34	2.98	2.84	3.65
Cushion CW Side (C3)	2.98	2.34	3.65	2.84
Oil Service Seals (S)	2.77	2.77	3.38	3.38
Oil Service with Angle Adjustment (AS)	3.41	3.41	4.19	4.19

### Double Rack Options (in)



	1-1/2" (098)		2" (247)	
	L1	L2	L1	L2
Adder per Degree of Rotation	0.0097	0.0097	0.0137	0.0137
Base Unit (No Options)	2.34	2.39	2.84	2.89
Bumper Both Sides (B1)	2.49	2.39	3.04	2.89
Bumper CCW Side (B2)	2.49	2.39	3.04	2.89
Bumper CW Side (B3)	2.49	2.39	3.04	2.89
Cushion Both Sides (C1)	2.98	2.39	3.65	2.89
Cushion CCW Side (C2)	2.98	2.39	3.65	2.89
Cushion CW Side (C3)	2.98	2.39	3.65	2.89
Oil Service Seals (S)	2.77	2.39	3.38	2.89
Oil Service with Angle Adjustment (AS)	3.41	2.39	4.19	2.89

“CCW Side” refers to the extreme rotation of the shaft in the counter-clockwise direction as viewed from the mounting pilot side of the actuator. The location of the optional feature chosen will be on tube B for single rack models and tube C for double rack models.

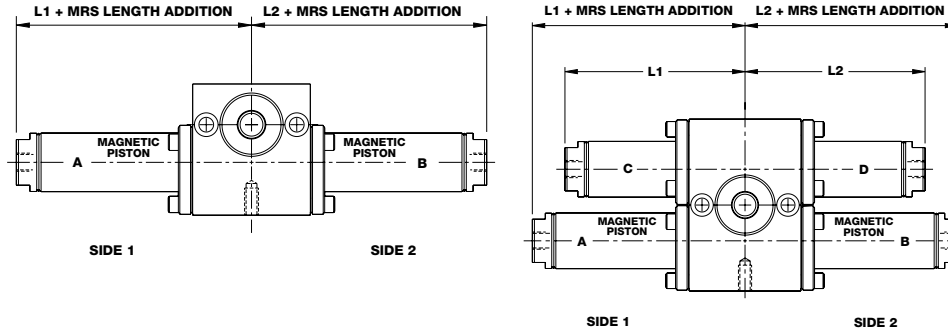
“CW Side” refers to the extreme rotation of the shaft in the clockwise direction as viewed from the mounting pilot side of the actuator. The location of the optional feature chosen will be on tube A for both single and double rack models.

# How to Specify

## Position Feedback Pneu-Turn Options

### MRS® Magnetic Position Sensing

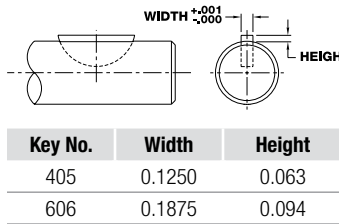
Magnetic pistons are located on the A and B tubes of both the single and double rack rotary actuators, guaranteeing switch operation at any point in the rotation.



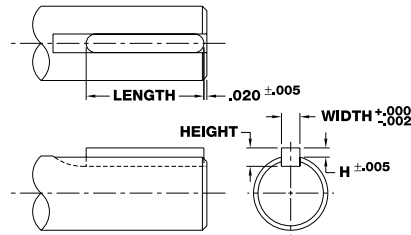
#### MRS® Length Adder (in)

Degrees	098/196	247/494
45°	0.75	0.75
90°	0.53	0.44
180°	0.09	0.00
325°	0.00	0.00

#### Woodruff Key (in)

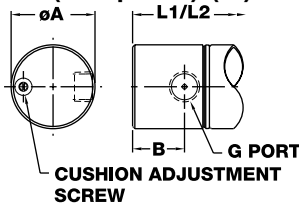


#### Square Key (in)

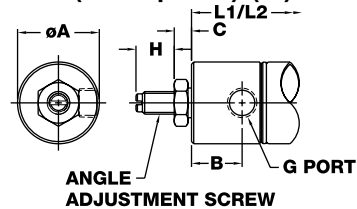


## Position Feedback Pneu-Turn Option Dimensions

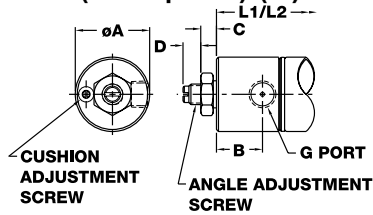
### Cushion (C Option) (in)



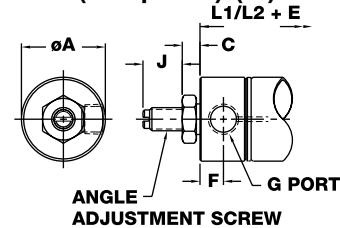
### Angle Adjustment with Oil Service Seals (AS Option) (in)



### Angle Adjustment with Cushion (AC Option) (in)



### Angle Adjustment (A Option) (in)



Bore Size	A	B	C	D	E	F	G	H	J
1-1/2" (098 and 196)	1.56	0.77	0.27	0.33	0.42	0.34	1/8 NPT	0.67	0.67
2" (247 and 494)	2.08	0.87	0.31	0.49	0.53	0.41	1/4 NPT	0.97	0.97

The model number of Pneu-Turn rotary actuators with shaft position feedback capabilities consists of an alphanumeric cluster designating product type, angle of rotation, and other optional components that together make up the complete part number to use in ordering. Use the ordering information below to build a valid part number.

An example of a basic Position Feedback Pneu-Turn unit with 1-1/2" bore, single rack, 180° rotation, and additional options is shown below.

## PTF - 098 180 - A1H1

Bore Size		Standard Stroke Lengths*		Options	
098	1-1/2" bore, single rack	045	45°	A1	Angle adjustment, both sides
196	1-1/2" bore, double rack	090	90°	A2	Angle adjustment, counter-clockwise rotation
247	2" bore, single rack	180	180°	A3	Angle adjustment, clockwise rotation
494	2" bore, double rack	325	325°	B1	Bumpers, both sides
				B2	Bumpers, counter-clockwise rotation
				B3	Bumpers, clockwise rotation
				C1	Cushion, both sides <sup>1</sup>
				C2	Cushion, counter-clockwise rotation <sup>1</sup>
				C3	Cushion, clockwise rotation <sup>1</sup>
				G	Magnalube® G lubrication
				H1	Plug connector, clockwise side
				H2	Plug connector, back of plate
				H3	Plug connector, bottom of plate
				K	Square key
				M	MRS® magnetic position sensing
				S	Seals, oil service <sup>2</sup>
				V	High temperature option (0° F to 250° F)

\* Larger rotational angles are available. Contact your Bimba distributor.

©Magnalube is a registered trademark of Carleton Stuart Corporation.

### Option Combination Availability

Due to design or compatibility restrictions, the following options may not be ordered in combination. For example, C (Cushions) and B (Bumpers) are not available in combination.

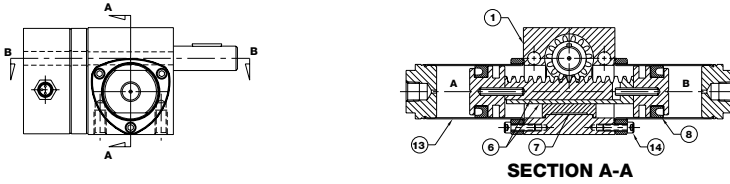
Series	Option						
	A	B	C	K	M	S	V
1-1/2" (098)	N/A	C,S	B,S	N/A	V	B,C	M
1-1/2" (196)	N/A	C,S	B,S	N/A	V	B,C	M
2" (247)	N/A	C,S	B,S	N/A	V	B,C	M
2" (494)	N/A	C,S	B,S	N/A	V	B,C	M

NOTE: Temperature range of ball bearing units with high temperature option is 0° F to 250° F.

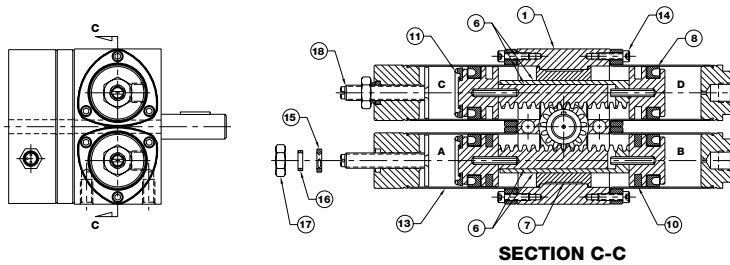
# How to Repair

## Position Feedback Cylinder Repair Parts

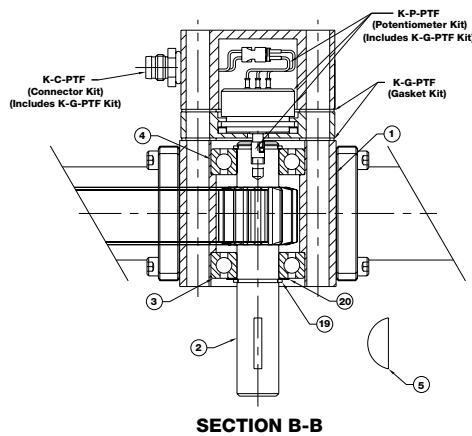
### Single Rack Model



### Double Rack Model



### Ball Bearing® Option



No.	Part Description	Quantity Required	
		Single	Double
PT-1-R	Actuator Body	1	1
PTF-2	Shaft/Pinion Assembly	1	1
PT-3-R	Front Shaft Ball Bearing	1	1
PT-4-R	Rear Shaft Ball Bearing	1	1
PT-5	Shaft Key	1	1
PT-7-X	Rack Support	1	2
PTF-8	Piston Seal <sup>1</sup>	2	4
PT-9	Piston Wear Ring (required for oil service only)	2	2
PT-10	Magnet	2	2
PT-11	Bumper	2	2
PT-13	Cylinder Body Assembly (includes Body, End Cap, and Retainer Ring)	2	4
PT-14	Cylinder Body Retainer Cap Screw <sup>2</sup>	6	12
PT-15	Cylinder Body Thread Seal	2	2
PT-16	Cylinder Body Thread Seal Ring	2	2
PT-17	Cylinder Body Jam Nut	2	2
PT-18	Angle Adjustment Screw	2	2
PT-19	Retainer Ring	2	2
PT-20	Shim Package	1	1

<sup>1</sup> Double Rack Models require two repair kits per rotary actuator. Oil Service Option: Single Rack models require four oil service seals or two oil service seal kits. Double Rack models require four oil service seals and two standard seals or two oil service seal kits and one standard seal kit.  
<sup>2</sup> 2" bore requires 8 or 16.

## Repair Kits

Bearing Kit (K-A-PT-R)		
PT-3-R	Front Shaft Ball Bearing	1
PT-4-R	Rear Shaft Ball Bearing	1

Shaft Kit (K-S-PTF)		
PTF-2	Shaft/Pinion Assembly	1
PT-5	Shaft Key	1

Seal Kit (K-L-PTF)		
PTF-8	Piston Seals	2

Gasket Kit (K-G-PTF)		
	Gasket	1

Connector Kit (K-C-PTF)		
	Connector Assembly	1
	Gasket	2

Potentiometer Kit (K-P-PTF)		
	Pin Header	1
	Potentiometer Assembly	1
	Potentiometer Coupler	1
	Gasket	2

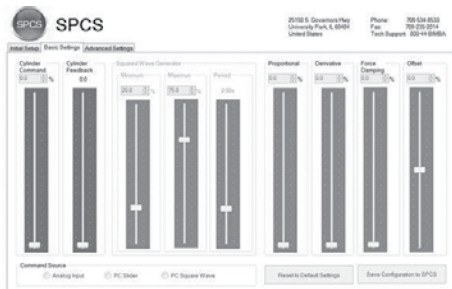
## SPCS-2 Servo Pneumatic Control System with Software Setup

The updated SPCS-2 provides a robust solution to accurate closed loop pneumatic positioning. Easily installed and software configured, this servo pneumatic control provides positioning accuracy up to  $\pm 1\%$  of the actuator's full stroke with loads up to 225 lbs and average velocity as high as 20 inches per second. Use the SPCS-2 with any of Bimba's position feedback actuators (PFC, PFCN, PTF) bore sizes 1-1/16" through 3", or actuators with external feedback sensors, to create a solution to your motion control application.



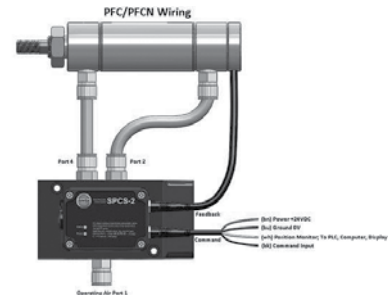
### Software Configured Setup Including:

- > Linear, rotary, or rodless actuator selection
- > 0-10VDC or 4-20mA command feedback selection
- > Response, overshoot, force, and orientation adjustments
- > Effective rod extend and retract control along with ramp up and ramp down speed adjustments
- > Square wave generator to simulate performance



### Easy Connection

- > Standard power, control, and feedback cables
- > No manual switch or jumper tuning
- > IP65 compatible



# How to Specify

## SPCS-2 Application Sizing

### Horizontal Applications

Bore Size	Average Velocity Without Overshoot @ Max Payload (in/sec)	Maximum Payload (lbs)	Average Velocity @ 50% Max Payload (in/sec)	Average Velocity @ 25% Max Payload (in/sec)
09	20	50	20	30
17	10	100	20	30
31	15	200	20	30
50	15	315	25	30
70	15	450	20	20

### Vertical Applications

Bore Size	Average Velocity Without Overshoot @ Max Payload (in/sec)	Maximum Payload (lbs)	Average Velocity @ 50% Max Payload (in/sec)	Average Velocity @ 25% Max Payload (in/sec)
09	70	5	100	100
17	70	10	60	60
31	50	30	40	60
50	15	95	30	30
70	20	135	20	20

### Complimentary Bimba Products to Create a Closed Loop Pneumatic Motion Control Solution

- > PFC – Linear Resistive position feedback cylinder
- > PFCN – Non-contact magnetostrictive sensor position feedback cylinder
- > PFCL and PFCNL – Rod lock models of the above cylinders. The rod lock activates and holds the cylinder in place in the event operating air is lost.
- > PTF - Rotary potentiometric feedback
- > 5 µm particulate
- > 0.3 µm coalescing filter



# How to Order

The model number of SPCS servo pneumatic control systems and supporting parts are non-configurable. Use the ordering information below to select a valid part number. Contact Bimba at [cs@bimba.com](mailto:cs@bimba.com) for additional information and customization options.

Part Number	Description
SPCS-2	Servo Pneumatic Control System
SPCS-CBL-PWR-CMD	2 Meters Female/Strip Wire
SPCS-CBL-FBK	2 Meters Female Connector Both Ends
SPCS2-USB-CBL	2 Meter USB Setup Cable

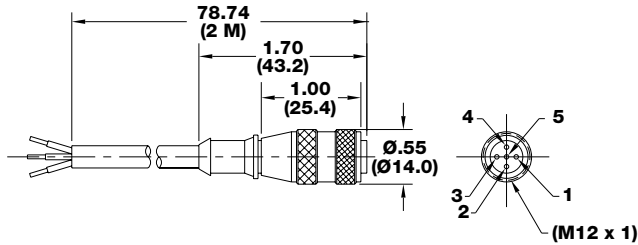
# How to Specify

## Dimensions (Quick Connect Cables)

Shown in inches (millimeters)

### PCS-CBL-PWR

**SPECIFICATIONS**  
5 CONDUCTORS OF 22 AWG LEADS RATED TO 250 V AT 4 AMPS SHIELDED

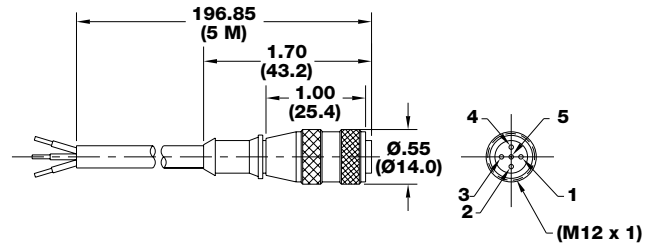


#### PCS-CBL-PWR Wire Color Codes

Color	Pin	Description
Brown	1	Positive
White	2	N/C
Blue	3	Negative
Black	4	N/C
Green/Yellow	5	N/C

### PCS-CBL-PWR-X

**SPECIFICATIONS**  
5 CONDUCTORS OF 22 AWG LEADS RATED TO 250 V AT 4 AMPS SHIELDED

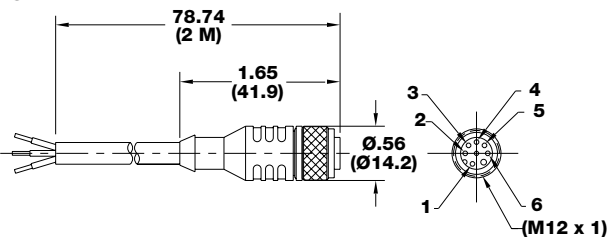


#### PCS-CBL-CMD Wire Color Codes

Color	Pin	Description
Brown	1	Input
White	2	@ Position
Blue	3	Ground
Black	4	Current Position
Grey	5	N/C
Pink	6	N/C

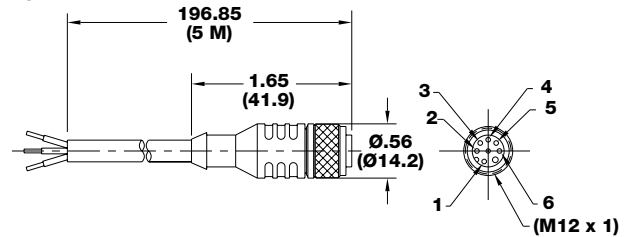
### PCS-CBL-CMD

**SPECIFICATIONS**  
6 CONDUCTORS OF 24 AWG LEADS RATED TO EITHER 30 VAC OR 36 VDC AT 4 AMPS SHIELDED



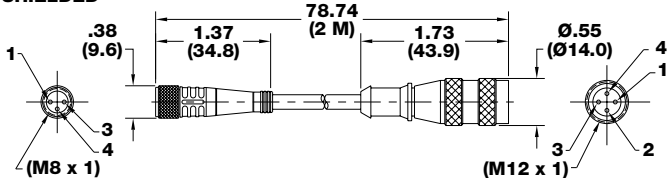
### PCS-CBL-CMD-X

**SPECIFICATIONS**  
6 CONDUCTORS OF 24 AWG LEADS RATED TO EITHER 30 VAC OR 36 VDC AT 4 AMPS SHIELDED



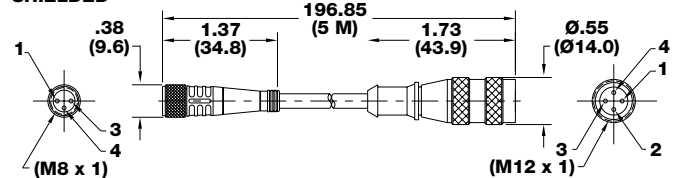
### PCS-CBL-FBK

**SPECIFICATIONS**  
3 CONDUCTORS OF 24 AWG LEADS RATED TO 120 V AT 4 AMPS SHIELDED



### PCS-CBL-FBK-X

**SPECIFICATIONS**  
3 CONDUCTORS OF 24 AWG LEADS RATED TO 120 V AT 4 AMPS SHIELDED



## Pneumatic Control System Options

Part Number	Description
PCS-CBL-PWR	2 meter Power Cable for Quick Connect Option
PCS-CBL-PWR-X	5 meter Power Cable for Quick Connect Option
PCS-CBL-CMD	2 meter Command Signal Cable for Quick Connect Option

Part Number	Description
PCS-CBL-CMD-X	5 meter Command Signal Cable for Quick Connect Option
PCS-CBL-FBK	2 meter Feedback Cable for Quick Connect Option
PCS-CBL-FBK-X	5 meter Feedback Cable for Quick Connect Option

One power, command, and feedback cable required if option Q is purchased.



