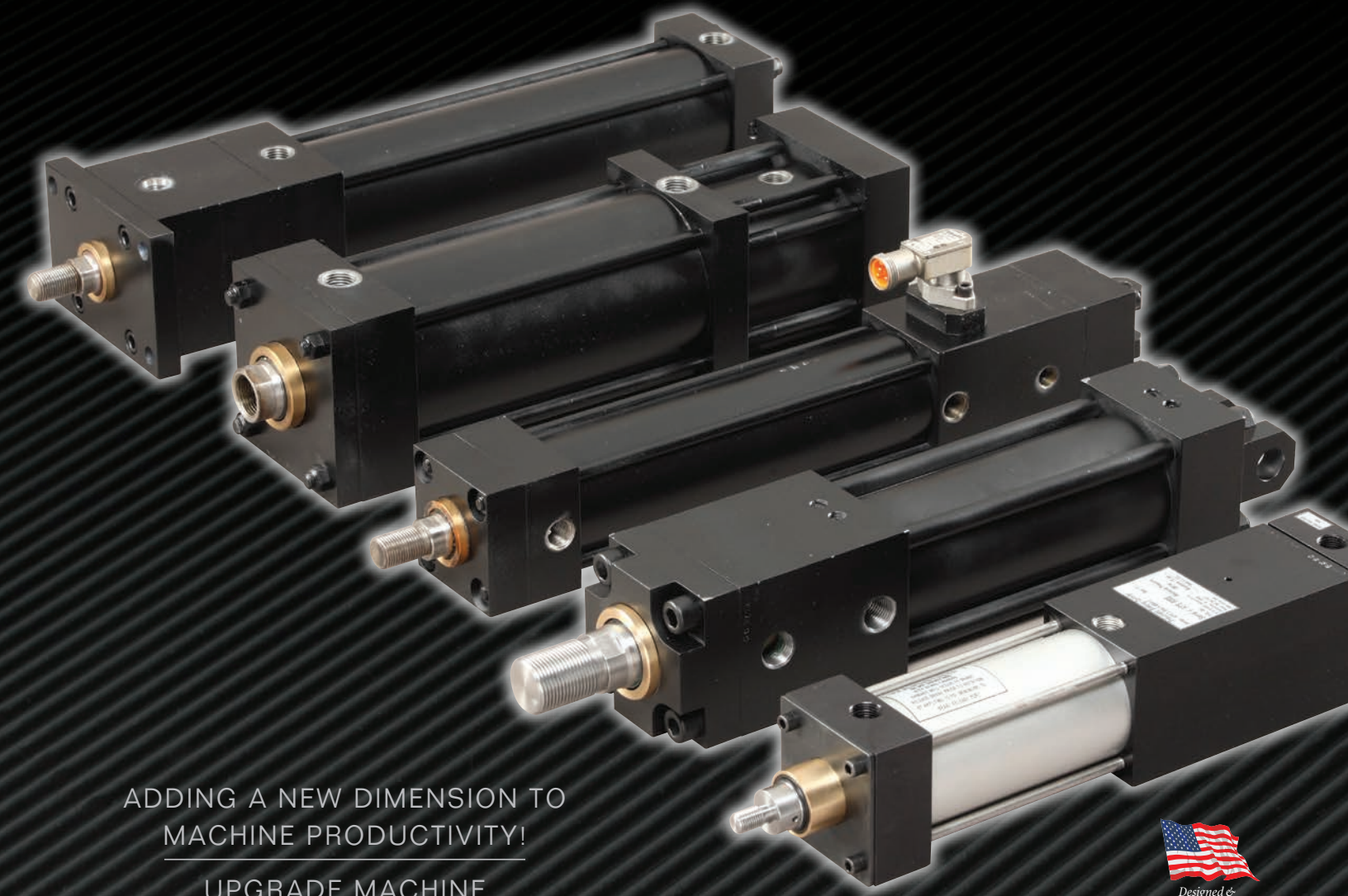
SELF-LOCKING & BRAKING CYLINDERS



ADDING A NEW DIMENSION TO MACHINE PRODUCTIVITY!

UPGRADE MACHINE PERFORMANCE & PROFITABILITY!

UPGRADE TO PFA!

Designed & Made in USA

PFA INCORPORATED

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Located just North of Milwaukee, Wisconsin, PFA is a leader in the design and manufacture of Quick Die Change Systems (QDC), Specialty Injection Mold Components, Specialty Industrial Cylinders, Quick Mold Change Systems (QMC), Multi-Slide Die Casting Solutions, and Robotic Automation End-Effectors.

- **SWITCHMAX® Connectivity Components and Electrical Cables** integrate various "on mold" sensors (relay, mechanical, and proximity DC) into a single signal interface common on most injection molding machines. LED indication also assists operators. No more complex wiring – just plug & play.
- **Robotic Automation End Effectors.** Modular products allow the coupling of Grippers, Gripper Pads (GP), Compliance Devices (RCC) and Crash Protection (OPD) into a simple and integrated robotic end-effector solution.
- **Quick Die Change Systems** provide easily customized solutions for stamping die "quick change". Bolster extensions, die rails/lifters, check valve and locking clamps, and electronic 5,000 psi pump controllers are just a few of the options available.
- **Hydra-Jaws™ Quick Mold Change and Hydra-Latch™ Quick Knockout Systems** provide consistent clamping and support rapid mold changes for a wide range of mold sizes in a single machine. Clamps move to fit the mold!
- **KOR-LOK™ Side-Action Systems** and **DIE-LOK™ Multislide Systems** for pre-loading and locking moveable cores on injection molds and die cast dies, provide improved part quality, speed and performance over traditional cam pin and toggle methods.

Our staff is committed to providing you with the best possible products and service. PFA offers a wide array of standard products plus custom solutions for especially challenging applications. Contact us with your needs. We will be glad to serve you!

PFA INCORPORATED

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CONTENTS

NOTE: All products are assumed to be operated with due regard to safety and at proper pressures. Note specifically that PVS cylinders are primarily pneumatic with the ability to operate with hydraulics at very limited pressures. KPS cylinders are pneumatic only. Selection of any product for any application is the responsibility of the customer. PFA assistance and recommendations are not a substitute for proper review and selection by the customer. PFA Terms of Sale apply. Dimensions are provided for reference only and subject to change without notice. Contact PFA regarding critical dimensions for any application prior to ordering.

WHY SELF-LOCKING & BRAKING CYLINDERS?

Self-Locking Cylinders and Brake Cylinders allow designers to defeat common barriers associated with hydraulic and pneumatic systems.

Locking Cylinders: Repeatable precise positioning along with high force holding capability is now attainable with PFA Self-Locking Cylinders. The metal-on-metal positive lock ensures "hard contact" repeatability and maintains position independent of system pressure. Because the locking mechanism physically blocks rod movement, common "spongy" air and hydraulic problems are eliminated. Once in the locked position, system pressure may be lost or removed without affecting position or load capacity.

Braking Cylinders: Holding the rod in position when air pressure is lost is the typical use of PFA's Braking Cylinders. The internal rod brake allows holding in any position.

MODULAR SUPPORT

PFA's modular systems replace custom and complex systems, allowing for drop-in support. That means that during production runs, when your customers need to do a quick replacement, they can do it.

SOME EXAMPLES

Lift and load devices, safety mechanisms, and non-drift applications are just three generic examples of possible uses. Specific examples include: foam molding, intermittent use lifting, movable platforms, staking, automated assembly, tooling fixtures, stamping, packaging and many more.

SIMPLER IS BETTER!

Often by eliminating the need for hydraulics, our pneumatic Self-Locking Cylinders and Braking Cylinders do the job better, faster, and at a lower cost, saving money in design, construction, and lifetime operation. For amazing hydraulic versions with 10x the holding force of standard hydraulic cylinders, try our HYS series.

DISCOVER THE BENEFITS OF CONTROL, PROTECTION, STRENGTH AND EASY OPERATION WITH PFA SELF-LOCKING CYLINDERS!

- **Mechanical Lock Protection.** True "rod interrupt" lock ensures full load capacity is maintained, even if system pressure is lost! (HYS/PVS)
- **Positive Locking Sensor Control.** Senses actual locking action engaging to ensure positive machine control.
- **Smooth & Easy Operation.** Complementary angles allow for ease of lock engagement and disengagement even under load!
- **Strong Compact Design.** Integral locking mechanism allows for ease of installation and can hold the force of a cylinder 10 to 15 times larger!
- **Standard Porting Flexibility.** When cylinder reaches end of stroke the spring bias causes the lock to engage. Retract pressure (LOE) or extend pressure (LOR) is ported internally to unlock the unit, making a 2-port system. (HYS/PVS)
- **Adjustable End of Stroke Cushioning.** Metered exhaust allows for adjustable cushions at either end of stroke. (HYS/PVS/KPS)

COMPARISON TO STANDARD CYLINDERS

PFA SELF-LOCKING CYLINDERS	VS.	OTHER STANDARD CYLINDERS
YES!	Move loads based on applied pressure?	YES!
YES!	Maintain position/force with pressure drops?	CAN'T DO IT!
YES!	Keep position/force with total loss of pressure?	CAN'T DO IT!
YES!	Hold loads up to 15 times the piston force?	CAN'T DO IT!
YES!	Perform intermittent operation with zero drift?	CAN'T DO IT!

HYS/PVS - HYDRAULIC/PNEUMATIC SELF-LOCKING CYLINDERS

LOCK-ON-EXTEND (LOE) STYLE *(see page 6)*

APPLICATION

The Lock-on-Extend (LOE) Self-Locking Cylinder locks the rod in position when the rod is fully extended. Load force is applied to the rod in a direction such that it is pushing on the rod (compression). Lock prevents retraction.

OPERATION

The Lock-on-Extend (LOE) Self-Locking Cylinder employs a tri-sectional locking ring (three segments) and an annular groove to maintain a metal-on-metal mechanical lock regardless of system pressure. As the cylinder reaches end-of-stroke (extend), the tri-sectional ring is forced into the annular groove in the rod by the locking slide. The locking slide is held in place by the bias springs and will maintain lock-up until pressure is applied to the retract port. The retract port supplies pressure to move the locking slide off the three locking segments and to retract the rod at the same time.

LOCK-ON-RETRACT (LOR) STYLE *(see page 10)*

APPLICATION

The Lock-on-Retract (LOR) Self-Locking Cylinder locks the rod in position when the rod is fully retracted. Load force is applied to the rod in a direction such that it is pulling on the rod (tension). Lock prevents extension.

OPERATION

The Lock-on-Retract (LOR) Self-Locking Cylinder employs a tri-sectional locking ring (three segments) and an annular groove to maintain a metal-on-metal mechanical lock regardless of system pressure. As the cylinder reaches end-of-stroke (retract), the rod engages a keeper slide allowing the tri-sectional ring is forced into the annular groove by the locking slide. The locking slide is held in place by the bias springs and will maintain lock-up until pressure is applied to the extend port. The extend port supplies pressure to move the locking slide off the three locking segments and to extend the rod at the same time.

KPS INTERNAL BRAKING CYLINDER *(see page 14)*

APPLICATION

The KPS Internal Braking Cylinder is designed for long life when properly utilized. Ideally, the brake element should be engaged when the piston rod is no longer moving. Braking with the cylinder rod stationary will reduce the wear of the braking element and allow for precise positioning. Brake holds rod in any position.

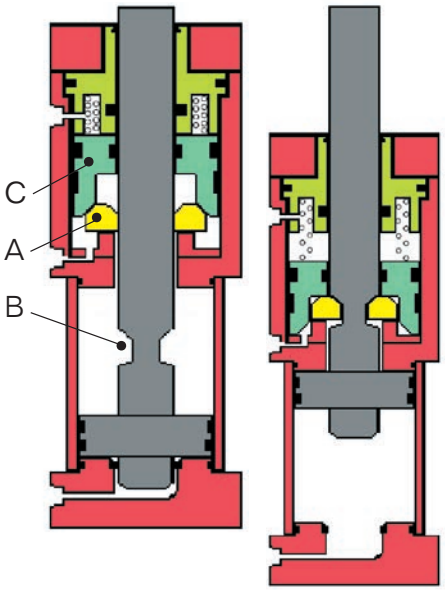
OPERATION

PFA's KPS Internal Braking Cylinder provides the freedom to stop and hold a load anywhere along the stroke, without relying on air pressure to hold position. While the KPS functions like any other double-acting pneumatic cylinder during normal cycling, when air pressure is removed from the brake port the internal spring-loaded brake mechanism will engage. The brake mechanism consists of spring washers, cone, brake piston and mandrel. When air pressure is removed from the brake port, the spring washers force the piston to pull the cone into the brake mandrel. As the cone enters the brake mandrel, the mandrel (similar to a collet) is forced to spread, contacting the inside surface of the piston rod and effectively holding it in place. When pressure is applied to the release side of the brake piston, the spring washers are compressed, relieving tension on the brake mandrel and releasing the piston rod. The KPS cylinder rod is now free to move.

SELF-LOCKING CYLINDERS (HYS/PVS)

LOCK-ON-EXTEND

SEE IN MOTION AT pfa-inc.com



LOCK ON EXTEND (LOE) CYLINDER TYPES

PVS (PNEUMATIC/AIR/LIGHT HYDRAULIC)

PVS Style Self-Locking Cylinders are commonly used for applications using air. Often the PVS model replaces or substitutes for more costly hydraulic systems. The solid metal-on-metal lock allows for high loading without the "squish" associated with standard air cylinders.

HYS (HEAVY HYDRAULIC)

HYS Style Self-Locking Cylinders are commonly used for applications where high moving forces are required. HYS is the perfect choice in applications where holding during loss of pressure is critical. The Heavy Hydraulic style may be operated pneumatically in some applications. Consult PFA for details.

ACCOMMODATION OF LOCKING CLEARANCE / OVERTRAVEL

Self-Locking Cylinders must fully extend to lock at the end of stroke. In many applications, the lock point is not restricted and the cylinder fully extends and locks. In other applications, a more precise lockup window is desirable and may be obtained with simple stops and shims.

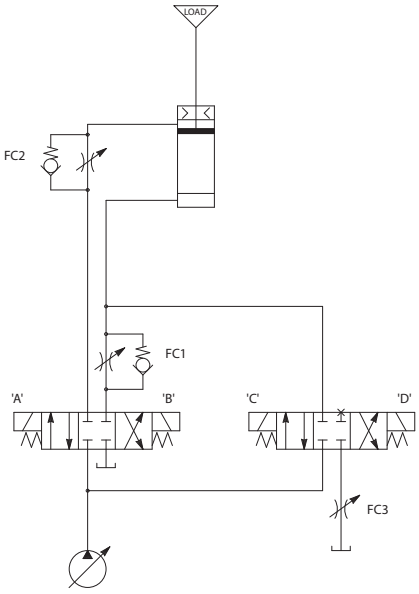
To ensure locking, the cylinders are manufactured with .004" to .013" of overtravel (end play) beyond the seating lock position. When pressure is removed or load applied after a locked condition is achieved, the rod will backup or move until the clearance is taken up. The overtravel clearance may be eliminated by adjusting load position at the rod-to-load interface. Consult a PFA Applications Specialist for details.

HOW IT WORKS

As the cylinder reaches end-of-stroke, the tri-sectional ring (A), is forced into the annular groove (B) in the rod by the locking slide ("C"). The locking slide is held in place by the bias springs and will maintain lock-up until pressure is applied to the retract port. The retract port supplies pressure to move the locking slide off the three locking segments and to retract the rod at the same time.

DIMENSIONAL INFORMATION

(All Dimensions nominal and in inches)



NOTE: Application sketches are offered as suggestions only. Feasibility, testing and usage of the product is the responsibility of the user. The product may be used to increase safety, but should not replace positive stop safety mechanisms. No liability is expressed or intended on the part of PFA, Inc., it's employees or agents.

SIMPLIFIED CIRCUIT/SEQUENCE-VERTICAL MOVEMENT

To support the vertical load and remove force on the lock prior to unlocking and lowering (with possible multiple speeds).

1. Valve "CD" is recommended in vertical applications to prevent uncontrolled dropping or movement of the load due to gravity when unlocked.
2. ENSURE LOAD IS GUIDED INDEPENDENTLY from the cylinder rod in vertical applications.
3. Energize solenoid (C) to lift/support the load off of the locking mechanism.
4. Leave (C) energized while energizing (A) to unlock the locking Mechanism (lock sensor off).
5. De-energize (C) to lower load at speed set at (FC1).
6. Energize (D) to lower load at higher speed based on parallel (combined) flow thru (FC1) and (FC3).
7. Energize (B) to lift the load with speed based on (FC2). At full extend the cylinder will lock (sensor on to verify lock).

SIMPLIFIED CIRCUIT/SEQUENCE-HORIZONTAL MOVEMENT

To allow for more simple horizontal cylinder operation.

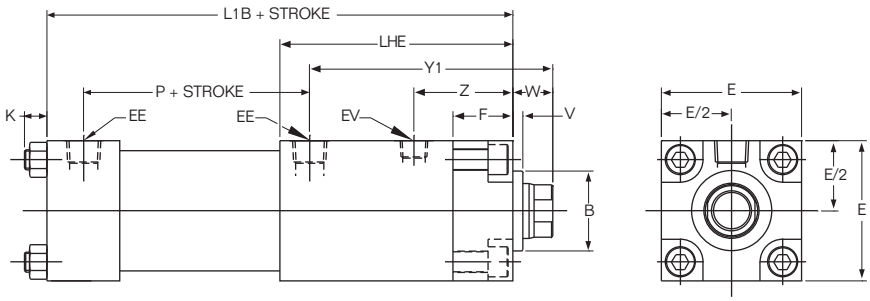
1. Valve "CD" is not needed in the horizontal application, IF the lock is NOT under load during unlocking. However, if the lock IS under load during unlocking, then follow the Vertical movement method.
2. ENSURE LOAD IS SUPPORTED INDEPENDENTLY from the cylinder rod in a horizontal application.
3. With no load on the lock, Energize A to unlock and retract at speed set by (FC1).
4. Energize (B) to extend the load at speed set at (FC2).

LOCK-ON-EXTEND (LOE) THEORETICAL PERFORMANCE DATA

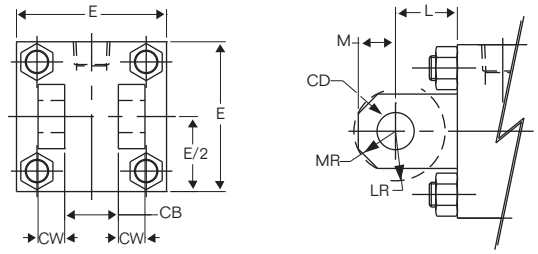
Lock-on-Extend Style Bore ø / Rod ø	Lock Holding Force** (Fully Extended)	Moving Force - Extending (LBS) Air/Hydraulic Pressure (psi)				Moving Force - Returning (LBS) Air/Hydraulic Pressure (psi)			
		75	1000	1500	3000	75	1000	1500	3000
PVS–2.000 / 0.625	2,500 lbs.	235	Maximum Pressure 1000 psi			210	Maximum Pressure 1000 psi		
PVS–2.500 / 1.000	11,000 lbs.	365	Maximum Pressure 1000 psi			305	Maximum Pressure 1000 psi		
PVS–4.000 / 1.375	17,500 lbs.	940	Maximum Pressure 1000 psi			830	Maximum Pressure 1000 psi		
PVS–5.000 / 1.750	45,000 lbs.	1,470	Maximum Pressure 750 psi			1,290	Maximum Pressure 750 psi		
PVS–6.000 / 1.750	45,000 lbs.	2,120	Maximum Pressure 750 psi			1,930	Maximum Pressure 750 psi		
HYS–2.000 / 1.000	20,000 lbs.	235	3,140	4,700	9,400	170	2,350	3,500	7,050
HYS–2.500 / 1.375	30,000 lbs.	365	4,900	7,300	14,700	250	3,420	5,100	10,250
HYS–4.000 / 1.750	50,000 lbs.	940	12,500	18,800	37,600	760	10,150	15,200	30,400

* Heavy Hydraulic Style may be operated pneumatically in some applications. Consult PFA for details.

** Cylinder locking / holding force is a function of rod column strength and depends on overall stroke length and proper load guidance/ installation.

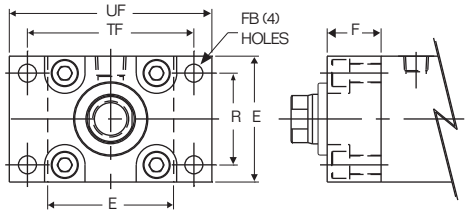


Style-Bore / Rod ø	B	V	W	E	F	K	EE	EV	P	Y1	Z	LHE	L1B
PVS–2.000 / 0.625	1.124	0.25	0.63	2.50	0.75	0.25	3/8 NPT	1/4 NPT	2.87	3.95	1.281	3.75	6.81
PVS–2.500 / 1.000	1.499	0.25	0.75	3.00	1.00	0.46	3/8 NPT	1/4 NPT	2.86	5.52	2.076	5.25	8.25
PVS–4.000 / 1.375	1.998	0.25	0.88	4.50	1.50	0.51	1/2 NPT	3/8 NPT	3.25	5.51	1.792	5.14	8.62
PVS–5.000 / 1.750	2.375	0.25	1.00	5.50	1.75	0.75	1/2 NPT	#6 SAE	4.00	7.92	2.900	8.17	11.92
PVS–6.000 / 1.750	2.375	0.25	1.00	6.50	1.75	0.75	1/2 NPT	#6 SAE	4.00	7.92	2.900	8.17	11.92
HYS–2.000 / 1.000	1.499	0.25	0.75	3.00	1.00	0.54	#8 SAE	#4 SAE	3.00	5.39	2.076	5.25	8.41
HYS–2.500 / 1.375	1.998	0.25	1.00	3.50	1.50	0.56	#8 SAE	#6 SAE	3.64	6.08	2.470	5.82	9.63
HYS–4.000 / 1.750	2.375	0.25	1.00	5.00	1.75	0.63	#12 SAE	#6 SAE	4.25	7.80	2.903	8.17	11.92

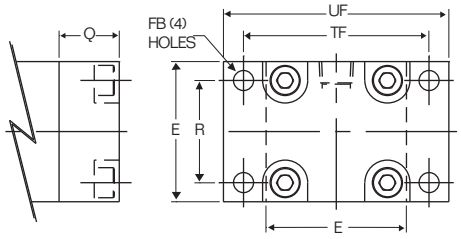


MP1 - Rear Clevis

MF1 - Front Flange

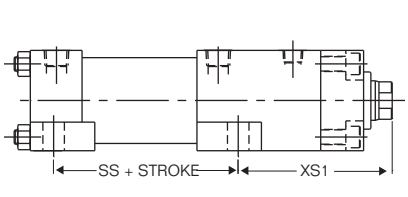


MF2 - Rear Flange

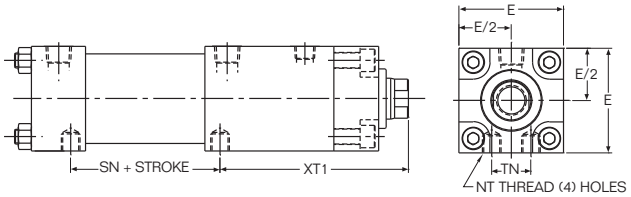


Series–Bore/Rod ø	CB	CD	CW	L	LR	M	MR	F	FB	R	TF	UF	Q*
PVS–2.000 / 0.625	0.75	0.50	0.50	0.75	0.63	0.50	0.63	0.750	0.406	1.844	3.375	4.125	0.750
PVS–2.500 / 1.000	0.75	0.50	0.50	0.75	0.63	0.50	0.63	1.000	0.438	2.192	3.875	4.625	1.000
PVS–4.000 / 1.375	1.25	0.75	0.63	1.25	1.00	0.75	0.85	1.500	0.438	3.320	5.440	6.250	1.500
PVS–5.000 / 1.750	1.25	0.75	0.63	1.25	1.00	0.75	0.94	1.750	0.560	4.100	6.625	7.630	1.750
PVS–6.000 / 1.750	CONSULT FACTORY							1.750	0.560	4.880	7.630	8.630	1.750
HYS–2.000 / 1.000	1.25	0.75	0.63	1.25	1.00	0.75	0.88	1.000	0.500	2.050	4.125	5.125	1.000
HYS–2.500 / 1.375	1.25	0.75	0.63	1.25	1.00	0.75	0.88	1.500	0.500	2.550	4.625	5.625	1.500
HYS–4.000 / 1.750	2.00	1.38	1.00	2.13	1.75	1.38	1.63	1.750	0.656	3.818	6.375	7.625	1.750

*Q dimension replaces K dimension for MF2–Rear Flange Mount only



MS2 - Foot Mount

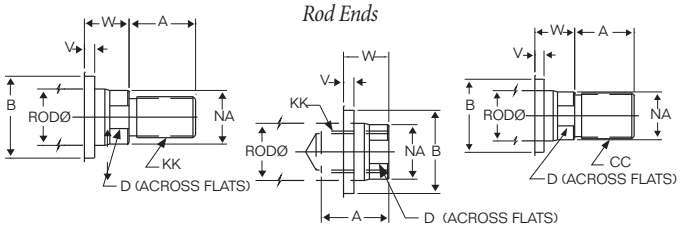


MS4 Bottom Tapped

	MS2 - FOOT MOUNT						MS4-BOTTOM TAPPED			
Series–Bore/Rod ø	XS1	SS	SB	ST	TS	US	XT1	SN	TN	NT
PVS–2.000 / 0.625	3.75	2.88	0.38	0.50	3.25	4.00	3.850	2.840	0.875	5/16 - 18
PVS–2.500 / 1.000	5.63	3.00	0.38	0.50	3.75	4.50	5.560	2.625	1.250	3/8 - 16
PVS–4.000 / 1.375	5.75	3.25	0.50	0.75	5.50	6.50	CONSULT FACTORY			
PVS–5.000 / 1.750	8.42	3.25	0.75	1.00	6.88	8.25	8.170	3.750	2.690	5/8 - 11
PVS–6.000 / 1.750	CONSULT FACTORY						CONSULT FACTORY			
HYS–2.000 / 1.000	5.50	3.25	0.50	0.75	4.00	5.00	5.430	2.875	0.938	1/2 - 13
HYS–2.500 / 1.375	6.00	3.81	0.75	1.00	4.88	6.25	6.315	3.000	1.313	5/8 - 11
HYS–4.000 / 1.750	8.18	3.75	1.00	1.25	6.75	8.50	8.420	3.500	2.063	1 - 8

Rod End Rod ø	SM or SF KK	IM CC	A	D	NA
0.625	7/16 - 20	1/2 - 20	0.75	0.50	0.56
1.000	3/4 - 16	7/8 - 14	1.13	0.88	0.94
1.375	1 - 14	1 1/4 - 12	1.63	1.19	1.31
1.750	1 1/4 - 12	1 1/2 - 12	2.00	1.53	1.72

Rod Ends



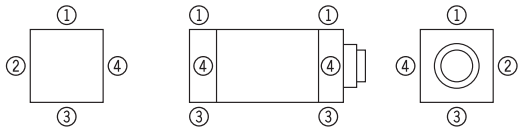
Small Male (SM) *Small Female (SF)* *Intermediate Male (IM)*

INSTRUCTIONS:

Each end of the cylinder has four positions for ports (P), sensors (S), cushion adjustments (C), and mountings (MS2, MS4 use a position).

Catalog drawings show standard ports "on top" in position ① and standard mounts "on the bottom" in position ③. Mounts MF1, MF2, and MP1 are oriented as shown in the drawings relative to position ① "on top."

Rear View (Blind End) *Side View* *Front View (Rod End*



NOTE: NO ADDITIONAL ORDER CODE IS REQUIRED TO OBTAIN THE STANDARD ORIENTATION.

When an alternate locations are desired for Ports, Cushions, Mounts, or Sensors, use the Figure above to select positions, remembering that each position can have only one option. Add the three character code(s) to the part number for each option. Sensors are all solid state, Normally Open style, available in 20-250 VAC/DC (load only) [-XAC] and 10-65 VDC [PNP]. PNP is recommended for most PLC type applications. See Page 18 and 19 for more information.

Note: Other mounting options and mating accessories are available. Please contact PFA for details on your specific application.

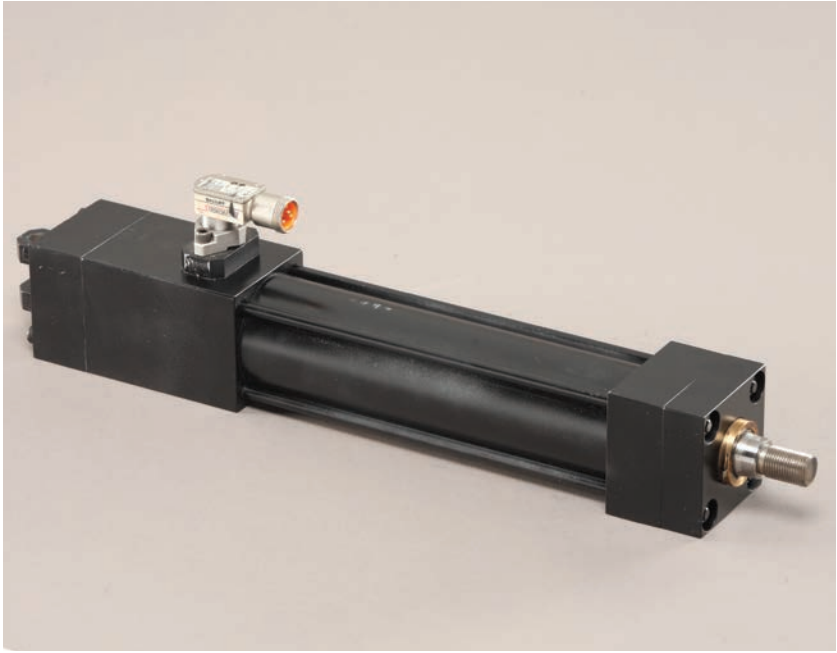
LOE Style	Stroke	Lock Position	Mounting	Rod End	Non-Standard Optional Items	Sensor Style (if applicable)
See Chart	*Stroke in inches as desired*	*Lock-On-Extend (LOE) = 1*	*MF1, MF2, MP1, MS2, MS4*	*Small Male = SM Intermediate Male = IM Small Female = SF*	*Option: P, C, S Front Position: 0-4 Rear Position: 0-4*	*20-250 VAC N.O. = ACX 10-65 VDC N.O. PNP = PNP 10-65 VDC N.O. NPN = NPN*
PVS-2.000/0.625	12.5	1	MF1	IM	C22–S44	PNP

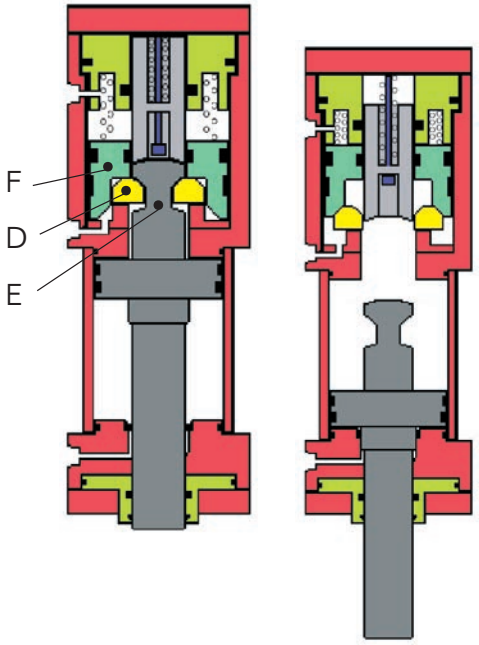
Part No: **PVS-2.000/0.625-12.5-1-MF1-IM-C22-S44-PNP**

SELF-LOCKING CYLINDERS (HYS/PVS)

LOCK-ON-RETRACT

SEE IN MOTION AT pfa-inc.com





LOCK ON RETRACT (LOR) CYLINDER TYPES

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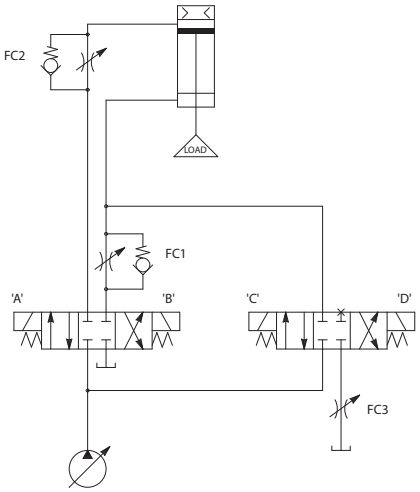
To ensure locking, the cylinders are manufactured with .004" to .013" of overtravel (end play) beyond the seating lock position. When pressure is removed or load applied after a locked condition is achieved, the rod will backup or move until the clearance is taken up. The overtravel clearance may be eliminated by adjusting load position at the rod-to-load interface. Consult a PFA Applications Specialist for details.

HOW IT WORKS

As the cylinder reaches end-of-stroke, the rod engages a keeper slide allowing the tri-sectional ring (D), to be forced into the annular groove (E) by the locking slide (F). The locking slide is held in place by the bias springs and will maintain lock-up until pressure is applied to the extend port. The extend port supplies pressure to move the locking slide off the three locking segments and to extend the rod at the same time.

DIMENSIONAL INFORMATION

(All Dimensions nominal and in inches)



NOTE: Application sketches are offered as suggestions only. Feasibility, testing and usage of the product is the responsibility of the user. The product may be used to increase safety, but should not replace positive stop safety mechanisms. No liability is expressed or intended on the part of PFA, Inc., it's employees or agents.

SIMPLIFIED CIRCUIT/SEQUENCE-VERTICAL MOVEMENT

To support the vertical load and remove force on the lock prior to unlocking and lowering (with possible multiple speeds).

1. Valve "CD" is recommended in vertical applications to prevent uncontrolled dropping or movement of the load due to gravity when unlocked.
2. ENSURE LOAD IS GUIDED INDEPENDENTLY from the cylinder rod in vertical applications.
3. Energize solenoid (C) to lift/support the load off of the locking mechanism.
4. Leave (C) energized while energizing (A) to unlock the locking Mechanism (lock sensor off).
5. De-energize (C) to lower load at speed set at (FC1).
6. Energize (D) to lower load at higher speed based on parallel (combined) flow thru (FC1) and (FC3).
7. Energize (B) to lift the load with speed based on (FC2). At full retract the cylinder will lock (sensor on to verify lock).

SIMPLIFIED CIRCUIT/SEQUENCE-HORIZONTAL MOVEMENT

To allow for more simple horizontal cylinder operation.

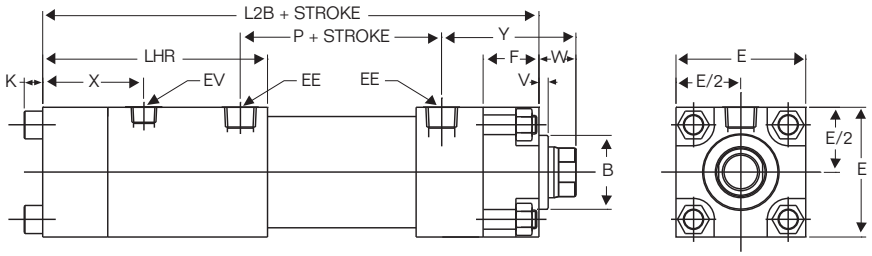
1. Valve "CD" is not needed in the horizontal application, IF the lock is NOT under load during unlocking. However, if the lock IS under load during unlocking, then follow use the Vertical application method above.
2. ENSURE LOAD IS SUPPORTED INDEPENDENTLY from the cylinder rod in a horizontal application.
3. With no load on the lock, Energize A to unlock and extend at speed set by (FC1).
4. Energize (B) to retract the load at speed set at (FC2).

LOCK-ON-RETRACT (LOR) THEORETICAL PERFORMANCE DATA

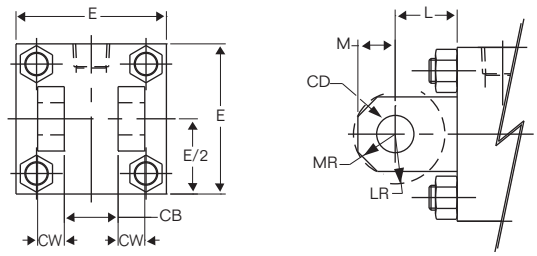
Lock-on-Retract Style Bore ø / Rod ø	Lock Holding Force** (Fully Retracted)	Moving Force - Extending (LBS) Air/Hydraulic Pressure (psi)				Moving Force - Returning (LBS) Air/Hydraulic Pressure (psi)			
		75	1000	1500	3000	75	1000	1500	3000
PVS–2.500 / 1.000	10,000 lbs.	365	Maximum Pressure 1000 psi			305	Maximum Pressure 1000 psi		
PVS–4.000 / 1.375	15,000 lbs.	940	Maximum Pressure 1000 psi			830	Maximum Pressure 1000 psi		
PVS–5.000 / 1.750	42,000 lbs.	1,470	Maximum Pressure 750 psi			1,290	Maximum Pressure 750 psi		
HYS–2.000 / 1.000	9,500 lbs.	235	3,140	4,700	9,400	170	2,350	3,500	7,050
HYS–2.500 / 1.375	14,000 lbs.	365	4,900	7,300	14,700	250	3,420	5,100	10,250
HYS–4.000 / 1.750	25,000 lbs.	940	12,500	18,800	37,600	760	10,150	15,200	30,400

* Heavy Hydraulic Style may be operated pneumatically in some applications. Consult PFA for details.

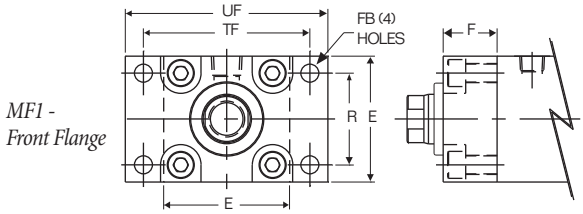
** Cylinder locking / holding force is a function of rod column strength and depends on overall stroke length and proper load guidance/ installation.



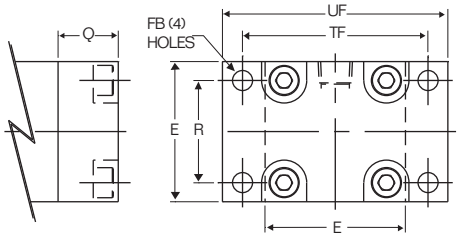
Style-Bore / Rod ø	B	V	W	E	F	K	EE	EV	P	X	Y	LHR	L2B
PVS–2.500 / 1.000	1.499	0.25	0.75	3.00	1.00	0.31	3/8 NPT	1/4 NPT	2.74	2.58	2.62	5.75	9.87
PVS–4.000 / 1.375	1.998	0.25	1.00	4.50	1.50	0.06	1/2 NPT	3/8 NPT	3.25	2.40	3.44	5.75	10.94
PVS–5.000 / 1.750	2.375	0.25	1.00	5.50	1.75	0.63	1/2 NPT	#6 SAE	4.00	3.40	4.25	8.67	14.67
HYS–2.000 / 1.000	1.499	0.25	0.75	3.00	1.00	0.50	#8 SAE	#4 SAE	2.87	2.83	2.61	6.00	10.13
HYS–2.500 / 1.375	1.998	0.25	1.00	3.50	1.50	0.50	#8 SAE	#6 SAE	3.43	2.72	3.63	6.07	11.38
HYS–4.000 / 1.750	2.375	0.25	1.00	5.00	1.75	0.63	#12 SAE	#6 SAE	4.25	3.40	4.12	8.67	14.67



MP1 - Rear Clevis



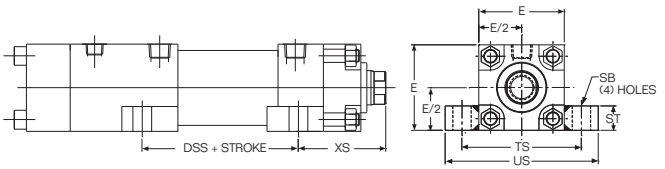
MF1 - Front Flange



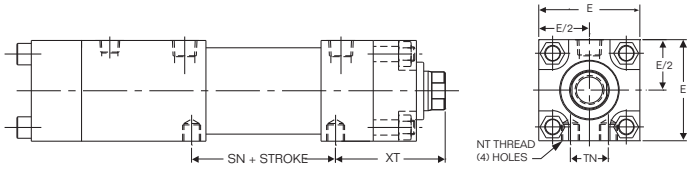
MF2 - Rear Flange

Series–Bore/Rod ø	CB	CD	CW	L	LR	M	MR	F	FB	R	TF	UF	Q*
PVS–2.500 / 1.000	0.75	0.50	0.50	0.75	0.63	0.50	0.63	1.000	0.438	2.192	3.875	4.625	1.000
PVS–4.000 / 1.375	1.25	0.75	0.63	1.25	1.00	0.75	0.85	1.500	0.438	3.320	5.440	6.250	1.500
PVS–5.000 / 1.750	1.25	0.75	0.63	1.25	1.00	0.75	0.94	1.750	0.560	4.100	6.625	7.630	1.750
HYS–2.000 / 1.000	1.25	0.75	0.63	1.25	1.00	0.75	0.88	1.000	0.500	2.050	4.125	5.125	1.000
HYS–2.500 / 1.375	1.25	0.75	0.63	1.25	1.00	0.75	0.88	1.500	0.500	2.550	4.625	5.625	1.500
HYS–4.000 / 1.750	2.00	1.38	1.00	2.13	1.75	1.38	1.63	1.750	0.656	3.818	6.375	7.625	1.750

*Q dimension replaces K dimension for MF2–Rear Flange Mount only



MS2 - Foot Mount

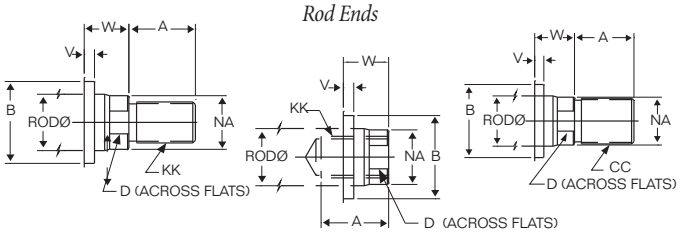


MS4 Bottom Tapped

	MS2 - FOOT MOUNT						MS4-BOTTOM TAPPED			
Series–Bore/Rod ø	XS	DSS	SB	ST	TS	US	XT	SN	TN	NT
PVS–2.500 / 1.000	2.12	3.13	0.38	0.50	3.75	4.50	2.688	2.625	1.250	3/8 – 16
PVS–4.000 / 1.375	3.00	3.44	0.50	0.75	5.50	6.50	CONSULT FACTORY			
PVS–5.000 / 1.750	4.25	3.50	0.75	1.00	6.88	8.25	4.130	3.880	2.690	5/8 – 11
HYS–2.000 / 1.000	2.11	3.25	0.50	0.75	4.00	5.00	2.560	2.875	0.938	1/2 – 13
HYS–2.500 / 1.375	3.50	3.63	0.75	1.00	4.88	6.25	3.813	3.000	1.313	5/8 – 11
HYS–4.000 / 1.750	4.00	4.00	1.00	1.25	6.75	8.50	4.250	3.500	2.063	1 – 8

Rod End Rod ø	SM or SF KK	IM CC	A	D	NA
0.625	7/16 - 20	1/2 - 20	0.75	0.50	0.56
1.000	3/4 - 16	7/8 - 14	1.13	0.88	0.94
1.375	1 - 14	1 1/4 - 12	1.63	1.19	1.31
1.750	1 1/4 - 12	1 1/2 - 12	2.00	1.53	1.72

Rod Ends

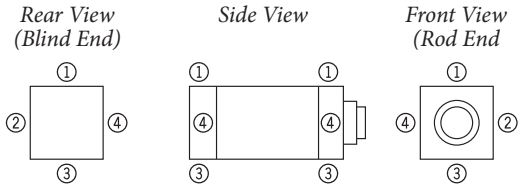


Small Male (SM) *Small Female (SF)* *Intermediate Male (IM)*

INSTRUCTIONS:

Each end of the cylinder has four positions for ports (P), sensors (S), cushion adjustments (C), and mountings (MS2, MS4 use a position).

Catalog drawings show standard ports "on top" in position ① and standard mounts "on the bottom" in position ③. Mounts MF1, MF2, and MP1 are oriented as shown in the drawings relative to position ① "on top."



NOTE: NO ADDITIONAL ORDER CODE IS REQUIRED TO OBTAIN THE STANDARD ORIENTATION.

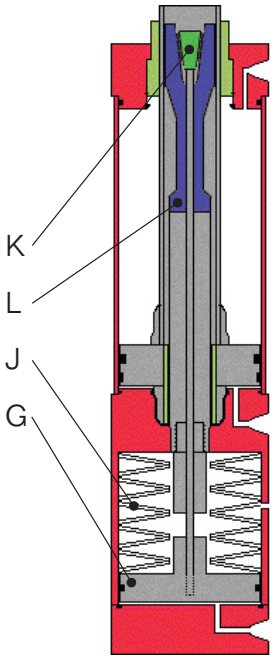
When an alternate locations are desired for Ports, Cushions, Mounts, or Sensors, use the Figure above to select positions, remembering that each position can have only one option. Add the three character code(s) to the part number for each option. Sensors are all solid state, Normally Open style, available in 20-250 VAC/DC (load only) [-XAC] and 10-65 VDC [PNP]. PNP is recommended for most PLC type applications. See Page 18 and 19 for more information.

Note: Other mounting options and mating accessories are available. Please contact PFA for details on your specific application.

LOE Style	Stroke	Lock Position	Mounting	Rod End	Non-Standard Optional Items	Sensor Style (if applicable)
See Chart	*Stroke in inches as desired*	*Lock-on-Retract (LOR) = 2*	*MF1, MF2, MP1, MS2, MS4*	*Small Male = SM Intermediate Male = IM Small Female = SF*	*Option: P, C, S Front Position: 0-4 Rear Position: 0-4*	*20-250 VAC N.O. = ACX 10-65 VDC N.O. PNP = PNP 10-65 VDC N.O. NPN = NPN*
PVS-2.500/1.000	12.5	2	MF1	IM	P22–S44	PNP

Part No: **PVS-2.500/1.000-12.5-2-MF1-IM-P22-S44-PNP**

BRAKING CYLINDERS (KPS)



ADVANTAGES

The KPS braking cylinder will *automatically* engage the brake if air pressure is lost, making it valuable in applications where avoiding potential damage to machinery is a priority.

With the braking action taking place *inside* the rod, there is no risk of damaging the outside of the rod, which may lead to seal failure in other products.

Since the KPS brake is adjustable, a great degree of control is achievable to facilitate highly complex applications.

HOW IT WORKS

As the cylinder reaches the desired position, air pressure is released from the brake piston (G), allowing the springs (J) to expand and pull the brake cone (K) to engage the brake (L). The brake holds the rod in place until pressure is applied to the brake port and the springs are compressed releasing the brake.

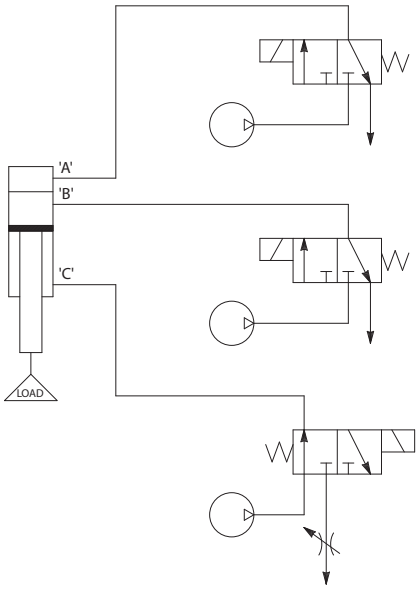
GENERAL SPECIFICATIONS

Piston Diameter	2.00" - 6.00"
Operating Pressure	250 psi Max.
Control Pressure	75 psi Min.
Stroke Speed	3 ft./sec. Max.
Operating Temperature	-40°F - +250°F
Shell Material	Aluminum, Anodized
Rod Material	Steel, Hard Chrome Plated
Seals	Buna-N Standard
Rod Bushings	Bronze
Ports	NOT Standard

Note: General specifications apply to standard KPS cylinders. Certain aspects of the KPS cylinder may be customized to accommodate individual applications. Please contact PFA for application assistance.

DIMENSIONAL INFORMATION

(All Dimensions nominal and in inches)



NOTE: Application sketches are offered as suggestions only. Feasibility, testing and usage of the product is the responsibility of the user. The product may be used to increase safety, but should not replace positive stop safety mechanisms. No liability is expressed or intended on the part of PFA, Inc., it's employees or agents.

SIMPLIFIED CIRCUIT/SEQUENCE-VERTICAL MOVEMENT

To support the vertical load and remove force on the brake prior to unbraking and lowering or raising the load. NOTE: BRAKE is ON when ZERO PRESSURE at Brake Port. Applying pressure disengages brake.

1. Very careful control of the pneumatics is needed in vertical applications to prevent uncontrolled dropping or movement of the load due to gravity when brake is disengaged.
2. ENSURE LOAD IS GUIDED INDEPENDENTLY from the cylinder rod in vertical applications.
3. With solenoid (C) in the normal position the load is supported and the braking mechanism holds position. SUPPLIED PRESSURE SHOULD BE REGULATED AND SET TO EXCEED THE WEIGHT OF THE LOAD SO THE LOAD LIFTS AT ALL TIMES.
4. Energize (A) to pressurize the brake ports and disengage the brake (load may lift).
5. Maintain (A) energized and Energize(C) or energize (B) to retract the load at the speed set at flow control or energize (B) to power load downward at a higher pressure (preferred).

SIMPLIFIED CIRCUIT/SEQUENCE-HORIZONTAL MOVEMENT

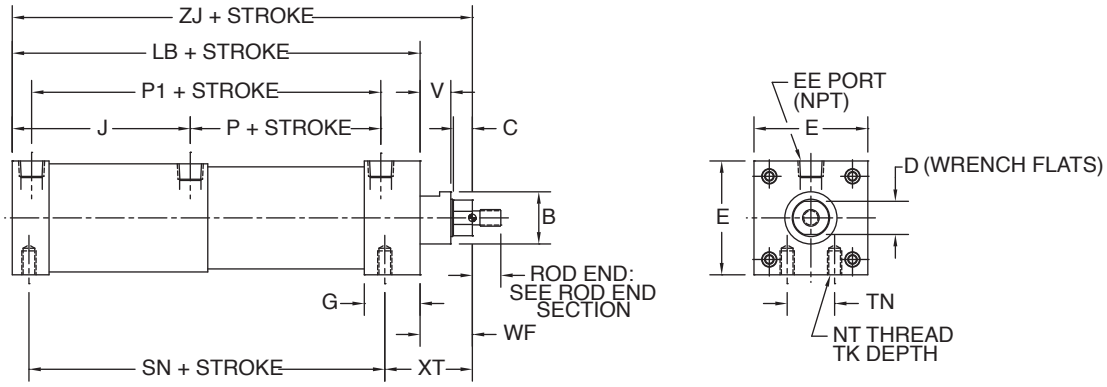
To allow for more simple horizontal cylinder operation.

1. Valve (B) would be setup in the same arrangement as (C) so air is constantly supplied to both sides of the piston at pressures determined to balance the piston areas and have nearly no movement.
2. ENSURE LOAD IS SUPPORTED INDEPENDENTLY from the cylinder rod in a horizontal application.
3. With no load on the brake (balanced), Energize A to disengage the brake.
4. Maintain (A) energized and Energize(C) to extend the load at speed set a Flow Control on valve C (meter out), or energize (B) to retract the load at the speed set at Flow Control on valve B.

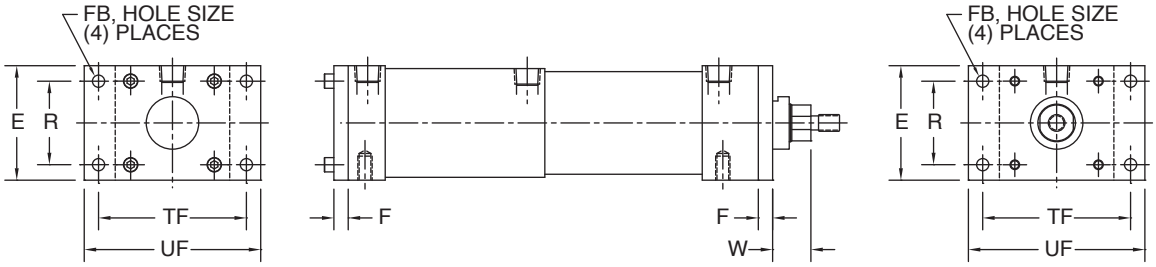
BRAKING CYLINDERS THEORETICAL PERFORMANCE DATA

Cylinder Bore Diameter	Extend Force at 90psi	Retract Force at 90psi	Holding Force* at 90psi
2.00	240	210	290
2.50	400	365	450
3.25	650	560	800
4.00	1,000	940	1,100
6.00	2,400	2,300	3,200

* Holding forces are approximate and based on factory settings using clean, dry air.
Customer can vary the holding force by following adjustment procedures provided with the product.

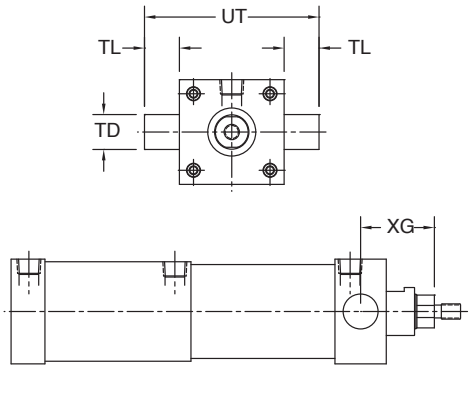


Bore / Rod ø	LB	P1	P	EE	B	C	D	E	G	J	V	NT	SN	TK	TN	WF	XT	ZJ
2.00 / 0.985	8.63	7.07	2.98	3/8	1.38	0.50	0.88	2.50	1.47	5.03	0.81	5/16-18	7.25	0.44	0.88	1.38	2.31	10.01
2.50 / 0.985	8.75	7.26	3.02	3/8	1.38	0.50	0.88	3.00	1.47	5.15	0.81	3/8-16	7.38	0.63	1.25	1.38	2.31	10.13
3.25 / 1.575	10.50	8.75	2.50	1/2	2.13	0.75	1.25	3.75	1.75	7.50	1.00	1/2-13	8.88	0.75	1.50	1.94	2.94	12.44
4.00 / 1.575	10.75	9.00	2.50	1/2	2.13	0.75	1.25	4.50	1.75	7.75	0.88	1/2-13	9.13	1.00	2.06	1.81	2.94	12.56
6.00 / 1.575	11.53	9.30	2.90	1/2	2.38	0.75	1.25	6.50	1.98	7.91	0.88	3/4-10	9.65	1.13	3.25	1.88	3.06	13.41

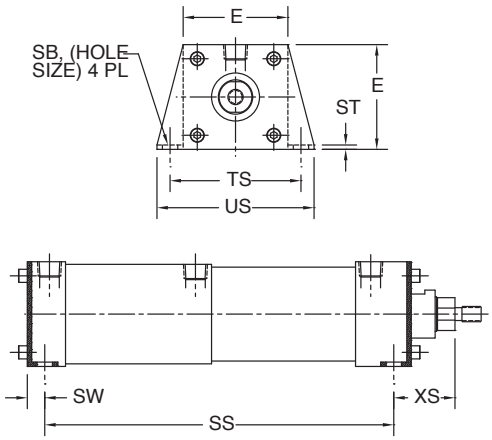


MF1 – Front Flange Mount

Bore	R	FB	F	TF	UF	E	W
2.00	1.84	0.34	0.38	3.38	4.13	2.50	1.00
2.50	2.19	0.32	0.38	3.88	4.63	3.00	1.00
3.25	2.76	0.40	0.63	4.69	5.50	3.75	1.43
4.00	3.32	0.38	0.63	5.44	6.25	4.50	1.43
6.00	4.88	0.53	0.75	7.63	8.63	6.50	1.13



MT1 – Front Trunion Mount

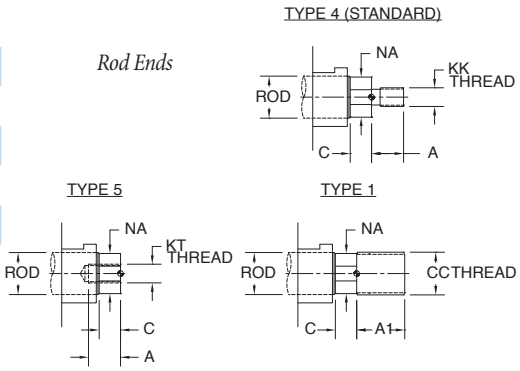


MS2 – Foot Mount

	MT1 – FRONT TRUNION MOUNT				MS2 – FOOT MOUNT						
Bore	TD	TL	UT	XG	SB	SS	ST	SW	TS	US	XS
2.00	1.00 ± .002	1.00	4.50	2.11	0.44	7.88	0.13	0.50	3.25	4.00	1.75
2.50	1.00 ± .002	1.00	5.00	2.11	0.44	8.00	0.13	0.50	3.75	4.50	1.75
3.25	1.00 ± .002	1.00	5.75	2.88	0.54	9.50	0.19	0.69	4.75	5.75	2.44
4.00	1.00 ± .002	1.00	6.50	2.81	0.54	9.75	0.25	0.75	5.50	6.50	2.31
6.00	1.38 ± .002	1.38	9.25	2.87	0.80	10.15	0.25	0.94	7.88	9.25	2.56

Bore	Rod ø	A	AI	C	CC	KK	KT
2.00	.985	0.75	1.13	0.50	1-14	7/16-20	7/16-20
2.50	.985	0.75	1.13	0.50	1-14	7/16-20	7/16-20
3.25	1.575	1.13	1.63	0.75	1 3/8-12	3/4-16	3/4-16
4.00	1.575	1.13	1.63	0.75	1 3/8-12	3/4-16	3/4-16
6.00	1.575	1.63	1.63	0.75	1 3/8-12	1-14	3/4-16

Rod Ends



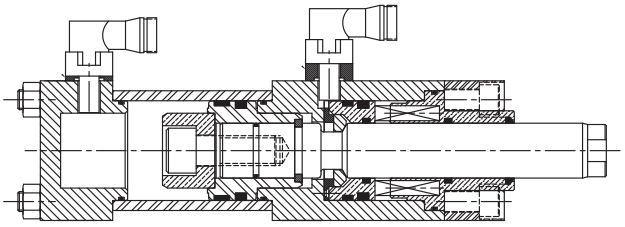
Note: Other mounting options and mating accessories are available. Please contact PFA for details on your specific application.

Example:

Brake Cylinder Style	Bore Size	Stroke Length	Mounting Style	Rod End Style	Option
KPS	*See Chart*	*See Chart*	*MF1, MF2, MP1, MS2, MS4*	*1, 4, 5*	*Magnetic Piston = MP*
KPS –	**2.5** –	**14** –	**MF1** –	**4** –	**MP**

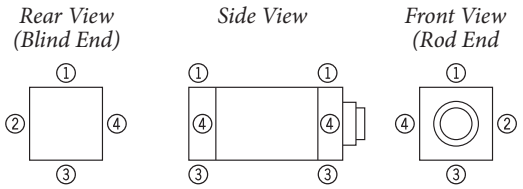
Part No: **KPS-2.5-14-MF1-4-MP**

SENSORS, LOCK ON EXTEND (-1)



For Lock-On-Extend cylinders the sensor closest to the rod end, also called the "front or forward sensor" senses the lock itself and can only be activated when the rod is fully extended and the lock is engaged. As the cylinder cannot lock until in the fully extended position, the front sensor acts as both a lock verification sensor and extended verification sensor.

The sensor closest to the opposite end (blind end), also called the "rear or back sensor" senses the piston and can only be activated when the Lock-On-Extend cylinder is in the fully retracted position.

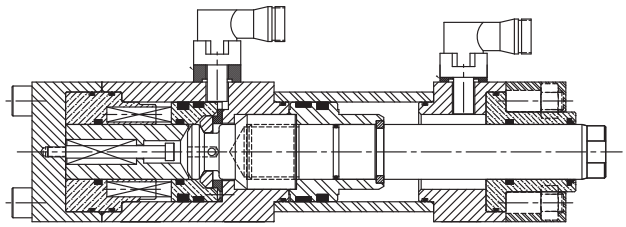


The sensor locations can be in any of four locations around the outside of the cylinder, but cannot be co-located with a cushion adjustment (cushion location), port location, or mount location (if applicable). Positions are noted as front location then rear location, and then quadrant clockwise from the top position 1 when looking down the rod toward the cylinder. For a Lock-On-Extend cylinder with Lock sensor only, specify "S" for "Sensor" then position 1,2,3, or 4 for location on the front, and then 0 for the rear location, where zero stands for none. Typically we recommend to stay with the default recommendations of Ports in position 1, Cushions in position 2, and Sensors in Positon 4. For example P11-C22-S44. (See page 9).

EXAMPLES FOR LOCK-ON-EXTEND SENSORS:

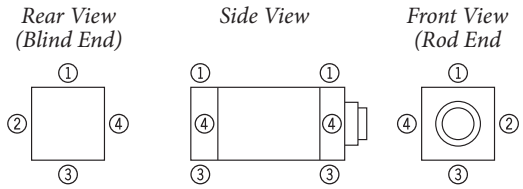
Front Locking Sensor Only: SX0 S10, S20, S30, S40
Rear Position Sensor Only: S0X S01, S02, S03, S04
Both Sensors: S11, S12, S13, S14, S21, S22, …. S44

SENSORS, LOCK ON RETRACT (-2)



For Lock-On-Retract cylinders the sensor on the blind end (farthest from the rod end), also called the "rear or back sensor", senses the lock itself and can only be activated when the rod is fully retracted and the lock is engaged. As the cylinder cannot lock until in the fully retracted position, the rear sensor acts as both a lock verification sensor and retract verification sensor.

The sensor closest to the rod end, also called the "front or forward sensor" senses the piston and can only be activated when the Lock-On-Retract cylinder is in the fully extended position.

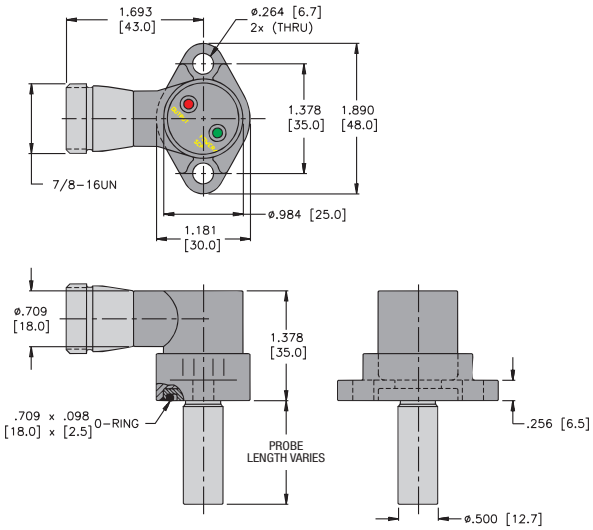


The sensor locations can be in any of four locations around the outside of the cylinder, but cannot be co-located with a cushion adjustment (cushion location), port location, or mount location (if applicable). Positions are noted as front location then rear location, and then quadrant clockwise from the top position 1 when looking down the rod toward the cylinder. For a Lock-On-Retract cylinder with Lock sensor only, specify "S" for "Sensor" then 0 for the front location, where zero stands for none, and then position 1,2,3, or 4 for location on the rear. Typically we recommend to stay with the default recommendations of Ports in position 1, Cushions in position 2, and Sensors in Positon 4. For example P11-C22-S44 (See page 13).

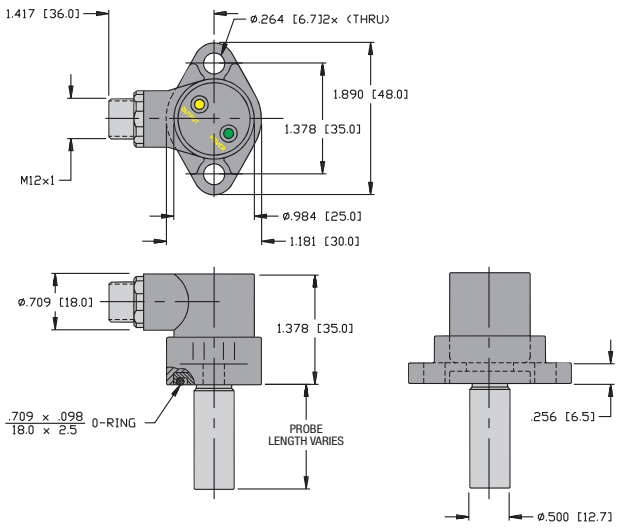
EXAMPLES FOR LOCK-ON-RETRACT SENSORS:

Front Position Sensor Only: SX0 S10, S20, S30, S40
Rear Locking Sensor Only: S0X S01, S02, S03, S04
Both Sensors: S11, S12, S13, S14, S21, S22, …. S44

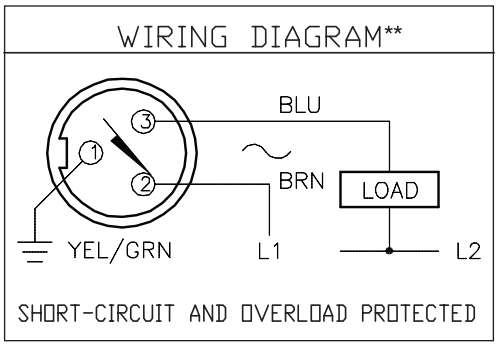
AC SENSOR (-XAC)

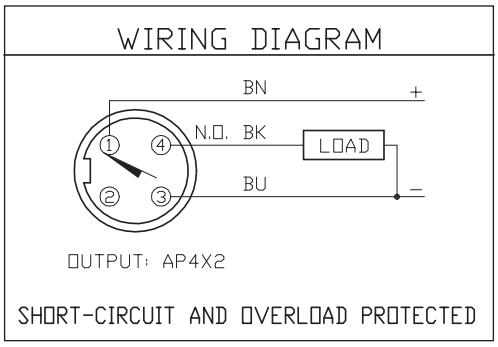


DC SENSORS (-PNP)



Sensors shown are generally typical. Various similar sensors may be installed from several manufacturers with similar functions. Consult PFA for specific sensor dimensions in production at time of order.





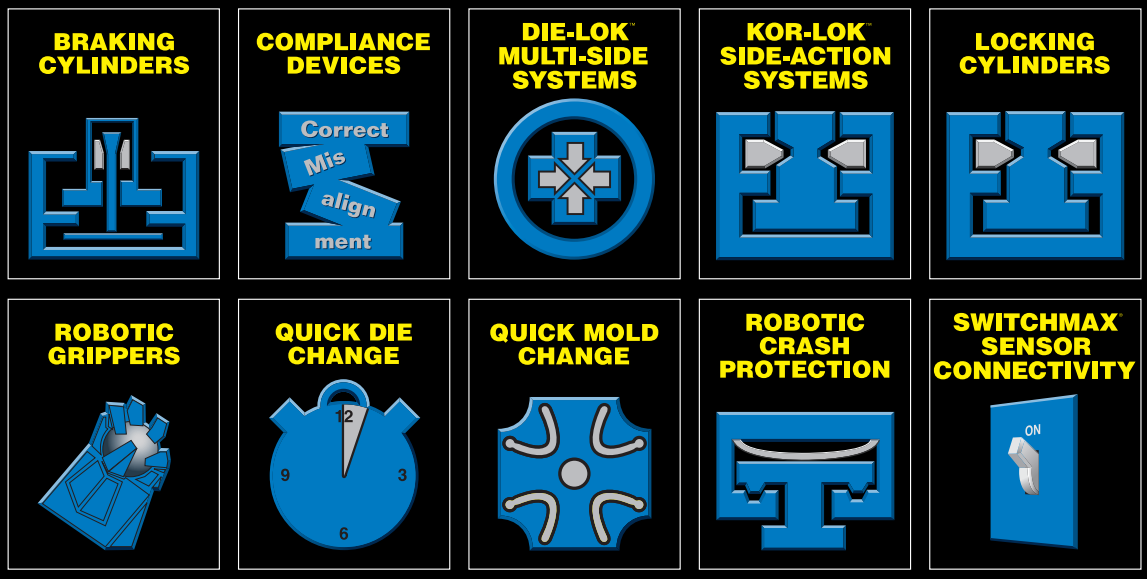
SPECIFICATIONS

Operating Voltage	20-250 VAC/DC
Voltage Drop	< 6 V at 400 mA
Output	Normally Open 2-Wire
Operating Temperature	-13°F to +158°F
LED	Green is Power On Red is Output On
Pressure	1500 PSI (max app. 3000 psi)
Connector Type	7/8"-16 Mini Style – Male – 3 pin
Alternate Wire Colors Depending on Standard	Pin 1 GRN Pin 2 BLK Pin 3 WHT

SPECIFICATIONS

Operating Voltage	10 – 65 V DC
Voltage Drop	2 V at 200 mA
Output	Normally Open 3-Wire
Operating Temperature	-13°F to +167°F
LED	Green is Power On Yellow is Output On
Pressure	1500 PSI (max app. 3000 psi)
Connector Type	M12x1 Euro/Micro Style – Male – 4 pin

Note: AC sensors may be used for DC Loads such as coils, but are not functional in DC PLC or control circuit applications. DC sensors are generally recommended for PLC applications. PNP style are typically used with NPN available for some legacy applications. Contact PFA for details.



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