



### Contents

Features .....	124	LDT & LRT Specifications.....	125
Valve Footprint & Manifold Position Options .....	125	How to Order PHX Series Cylinders.....	126

**B**

PL-2

PH-2

PH-3

**PHX**

SHM

CHE/CHD

## Schrader Bellows Series PHX Electrohydraulic Actuators

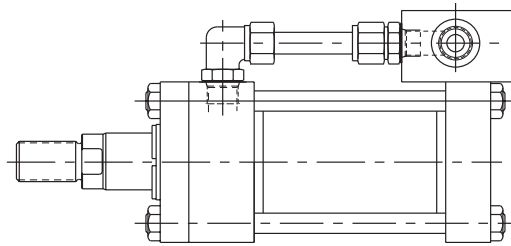
Schrader Bellows Series PHX actuators can be customized to meet your exact specifications for NFPA interchangeable hydraulic cylinders with valve manifolds, integral feedback devices, or both!

Schrader Bellows Series PHX actuators combine the rugged Schrader Bellows PH-2 Series cylinders with the following:

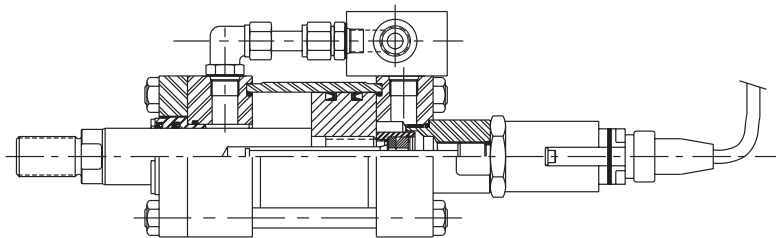
- Bolt-on or Integral Manifolds for direct-mounted Servo, Proportional or Industrial NFPA Hydraulic Valves. A custom steel transfer tube is provided between the valve manifold and the opposite cylinder end cap.
- Linear Displacement Transducer (LDT) or Linear Resistance Transducer (LRT) provide precise digital or analog position (or velocity) feedback.

Series PHX Linear Actuators are specifically designed to meet today's demand for readily available, low cost linear actuators. With the industry's broadest range of standard manifold and feedback options, we are ready to meet your most challenging control application.

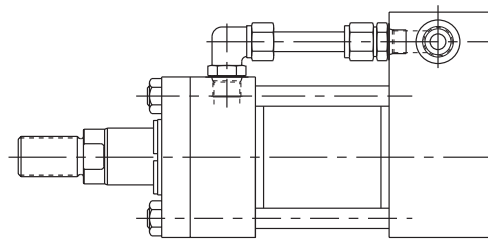
PHX with Bolt-On Manifold



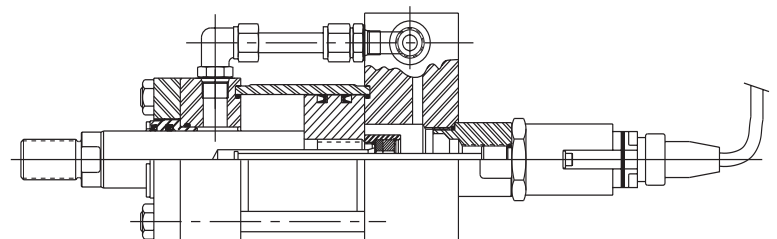
PHX with Bolt-On Manifold and LDT



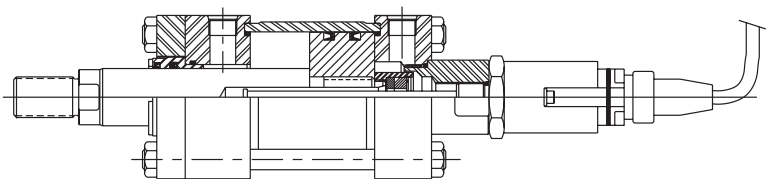
PHX with Integral Manifold



PHX with Integral Manifold and LDT



PHX with LDT Feedback Only



**Table A – Standard Valve Footprint Options**

Group	Valve Footprint Pattern	Bolt-On Manifold Available Bores	Integral Manifold Available Bores
Group A	Servo (see "Group A" at right)	2" through 8"	2" through 5"
Group D	Servo (see "Group D" at right)	3.25" through 8"	2" through 5"
Group G	NFPA D03	2" through 8"	2" through 5"
Group H	NFPA D05	2" through 8"	2" through 5"
Group J	NFPA D06	6" through 8"	not available
Group K	NFPA D07	6" through 8"	not available
Group M	NFPA D08	6" through 8"	not available

**Group A servo patterns**  
 Parker BD15  
 Atchley 215A-XXX  
 Moog Series 62, 73, 760  
 Pegasus M & MP  
 Vickers Series SM4-20-X-X-10

**Group D servo patterns**  
 Parker BD-30  
 Atchley 240-XXX  
 Moog Series 78  
 Pegasus 180L & 180R  
 Vickers Series SM4-40-X-X-10

(Consult factory for mounting and stroke limitations and exclusions)

**Table B – Available Mounting and Manifold Position**

MOUNTING STYLE	DESCRIPTION	BOLT-ON-MANIFOLD MOUNTING POSITION		INTEGRAL MANIFOLD	APPLICABLE FEEDBACK DEVICES
		CAP END <sup>1</sup>	HEAD END <sup>1</sup>	CAP END ONLY	
MX3	Head Tie Rods Extended	1,2,3,4	1,2,3,4	1	LRT and LDT†
MX2	Cap Tie Rods Extended	1,2,3,4	1,2,3,4	N/A	
MX1	Both Ends Tie Rods Extended	1,2,3,4	1,2,3,4	N/A	LRT and LDT
MF1	Head Rectangular Flange	1,2,3,4	CF	1	
MF5	Head Square Flange	1,2,3,4	CF	1	
ME5	Head Rectangular	1,2,3,4	CF	1	
MF2	Cap Rectangular Flange	CF	1,2,3,4	N/A	
MF6	Cap Square Flange	CF	1,2,3,4	N/A	LRT
ME6	Cap Rectangular	CF	1,2,3,4	N/A	
MS2	Side Lug	1	1	1	LRT and LDT††
MS4	Side Tapped	1,2&4 CF	1,2&4 CF	1	LRT and LDT††
MP1*	Cap Fixed Clevis	CF	1,2,3,4	1	
MT1	Head Trunnion	1,2,3,4	1,3	1	LRT and LDT
MT2	Cap Trunnion	1,3	1,2,3,4	N/A	
MT4	Intermediate Fixed Trunnion	1,2,3,4	1,2,3,4	1	
MPU3*	Spherical Bearing	CF	1,2,3,4	1	LRT and LDT††

Note:

\* Overhang of Bolt-On-Manifold may affect mounting and application of cylinder, consult factory.

1 If cylinder has cushions, needle and check valve will be located at standard positions.

† LDT Feedback devices extend beyond the face of the cap and may interfere with cap end mounts.

†† When LDT Feedback devices are selected with cap end mounts a false stage cylinder body is required.

N/A = Not Available.

CF = Consult Factory.

**LDT Specifications – Temposonics GH™**

Input Voltage:

+24Vdc (+20%, -15%) standard

+9 to 23 Vdc optional

Stroke Length: 1 to 120"

Dead Zone: 2.5"

Electronics Enclosure: IP67

Vibration: Complies with IEC 68-2-6

Operating Pressure: 5000 psi

Non-Linearity: ±.02% of stroke or ±.002", whichever is greater.

Repeatability: ±.001% of stroke or ±.0001", whichever is greater

Operating Temperature: -40 to +185° F

Note: LDT comes standard with a DIN 6 style connector and 5' extension cable. If cylinder includes style A protective enclosure, LDT will be supplied with RO Integral Pigtail Cable (5' length).

Adaptor cables are available when replacing cylinders equipped with Temposonics LH™ LDT's. Contact the factory for details.

**LDT Output Options – Temposonics GH™**

The LDT utilizes on-board electronics contained in the sensor head to generate several absolute output options. The required output must be specified at the time of order. In applications where it is desirable to locate the output electronics in a remote location, or where the sensor head is not accessible, and optional Analog Output Module (AOM) is available. The standard outputs for each option are at right:

**LDT Outputs**

- Analog Outputs
  - 0 to 10 Vdc or 10 to 0 Vdc
  - 10 to +10 Vdc or +10 to -10 Vdc
  - 4 to 20 mA or 20 to 4 mA
  - 0 to 20 mA or 20 to 0 mA

- Digital Pulse Outputs
  - PWM
  - Start/Stop

Note: Velocity output or velocity and position output requires use of an AOM.

**LRT Specifications**

Non-Linearity – Less than 0.1% of full scale up to 48" stroke. Less than 1.0% of full scale over 48" stroke.

Repeatability – .001 inch

Input Voltage – Nominal 5-50 Vdc

Operating Temperature Range – -40°F to +160°F

Cylinder Stroke Length – Up to 120"

Electrical Connector – Brad Harrison 3-pin mini connector interface at position #4 standard.

Total Resistance – 800Ω per inch of stroke (±20%) + end resistance.

End Resistance – 800Ω

Maximum Velocity – 30 inches per second

Life Expectancy – Greater than 50 x 10<sup>6</sup> cycles (Based on 1" stroke @10 ips)

Fluid Medium – Petroleum based hydraulic fluids. May not be used with water based or high water content fluids.

End Voltage Loss – (V source) x (400/stroke x 800)

Power Dissipation – supply voltage squared, divided by the total resistance.

The LRT requires a high impedance interface greater than 100K ohms. A maximum of 1 microamp should be required from the LRT.

**How to Order**

Schrader Series PHX cylinders can be completely described by a model number consisting of coded symbols of digits and letters used in a prescribed sequence. To develop a model number, select only those symbols that represent the cylinder required, and place them in the sequence indicated by the tables below. For additional cylinder specifications and dimensions see Schrader PH-2 Series cylinder catalog.

When a Series PHX actuator is ordered the following information must be developed.

- 1) The basic actuator model number including PHX under Series as shown in Table 1 below.
- 2) If a rod extension is required, specify rod end thread Style 0.
- 3) A five digit code describing the valve and feedback type if any, and the supplier.
- 4) If an actuator is to accept a D03, D05, D06, D07, or D08 pattern valve no additional information is necessary. If an actuator is to accept a servo valve, a manufacturer and model number should be supplied below the five digit code.
- 5) If a cylinder is to include a feedback device the following information must be called out below the five digit code:

**Linear Displacement Transducer (LDT)**

Analog Position

- 1) Position Output Signal and connection type (DIN 6, RO)
- 2) Electrical Cable Length (from probe if integral cable)
- 3) Cable Length to AOM (if AOM specified)

Analog Position and Velocity

- 1) Position Output Signal
- 2) Velocity Output Signal and maximum piston velocity for calibration in inches per second
- 3) Electrical Cable Length to AOM

Digital Position

- 1) Specify Pulse Duration Output only (Specify Internal or External Interrogation and the number of circulations)  
Pulse Duration Output and Counter Card (Specify Output: 16 Bit, 18 Bit, BCD or Scaled)
- 2) Data Ready Line
- 3) Update Time

**Linear Potentiometer (LRT)**

- 1) Electrical connector position 1-4 cap end
- 2) Consult factory for dimensional information

**Other Feedback Device**

- 1) Device Type, Manufacturer, and Model Number
- 2) Output Signal

**Integral Manifold Option**

The integral manifold option is only available with the Schrader Series PHX 2" through 5" bores. All integral manifolds are available at the cap end position #1 only. For special integral manifolds — consult factory.

**Bolt-On Manifold Option**

The bolt-on manifold option is available with Schrader Series PHX. Manifolds may be located on either the head or cap end at any position that does not interfere with mounting.

**Feedback Option**

Schrader Series PHX actuators may be ordered prepared for a feedback device or prepared for and supplied with a feedback device. The LRT option may only be ordered installed at the factory. See the ordering code on the opposite page. Schrader standard LDT option is a Temposonics™ GH position sensor. To specify another manufacturer's magneto-restrictive position sensor place an "S" in the cylinder model code and specify the manufacturer's name and model number. Schrader will install any other type and brand of feedback specified by the customer as long as it is reasonably designed to fit into an NFPA type cylinder — consult factory.

<b>1</b>	<b>Model Number</b>					
	<b>PH-2 Series Hydraulic</b>					
Single End - SAE Ports	PHX					
<b>2</b>	<b>Model Number Code</b>					
<b>Bore Size</b>	<b>Rod Dia.</b>	<b>Model Code</b>	<b>Bore Size</b>	<b>Rod Dia.</b>	<b>Model Code</b>	
2"	1"	BA1	4	1 3/4"	EA3	
	1 3/8"	BA2		2"	EA4	
				2 1/2"	EA5	
2 1/2"	1"	CA1	5"	2"	FA4	
	1 3/8"	CA2		2 1/2"	FA5	
	1 3/4"	CA3		3 1/2"	FA7	
3 1/4"	1 3/8"	DA2	6"	2 1/2"	GA5	
	1 3/4"	DA3		3 1/2"	GA7	
	2"	DA4		4"	GA8	
			8"	3 1/2"	JA7	
				4"	JA8	
				5 1/2"	JD2	

<b>3</b>	<b>Model Number Code</b>					
<b>Mounting Style</b>	<b>NFPA Style</b>	<b>Non-Cush.</b>	<b>Cush. Head</b>	<b>Cush. Cap</b>	<b>Cush. Both</b>	
Side Lug	MS2	05	06	07	08	
Head Rectangular Flange	MF1	21	22	23	24	
Cap Rectangular Flange	MF2	25	26	27	28	
Head Square Flange	MF5	29	30	31	32	
Cap Square Flange	MF6	33	34	35	36	
Head Rectangular	ME5	45	46	47	48	
Cap Rectangular	ME6	49	50	51	52	
Tie Rods Extended Cap End	MX2	57	58	59	60	
Tie Rods Extended Head End	MX3	61	62	63	64	
Head Trunnion	MT1	69	70	71	72	
Cap Trunnion	MT2	73	74	75	76	
Intermediate Fixed Trunnion	MT4	77	78	79	80	
Cap Fixed Clevis	MP1	81	82	83	84	
Cap Fixed Universal Clevis	MPU3	89	90	91	92	

<b>4 Rod End Style</b>	<b>Model Number Code</b>
Small Male	2
Short Female	3
Intermediate Male	4
Special Specify	0

<b>5 Seal Type*</b>	<b>Model Number Code</b>
Buna N Seals	1
Fluorocarbon Seals	2
Buna N Seals w/Piston Rings	3
Fluorocarbon Seals w/Piston Rings	4

<b>6 Specify Stroke Length</b>	6.00"
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**Valve and Feedback Codes (Required for PHX Ordering)**

\* Bolt-On Manifolds will be located at position #1 on cap end unless an "S" is placed in the cylinder model code and the mounting position is indicated. Bolt-On Manifolds may be positioned on either the head or cap end at any location not occupied by a mount or port or cushion.  
 \*\* Integral Manifolds are only available at cap end position #1.  
 \*\*\*When selecting "other" an "S" must be placed in the model code and the valve or feedback device must be specified by the customer.  
 † Valve patterns D06 (Group J), D07 (Group K), and D08 (Group M) are only available as Bolt-On Manifolds. Consult factory for MT4 Mounts.  
 ‡ Consult Factory for Servo Valve mounting pattern descriptions.

<b>Manifold</b> N = None B = Bolt-On* I = Integral**	<b>Valve Pattern</b> N = Not applicable A = Servo (Group A)†† D = Servo (Group D)†† G = D03 (Group G) H = D05 (Group H) J = D06 (Group J)† K = D07 (Group K)† M = D08 (Group M)† X = Other (Please Specify)***	<b>Valve Location</b> N = Not Applicable H = Head C = Cap	<b>Feedback Option</b> N = None C = LDT• F = LRT•• X = Other (Please specify)***	<b>Feedback Furnished</b> N = Not Applicable 1 = By Customer 2 = By Factory	<b>Feedback Furnished Enclosures</b> N = Not Applicable A = False Stage D = Light Duty F = Medium Duty
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• When an LDT is to be supplied by the customer, Schrader prepares the actuator with an SAE port, magnet, and gun drilled to accept a 2.5" dead zone LDT.  
 •• LRTs can only be installed by Schrader at the factory. Electrical connector will be at position #4 standard.