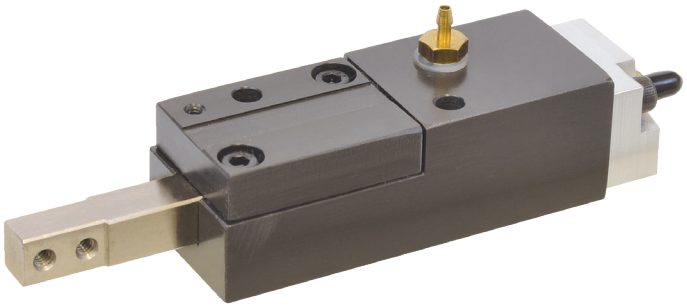
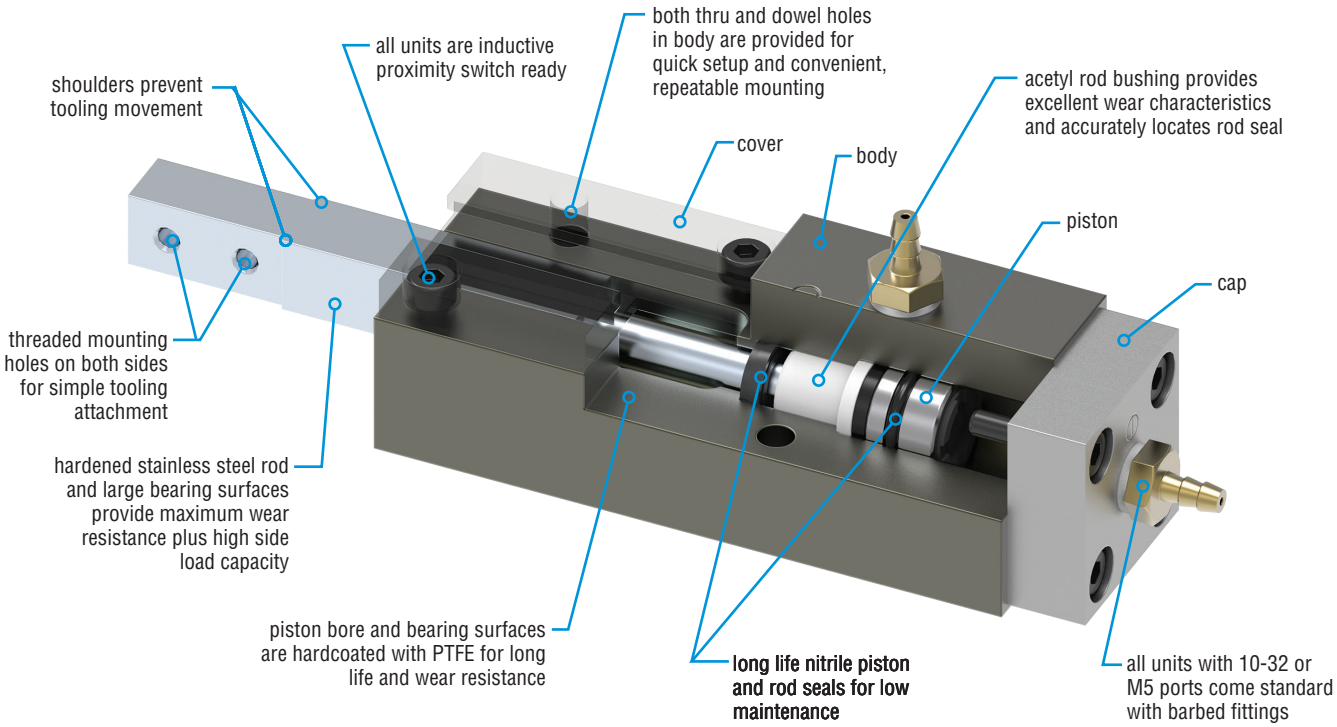
LC



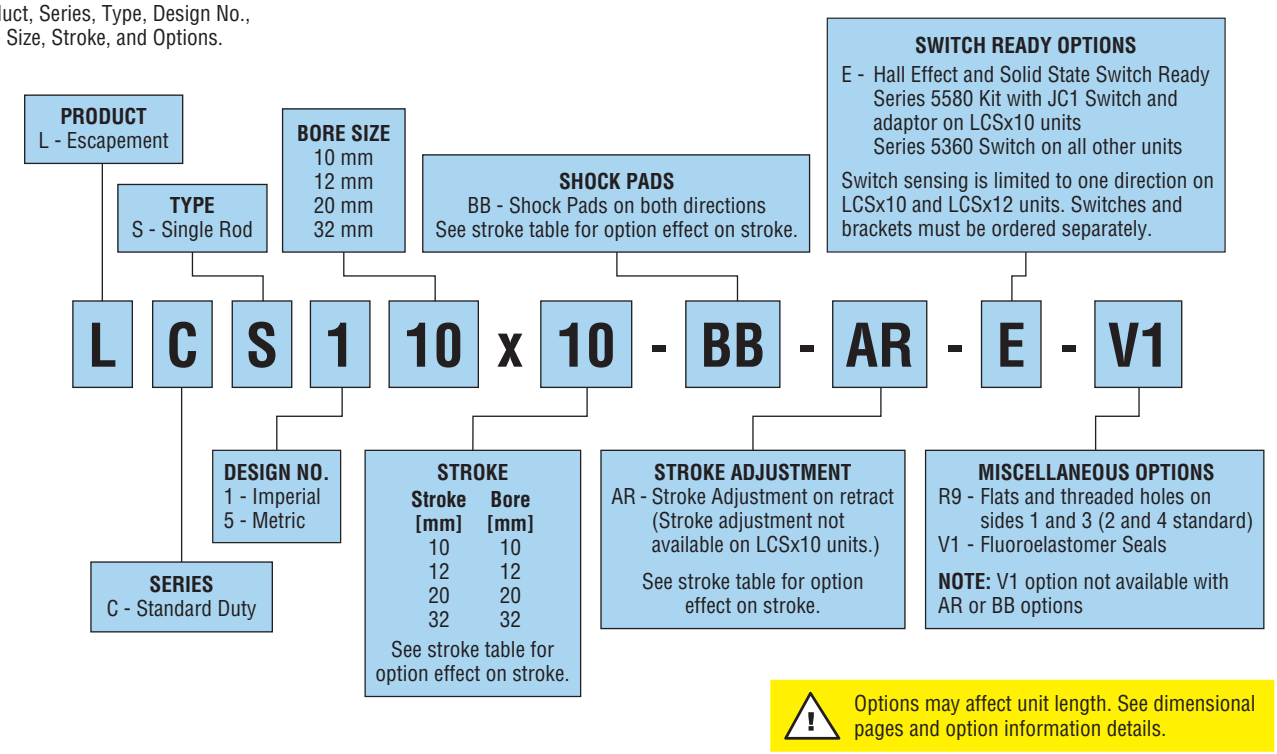
Major Benefits

- Ideal for shot pin applications
- Shock pad options reduce noise and minimize end of stroke shock
- Imperial or metric versions available
- Simple construction for easy field maintenance
- Large rod bearing area ensures high side load capacity



ORDERING DATA: Series LC Escapements

TO ORDER SPECIFY:
Product, Series, Type, Design No., Bore Size, Stroke, and Options.



Options may affect unit length. See dimensional pages and option information details.

4 mm ROUND INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18430-001-02	NPN (Sink) 2 meter cable
18430-002-02	PNP (Source) 2 meter cable

6 mm SQUARE INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18431-001-02	NPN (Sink) 2 meter cable
18431-002-02	PNP (Source) 2 meter cable

PROXIMITY SWITCH MOUNTING KITS

KIT NO.	PROXIMITY SWITCH
57879	4 mm Round Inductive
57880	6 mm Square Inductive

Each proximity switch mounting kit contains: 1 switch bracket and 1 bracket mounting screw

SERIES 5360 HALL EFFECT SWITCHES

PART NO.	COLOR	DESCRIPTION
53603-1-02	Yellow	NPN (Sink) 4.5-24 VDC, 2 meter cable
53604-1-02	Red	PNP (Source) 4.5-24 VDC, 2 meter cable
53623-1	Yellow	NPN (Sink) 4.5-24 VDC, Quick Connect
53624-1	Red	PNP (Source) 4.5-24 VDC, Quick Connect

5580 SWITCH REPLACEMENT CHART

SWITCH KIT NUMBER	REPLACEMENT KIT INCLUDES	JC1 SWITCH DESCRIPTION
55803-1-02	JC1HDN-5 switch with adaptor	NPN (Sink), Radial Sensing, 5 meter cable
55823-1	JC1HDN-K switch with adaptor	NPN (Sink), Radial Sensing, Quick Connect
55804-1-02	JC1HDP-5 switch with adaptor	PNP (Source), Radial Sensing, 5 meter cable
55824-1	JC1HDP-K switch with adaptor	PNP (Source), Radial Sensing, Quick Connect

See 5580 catalog page for additional information.

CORDSETS

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable

Cordsets are ordered separately.

CAD & Sizing Assistance

Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

SPECIFICATIONS	SERIES LC
OPERATING PRESSURE	20 psi min to 150 psi max [1.4 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]
STANDARD TOLERANCE	+0.031/-0.000 [+0.8/-0.0]
RATED LIFE	5 million cycles*
VELOCITY	20 in/sec [0.5 m/sec] typical min, zero load at 100 psi [7 bar]
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

*-V1 option may reduce life.

MODEL NO.	BORE		ROD DIRECTION	EFFECTIVE AREA		WEIGHT TABLE			
						STANDARD		STROKE ADJUSTMENT	
	in	mm		in^2	mm^2	lb	kg	lb	kg
LCSx10	0.394	10	EXTEND RETRACT	0.122 0.094	78.5 60.5	0.22	0.1	—	—
LCSx12	0.472	12	EXTEND RETRACT	0.175 0.126	112.6 81.1	0.45	0.21	0.51	0.24
LCSx20	0.787	20	EXTEND RETRACT	0.487 0.410	313.4 263.8	0.90	0.42	1.1	0.51
LCSx32	1.260	32	EXTEND RETRACT	1.247 1.050	802.4 675.6	2.80	1.3	3.4	1.6

CYLINDER THRUST CALCULATIONS

	Imperial F = P x A	Metric F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in^2	mm^2

STROKE TABLE

OPTION	LCSx10	LCSx12	LCSx20	LCSx32
STANDARD UNIT	0.394 [10]	0.472 [12]	0.787 [20]	1.26 [32]
SHOCK PAD (-BB)	0.354 [9]	0.433 [11]	0.787 [20]	1.26 [32]
STROKE ADJ (-AR)	—	0.413 [10.5]	0.728 [18.5]	1.20 [30.5]
-AR -BB	—	0.374 [9.5]	0.728 [18.5]	1.20 [30.5]

FOUR MAJOR FACTORS TO CONSIDER WHEN SELECTING AN ESCAPEMENT:

1 **RESPONSE TIME (T) -** The time it takes to extend or retract the piston rod.

2 **MAXIMUM ROD TORQUE -** Torque applied to the rod by off-center parts and tooling.

3 **STATIC SIDE LOAD (Q) -** Constant load on the rod applied by the parts being held back.

4 **IMPACT LOAD (F) -** The load applied to the rod when a part or stack of parts impacts dynamically on the rod tooling or additional parts are added dynamically to an existing stack.

1 RESPONSE TIME

Following is a reference guide to response times of the piston rod for extend and retract based on a typical load at 87 psi [6 bar]. The response time for rod extension will be less than the response time for retraction. Varying the operating pressure, air line diameter, and the applied load will affect the response time. Response times shown do not include valve response time.

MODEL NO.	TYPICAL LOAD		RETRACT TIME	EXTEND TIME
	lb	kg	sec	sec
LCSx10	1	0.45	0.03	0.02
LCSx12	2	0.91	0.04	0.03
LCSx20	5	2.3	0.06	0.04
LCSx32	10	4.5	0.08	0.06

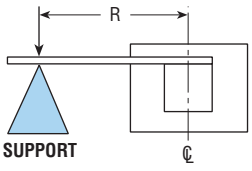
2 MAXIMUM ROD TORQUE

MODEL NO.	STANDARD DUTY	
	in-lb	Nm
LCSx10	1.2	0.14
LCSx12	2.0	0.25
LCSx20	5.0	0.6
LCSx32	9.0	1.1

For applications which exceed the maximum allowable rod torque, the tooling should be supported as shown.

Calculation without the support:
Max. Rod Load Torque = (Load) x R

MAX. ROD LOAD TORQUE = (LOAD) x R



*Support if torque exceeds maximum

Application & Sizing Assistance

Use PHD's free online Product Sizing and Application at **www.phdinc.com/apps/sizing**

SYMBOL DEFINITIONS

L - Distance from face of escapement to centerline of parts in inches [mm]
N - Number of parts backed up
For correct sizing calculation results, always divide "N" by the number of escapements that may be used. This must be done PRIOR to using "N" in a sizing calculation.
f - Friction coefficient between the conveyor belt and the part (use 0.5 [0.5] if unknown)
P - Working pressure in psi [bar]
R - Offset distance between the rod centerline and the load which applies a moment to the rod.
Q - Maximum side load factor value the rod can support and still cycle (assumes zero friction between tooling and part)
V - Conveyor belt velocity in inches/sec [mm/sec]
W - Weight of each part in lb [N]

NOTE: W = 9.8 (mass in kg)

CONSTANTS FOR USE IN PERFORMANCE CALCULATIONS

EQUATION	IMPERIAL					METRIC				
	CONSTANT	LCS110	LCS112	LCS120	LCS132	CONSTANT	LCS510	LCS512	LCS520	LCS532
STATIC LOAD	Q at 40 psi	1.74	3.5	10.4	52.2	Q at 3 bar	195	392	1160	5846
	Q at 60 psi	5.2	10.4	31.3	156.6	Q at 4 bar	582	1160	3500	17540
	Q at 80 psi	10.4	20.9	62.6	313.2	Q at 6 bar	1165	2340	7000	35080
	Q at 100 psi	15.7	31.3	94.0	469.8	Q at 7 bar	1758	3500	10500	52620
	A	0.311	0.392	0.507	0.802	A	7.9	10	12.9	20.4
	B	2.76	2.17	2.10	1.88	B	2.76	2.17	2.10	1.88
IMPACT LOAD	C	0.611	0.813	1.135	2.01	C	10.2	20.6	28.8	51.1
	D	0.0122	0.0217	0.0537	0.369	D	200	356	879	6050
	E	40200	80400	307000	2360000	E	1.165 E8	2.31 E8	8.81 E8	67.7 E8
	F	3440	3440	3440	3440	F	23.7	23.7	23.7	23.7
	G	52	104	397	3050	G	5940	11750	44900	345000

NOTE: A, B, C, D, E, F, and G are empirical numbers determined through testing.

HORIZONTAL TRANSFER

3 STATIC LOAD

$$(f\,N\,W)\,[\,L + A + (B \times R)\,] \le Q$$

4 IMPACT LOAD

From the stack of parts transferring from one rod to the other.

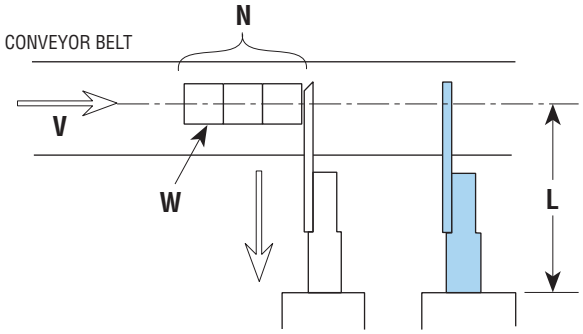
$$\frac{(N\,W)\,(L - C)}{D}\left[\sqrt{G\,\frac{V^2}{L^3\,N\,W}}\right] \le F$$

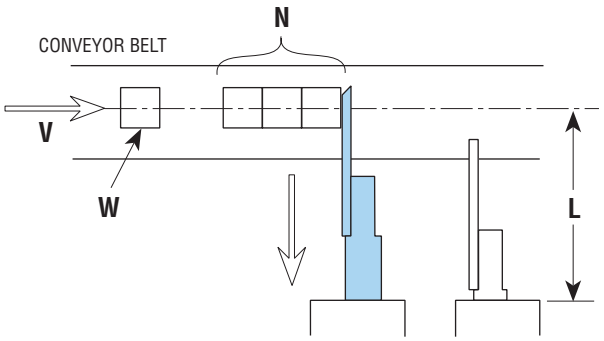
4 IMPACT LOAD

From additional part or parts being added onto the stack.

$$\frac{W\,(L - C)}{D}\left[Nf + \sqrt{G\,\frac{V^2}{L^3\,W}}\right] \le F$$

Note: If the above equations do not yield an acceptable answer, either choose a larger escapement, shorten the "L" dimension, decrease the number of parts in the stack "N", or decrease the velocity "V".





VERTICAL TRANSFER

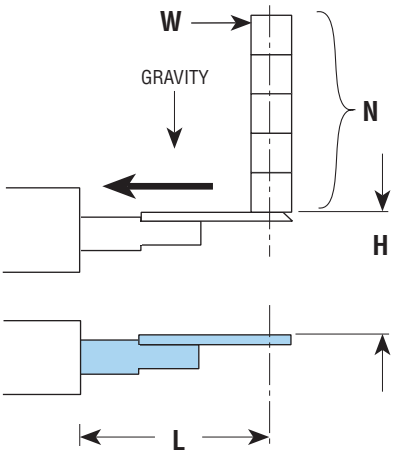
Example below shows two units being used to sequence parts.

STATIC LOAD

$$(f\ N\ W) [L + A + (B \times R)] \leq Q$$

IMPACT LOAD - From the stack of parts transferring from the top unit to the bottom unit.

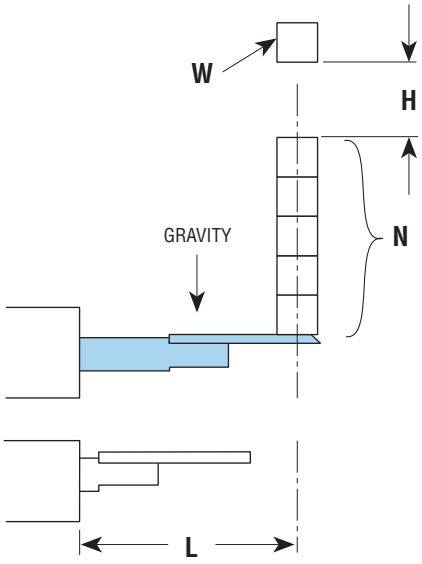
$$\frac{(N\ W) (L - C)}{D} \left[\sqrt{E \frac{H}{L^3\ N\ W}} \right] \leq F$$



IMPACT LOAD - From additional part or parts being added onto the stack.

$$\frac{W (L - C)}{D} \left[N + \sqrt{E \frac{H}{L^3\ W}} \right] \leq F$$

NOTE: If the above equations do not yield an acceptable answer, either choose a larger escapement, shorten the "L" dimension, decrease the number of parts in the stack "N", or decrease the distance "H".



EXAMPLE - Vertical Transfer

Model = LCSx12
A = 0.392 [10] B = 2.17 [2.17] C = 0.813 [20.6] D = 0.0217 [356] E = 80400 [2.31 E8] F = 3440 [23.7]
H = 0.5 in [13 mm] L = 2 in [50 mm] N = 15 Q = 20.9 at 80 psi [2340 at 6 bar] R = 0 W = 0.03 lb [0.13 N]

3 STATIC LOAD

IMPERIAL

$$(N\ W) [L + A + (B \times R)] \leq Q$$

$$(15 \times 0.03) [2 + 0.392 + (2.17 \times 0)] \leq 20.9$$

$$1.1 \leq 20.9$$

METRIC

$$(N\ W) [L + A + (B \times R)] \leq Q$$

$$(15 \times 0.13) [50 + 10 + (2.17 \times 0)] \leq 2340$$

$$117 \leq 2340$$

Therefore the Static Load is acceptable.

4 IMPACT LOAD

IMPERIAL

$$\frac{(N\ W) (L - C)}{D} \left[\sqrt{E \frac{H}{L^3\ N\ W}} \right] \leq F$$

$$\frac{(15 \times 0.03) (2 - 0.81)}{0.0217} \left[\sqrt{80400 \times \frac{0.5}{2^3 \times 15 \times 0.03}} \right] \leq 3440$$

$$2608 \leq 3440$$

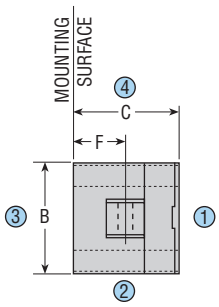
METRIC

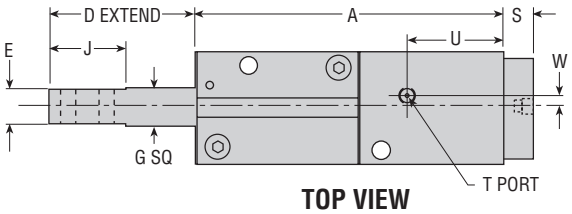
$$\frac{(N\ W) (L - C)}{D} \left[\sqrt{E \frac{H}{L^3\ N\ W}} \right] \leq F$$

$$\frac{(15 \times 0.13) (50 - 20)}{356} \left[\sqrt{2.31\ E8 \times \frac{13}{50^3 \times 15 \times 0.13}} \right] \leq 23.7$$

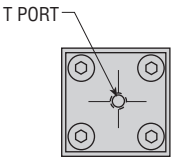
$$18.2 \leq 23.7$$

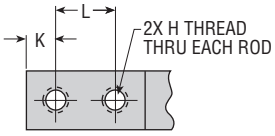
Therefore the Impact Load is acceptable.



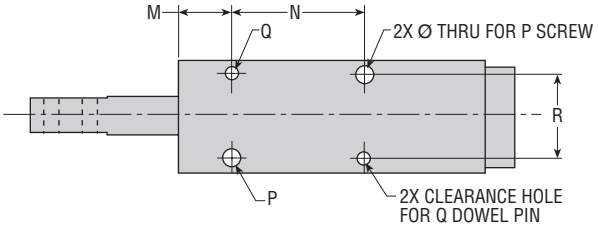


TOP VIEW

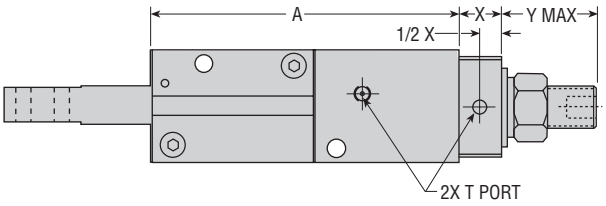


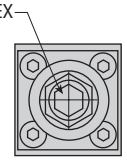


ROD MOUNTING DETAIL



BOTTOM VIEW





TOP VIEW WITH OPTIONAL STROKE ADJUSTMENT

(Not available on LCSx10 units)

LETTER DIM.	IMPERIAL MODEL NO.				METRIC MODEL NO.			
	LCS110x10	LCS112x12	LCS120x20	LCS132x32	LCS510x10	LCS512x12	LCS520x20	LCS532x32
PHD BORE	0.394	0.472	0.787	1.260	10 mm	12 mm	20 mm	32 mm
A	2.480	3.012	3.937	6.142	63.0	76.5	100.0	156.0
B	0.964	1.082	1.417	1.850	24.5	27.5	36.0	47.0
C	0.807	1.024	1.339	1.811	20.5	26.0	34.0	46.0
D	1.043	1.358	1.890	3.406	26.5	34.5	48.0	86.5
E	0.259	0.310	0.435	0.768	6.6	7.9	11.0	19.5
F	0.354	0.512	0.668	0.904	9.0	13.0	17.0	23.0
G	0.300	0.364	0.490	0.860	7.6	9.2	12.4	21.8
H	4-40 UNC	6-32 UNC	10-32 UNC	5/16-18 UNC	M3 x 0.5	M3 x 0.5	M5 x 0.8	M8 x 1.25
J	0.500	0.750	1.000	2.000	12.7	19.0	25.4	50.8
K	0.125	0.187	0.250	0.500	3.2	4.7	6.4	12.7
L	0.250	0.375	0.500	0.875	6.4	9.5	12.7	22.2
M	0.512	0.512	0.669	1.004	13.0	13.0	17.0	25.5
N	0.984	1.339	1.713	2.874	25.0	34.0	43.5	73.0
P	#6	#6	#10	5/16	M3	M3	M5	M8
Q	3 mm	3 mm	4 mm	5 mm	3 mm	3 mm	4 mm	5 mm
R	0.591	0.748	1.063	1.338	15.0	19.0	27.0	34.0
S	0.374	0.374	0.374	0.472	9.5	9.5	9.5	12.0
T	10-32 THD	10-32 THD	10-32 THD	1/8 NPT	M5 x 0.8	M5 x 0.8	M5 x 0.8	1/8 BSP
U	0.767	0.787	1.220	1.792	19.5	20.0	31.0	45.5
W	0.157	0.157	0.157	0.472	4.0	4.0	4.0	12.0
X	—	0.552	0.552	0.827	—	14.0	14.0	21.0
Y	—	0.787	1.26	1.831	—	20.0	32.0	46.5
Z	—	4 mm	6 mm	8 mm	—	4 mm	6 mm	8 mm

NOTES:
1) METRIC DIMENSIONS ARE IN mm.
2) ALL DIMENSIONS ARE ABOUT THE CENTERLINE UNLESS OTHERWISE SPECIFIED.

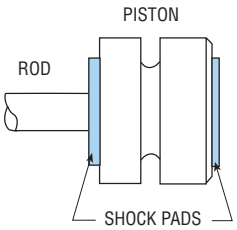
CAD & Sizing Assistance

Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

All dimensions are reference only unless specifically toleranced.

BB SHOCK PADS INSTALLED ON BOTH DIRECTIONS

Polyurethane shock pads for noise reduction and absorption of shock at ends of stroke are available on each end of Series LC Escapements. Shock pads permit higher piston velocities for shorter cycle times. Noise reduction is beneficial for the working environment.

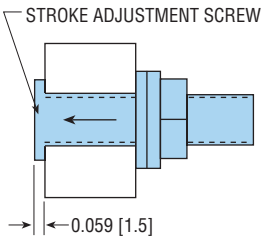


NOTE: Shock pads reduce standard stroke by 0.039 [1 mm] on LCSx10 and LCSx12 units.

AR STROKE ADJUSTMENT ON RETRACT

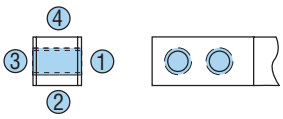
Stroke adjustment screws can be set for precise adjustment of the retracted position from 0" to full stroke. Stroke adjustment option reduces the standard stroke by 0.059 [1.5 mm].

NOTE: Not available on LCSx10 unit.



R9 ROD END OPTION

This option specifies flats and threaded holes on sides 1 and 3. Mounting holes and flats on sides 2 and 4 are standard.



E SWITCH READY

Series 5580 on LCSx10 units
Series 5360 on all other units

Switch Ready option includes magnets on the rod for PHD solid state switches. Units are equipped to sense in two directions, both extend and retract. Switches must be ordered separately. **See Switches and Sensors catalog for complete specifications.**

NOTE: LCSx10 and LCSx12 units will sense in one direction only.

SERIES 5580 SWITCH REPLACEMENT CHART

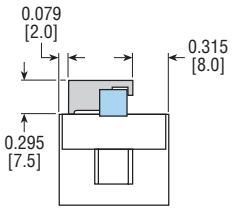
SWITCH KIT NUMBER	REPLACEMENT KIT INCLUDES	JC1 SWITCH DESCRIPTION
55803-1-02	JC1HDN-5 switch with adaptor	NPN (Sink), Radial Sensing, 5 meter cable
55823-1	JC1HDN-K switch with adaptor	NPN (Sink), Radial Sensing, Quick Connect
55804-1-02	JC1HDP-5 switch with adaptor	PNP (Source), Radial Sensing, 5 meter cable
55824-1	JC1HDP-K switch with adaptor	PNP (Source), Radial Sensing, Quick Connect

For additional switch information, go to phdinc.com.

SERIES 5360 HALL EFFECT SWITCHES

PART NO.	COLOR	DESCRIPTION
53603-1-02	Yellow	NPN (Sink) 4.5-24 VDC, 2 meter cable
53604-1-02	Red	PNP (Source) 4.5-24 VDC, 2 meter cable
53623-1	Yellow	NPN (Sink) 4.5-24 VDC, Quick Connect
53624-1	Red	PNP (Source) 4.5-24 VDC, Quick Connect

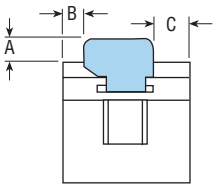
SERIES 5580 HALL EFFECT DIMENSIONS



SWITCH BRACKET KIT NO. 57880
MUST BE ORDERED SEPARATELY.

SERIES 5580 IS AVAILABLE ON LCSx10 UNITS ONLY.

SERIES 5360 HALL EFFECT DIMENSIONS



MODEL NO.	DIM A	DIM B	DIM C
LCSx12	0.322 [8.2]	0.188 [4.8]	0.315 [8.0]
LCSx20	0.177 [4.5]	0.354 [9.0]	0.486 [12.3]
LCSx32	0.217 [5.5]	0.571 [14.5]	0.692 [17.6]

Switch information is continued on next page.
Numbers in [ ] are for metric units and are in mm.

All dimensions are reference only unless specifically toleranced.

INDUCTIVE PROXIMITY SWITCH READY

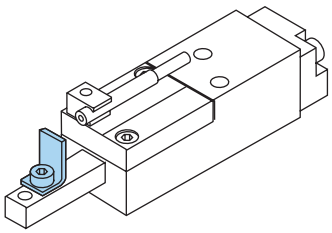
All units are inductive proximity switch ready as standard. A threaded hole is provided in the body cover to allow attachment of PHD bracket kits for 4 mm round or 6 mm square inductive proximity switches. **See Switches and Sensors catalog for complete specifications.**

NOTE: Switch targets mounted on the rod end or on the rod tooling are to be provided by the end user.

PROXIMITY SWITCH MOUNTING KITS

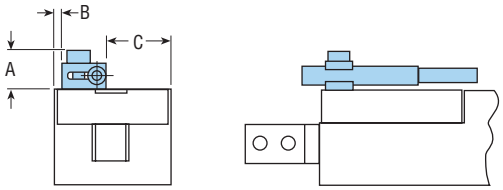
KIT NO.	PROXIMITY SWITCH
57879	4 mm Round Inductive
57880	6 mm Square Inductive

Each proximity switch mounting kit contains: 1 switch bracket and 1 bracket mounting screw

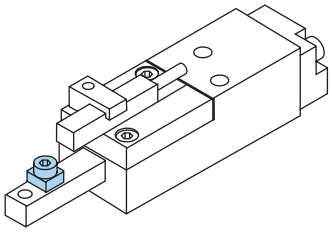


4 mm ROUND INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18430-001-02	NPN (Sink) 2 meter cable
18430-002-02	PNP (Source) 2 meter cable

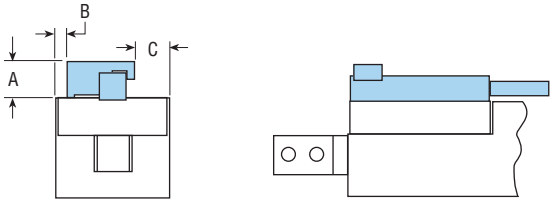


MODEL NO.	DIM A	DIM B	DIM C
LCSx10	0.335 [8.5]	0.059 [1.5]	0.524 [13.3]
LCSx12	0.21 [5.3]	0.118 [3.0]	0.583 [14.8]
LCSx20	0.315 [8.0]	0.283 [7.2]	0.748 [19.0]
LCSx32	0.315 [8.0]	0.500 [12.7]	0.966 [24.5]



6 mm SQUARE INDUCTIVE PROXIMITY SWITCHES

PART NO.	DESCRIPTION
18431-001-02	NPN (Sink) 2 meter cable
18431-002-02	PNP (Source) 2 meter cable



MODEL NO.	DIM A	DIM B	DIM C
LCSx10	0.295 [7.5]	0.079 [2.0]	0.315 [8.0]
LCSx12	0.177 [4.5]	0.138 [3.5]	0.374 [9.5]
LCSx20	0.268 [6.8]	0.305 [7.7]	0.541 [13.7]
LCSx32	0.268 [6.8]	0.522 [13.3]	0.757 [19.2]

All dimensions are reference only unless specifically toleranced.

PHDESCAPE01 9/25 11925

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