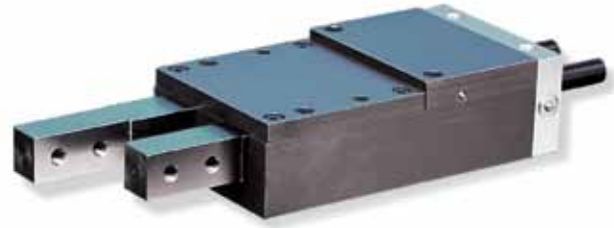


## DOUBLE ROD PNEUMATIC ESCAPEMENT

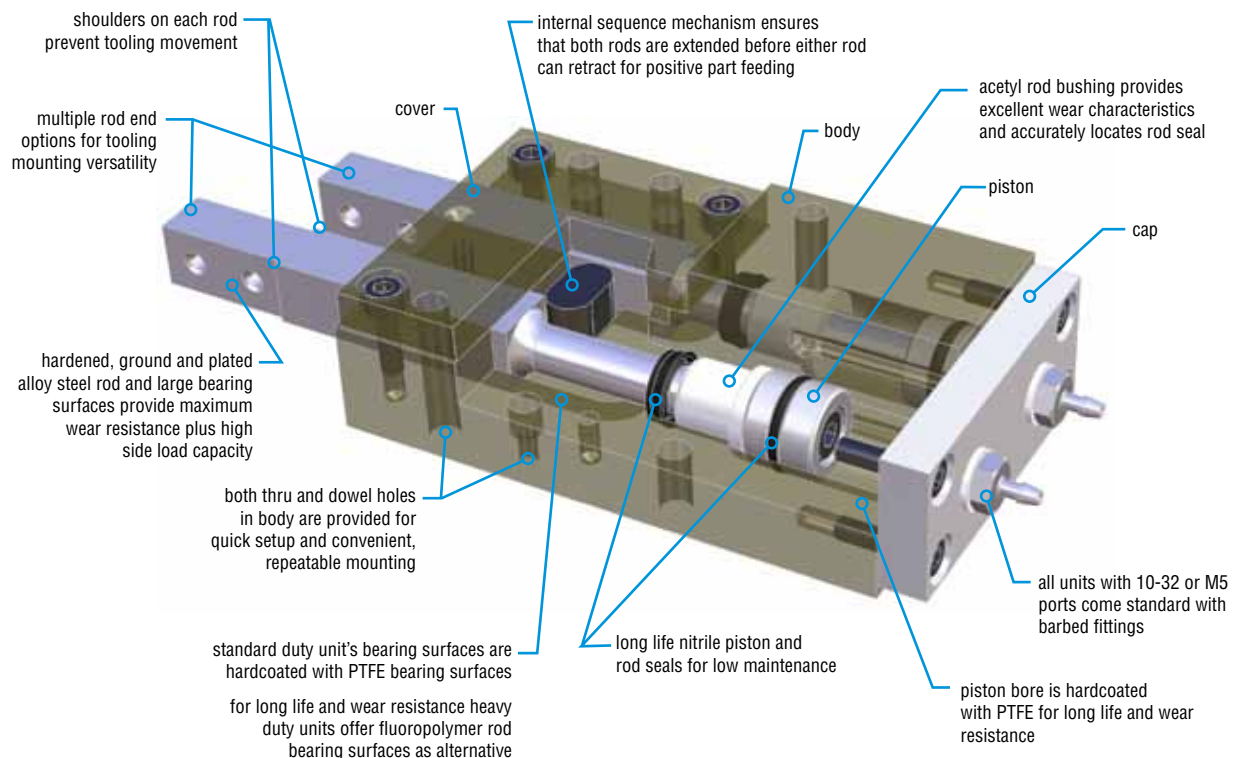
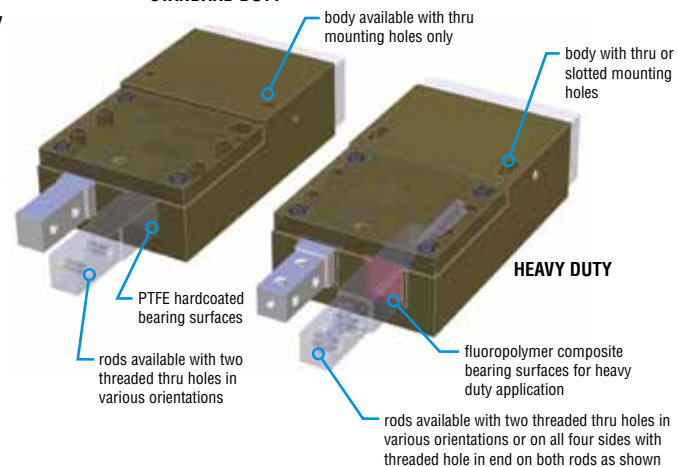


### Major Benefits

- Ideal for isolating and feeding individual parts from vibrating feeders, magazines, hoppers or conveyors
- Internally ported design requires only one 4-way valve for operation offered in standard and heavy duty
- Switch and flow control options
- Large rod bearing area ensures high side load capacity

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#### STANDARD DUTY

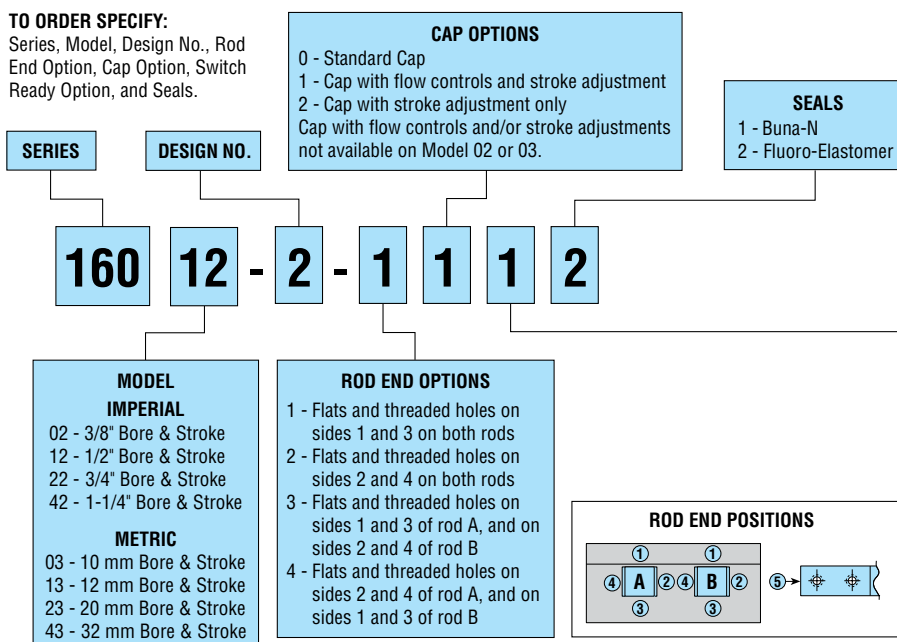


# ORDERING DATA: SERIES 160 DOUBLE ROD ESCAPEMENTS

## STANDARD DUTY

### TO ORDER SPECIFY:

Series, Model, Design No., Rod End Option, Cap Option, Switch Ready Option, and Seals.



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



Refer to this product's online catalog in the product section for complete information including related dimensions and additional specifications. See link at bottom of this page.

### SWITCH READY OPTIONS

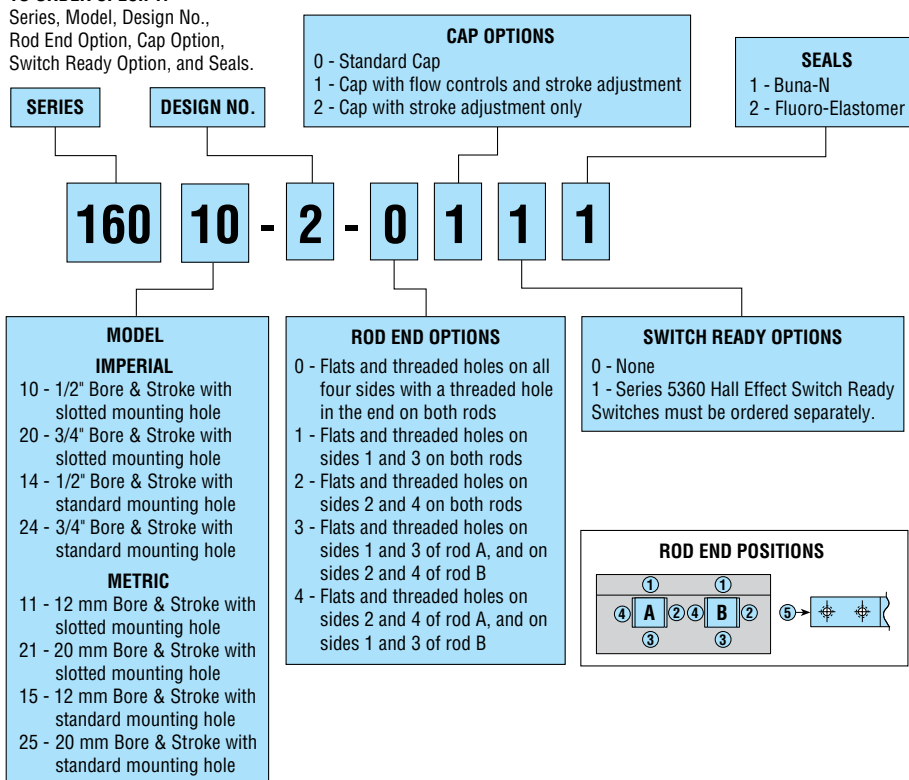
- 0 - None
  - 1 - Series 5360 Hall Effect Switch Ready (Not available on 16002 & 16003 units.)
  - 2\* - 4 mm Round/6 mm Square Inductive Proximity Switch Ready (Available on 16002 & 16003 only.)
- Switches and Mounting Kits (as applicable) must be ordered separately.

**NOTE:** \*Customer to provide target for proximity switch sensing on -2 switch ready option.

## HEAVY DUTY

### TO ORDER SPECIFY:

Series, Model, Design No., Rod End Option, Cap Option, Switch Ready Option, and Seals.



### 4 mm SQUARE

#### 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

### INDUCTIVE SWITCH MOUNTING KITS

PROXIMITY SWITCH	KIT NUMBER
4 mm Round Inductive	57879
6 mm Square Inductive	57880

EACH PROXIMITY SWITCH MOUNTING KIT CONTAINS:  
1 SWITCH BRACKET  
1 BRACKET MOUNTING SCREW

### SERIES 5360 HALL EFFECT SWITCHES

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



### CAD & Sizing Assistance

Use PHD's free online Product Sizing and CAD Configurator at [www.phdinc.com/myphd](http://www.phdinc.com/myphd)

# ENGINEERING DATA: SERIES 160 DOUBLE ROD ESCAPEMENTS

SPECIFICATIONS	SERIES 160
OPERATING PRESSURE	30 psi min to 150 psi [2 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-28° to +82°C]
VELOCITY	20 in/sec [0.5 m/sec] typical min, zero load at 100 psi [7 bar]
LUBRICATION	5 million cycles
MAINTENANCE	Field repairable

UNIT	DESCRIPTION	BORE		STROKE		ROD DIRECTION	EFFECTIVE AREA		WEIGHT	
		in	mm	MIN	MAX		in	mm	lb	kg
16002/16003	STD DUTY, STD MTG	.375	10	.378	.404	EXTEND RETRACT	.122 .094	78.5 60.5	0.35	.16
16010/16011	HEAVY DUTY, SLOTTED MTG	.500	12	.468	.494	EXTEND	.175	112.6	0.65	.29
16012/16013	STD DUTY, STD MTG					RETRACT	.126	81.1		
16014/16015	HEAVY DUTY, STD MTG									
16020/16021	HEAVY DUTY, SLOTTED MTG	.750	20	.735	.761	EXTEND	.487	313.4	1.56	.71
16022/16023	STD DUTY, STD MTG					RETRACT	.410	263.8		
16024/16025	HEAVY DUTY, STD MTG									
16042/16043	STD DUTY, STD MTG	1.250	32	1.245	1.271	EXTEND RETRACT	1.247 1.050	802.4 675.6	6.25	2.8

## CYLINDER THRUST CALCULATION

IMPERIAL  
 $F = P \times A$

METRIC  
 $F = 0.1 \times P \times A$

F = Cylinder Force  
P = Operating Pressure  
A = Effective Area

lb  
psi  
in<sup>2</sup>

N  
bar  
mm<sup>2</sup>

## RESPONSE TIME

$$T = U - \frac{P}{S} + \frac{W}{X}$$

TOTAL CYCLE TIME = 2T + DWELL TIMES

P - Working pressure in psi [bar]  
T - Time in seconds to extend one rod and retract the other  
W - Total weight applied to rod in pounds [kg]

EQUATION	CONSTANT	STANDARD DUTY				HEAVY DUTY	
		1600x	1601x	1602x	1604x	1601x	1602x
RESPONSE TIME	U	0.125 [0.125]	0.200 [0.200]	0.250 [0.250]	0.350 [0.350]	0.200 [0.200]	0.250 [0.250]
	S	6500 [448]	1250 [86]	1000 [69]	1000 [69]	1250 [86]	1000 [69]
	X	1500 [580]	750 [340]	500 [227]	900 [408]	750 [340]	500 [227]

## MAXIMUM ROD TORQUE

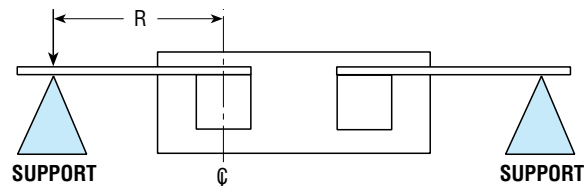
MODEL NO.	STANDARD DUTY		HEAVY DUTY	
	in-lb	[Nm]	in-lb	[Nm]
1600x	1.2	[0.14]	—	—
1601x	2.0	[0.25]	2.0	[0.25]
1602x	5.0	[0.6]	5.0	[0.6]
1604x	9.0	[1.1]	—	—

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

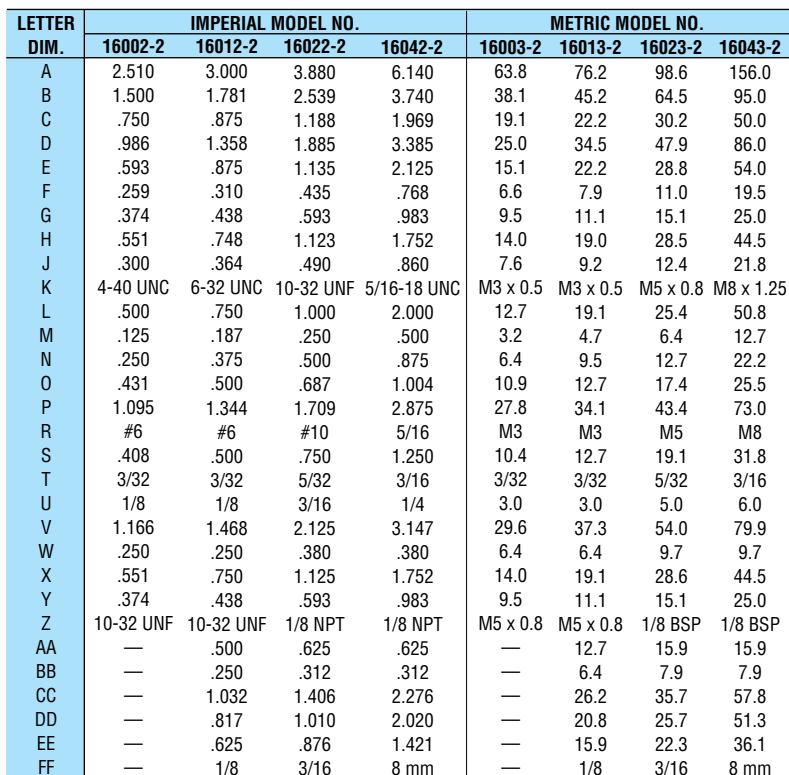
MAX. ROD LOAD TORQUE = (LOAD) x R



### Sizing & Application Assistance

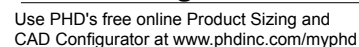
Use PHD's free online Product Sizing Application or view the Product Sizing Catalog at: [www.phdinc.com/apps/sizing](http://www.phdinc.com/apps/sizing)

## 160

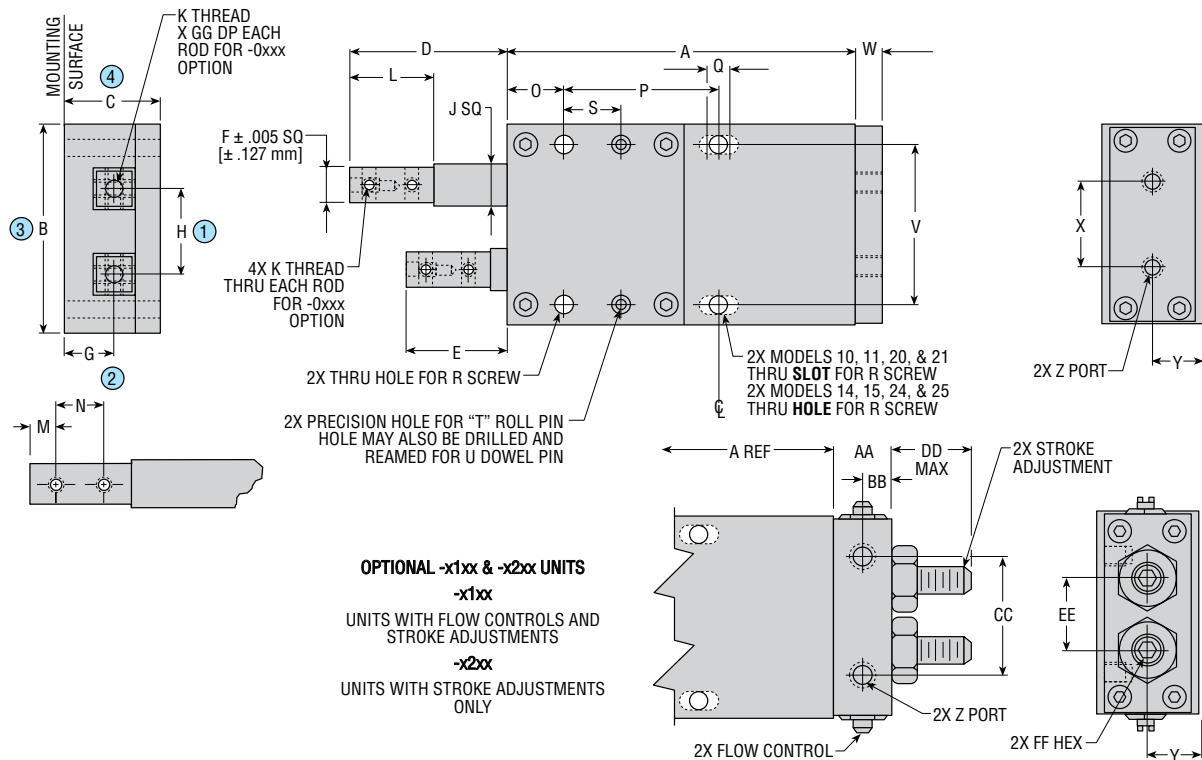


- 1) METRIC DIMENSIONS ARE IN MILLIMETERS
- 2) ROD STROKES MAY BE LIMITED TO .125" [3.17 mm] BY USE OF OPTIONAL STROKE ADJUSTMENT SCREWS
- 3) FULLY EXTENDED ROD MAY RETRACT UP TO 0.025" [0.64 mm] UPON PRESSURIZATION OF RETRACTED ROD
- 4) ROD SHOWN WITH -2xxx OPTION

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# DIMENSIONS: SERIES 160 DOUBLE ROD ESCAPEMENTS HEAVY DUTY



LETTER DIM.	IMPERIAL MODEL NO.		METRIC MODEL NO.	
	16010 & 16014	16020 & 16024	16011 & 16015	16021 & 16025
A	3.000	3.880	76.2	98.6
B	1.781	2.539	45.2	64.5
C	.875	1.188	22.2	30.2
D	1.358	1.885	34.5	47.9
E	.875	1.135	22.2	28.8
F	.310	.435	7.9	11.0
G	.471	.594	12.0	15.1
H	.746	1.121	18.9	28.5
J	.364	.490	9.2	12.4
K	6-32 UNC	10-32 UNF	M3 x 0.5	M5 x 0.8
L	.750	1.000	19.1	25.4
M	.187	.250	4.8	6.4
N	.375	.500	9.5	12.7
O	.500	.687	12.7	17.4
P	1.344	1.709	34.1	43.4
Q	.189	.170	4.8	4.3
R	#6	#10	M3	M5
S	.500	.750	12.7	19.1
T	3/32	5/32	3/32	5/32
U	1/8	3/16	3.0	5.0
V	1.468	2.125	37.3	54.0
W	.250	.380	6.4	9.7
X	.750	1.125	19.1	28.6
Y	.437	.594	11.1	15.1
Z	10-32 UNF	1/8 NPT	M5 x 0.8	1/8 BSP
AA	.500	.625	12.7	15.9
BB	.250	.312	6.4	7.9
CC	1.032	1.406	26.2	35.7
DD	.817	1.010	20.8	25.7
EE	.625	.876	15.9	22.3
FF	1/8	3/16	1/8	3/16
GG	.312	.437	8.0	11.0

## NOTES:

- 1) METRIC DIMENSIONS ARE IN MILLIMETERS
- 2) ROD STROKES MAY BE LIMITED TO .125" [3.17 mm] BY USE OF OPTIONAL STROKE ADJUSTMENT SCREWS
- 3) FULLY EXTENDED ROD MAY RETRACT UP TO 0.025" [0.64 mm] UPON PRESSURIZATION OF RETRACTED ROD
- 4) ROD SHOWN WITH -0xxx OPTION (SEE PAGE 3-6 FOR EXAMPLE OF -2xxx OPTION. K THREAD - 1 ON END OF EACH ROD)

All dimensions are reference only unless specifically toleranced.

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# DESIGN SELECTION AND OPERATION: SERIES 160

## HEAVY DUTY VS. STANDARD DUTY

PHD Escapements are available in heavy and standard duty models. The heavy duty model is offered in two sizes and uses fluoropolymer composite rod bearings which allow higher static and impact loads on the stroke rods. The standard duty model is offered

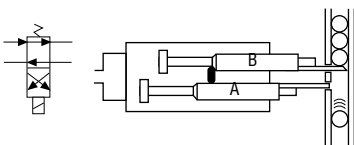
in four sizes. It utilizes PTFE impregnated hardcoat rod bearings for applications requiring moderate static and impact loads on the stroke rods.

## TYPICAL OPERATION

### WORKING PRINCIPLE

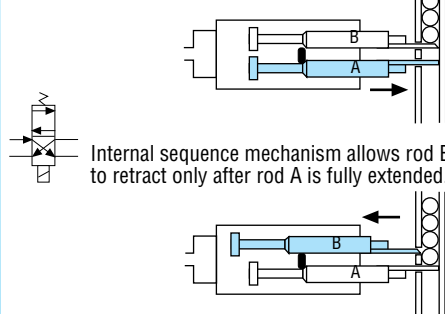
PHD Escapements are internally ported allowing both double acting stroke rods to be operated by a single 4 port, 2 position valve. The sequence of rod motions allows parts being fed continuously from a magazine or feeder to be separated or grouped for subsequent processing.

### INITIAL VALVE POSITION



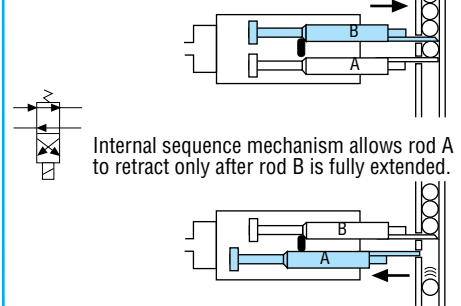
### ACTIVATED VALVE POSITION

Rod A extends.



### RETURN TO INITIAL VALVE POSITION

Rod B extends.



## OPTIONS: SERIES 160 DOUBLE ROD ESCAPEMENTS

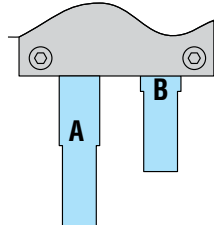
### -Xxxx ROD END OPTIONS

PHD Escapements can be specified with a number of rod end options. The dimensioned drawing on page 3-7 shows rod option -0 specifying flats and threaded holes on four sides with an additional threaded hole in the end of the rod.

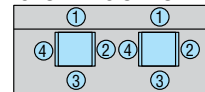
The most cost effective rod end options are -1, -2, -3, and -4. These options provide mounting holes and flats on two sides only of each rod.

- 0 - Flats and threaded holes on all four sides with a threaded hole in the end on both rods (heavy duty option only)
- 1 - Flats and threaded holes on sides 1 and 3 on both rods
- 2 - Flats and threaded holes on sides 2 and 4 on both rods
- 3 - Flats and threaded holes on sides 1 and 3 of rod A and on sides 2 and 4 of rod B
- 4 - Flats and threaded holes on sides 2 and 4 of rod A and on sides 1 and 3 of rod B

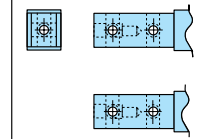
### OPTIONS -1 THROUGH -4 REFERENCE DRAWING



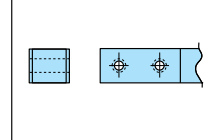
### SHOWN AS OPTION -2



### OPTION -0



### OPTION -2



## 1 HALL EFFECT SWITCH READY -xx1x

This option equips the escapement with magnets on both rods for use with PHD Series 5360 Hall Effect Switches. These switches mount easily to the escapement using "T" slots in the body. Not available on 16002 and 16003 units. Switches must be ordered separately.

## 2 SWITCH READY -xx2x 16002 AND 16003 UNITS ONLY

This option equips the escapement with mounting holes for use with either 4 mm round or 6 mm square metal sensing proximity switches on the Series 16002 and 16003 Escapements. Proximity switches and mounting kits must be ordered separately. See Switches and Sensors section for complete switch specifications.



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



Refer to this product's online catalog in the product section for complete information including related dimensions and additional specifications. See link at bottom of this page.



# OPTIONS: SERIES 160 DOUBLE ROD ESCAPEMENTS

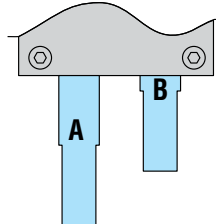
## -Xxxx ROD END OPTIONS

PHD Escapements can be specified with a number of rod end options. The dimensioned drawing on page 3-7 shows rod option -0 specifying flats and threaded holes on four sides with an additional threaded hole in the end of the rod.

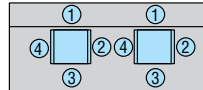
The most cost effective rod end options are -1, -2, -3, and -4. These options provide mounting holes and flats on two sides only of each rod.

- 0 - Flats and threaded holes on all four sides with a threaded hole in the end on both rods (heavy duty option only)
- 1 - Flats and threaded holes on sides 1 and 3 on both rods
- 2 - Flats and threaded holes on sides 2 and 4 on both rods
- 3 - Flats and threaded holes on sides 1 and 3 of rod A and on sides 2 and 4 of rod B
- 4 - Flats and threaded holes on sides 2 and 4 of rod A and on sides 1 and 3 of rod B

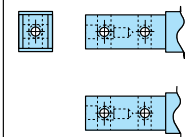
OPTIONS -1 THROUGH -4  
REFERENCE DRAWING



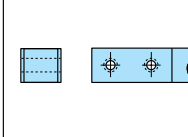
SHOWN AS OPTION -2



OPTION -0

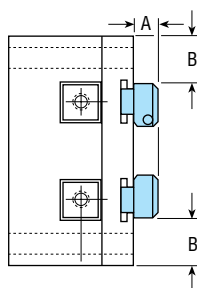


OPTION -2



## 1 HALL EFFECT SWITCH READY -xx1x

This option equips the escapement with magnets on both rods for use with PHD Series 5360 Hall Effect Switches. These switches mount easily to the escapement using "T" slots in the body. Not available on 16002 and 16003 units. Switches must be ordered separately. **See Switches and Sensors section for complete specifications.**



SERIES 5360 MINIATURE HALL EFFECT SWITCHES

MODEL	STANDARD DUTY		HEAVY DUTY	
	DIM. A	DIM. B	DIM. A	DIM. B
1601x	.317 [8.1]	.275 [7.0]	.317 [8.1]	.275 [7.0]
1602x	.234 [6.0]	.475 [12.1]	.234 [6.0]	.475 [12.1]
1604x	.200 [5.1]	.752 [19.1]	—	—

Numbers shown in [ ] are mm.

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

## 2

## SWITCH READY -xx2x 16002 AND 16003 UNITS ONLY

This option equips the escapement with mounting holes for use with either 4 mm round or 6 mm square metal sensing proximity switches on the Series 16002 and 16003 Escapements. Proximity switches and mounting kits must be ordered separately. **See Switches and Sensors section for complete switch specifications.**

**NOTE:** Switch targets must be supplied by the end user (see below).

### PROXIMITY SWITCH MOUNTING KITS

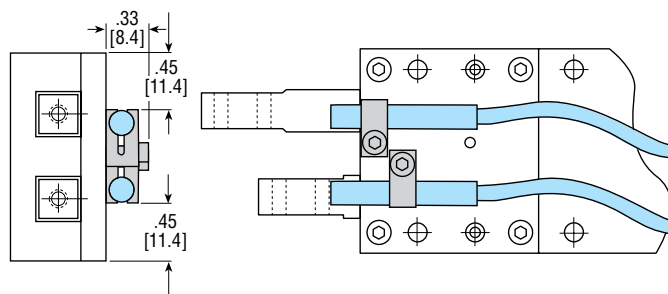
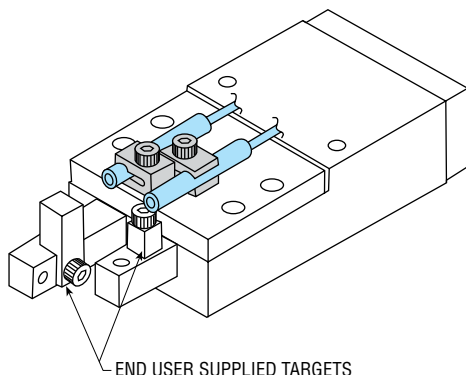
PROXIMITY SWITCH	KIT NUMBER
4 mm Round Inductive	57879
6 mm Square Inductive	57880

EACH PROXIMITY SWITCH MOUNTING KIT CONTAINS:

- 1 SWITCH BRACKET
- 1 BRACKET MOUNTING SCREW

### 4 mm ROUND

Illustrated below is a suggested method of installing switch targets for use with a 4 mm inductive proximity switch. Suggested maximum gap between target and switch is .032 inch [0.8 mm].

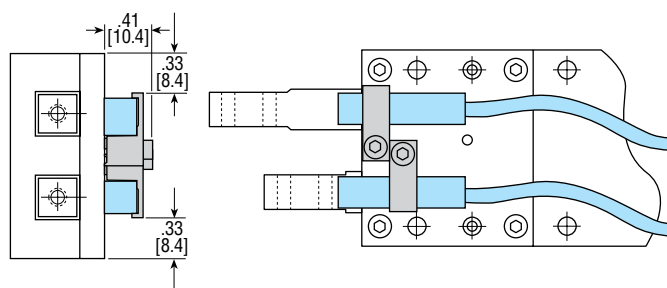
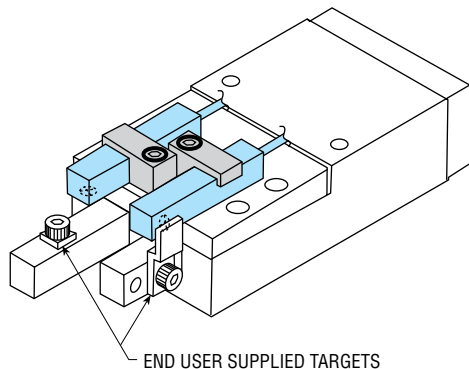


### 4 mm ROUND INDUCTIVE PROXIMITY SWITCHES

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

### 6 mm SQUARE

Illustrated below is a suggested method of installing switch targets for use with a 6 mm inductive proximity switch. Suggested maximum gap between target and switch is .032 inch [0.8 mm].



### 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

Numbers in [ ] are for metric units.

All dimensions are reference only unless specifically tolerated.

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