

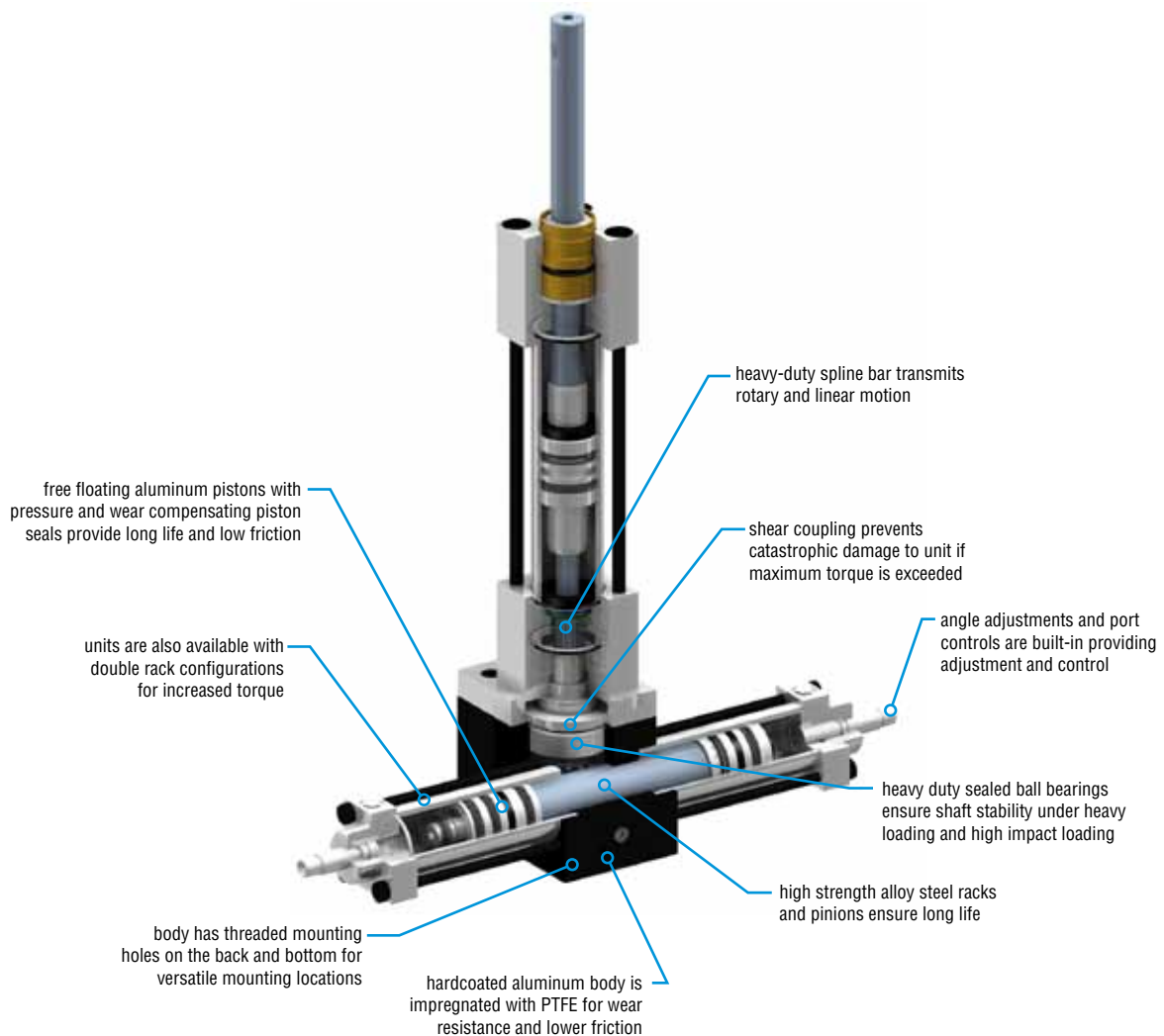
1000-8000



PNEUMATIC AND HYDRAULIC MULTI-MOTION ACTUATOR

Major Benefits

- Provides independent rotary and linear motion from one output shaft.
- Ideal for part transfer, positioning, and orientation.
- Sealed shaft ball bearings on rotary section provide long life and low friction.
- Shear coupling prevents catastrophic damage to unit if maximum torque is exceeded.
- Simple construction allows easy field repairability.

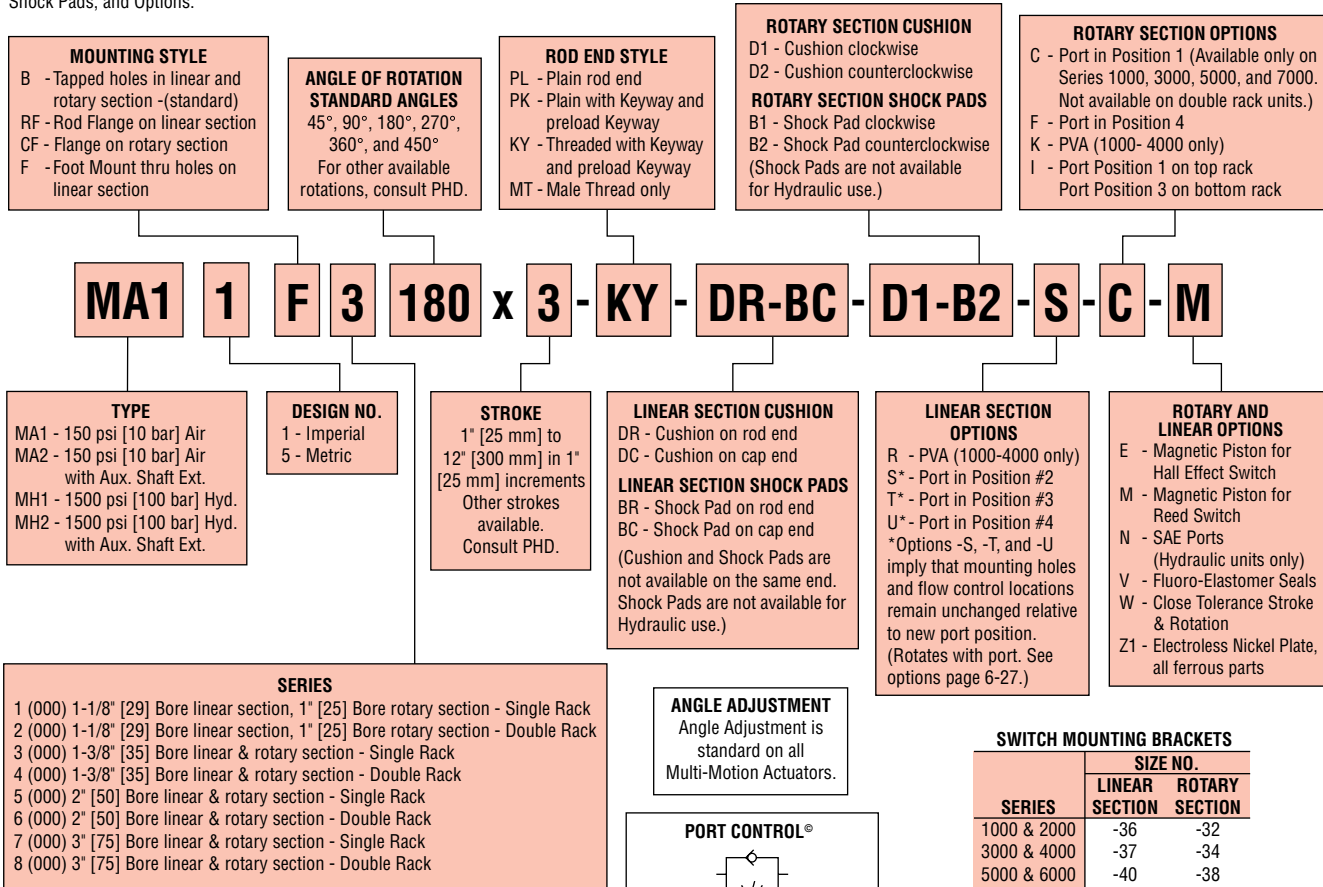


1000-8000

ORDERING DATA: 1000-8000 MULTI-MOTION ACTUATORS

TO ORDER SPECIFY:

Type, Design No., Mounting Style, Series, Angle of Rotation, Stroke, Rod End Style, Cushions and/or Shock Pads, and Options.



1000-8000

NOTE:

1) SAE Ports available. Consult PHD for specific port size.

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.

COMPACT REED SWITCHES

PART NO.	DESCRIPTION
17502-2-06	Sink or Source Type 4.5-24 VDC
17509-3-06	AC Type 110-120 VAC with Current Limit
17522-2	Sink or Source Type VDC, Quick Connect
17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

COMPACT HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
17503-2-06	NPN Type 4.5-24 VDC
17504-2-06	PNP Type 4.5-24 VDC
17523-2	NPN Type 4.5-24 VDC, Quick Connect
17524-2	PNP Type 4.5-24 VDC, Quick Connect



CAD & Sizing Assistance

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



ENGINEERING DATA: 1000-8000 MULTI-MOTION ACTUATORS

SPECIFICATIONS	SERIES 1000-8000
PNEUMATIC OPERATING PRESSURE	20 to 150 psi [1.4 to 10 bar]
HYDRAULIC OPERATING PRESSURE*	40 to 1500 psi [2.8 to 103 bar]
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]
ROTATIONAL TOLERANCE	Nominal rotation +10°/-0°
STROKE TOLERANCE	±.031 [.8 mm]
ROTATIONAL BACKLASH	2° (1000/2000), 1° 30' (3000/4000) 1° 0' (5000/6000), 0° 30' (7000/8000)
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

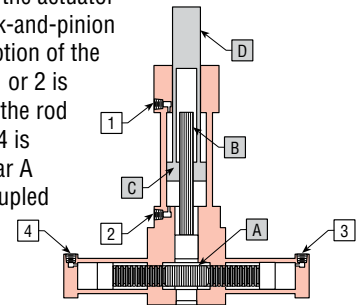
*See hydraulic pressure ratings for options chart below. All hydraulic ratings are based on non-shock hydraulic service.

SERIES	WEIGHT						ROTARY BORE		LINEAR BORE		ROTARY DISPLACEMENT		LINEAR DISPLACEMENT			
	BASE		ROT. ADDER		LINEAR ADDER		DIAMETER		DIAMETER		DISPLACEMENT		EXTEND		RETRACT	
	lb	kg	lb/deg	kg/deg	lb/in	kg/mm	in	mm	in	mm	in ³ /°	cm ³ /°	in ³ /in	cm ³ /mm	in ³ /in	cm ³ /mm
1000	6.3	2.9	.0022	.0010	.38	.0068	1.000	25.4	1.125	25.4	.007	0.115	.995	16.3	.690	11.3
2000	7.3	3.3	.0043	.0020	.38	.0068	1.000	25.4	1.125	25.4	.014	0.229	.995	16.3	.690	11.3
3000	13.9	6.3	.0064	.0029	.25	.0045	1.375	34.9	1.375	34.9	.019	0.312	1.485	24.3	1.043	17.1
4000	16.7	7.6	.0127	.0058	.25	.0045	1.375	34.9	1.375	34.9	.038	0.623	1.485	24.3	1.043	17.1
5000	32.3	14.7	.0093	.0042	1.39	.0249	2.000	50.8	2.000	50.8	.041	0.672	3.142	51.5	1.653	27.1
6000	37.3	16.9	.0185	.0084	1.39	.0249	2.000	50.8	2.000	50.8	.082	1.344	3.142	51.5	1.653	27.1
7000	94.0	42.6	.0289	.0131	2.50	.0448	3.000	76.2	3.000	76.2	.185	3.032	7.069	115.8	3.927	64.4
8000	107.0	48.5	.0578	.0262	2.50	.0448	3.000	76.2	3.000	76.2	.370	6.064	7.069	115.8	3.927	64.4

SERIES	TORQUE OUTPUT		THRUST FORCE EXTEND		THRUST FORCE RETRACT	
	in-lb/psi	Nm/bar	lb/psi	N/bar	lb/psi	N/bar
1000	.39	.64	.99	63.9	.69	44.5
2000	.78	1.28	.99	63.9	.69	44.5
3000	1.11	1.82	1.48	95.5	1.04	67.0
4000	2.22	3.64	1.48	95.5	1.04	67.0
5000	2.36	3.87	3.14	202.5	1.65	106.5
6000	4.72	7.74	3.14	202.5	1.65	106.5
7000	10.60	17.37	7.06	455.4	3.93	253.5
8000	21.20	34.75	7.06	455.4	3.93	253.5

WORKING PRINCIPLE

The main components of the actuator consist of a cylinder and a rack-and-pinion type rotary actuator. Linear motion of the rod D is produced when port 1 or 2 is pressurized. Rotary motion of the rod D is produced when port 3 or 4 is pressurized causing pinion gear A and spline bar B, which are coupled together, to rotate coupled piston C.



1000-8000

HYDRAULIC PRESSURE RATINGS FOR OPTIONS

SERIES	ROTARY SECTION							
	OPTION psi [bar]							
	PLAIN		PORT CONTROLS		-Dx		-E or -M	
	psi	bar	psi	bar	psi	bar	psi	bar
1000	—	—	—	—	—	—	—	—
2000	1000	69	750	52	750	52	—	—
3000	—	—	—	—	—	—	—	—
4000	—	—	750	52	750	52	—	—
5000	—	—	—	—	—	—	750	52
6000	—	—	750	52	750	52	750	52
7000	—	—	—	—	—	—	500	35
8000	—	—	750	52	750	52	500	35

SERIES	LINEAR SECTION							
	OPTION psi [bar]							
	PLAIN		PORT CONTROLS		-Dx		-E or -M	
	psi	bar	psi	bar	psi	bar	psi	bar
1000	—	—	—	—	—	—	—	—
2000	—	—	—	—	—	—	—	—
3000	—	—	—	—	—	—	—	—
4000	—	—	—	—	—	—	—	—
5000	—	—	N/A	N/A	—	—	750	52
6000	—	—	N/A	N/A	—	—	750	52
7000	—	—	N/A	N/A	—	—	500	35
8000	—	—	N/A	N/A	—	—	500	35

Note: — = Standard Rating



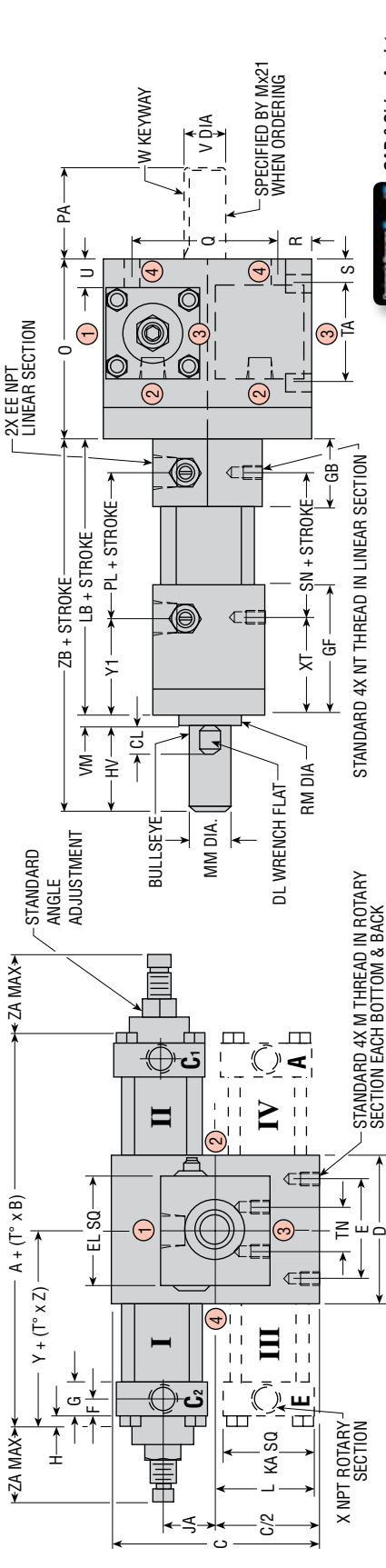
Sizing & Application Assistance

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

DIMENSIONS: 1000-8000 MULTI-MOTION ACTUATORS

IMPERIAL

1000-8000



CAD & Sizing Assistance
Use PHD's free online Product Sizing and CAD Configurator at www.phd.com/myphd

CAP STYLE	SERIES	ROTARY SECTION																								
		A	B	C	D	E	F	G	H	JA	KA	L	M	O	PA	Q	R	S	TA	U	V	W	X	Y	Z	ZA
PLAIN	2000	5.698	.0174	3.000	2.000	1.500	.250	.500	0.00	.750	1.375	1.437	1/4-20 x .312 DP	2.500	.875	2.000	.500	.250	1.500	.312	.4998/5003	1/8 x 1/16 x .625	1/8	2.849	.0087	.000
	-A	6.198	.0174	3.000	2.000	1.500	.500	.750	0.00	.750	1.375	—	1/4-20 x .312 DP	2.500	.875	2.000	.500	.250	1.500	.312	.4998/5003	1/8 x 1/16 x .625	1/8	3.099	.0087	1.125
BOTH	3000 & 4000	7.906	.026	4.250	3.000	2.000	.344	.688	.250	1.156	1.875	2.094	5/16-18 x .500 DP	3.625	1.875	3.000	.625	.500	2.000	.562	.8748/8753	3/16 x 3/32 x 1.500	1/4	3.953	.013	1.500
	BOTH	5000 & 6000	9.126	.026	5.000	4.000	2.500	.375	.750	.203	1.156	2.250	2.281	3/8-16 x .625 DP	3.750	1.875	3.500	.750	.500	2.000	.375	1.124/1.125	1/4 x 1/8 x 1.500	1/4	4.563	.013
BOTH	7000 & 8000	12.160	.052	8.000	5.000	3.000	.469	1.062	.437	1.875	3.500	3.625	3/4-10 x 1.250 DP	6.250	3.500	5.000	1.500	1.250	2.500	.750	1.749/1.750	3/8 x 3/16 x 3.000	3/8	6.080	.026	2.875

SERIES	DEGREE OF ROTATION					
	45	90	180	270	360	450
*1000 & 2000	6.481	7.264	8.830	10.396	11.962	13.528
3000 & 4000	9.076	10.246	12.586	14.926	17.266	19.606
5000 & 6000	10.296	11.466	13.806	16.146	18.486	20.826
7000 & 8000	14.500	16.840	21.520	26.200	30.880	35.560

SERIES	LINEAR SECTION																		
	CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	XT	Y1	ZB	
1000 & 2000	.530	1/2	1/4	1.750	1.250	1.000	2.187	1.500	5.000	.625	1/4-28 x .312 DP	2.812	1.000	2.812	.625	.250	1.562	1.562	6.750
3000 & 4000	.530	5/8	3/8	2.250	1.375	1.000	2.625	1.625	5.562	.750	5/16-24 x .500 DP	2.937	1.250	2.937	.875	.250	1.937	1.937	7.437
5000 & 6000	.987	1-1/8	3/8	3.000	2.000	1.250	3.750	3.000	7.250	1.375	3/8-24 x .500 DP	3.125	2.000	3.125	1.250	.375	2.937	2.937	10.625
7000 & 8000	1.211	1-5/8	1/2	4.000	2.875	1.500	5.250	4.000	10.125	2.000	1/2-20 x .750 DP	4.625	2.750	4.625	1.875	.500	3.937	3.937	14.625

BULLSEYE: REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION
SHAFT KEYWAY & BULLSEYE: SHOWN AT MID-ROTATION
ROD END: STANDARD IS A "PL" (PLAIN) ROD END
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT POSITIONS.
TUBES III & IV: INCLUDED ON SERIES 2000, 4000, 6000, & 8000 ONLY
MTG. HOLES: CENTERED ON CENTERLINE OF UNIT
CUSHIONS: SERIES 1000 & 2000 ROTARY SECTIONS ONLY:
 ADD 1/2" TO RESPECTIVE "AY" AND "VY" DIMENSIONS FOR EACH CUSHION
 ALL LINEAR SECTIONS:
 ADD DIMENSION "GC" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
SHOCK PADS: LINEAR SECTION:
 ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

QUICK REFERENCE FOR: A + (T° x B)

SERIES	45	90	180	270	360	450
*1000 & 2000	6.481	7.264	8.830	10.396	11.962	13.528
3000 & 4000	9.076	10.246	12.586	14.926	17.266	19.606
5000 & 6000	10.296	11.466	13.806	16.146	18.486	20.826
7000 & 8000	14.500	16.840	21.520	26.200	30.880	35.560

*DIMENSIONS CALCULATED USING PLAIN CAP STYLE. ADD .250 TO DIMENSION FOR EACH -A STYLE CAP USED ON SERIES 1000/2000 ONLY.

ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER				PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS				
	-B	-B2	-D1	-D2	STANDARD	-E	-M	-P	-F
MA11 & MA21	II	I	II	I	I & II	I & II	I & II	I	I, 3
MH11 & MH21	—	—	II	I	I & II	I & II	I	I	1, 3

PORT PRESSURIZED - FULL CCW POSITION
 C1 ON SERIES 1000, 3000, 5000, & 7000
 OR C2 & A ON SERIES 2000, 4000, 6000, & 8000

PORT PRESSURIZED - FULL CW POSITION
 C2 ON SERIES 1000, 3000, 5000, & 7000
 OR C1 & A ON SERIES 2000, 4000, 6000, & 8000

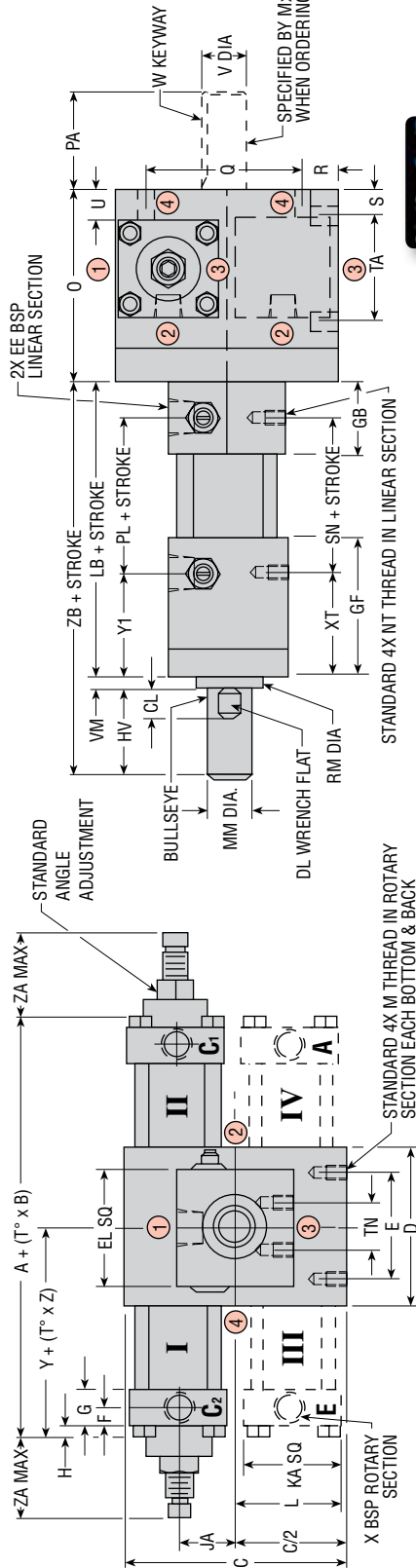
ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER				PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS				
	-B	-B2	-D1	-D2	STANDARD	-E	-M	-P	-F
MA11 & MA21	II	I	II	I	I & II	I & II	I & II	I	I, 3
MH11 & MH21	—	—	II	I	I & II	I & II	I	I	1, 3

All standard rod ends have four wrench flats.

DIMENSIONS: 1000-8000 MULTI-MOTION ACTUATORS

METRIC



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



ROTARY SECTION

CAP STYLE	SERIES	LETTER DIMENSION																									
		A	B	C	D	E	F	G	H	JA	KA	L	M	O	PA	Q	R	S	TA	U	V	W	X	Y	Z	ZA	
PLAIN	2000	145	0.44	76	51	38.1	6	13	0	19	35	36	M6 x 1.0 x 8	63	22	50.8	13	6	38.1	8	12.69/12.71	3.18 x 1.59 x 16	1/8	72	0.22	0	
	-A	1000 & 2000	157	0.44	76	51	38.1	13	19	0	19	35	36	M6 x 1.0 x 8	63	22	50.8	13	6	38.1	8	12.69/12.71	3.18 x 1.59 x 16	1/8	78	0.22	29
BOTH	3000 & 4000	201	0.66	108	76	50.8	9	17	6	29	48	53	M8 x 1.25 x 13	92	48	76.2	16	13	50.8	14	22.22/22.23	4.75 x 2.36 x 38	1/4	100	0.33	38	
	5000 & 6000	232	0.66	127	102	63.5	10	19	5	29	57	58	M10 x 1.5 x 16	95.3	48	88.9	19	13	50.8	10	28.55/28.58	6.35 x 3.18 x 38	1/4	116	0.33	48	
BOTH	7000 & 8000	309	1.33	203	127	76.2	12	27	11	48	89	92	M20 x 2.5 x 32	159	89	127.0	38	32	63.5	19	44.42/44.45	9.53 x 2.36 x 76	3/8	154	0.66	73	

LINEAR SECTION

SERIES	LETTER DIMENSION																									
	CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	XT	Y1	ZB							
1000 & 2000	13	13	1/4	44	32	25	56	38	127	15.9	M6 x 1.0 x 8	71	25.4	71.4	15.9	6	40	40	171							
3000 & 4000	13	16	3/8	57	35	25	67	41	141	19.0	M8 x 1.25 x 13	75	31.8	74.6	22.2	6	49	49	189							
5000 & 6000	25	29	3/8	76	51	32	95	76	184	34.9	M10 x 1.50 x 13	79	50.8	79.4	31.8	10	75	75	270							
7000 & 8000	31	41	1/2	102	73	38	133	102	257	50.8	M12 x 1.25 x 19	117	69.9	117.5	47.6	13	100	100	371							

QUICK REFERENCE FOR: A + (T° x B)

SERIES	DEGREE OF ROTATION					
	45	90	180	270	360	450
*1000 & 2000	164.6	184.5	224.3	264.1	303.8	343.6
3000 & 4000	230.5	260.2	319.7	379.1	438.6	498.0
5000 & 6000	261.5	291.1	351.4	350.7	469.5	529.0
7000 & 8000	368.3	427.7	548.0	546.6	784.4	903.2

*DIMENSIONS CALCULATED USING PLAIN CAP STYLE. ADD 6.3 TO DIMENSION FOR EACH -A STYLE CAP USED ON SERIES 1000/2000 ONLY.

PORT PRESSURIZED - FULL CCW POSITION
C1 ON SERIES 1000, 3000, 5000, & 7000
OR C1 & E ON SERIES 2000, 4000, 6000, & 8000 **I**

PORT PRESSURIZED - FULL CW POSITION
C2 ON SERIES 1000, 3000, 5000, & 7000
OR C2 & A ON SERIES 2000, 4000, 6000, & 8000 **II**

BULLSEYE: REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION

SHAFT KEYWAY & BULLSEYE: SHOWN AT MID-ROTATION

ROD END: STANDARD IS A "PL" (PLAIN) ROD END

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT POSITIONS.

TUBES III & IV: INCLUDED ON SERIES 2000, 4000, 6000, & 8000 ONLY

MTG. HOLES: CENTERED ON CENTERLINE OF UNIT

CUSHIONS: SERIES 1000 & 2000 ROTARY SECTIONS ONLY:

ADD 13 mm TO RESPECTIVE "A" AND "Y" DIMENSIONS FOR EACH CUSHION
ALL LINEAR SECTIONS:

ADD DIMENSION "GC" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION

SHOCK PADS: LINEAR SECTIONS:

ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER						PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS						
	-B	-B1	-B2	-D	-D1	-D2	-E	-M	-P	STANDARD	-C	-F	-I
MA15 & MA25	II	I	I	II	I	I	I & II	I & II	I & II	I & II	I	I	I
MH15 & MH25	—	—	—	II	I	I	I & II	I & II	I & II	I & II	I	I	I

All dimensions are reference only unless specifically tolerated.

www.phdinc.com/18000m • (800) 624-8511

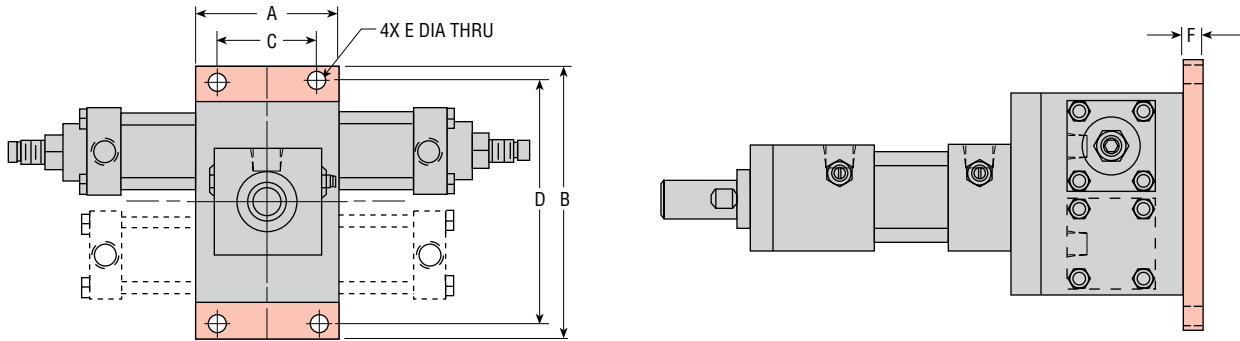


1000-8000

All standard rod ends have four wrench flats.

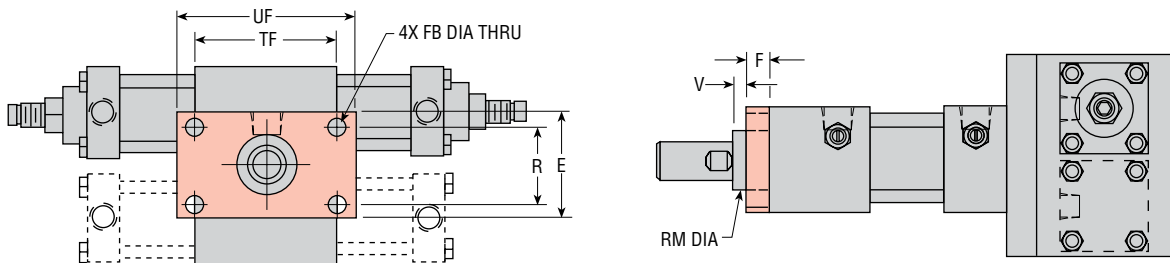
DIMENSIONS: MOUNTING STYLES

CF MOUNTING STYLE



SERIES	LETTER DIMENSION					
	A	B	C	D	E	F
1000 & 2000	2.000 [50.8]	4.250 [108.0]	1.375 [34.9]	3.625 [92.1]	.281 [7.1]	.250 [6.4]
3000 & 4000	3.000 [76.2]	5.750 [146.1]	2.125 [54.0]	5.125 [130.2]	.406 [10.3]	.437 [11.1]
5000 & 6000	4.000 [101.6]	6.500 [165.1]	3.375 [85.7]	5.875 [149.2]	.406 [10.3]	.437 [11.1]
7000 & 8000	5.000 [127.0]	12.000 [304.8]	3.000 [76.2]	10.000 [254.0]	.781 [19.8]	.750 [19.1]

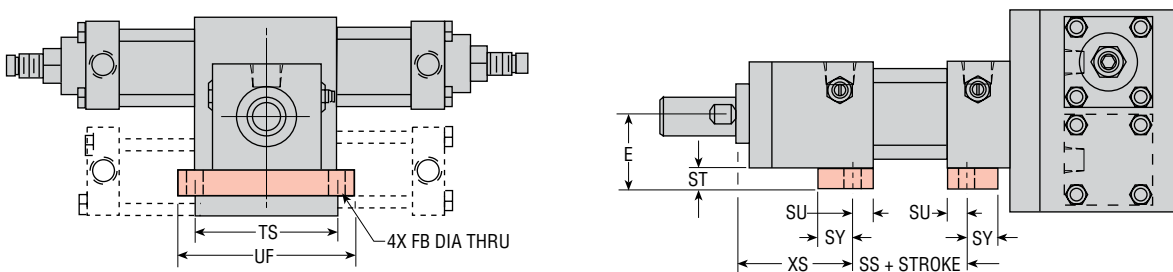
RF MOUNTING STYLE



SERIES	LETTER DIMENSION							
	E	F	FB	R	RM	TF	UF	V
1000 & 2000	1.750 [44.5]	.500 [12.7]	.281 [7.1]	1.250 [31.8]	1.000 [25.4]	2.500 [63.5]	3.000 [76.2]	.250 [6.4]
3000 & 4000	2.250 [57.2]	.500 [12.7]	.343 [8.7]	1.625 [41.3]	1.250 [31.8]	3.000 [76.2]	3.750 [95.3]	.250 [6.4]
5000 & 6000	3.000 [76.2]	1.000 [25.4]	.562 [14.3]	2.000 [50.8]	2.000 [50.8]	4.125 [104.8]	5.125 [130.2]	.375 [9.9]
7000 & 8000	4.000 [101.6]	1.125 [28.6]	.687 [17.4]	2.750 [69.9]	2.750 [69.9]	5.875 [149.2]	7.125 [181.0]	.500 [12.7]

CYLINDER LENGTH IS NOT CHANGED BY RF MOUNTING

F MOUNTING STYLE



SERIES	LETTER DIMENSION									
	E	FB	SS	ST	SU	SY	TS	UF	XS	
1000 & 2000	1.250 [31.8]	.281 [7.1]	2.187 [55.5]	.375 [9.5]	.312 [7.9]	.937 [23.8]	2.500 [63.5]	3.000 [76.2]	2.125 [54.0]	
3000 & 4000	1.625 [41.3]	.344 [8.7]	2.437 [61.9]	.500 [12.7]	.437 [11.1]	.937 [23.8]	3.000 [76.2]	3.750 [95.3]	2.437 [61.9]	
5000 & 6000	2.250 [57.2]	.562 [14.3]	4.000 [101.6]	.750 [19.1]	1.250 [31.8]	.500 [12.7]	4.000 [101.6]	5.000 [127.0]	2.875 [73.0]	
7000 & 8000	3.000 [76.2]	.812 [20.6]	5.000 [127.0]	1.000 [25.4]	1.500 [38.1]	1.000 [25.4]	5.875 [149.2]	7.250 [184.2]	4.250 [108.0]	

CUSHIONS: ADD TO (+ STROKE) DIMENSION FOR EACH CUSHION:

SERIES 1000, 2000, 3000, & 4000 = 1" [25 mm], SERIES 5000 & 6000 = 1-1/4" [32 mm], SERIES 7000 & 8000 = 1-1/2" [38 mm]

SHOCK PADS: ADD 1/4" [6.4 mm] TO (+ STROKE) DIMENSION FOR EACH SHOCK PAD

2000-8000

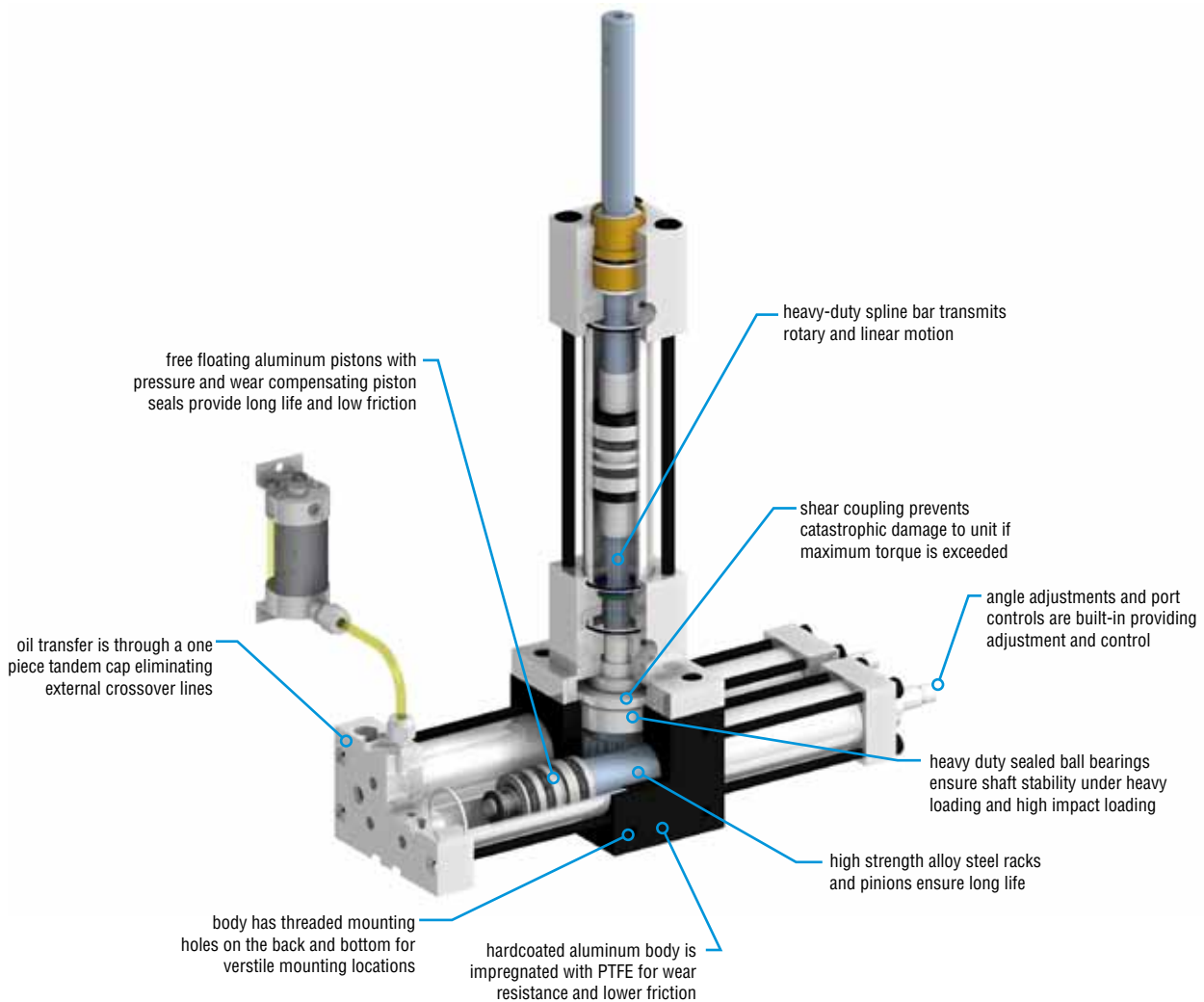
air/oil tandem



MULTI-MOTION ACTUATOR

Major Benefits

- Sealed shaft ball bearings on rotary section provide long life and low friction.
- Air-oil tandem multi-motion actuators provide smooth consistent rotary motion even at low speeds.
- Oil transfer is through a one-piece tandem cap eliminating external crossover lines.
- Shear coupling prevents catastrophic damage to unit if maximum torque is exceeded.
- Built-in flow controls and angle adjustments are standard on most sizes.



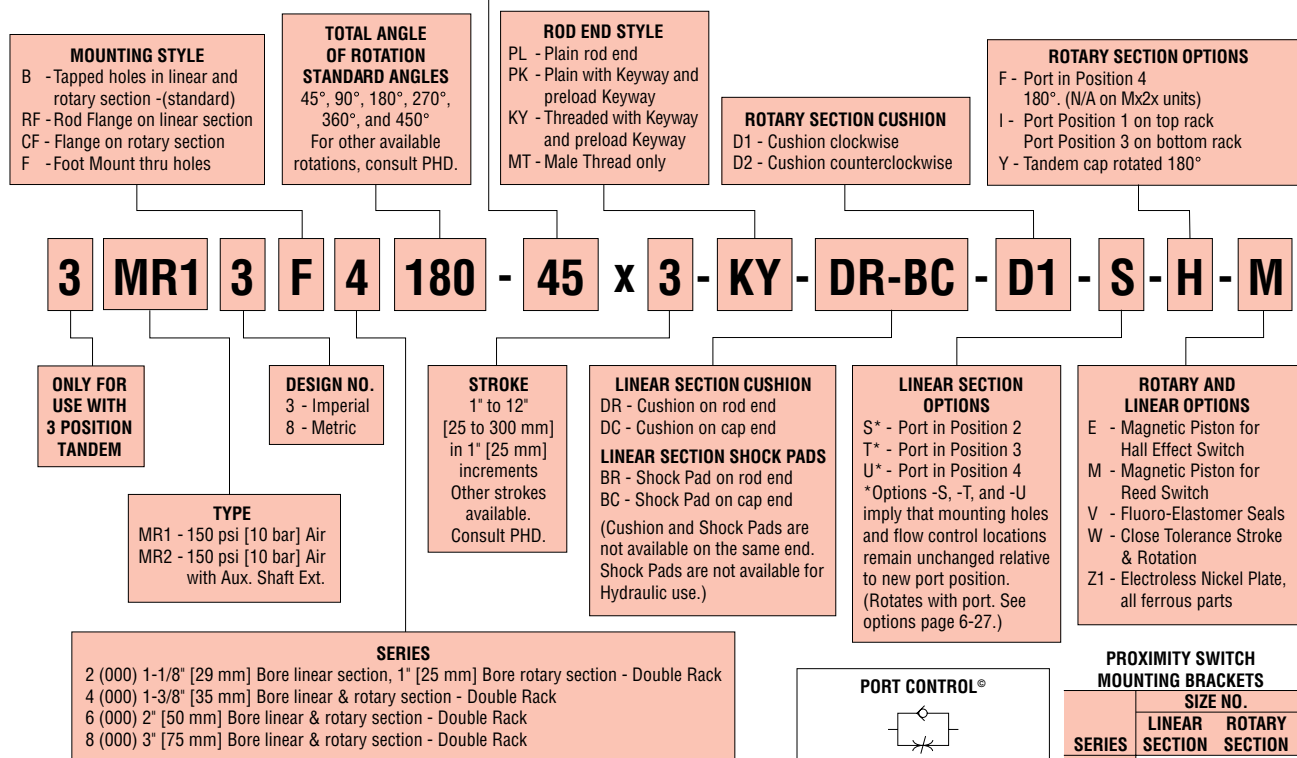
2000-8000
air/oil tandem

ORDERING DATA: AIR/OIL TANDEM MULTI-MOTION ACTUATORS

TO ORDER SPECIFY:

Position, Type, Design No., Mounting Style, Series, Total Angle of Rotation, Stroke, Rod End Style, Cushions and/or Shock Pads, and Options.

ANGLE OF ROTATION FROM POSITION I TO POSITION II. USED ON 3 POSITION ONLY.



2000-8000
air/oil tandem



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.

COMPACT REED SWITCHES

PART NO.	DESCRIPTION
17502-2-06	Sink or Source Type 4.5-24 VDC
17509-3-06	AC Type 110-120 VAC with Current Limit
17522-2	Sink or Source Type VDC, Quick Connect
17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

COMPACT HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
17503-2-06	NPN Type 4.5-24 VDC
17504-2-06	PNP Type 4.5-24 VDC
17523-2	NPN Type 4.5-24 VDC, Quick Connect
17524-2	PNP Type 4.5-24 VDC, Quick Connect



CAD & Sizing Assistance

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

www.phdinc.com/28000aom • (800) 624-8511



ENGINEERING DATA: AIR/OIL TANDEM MULTI-MOTION ACTUATORS

SPECIFICATIONS	SERIES 2000-8000
PNEUMATIC OPERATING PRESSURE	40 to 150 psi [2.8 to 10 bar]
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]
ROTATIONAL TOLERANCE	Nominal rotation +10°/-0°
STROKE TOLERANCE	±.031 [.8 mm]
ROTATIONAL BACKLASH	2° (2000), 1° 30' (4000) 1° 0' (6000), 0° 30' (8000)
LUBRICATION	Factory lubricated for rated life
MAINTENANCE	Field repairable

3-POSITION UNITS INTERMEDIATE POSITION	SERIES			
	2000	4000	6000	8000
ROTATIONAL TOLERANCE MEASURED AT CENTER OF BACKLASH	± 1°	± 0° 30'	± 0° 30'	± 0° 15'
ROTATIONAL BACKLASH	2°	1° 45'	1° 45'	1° 15'

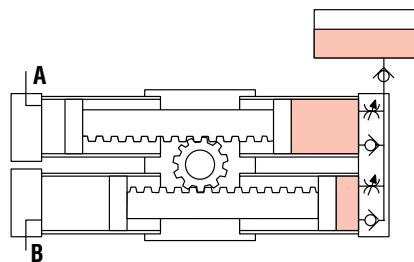
SERIES	WEIGHT				ROTARY BORE DIAMETER		LINEAR BORE DIAMETER		ROTARY DISPLACEMENT		LINEAR DISPLACEMENT					
	BASE lb	kg	ROT. ADDER lb/deg	kg/deg	LINEAR ADDER lb/in	kg/mm	in	mm	in ³ /deg	cm ³ /deg	EXTEND		RETRACT			
											in ³ /in	cm ³ /mm	in ³ /in	cm ³ /mm		
2000	7.3	3.3	.0043	.0020	.38	.0068	1.000	25.4	1.125	28.6	.014	0.229	.995	16.3	.690	11.3
4000	16.7	7.6	.0127	.0058	.25	.0045	1.375	34.9	1.375	34.9	.038	0.623	1.485	24.3	1.043	17.1
6000	37.3	16.9	.0185	.0084	1.39	.0249	2.000	50.8	2.000	50.8	.082	1.344	3.142	51.5	1.653	27.1
8000	107.0	48.5	.0578	.0262	2.50	.0448	3.000	76.2	3.000	76.2	.370	6.064	7.069	115.8	3.927	64.4

SERIES	TORQUE OUTPUT		THRUST FORCE EXTEND		THRUST FORCE RETRACT	
	in-lb/psi	Nm/bar	lb/psi	N/bar	lb/psi	N/bar
2000	.39	.64	.99	63.9	.69	44.5
4000	1.11	1.82	1.48	95.5	1.04	67.0
6000	2.36	3.87	3.14	202.5	1.65	106.5
8000	10.60	17.37	7.06	455.4	3.93	253.5

WORKING PRINCIPLE

Air/Oil Tandem rotary section provides the smooth control of hydraulics with the simplicity of air. The closed loop oil system gives smooth precise speed control throughout the rotation using built-in PHD Port Controls®. The illustration shows a Tandem Actuator with built-in Port Controls® in the crossover manifold. As air is applied to ports A and B, the unit rotates forcing oil from one rack to the other across the manifold. The reservoir serves as an accumulator to compensate for oil volume changes due to temperature variation.

NOTE: The reservoir should have 20 psi [1.4 bar] pressure at all times to ensure the system remains purged.



Sizing & Application Assistance

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

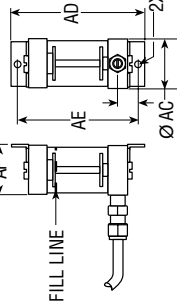
DIMENSIONS: AIR/OIL TANDEM MULTI-MOTION ACTUATORS

IMPERIAL

2000-8000
air/oil tandem

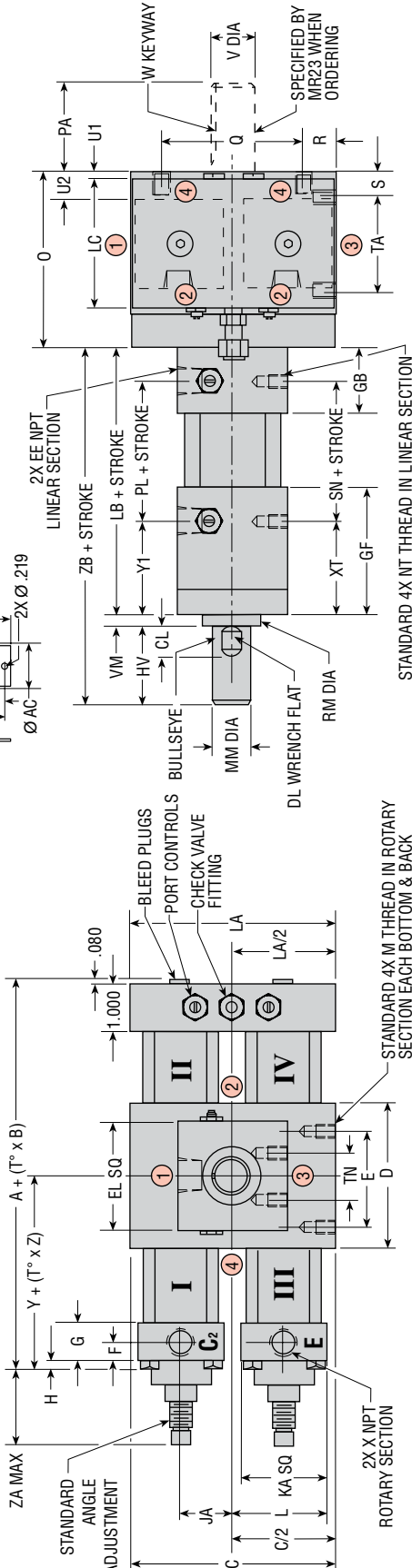
RESERVOIR PART NO.	AB	AC	AD	AE	AF
13459-02-2	16.4	63.5	139.7	130.2	64.3
13459-03-2	13.8	38.1	98.4	88.9	38.9

TANK DIMENSIONS



RESERVOIR ASSEMBLY IS INCLUDED WITH UNIT. SERIES 2000, 4000, & 6000 UNITS USE PART NO. 13459-03-2. SERIES 8000 UNITS USE PART NO. 13459-02-2.

NOTE: THE RESERVOIR SHOULD HAVE 1.4 bar PRESSURE AT ALL TIMES TO ENSURE THE SYSTEM REMAINS PURGED.



ROTARY SECTION

SERIES	LETTER DIMENSION																											
	A	B	C	D	E	F	G	H	JA	KA	L	LA	LC	M	O	PA	Q	R	S	TA	U1	U2	V	W	X	Y	Z	ZA
2000	6.215	.0174	3.000	2.000	1.500	.250	.500	0.00	.750	1.375	1.437	2.875	1.750	1/4-20 x .312 DP	2.500	.875	2.000	.500	.250	1.500	.125	.312	.4998/5003	1/8 x 1/16 x .625	1/8	2.849	.0087	1.125
4000	7.986	.026	4.250	3.000	2.000	.344	.688	.250	1.156	1.875	2.094	4.187	2.750	5/16-18 x .500 DP	3.625	1.875	3.000	.625	.500	2.000	.125	.562	.8748/8753	3/16 x 3/32 x 1.500	1/4	3.953	.013	1.500
6000	9.190	.026	5.000	4.000	2.500	.375	.750	.203	1.156	2.250	2.281	4.687	2.750	3/8-16 x .625 DP	3.750	1.875	3.500	.750	.500	2.000	.125	.375	1.124/1.125	1/4 x 1/8 x 1.500	1/4	4.563	.013	1.875
8000	11.128	.052	8.000	5.000	3.000	.469	1.062	.437	1.875	3.500	3.625	6.125	3.000	3/4-10 x 1.250 DP	6.250	3.500	5.000	1.500	1.250	2.500	1.000	.750	1.749/1.750	3/8 x 3/16 x 3.000	3/8	6.080	.026	2.875

LINEAR SECTION

SERIES	LETTER DIMENSION																		
	CL	DL	EL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	XT	Y1
2000	.530	1/2	1/4	1.750	1.250	1.000	2.187	1.500	5.000	.625	1/4-28 x .312 DP	2.812	1.000	2.812	.625	.250	1.562	1.562	6.750
4000	.530	5/8	3/8	2.250	1.375	1.000	2.625	1.625	5.562	.750	5/16-24 x .500 DP	2.937	1.250	2.937	.875	.250	1.937	1.937	7.437
6000	.987	1-1/8	3/8	3.000	2.000	1.250	3.750	3.000	7.250	1.375	3/8-24 x .500 DP	3.125	2.000	3.125	1.250	.375	2.937	2.937	10.625
8000	1.211	1-5/8	1/2	4.000	2.875	1.500	5.250	4.000	10.125	2.000	1/2-20 x .750 DP	4.625	2.750	4.625	1.875	.500	3.937	3.937	14.625

QUICK REFERENCE FOR: A + (T° x B)

SERIES	DEGREE OF ROTATION					
	45	90	180	270	360	450
2000	6.998	7.781	9.347	10.913	12.479	14.045
4000	9.156	10.326	12.666	15.006	17.346	19.686
6000	10.360	11.530	13.870	16.210	18.550	20.890
8000	13.468	15.808	20.488	25.168	29.848	34.528

BULLSEYE: REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION

SHAFT KEYWAY & BULLSEYE: SHOWN AT MID-ROTATION

ROD END: STANDARD IS A "PL" (PLAIN) ROD END

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT POSITIONS.

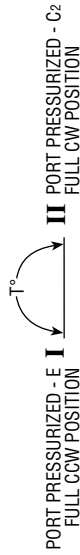
MTG. HOLES: CENTERED ON CENTERLINE OF UNIT

CUSHIONS: ADD DIMENSION "GC" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION

SHOCK PADS: LINEAR SECTION: ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER		PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS	
	-D	-P	STANDARD	-F
MR13 & MR23	II	IV	II & IV	I & III
	2	2	2	2
	4	4	4	2
	2	2	2	2
	2	2	2	2
	2	2	2	2



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

All standard rod ends have four wrench flats.

DIMENSIONS: 3 POSITION AIR/OIL TANDEM MULTI-MOTION ACTUATORS

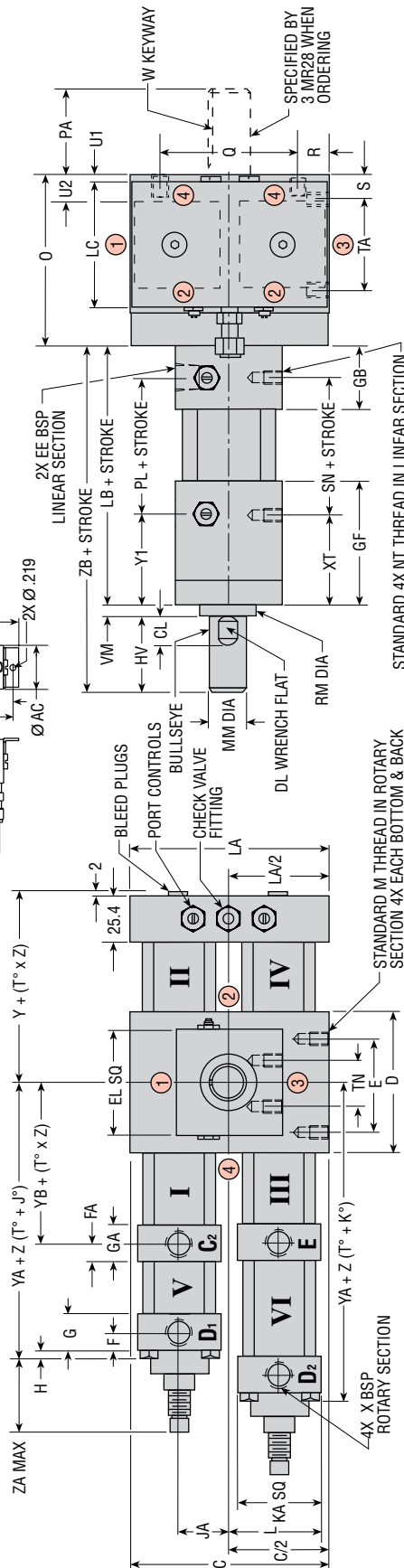
METRIC

TANK DIMENSIONS

RESERVOIR PART NO.	AB	AC	AD	AE	AF
68397-02-2	16.4	63.5	139.7	130.2	64.3
68397-03-2	13.8	38.1	98.4	88.9	38.9

RESERVOIR ASSEMBLY IS INCLUDED WITH UNIT. SERIES 2000, 4000, & 6000 UNITS USE PART NO. 68397-03-2. SERIES 8000 UNITS USE PART NO. 68397-02-2.

NOTE: THE RESERVOIR SHOULD HAVE 1.4 bar PRESSURE AT ALL TIMES TO ENSURE THE SYSTEM REMAINS PURGED.



STANDARD M THREAD IN ROTARY SECTION 4X EACH BOTTOM & BACK

STANDARD 4X NT THREAD IN LINEAR SECTION

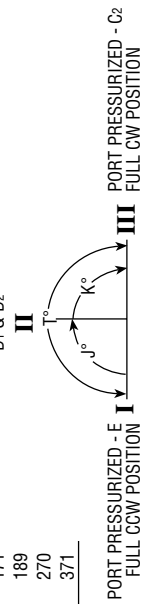
ROTARY SECTION

SERIES	LETTER DIMENSION																												
	C	D	E	F	G	H	JA	KA	L	LA	LC	M	O	PA	Q	R	S	TA	U1	U2	V	W	X	Y	YA	YB	Z	ZA	
2000	76	51	38.1	13	13	19	0	19	35	36	73.0	44.5	M6 x 1.0 x 8	63	22	50.8	13	6	38.1	3	8	12.69/12.71	3.18 x 1.59 x 16	G1/8	85	152	66	0.22	29
4000	108	76	50.8	9	10	17	6	29	48	53	106.4	69.9	M8 x 1.25 x 13	92	48	76.2	16	13	50.8	3	14	22.22/22.23	4.75 x 2.36 x 38	G1/4	102	171	85	0.33	38
6000	127	102	63.5	10	9	19	5	29	57	58	119.1	69.9	M10 x 1.5 x 16	95.3	48	88.9	19	13	50.8	3	10	28.55/28.58	6.35 x 3.18 x 38	G1/4	118	186	101	0.33	48
8000	203	127	76.2	12	12	27	11	48	89	92	155.6	76.2	M20 x 2.5 x 32	159	89	127.0	38	32	63.5	25	19	44.42/44.45	9.53 x 2.36 x 76	G3/8	128	251	133	0.66	73

LINEAR SECTION

SERIES	LETTER DIMENSION																		
	CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	Y1	Y2	ZB
2000	13	13	G1/4	44	32	25	56	38	127	15.9	M6 x 1.0 x 8	71	25.4	71.4	15.9	6	40	40	171
4000	13	16	G3/8	57	35	25	67	41	141	19.0	M8 x 1.25 x 13	75	31.8	74.6	22.2	6	49	49	189
6000	25	29	G3/8	76	51	32	95	76	184	34.9	M10 x 1.50 x 13	79	50.8	79.4	31.8	10	75	75	270
8000	31	41	G1/2	102	73	38	133	102	257	50.8	M12 x 1.25 x 19	117	69.9	117.5	47.6	13	100	100	371

PORTS PRESSURIZED D₁ & D₂



PORT PRESSURIZED - E FULL CCW POSITION
PORT PRESSURIZED - C₂ FULL CW POSITION



CAD & Sizing Assistance
For more information visit
www.phdinc.com/myphd
CAD Configurator at www.phdinc.com/myphd

BULLSEYE: REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION

SHAFT KEYWAY & BULLSEYE: SHOWN AT MID-ROTATION

ROD END: STANDARD ISA "PL" (PLAIN) ROD END

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT POSITIONS.

MTG. HOLES: CENTERED ON CENTERLINE OF UNIT

CUSHIONS: ADD DIMENSION "GC" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION

SHOCK PADS: LINEAR SECTION: ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER		PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS	
	-D	-E	STANDARD	-F
3MR18 & 3MR28	II	IV	V & VI	V & VI
	-D	-E	PORT -D	PORT -D
	II	IV	2	2
	III	III	2	2
	I	I	2	2
	II	II	2	2
	III	III	2	2
	IV	IV	2	2
	V	V	2	2
	VI	VI	2	2
	VII	VII	2	2
	VIII	VIII	2	2

All standard rod ends have four wrench flats.

2000-8000
air/oil tandem

2000-8000
air/oil tandem

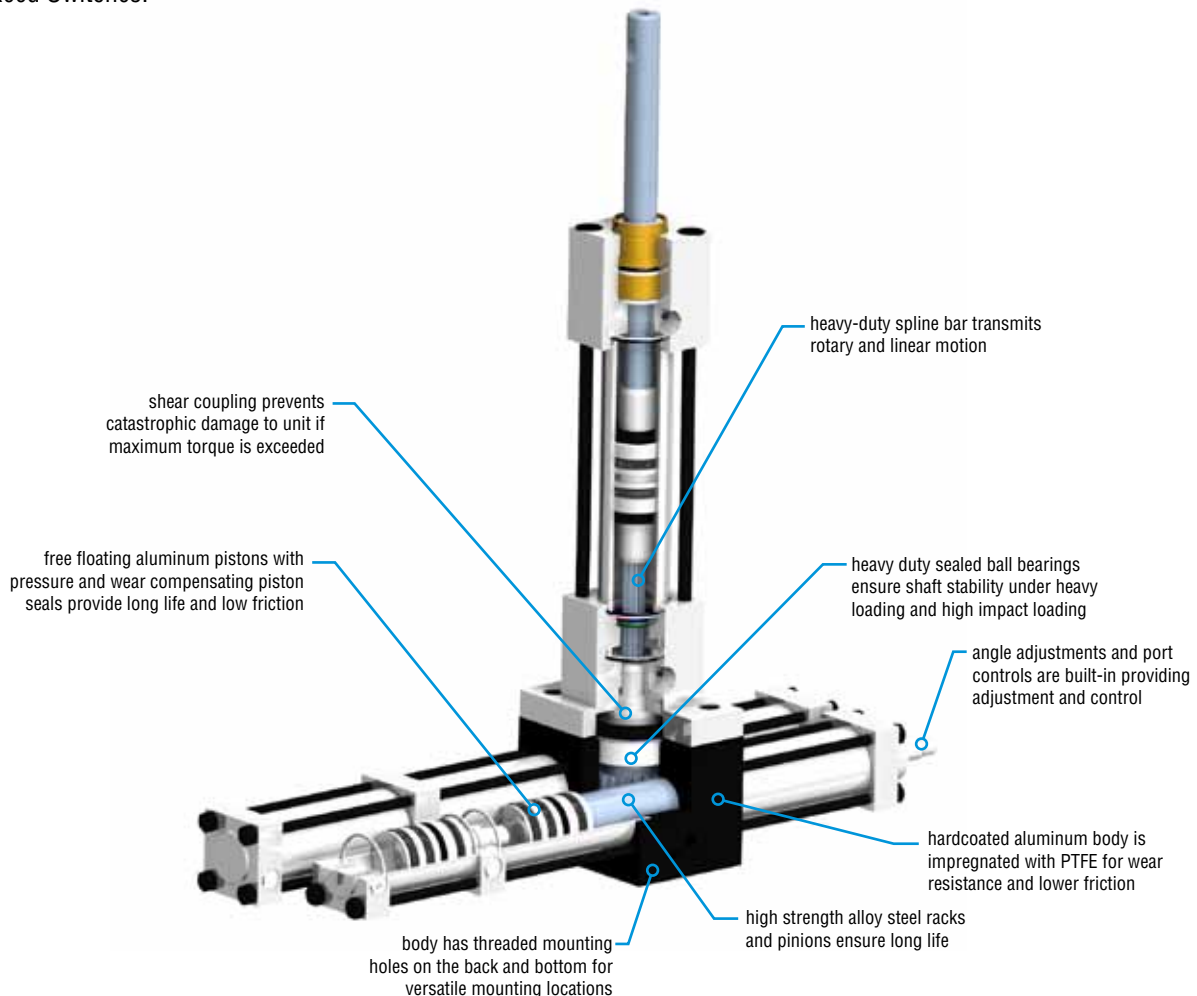
2000-8000 multi-position



MULTI-POSITION HYDRAULIC AND PNEUMATIC MULTI-MOTION ACTUATOR

Major Benefits

- PHD multi-position units in 3, 4, or 5 rotary positions ideal for feeding and positioning applications.
- Pneumatically or hydraulically powered.
- Sealed shaft ball bearings on rotary section provide long life and low friction.
- Shear coupling prevents catastrophic damage to unit if maximum torque is exceeded.
- Multiple positioning design eliminates expensive and cumbersome fixturing and pinning.
- Options include built-in adjustable cushions, shock pads, rod end styles, and magnetic pistons for use with Hall and Reed Switches.

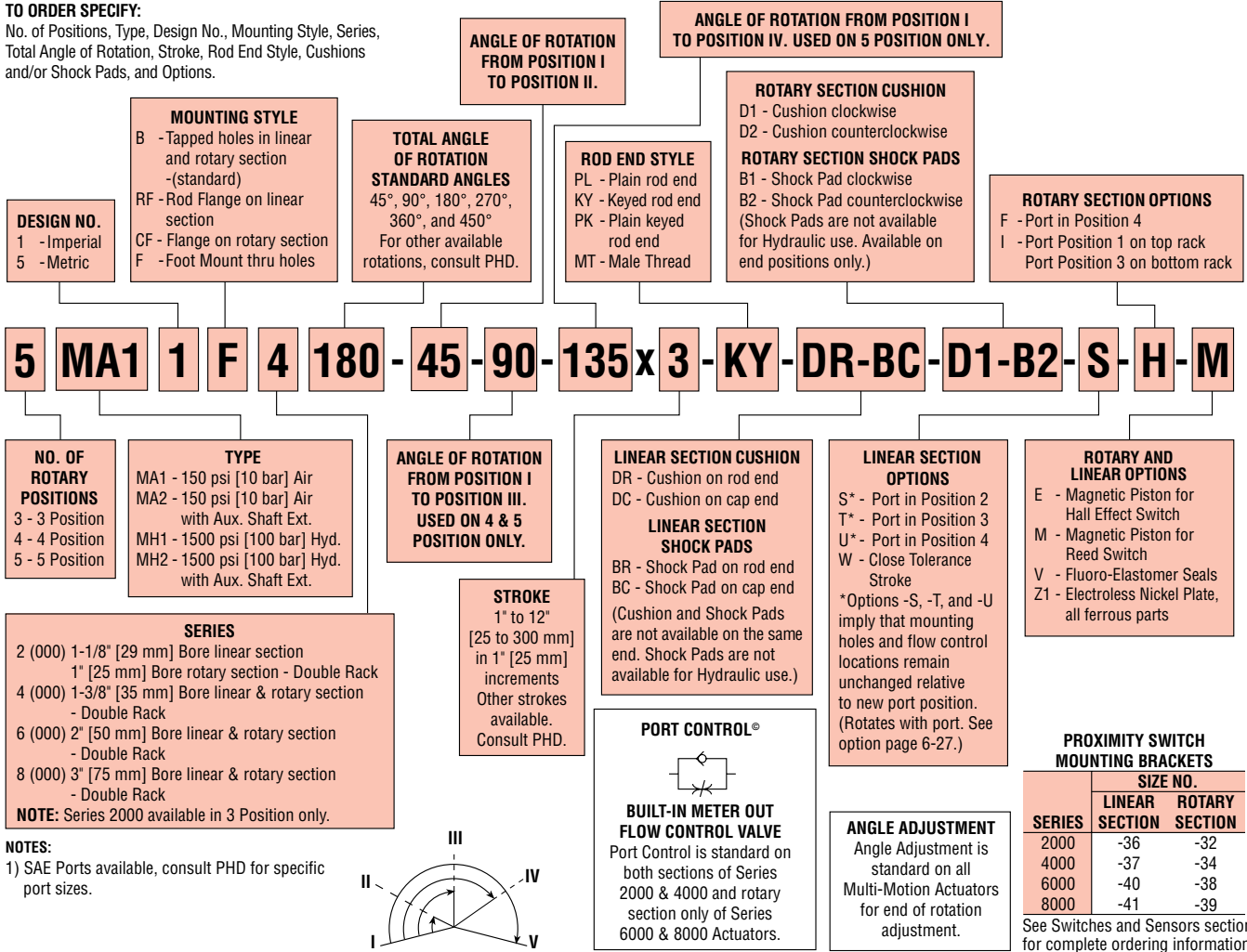


2000-8000
multi-position

ORDERING DATA: MULTI-POSITION MULTI-MOTION ACTUATORS

TO ORDER SPECIFY:

No. of Positions, Type, Design No., Mounting Style, Series, Total Angle of Rotation, Stroke, Rod End Style, Cushions and/or Shock Pads, and Options.



2000-8000 multi-position

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.

COMPACT REED SWITCHES

PART NO.	DESCRIPTION
17502-2-06	Sink or Source Type 4.5-24 VDC
17509-3-06	AC Type 110-120 VAC with Current Limit
17522-2	Sink or Source Type VDC, Quick Connect
17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

COMPACT HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
17503-2-06	NPN Type 4.5-24 VDC
17504-2-06	PNP Type 4.5-24 VDC
17523-2	NPN Type 4.5-24 VDC, Quick Connect
17524-2	PNP Type 4.5-24 VDC, Quick Connect



CAD & Sizing Assistance

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



ENGINEERING DATA: MULTI-POSITION MULTI-MOTION ACTUATORS

SPECIFICATIONS	SERIES 2000-8000
PNEUMATIC OPERATING PRESSURE	20 to 150 psi [1.4 to 10 bar]
HYDRAULIC OPERATING PRESSURE*	40 to 1500 psi [2.8 to 103 bar]
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]
ROTATIONAL TOLERANCE	Nominal rotation +10°/-0°
STROKE TOLERANCE	±.031 [.8 mm]
END OF ROTATION BACKLASH	2° (2000), 1° 30' (4000) 1° 0' (6000), 0° 30' (8000)
LUBRICATION MAINTENANCE	Factory lubricated for rated life Field repairable

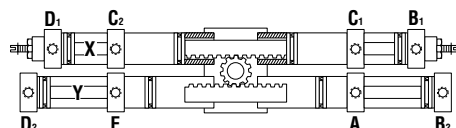
*See hydraulic pressure ratings for options chart below. All hydraulic ratings are based on non-shock service.

INTERMEDIATE POSITION(S)	SERIES			
	2000**	4000	6000	8000
ROTATIONAL TOLERANCE - FROM ONE INTERMEDIATE POSITION TO ANOTHER MEASURED AT CENTERS OF BACKLASH	± 1°	± 0° 30'	± 0° 30'	± 0° 15'
ROTATIONAL BACKLASH	2°	1° 45'	1° 45'	1° 15'

** Available in 3-position units only

SERIES	ROTARY BORE DIAMETER		LINEAR BORE DIAMETER		ROTARY DISPLACEMENT		LINEAR DISPLACEMENT			
							EXTEND		RETRACT	
	in	mm	in	mm	in ³ /°	cm ³ /°	in ³ /in	cm ³ /mm	in ³ /in	cm ³ /mm
2000	1.000	25.4	1.125	28.6	.014	0.229	.995	16.3	.690	11.3
4000	1.375	34.9	1.375	34.9	.038	0.623	1.485	24.3	1.043	17.1
6000	2.000	50.8	2.000	50.8	.082	1.344	3.142	51.5	1.653	27.1
8000	3.000	76.2	3.000	76.2	.370	6.064	7.069	115.8	3.927	64.4

SERIES	TORQUE OUTPUT		THRUST FORCE EXTEND		THRUST FORCE RETRACT	
	in-lb/psi	Nm/bar	lb/psi	N/bar	lb/psi	N/bar
2000	.39	.64	.99	63.9	.69	44.5
4000	1.11	1.82	1.48	95.5	1.04	67.0
6000	2.36	3.87	3.14	202.5	1.65	106.5
8000	10.60	17.37	7.06	455.4	3.93	253.5



WORKING PRINCIPLE

PHD Multi-Motion Actuators can be provided to yield three, four, or five rotary output positions. The various angle increments are fixed as specified and only the extreme positions can be adjusted in the field. Available for air or hydraulic service.

The schematic example shows a five position actuator. Pressurizing port A provides full clockwise rotation (position V). Pressurizing both ports B₁ and B₂ traps the racks between the rod ends of the outer pistons X and Y to rotate output shaft to position IV. Pressurizing ports C₁ and C₂ moves floating pistons in the inside upper rack cylinders against stop tubes to trap upper rack in position III. Similarly, positions II and I can be obtained by pressurizing ports D₁ and D₂, or E, respectively. Output positions can be selected in any sequence, allowing the shaft to stop at, or pass, any of the intermediate positions (II, III, or IV).

HYDRAULIC PRESSURE RATINGS FOR OPTIONS

All pneumatic rotary actuators have a maximum pressure rating of 150 psi [10 bar] air. Most hydraulic rotary actuators have a maximum pressure rating of 1500 psi [100 bar], except as noted in the chart.

ROTARY SECTION

HYD SERIES	OPTION psi [bar]		
	-P	-D	-E or -M
2000	—	—	—
4000	—	—	—
6000	—	—	750 [52]
8000	—	—	500 [35]

LINEAR SECTION

SERIES	OPTION psi [bar]							
	PLAIN		PORT CONTROLS		-Dx		-E or -M	
	psi	bar	psi	bar	psi	bar	psi	bar
2000	—	—	—	—	—	—	—	—
4000	—	—	—	—	—	—	—	—
6000	—	—	N/A	N/A	—	—	750	52
8000	—	—	N/A	N/A	—	—	500	35

NOTE: — = Standard Rating



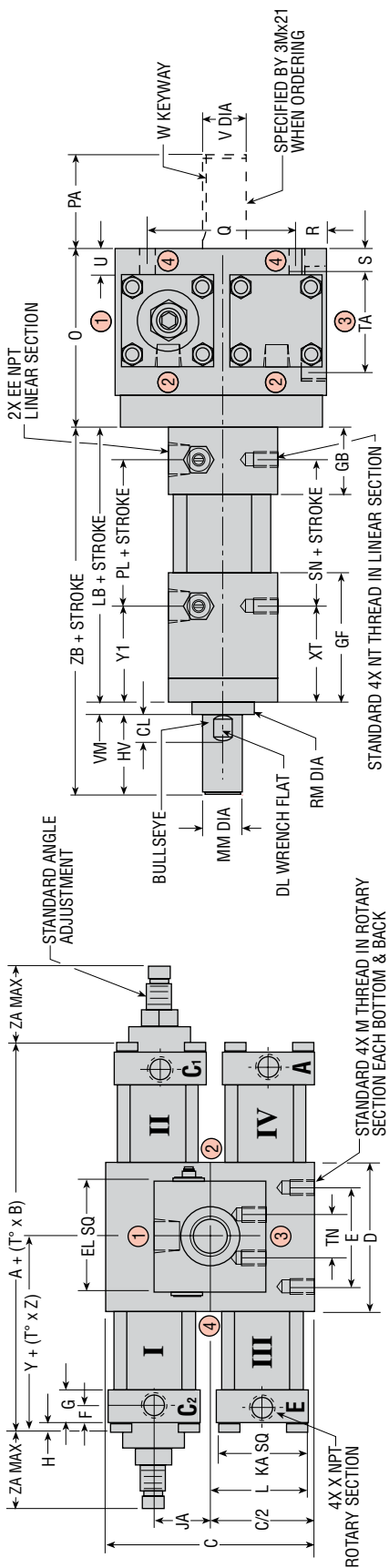
Sizing & Application Assistance

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

DIMENSIONS: 3 POSITION MULTI-MOTION ACTUATORS

IMPERIAL

2000-8000
multi-position



ROTARY SECTION

CAP STYLE	SERIES	LETTER DIMENSION																							
		A	B	C	D	E	F	G	H	JA	KA	L	M	O	PA	R	S	TA	U	V	W	X	Y	Z	ZA
PLAIN	2000	5.698	.0174	3.000	2.000	1.500	.250	0.00	.750	1.375	1.437	1/4-20 x .312 DP	2.500	.875	2.000	.500	.250	1.500	.312	4.998/5.003	1/8 x 1/16 x .625	1/8	2.849	.0087	.000
-A	2000	6.198	.0174	3.000	2.000	1.500	.500	0.00	.750	1.375	1.437	1/4-20 x .312 DP	2.500	.875	2.000	.500	.250	1.500	.312	4.998/5.003	1/8 x 1/16 x .625	1/8	3.099	.0087	1.125
BOTH	4000	7.906	.026	4.250	3.000	2.000	.344	.688	.250	1.156	2.094	5/16-18 x .500 DP	3.625	1.875	3.000	.625	.500	2.000	.562	8.748/8.753	3/16 x 3/32 x 1.500	1/4	3.953	.013	1.500
BOTH	6000	9.126	.026	5.000	4.250	2.500	.375	.750	.203	1.156	2.250	3/8-16 x .625 DP	3.750	1.875	3.500	.750	.500	2.000	.375	1.124/1.125	1/4 x 1/8 x 1.500	1/4	4.563	.013	1.875
BOTH	8000	12.160	.052	8.000	5.000	3.000	.469	1.062	.437	1.875	3.500	3/4-10 x 1.250 DP	6.250	3.500	5.000	1.500	1.250	2.500	.750	1.749/1.750	3/8 x 3/16 x 3.000	3/8	6.080	.026	2.875

LINEAR SECTION

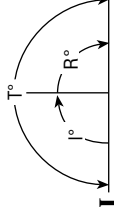
SERIES	LETTER DIMENSION																		
	CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	XT	Y1	ZB
2000	.530	1/2	1/4	1.750	1.250	1.000	2.187	1.500	5.000	.625	1/4-28 x .312 DP	2.812	1.000	2.812	.625	.250	1.562	1.562	6.750
4000	.530	5/8	3/8	2.250	1.375	1.000	2.625	1.625	5.562	.750	5/16-24 x .500 DP	2.937	1.250	2.937	.875	.250	1.937	1.937	7.437
6000	.987	1-1/8	3/8	3.000	2.000	1.250	3.750	3.000	7.250	1.375	3/8-24 x .500 DP	3.125	2.000	3.125	1.250	.375	2.937	2.937	10.625
8000	1.211	1-5/8	1/2	4.000	2.875	1.500	5.250	4.000	10.125	2.000	1/2-20 x .750 DP	4.625	2.750	4.625	1.875	.500	3.937	3.937	14.625

QUICK REFERENCE FOR: A + (T° x B)

SERIES	DEGREE OF ROTATION			
	45	90	180	270
*2000	6.481	7.264	8.830	10.396
4000	9.076	10.246	12.586	14.926
6000	10.296	11.466	13.806	16.146
8000	14.500	16.840	21.520	26.200

*DIMENSIONS CALCULATED USING PLAIN CAP STYLE. ADD .250 TO DIMENSION FOR EACH -A STYLE CAP USED ON SERIES 2000 ONLY.

II PORTS PRESSURIZED
C1 & C2



BULLSEYE: REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION

SHAFT KEYWAY & BULLSEYE: SHOWN AT MID-ROTATION

ROD END: STANDARD IS A "PL" (PLAIN) ROD END

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT POSITIONS.

MTG. HOLES: CENTERED ON CENTERLINE OF UNIT

STOP TUBES: LOCATED IN TUBES I & II

CUSHIONS: SERIES 2000 ROTARY SECTIONS ONLY:

ADD 1/2" TO RESPECTIVE "A" AND "Y" DIMENSIONS FOR EACH CUSHION

ALL LINEAR SECTIONS:

ADD DIMENSION "GC" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION

SHOCK PADS: LINEAR SECTION:

ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER				PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS			
	-B	-D	STANDARD	-M	-E	-P	-D	-P
3MA11 & 3MA21	I & II	I & II	ALL	ALL	2	1 & 3	1	4
3MH11 & 3MH21	—	I & II	ALL	ALL	2	1 & 3	1	4

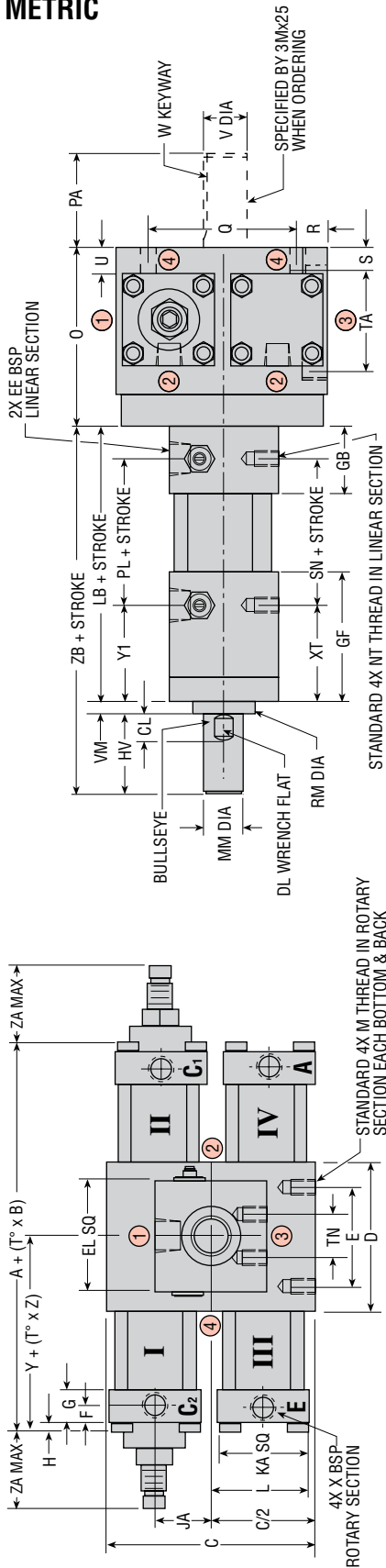
All standard rod ends have four wrench flats.



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

DIMENSIONS: 3 POSITION MULTI-MOTION ACTUATORS

METRIC



ROTARY SECTION

CAP STYLE	SERIES	LETTER DIMENSION																								
		A	B	C	D	E	F	G	H	JA	KA	L	M	N	O	PA	Q	R	S	TA	U	V	W	X	Y	Z
PLAIN	2000	145	0.44	76	51	38.1	6	13	0	19	35	36	M6 x 1.0 x 8	63	22	50.8	13	6	38.1	8	12.69/12.71	3.18 x 1.59 x 16	G1/8	72	0.22	0
-A	2000	157	0.44	76	51	38.1	6	13	0	19	35	36	M6 x 1.0 x 8	63	22	50.8	13	6	38.1	8	12.69/12.71	3.18 x 1.59 x 16	G1/8	78	0.22	29
BOTH	4000	201	0.66	108	76	50.8	9	17	6	29	48	53	M8 x 1.25 x 13	92	48	76.2	16	13	50.8	14	22.22/22.23	4.75 x 2.36 x 38	G1/4	100	0.33	38
BOTH	6000	292	0.66	127	102	63.5	10	19	5	29	57	58	M10 x 1.5 x 16	95.3	48	88.9	19	13	50.8	10	28.55/28.58	6.35 x 3.18 x 38	G1/4	116	0.33	48
BOTH	8000	309	1.32	203	127	76.2	12	27	11	48	89	92	M20 x 2.5 x 32	159	89	127.0	38	32	63.5	19	44.42/44.45	9.53 x 2.36 x 76	G3/8	154	0.66	73

LINEAR SECTION

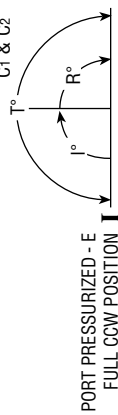
SERIES	LETTER DIMENSION																		
	CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	XT	Y1	ZB
2000	13	13	G1/4	44	32	25	56	38	127	15.9	M6 x 1.0 x 8	71	25.4	71.4	15.9	6	40	40	171
4000	13	16	G3/8	57	35	25	67	41	141	19.0	M8 x 1.25 x 13	75	31.8	74.6	22.2	6	49	49	189
6000	25	29	G3/8	76	51	32	95	76	184	34.9	M10 x 1.50 x 13	79	50.8	79.4	31.8	10	75	75	270
8000	31	41	G1/2	102	73	38	133	102	257	50.8	M12 x 1.25 x 19	117	69.9	117.5	47.6	13	100	100	371

QUICK REFERENCE FOR: A + (T° x B)

SERIES	DEGREE OF ROTATION			
	45	90	180	270
**2000	164.6	184.5	224.2	264.1
4000	230.5	260.2	319.8	379.1
6000	261.5	291.1	410.8	350.7
8000	368.3	427.7	539.6	546.6

*DIMENSIONS CALCULATED USING PLAIN CAP STYLE.
ADD 6.3 TO DIMENSION FOR EACH -A STYLE CAP USED ON SERIES 2000 ONLY.

II PORTS PRESSURIZED
C1 & C2



BULLSEYE: REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION

SHAFT KEYWAY & BULLSEYE: SHOWN AT MID-ROTATION

ROD END: STANDARD IS A "PL" (PLAIN) ROD END

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT POSITIONS.

MTG. HOLES: CENTERED ON CENTERLINE OF UNIT

STOP TUBES: LOCATED IN TUBES I & II

CUSHIONS: SERIES 2000 ROTARY SECTIONS ONLY.

ADD 13 mm TO RESPECTIVE "A" AND "Y" DIMENSIONS FOR EACH CUSHION

ALL LINEAR SECTIONS: ADD DIMENSION "GC" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION

SHOCK PADS: LINEAR SECTION: ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER		PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS	
	-B	-D	-M	-E
3MA15 & 3MA25	I & II	I & II	ALL	ALL
3MH15 & 3MH25	—	I & II	ALL	ALL

PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS

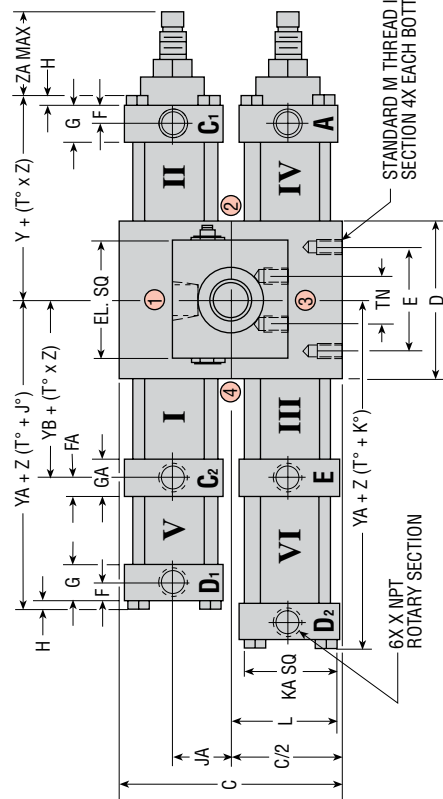
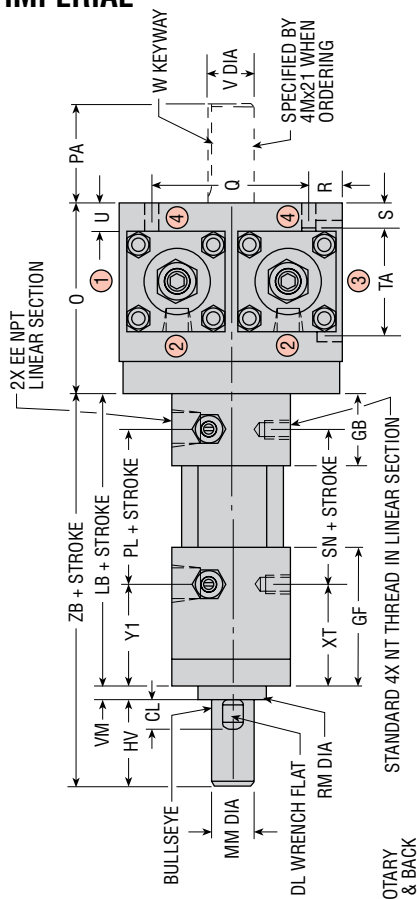
ACTUATOR TYPE	STANDARD		-F	
	-P	-D	-P	-D
3MA15 & 3MA25	1 & 3	1 & 3	1 & 3	1 & 3
3MH15 & 3MH25	1 & 3	1 & 3	1 & 3	1 & 3

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



DIMENSIONS: 4 POSITION MULTI-MOTION ACTUATORS

IMPERIAL



ROTARY SECTION

SERIES	LETTER DIMENSION																										
	C	D	E	F	FA	G	GA	H	JA	KA	L	M	O	PA	Q	R	S	TA	U	V	W	X	Y	YA	YB	Z	ZA
4000	4.250	3.000	2.000	.344	.375	.688	.719	.250	1.156	1.875	2.094	5/16-18 x .500 DP	3.625	1.875	3.000	.625	.500	2.000	.562	.8748/8753	3/16 x 3/32 x 1.500	1/4	3.953	6.721	3.360	.013	1.500
6000	5.000	4.000	2.500	.375	.344	.750	.719	.203	1.156	2.250	2.281	3/8-16 x .625 DP	3.750	1.875	3.500	.750	.500	2.000	.375	1.124/1.125	1/4 x 1/8 x 1.500	1/4	4.563	7.325	3.980	.013	1.875
8000	8.000	5.000	3.000	.469	.469	1.062	1.062	.437	1.875	3.500	3.625	3/4-10 x 1.250 DP	6.250	3.500	5.000	1.500	1.250	2.500	.750	1.749/1.750	3/8 x 3/16 x 3.000	3/8	6.080	9.865	5.236	.026	2.875

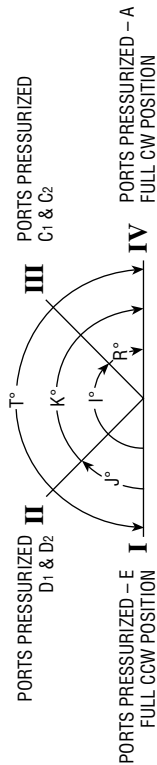
LINEAR SECTION

SERIES	LETTER DIMENSION																		
	CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	XT	Y1	ZB
4000	.530	5/8	3/8	2.250	1.375	1.000	2.625	1.625	5.562	.750	5/16-24 x .500 DP	2.937	1.250	2.937	.875	.250	1.937	1.937	7.437
6000	.987	1-1/8	3/8	3.000	2.000	1.250	3.750	3.000	7.250	1.375	3/8-24 x .500 DP	3.125	2.000	3.125	1.250	.375	2.937	2.937	10.625
8000	1.211	1-5/8	1/2	4.000	2.875	1.500	5.250	4.000	10.125	2.000	1/2-20 x .750 DP	4.625	2.750	4.625	1.875	.500	3.937	3.937	14.625



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

- BULLSEYE:** REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION
- SHAFT KEYWAY & BULLSEYE:** SHOWN AT MID-ROTATION
- ROD END:** STANDARD IS A "PL" (PLAIN) ROD END
- PORT POSITIONS:** INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT POSITIONS.
- MTG. HOLES:** CENTERED ON CENTERLINE OF UNIT
- STOP TUBES:** LOCATED IN TUBES I & II
- CUSHIONS:** ADD DIMENSION "GC" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
- SHOCK PADS:** LINEAR SECTION:
ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD



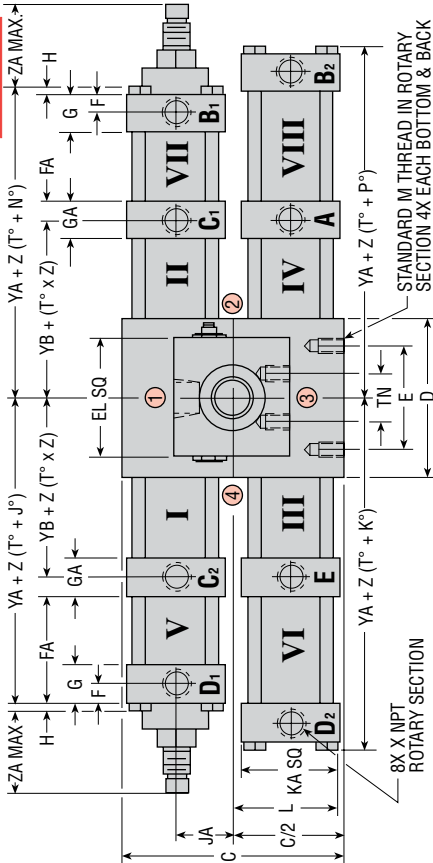
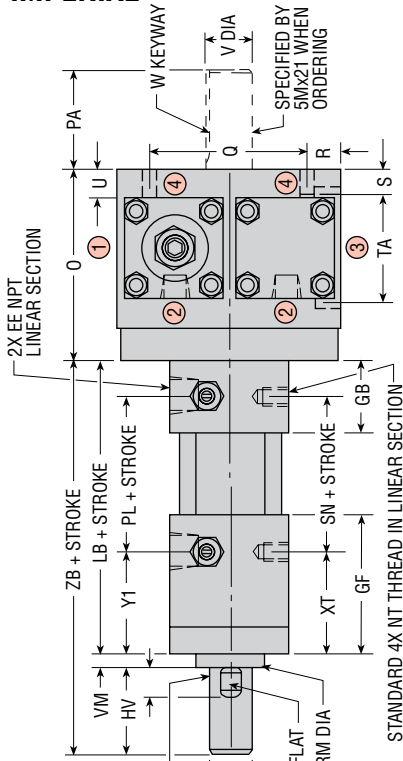
ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION				PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS			
	-B	-D	-E	-M	-P	STANDARD	-P	-D
4MA11 & 4MA21	II & IV	II & IV	ALL	ALL	2	1 & 3	1	4
4MH11 & 4MH21	—	II & IV	ALL	ALL	2	1 & 3	1	4

All standard rod ends have four wrench flats.

DIMENSIONS: 5 POSITION MULTI-MOTION ACTUATORS

IMPERIAL



ROTARY SECTION

SERIES	LETTER DIMENSION																									
	C	D	E	F	G	GA	H	JA	KA	L	M	O	PA	Q	R	S	TA	U	V	VM	XT	Y1	ZB	ZA		
4000	4.250	3.000	2.000	.344	.375	.688	.719	.250	1.156	1.875	2.094	5/16-18 x .500 DP	3.625	1.875	3.000	.625	5.000	.562	.8748/8753	3/16 x 3/32 x 1.500	1/4	6.721	3.360	.013	1.500	
6000	5.000	4.000	2.500	.375	.344	.750	.719	.203	1.156	2.250	2.281	3/8-16 x .625 DP	3.750	1.875	3.500	.750	5.000	.375	1.124/1.125	1/4 x 1/8 x 1.500	1/4	7.325	3.980	.013	1.875	
8000	8.000	5.000	3.000	.469	.469	1.062	1.062	.437	1.875	3.500	3.625	3/4-10 x 1.250 DP	6.250	3.500	5.000	1.500	1.250	2.500	.750	1.749/1.750	3/8 x 3/16 x 3.000	3/8	9.865	5.236	.026	2.875

LINEAR SECTION

SERIES	LETTER DIMENSION																	
	CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	XT	Y1
4000	.530	5/8	3/8	2.250	1.375	1.000	2.625	1.625	5.562	.750	5/16-24 x .500 DP	2.937	1.250	2.937	.875	.250	1.937	7.437
6000	.987	1-1/8	3/8	3.000	2.000	1.250	3.750	3.000	7.250	1.375	3/8-24 x .500 DP	3.125	2.000	3.125	2.000	.375	2.937	10.625
8000	1.211	1-5/8	1/2	4.000	2.875	1.500	5.250	4.000	10.125	2.000	1/2-20 x .750 DP	4.625	2.750	4.625	1.875	.500	3.937	14.625

BULLSEYE: REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION
SHAFT KEYWAY & BULLSEYE: SHOWN AT MID-ROTATION
ROD END: STANDARD IS A "PL" (PLAIN) ROD END
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT POSITIONS.

MTG. HOLES: CENTERED ON CENTERLINE OF UNIT

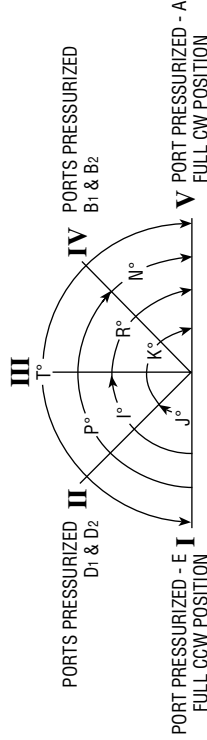
STOP TUBES: LOCATED IN TUBES I & II

CUSHIONS: ADD DIMENSION "GC" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION

SHOCK PADS: LINEAR SECTION:

ADD 1/4" TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

PORTS PRESSURIZED
C₁ & C₂



ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER				PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS			
	-B	-D	STANDARD	-M	-E	-P	-D	-P
5MA11 & 5MA21	VII & V	VII & V	ALL	ALL	ALL	2	1 & 3	1
5MH11 & 5MH21	—	VII & V	ALL	ALL	2	1 & 3	1	1, 3
								2

2000-8000 multi-position

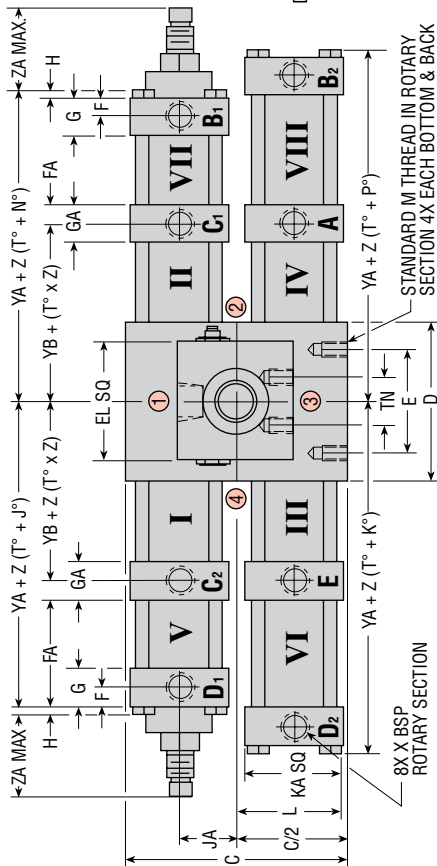
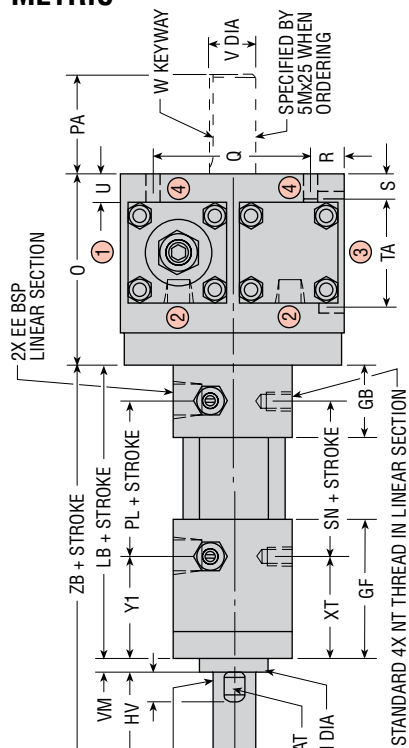


CAD & Sizing Assistance
 Use PHD's free online Product Sizing and CAD Configurator at www.phdinc.com/myphd

All standard rod ends have four wrench flats.

DIMENSIONS: 5 POSITION MULTI-MOTION ACTUATORS

METRIC



ROTARY SECTION

SERIES	LETTER DIMENSION																									
	C	D	E	F	G	GA	H	JA	KA	L	M	O	PA	Q	R	S	TA	U	V	W	X	YA	YB	Z	ZA	
4000	108	76	50.8	9	10	17	18	6	29	48	53	M8 x 1.25 x 13	92	48	76.2	16	13	50.8	14	22.22/22.23	4.75 x 2.36 x 38	G1/4	171	85	0.33	38
6000	127	102	63.5	10	9	19	18	5	29	57	58	M10 x 1.5 x 16	95.3	48	88.9	19	13	50.8	10	28.55/28.58	6.35 x 3.18 x 38	G1/4	186	101	0.33	48
8000	203	127	76.2	12	12	27	27	11	48	89	92	M20 x 2.5 x 32	159	89	127.0	38	32	63.5	19	44.42/44.45	9.53 x 2.36 x 76	G3/8	251	133	0.66	73

LINEAR SECTION

SERIES	LETTER DIMENSION																		
	CL	DL	EE	EL	GB	GC	GF	HV	LB	MM	NT	PL	RM	SN	TN	VM	XT	Y1	ZB
4000	13	16	G3/8	57	35	25	67	41	141	19.1	M8 x 1.25 x 13	75	31.8	74.6	22.2	6	49	49	189
6000	25	29	G3/8	76	51	32	95	76	184	34.9	M10 x 1.50 x 13	79	50.8	79.4	31.8	10	75	75	270
8000	31	41	G1/2	102	73	38	133	102	257	50.8	M12 x 1.25 x 19	117	69.9	117.5	47.6	13	100	100	371

BULLSEYE: REFERENCE MARK INDICATING ORIENTATION OF ROD END TO ROTARY SECTION
SHAFT KEYWAY & BULLSEYE: SHOWN AT MID-ROTATION
ROD END: STANDARD IS A "PL" (PLAIN) ROD END
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS. LINEAR SECTION NEEDLE & MTG. HOLES / REMAIN UNCHANGED RELATIVE TO PORTS WITH OPTIONAL PORT POSITIONS.

MTG. HOLES: CENTERED ON CENTERLINE OF UNIT

STOP TUBES: LOCATED IN TUBES I & II

CUSHIONS: ADD DIMENSION "GC" TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION

SHOCK PADS: LINEAR SECTION:
 ADD 6.4 mm TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD

PORTS PRESSURIZED
 C₁ & C₂

III

PORTS PRESSURIZED
 D₁ & D₂

PORTS PRESSURIZED
 B₁ & B₂

PORT PRESSURIZED - E I
 FULL CCW POSITION

PORT PRESSURIZED - A
 FULL CW POSITION

ROTARY SECTION OPTION LOCATION REFERENCE

ACTUATOR TYPE	LETTER OPTION REFERENCED BY TUBE NUMBER		PORT & NEEDLE LOCATIONS REFERENCED BY CIRCLED NUMBERS	
	-B	-D	STANDARD	-F
5MA15 & 5MA25	VII & V	ALL	ALL	ALL
5MH15 & 5MH25	VII & V	ALL	ALL	ALL

All standard rod ends have four wrench flats.

2000-8000
 multi-position

OPTIONS: 1000-8000 MULTI-MOTION ACTUATORS

PORT CONTROL®

The exclusive PHD Port Control®, based on the “meter-out” principle, features an adjustable needle and a separate ball check. Both are built into the linear and rotary section and are used to control the speed of the actuator over its entire cycle.

DR DC LINEAR SECTION CUSHIONS

D1 D2 ROTARY SECTION CUSHIONS

Adjustable cushions, available on all PHD Multi-Motion Actuators, allow smooth deceleration at the end of stroke and rotation to eliminate mechanical shock and hammer effect.

Effective cushioning length (approximate)

Rotary Section 1000-8000 = 30°

Linear Section 1000-4000 = 3/4", 5000-6000 = 1", 7000-8000 = 1-1/4"

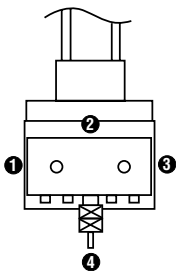
MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES

E HALL EFFECT SWITCHES

Multi-Motion Actuators may be equipped with a magnetic band (specify -E) on the pistons which activates externally mounted PHD Hall Effect Switches. These switches allow the interfacing of the PHD Air or Hydraulic Multi-Motion Actuators to various logic systems. This option is for use with the following switches.

Y TANDEM CAP ROTATED 180°

This option rotates the cap of an Air/Oil Tandem Multi-Motion Actuator 180°. This places the Port Control (and Cushion) needles and the Tandem fitting in position 4. Standard position for these is position 2.



BR BC LINEAR SECTION SHOCK PADS

B1 B2 ROTARY SECTION SHOCK PADS

Polyurethane pads for absorption of shock and noise are available on each end of stroke and rotation on Series 1000-8000 Multi-Motion Actuators. Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Pads eliminate metal-to-metal contact between piston and end caps.

K PILOT VALVE ACTUATOR (PVA) ROTARY SECTION

R PILOT VALVE ACTUATOR (PVA) LINEAR SECTION

The PVA functions as a built-in pneumatic limit switch. An air pressure signal is provided at the end-of-piston travel as the piston seal uncovers an orifice in the block. Upon reversal of piston travel the pilot pressure is shut off and the pilot line is vented through the rotary actuator housing.

Air pilot signal is provided approximately .03 inch [.8 mm] prior to end of piston travel (or 1 to 5 degrees prior to end of rotation). For pneumatic use only.

PVA ports are located in position 1 on linear section and position 2 on the rotary section unless otherwise specified. They are available on both linear and rotary sections of the Series 1000-4000 only.

Units with PVA are supplied without angle adjustments.

M REED SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the Hall Effect Switches are not applicable. As with the Hall Effect Switches, a magnetic band (specify -M) on the pistons activates the externally mounted PHD Reed Switches. The Reed Switches may be used to signal a programmable controller, sequencer, relay, or in some cases, a valve solenoid. This option is for use with the following switches.



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.

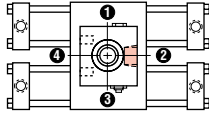
OPTIONS: 1000-8000 MULTI-MOTION ACTUATORS

PORT POSITIONS

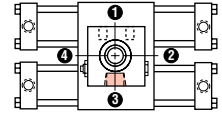
LINEAR SECTION

Port Position 1 is standard. **NOTE:** Options -S, -T, and -U imply that mounting holes and flow control needle locations remain unchanged relative to new port positions. (Rotates with port.)

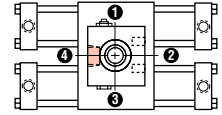
S PORT POSITION 2



T PORT POSITION 3



U PORT POSITION 4

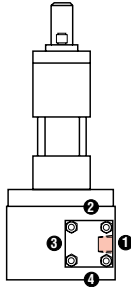


ROTARY SECTION

Port Position 2 is standard.

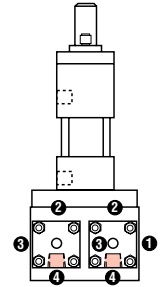
C PORT POSITION 1

Available only on Series 1000, 3000, 5000, and 7000 Actuators.



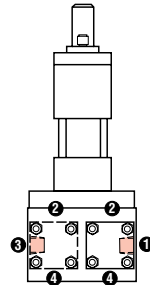
F PORT POSITION 4

Available on all series actuators.



I PORT POSITION 1 TOP RACK PORT POSITION 3 BOTTOM RACK

This option positions the ports in position 1 on tubes I and II and in position 3 on tubes III and IV. This allows access to the ports on the "Top" and "Bottom" sides of the actuator. Available on 2000, 4000, 6000, and 8000 actuators.



N SAE PORTS FOR HYDRAULIC UNITS

SAE Ports are available on most PHD hydraulic Multi-Motion Actuators. The Series 1000 & 2000 Multi-Motion Actuators require a boss which is brazed to the rotary caps. All other sizes, the port remains in the standard location.

Consult PHD for optional port position or units with Port Controls.

V FLUORO-ELASTOMER SEALS

Fluoro-Elastomer seals are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the fluid manufacturer for proper application. Consult PHD for high temperature use.

W CLOSE TOLERANCE STROKE AND ROTATION

This option may be specified when a precise stroke and rotation is required and angle adjustment is not acceptable. By specifying this option, rotation will be within a tolerance of +30 minutes, -0 minutes and stroke will be a tolerance of $\pm .005$ [± 0.127 mm].

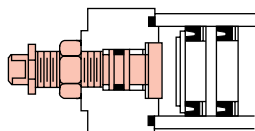
Z1 ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except the pinion shaft and rod end. This optional plating treatment gives an alternative method of protecting the unit from severe environments. **NOTE:** Standard plating is Zinc.

ANGLE ADJUSTMENT (STANDARD) SERIES 1000-8000

Adjusting screw(s) for reducing angle of rotation in either or both directions for use where exact degree of desired rotation cannot be predetermined or where requirements may vary during operation. Standard adjusting screw will reduce angle of rotation up to 30°. Available in conjunction with all other optional features.

Cushions are normally engaged over the last 30° of angle. The use of angle adjusting screws to reduce angle of rotation has a direct effect on the length of cushion engagement. Example: 10° angle reduction will reduce cushion engagement by 10°.



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.

All dimensions are reference only unless specifically toleranced.

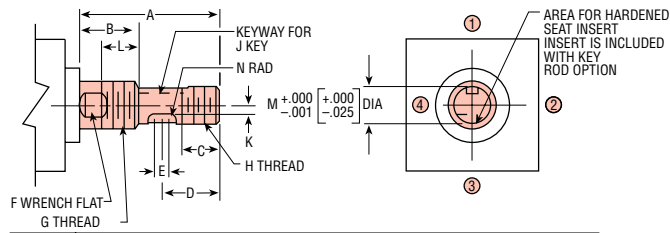
www.phdinc.com/multimotion • (800) 624-8511

2000-8000
multi-position

OPTIONS: 1000-8000 MULTI-MOTION ACTUATORS

OPTIONAL ROD ENDS

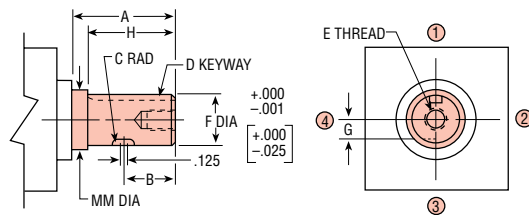
-KY THREADED ROD END WITH KEYWAY AND PRE-LOAD



LETTER DIM.	SERIES			
	1000 & 2000	3000 & 4000	5000 & 6000	7000 & 8000
A	2.187 [55.5]	2.375 [60.5]	5.187 [132.0]	7.156 [182.0]
B	1.000 [25]	1.000 [25]	2.187 [55.5]	2.906 [74]
C	.562 [14.3]	.625 [16]	1.625 [41.3]	2.250 [57]
D	.852 [21.6]	.977 [25]	2.313 [58.7]	3.250 [82.5]
E	.215 [5.5]	.242 [6]	.437 [11]	.625 [16]
F	1/2 [12.7]	5/8 [16]	1-1/8 [28.6]	1-5/8 [41.2]
G	5/8-18 [M16 x 1.5]	3/4-16 [M18 x 1.5]	1-3/8-12 [M33 x 2.0]	2-12 [M48 x 2.0]
H	1/2-20 [M12 x 1.25]	5/8-18 [M16 x 1.5]	1-1/4-12 [M30 x 2.0]	1-3/4-12 [M42 x 2.0]
J	1/8 x 1/8 x 5/8 [3.18 x 3.18 x 16]	3/16 x 3/16 x 3/4 [4.75 x 4.75 x 19]	1/4 x 1/4 x 1-3/8 [6.35 x 6.35 x 35]	1/2 x 1/2 x 2 [12.7 x 12.7 x 50]
K	.125 [3]	.156 [4]	.422 [10.7]	.594 [15]
L	.625 [16]	.625 [16]	1.345 [34]	1.875 [48]
M	.500 [12.70]	.625 [15.88]	1.250 [31.75]	1.750 [44.45]
N	.093 [2.4]	.125 [3.2]	.156 [4]	.187 [5]

NOTE: Keyway shown at mid-rotation

-PK PLAIN ROD END WITH KEYWAY AND PRE-LOAD



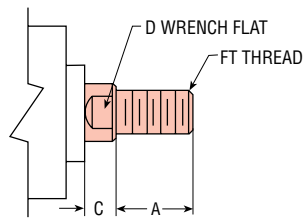
CIRCLED NUMBERS: INDICATE PORT POSITIONS
KEY: INCLUDED WITH ROD END OPTION

LETTER DIM.	SERIES			
	1000 & 2000	3000 & 4000	5000 & 6000	7000 & 8000
A	1.500 [38]	1.625 [41.3]	3.000 [76.2]	4.000 [101.6]
B	.375 [9.5]	.812 [20.6]	.812 [20.6]	1.500 [38]
C	.156 [4]	.219 [5.6]	.250 [6.4]	.437 [11]
D	1/8 x 1/16 x 1.00 [3.18 x 1.59 x 25]	3/16 x 3/32 x 1.10 [4.76 x 2.38 x 28]	1/4 x 1/8 x 1.50 [6.35 x 3.18 x 38]	3/8 x 3/16 x 3.00 [9.52 x 4.75 x 76]
E	10-32 x .31 DP [M5 x 0.8 x 7]	5/16-24 x .44 DP [M8 x 1.25 x 11]	3/8-24 x .56 DP [M10 x 1.5 x 14]	1/2-20 x .68 DP [M12 x 1.75 x 17]
F	.500 [12.70]	.750 [19.05]	1.125 [28.57]	1.750 [44.45]
G	.094 [2.4]	.156 [4.0]	.312 [7.9]	.438 [11.1]
H	1.375 [35]	—	2.720 [69]	3.695 [94]
MM	.625 [15.9]	—	1.375 [34.9]	2.000 [50.8]

2000-8000 multi-position

- MT MALE THREAD ROD END

SERIES	ROD DIA.	LETTER DIMENSION			
		A	C	D	FT
1000 & 2000	.625 [15.87]	.750 [19]	.375 [9.5]	1/2 [19.00]	7/16-20 [M12 x 1.25]
	.750 [19.05]	1.000 [25]	.375 [9.5]	5/8 [15.80]	9/16-18 [M14 x 1.50]
5000 & 6000	1.375 [34.93]	2.375 [60.5]	.625 [15.9]	1-1/8 [28.5]	1-14 [M27 x 2.0]
	2.000 [50.80]	2.938 [79.5]	.882 [22.2]	1-5/8 [44.5]	1-1/2-12 [M42 x 2.0]



Numbers in [] are metric and are in mm.

All standard rod ends have four wrench flats.

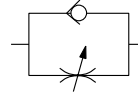
OPTIONS: MULTI-MOTION ACTUATORS

PORT CONTROL®

The exclusive PHD Port Control®, based on the “meter-out” principle, features an adjustable needle and a separate ball check. Both are built into the linear and rotary section and are used to control the speed of the actuator over its entire cycle.

The self-locking needle is adjustable under pressure. It determines the orifice size which controls the exhaust volume. The separate ball check is closed while fluid is exhausting from the

actuator, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for multi-motion actuators. It saves space and eliminates the cost of installation and fittings for external flow control valves.

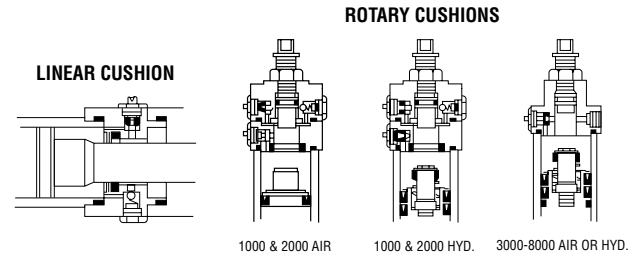


Standard on Series 1000-4000 and on the rotary section only of Series 5000-8000.

DR DC LINEAR SECTION CUSHIONS

D1 D2 ROTARY SECTION CUSHIONS

Adjustable cushions, available on all PHD Multi-Motion Actuators, allow smooth deceleration at the end of stroke and rotation to eliminate mechanical shock and hammer effect.



Effective cushioning length (approximate)
 Rotary Section 1000-8000 = 30°
 Linear Section 1000-4000 = 3/4", 5000-6000 = 1", 7000-8000 = 1-1/4"

BR BC LINEAR SECTION SHOCK PADS

B1 B2 ROTARY SECTION SHOCK PADS

Polyurethane pads for absorption of shock and noise are available on each end of stroke and rotation on Series 1000-8000 Multi-Motion Actuators. Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Pads eliminate

LINEAR SHOCK PAD ROTARY SHOCK PAD



metal-to-metal contact between piston and end caps.

NOTE: Pneumatic application only. Linear Section, add 1/4" [6.4 mm] to all (+ Stroke) dimensions for each shock pad. Rotary Section, no increase.

K PILOT VALVE ACTUATOR (PVA) ROTARY SECTION

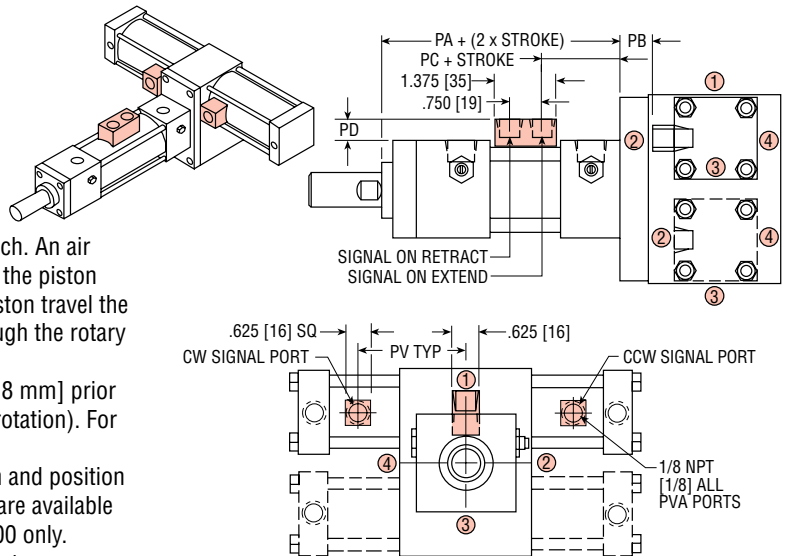
R PILOT VALVE ACTUATOR (PVA) LINEAR SECTION

The PVA functions as a built-in pneumatic limit switch. An air pressure signal is provided at the end-of-piston travel as the piston seal uncovers an orifice in the block. Upon reversal of piston travel the pilot pressure is shut off and the pilot line is vented through the rotary actuator housing.

Air pilot signal is provided approximately .03 inch [.8 mm] prior to end of piston travel (or 1 to 5 degrees prior to end of rotation). For pneumatic use only.

PVA ports are located in position 1 on linear section and position 2 on the rotary section unless otherwise specified. They are available on both linear and rotary sections of the Series 1000-4000 only.

Units with PVA are supplied without angle adjustments.



PVA AVAILABILITY: SERIES 1000-4000 WITH A MINIMUM ROTATION OF 45°

CUSHIONS: LINEAR SECTIONS:

ADD 1" [25 mm] TO "PA" DIMENSION FOR EACH CUSHION (-DR, -DC)

ADD 1" [25 mm] TO "PC" DIMENSION FOR -DC OPTION

SHOCK PADS: ADD 1/4" [6.4 mm] FOR EACH SHOCK PAD TO "PA" DIM. (-BR, -BC)

ADD 1/4" [6.4 mm] TO "PC" DIMENSION FOR -BC OPTION

SERIES	LETTER DIMENSION					PV	
	PA	PB	PC	PD	STANDARD	W/-B	
1000 & 2000	4.500 [114]	.375 [9.5]	1.281 [32.5]	.375 [9.5]	2.191 [55.7]	1.848 [46.9]	
3000 & 4000	5.125 [130]	.812 [20.6]	1.406 [35.7]	.312 [7.9]	2.847 [72.3]	2.410 [61.2]	

Numbers in [] are mm—imperial equivalents are provided for convenience.

All dimensions are reference only unless specifically tolerated.

www.phdinc.com/multimotion • (800) 624-8511

OPTIONS: MULTI-MOTION ACTUATORS

MAGNETIC PISTON FOR USE WITH PHD PROXIMITY SWITCHES

E HALL EFFECT SWITCHES

Multi-Motion Actuators may be equipped with a magnetic band (specify -E) on the pistons which activates externally mounted PHD Hall Effect Switches. These switches allow the interfacing of the PHD Air or Hydraulic Multi-Motion Actuators to various logic systems. This option is for use with the following switches.

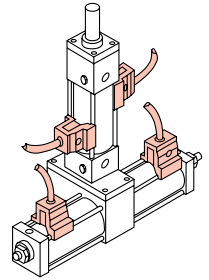
COMPACT HALL EFFECT SWITCHES

PART NO.	DESCRIPTION
17503-2-06	NPN Type 4.5-24 VDC
17504-2-06	PNP Type 4.5-24 VDC
17523-2	NPN Type 4.5-24 VDC, Quick Connect
17524-2	PNP Type 4.5-24 VDC, Quick Connect

See engineering data page for Hydraulic Pressure Ratings with these options. See each ordering data for magnetic piston ordering information. See Switches and Sensors section for complete switch specifications. Switches and mounting brackets must be ordered separately.

M REED SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the Hall Effect Switches are not applicable. As with the Hall Effect Switches, a magnetic band (specify -M) on the pistons activates the externally mounted PHD Reed Switches. The Reed Switches may be used to signal a programmable controller, sequencer, relay, or in some cases, a valve solenoid. This option is for use with the following switches.

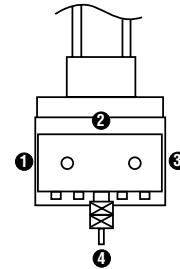


COMPACT REED SWITCHES

PART NO.	DESCRIPTION
17502-2-06	Sink or Source Type 4.5-24 VDC
17509-3-06	AC Type 110-120 VAC with Current Limit
17522-2	Sink or Source Type VDC, Quick Connect
17529-3	AC Type 110-120 VAC, Quick Connect with Current Limit

Y TANDEM CAP ROTATED 180°

This option rotates the cap of an Air/Oil Tandem Multi-Motion Actuator 180°. This places the Port Control (and Cushion) needles and the Tandem fitting in position 4. Standard position for these is position 2.



1000-8000

OPTIONS: MULTI-MOTION ACTUATORS

PORT POSITIONS

LINEAR SECTION

Port Position 1 is standard. **NOTE:** Options -S, -T, and -U imply that mounting holes and flow control needle locations remain unchanged relative to new port positions. (Rotates with port.)



S PORT POSITION 2



T PORT POSITION 3



U PORT POSITION 4

ROTARY SECTION

Port Position 2 is standard.



C PORT POSITION 1

Available only on Series 1000, 3000, 5000, and 7000 Actuators.



I PORT POSITION 1 TOP RACK
PORT POSITION 3 BOTTOM RACK

This option positions the ports in position 1 on tubes I and II and in position 3 on tubes III and IV. This allows access to the ports on the "Top" and "Bottom" sides of the actuator. Available on 2000, 4000, 6000, and 8000 actuators.



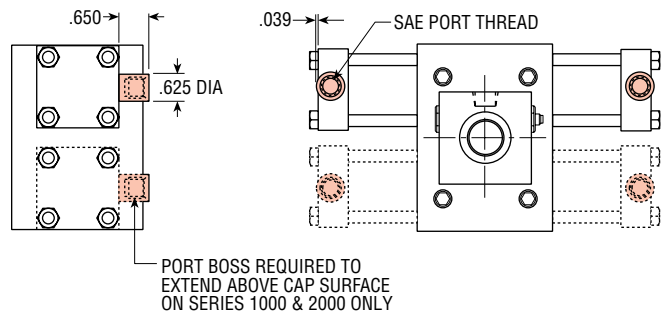
F PORT POSITION 4
(Available on all series actuators.)

N SAE PORTS FOR HYDRAULIC UNITS

SAE Ports are available on most PHD hydraulic Multi-Motion Actuators. The Series 1000 & 2000 Multi-Motion Actuators require a boss which is brazed to the rotary caps. All other sizes, the port remains in the standard location.

Consult PHD for optional port position or units with Port Controls.

SERIES	PORT SIZE
1000 & 2000	7/16 - 20 SAE
3000 & 4000	7/16 - 20 SAE
5000 & 6000	9/16 - 18 SAE
7000 & 8000	3/4 - 16 SAE



1000-8000

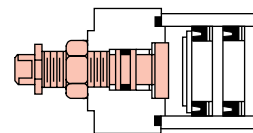
ANGLE ADJUSTMENT (STANDARD)

SERIES 1000-8000

Adjusting screw(s) for reducing angle of rotation in either or both directions for use where exact degree of desired rotation cannot be predetermined or where requirements may vary during operation. Standard adjusting screw will reduce angle of rotation up to 30°. Available in conjunction with all other optional features.

Cushions are normally engaged over the last 30° of angle.

The use of angle adjusting screws to reduce angle of rotation has a direct effect on the length of cushion engagement. Example: 10° angle reduction will reduce cushion engagement by 10°.



All dimensions are reference only unless specifically toleranced.

OPTIONS: MULTI-MOTION ACTUATORS

V FLUORO-ELASTOMER SEALS

Fluoro-Elastomer seals are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the fluid manufacturer for proper application. Consult PHD for high temperature use.

W CLOSE TOLERANCE STROKE AND ROTATION

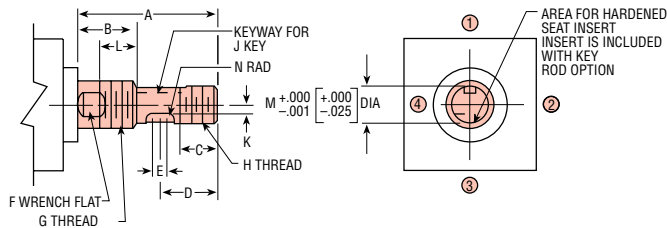
This option may be specified when a precise stroke and rotation is required and angle adjustment is not acceptable. By specifying this option, rotation will be within a tolerance of +30 minutes, -0 minutes and stroke will be a tolerance of $\pm .005$ [± 0.127 mm].

Z1 ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except the pinion shaft and rod end. This optional plating treatment gives an alternative method of protecting the unit from severe environments. **NOTE:** Standard plating is Zinc.

OPTIONAL ROD ENDS

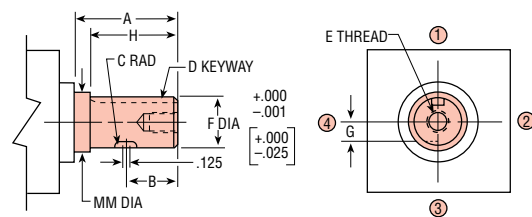
-KY THREADED ROD END WITH KEYWAY AND PRE-LOAD



LETTER DIM.	SERIES			
	1000 & 2000	3000 & 4000	5000 & 6000	7000 & 8000
A	2.187 [55.5]	2.375 [60.5]	5.187 [132.0]	7.156 [182.0]
B	1.000 [25]	1.000 [25]	2.187 [55.5]	2.906 [74]
C	.562 [14.3]	.625 [16]	1.625 [41.3]	2.250 [57]
D	.852 [21.6]	.977 [25]	2.313 [58.7]	3.250 [82.5]
E	.215 [5.5]	.242 [6]	.437 [11]	.625 [16]
F	1/2 [12.7]	5/8 [16]	1-1/8 [28.6]	1-5/8 [41.2]
G	5/8-18 [M16 x 1.5]	3/4-16 [M18 x 1.5]	1-3/8-12 [M33 x 2.0]	2-12 [M48 x 2.0]
H	1/2-20 [M12 x 1.25]	5/8-18 [M16 x 1.5]	1-1/4-12 [M30 x 2.0]	1-3/4-12 [M42 x 2.0]
J	1/8 x 1/8 x 5/8 [3.18 x 3.18 x 16]	3/16 x 3/16 x 3/4 [4.75 x 4.75 x 19]	1/4 x 1/4 x 1-3/8 [6.35 x 6.35 x 35]	1/2 x 1/2 x 2 [12.7 x 12.7 x 50]
K	.125 [3]	.156 [4]	.422 [10.7]	.594 [15]
L	.625 [16]	.625 [16]	1.345 [34]	1.875 [48]
M	.500 [12.70]	.625 [15.88]	1.250 [31.75]	1.750 [44.45]
N	.093 [2.4]	.125 [3.2]	.156 [4]	.187 [5]

NOTE: Keyway shown at mid-rotation

-PK PLAIN ROD END WITH KEYWAY AND PRE-LOAD

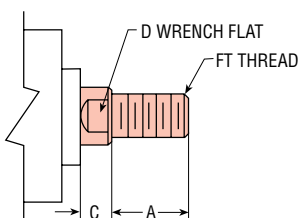


CIRCLED NUMBERS: INDICATE PORT POSITIONS
KEY: INCLUDED WITH ROD END OPTION

LETTER DIM.	SERIES			
	1000 & 2000	3000 & 4000	5000 & 6000	7000 & 8000
A	1.500 [38]	1.625 [41.3]	3.000 [76.2]	4.000 [101.6]
B	.375 [9.5]	.812 [20.6]	.812 [20.6]	1.500 [38]
C	.156 [4]	.219 [5.6]	.250 [6.4]	.437 [11]
D	1/8 x 1/16 x 1.00 [3.18 x 1.59 x 25]	3/16 x 3/32 x 1.10 [4.76 x 2.38 x 28]	1/4 x 1/8 x 1.50 [6.35 x 3.18 x 38]	3/8 x 3/16 x 3.00 [9.52 x 4.75 x 76]
E	10-32 x .31 DP [M5 x 0.8 x 7]	5/16-24 x .44 DP [M8 x 1.25 x 11]	3/8-24 x .56 DP [M10 x 1.5 x 14]	1/2-20 x .68 DP [M12 x 1.75 x 17]
F	.500 [12.70]	.750 [19.05]	1.125 [28.57]	1.750 [44.45]
G	.094 [2.4]	.156 [4.0]	.312 [7.9]	.438 [11.1]
H	1.375 [35]	—	2.720 [69]	3.695 [94]
MM	.625 [15.9]	—	1.375 [34.9]	2.000 [50.8]

- MT MALE THREAD ROD END

SERIES	ROD DIA.	LETTER DIMENSION			
		A	C	D	FT
1000 & 2000	.625 [15.87]	.750 [19]	.375 [9.5]	1/2 [19.00]	7/16-20 [M12 x 1.25]
	.750 [19.05]	1.000 [25]	.375 [9.5]	5/8 [15.80]	9/16-18 [M14 x 1.50]
5000 & 6000	1.375 [34.93]	2.375 [60.5]	.625 [15.9]	1-1/8 [28.5]	1-14 [M27 x 2.0]
	2.000 [50.80]	2.938 [79.5]	.882 [22.2]	1-5/8 [44.5]	1-1/2-12 [M42 x 2.0]



Numbers in [] are metric and are in mm.

All standard rod ends have four wrench flats.

All dimensions are reference only unless specifically tolerated.