

GRA SERIES GRA PARALLEL GRIPPERS

Compact Precision Grippers Ideal for Medical, Electronics, Assembly and Robotics



- Consistent Jaw Movement Over Life of Unit
- 10 Million Cycle Life in a Robust, Compact Design
- Flexible Mounting Capability



**ISO-9001
CERTIFIED**

Quality Management
System Certified

GRA01



PHD is a member of the
MAC Distributor Network

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SOLUTIONS FOR INDUSTRIAL AUTOMATION

www.phdinc.com

ORDERING DATA: SERIES GRA PARALLEL GRIPPERS

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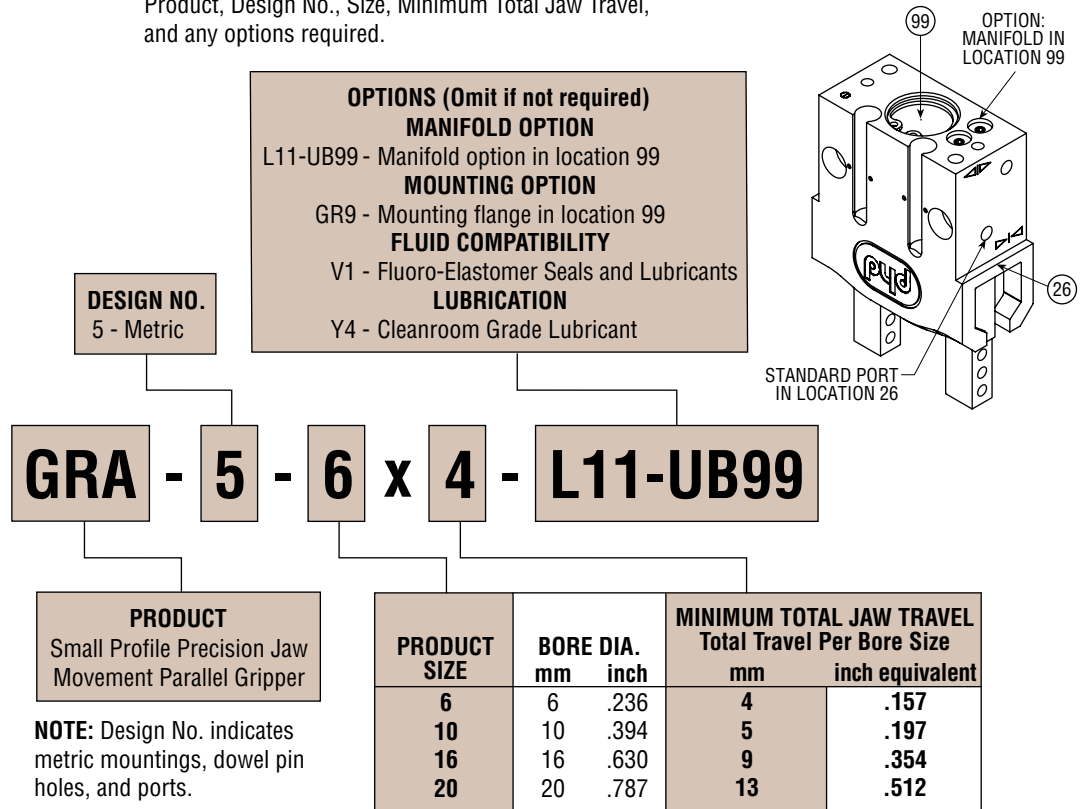
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Exploded View & Parts List

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TO ORDER SPECIFY:

Product, Design No., Size, Minimum Total Jaw Travel, and any options required.



SERIES JC1SD MAGNETIC SWITCHES

PART NO.	SWITCH DESCRIPTION
JC1SDP-5	PNP (Source), Solid State, 10-30 VDC, 5 meter cable
JC1SDP-K	PNP (Source), Solid State, 10-30 VDC, Quick Connect
JC1SDN-5	NPN (Sink), Solid State, 10-30 VDC, 5 meter cable
JC1SDN-K	NPN (Sink), Solid State, 10-30 VDC, Quick Connect

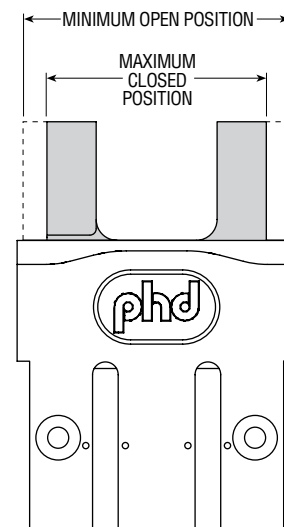
Includes one switch and installation directions

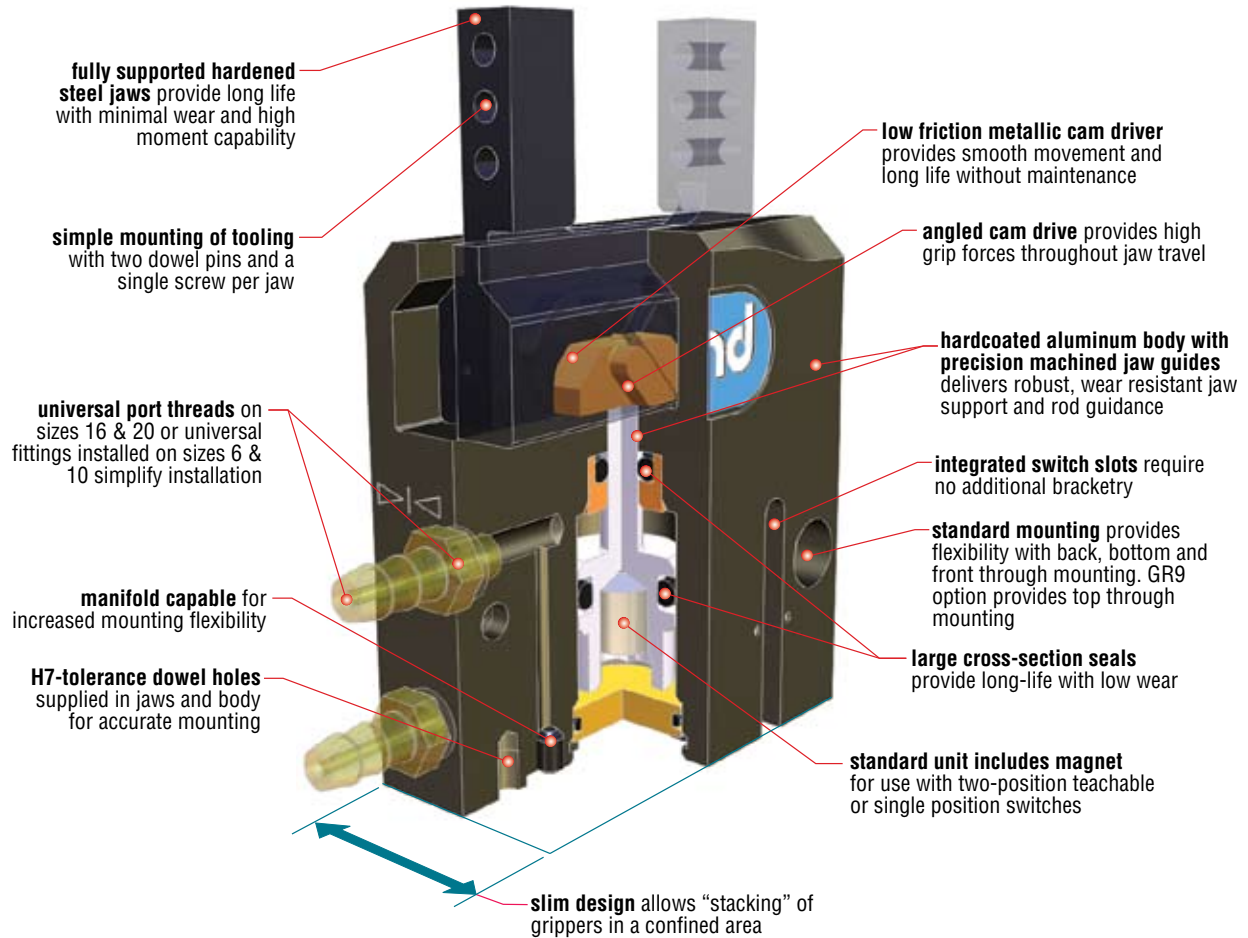
SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	SWITCH DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

Includes one switch and installation directions

MINIMUM JAW TRAVEL = MINIMUM OPEN POSITION - MAXIMUM CLOSED POSITION





Major Benefits

- Series GRA Gripper's compact, flexible design provides large moment capacities and long tooling lengths.
- Factory set jaw guide system minimizes jaw "free-play" and reduces jaw deflection when gripping or moving loads.
- Robust construction ensures long operating life.
- True parallel jaw motion simplifies jaw tooling and is ideal for centering parts of various sizes.
- H7-tolerance dowel pin holes included for accurate alignment of tooling and gripper mounting.
- Double acting for use in both internal and external gripping applications.
- Manifold porting capability allows for nested gripper installation.
- Mounting provided from top (with option GR9), bottom, front, and back of gripper.
- Internal speed control is standard, no external speed control required.
- Standard with imperial / metric porting, metric mounting threads and dowel holes for global appeal.
- Supplied "switch-ready" for easy integration of optional magnetic position sensing switches.
- Magnetic sensing two-teachable position switch available to simplify set-up and integration.
- Standard four working day delivery reduces integration time.

Industry/Process Uses

- Medical device manufacture
- Semiconductor manufacture
- Laboratory processing applications
- Clamping and fixturing during assembly operations
- Centering and registration of parts
- Incorporation into space restricted processing and manufacturing equipment

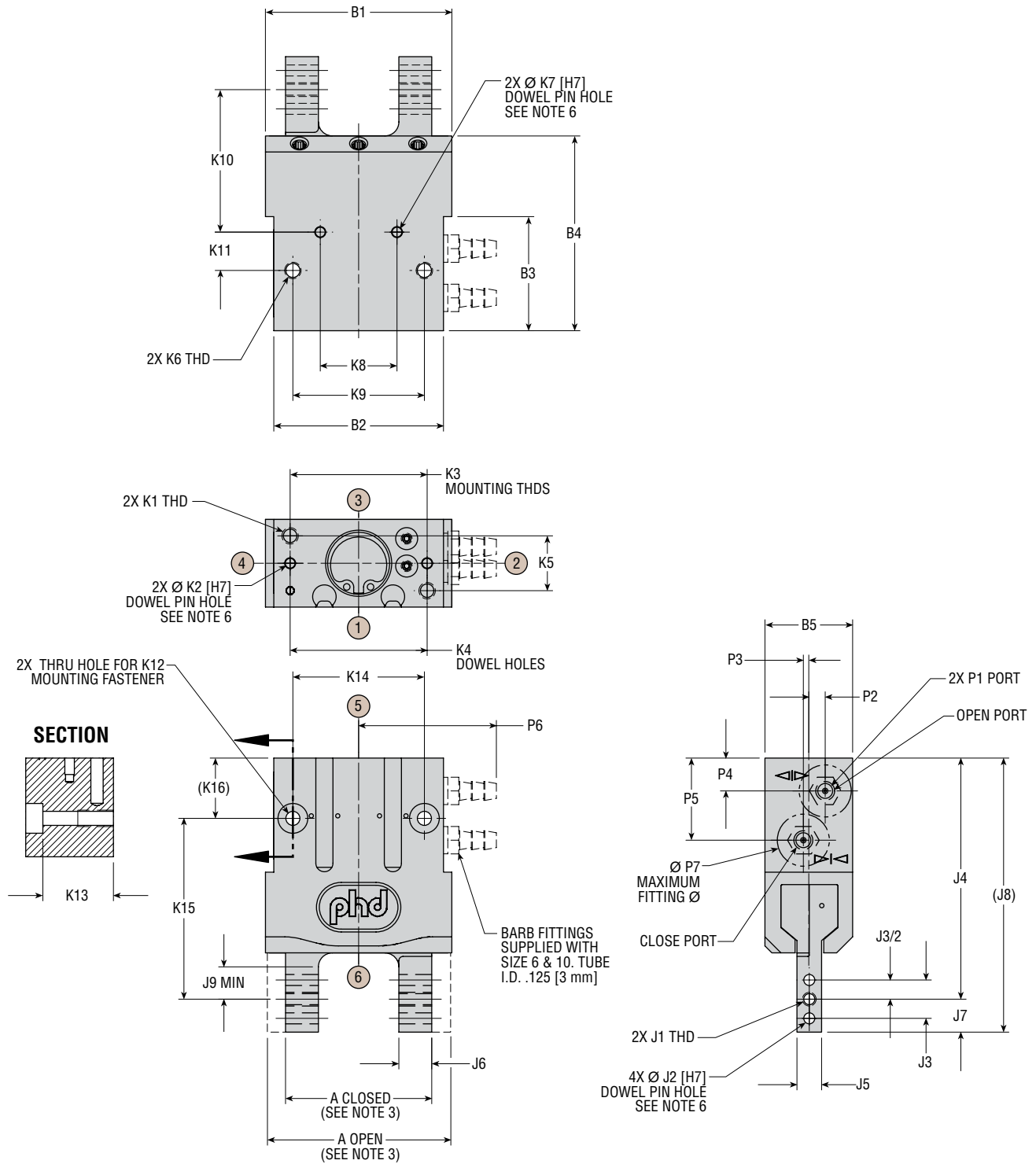
Consistent Jaw Movement Over Life of Unit

10 Million Cycle Life in a Robust, Compact Design

Flexible Mounting Capability



DIMENSIONS: SERIES GRA PARALLEL GRIPPERS



DIMENSIONS: SERIES GRA PARALLEL GRIPPERS

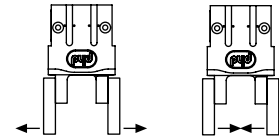
LETTER DIM	MODEL NUMBER							
	GRA-5-6x4		GRA-5-10x5		GRA-5-16x9		GRA-5-20x13	
	in	mm	in	mm	in	mm	in	mm
NOMINAL TOTAL JAW TRAVEL	.157	4.0	.198	5.0	.353	9.0	.511	13.0
A CLOSED	.985	25.0	1.063	27.0	1.339	34.0	1.418	36.0
A OPEN	1.142	29.0	1.261	32.0	1.692	43.0	1.929	49.0
B1	1.220	31.0	1.339	34.0	1.772	45.0	2.008	51.0
B2	N/A	N/A	N/A	N/A	1.496	38.0	1.811	46.0
B3	N/A	N/A	N/A	N/A	1.0191	25.9	1.221	31.0
B4	1.355	34.4	1.518	38.6	1.784	45.3	2.110	53.6
B5	.394	10.0	.630	16.0	.866	22.0	1.102	28.0
J1	M1.6 x 0.35		M2.5 x 0.45		M4 x 0.7		M5 x 0.8	
J2	1.5		2.0		2.5		3.0	
J3	.1969	5.00	.2756	7.00	.3937	10.00	.4724	12.00
J4	1.535	39.0	1.850	47.0	2.224	56.5	2.618	66.5
J5	.118	3.0	.177	4.5	.276	7.0	.335	8.5
J6	.197	5.0	.236	6.0	.354	9.0	.394	10.0
J7	.177	4.5	.236	6.0	.315	8.0	.354	9.0
J8	1.713	43.5	2.087	53.0	2.540	64.5	2.972	75.5
J9 MIN	.172	4.4	.215	5.5	.288	7.3	.359	9.1
K1	M2.5 x 0.45 x 5 DP		M3 x 0.5 x 6.5 DP		M3 x 0.5 x 6.5 DP		M4 x 0.7 x 8 DP	
K2	2.0 x 3.0 DP		2.0 x 3.0 DP		3.0 x 4.0 DP		4.0 x 4.0 DP	
K3	.945	24.0	.984	25.0	1.260	32.0	1.417	36.0
K4	.6890	17.50	.9843	25.00	1.2598	32.00	1.4173	36.00
K5	.177	4.5	.394	10.0	.591	15.0	.748	19.0
K6	M3 x 0.5 x 6 DP		M3 x 0.5 x 6.5 DP		M4 x 0.7 x 8 DP		M5 x 0.8 x 10 DP	
K7	2.0 x 3.0 DP		2.0 x 3.0 DP		3.0 x 4.0 DP		4.0 x 4.0 DP	
K8	.5120	13.00	.5512	14.00	.7874	20.00	.8661	22.00
K9	.945	24.0	1.063	27.0	1.181	30.0	1.417	36.0
K10	.827	21.0	1.024	26.0	1.378	35.0	1.595	40.5
K11	.295	7.5	.315	8.0	.315	8.0	.354	9.0
K12	M2.5		M2.5		M3		M4	
K13	.289	7.3	.507	12.9	.708	18.0	.925	23.5
K14	.945	24.0	1.063	27.0	1.181	30.0	1.417	36.0
K15	1.112	28.25	1.339	34.0	1.693	43.0	1.949	49.5
K16	.413	10.5	.512	13.0	.531	13.5	.669	17.0
P1	M3 x 0.5 x 3 DP		M3 x 0.5 x 3 DP		M5 x 0.8 x 4.5 DP		M5 x 0.8 x 4.5 DP	
P2	.059	1.5	.118	3.0	.158	4.0	.197	5.0
P3	.039	1.0	.019	.5	.138	3.5	.158	4.0
P4	.256	6.5	.236	6.0	.295	7.5	.354	9.0
P5	.610	15.5	.709	18.0	.750	19.1	.945	24.0
P6	.990	25.1	1.050	26.7	N/A	N/A	N/A	N/A
P7	.256	6.5	.374	9.5	.512	13.0	.512	13.0

NOTES:

- 1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
- 2) METRIC INFORMATION SHOWN IN [] DESIGNATED mm
- 3) A OPEN REFLECTS SMALLEST POSSIBLE OPEN DIMENSION (+.052/-0.000 [+1.3 mm/-0 mm])
A CLOSED REFLECTS LARGEST POSSIBLE CLOSED DIMENSION (+.000/-0.024 [+0 mm/-6 mm])
- 4) CIRCLED NUMBERS INDICATE POSITIONS
- 5) DESIGNATED ϕ IS CENTERLINE OF UNIT
- 6) DOWEL PINS OR SPRING PINS OF THE SAME DIAMETER ARE RECOMMENDED. THIS PROVIDES A SMALL PRESS TO SLIGHT SLIP FIT DURING ASSEMBLY. PHD RECOMMENDS THE USE OF ANTI-SEIZE COMPOUNDS DURING ASSEMBLY.

ENGINEERING DATA: SERIES GRA PARALLEL GRIPPERS

SPECIFICATIONS	SERIES GRA	
	IMPERIAL	METRIC
OPERATING AIR PRESSURE	30 psi min. to 120 psi max. air	2 bar min. to 8.3 bar max. air
OPERATING TEMPERATURE	-20°F min. to +180°F max.	-28°C min. to +82°C max.
GRIP REPEATABILITY	± .0004 inch of original position	± .01 mm of original position
RATED LIFE	10 million cycles	
LUBRICATION	Factory lubricated for rated life	



SIZE	MINIMUM TOTAL JAW TRAVEL		TOTAL CLOSE GRIP FORCE AT 87 psi [6 bar]		GRIPPER WEIGHT		DISPLACEMENT		CLOSE OR OPEN TIME AT 87 psi [6 bar]	MAXIMUM TOOLING LENGTH		GRIP FORCE FACTOR			
												INTERNAL GRIP		EXTERNAL GRIP	
	in	mm	lb	N	lb	kg	in³	cm³	sec	in	mm	IMP	MET	IMP	MET
6	.158	4.0	2.55	11	0.08	0.036	0.005	0.08	.030	1.18	30	0.024	1.5	0.029	1.89
10	.197	5.0	8.2	37	0.163	0.074	0.016	0.26	.030	1.77	45	0.080	5.2	0.094	6.10
16	.354	9.0	18.2	81	0.36	0.16	0.063	1.03	.040	3.15	80	0.167	10.8	0.209	13.5
20	.512	13.0	27.7	123	0.62	0.28	0.134	2.20	.105	3.94	100	0.254	16.4	0.318	20.5

SIZE	AXIAL FORCE		MAXIMUM INDIVIDUAL MOMENTS					
	Fa		Mx		My		Mz	
	lb	N	in-lb	Nm	in-lb	Nm	in-lb	Nm
6	3.25	14	3.50	0.40	1.70	0.19	1.70	0.19
10	12	53	10.0	1.1	5.0	0.56	5.0	0.56
16	25	111	25	2.8	25	2.8	20	2.3
20	40	178	45	5.1	45	5.1	30	3.4

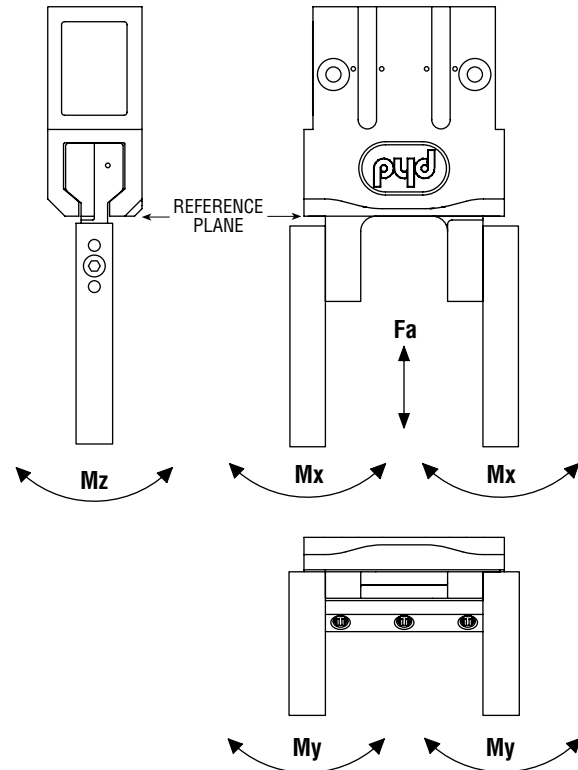
Fa: Total for both jaws

Mx: Maximum allowable moment per jaw, relative to the reference plane

My: Maximum allowable moment per jaw, relative to the geometric center of the jaw finger

Mz: Maximum allowable moment per jaw, relative to the reference plane

When calculating the value for Fa, include the tooling weight, part weight, external forces, and accelerations. When calculating values for Mx, My, and Mz, include the grip force per jaw, tooling weight, part weight, external forces, and accelerations as applicable.



RECOMMENDATIONS

Design tooling so that the grip point is as close to the gripper surfaces as possible. The grip force factor (Gf) values given in the table on page 6 are for zero tooling length. As the grip point is moved away from the jaw surface, the applied moment causes jaw friction to increase, resulting in reduced effective grip force. Use the tooling length factor chart on the following page to calculate the effective grip force for a specific grip point.

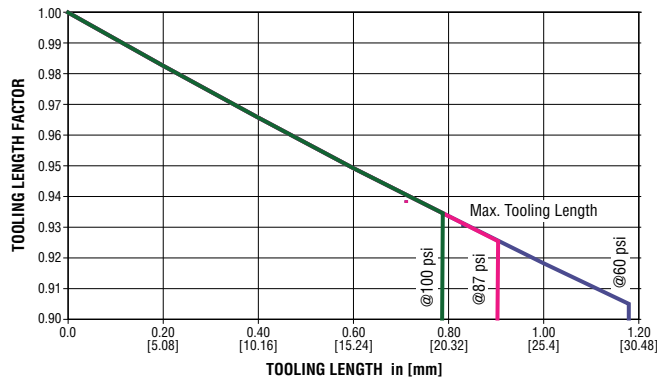
The maximum load that grippers can handle will vary based on: size of the part being picked up, shape of the part, texture of the part, speed at which the part is transferred, working pressure, shape of the fingers, etc.

ENGINEERING DATA: SERIES GRA PARALLEL GRIPPERS

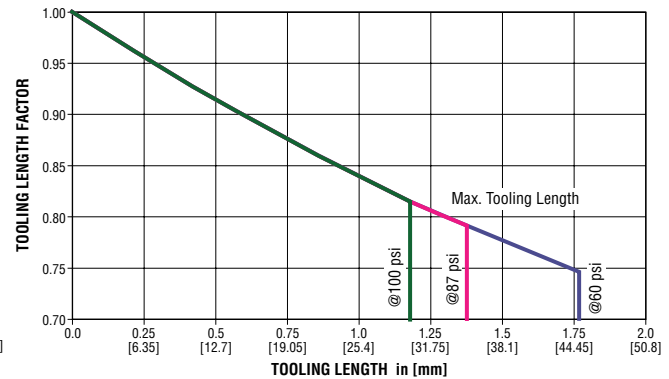
TOOLING LENGTH FACTOR

As the grip point is moved away from the jaw surface, the grip force is reduced due to additional friction generated by the grip induced moment. The tooling length factor allows calculation of the grip force at any grip point. The graph also indicates the maximum tooling length for each gripper size.

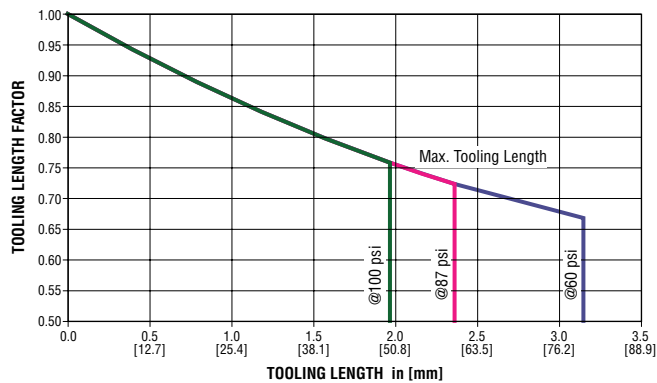
GRA 6



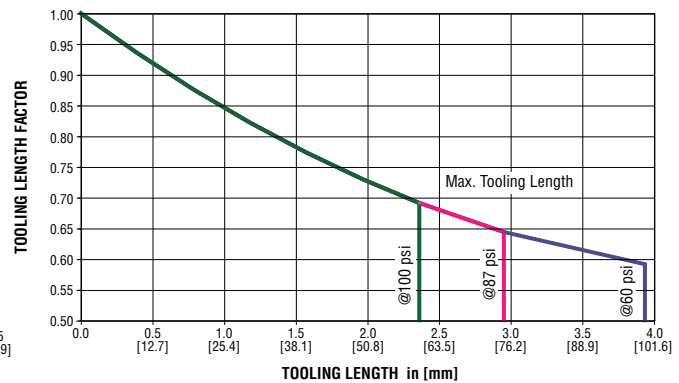
GRA 10



GRA 16



GRA 20



GRIP FORCE CALCULATION EQUATIONS:

IMPERIAL:

Total Grip Force [lb] = (Pressure [psi] x Gf) x Tooling Length Factor

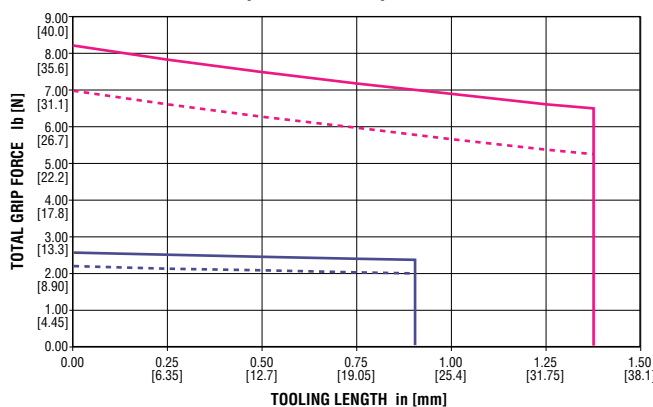
METRIC:

Total Grip Force [N] = (Pressure [bar] x Gf) x Tooling Length Factor

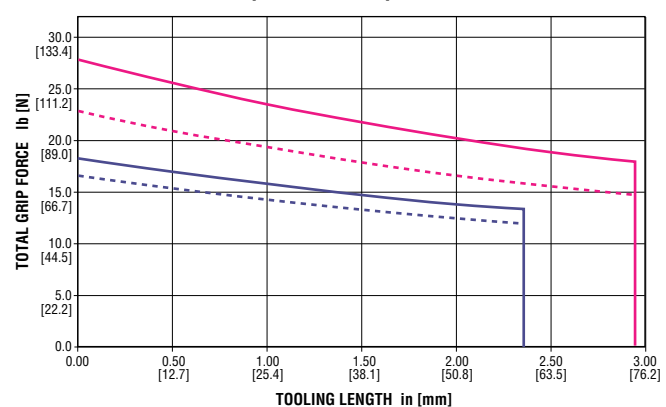
GRIP FORCE

Total gripping force relative to tooling length is shown below at 87 psi [6 bar] pressure. Grip force per jaw equals the total grip force divided by two. The graphs also indicate the maximum tooling length for each gripper size.

GRA 6 & 10
Grip Force at 87 psi [6 bar]



GRA 16 & 20
Grip Force at 87 psi [6 bar]



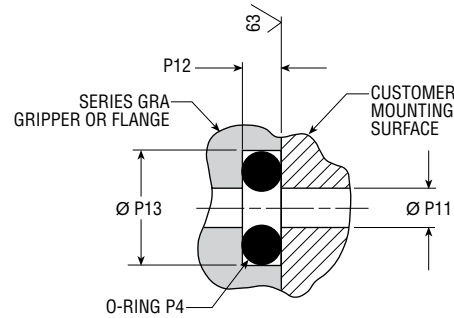
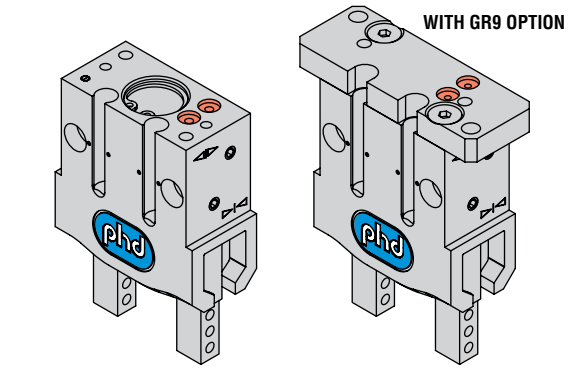
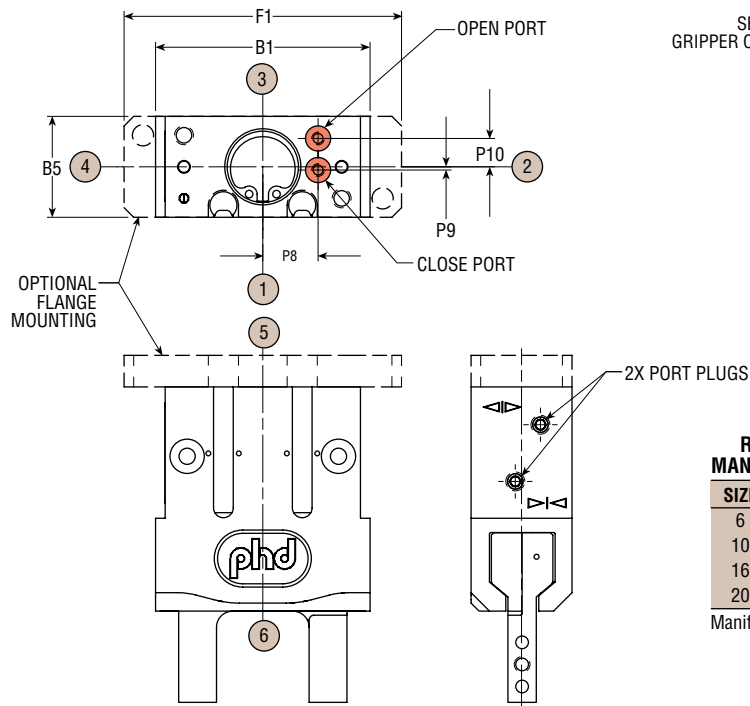
OPTIONS: SERIES GRA PARALLEL GRIPPERS

L11-UB99

MANIFOLD PORTS

With this option the gripper is configured for manifold mounting on the indicated mounting face. The standard ports are plugged. O-ring seals are provided for mounting between the gripper and the manifold.

The manifold port option is also available in kit form. See the Manifold Conversion Kits chart below.



MANIFOLD PORTING DIMENSIONS
For customer use (dimensions required on customer mounting surface)

REPLACEMENT MANIFOLD SEAL KITS

SIZE	KIT NUMBER
6	82013
10	82013
16	82013
20	82013

Manifold kit includes seals

MANIFOLD CONVERSION KITS

SIZE	KIT NUMBER
6	82014-06-5
10	82014-10-5
16	82014-16-5
20	82014-20-5

Manifold kit includes seals, port plugs, and installation directions

LETTER DIM	MODEL NUMBER							
	GRA-5-6x4		GRA-5-10x5		GRA-5-16x9		GRA-5-20x13	
	in	mm	in	mm	in	mm	in	mm
P8	.226	5.75	.345	7.75	.453	11.5	.551	14.0
P9	.099	2.5	.020	.5	.118	3.0	.138	3.5
P10	.099	2.5	.177	4.5	.118	3.0	.138	3.5
P11	.047	1.2	.047	1.2	.047	1.2	.047	1.2
P12	.030	.8	.030	.8	.030	.8	.030	.8
P13	.158	4.0	.158	4.0	.158	4.0	.158	4.0
P4 O-RING*	2 mm x 1 mm		2 mm x 1 mm		2 mm x 1 mm		2 mm x 1 mm	
(F1)	1.653	42.0	1.850	47.0	2.047	52.0	2.499	63.5
(B1)	1.220	31.0	1.339	34.0	1.772	45.0	2.008	51.0
(B5)	.394	10.0	.630	16.0	.866	22.0	1.102	28.0

NOTES:

- 1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
- 2) CIRCLED NUMBERS INDICATE POSITIONS
- 3) *I.D. x CROSS-SECTION

OPTIONS: SERIES GRA PARALLEL GRIPPERS

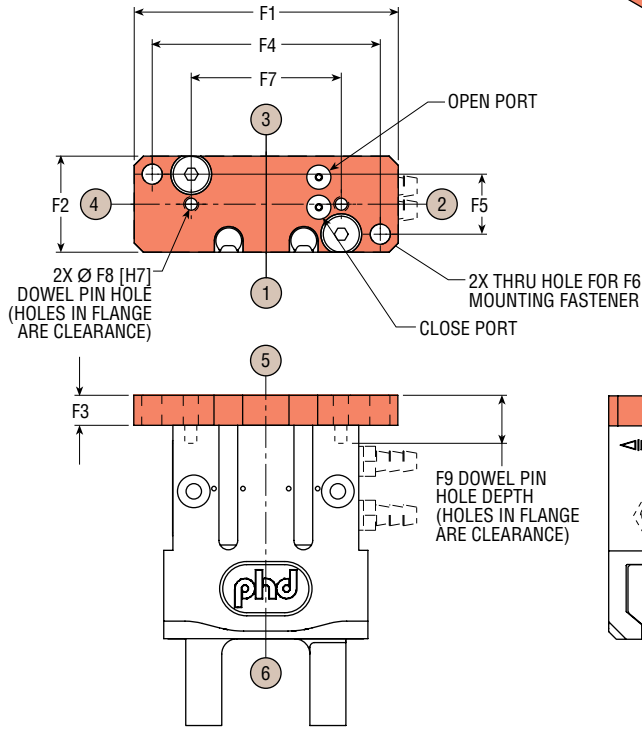
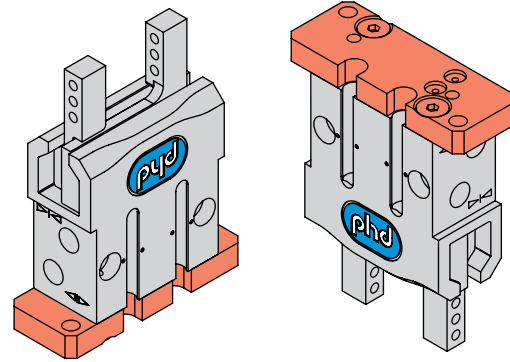
GR9

BOTTOM MOUNTING FLANGE

The GR9 option adds a flange with thru holes to the bottom of the gripper allowing for top mounting. Dowel pin holes in the flange are clearance to allow dowel pins to install in the body for accurate mounting. See chart for recommended dowel pin lengths.

The GR9 option is sealed between the body and the flange to allow use of the L11-UB99 manifold option.

The GR9 flange is also available in kit form. See Flange Mounting Kit chart below.



FLANGE MOUNTING KIT

SIZE	KIT NUMBER
6	81867-06-5
10	81867-10-5
16	81867-16-5
20	81867-20-5

Kit includes: Flange, manifold seals, assembly fasteners, and installation directions

LETTER DIM	MODEL NUMBER							
	GRA-5-6x4		GRA-5-10x5		GRA-5-16x9		GRA-5-20x13	
F1	1.653	42.0	1.850	47.0	2.047	52.0	2.499	63.5
F2	.394	10.0	.630	16.0	.866	22.0	1.102	28.0
F3	.197	5.0	.197	5.0	.236	6.0	.236	6.0
F4	1.457	37.0	1.614	41.0	1.772	45.0	2.165	55.0
F5	.177	4.5	.394	10.0	.591	15.0	.748	19.0
F6	M2.5		M3		M3		M4	
F7	.6890	17.5	.9843	25.0	1.2598	32.0	1.4173	36.0
F8	2.0 mm x 3.0 mm DP		2.0 mm x 3.0 mm DP		3.0 mm x 4.0 mm DP		4.0 mm x 4.0 mm DP	
F9	.315	8.0	.315	8.0	.394	10.0	.394	10.0

NOTES:

- 1) ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED
- 2) METRIC INFORMATION SHOWN IN [] DESIGNATED mm
- 3) GR9 OPTION INCLUDES SEALS BETWEEN BODY AND FLANGE

V1

FLUORO-ELASTOMER SEALS & LUBRICANTS

Fluoro-elastomer seals and lubricants are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the fluid manufacturer for proper application.

Y4

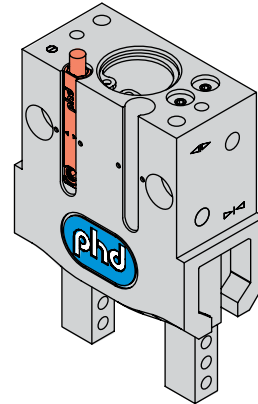
CLEANROOM GRADE LUBRICANT

Cleanroom grade lubricant replaces all standard lubricants.

ACCESSORIES: SERIES GRA GRIPPERS

SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCH

This switch provides the ability to identify two separately programmable jaw positions with a single switch. Programmable capability means no “fine-tuning.” With switch properly aligned, just place jaws in desired position and program. Solid-state sensing technology provides a highly reliable switch. Elliptical housing allows for easy “drop-in” installation on sizes 16 and 20 only. Includes LED indicators for convenient means of positioning and programming. Available with cable or 8 mm threaded Quick Connect.



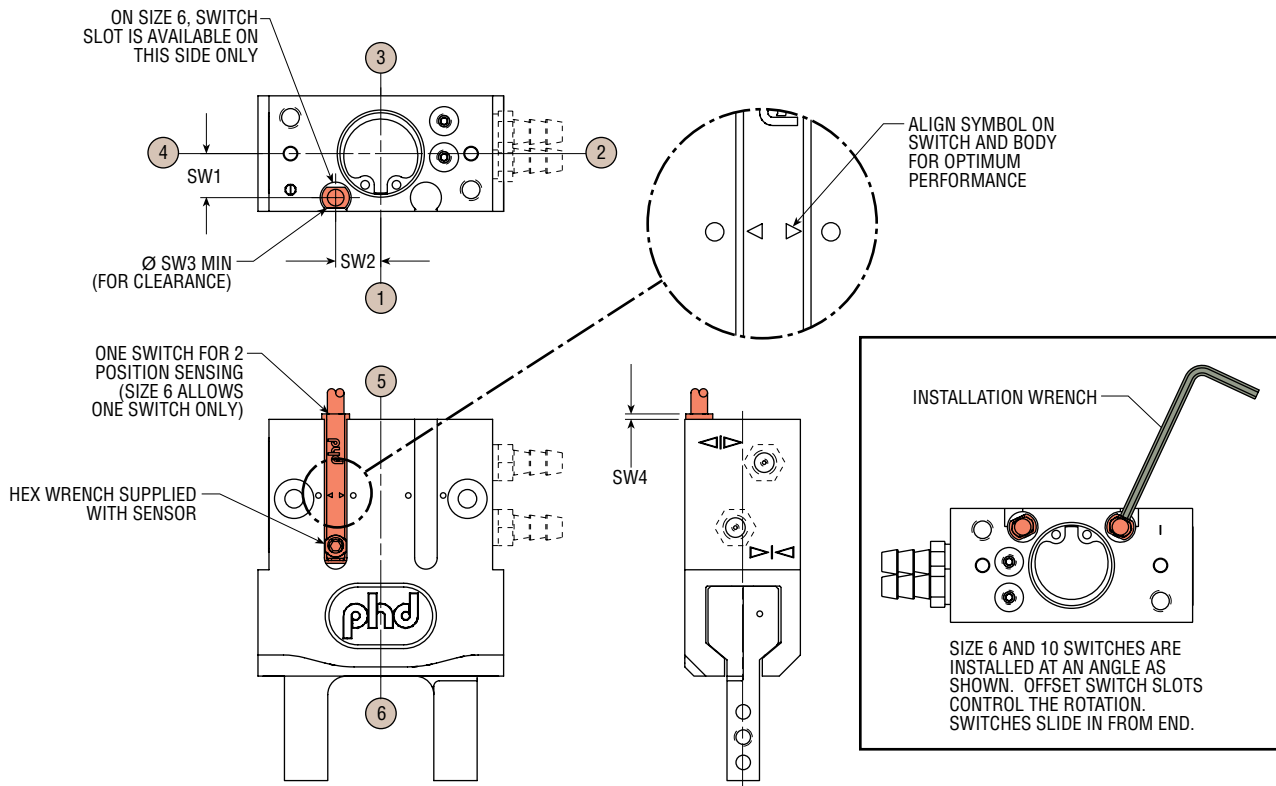
SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	SWITCH DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

Includes one switch and installation directions

MATCHING CORDSET

PART NO.	DESCRIPTION
81284-1-001	M8, 4 pin, Straight Female Connector, 5 meter cable



LETTER DIM	MODEL NUMBER							
	GRA-5-6x4		GRA-5-10x5		GRA-5-16x9		GRA-5-20x13	
	in	mm	in	mm	in	mm	in	mm
SW1	.100	2.5	.270	6.9	.358	9.1	.475	12.1
SW2	.230	5.8	.213	5.4	.305	7.7	.315	8.0
SW3	.169	4.3	.169	4.3	.169	4.3	.169	4.3
SW4	.135	3.4	.070	1.8	—	—	—	—

NOTE: ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED

ACCESSORIES: SERIES GRA GRIPPERS

SERIES JC1SD MAGNETIC SWITCH

This switch provides the ability to identify a single jaw position. Solid-state sensing technology provides a highly reliable switch. Elliptical housing allows for easy “drop-in” installation. Includes LED indicator for convenient means of positioning. Available with PNP or NPN output. Available with cable or 8 mm threaded Quick Connect.

NOTE: Series JC1SD Switches only function on 16 and 20 mm units. Series 6790 Reed Switches are not applicable.



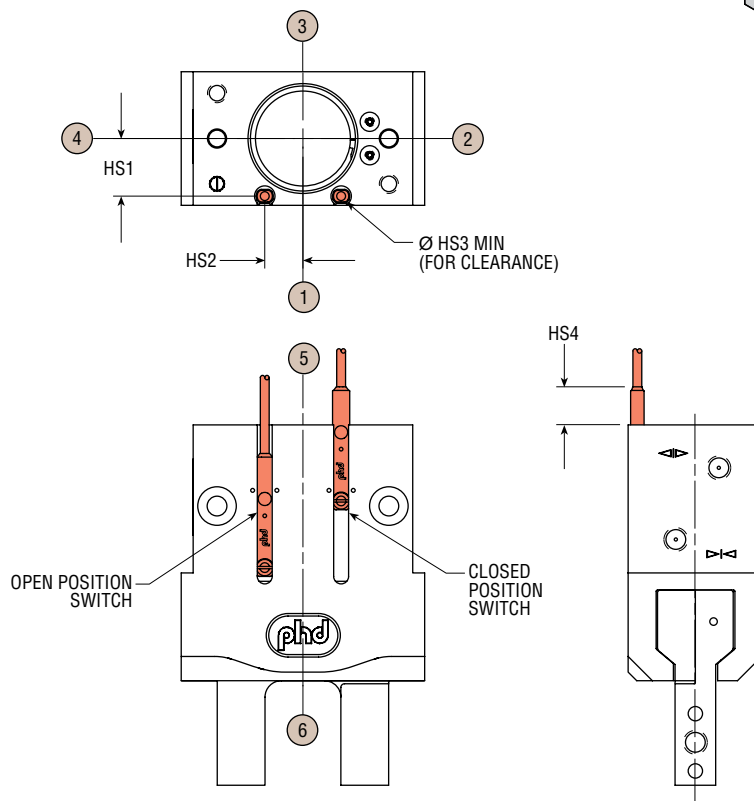
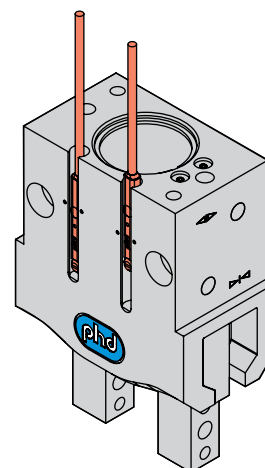
SERIES JC1SD MAGNETIC SWITCHES

PART NO.	SWITCH DESCRIPTION
JC1SDP-5	PNP (Source), Solid State, 10-30 VDC, 5 meter cable
JC1SDP-K	PNP (Source), Solid State, 10-30 VDC, Quick Connect
JC1SDN-5	NPN (Sink), Solid State, 10-30 VDC, 5 meter cable
JC1SDN-K	NPN (Sink), Solid State, 10-30 VDC, Quick Connect

Includes one switch and installation directions

MATCHING CORDSET

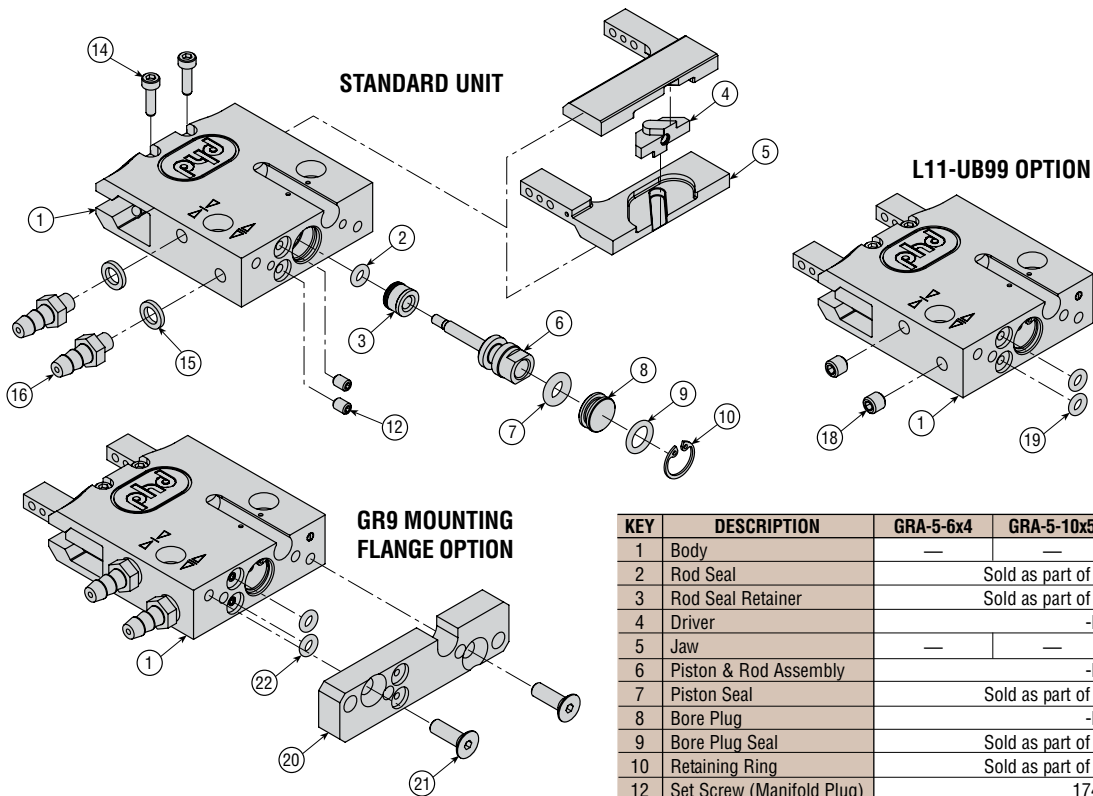
PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable



LETTER DIM	MODEL NUMBER			
	GRA-5-16x9		GRA-5-20x13	
	in	mm	in	mm
HS1	.358	9.1	.475	12.1
HS2	.305	7.7	.315	8.0
HS3	.169	4.3	.169	4.31
HS4	.580	14.7	.560	14.2

NOTE: ALL DIMENSIONS ARE REFERENCE ONLY UNLESS SPECIFICALLY TOLERANCED

EXPLODED VIEW & PARTS LIST: SERIES GRA GRIPPERS



KEY	DESCRIPTION	GRA-5-6x4	GRA-5-10x5	GRA-5-16x9	GRA-5-20x13
1	Body	—	—	—	—
2	Rod Seal	Sold as part of seal kit only -H9000			
3	Rod Seal Retainer	Sold as part of seal kit only -H9000			
4	Driver	-H5610			
5	Jaw	—	—	—	—
6	Piston & Rod Assembly	-H1000			
7	Piston Seal	Sold as part of seal kit only -H9000			
8	Bore Plug	-H3100			
9	Bore Plug Seal	Sold as part of seal kit only -H9000			
10	Retaining Ring	Sold as part of seal kit only -H9000			
12	Set Screw (Manifold Plug)	17424-101			
14	SHCS (Spacer)	14308-789	—	—	—
15	Barb Fitting Washer	Part of -H2800 (1 fitting)	—	—	—
16	Barb Fitting	Part of -H2800 (1 washer)	—	—	—
18	Set Screw (Port Plug)	Sold as part of manifold conversion kit only -H9091			
19	O-Ring Seal (Manifold)	Sold as part of manifold kits -H9090 or -H9091			
20	GR9 Mounting Flange	Sold as part of GR9 mounting flange kit only -H9055			
21	SFHCS (GR9 Mounting)				
22	O-Ring Seal (Manifold)				

KITS

DESCRIPTION	GRA-5-6x4	GRA-5-10x5	GRA-5-16x9	GRA-5-20x13
Seal Kit	Seal Kit -H9000			
Manifold Conversion Kit	Manifold Conversion Kit -H9091			
Manifold Seal Replacement Kit	Manifold Seal Kit -H9090			
Flange Mounting Kit	Flange Mounting Kit -H9055			

NOTE: -H codes must be used with full unit description. Example: GRA-5-10x5-V1-GR9-H1000. This ensures the correct configuration of components is provided.



Illustrations are concept only. Contact your local PHD Distributor for more information.

