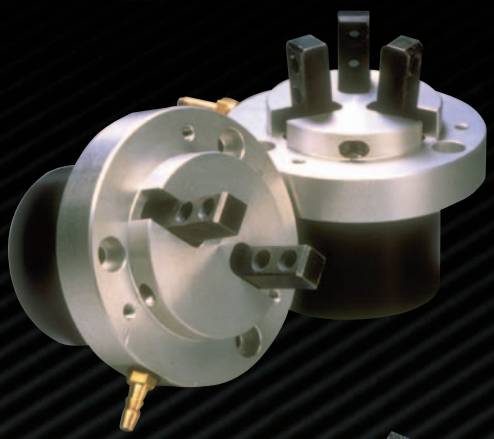
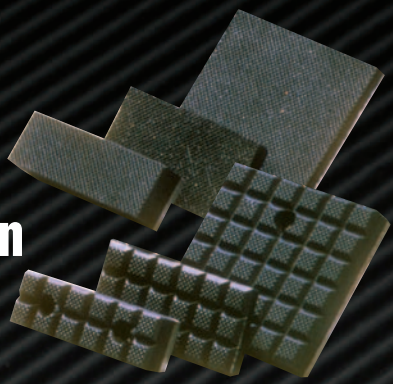
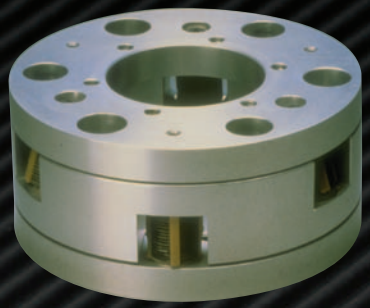
MODULAR END-OF-ARM AUTOMATION

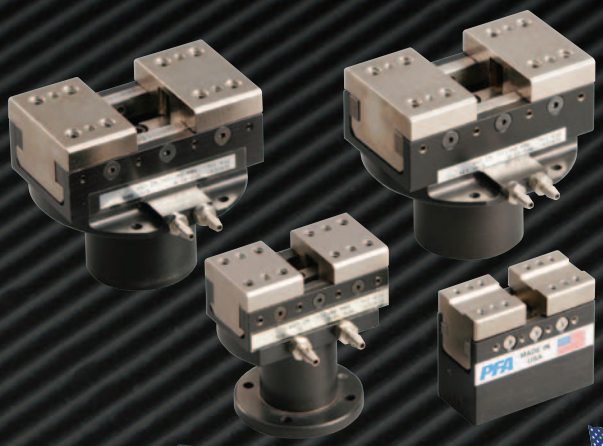
COMPLETE SYSTEM SOLUTIONS



Robotic Grippers
Gripper Pads
Compliance Devices
Robotic Crash Protection







Designed & Made in USA

ADDING A NEW DIMENSION TO AUTOMATION PRODUCTIVITY!

UPGRADE ROBOTIC PERFORMANCE & PROFITABILITY!

UPGRADE TO PFA!

PFA INCORPORATED

pfa-inc.com

Located just North of Milwaukee, Wisconsin, PFA is an ISO 9001:2000 Registered leader in the design and manufacture of Quick Mold Change Systems (QMC), Specialty Injection Mold Components, Specialty Industrial Cylinders, Quick Die Change Systems (QDC), Multi-Slide Die Casting Solutions, and Robotic Automation End-Effectors.

Our staff is committed to providing you with the best possible products and service. PFA offers a wide array of standard products plus custom solutions for especially challenging applications. Contact us with your needs. We will be glad to serve you!

PFA INCORPORATED

N118 W18251 Bunsen Drive
Germantown, WI 53022
(262) 250-4410 • Fax (262) 250-4409
automation@pfa-inc.com

- **KOR-LOK™ Side-Action Systems** and **DIE-LOK™ Multislide Systems** for pre-loading and locking moveable cores on injection molds and die cast dies, provide improved part quality, speed and performance over traditional cam pin and toggle methods.

- **SWITCHMAX®** Connectivity components integrate various "on mold" sensors (relay, mechanical, and proximity DC) into a single signal interface common on most injection molding machines. LED indication also assists operators. No more complex wiring – just plug & play.

- **Quick Die Change Systems** provide easily customized solutions for stamping die "quick change". Bolster extensions, die rails/lifters, check valve and locking clamps, and electronic 5,000 psi pump controllers are just a few of the options available.

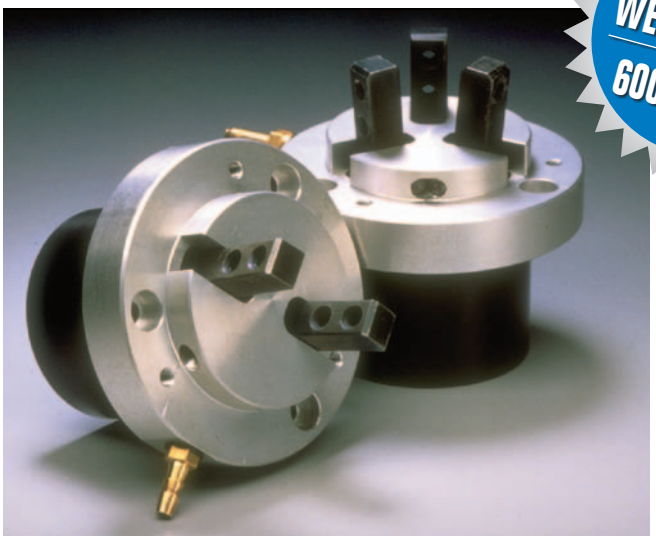
- **Hydra-Jaws™ Quick Mold Change and Hydra-Latch™ Quick Knockout Systems** provide consistent clamping and support rapid mold changes for a wide range of mold sizes in a single machine. Clamps move to fit the mold!

- **Self-Locking and Braking Cylinders** hold large loads many times that of standard cylinders, even with pressure removed, making them ideal for a wide variety of industrial applications, where large load capacity or loss of air scenarios demand greater performance and simplicity.

CONTENTS

THE GTP-45 DELIVERS 600# OF GRIP FORCE IN A TWO OR THREE FINGER CONFIGURATION

SINGLE ACTING ROBOTIC GRIPPERS



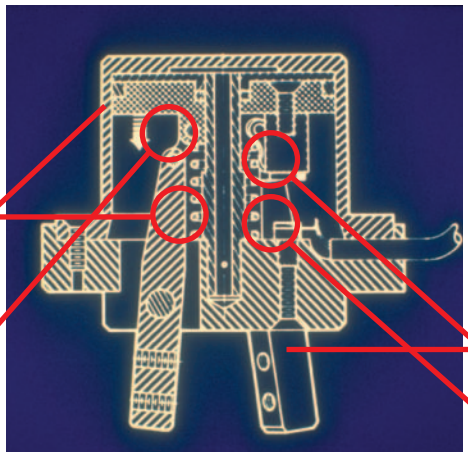
Light Weight
At less than eight ounces, these featherweight grippers provide an unprecedented grip force to weight ratio.

Multiple Jaw Configurations
6˚ Gripper available in two or three finger, expanding or contracting styles. 12˚ Gripper available in two finger contracting style.

Large Grip Force
Large piston areas and toggle linkages generate 600# grip force @ 100 psi and 0˚ travel point (520# for the 12˚ contracting type).

Modular
Recess mount and universal mount available to mount in our Compliance Device (RCC) or your own mountings.

Single Acting
Spring quickly returns gripper to the original position.



High Strength Materials
Hardened parts ensure low wear and long lasting ±0.2 Degree repeatability.

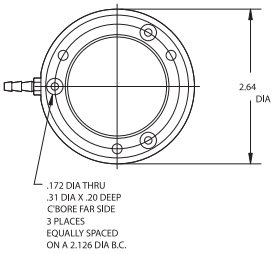
Positive Part
Pick-up Activating magnet trips sensor if part is not present (Gripper travels 1/2˚ past grip point).

Hall Effect Sensors
Available in either current sourcing or sinking type - 6-24 VDC (13mA max supply/ 20mA max output) switching time of .2 Microseconds

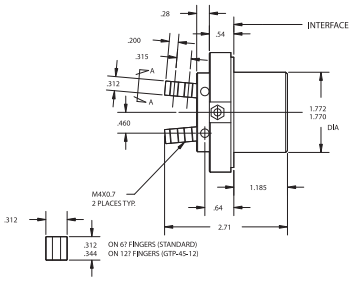
GTP grippers are designed to accommodate added tooling on the fingers and grip complex components using PFA's Gripper Pads (page 11). "3X" Style units are excellent for ID and Inside Bore applications and Recess Mount "R" style units mate easily with our Compliance Devices to support "jam free" assembly.

RECESSED MOUNT (R)

FITS ASP 85 AND AST 100
REMOTE CENTER COMPLIANCE DEVICES

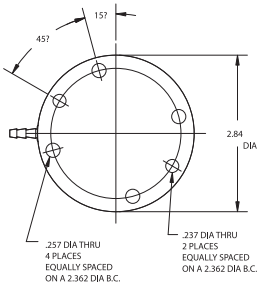


Mounting Pattern
Top View

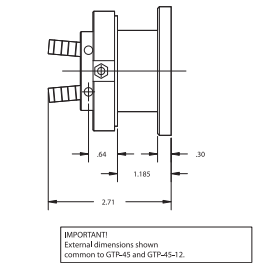


Side View

UNIVERSAL FLANGE MOUNT (U)

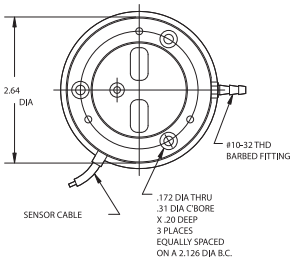


Mounting Pattern
Top View

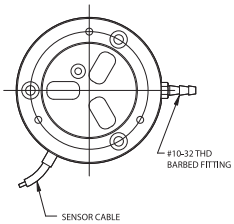


Side View

FINGER OPTIONS
(2 OR 3 FINGERS)



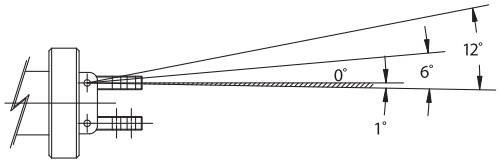
Two Finger Type
Bottom View



Three Finger Type
Bottom View

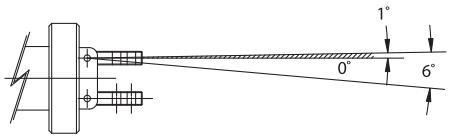
NOTE: DIMENSIONS ARE IN INCHES EXCEPT WHERE NOTED.

FINGER TRAVEL



Contracting (C)

Fingers start at the outer position and contract inward to grip object at the zero degree position



Expanding (E)

Fingers start at the inner position and expand outward to grip object at the zero degree position

IDENTIFY YOUR PART NUMBER

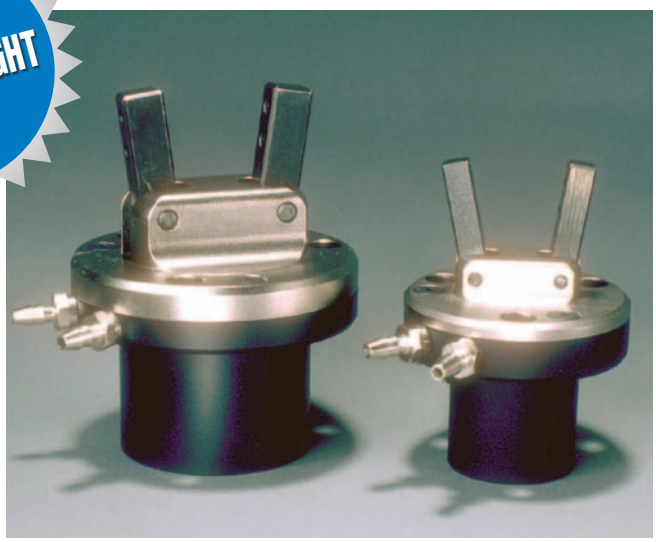
Gripper Designation	Mounting	Finger Style	Activation	Finger Travel	Optional Sensor Type
	R = Recessed *U = Universal*	*2 = Two Finger* *3 = Three Finger*	*C = Contracting* *X = Expanding*	*6° = All Styles* *12° = Two Finger Closing Only*	*SI = Sinking* *SO = Sourcing* *O = None*
GTP-45	R	3	C	6	SI

Example Part No: **GTP-45R-3C-6-SI**

SELECT THE EXACT DOUBLE ACTING GRIP FORCE YOU NEED

DOUBLE ACTING ROBOTIC GRIPPERS

1000:1 FORCE/WEIGHT RATIO



1,000# of Grip Force*
DAG-80

800# of Grip Force*
DAG-45

250# of Grip Force*
DAG-30

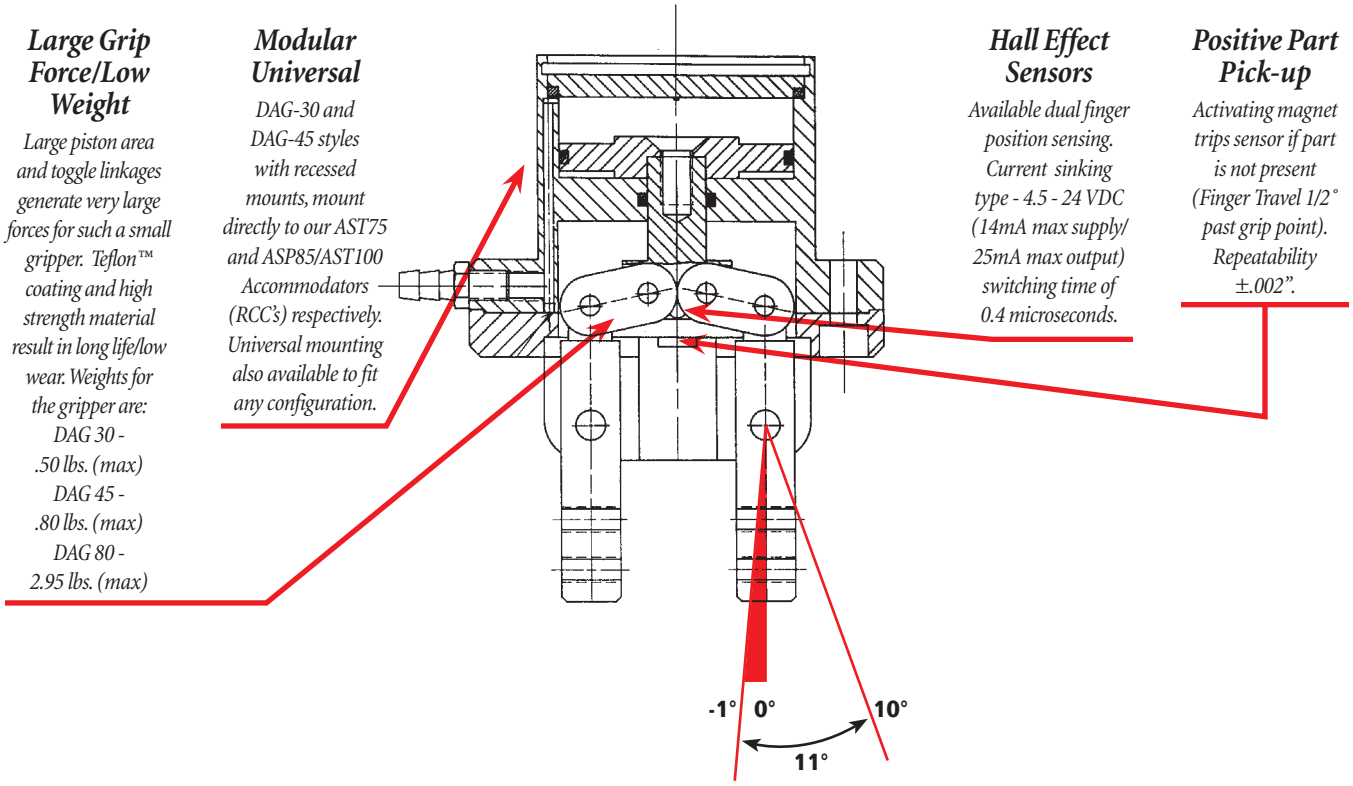
*Based on 100psi air pressure - measured at tip of finger.

Large Grip Force/Low Weight

Large piston area and toggle linkages generate very large forces for such a small gripper. Teflon™ coating and high strength material result in long life/low wear. Weights for the gripper are:
DAG 30 - .50 lbs. (max)
DAG 45 - .80 lbs. (max)
DAG 80 - 2.95 lbs. (max)

Modular Universal

DAG-30 and DAG-45 styles with recessed mounts, mount directly to our AST75 and ASP85/AST100 Accommodators (RCC's) respectively. Universal mounting also available to fit any configuration.



Hall Effect Sensors

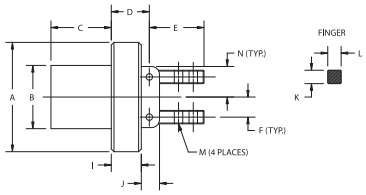
Available dual finger position sensing. Current sinking type - 4.5 - 24 VDC (14mA max supply/ 25mA max output) switching time of 0.4 microseconds.

Positive Part Pick-up

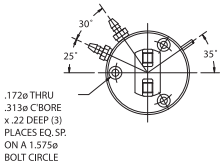
Activating magnet trips sensor if part is not present (Finger Travel 1/2° past grip point). Repeatability ±.002".

RECESSED MOUNT

NOTE: DIMENSIONS ARE IN INCHES EXCEPT WHERE NOTED.



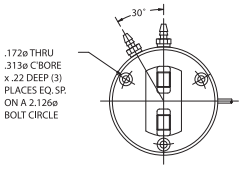
Side View, Recessed Mount



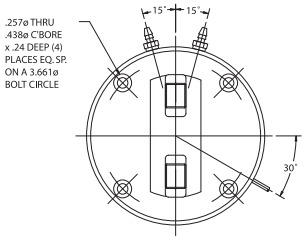
DAG-30

PART NUMBER

Drawing Reference	DAG-30	DAG-45	DAG-80
A	2.04	2.64	4.35
B	1.180 1.178	1.772 1.770	3.250 3.248
C	1.126	1.277	1.89
D	.71	1.04	1.31
E	1.02	1.10	1.70
F	.375	.550	1.050
G	.275	.315	.511
H	.20	.20	.34
I	.56	.61	.75
J	.34	.65	.90
K	.250	.375	.60
L	.250	.320	.50
M	M4 x .07 thread	M4 x .07 thread	M6 x 1.0 thread
N	.57	.85	1.50



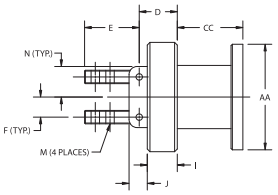
DAG-45

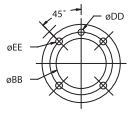


DAG-80

UNIVERSAL FLANGE MOUNT

NOTE: DIMENSIONS ARE IN INCHES EXCEPT WHERE NOTED.

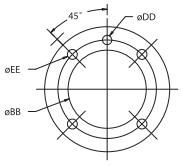




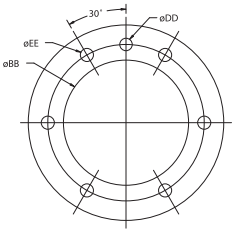
DAG-30

PART NUMBER

Drawing Reference	DAG-30	DAG-45	DAG-80
AA	1.97	3.15	4.92
BB	1.263/ 1.260 Dia. x .10 DP C'Bore	1.972/ 1.969 Dia. x .10 DP C'Bore	3.153/ 3.150 Dia. x .20 DP C'Bore
CC	1.224	1.375	2.087
DD	.157/ .156 Dia. thru on 1.575 Dia. BC	.236/ .235 Dia. thru on 2.480 Dia. BC	.315/ .314 Dia. thru on 3.937 Dia. BC
EE	.17 Dia. thru, 4 PLS EQ SP on a 1.575 Dia. BC	.25 Dia. thru, 4 PLS EQ SP on a 2.480 Dia. BC	.33 Dia. thru, 6 PLS EQ SP on a 3.937 Dia. BC



DAG-45



DAG-80

IDENTIFY YOUR PART NUMBER

Size	Mounting	Optional Sensor Type
DAG-30 *DAG-45* *DAG-80*	*R = Recessed* *U = Universal*	*SI = Sinking* *SO = Sourcing* *O = None*
DAG-80 -	U -	SI

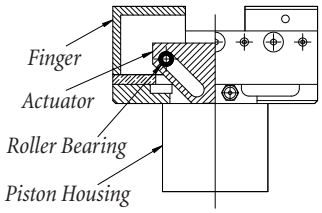
Example Part No: **DAG-80-U-SI**

ALL THE FORCE AT A FRACTION OF THE WEIGHT AND MOVEMENT. CLEANROOM, TOO!

APG DOUBLE ACTING PARALLEL JAW GRIPPERS

Light Weight

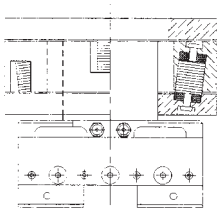
At less than eight ounces, these featherweight grippers provide an unprecedented grip force to weight ratio.



RCC Mount Version

Multiple Jaw Configurations

6° Gripper available in two or three finger, expanding or contracting styles.
12° Gripper available in two finger contracting style.



Cleanroom - Class 100

Accepted for cleanroom use, the CR100 versions of the APG30 and 45 keep the lines running smoothly - no particle problems here!

Constant Force Application

Grip force is constant at any point along slide, allowing for very large finger travel without sacrificing grip force.

Also Available with Sensors

Hall Effect Sensors can be adjusted to sense the desired open and closed position. The sensors detect part absence and ensure part release.

Sensor Specifications

Supply Voltage Operating:	4.5V - 24VDC
Supply Voltage (max):	24VDC
Current (max):	14mA @ 24VDC
Interconnect Cable:	3 conductor, 24 AWG, with shield. 48 in (122mm) long
Output Configuration:	Open collector, current sinking
Output Voltage (max):	24VDC
Current (max):	25mA
Operating Temperature:	0°C (32°F) -70°C (158°F)
Output Switching Time (max):	.04 microseconds

IDENTIFY YOUR PART NUMBER

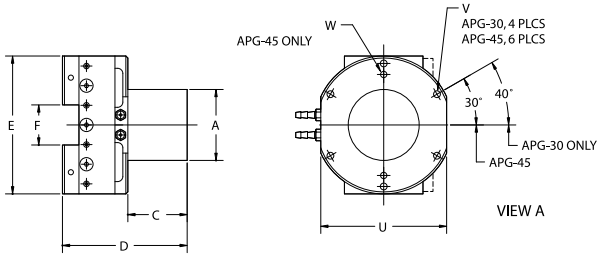
Size	Mounting	Finger Sensor (optional)	Finger Sensor (optional)	Optional Class 100 Cleanroom
APG-30 = 0.5" Stroke *APG-45 = 1.0" Stroke* *APG-80 = 2.0" Stroke*	*R = Recessed* *U = Universal*	*SX = Open*	*SC = Closed*	*APG-30 and APG-45 only*
APG-80 -	R -	SX -	SC -	CR100

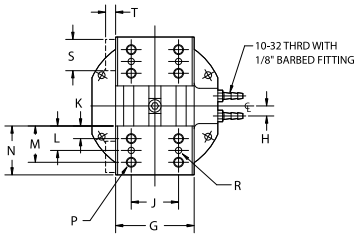
Example Part No: **APG-80-R-SX-SC-CR100**

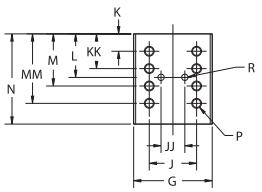
RECESSED MOUNT (R)

APG-30, APG-45 ONLY

NOTE: DIMENSIONS ARE IN INCHES EXCEPT WHERE NOTED.





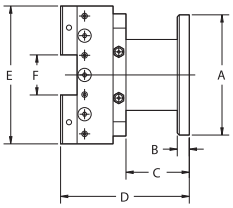


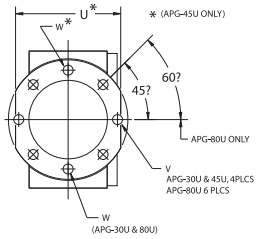
Detail of APG-80 finger showing added holes.

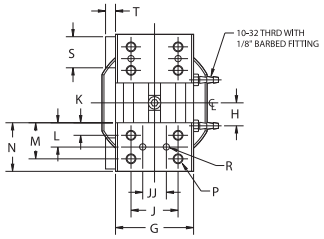
Reference	APG-30R	APG-45R
A	1.80 1.78	1.772 1.770
C	1.25	1.48
D	2.60	3.11
E	2.44	3.44
F	.50	1.00
G	1.25	1.96
H	.25 2 PLCS	.25 2 PLCS
J	.709 Centered	1.181 Centered
K	.197	.315
L	.492	.610
M	.787	.906
N	.97	1.22
P	M4 x 0.7 THD .27DP 4 PLCS Each Finger Block	M5 x 0.8 THD .33 DP 4 PLCS Each Finger Block
R	4.05 4.01 x .27 DP 2 PLCS Each Finger Block	4.05 4.01 x .33 DP 2 PLCS Each Finger Block
S	.78	.78
T	.32	.32
U	2.32	3.15
W	N/A	.159 .158 2 PLCS equally
V	1.70 Thru 4 EQ. SP. 2.4 B.C.	.170 Thru 6 PLS. EQ. SP. 3.07 B.C.

UNIVERSAL MOUNT (U)

NOTE: DIMENSIONS ARE IN INCHES EXCEPT WHERE NOTED.



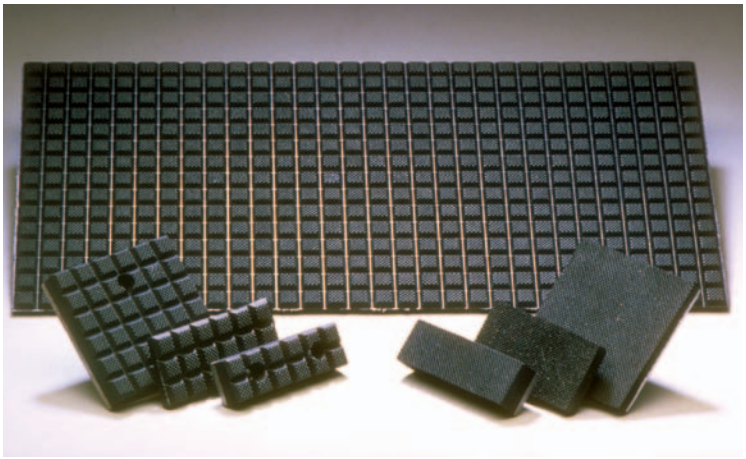




Reference	APG-30U	APG-45U	APG-80U
A	1.97	3.00	4.92
B	.22	.30	0.50
C	1.35	1.58	3.30
D	2.69	3.20	5.57
E	2.44	3.44	6.50
F	.50	1.00	2.0
G	1.25	1.96	3.25
H	.41 2 PLCS	.58 2 PLCS	.75 2 PLCS
J	.709 Centered	1.181 Centered	2.165 Centered
JJ	.709 Centered	1.181 Centered	1.575 Centered
K	.197	.315	.433
KK	---	---	.866
L	.492	.610	1.083
M	.787	.906	1.299
MM	---	---	1.732
N	.97	1.22	2.250
P	M4 x 0.7 THD .27DP 4 PLCS Each Finger Block	M5 x 0.8 THD .33 DP 4 PLCS Each Finger Block	M6 x 1.0 THD .40 DP 8 PLCS Each Finger Block
R	.159 .158 x .27 DP 2 PLCS Each Finger Block	.159 .158 x .33 DP 2 PLCS Each Finger Block	.199 0.197 x 0.40 DP 2 PLCS Each Finger Block
S	.78	.78	1.40
T	.32	.32	.47
U	N/A	2.64	N/A
V	.17 Dia. thru 4 PLCS equally spaced on a 1.575 Dia. B.C.	.25 Dia. thru 4 PLCS equally spaced on a 2.480 Dia. B.C.	0.33 Dia. thru 6 PLCS equally spaced on a 3.937 Dia. B.C.
W	.157 .156 thru on a 1.575 Dia. B.C.	.236 .235 thru on a 2.480 Dia. B.C.	0.315 0.314 thru on a 3.937 Dia. B.C.

CUSTOM FIT PFA COMPLIANT GRIPPER PADS TO YOUR PRECISE NEEDS

GRIPPER PADS



Durable, non-slip elastomer gripper pads for industrial robots provide an efficient means of grasping work pieces. Elastomers are selected to operate over a broad temperature range and resist oils, other liquids, and corrosive elements. The elastomer is adhered to a metal plate for ease of attachment to a gripper. The pad is easily machined to match custom applications, and holes may be drilled to provide quick attachment and removal. Gripper pads are also available without metal backplates for specialized applications.

Features

- Compliant surface
- Resistance to specific types of harsh industrial environments
- Easy installation/replacement
- Adaptable to custom applications

Specifications

- Operating temperature: -20°F (-29°C) to +180°F (+82°C)

Materials

- Plate: 6061-T6 Aluminum/low carbon steel as indicated above
- Elastomer: 60 ±5 Duro, Shore A

Weight

PER SQUARE INCH

Part Number	Weight (oz./in.2)
GP701-1	.76
GP703-1	.18
GP705-1	.13
GP702-1A	.82
GP704-1A	.22
GP706-1A	.17
GP706-2A	.07
GP801-1	.82
GP803-1	.22
GP805-1	.17
GP805-2	.07

To Order Specify Part No. and Quantity.
Example: Qty. 2 GP-702-1A

GRIPPER PAD COEFFICIENT OF FRICTION

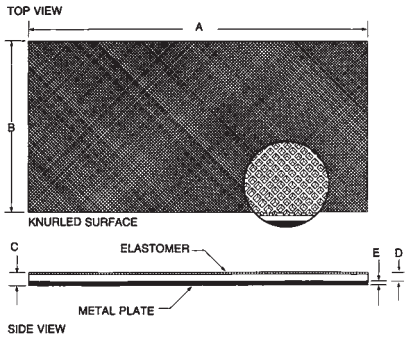
The coefficient of friction for an application in which steel fingers grip a steel part is estimated as .28. Gripper pads provide additional friction for those applications in which grip force and finger friction are not sufficient to grasp the part. The coefficient of friction for two sample part materials was calculated for the three gripper pads types in the chart listed here.

The coefficients of friction determined in the chart are application dependent. The test results were generated under ideal laboratory conditions. Actual performance may differ. In this test situation a metal sheet with a 63 microinch ground finish was placed between two 72 square inch gripper pads and a compressive load of 200 lbs was applied perpendicular to the contact area. All surfaces were clean and dry. In other situations the coefficient may be lower due to lubricants introduced into the system; or much higher if the rubber is able to conform to the part.

	Coefficient of Part Material	
Finger Material	**Steel**	**Aluminum**
Steel Fingers	.28	.32
Knurled Pad	.53	.78
Waffled Pad	.48	.87
Pebbled Pad	.52	.76

The coefficient of friction is used in conjunction with tooling weight and robot acceleration to calculate the required grip force for a specific application. The following formula can be applied when attempting to determine the approximate minimum grip force for an application. Note: An additional safety factor of 10X may be required depending upon the application.

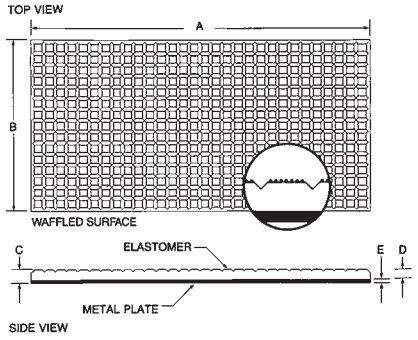
$$\textbf{Grip Force (lbs)} = \frac{\textbf{The weight of the tooling (lbs)}}{\textbf{The coefficient of friction}}$$



DIMENSIONS mm (inches)

P/N	A**	B**	C	D	E	Notes
GP-702-1A	304.8 (12.0)	152.4 (6.0)	13.5 (0.53)	10.2 (0.40)	3.3 (0.13)	w/Steel backplate
GP-704-1A	304.8 (12.0)	152.4 (6.0)	6.4 (0.25)	4.8 (0.19)	1.5 (0.06)	w/Alum. backplate
GP-706-1A	304.8 (12.0)	152.4 (6.0)	n/a n/a	6.4 (0.25)	n/a n/a	Elastomer pads only**
GP-706-2A	304.8 (12.0)	152.4 (6.0)	n/a n/a	3.3 (0.13)	n/a n/a	Elastomer pads only**

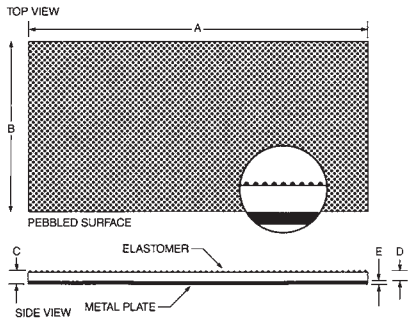
**No metal plate*
***Elastomer only pads may show some dimensional contraction. Use A=11⅝" and B=5¾" actual for planning*



DIMENSIONS mm (inches)

P/N	A**	B**	C	D	E	Notes
GP-701-1	304.8 (12.0)	152.4 (6.0)	12.7 (0.50)	9.4 (0.37)	3.3 (0.13)	w/Steel backplate
GP-703-1	304.8 (12.0)	152.4 (6.0)	6.4 (0.25)	4.8 (0.19)	1.5 (0.06)	w/Alum. backplate
GP-705-1	304.8 (12.0)	152.4 (6.0)	n/a n/a	6.4 (0.25)	n/a n/a	Elastomer pads only**

**No metal plate*
***Elastomer only pads may show some dimensional contraction. Use A=11⅝" and B=5¾" actual for planning*



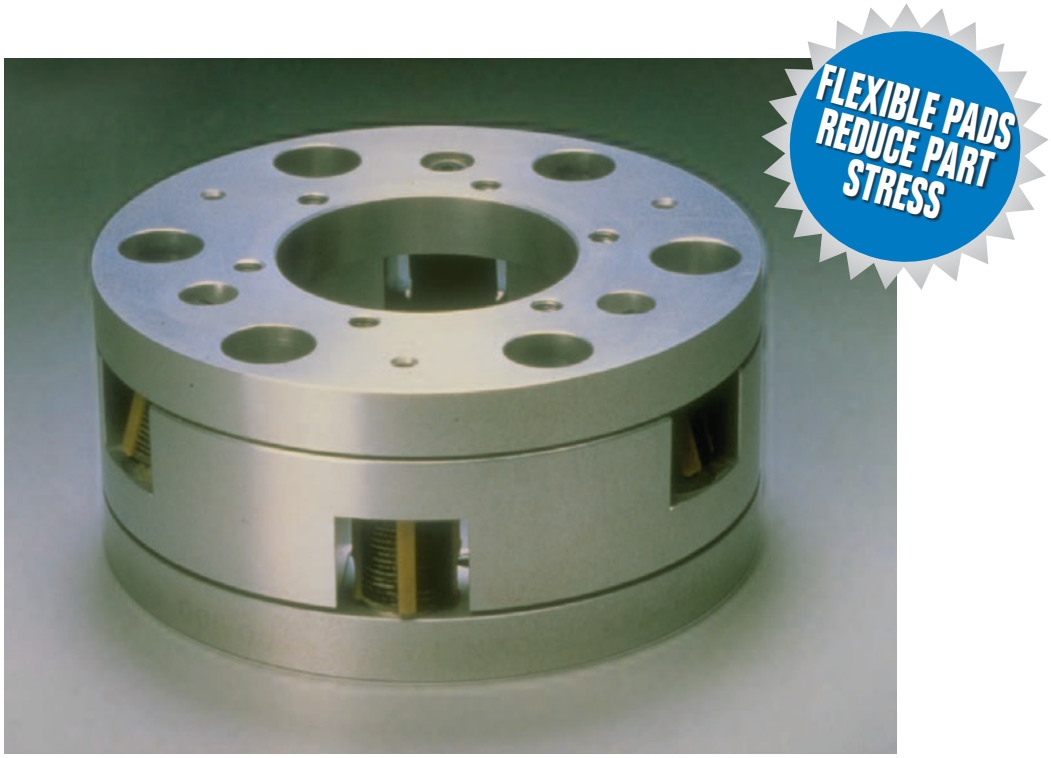
DIMENSIONS mm (inches)

P/N	A**	B**	C	D	E	Notes
GP-801-1	304.8 (12.0)	152.4 (6.0)	13.5 (0.53)	10.2 (0.40)	3.3 (0.13)	w/Steel backplate
GP-803-1	304.8 (12.0)	152.4 (6.0)	6.4 (0.25)	4.8 (0.19)	1.5 (0.06)	w/Alum. backplate
GP-805-1	304.8 (12.0)	152.4 (6.0)	n/a n/a	6.4 (0.25)	n/a n/a	Elastomer pads only**
GP-805-2	304.8 (12.0)	152.4 (6.0)	n/a n/a	3.3 (0.13)	n/a n/a	Elastomer pads only**

**No metal plate*
***Elastomer only pads may show some dimensional contraction. Use A=11⅝" and B=5¾" actual for planning*

PROVIDES CRITICAL FORCE AXIS DE-COUPLING TO REDUCE PART STRESS DURING ASSEMBLY

TWO-STAGE RCC ACCOMMODATOR



Lateral and Rotational Compensation

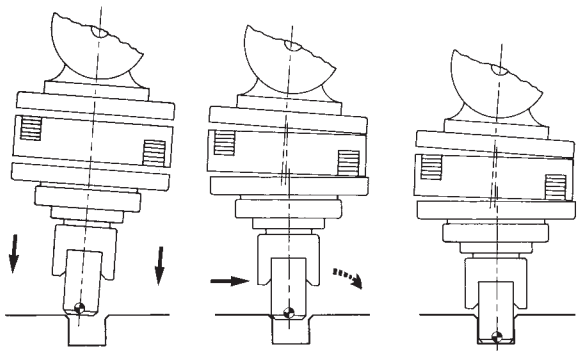
Because of the two stage configuration, the part being inserted can comply laterally and rotate around the center of compliance reducing wear of machinery and the need for highly accurate robots.

Automatic Compensation

RCC compensates for positioning errors in automated assembly, thus minimizing the required assembly forces and the possibility of parts jamming.

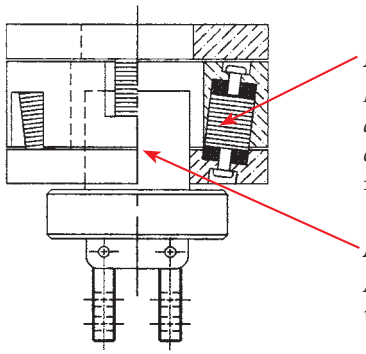
Variable Durometer Elastomers

Six elastomeric shear pads make RCC's stiff in compression yet relatively soft in shear ensuring more accurate side to side accommodation. Choose from four different shear pad types to achieve the best compliance for your application.



The Importance of the Remote Center of Compliance (RCC).

The critical aspect of PFA's RCC is the true de-coupling of the lateral, shear, and rotational forces. The point of de-coupling occurs at a remote point called the Remote Center of Compliance (RCC). Although other compliant devices are flexible, PFA's Accommodator provides the critical de-coupling effect necessary for critical assembly applications.



Different Angles

Five different angles are available for four different centers of compliance with ±.002" self-centering ability.

Modular Components

A multitude of PFA's grippers will mount within the RCC.

Stiffness

The RCC design allows for a trade-off between the lateral and rotational stiffness values for a given projection distance and shear pad type. The units listed have been chosen to balance these two parameters. Stiffness selection should be based on tightness of fit, payload and operating speed. Units optimized for minimum rotation and torque transmission are also available in the anti-rotation (AR) option.

Mechanical Outline Specifications

SHEAR PAD (ELASTOMER) SELECTION

Properties	CR Neoprene	MO Silicone
Operating Temperature (Min.)	-29°C (-20°F)	-54°C (-65°F)
Operating Temperature (Max.)	+82°C (+180°F)	+177°C (+350°F)
Mechanical Properties	Good	Good
Oil Resistance	Good	Fair
Ozone Resistance	Good	Excellent
Resistance to Heat Aging	Good	Excellent
Compound Color	Black	Red
Durometer Shore A ± 5	35-Red Stripe 45-Green Stripe 55-Blue Stripe	30

ACCESSORIES/ OPTIONS

Cleanroom Capability

Cleanroom class 100 is available for contamination free assembly processes as part of PFA's modular cleanroom line. Contact PFA for details.

Adaptor Plates

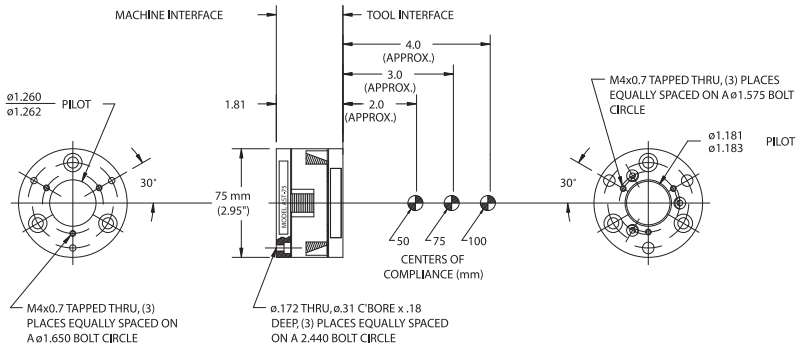
Blank adaptors that mate with the RCC pilot and bolt circle are available for both the machine and tooling interfaces. They are center-drilled so that the customer may adapt the unit to any mounting surface.

Shear Pads

Elastomer Shear Pads are available separately for a variety of custom compliance applications, simply ordered by name. (Example: CR35 Shear Pad)

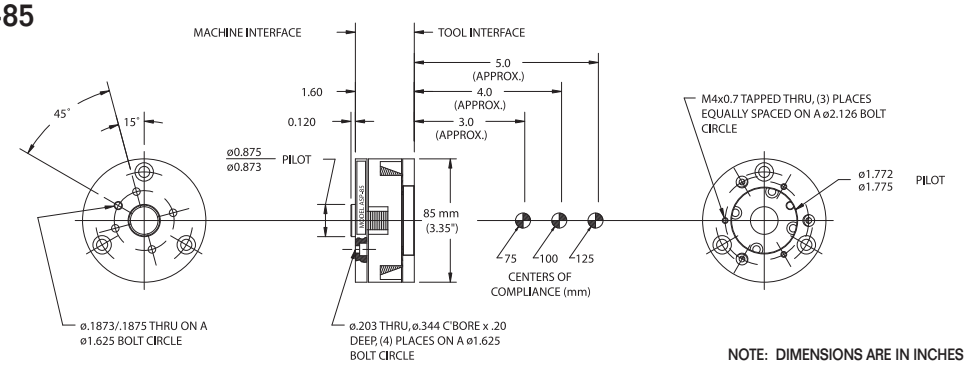
See page 14 for Specifications...

MODEL AST-75



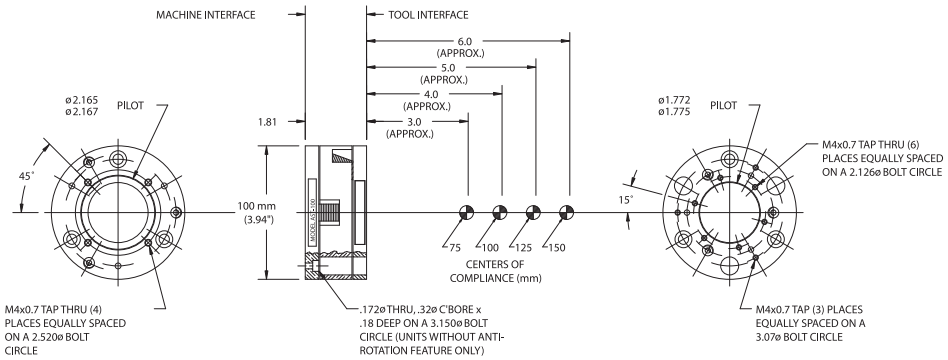
		Center-of-Compliance Projection mm (in)	SHEAR PAD TYPE MO-30	CR-35	CR-45	CR-55
MODEL AST-75	Lateral stiffness N/mm (lb/in)	50 (2.0) 75 (3.0) 100 (3.9)	12.3 (70) 12.3 (70) 10.5 (60)	21.1 (120) 21.1 (120) 18.0 (103)	34.7 (197) 34.7 (197) 29.6 (169)	49.2 (280) 49.2 (280) 42.0 (240)
	Rotational stiffness N-mm/mrad	50 (2.0) 75 (3.0) 100 (3.9)	49 (436) 90 (797) 169 (1500)	84 (749) 155 (1370) 290 (2580)	139 (1230) 254 (2250) 477 (4230)	197 (1740) 360 (3190) 676 (6000)
	Axial stiffness N/mm (lb/in)		705 (4020)	1210 (6910)	1990 (11340)	2820 (16080)
	Torsional stiffness N-mm/mrac in-lb/rad)		4.5 (40)	7.7 (68)	12.7 (112)	18.0 (159)
	Axial load (max usable) N (lb)		1200 (275)	2000 (450)	3400 (775)	4900 (1100)
		Weight 0.40 kg (0.87 lb) Lateral travel ±2.5 mm (0.100 in) Rotational travel ±17 mrad (1.0 deg) Self-centering repeatability ±0.05 (0.002) Structure material is anodized aluminum				
MODEL ASP-85	Lateral stiffness N/mm (lb/in)	75 (3.0) 100 (3.9) 125 (4.9)	12.2 (70) 13.6 (78) 10.5 (60)	21.1 (120) 23.4 (134) 18.0 (103)	34.4 (197) 38.4 (220) 29.6 (169)	48.8 (280) 54.4 (312) 42.0 (240)
	Rotational stiffness N-mm/mrad	75 (3.0) 100 (3.9) 125 (4.9)	86 (766) 130 (1140) 233 (2060)	148 (1320) 223 (1960) 400 (3540)	243 (2160) 367 (3220) 657 (5810)	344 (3060) 520 (4560) 932 (8240)
	Axial stiffness N/mm (lb/in)		720 (4080)	1240 (7020)	2030 (11500)	2880 (16300)
	Torsional stiffness N-mm/mrac in-lb/rad)		5.8 (55)	9.9 (94)	16.3 (154)	23.1 (218)
	Axial load (max usable) N (lb)		1600 (350)	2700 (600)	4400 (1000)	6400 (1400)
		Weight 0.40 kg (0.81 lb) Lateral travel ±2.5 mm (0.100 in) Rotational travel ±17 mrad (1.0 deg) Self-centering repeatability ±0.05 (0.002) Structure material is anodized aluminum				

MODEL ASP-85



NOTE: DIMENSIONS ARE IN INCHES EXCEPT WHERE NOTED.

MODEL AST-100



MODEL AST-100	Center-of-Compliance Projection mm (in)	SHEAR PAD TYPE MO-30	CR-35	CR-45	CR-55
Lateral stiffness N/mm (lb/in)	75 (3.0) 100 (3.9) 125 (4.9) 150 (5.9)	14.9 (85) 14.9 (85) 16.9 (97) 10.5 (60)	25.6 (147) 25.6 (147) 29.0 (166) 18.0 (103)	42.0 (241) 42.0 (241) 47.7 (272) 29.6 (169)	59.6 (341) 59.6 (341) 67.6 (386) 42.0 (240)
Rotational stiffness N-mm/mrad	75 (3.0) 100 (3.9) 125 (4.9) 150 (5.9)	81 (720) 128 (1130) 175 (1550) 338 (2990)	140 (1240) 220 (1940) 301 (2660) 581 (5140)	230 (2030) 361 (3190) 494 (4370) 953 (8430)	326 (2880) 512 (4220) 700 (6200) 1350 (11960)
Axial stiffness N/mm (lb/in)		670 (3800)	1140 (6530)	1800 (10720)	2660 (15200)
Torsional stiffness N-mm/mrac in-lb/rad)		8.8 (78)	15.2 (135)	25.0 (221)	35.4 (313)
Axial load (max usable) N (lb)		2200 (500)	3700 (850)	6200 (1400)	8800 (2000)
	Weight 0.60 kg (1.30 lb) Lateral travel ±2.5 mm (0.100 in) Rotational travel ±17 mrad (1.0 deg) Self-centering repeatability ±0.05 (0.002) Structure material is anodized aluminum				

NOTE: DIMENSIONS ARE IN INCHES EXCEPT WHERE NOTED.

IDENTIFY YOUR PART NUMBER

Model Identification	Unit Diameter (mm)	Center-of-Compliance Projection (mm)	Shear Pad Selection	Anti-Rotation Feature (optional)
		50, 75, 100, 125, 150	*MO30, CR35, CR45, CR55*	*Model AST-100 & ASP-85 Only*
AST -	100 -	75 -	CR35 -	AR

Example Part No: **AST-75-75-CR35**

Model Identification (optional)	Unit Diameter (mm)	
		MB = Machine Blank TB = Tooling Blank
AST -	100 -	75

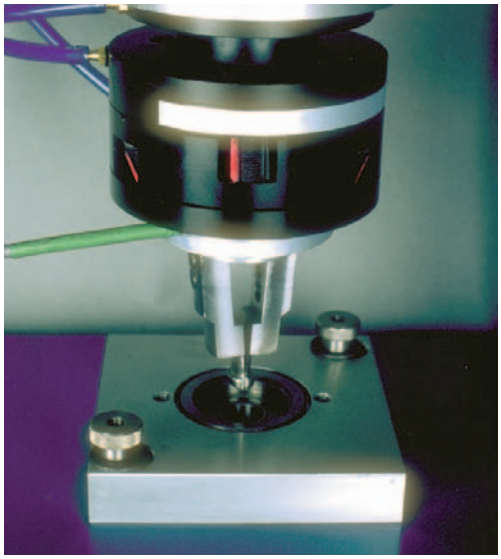
Example Part No: **AST-100-75**

For elimination of "setting time" in high speed applications, see PFA's Lock-Out System on page 16.

INCREASED PRODUCTIVITY OF RCC ACCOMMODATOR WITH REDUCED CYCLE TIMES

RCC ACCOMMODATOR WITH LOCK-OUT SYSTEM

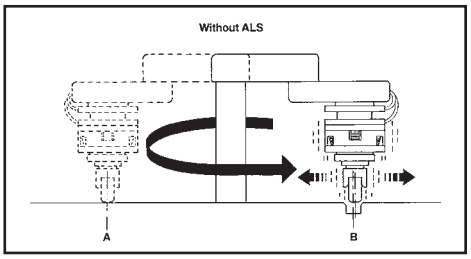
The Lock-Out/RCC System (ALS) has been developed to alleviate the effects of inertia and solve operational problems, such as the need for shorter cycle times, for automated assembly tasks. The system consists of a lock-out device and the incomparable Accommodator RCC. The lock-out device is pneumatically activated and electronically sensed as it locks the X, Y, and Z planes of the RCC on command.



The lock-out device is locked during movement and unlocked immediately before part insertion to allow the RCC to compensate for misalignment during assembly.

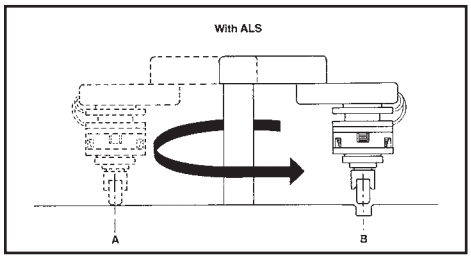
Features

- Reduces cycle times
- Permits rapid accelerations/ decelerations
- Integrates with modified AST-100 Accommodator RCC's
- Prevents X, Y, Z, and rotational travel during transition
- Allows a high degree of repeatability



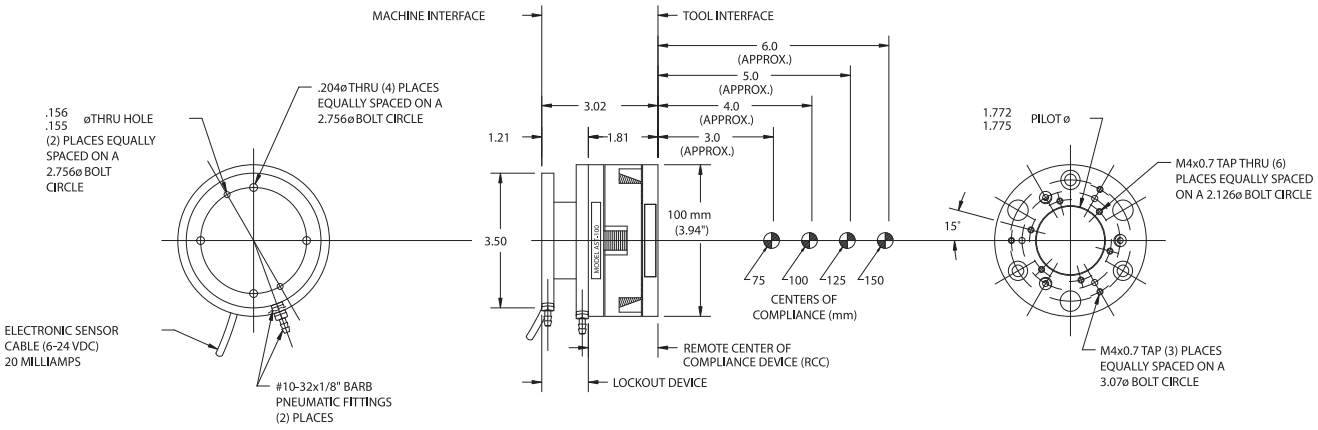
Without Lock Out System

Effects of inertia cause residual oscillation. The net result is a slower cycle time.



With the Lock Out System

ALS System rigidly locks the RCC and tooling in place during acceleration, transport and deceleration. The net result is a faster cycle time.



Mechanical Specifications

MECHANICAL

Locked Repeatability (at center of RCC)	X, Y, Z axis ± 0.03mm (±0.001 in.), rotationally ± 30'
Unlocked Repeatability (at center of RCC)	X, Y, Z axis ± 0.05mm (0.002 in.) rotationally ± 17'
Operating Pressure	350 - 800 KPA (50 - 120 PSI)
Weight (ALS)	0.95kg (2.1 lbs)
Weight (ALOD-2)	0.34kg (0.75 lbs)
Material	Lock-out device - Teflon impregnated hardcoat aluminum. RCC Accommodator - Anodized aluminum

ELECTRONIC

Supply voltage (operation)	4.5 - 24VDC
Supply current (max)	14mA
Interconnect cable	3 conductor, 24 AWG, with shield 48 in. (122mm) long
Output configuration	24VDC; open collector (current sinking) 25 mA max.
Output switching time (max)	.04 microseconds
Cable connections	red - +DC black - ground white - output

Caution: failure to observe supply voltage and output current limits may lead to sensor failure!

IDENTIFY YOUR PART NUMBER

System Identification	Center-of-Compliance Projection (mm)	Elastomer Selection
Lock-Out Device and RCC	*75, 100, 125, 150*	*MO30, CR35, CR45, CR55*
ALS-100	75	CR35

Example Part No: **ALS-100-75-CR35**

Lock-out device may be ordered as a separate part (standard AST-100 must be modified) Use Part Number: **ALOD-2**

SAFEGUARD YOUR TOOLING, ROBOT & ASSEMBLY SYSTEM WITH AN OVERLOAD PROTECTION DEVICE (OPD)

ROBOTIC CRASH PROTECTION

PLUG & PLAY - NO PROGRAMMING NEEDED

FORCE & SENSITIVITY ADJUSTMENT INCLUDED!

OPD-EM-U *OPD-MS-2HD*

How It Works

The OPD's mechanical wrist is held rigid pneumatically during normal operation. Varied stiffness to accommodate payload is achieved by adjusting the input air pressure. Once an overload is detected, a signal is generated to shut down, or correct your process, and the mechanical wrist transforms to a compliant state, protecting equipment and end-of-arm tooling. The OPD is easily reset by placing the mechanical wrist and interface module in their ready positions.

Two Modes of Protection

PFA's OPD provides for independent adjustment of both pneumatic rigidity and electronic sensitivity, thus allowing you independent control of the amount of force and the amount of tooling plate travel required to initiate a protective function. As applications vary, this flexibility ensures the best possible performance under all conditions.

Modular Interface

The interface module provides all the necessary components for "plug and play" operation. Multiple signal outputs (source, sink, and NO/NC relay contacts), three point sensor adjustments, and integrated air valve, vent valve controls, ensure that all the work is done for you. Install, apply services, and you're protected.

OPD-MS

OPD-EM-U & OPD-MS-2HD
Nested Configuration

OPD-EM

OPD-MS-1A Mechanical Unit

Load Capacity:	10 lbs. (dynamic load)
Operating Pressure:	5 - 50 psi.
Weight:	0.8 lbs.
Operating Temp:	-4˚ to +248˚ F
Sensitivity: (at interface center)	0.002 in. axial
Repeatability: (at interface center)	X, Y, Z, Axis +/-0.0005 in. Rotationally +/-20'.
Material:	Aluminum and Nickel Plated Aluminum

OPD-MS-2HD Mechanical Unit

Load Capacity:	65 lbs. (dynamic load)
Operating Pressure:	5 - 60 psi.
Weight:	2.0 lbs.
Operating Temp:	-4˚ to +248˚ F
Sensitivity: (at interface center)	0.002 in. axial
Repeatability: (at interface center)	X, Y, Z, Axis +/-0.0008 in. Rotationally +/-20'.
Material:	Aluminum and Nickel Plated Aluminum

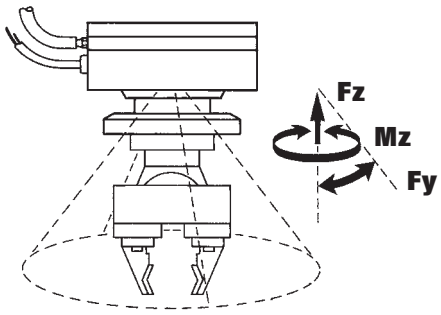
OPD-MS-3 Mechanical Unit

Load Capacity:	350 lbs. (dynamic load)
Operating Pressure:	10 - 80 psi.
Pilot for Valve:	20 psi. minimum
Weight:	30.0 lbs.
Operating Temp:	-4˚ to +248˚ F
Sensitivity: (at interface center)	0.002 in. axial
Repeatability: (at interface center)	X, Y, Z, Axis +/-0.001 in. Rotationally +/-20'
Material:	Aluminum, Nickel Plated Aluminum, and Steel

OPD-EM-U Interface Module

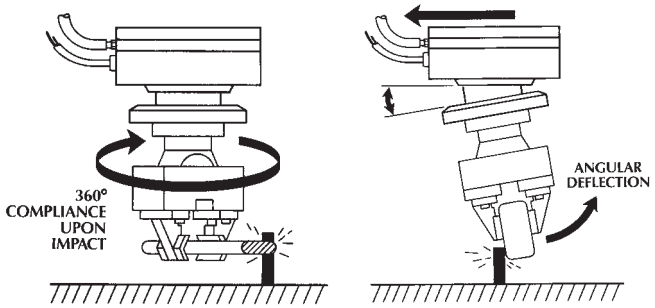
Signal Outputs:	12 VDC Current Source, 50 mA max. 5 - 24 VDC Current Sink. 75 mA max. Pulsed Signal for 1 second or continuous 2 Relay NO or NC, 110 VAC, 1 A max.
Response Speed:	Signal - 5 microseconds max. Relay - 6 milliseconds max.
Supply Voltage:	+12 VDC or +24 VDC
Maximum Current:	250 mA.
Operating Temp:	+35˚ to +112˚ F
Weight:	20 oz.

Typical Overload Conditions



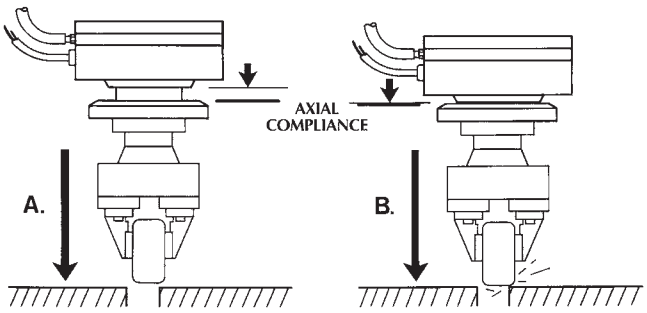
Three Axes of Protection

Axial, angular and rotational sensing ability allow for unlimited applications.



Immediate Shutdown

Coupled with the interface module, the OPD signals your process to shut down immediately when a disruption is sensed.



Immediate Compliance

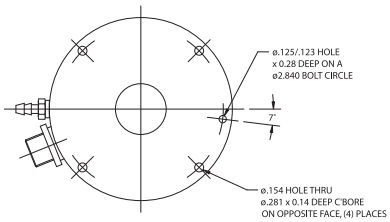
Because of the OPD's quick response after a "crash", you won't have to spend time and money retooling.

NEW! All outputs selectable for independent pulsed or continuous operation!

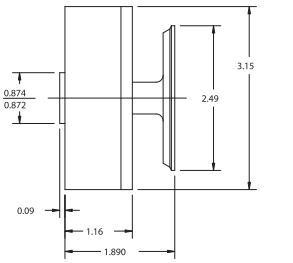
WITH PFA'S
OVERLOAD PROTECTION DEVICE (OPD),
SAVE TIME, SAVE MONEY, SAVE YOUR TOOLING!

OPD-MS-1A

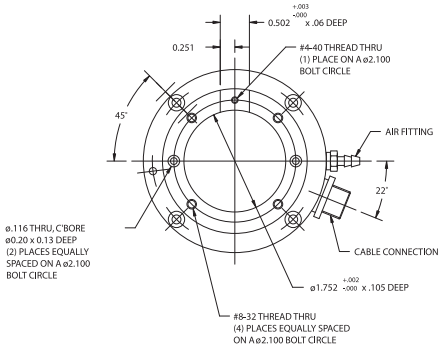
MACHINE INTERFACE



SIDE VIEW



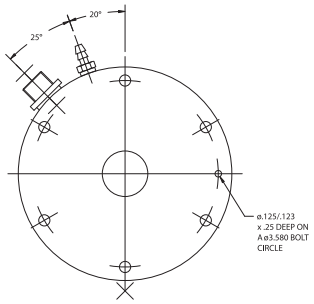
TOOLING INTERFACE



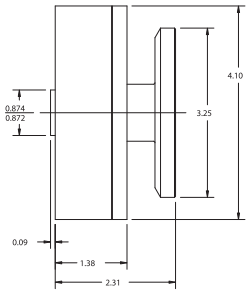
ø.116 THRU, C'BORE
ø0.20 x 0.13 DEEP
(2) PLACES EQUALLY
SPACED ON A ø2.100
BOLT CIRCLE

OPD-MS-2HD

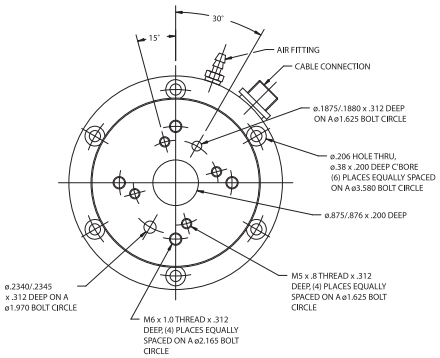
MACHINE INTERFACE



SIDE VIEW

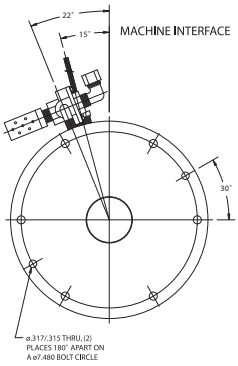


TOOLING INTERFACE

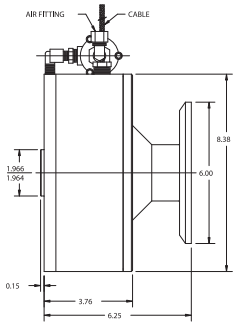


OPD-MS-3

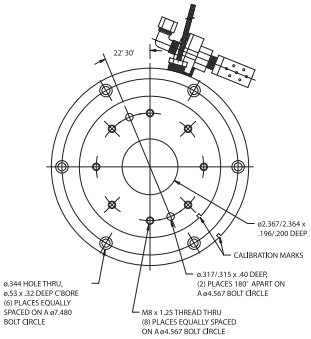
MACHINE INTERFACE



SIDE VIEW

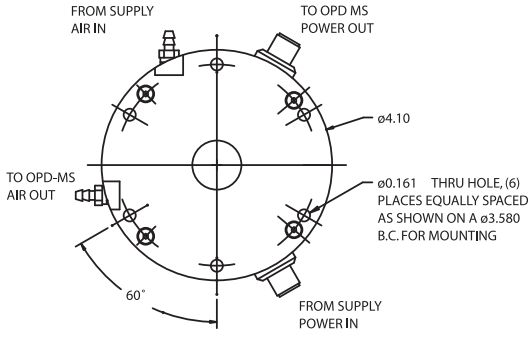


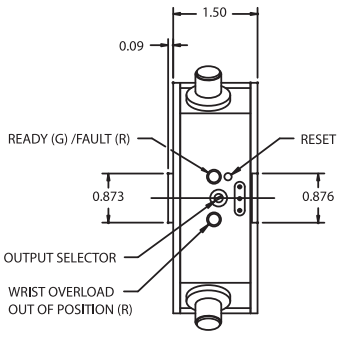
TOOLING INTERFACE



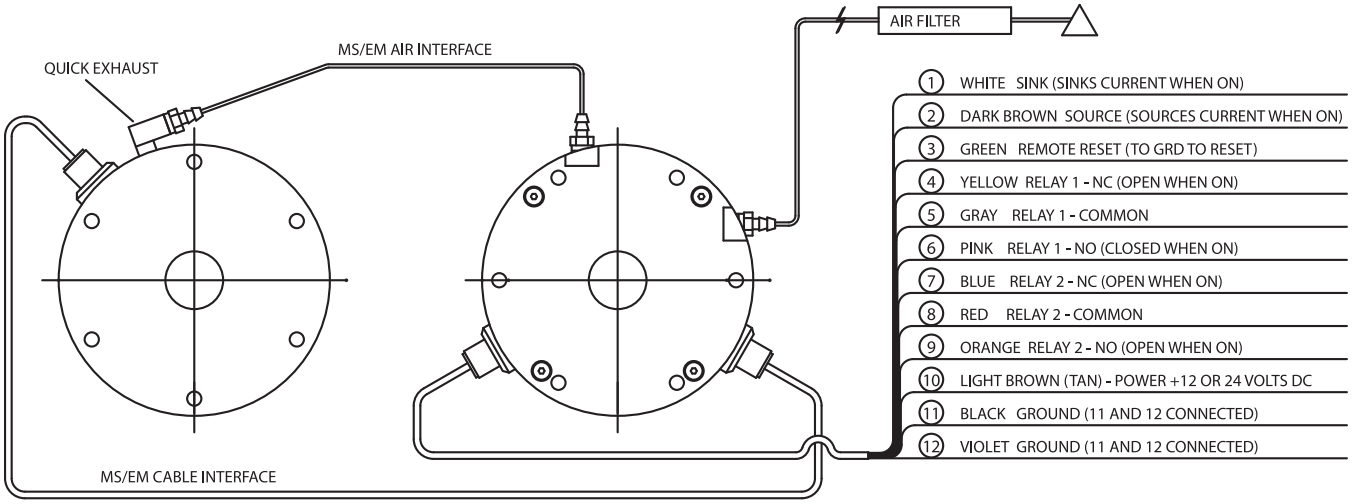
ø.344 HOLE THRU,
ø.53 x .32 DEEP C'BORE
(6) PLACES EQUALLY
SPACED ON A ø7.480
BOLT CIRCLE

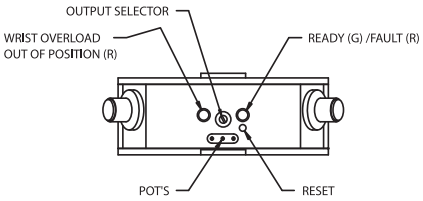
OPD-EM-U



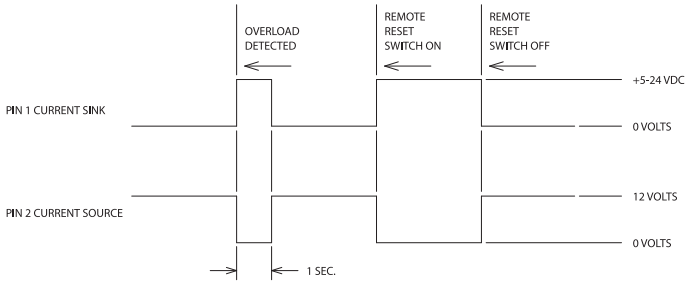


CUSTOMER INTERFACE WIRING DIAGRAM





For a complete system, order both an OPD-MS of the appropriate size and the OPD-EM-U (Electronic Interface Module)



IDENTIFY YOUR PART NUMBER

MECHANICAL UNIT (MS)

System Identification	Size
Overload Protection Device - Mechanical Unit	*1A 2HD 3*
OPD-MS_	1A

Example Part No: **OPD-MS-1A**

For OPD-MS-3 it is recommended that the air dump feature be used to actuate a larger pilot operated air dump value. Contact PFA for details.

ELECTRONIC INTERFACE MODULE (EM)

System Identification	System Voltage	Output
Overload Protection Device - Electronic Unit	*Voltage 12 to 24 VDC*	*Output Pulse or Continuous - Selectable*
OPD-EM-U		

Includes the "Home Run" cable for connection to the Robot Controller/Power. OPD Protection Devices are designed to fulfill all your collision protection needs. Because each process is different, PFA offers multiple configurations. For application assistance or technical questions, please contact our staff.

APPLICATION DATA

To estimate the approximate input air pressure for your specific application perform the following steps.

Purely Lateral Overloads

Step 1: Determine the total weight in lbs. of your end of arm tooling. This will give you your mass at the end of the tooling. Let this = M.

$$M = \frac{\text{Weight of Tooling + Part (lbs)}}{32}$$

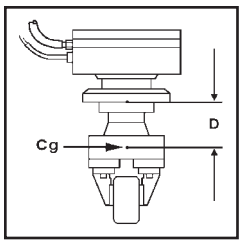
Step 2: Determine the maximum acceleration in ft/sec2 under full payload for your application at the end of the robot arm. Let this = A

Step 3: Use the following formula to determine your known expected force in lbs.

Force (Fy) = M x A

Step 4: Use your Force (Fy) in the following equation to determine P in psi, your ideal input pressure.
Note: D = Distance from OPD plate to Cg (center of gravity) in inches.

Model	
OPD-MS-1A	P = Fy [(D) x (.581) + .389]
OPD-MS-2HD	P = Fy [(D) x (.172) + .166]
OPD-MS-3	P = Fy [(D) x (0.019) + 0.05]



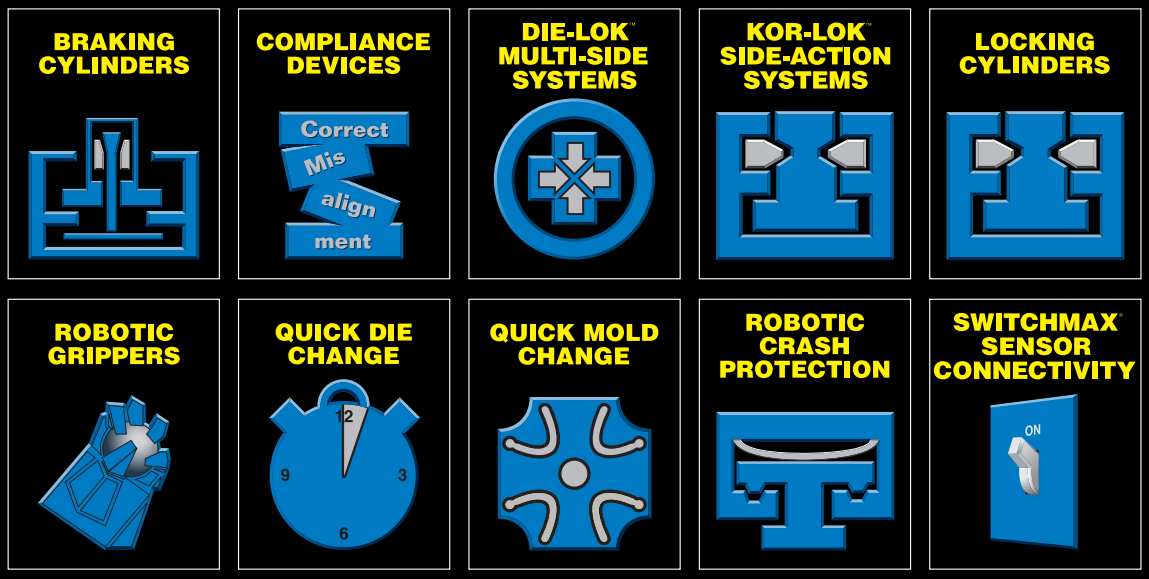
Purely Axial or Torsional Overloads

To approximate the operational input air pressure (P) for pure Z axis axial overloads, or purely torsional overloads about the Z axis, determine your maximum torque (Mz) in in-lbs or axial force (Fz) lbs. and apply it to the appropriate formula listed below.

Model	Pure Axial Overload	Pure Torsional Overload
OPD-MS-1A	P = Fz (.389)	P = Mz (.512)
OPD-MS-2HD	P = Fz (.166)	P = Mz (.247)
OPD-MS-3	P = Fz (.05)	P = Mz (.024)

Note: Input air pressure settings were determined under laboratory conditions. Your performance settings may vary. The input air pressure may be varied in process to achieve the most sensitive overload protection without sacrificing high payload capacities.

Electrical Interface. The OPD Electronic Interface Module can be used on 12 VDC or 24 VDC Systems. Module outputs are both current sinking, sourcing, and isolated relay contacts. The outputs are independently selectable to (1) a momentary off pulse typically interfaced to the systems emergency stop circuit or (2) a continuous off signal when faulted (until reset).



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